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DEPARTMENT OF ENERGY

TO: Hal Hollister
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The Enewetak Advisory Group met on April 26 and 27, 1978 in Denver, Colorado. Present were: W. L. Templeton, C. W. Francis, B. W. Wachholz, J. Healy, R. O. Gilbert, R. C. Thompson, R. O. McClellan, and W. J. Bair. The purpose of the meeting was to consider the following questions:

1. Is it possible to develop dose-related cleanup guidance that would assure that doses to future residents of Enewetak Atoll would not significantly exceed proposed EPA guidelines for transuranics?
2. What advice can be given to the Defense Nuclear Agency on May 3, 1978 to facilitate planning for cleanup of transuranics on Enewetak?
3. What additional information can be obtained that could improve the confidence of the dose estimates and cleanup criteria for transuranics?
4. Can plowing be used as an effective cleanup measure for transuranics in soils?

The Advisory Group reviewed information and data provided by DOE-Division of Occupational and Environmental Safety, Lawrence Livermore Laboratory, DOE-Nevada Operations Office, and Defense Nuclear Agency and offers the following response to the above questions. (This pertains only to transuranic elements and does not consider radiation doses from other radionuclides which, the Advisory Group understands, will delay the resettlement of some of the islands for many years.)

1. The Enewetak Advisory Group does not find it possible to develop reasonable cleanup guidance that would assure that radiation doses from transuranics to future residents would not significantly exceed proposed EPA guidelines. Obviously, the more stringent the cleanup criteria, the greater the degree of assurance; but uncertainties inherent in our present understanding of the problem preclude absolute assurance. One cannot predict with certainty the contamination levels that will exist in the islands after cleanup--this must be determined at a future time. One cannot predict the lifestyle and dietary habits of every individual who returns to the islands. Perhaps most important, many of the factors that are involved in movement of transuranics in the environment and the deposition and retention of transuranics in human beings are not well established.

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The Advisory Group is of the opinion that the recommended cleanup criteria as discussed in item 2 below will result in average transuranic radiation doses to subsequently exposed populations that will be commensurate with proposed EPA guidelines. The EPA considers its guidance levels to be equivalent to a lifetime risk of about 14 premature cancer deaths per 100,000 persons exposed and to perhaps an equal number of genetic effects, although these estimates are based on many uncertain assumptions and are generally considered to be quite conservative. An estimate of 14 cancers per 100,000 people would correspond to a 3% chance of one cancer appearing in a population of 200 people exposed to EPA guidance levels for their lifetime; or expressed differently, to a probability of one cancer in every 2100 years (assuming a constant population size).

2. Considering the physical and ecological limitations to removal of transuranics from the Enewetak Atoll, the Advisory Group recommends the following. From the information currently available and used for dose assessment, we believe that cleanup of all one-quarter or one-half* hectare areas exceeding (with 70% confidence) 40 pCi/g of surface (0 to 3 cm.) soils of village islands will provide a reasonable expectation that doses in the bone and lung will be commensurate with the EPA guidance. In terms of radiation dose-sparing benefit to future inhabitants, cleanup of a standard area on a village island is worth about 4 times as much as cleanup to a given level on an agricultural island and 12 times as much as cleanup of the same area to the same level on a picnic island. However, in the light of existing contamination levels and available cleanup resources, it would appear that cleanup of all one-quarter hectare areas on village islands that exceed 40 pCi/g should receive first priority. Because the other islands may have increased use over that currently assumed, a second priority should be the cleanup of agriculture island half-hectare areas exceeding (with 70% confidence) 80 pCi/g. A third priority should be the cleanup of picnic island half-hectare areas exceeding (with 70% confidence) 160 pCi/g. If resources are exhausted, some islands may not be cleaned up; final dose assessment may indicate that these islands will have to be permanently quarantined. We note that the soil profile on Pearl is anomalous since the concentration of transuranics appears to be uniform with depth. We believe that the possibility of effective cleanup for use as a village or agriculture island is remote. However, the possibility of covering Pearl with the less contaminated soil from the village islands and, perhaps, from the agricultural islands should be considered for lowering the average surface contamination levels and reducing the logistics problems of transporting the soil from the other islands to Runit.

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*1/4 hectare if IMP readings are taken on a 25 meter grid; 1/2 hectare if a 50 meter grid is used.

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3. In the next few weeks the following should be accomplished to improve the capability to make dose assessments and guide cleanup activities:
 - a. The analysis of coconut and associated soils now in progress at LLL should be expedited.
 - b. The urine bioassay data from Bikini should be obtained and analyzed for use by the Advisory Group. We believe it would be informative to compare estimates of the body burdens of transuranics in the people who have been living on Bikini with the levels of transuranics in the environment and in the food harvested from Bikini islands.
 - c. A data bank that accumulates all data from all organizations participating in Marshall Islands studies should be started and made available to all persons involved in the Marshall Islands program.
 - d. The organization and responsibilities of all DOE contractor personnel should be reviewed and clearly defined.
 - e. Questions raised concerning possible bias in IMP ²⁴¹Am readings relative to soil Am and Pu levels should be resolved.
 - f. An inventory of all current Enewetak projects for use by the Advisory Group should be provided.

Further suggestions will be forwarded following the next meeting of the Advisory Group the week of June 5, 1978. We plan to review the calibration of the IMP and the Am-Pu soil data; review new data Dr. Robison expects to bring from Enewetak; comment on the draft dose assessment report; consider long-term issues related to final phases of the cleanup operations, certification and reassessment of dose based on contamination levels remaining after cleanup; and review organizational responsibilities.

4. Plowing may reduce the surface soil concentrations and hence reduce the potential inhalation problem. Plowing is unlikely to reduce plant uptake, since it merely redistributes the transuranics in the plowed area. Decisions on plowing should await the results of the proposed plowing experiment to be conducted at Enewetak. We recommend that a statistician participate in the planning of the experiment and analysis of the soil sampling data. Since DNA has requested advice on this technique, the experiment should be conducted as soon as possible. It has also been drawn to our attention that on Enjebi, for instance, the depth to beach rock is variable and hence consistent plowing to depth may be impracticable.]

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In addition, experience has shown that there are large quantities of unexploded ordnance and other dangerous hardware in the subsurface. These pose to the operators a potential risk that may outweigh the benefits to be obtained from plowing.

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