

BROOKHAVEN NATIONAL LABORATORY  
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Safety & Environmental Protection Division

December 17, 1980

Jacob Thiessen, MD, CHP  
Director, Human Health &  
Assessments Division  
Office of Health & Environmental Research  
U. S. Department of Energy  
Washington, D.C. 20545

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Dear Dr. Thiessen:

Congratulations on your new role as Director of the Human Health and Assessments Division. I would like to take this opportunity to present a synopsis of Brookhaven's Marshall Islands Radiological Safety Program activities which are related to dose reassessment since our research projects in this area are in part supported by your Division. The purpose of this research is to refine the previous estimates of dose equivalent which were received by members of the Rongelap and Utirik Atoll populations in the Marshall Islands of Micronesia who were exposed to ionizing radiation as a result of the U. S. weapons testing program. As you are probably aware, their current medical histories indicate a statistically significant elevation above the spontaneous thyroid nodule incidence in the acutely exposed population, relative to a comparison Marshallese and the United States population. This information is shown in Tables 1 and 2, along with dose equivalent estimates from two sources. The acute dose estimates are based on reports by Conard (Co 75) and upon calculations which utilize our I-129 in soil samples study. The chronic dose estimates are obtained from Conard (Co 75) and Lessard (Lo 80). The thyroid nodule prevalence in the Marshallese exposed population and the comparison population is taken from a draft of Conard's 25 year review (Co 80). Since the Marshallese comparison population was also exposed to chronic low level radiation from the weapons testing program, another estimate of the spontaneous number of benign and cancer nodules is based on United States incidence and is indicated in parenthesis.

Although there are uncertainties in the mean values reported in Tables 1 and 2, these data may be used to derive a cancer incidence per unit dose equivalent which would have practical impact on human health assessment with regard to the uses of radiation and radioactivity. In order to estimate a range and a true mean value for the incidence of nodules per unit dose equivalent and to establish the associated confidence level of the estimate, the following projects have been undertaken:

1. acute dose reassessment,
2. chronic dose reassessment,
3. analysis of plutonium and strontium in urine and teeth,
4. analysis of Castle Bravo fallout, and
5. diet and living pattern study.

The acute dose reassessment from Castle Bravo fallout on Rongelap and Utirik Atolls is partially complete and uses three independent approaches: 1) biological samples, 2) soil samples and 3) weather data obtained during the 1954 thermonuclear test experiment at Bikini Atoll. Each approach requires the evaluation of large volumes of data, the development of mathematical models, and the performance and verification of numerous calculations. Additionally, we are considering other factors such as the solubility of iodine isotopes in fallout, the possible contribution from neutron induced activity, the impact of thyroid seekers other than iodine isotopes on dose, and confidence levels for values of derived quantities such as airborne activity concentrations and thyroid dose equivalents for different age groups.

The chronic dose reassessment is completed and results for the population averages are available (Le 80). This work has application to the ongoing radiological safety program on Rongelap and Utirik Atolls and is useful in predicting future dose equivalents to persons who return to Enewe Island at Bikini Atoll and to Enewetak Atoll. Individual dosimetric data is maintained in a data base at Brookhaven National Laboratory.

Analysis of plutonium in urine and teeth has led to large uncertainty in the estimate of the true mean value for the sample population due to the fact that measurements are at or near the lowest limit of detection. The practical significance of this has led us to optimize our procedures and to employ a variety of techniques for measurement. Our main goal will be to achieve measurements at a level which impacts insignificantly on the dose estimate for blood forming organs.

Currently we are attempting to obtain a small amount of Castle Bravo fallout which has been kept in Japan following its removal from the Lucky Dragon, a Japanese fishing vessel which had sailed through the tropospheric Bravo cloud in March, 1954. Analysis of this ash could lead to a verification of the iodine isotope yield per unit fission. This could be analyzed by neutron activation (as were the historic soil samples which were used in the acute dose reassessment) in order to quantify the long lived fission product I-129. The iodine isotope production is a variant according to weapon design and its value has a major impact on acute exposure thyroid dose equivalent estimates.

The evaluation of diet and living patterns among the inhabitants of the Northern Marshall Islands and the data gathered on their anthropometric and physiologic characteristics are used as input to the external and internal

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dose equivalent estimates. This project is ongoing and relates directly to contemporary radiation protection operations. For example, we are currently focusing on infant and small child dosimetric parameters, such as absorbed fractions and daily activity ingestion rates, which have impact on both retrospective and prospective dose assessments.

This letter is meant to acquaint you with some of the activities of members of the Marshall Islands Radiological Safety Program. We, Jan Naidu, Robert Miltenberger and myself extend our best regards in your new role as Director of the Human Health and Assessments Division. Additionally, I would like to meet with you briefly in the future in order to update our progress. I hope that it will be convenient for you if I stop in during my next visit to DOE headquarters which will occur after the holidays.

Sincerely,

*Edward T. Lessard*

Edward T. Lessard  
Project Leader, Marshall Islands  
Radiological Safety Program

ETL/slg

cc: C. Meinhold  
T. McCraw

## References

- Co 75 Conard, R. A., et.al, 1975, A Twenty Year Review of Medical Findings in a Marshallese Population Accidentally Exposed to Radioactive Fallout, BNL 50424.
- Co 80 Conard, R. A., et.al., 1980, A Twenty <sup>Six</sup> ~~Five~~ Year Review of Medical Findings in a Marshallese Population Accidentally Exposed to Radioactive Fallout, BNL in press.
- Le 80 Lessard, E. T., Greenhouse, N. A., and Miltenberger, R. P., A Reconstruction of Chronic Dose Equivalents for Rongelap and Utirik Residents-1954 to 1980, BNL 51257

Table One  
People (>18) Thyroid Dose Equivalent and  
Thyroid Nodules

<u>Group</u>	<u>Rem(A)</u>	<u>Rem(B)</u>	<u>Population</u>	<u>Observed Number(C)</u>		<u>Expected Spontaneous Number(C)</u>	
				<u>Benign Nodules</u>	<u>Cancer Nodules</u>	<u>Benign Nodules</u>	<u>Cancer Nodules</u>
Acute Rongelap	340	4200	44	7	2	3.6 (1.7)	.35 (.23)
Acute Utirik	30.	D	79	8	1	6.4 (3.0)	.63 (.41)
Chronic Rongelap	7.0	4.5	73	9	1	5.9 (2.8)	.58 (.38)
Chronic Utirik	4.0	16	38	2	1	3.1 (1.4)	.30 (.20)
Total	_____	_____	234	26	5	19 (8.9)	1.9 (1.2)

- A. Co 75
- B. Lessard, E.T., Naidu, J., Miltenberger, R.
- C. Co 80
- D. To be analyzed

Table Two  
People (<18) Thyroid Dose Equivalent and  
Thyroid Nodules

<u>Group</u>	<u>Rem(A)</u>	<u>Rem(B)</u>	<u>Observed Number(C)</u>			<u>Expected Spontaneous Number(C)</u>	
			<u>Population</u>	<u>Benign Nodules</u>	<u>Cancer Nodules</u>	<u>Benign Nodules</u>	<u>Cancer Nodules</u>
Acute Rongelap	450	9200	42	20	2	.42 (.32)	.13 (.034)
Acute Utirik	62	(D)	79	4	2	.79 (.57)	.24 (.063)
Chronic Rongelap	3.5	4.8	487	2	1	4.9 (3.5)	1.5 (.39)
Chronic Utirik	2.0	19	335	4	1	3.4 (2.4)	1.0 (.27)
Total	_____	_____	943	30	6	9.5 (6.8)	2.9 (.76)

A. Co 75

B. Lessard, E.T., Naidu, J., Miltenberger, R.

C. Co 80

D. To be analyzed



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Jacob Thiessen, M.D., CHP  
Director, Human Health &  
Assessments Division  
Office of Health & Environmental  
Research  
U.S. Department of Energy  
Washington, D.C. 20545

Dear Dr. Thiessen:

The following error in my December 17, 1980 communication to you should be corrected as follows:

Co 80 Conard, R. A., et. al., 1980, A Twenty Five Year Review of Medical Findings in a Marshallese Population Accidentally Exposed to Radioactive Fallout, BNL in press.

should read:

Co 80 Conard, R. A. , et. al., A Twenty Six Year Review of Medical Findings in a Marshallese Population Accidentally Exposed to Radioactive Fallout, Draft.

At this time I should like to wish you a happy holiday season.

Sincerely,

*Edward T Lessard*

Edward T. Lessard  
Project Leader,  
MIRSP

ETL/cc