OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

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# *Memorandum*

**TO** : Those listed below **DATE:** March 3, 1967

**FROM** : Gordon M. Dunning for
Tommy F. McCraw, Physicist
Nuclear Explosives Environmental Safety Branch, OS

**SUBJECT:** PRELIMINARY DRAFT PLAN FOR MEASUREMENT OF EXTERNAL NUCLEAR RADIATION LEVELS AT BIKINI ATOLL

OS:NEES:TFM

Mr. Arnold Joseph and I have discussed the desirability of circulating for comment a draft copy of the plan for external radiation measurements at Bikini. The attached plan is a first attempt to describe the types and numbers of measurements of external nuclear radiation that would be needed to determine what exposure any future residents may receive. It is, of course, tentative, incomplete, and subject to change. Any comments, changes, or additions you may have would be most welcomed.

Attachment:
Draft Plan for Measurement of External
Nuclear Radiation Levels at Bikini Atoll

Addressees:
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With attachments
CONFIRMED TO BE UNCLASSIFIED
AUTHORITY: DOE/SA-20
BY ~~H.R. SCHMIDT~~ D.R. GILSON DATE: 6-16-94

From NMP-K

From NMP-K

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D/C - Navy - Re. medical Survey

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PLAN FOR MEASUREMENT OF EXTERNAL NUCLEAR RADIATION LEVELS AT BIKINI ATOLL, MARCH 1967

Purpose. The purpose of this plan is to describe procedures to be used ~~(in obtaining data that will provide a basis)~~ for determining external radiation levels that exist on various islands of Bikini Atoll.

Discussion. In order to establish the levels of radiation that may be found at Bikini Atoll, it may be worthwhile to review briefly the data collected during the most recent sampling mission conducted in 1964 by the University of Washington, under contract with the Division of Biology and Medicine, and to present for comparison the reported levels for Rongelap Atoll at the time of repatriation. The attached Table presents these data. The average level of external radiation on Rongelap Island (0.03 mr/hr) at the time the inhabitants were returned was only slightly higher than the average value used for natural background radiation for the U. S. population of about 100 to 200 mr/yr. or about 0.02 mr/hr. The average level on Bikini Island in 1964 was about 0.04 mr/hr with Enyu Island at a somewhat lower level of 0.01 mr/hr. These two islands contain the major land masses within the atoll and as such represent the most likely areas of habitation. Though these values are low, it is important to determine with confidence the range of external radiation levels that exist on Bikini Atoll. Such external radiation exposures, above background, must be added to that from internal emitters in order to arrive at the total dose any permanent resident may receive from past tests. Considering the uncertainties inherent

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in making measurements at such low levels in the field, it is highly desirable to have a redundancy in measurements and in instrumentation. Considering that there will be degrees in mobility among any future residents, as a function of age, sex, etc., it is necessary to collect data for a number of locations within the Atoll with particular attention given to possible village sites on the larger islands.

Types of Measurements. To provide a redundancy in types of measurements for the two main islands of Bikini and Enyu, measurements will be made by use of both portable hand held (beta-gamma) instruments and by dosimeters such as the thermoluminescent type throughout locations determined to be potential village sites./ The type, number, and source of instruments is presented under instrumentation. Where possible, both types of measurements will also be made at locations where soil samples are collected to provide for a comparison between measured levels of gamma radiation and gamma levels predicted from soil radionuclide determination. Area coverage of gamma and beta-gamma levels over these two islands will consist of measurements at the surface and three feet above the surface by portable hand held instruments. One or more lines of measurement locations will be established across each of the two islands with at least one such line at or near the geographic midpoint. The exact locations and number of transects will be determined on-site considering the impediment of vegetation and the time available. Other measurement points will be selected along the length of each island, the number and location determined on-site considering accessability and available time. Where possible, monitoring at each point will consist of

three measurements spaced around the point, to be averaged for a value at that point.

To provide the maximum exposure duration for dosimeters, such devices will be put in place on Bikini and Enyu Islands upon arrival at the Atoll. It is desirable to establish five or more measurement locations for each potential village site with dosimeters placed at the surface and three feet above the surface. Dosimeters are to be placed in each remaining structure such as buildings and bunkers that could be used for shelters. These devices will be recovered just prior to departure and will be transported to USNRDL for processing (readout) by the fastest available means. There will be minimum delay in analysis.

Present plans (see attached schedule) call for a single visit to ten or more additional islands in Bikini Atoll although it may be practical to modify the tentative schedule such that certain islands may be visited more than once. A single short visit generally rules out use of devices that require an extended exposure period. There may be some exception for any area wherein portable instruments indicate levels sufficiently high that a readable exposure may be accumulated during the planned stay time on the island. Therefore, exposure levels on islands with a one day visit will be documented primarily through measurements by portable hand held instruments. A number of measurements sufficient to cover the area of the island and providing redundancy in the data will be taken. Any remaining structures including bunkers that could be used for shelter will be monitored both inside and outside.



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Where possible, measurements will also be made for comparison with predictions from soil sampling data. Generous use will be made of photography to describe the areas monitored.

Several of the islands of Bikini Atoll have been exposed to the cratering effects of past tests. Eninman Island, which showed some of the higher radiation levels in 1964, is such an island having had two events, Koon and Zuni, which resulted in cratering a portion of the island (see UCRL-12172). Portable instrument measurements of gamma and beta-gamma levels will be obtained in the vicinity of the cratered portion of each such island. Debris and any remaining man-made objects, particularly those that may have utility as building materials, will be checked for surface contamination and induced radioactivity through measurement of gamma, beta, and alpha levels. Locations showing higher levels for the August 1964 survey will be remonitored. These locations are shown in the field notes prepared during the earlier survey. Where practical, island locations with lower levels, as specified in these notes, will also be remonitored.

Documentation. Appropriate procedures will be employed to assure proper calibration of portable instruments and to provide an acceptably small degree of uncertainty in measurements. Records will be developed identifying the time and location of each measurement, and the instrument type and number and the expected accuracy of the measurement will be shown. Records will also be developed describing the use of controls and the processing of dosimeter devices with expected accuracy for each data point.

Personnel Dosimetry. Each member of the team will be provided one or more personnel dosimeters to be worn throughout the stay at Bikini Atoll. These devices will be processed at the first opportunity and records will be prepared showing the dose received and the itinerary of the individual wearing the dosimeters. Where practical, each member of the team will arrange for whole body counting for $^{137}Cs$ prior to departure and again upon return. These measurements will be included in the records of measurements obtained by the team.

Special Measurements. A return to Bikini Atoll will undoubtedly result in some modification of the radiation environment. It is desirable to take account of this fact in any estimates of exposures that may be received. For instance, the clearing of vegetation for a village site may have a significant effect upon external radiation levels in that area. Such vegetation provides shielding against radiation from radioactivity in the environment. However, there may be a contribution to the external radiation field from radioactivity in the vegetation.

Measurements of gamma and beta-gamma radiation will be made at ground level and at three feet before and after removal of vegetation. These measurements will be made in conjunction with another study, based on agricultural considerations, to determine the weight of vegetation per unit area. Ideally it would be desirable to remove the vegetation in a large circular area within the village site on Bikini ~~At~~ Island. From a practical viewpoint, the size of the cleared area will be determined by the physical ability of those who perform this chore and available equipment. A single area

with a radius of 15 to 20 feet may be possible. A lightweight gasoline powered chain saw may be of great assistance. Such an activity will not be allowed to interfere with other portions of the monitoring effort.

An additional series of measurements is planned for the potential village sites on Bikini and Enyu Islands using a high pressure ion chamber, for total dose measurements, and a portable field gamma spectrometer to determine the contribution to dose from various radionuclides. The equipment for these measurements is listed in the section in Instrumentation. Locations for such measurements in the village sites will be chosen to provide for an intercomparison of measurements that have been obtained by various types of instruments. The records prepared for these measurements will contain a description of each monitored location, time, a description of the instrumentation and calibration procedures, and expected accuracy for the measurements.

Assignment of Tasks. A division in responsibilities for performing the external measurements is presented in the attached "Assignment of Tasks".

Instrumentation. The following instruments are to be used.

| Type | Number | Supplier | Comments |
|---|---|---|---|
| ANPDR-27F | 6 + spares | USNRDL | Beta, plus beta-gamma, low scale to read 0.01 mr/hr. |
| Mark 54 | 2 + spares | USNRDL | Alpha. |
| TLD | 100 | USNRDL | To be prepared and read at NRDL. |
| Radioactive Source | 1 | USNRDL | For instrument calibration. |
| High Pressure Ion Chamber | 1 | HASL | For dose measurements. |
| Portable Gamma Spectrometer | 1 | HASL | To determine contribution to dose by radionuclide. |

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TABLE

SUMMARY OF EXTERNAL GAMMA LEVELS AT RONGELAP AND BIKINI ATOLL

RONGELAP ISLAND [1]

Rongelap Island[2]

End of July 1956. 0.2 - 0.5 mr/hr ave. = 0.4 mr/hr

Dose rates at time of repatriation should be < 30 mr/wk

June 1957, 3 ft. above ground (time of repatriation).

| | |
|---|---|
| Highest | 0.13 mr/hr |
| Lowest | 0.01 mr/hr |
| Ave. | 0.03 mr/hr |

Other Islands

The highest level on any other island at the time of repatriation was about a factor of twelve higher than Rongelap.

Bikini Atoll[3]

Bikini Island

August 1964, 3 ft. above ground.
ave. = 0.04 mr/hr

Enyu Island

August 1964, 3 ft. above ground.
ave. = 0.01 mr/hr

Aomoen to Yurochi Islands

August 1964, 3 ft. above ground.
ave. = 0.16 mr/hr

(According to the field notes, Station V at the eastern end of Romuk showed the highest levels found with average values of 2 mr/hr and 0.5 mr/hr gamma at ground level and at 3 feet and 10 mr/hr and 4.6 mr/hr beta-gamma for the same conditions.)

Nømu Island

August 1964, 3 ft. above ground
ave. = 0.09 mr/hr

Bokororyuro Island

August 1964, 3 ft. above ground.
ave. = 0.07 mr/hr

Eninman to Airukiiji Island

August 1964, 3 ft. above ground.
ave. = 0.15 mr/hr

Average for Bikini Atoll is 0.08 mr/hr.

1. "Radioactive Contamination of Certain Areas in the Pacific Ocean From Nuclear Tests", August 1957, Gordon M. Dunning.

2. Possibly influenced by fallout from later tests during Operation Redwing.

3. Results obtained by University of Washington sampling mission, August 1964, under contract with Division of Biology and Medicine.

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# TENTATIVE BIKINI EXPEDITION SCHEDULE - MARCH & APRIL

| | | | |
|---|---|---|---|
| Thursday | March | 9 | Seattle to Honolulu |
| Friday | | 10 | Honolulu - Booking, meeting with Mason |
| Saturday | | 11 | Pick up supplies |
| Sunday | | 12 | Free |
| Monday | | 13 | Leave Honolulu |
| Tuesday | | 14 | Arrive Kwaj (Day lost crossing date line) |
| Wednesday | | 15 | Kwaj |
| Thursday | | 16 | Kwaj - Load ship, depart P.M. |
| Friday | | 17 | Arrive Bikini Island - Unload, ship departs P.M. |
| Saturday | | 18 | Bikini Island |
| Sunday | | 19 | Bikini Island |
| Monday | | 20 | Bikini Island |
| Tuesday | | 21 | Bikini Island - Part of party to Bokan and Yoran and return |
| Wednesday | | 22 | Bikini Island to Enyu Island |
| Thursday | | 23 | Enyu Island to Bikini Island via Ion Island and Rokar Island |
| Friday | | 24 | Bikini Island to Erik Island |
| Saturday | | 25 | Erik Island - Arji Island |
| Sunday | | 26 | Erik Island - Arji Island |
| Monday | | 27 | Arji Island to Bikini Island |
| Tuesday | | 28 | Bikini Island to Amoen Island |
| Wednesday | | 29 | Amoen Island - Yuro Island |
| Thursday | | 30 | Yuro Island - Namu Island |
| Friday | | 31 | Namu Island - P.M. ship arrive (or see below) |
| Saturday | April | 1 | A.M. ship arrive - Move party to Boro Island and Chieeriete Island, P.M. anchor off Bikini Island |
| Sunday | | 2 | Load gear, collect food samples, P.M. depart for Kwaj |
| Monday | | 3 | A.M. arrive Kwaj - Ship released after unloadi |
| Tuesday | | 4 | Leave Kwaj<br>Day gained crossing date line |
| Monday | | 3 | Two members of party arrive Johnston Atoll - Remainder of party proceed to Honolulu |
| Tuesday | | 4 | Johnston Atoll |
| Wednesday | | 5 | Johnston Atoll |
| Thursday | | 6 | Johnson Atoll |
| Friday | | 7 | Leave Johnston Atoll - Arrive Honolulu |
| Saturday | | 8 | Leave Honolulu |

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SHIPS SCHEDULE

| | | | |
|---|---|---|---|
| Wednesday | March | 15 | Arrive Kwaj with Conard's party |
| | | 16 | Load Bikini party - proceed to Bikini Island |
| | | 17 | Arrive Bikini; set party and gear ashore; ship released. |
| | April | 1 | A.M. Arrive Namu Island, Bikini Atoll |
| | | 2 | P.M. Leave Bikini |
| | | 3 | A.M. Arrive Kwaj; off load party and gear; ship released. |

ASSIGNMENT OF TASKS

| Name | Organization | Telephone | Duties |
|---|---|---|---|
| McCraw, T. F. | OS, USAEC | 973-4281 (Code 301) | Plan and conduct program of external radiation measurements. Liaison with HASL, USNRDL, FRC, and University of Washington. Assistance in radiation measurement and sample collection activities. Evaluation of collected data. |
| Tomnovec, F. M. | USNRDL | 648-6900 (Code 415) | Scientific coordinator for USNRDL. Planning for field measurements of gamma, beta-gamma, and alpha radiation. Selection, preparation, calibration, and employment of hand-held survey instruments and dosimeters. Laboratory analysis of dosimetric devices. Assistance in other radiation measurement and sample collection activities. |
| Beck, H. | HASL | 989-1201 (Code 212) | Planning for high pressure ion chamber and gamma spectrometer measurements at potential village sites. Preparation, calibration, and employment of instruments and equipment. Assistance in other radiation measurement and sample collection activities. |
| Jones, E. W. | USNRDL | 648-6900 (Code 415) | Instrument maintenance and repair and data recording. Assistance with radiation measurement and sample collection activities. |



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July 10, 1968

SECRETARIAT

AEC 604/110

# INFORMATION MEETING ITEM

## RADIOLOGICAL HAZARDS OF RESETTLEMENT OF THE BIKINI ATOLL

### Note by the Secretary

1. The General Manager has requested that the attached memorandum of July 8, 1968 from the Director of Biology and Medicine transmitting the Ad Hoc Committee's report, with attachments, be circulated for consideration by the Commission at an early Information Meeting.

2. Additional background information is contained in Secretary of Interior Udall's June 26, 1968 letter to the Chairman and in Mr. S. D. Ripley, Smithsonian Institution, June 4, 1968 letter.

F. T. Hobbs

Acting Secretary

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From NMB-K

With attachment



ADD

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D/C. Navy - Resettlement Bikini Atoll



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