Department of Energy
Washington, D.C. 20545

409832

Communication Center
Germantown, Maryland 20545

R

XEROX 200 TELECOPIER
FTS 233-3870
COMMERCIAL 301-353-3870

VERFICATION
FTS 233-3486
COMMERCIAL 301-353-3486

U.S. DEPT. OF ENERGY 1978 APR 19 AM 11 39

DATE April 19, 1978

Telecopier No. 509-946-1271 8

TO: Bill Bair — PNL, Richland, Wash. — 509-946-2121
Name — Location — Office Telephone Number

FROM: Bruce Wachholz — DOE-NQRS. — 233-9365
Name — Location — Office Telephone Number

This transmittal consists of 7 pages (EXCLUDING COVER SHEET)

I want original back:
YES X NAME: Linda Hurley EXT. _____ MAIL STOP E-201
(IF TO BE PICKED UP) (TO SEND BACK IN MAIL)

NO _____

DOCUMENT **DOES NOT** CONTAIN ECI

Reviewed by [signature] Date 4/29/47

RECEIVED
APR 19 1978
W. J. BAIR

REPOSITORY PNNL
COLLECTION Marshall Islands
BOX No. 5685
FOLDER Enewetak April 1978

BEST COPY AVAILABLE

Bill - It may be that some of my comments/questions are less applicable to the LLL document than they might be to DOE or DOI. - Bruce Wachholz.

COMMENTS ON THE LLL DRAFT,
"ASSESSMENT OF POTENTIAL DOSES TO POPULATIONS
FROM THE TRANSURANIC RADIONUCLIDES AT ENEWETAK ATOLL,"
BY W. L. ROBISON, W. A. PHILLIPS AND V. E. NOSHKIN

General Comments:

The document gives the impression of being much more authoritative than it actually is. While the assumptions used are stated, the extent of uncertainty or degree of conservatism/non-conservatism is not always discussed (e.g., AMAD = 0.5 μm).

Perhaps even more importantly, the validity, reliability and/or limitations of the data base are not discussed. This becomes of significant and perhaps critical importance with respect to the gut absorption factor. Although the reported ranges are mentioned, little in the way of applicability or experimental conditions is discussed (e.g., the reader may conclude that based on the LLL comments a factor of 10^{-2} should be used for chlorinated water, when apparently it is difficult to maintain Pu in the +6 state under physiological conditions). Similar comments pertain to other parameters contributing to dose (e.g., coconuts, marine food).

It would be helpful for real world decisions to have some idea of the effect of multiple conservatisms upon the final dose estimates (e.g., mass loading of 100 $\mu g/m^3$, all of which is respirable, all of which is same concentration and ratio of Pu/Am in soil). Perhaps a comparative listing of "conservative" and "realistic" values would be appropriate, or at least a table listing the several conservatisms or non-conservatisms.

Specific Comments:

1) To what extent, if any, is the assumed diet realistic or conservative? After what period of time is it anticipated that this diet will, in fact, be available as the primary, if not sole, source of food? For example, are the people now to some extent dependent upon imported food, and would this continue?

2) How do LLL soil surface (0-3 cm) measurements compare with EPA recommendations (0-1 cm)? (Perhaps info related to this could be obtained from the Rockwell comparative soil sampling program at Rocky Flats.)

3) How reliable and consistent is the Pu:Am ratio of 2:1? Is it justifiable to assume a 2:1 ratio for both the surface soil (0-3 cm) and the root zone (0-30 cm)?

4) How realistic are the occupancy factors stated? Are these valid also for women and children? For example, children might be expected to spend more time on a village or picnic island, but would their estimated dose be decreased because of avoidance of agricultural islands, increased because they might be expected to play in the dirt, sand or coral, or would the dose be essentially the same as for an adult?

5) A gut transfer factor of 3.0×10^{-5} may not be conservative. EPA recommends 10^{-4} for Pu-239, 240 oxide, 10^{-3} for oxides and non-oxides of other isotopes of Pu, Am and Cm, and 5×10^{-3} for biologically incorporated material. Use of 10^{-3} for Am is okay, but Pu-239, to say nothing of Pu-238, absorption factors may have been underestimated.

This subject is one in which numbers are given in the report, but little is said about the experimental conditions or the applicability of the numbers to the Enewetak dose assessments:

a) Pu in chlorinated water may not remain as +6 in physiological milieu

b) Reference to Stuart is not given.

c) How significant is Pu-238 dose from marine pathway if transfer factor of 10^{-3} is used.

d) Concentration factors (ratios?) appear very important for coconut meat and milk. To base such an important parameter upon 5 coconuts (some of which are lower values than "LT" values) raises questions as to their suitability and accuracy. (It is incredible that the Bikini soil and coconuts have not yet been analyzed; also, presumably nothing is known regarding biological incorporation of Pu in coconut meat/milk!)

e) Is there no information on leaf vs. fruit concentrations?

6) Little was said about analytical methods and deviations.

7) All derivations progress from food, water and air concentrations to dose. It might be informative to understand inhalation/ingestion → body/organ content → dose.

8) The marine pathway raises a number of questions as to the '72 survey and the '76 survey which probably can only be resolved by additional data. The conflicts between the two sets of data are not resolved, and the reasons given for accepting the '76 values (e.g., the data match global values) are not convincing, especially when the '72 samples were conducted by 3 labs and the '76 data is given only by one. (Is it to be expected that the Enewetak marine life Pu values should match those in the North Atlantic or the Irish Sea? I would be a bit surprised

to expect similar values.)

Other issues re marine food paths and derivations include:

a) How representative is a single fish, the mullet, of either the islanders' diet or of the fish and seafood population? I would think that other fish and the coconut crab would need to be sampled before stating that the dose via marine life is insignificant.

b) How valid are the statements (made at the meeting) that the mullet does not migrate, presumably either between islands or across ocean/lagoon barriers? If it is not a migrating fish, were the fish obtained in those areas most likely to be fished by the islanders?

c) What is the basis for the assumption that the mullet is the most direct and representative link between marine contamination levels and dose to man?

d) It is stated that there is some uncertainty about what fish tissue the Marshallese actually ingest. This sounds difficult to believe considering that we have had 30 years--more or less--to observe/study their diet. If nothing else, why don't we ask them? Unreal! If it is true that we really don't know, why are muscle and skin assumed?

e) If there is a difference of a factor of 8 in the $^{238}Pu/^{239}Pu$ ratios in fish (mullet?) muscle in different parts of the atoll, why are mean concentrations used and why is 3×10^{-5} used as the gut transport factor for ^{238}Pu?

f) On page 8 it is stated that use of 10^{-3} instead of 3×10^{-5} for Pu-239, -240 would increase the dose rate from 3.2 mrad/yr (Table 5) to 9.9 mrad/yr. Does this also include ^{238}Pu? What if the

^{238}Pu component value is 10^{-3} and $^{239,240}Pu$ is 10^{-4} or 3×10^{-5}?

g) What it all reduces to is that we don't really know anything more about the marine pathway than we do the terrestrial or, for that matter, the inhalation one.

9) If there may be a Pu problem at Bikini with surface soil concentrations of 10 pCi/g (page 11), how can we consider settlement at Enewetak with levels of 10-40 pCi/g?

10) The uncertainties of the inhalation dose calculations have already pretty well been identified:

a) How realistic is a mass loading of 100 $\mu g/m^3$, especially if used as a yearly average?

b) It seems extremely conservative to assume that ALL of the resuspended material is of respirable size, or to assume that the AMAD is 0.5 μm.

c) Is it realistic to assume a Pu/Am ratio identical to that in soil for all respirable particles? It seems to me that at least some of the mass loading would be due to particles from ocean/lagoon spray which probably have little or no Pu content.

d) Can one assume that inhaled material is high-fired oxide?

Other comments:

1) It may be misleading or misinterpreted to retain tables for average soil concentrations up to 400 pCi/gm. Even 40 pCi/gm probably is unreasonably high as an island average.

2) The use of average soil concentrations is a delicate one. If averages are NOT used, presumably ALL island areas must be measured. If island

averages ARE used, individual values may exceed the average (almost by definition). There probably are two aspects to this issue: para-legal and moral. In terms of what regulatory guidance is available, the use of averages probably is okay assuming that reasonable statistics are used--soil/island averages, annual inhalation/ingestion averages, occupancy averages, etc. Without the use of averages, the habits and location and exposure of each individual presumably would need to be estimated. The moral aspect is more difficult: should anyone need to accept a higher risk than the "average"?

Considering all of the uncertainties, my own feeling is that averages are acceptable as long as maxims similarly are defined (e.g., a residence island might have an average of 6-8 pCi/gm with no area of the island to exceed, say, 30 pCi/gm).

3) The above becomes tied into the applicability of the EPA Guidance to the Enewetak return. This has literally forced OES to consider dose projections from transuranics, something that heretofore had been either not considered or considered to be insignificant. Obviously both "considereds" were in error. I feel that the EPA Guidance should be considered to be what it is--guidance. The closer we can get to or below it, the better off DOE and the Enewetak people will be. However, it is doubtful that EPA will insist on the use of their Guidance as an upper exposure level and have indicated that if it can be met we should by all means do so, but if it cannot be met the reasons are understandable because of the uniqueness of the situation and because the benefits, while intangible, no doubt exceed the

additional risk. Furthermore, EPA stated that their Guidance was intended for use in land deeds, development and use, and that these concepts undoubtedly do not apply to the Enewetak culture. In addition it was stated that the Guidance was intended for U.S. public/private land use, and was not directed toward sites of atmospheric nuclear weapons tests (i.e., NTS, N.M., Bikini, Enewetak). Consequently we should make every reasonable effort to assure that the Guidance is complied with, but it is not necessarily a prerequisite for resettlement--at least from EPA's perspective.

4) How all this will help OES within 2 weeks is a mystery to me. Any suggestions or help in determining clean-up levels for residence, agriculture, and visiting islands would be most gratefully appreciated, I'm sure.

5) While the bone dose exceeds EPA Guidance to a much greater extent than does the lung dose, the largest single contributor to the bone dose is translocation from the lung. If the inhalation assumptions are conservative by up to a factor of 10, the lung dose becomes quite acceptable and the bone dose is reduced almost by 1/3. Possible conservatisms in ingestion parameters (e.g., concentration ratios) diet estimates may lower the bone dose still further; on the other hand, raising the GI absorption factor will increase it. The unknowns and uncertainties in the terrestrial and marine ingestion pathways almost preclude any realistic estimates via this exposure route.