[redacted] we have far too many things going on right now to afford the time.

My general thought is that we could have saved a lot of everybody's time if Bramlitt would have discussed this paper with us ahead of time like we asked him to if he were going to continue with it. He has misused data and made comparisons with a draft copy of our paper which had an error in one of the tables. This error was pointed out to those who had a need to know and were officially given the draft for review.

I don't plan to spend any more time than I have reviewing the document but I hope my brief comments will be useful.

Sincerely,

Bill

William L. Robison
Section Leader
Terrestrial & Atmospheric Sciences

WLR/mt
encl.

cc:

| | | | |
|---|---|---|---|
| J.A. Auxier | ORNL | R.C. Thompson | PNL |
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| C.W. Francis | ORNL | B.W. Wacholz | DOE/HQ ← |
| R.O Gilbert | PNL | R.L. Walters | DOE/HQ |
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Comments on "Dose Estimates for Post-Clean-Up use of Enewetak Atoll"

by E. T. Bramlitt

The first major point I will make is that the paper is presented as though the author just discovered that the suburanics (specifically $^{137}Cs$ and $^{90}Sr$) are the major potential dose contributors at the atoll. This point was clearly made in our initial reports in NVOO-140. Since that time we have emphasized that point in interagency meetings, scientific meetings and publications. We have emphasized for 5 years that the transuranics will contribute an extremely small fraction of the total dose over the next 100 years.

The second major point is that the author calculates excessive doses from $^{137}Cs$ and $^{90}Sr$ via coconut consumption because he has based his calculations on a totally unrealistic diet.

Two examples will highlight my point:

1. Coconut trees are now planted at 30 foot centers as standard agricultural practice in the Marshall Islands; Bikini and Eneu Islands are recent examples. Based on 30 foot centers 64 cocount trees can be planted per acre.

The total land area at Enewetak Atoll is 1760 acres. Assume now that 30 % of the land will now be planted with cocounts. This is probably a high estimate in that much of the land area on the residence islands is unavailable; Enewetak Island has a major size runway; beaches make up a part of the land area; and some islands will never be planted for logistic reasons. However, for now we will accept 30 % which leads to 528 acres being available for coconut. Therefore the number of coconut to be planted is:

$$538 \text{ acres} \times 64 \frac{\text{trees}}{\text{acre}} = 33{,}792 \text{ coconut trees}$$

Assume production of 100 nuts per tree per year; this is a number consistent with several published values. Therefore, the total number of coconuts available per year is:

$$33{,}792 \text{ trees} \times 100 \frac{\text{nuts}}{\text{tree-year}} = 3{,}379{,}200 \frac{\text{nuts}}{\text{year}}$$

Now, lets look at how many coconuts will be consumed per year according to the diet proposed by the author (table III of the report) assuming that women consume 2/3 and children 1/2 of the male diet and that the population will consist of 200 men, 200 women and 200 children. These population figures are not unreasonable for the population a few years after return. The results are given in Table 1. The total number of cocounts consumed according to the authors diet is 2,879,600. This is 85% of the total available production of 3,379,200 cocounts. This leaves hardly anything for a copra crop. To put it another way, they would have to plant 26% of the available land area to supply simply the dietary needs-nothing yet said about a cash copra crop!

In summary the coconut diet is totally unrealistic. In fact if they were eating as many drinking cocounts as the author suggests and harvesting the remaining ones for copra it would be nearly impossible for a coconut to fall to the ground and become a sprouting coconut.

2. A second way to look at this proposed coconut intake is from a dietary standpoint. On page 11 the daily intake based on the authors proposed diet is 2.05 kg/day for cocount meat and 2.6 kg/day of coconut fluid for a total consumption for coconut of 4.65 kg/day. For comparison, the average U.S. daily intake of all foods is 1.75 kg per day (from Supplement for 1975 to Agricultural Report No. 138, U.S.D.A., "Food,Consumption, Prices, Expenditures." January 1977) or 0.78 kg/day according to Bramlitts reference.

[redacted]

3000 g per day (3.0 kg/day) for fish. Added to the average daily coconut intake of 4.65 kg/day this gives a total average daily intake for only 3 foods (coconut, breadfruit and fish) of 9 kg per day. This is compared to an average daily intake for the U.S. of 1.75 kg per day.

The net result is that I feel all of this dietary information is grossly exaggerated.

Another interesting aspect of the dietary evaluation, in addition to total mass intake, is the proposed caloric intake. These data, along with the total mass intake data, are summarized in Table 2. The total caloric intake for coconut alone is 8300 calories per day. The average U.S. caloric intake is 3210 calories per day (from Supplement for 1975 to Agricultural Report No. 138, U.S.D.A.,"

[redacted]

Again, just the cocount estimate is totally out of line. If the other two food products are included average daily caloric intake is 14,700 calories per day. I venture to say that if this were the true route of consumption there would be no such thing as a small Marshallese.

In addition to our sources of estimating the average daily coconut intake in our reports of 300 g of coconut fluid per day and 100 g coconut meat we have more recent direct observations of Jan Naidu, of Brookhaven National Laboratory. He has been living with people at both Rongelop and Uterik atolls for 6 weeks at a time and has been eating the native diet. His own

personal experience for average daily coconut intake is very near our 400 g per day total (private communication Jim Naidu, BNL). He further states that he has not observed a coconut intake anywhere near that proposed in the Bramlitt draft and feels it would be physically impossible to consume such a diet.

I think the total daily mass and calorie analyses I have gone through would indicate this to be the case.

The net result is that I feel the dose estimates based upon $^{137}Cs$, $^{90}Sr$ and transuranic intake via coconut are too high by an order of magnitude based upon dietary intake alone.

Table 1. Total Coconut Conspumtion Based upon a Population of 200 Men, 200 Women and 200 Children.

| | Men | Women | Children | Total |
|---|---|---|---|---|
| Copra Production | 360,000 | 240,000 | 180,000 | 780,000 |
| Famine | 360,000 | 240,000 | 180,000 | 780,000 |
| Food Gathering | 48,000 | 36,000 | 24,000 | 108,000 |
| Rest of the Year | 559,200 | 372,800 | 279,600 | 211,600 |
| | 1,327,200 | 888,800 | 663,600 | 2,879,600 |

Table 2. Daily Mass and Caloric Intake

| Food Product | Daily Intake g/day | Daily Intake Cumulative g/day | Calories gram | Daily Caloric Intake | Daily Cumulative Caloric Intake |
|---|---|---|---|---|---|
| Breadfruit | 1350 | 1350 | 1.09* | 1,472 | 1,472 |
| Coconut Meat | 2050 | 3400 | 4.04* | 8,282 | 9,754 |
| Coconut Fluid | 2600 | 6000 | 0.22* | 572 | 10,326 |
| Fish | 3000 | 9000 | 1.46† | 4,380 | 14,706 |

* from A Guide to Pacific Island Dietaries
J. C. R. Buchanan
South Pacific Board of Health

† from Composition of Foods-Agricultural Handbook No. 8 U.S.D.A. 1963

they would be lower than our number. Furthermore, the author reduces the dry weight coconut concentration ratio by a factor of 2 to develop the wet weight concentration ratio. However, for the major coconut form used in his diet, i.e. drinking coconuts and sprouting coconuts, the dry weight ratio must be reduced by a factor of 5 to develop the wet weight ratio. The net effect is that the author is in error by at least a factor of 2, maybe a factor 3, is the way he used our most recent concentration ratio data.

The overall error in the $^{137}Cs$ and $^{90}Sr$ dose calculations (including dietary intake and use of concentration ratio's) I feel is at least a factor of 20.

In addition the author used a wet weight concentration ratio of $4 \times 10^{-3}$ (page 15) for the transuranics. The value used in our final report [redacted] for the transuranics are off by two orders of magnitude from this parameter alone.

Corrections by a factor of 20 of the doses listed in Table X1X would indicate whole body doses from $^{137}Cs$ ranging from 15 to 80 mrem/y. The group 1 and group 1 & 2 island average is 30 and 36 mrem/y respectively.

In Table XX the maximum bone dose from $^{90}$Sr will be 97 mrem/y (Kate). The group 1 and group 1 & 2 island average for total bone dose ($^{137}$Cs + $^{90}$Sr) are 63 and 75 mrem/y respectively. All of these doses are certainly within guidelines.

The transuranic doses listed in Table XX1 are in error by at least two orders of magnitude. In addition, the last column of Table XX11 is off by a factor of 100.

As a result of the above major points I will not respond in any more detail other than to state as I did in the cover letter that the discrepancy referred to in one of our tables (see his discussion-Appendix B-LLL Study) is the result of his using a draft copy which is not to be used by someone who is not being updated on the draft. A table was printed with an error of a factor of 10. This was pointed out to those people who were supposed to be reviewing the paper and had "need to know" about the correction.

A last comment-

The final draft of our report, "Transuranic Dose Assessment at Enewetak Atoll", includes the dose estimates for $^{238}$Pu and $^{241}$Am due to grow-in from $^{241}$Pu. This addition has been planned all along although the author of the report being reviewed didn't know that as a result of misusing a draft copy of our report.

REPOSITORY PNNL

COLLECTION Marshall Islands

BOX No. 5686

FOLDER Enewetak Nov - Dec 1978

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Reviewed by [signature] Date 4/30/97