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UNITED KINGDOM ATOMIC ENERGY AUTHORITY

Atomic Weapons Research Establishment,
Aldermaston,
Berkshire.

Ref: 207/6/59/D

15th June, 1959.

Dear Ernest,

The hazards which could arise as the result of accidents, in which there is a release of plutonium or associated materials, have been subjects of considerable discussion here in the past year or so. Clearly our interests lie not only in weapons but also in the accidental release of plutonium from reactors. The Vixen series of experiments in this year's Assessment Test Programme at Maralinga are part of the experimental programme to study the formation and dispersion of particulate material by explosion and fire. Recent laboratory experiments on the burning of plutonium have given encouraging results regarding the magnitude of these hazards and we now feel that it would be worthwhile to augment the 1959 Vixen series by adding two burning trials to determine the dispersion of plutonium under representative field conditions. Earlier it had been considered this should not be attempted before 1960.

The proposal is to carry out two trials in each of which about 200 gm of plutonium metal would be burnt in a controlled petrol fire. A sampling array to measure airborne concentration, particle size distribution and deposition out to a range of several thousand yards would be used. At the same time appropriate micro-meteorological variables (including gustiness) would be measured.

In order to assess the potential hazard which might be caused by this work some assumptions have been made pending the possession of more accurate data which is one of the objects of the trials.

These assumptions are :-

(a) A ground deposition of less than 1×10^{-4} uc/cm^2 is safe for continued non-occupational habitation. (Code of Practice for the Protection of Persons exposed to Ionizing Radiations prepared by the Standing Advisory Committee (Chairman Sir Charles Darwin) set up to advise Ministers under the Radioactive Substances act. Published by HMSO 1957).

(b) A dose to the lungs of 0.5 rem/year is acceptable for non-occupational workers. (Recommendations of the International Commission on Radiological Protection - To be published July 1959).

(c) The airborne activity behaves according to Sutton's equation (J.R. Met. Soc. 1947, 73, 427) modified to allow for finite particle sizes. Particle size has been chosen to give the greatest distance for the hazard criteria.

/(d)....

Professor E. Titterton,
Australian National University,
CANBERRA.

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(d) Both fall-out plumes will be superimposed. This is highly improbable.

(e) Burnings will result in as much as 10% of the material becoming airborne in particles of such a size that they can travel distances measured in kilometres. Laboratory experiments at A.W.R.E. suggest that this is pessimistic.

(f) Meteorological conditions are average with a wind speed of about 5 metres/sec. Experimental criteria preclude burning under much worse conditions.

(g) The fraction of material which becomes airborne contains 12½% of particles in the biologically hazardous range following I.C.R.P. (Recommendations of the International Commission on Radiological Protection. Revised. December 1st, 1954). Laboratory experiments at A.W.R.E. suggest that this is also pessimistic.

(h) The effect of the "thermal lift" is equivalent to a release height of 15 metres. The results are not very sensitive to this figure..

Using the above assumptions our calculations show that there would be no breathing hazard (assumption (b)) beyond a distance of 3,600 yds., and no subsequent deposition hazard (assumption (a)) beyond a distance of 2,500 yds. To achieve an additional safety factor, we would ensure that no unauthorised person could be within 2½ miles downwind for at least two hours after the conclusion of each fire, and that access within this distance would be through health physics control at all times subsequently, unless the results of the tests showed clearly that this could be modified.

I As you know, we have not previously used plutonium in Assessment Tests at Maralinga and since its use could easily be misinterpreted politically I am seeking your advice about how best to seek approval for these tests. If these are agreed and the results prove to be worthwhile we may well ask for further similar experiments next year. We hope the results will be of general interest, and we should, of course, make them available to Australia.

I would appreciate your reply by signal as we have to make arrangements about transport of the material and the time available for tests this year is getting short. If you feel that the "political" complications will make it difficult for you to give a quick answer, I would be much obliged if you could let me know this, also by signal.

With best wishes,

Yours sincerely,

Bill.

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