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PLANNING AND OPERATIONS DIRECTIVE 1975 BIKINI RADIOLOGICAL SURVEY

JUNE 1975

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
NEVADA OPERATIONS OFFICE
LAS VEGAS, NEVADA

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U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
LAS VEGAS, NEVADA

PLANNING AND OPERATIONS DIRECTIVE
(NVO -- 58)

PROJECT:	1975 Bikini Atoll Radiological Survey
SPONSOR:	U. S. Energy Research and Development Administration
TECHNICAL AGENCIES:	LLL, EPA, University of Washington Brookhaven National Laboratory

Signed: for C. E. Williams
Mahlon E. Gates, Manager

Date: 12 June 1975

PLANNING AND OPERATIONS DIRECTIVE

(NVO - 158)

1975 BIKINI ATOLL RADIOLOGICAL SURVEY

PLANNING AND OPERATIONS DIRECTIVE

(NVO - 158)

I. BACKGROUND

The Bikini Atoll was extensively used during the 1950's for atmospheric nuclear testing, necessitating displacement of the Bikinians. The rehabilitation of Bikini Atoll and the resettlement of people on Bikini and Enyu Islands has been approved and the project is underway with approximately 80 people now residing on these two islands.

The need for a more comprehensive survey of Bikini Atoll was recognized in October, 1974, following a visit to the Marshall Islands by Defense Nuclear Agency, Department of Interior and ERDA representatives. ERDA became committed to the early accomplishment of this survey in a meeting with Trust Territory representatives in Anaheim, California, in January, 1975.

II. PURPOSE

The purpose of the 1975 Bikini Atoll Radiological Survey is to conduct a Gamma Survey which will supplement Brookhaven National Laboratory data and provide information for advising the Department of the Interior on the location of Phase II homes and to conduct a soil, plant and water sampling program. This planning and operations directive provides guidance and defines responsibilities for the conduct of this survey.

III. AUTHORITY

Authorization and guidance for the Bikini Atoll Radiological Survey was furnished NV per teletype from ERDA/HQ dated May 19, 1975, attached as Appendix A.

IV. CONCEPT OF OPERATIONS

The 1975 Bikini Atoll Radiological Survey will include sampling of biota, soil and ground water on Bikini and Enyu Islands (see Appendix B). Specifically, soil profile and surface samples will be taken around existing structures, proposed housing sites and in agricultural areas. Skimming wells will be dug to take soil samples at various depths and to collect water samples.

IV. CONCEPT OF OPERATIONS (Cont'd)

Initial deployment of equipment and survey personnel will be via commercial aircraft and military aircraft from various CONUS points to Kwajalein. Personnel and equipment will assemble at Kwajalein and continue on to the Wake Island Facility (WMK) (I-54 and the Marshall Islands Facility (MAJ) (Majuro). Upon completion of the survey, personnel will return to Kwajalein via MAJ (I-54 commercial aircraft). Equipment shipments will be handled by military aircraft. The [illegible] survey itself will be followed by [illegible] of targets by [illegible] photographers and Lawrence Livermore Laboratory.

V. ORGANIZATION

Management of the survey operations will be the responsibility of the KV Flood Survey Leader. The Test Director (TD) will advise and support the KV Flood Survey Leader and has full authority and responsibility for the test portion of the plan (see Appendix C).

The survey party is expected to include representatives of:

A. Division of Nuclear Safety (DNS), IAEA/UN

B. Office of the Assistant Manager for Operations (AMO), DOE

C. Lawrence Livermore Laboratory (LLL)

D. Environmental Protection Agency (EPA)

E. Brookhaven National Laboratory (BNL)

F. University of Washington

VI RESPONSIBILITIES

A. Department of Energy (DOE)

1. Grant authority for the conduct of the 1975 Bikini Atoll radiological survey to the Division of Operational Safety (DOS) IAEA/UN.

VI. RESPONSIBILITIES (Cont'd)

2. Assure that the Bureau of Indian Affairs Administrative and other appropriate agencies or organizations are aware of the survey responsibilities and guidelines of the survey.

B. Division of Operational Safety (DOS/WO)

The Division of Operational Safety, DOS/WO, is responsible for coordination with the Department of Interior and all other Washington level agencies and officials.

DOS will also be responsible for program guidance, evaluation of survey data and for dissemination of information concerning plans for further development of Island Atoll.

C. Nevada Operations Office

1. Assistant Manager for Operations, NV

a. Is responsible to the Manager, NV for successful accomplishment of the DOE share of survey and preparation of required survey reports.

b. Is responsible for interfacing Trust Territory and Bikini Island staff with other concerned field agencies.

c. Assures the appropriate technical and logistic support for the conduct of the terrestrial survey.

d. Will select Lead Agency to accomplish the laboratory analysis work.

e. Assures that the agency survey reports are developed and submitted to DOS/WO as required.

2. Assistant Manager for Plans, Evaluation and Budget, NV

NV is responsible for assuring preparation of fiscal support and survey funding.

D. Technical Director

The Technical Director will be responsible to the ARC, NV, for the following:

1. Preparation of a definitive technical plan.

2. Direction of the recorder's staff in the field.

3. Preparation of the final survey report.

E. Lawrence Livermore Laboratory (LLL)

LLL will be responsible to the ARC, NV, for the following.

1. Providing a recorder's function.

2. Supporting sample collection and laboratory analysis required for dose assessment, pathway assessment and leaching studies.

F. Environmental Protection Agency (EPA)

EPA, NERC/LV will participate in the conduct of this survey by assisting the technical director in radiation measurement, and soil sampling programs.

G. University of Washington

U of W will assist in sample collection, analysis and dose assessment as required.

H. Brookhaven National Laboratory (BNL)

BNL will assist in sample collection, analysis and dose assessment as required.

I. EG&G, Inc.

EG&G will provide aerial photography, photo mapping of Bikini and Enewetak to facilitate participation in the ground survey (photographic mission completed May 28, 1978).

VII. SCHEDULE

The schedule for the 1975 Bikini Radiological Survey is:

June 13 All survey parties and equipment on location at Kwajalein.

9 Personnel and ships prepare for departure.

11 0800 ship departs Kwajalein for Bikini.

15 1400 arrives Bikini; personnel depart Kwajalein for Bikini via C-54.

16-20 Survey conducted.

20 Personnel depart Bikini via C-54, LCU depart Bikini for Kwajalein.

27 Personnel depart for Honolulu.

VIII. FUNDING

Funding for this survey is the responsibility of each participant organization.

IX. REPORTS

Survey reports from participating personnel will be submitted to the Technical Director for his review and approval.

The final survey report will be prepared by NV and submitted to DOE, ERDA/NV for evaluation.

WWM

[illegible] REFERENCE [illegible]

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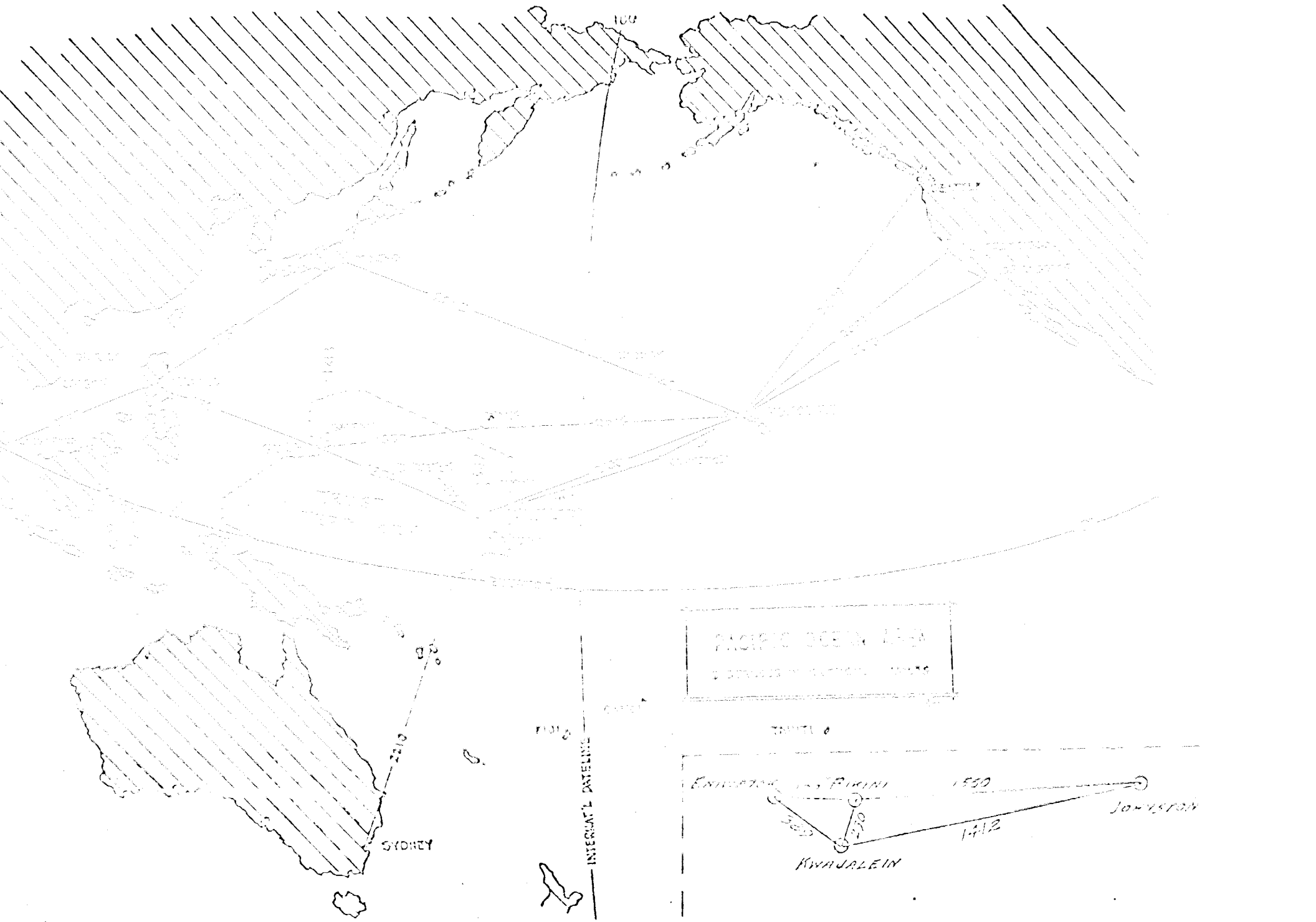
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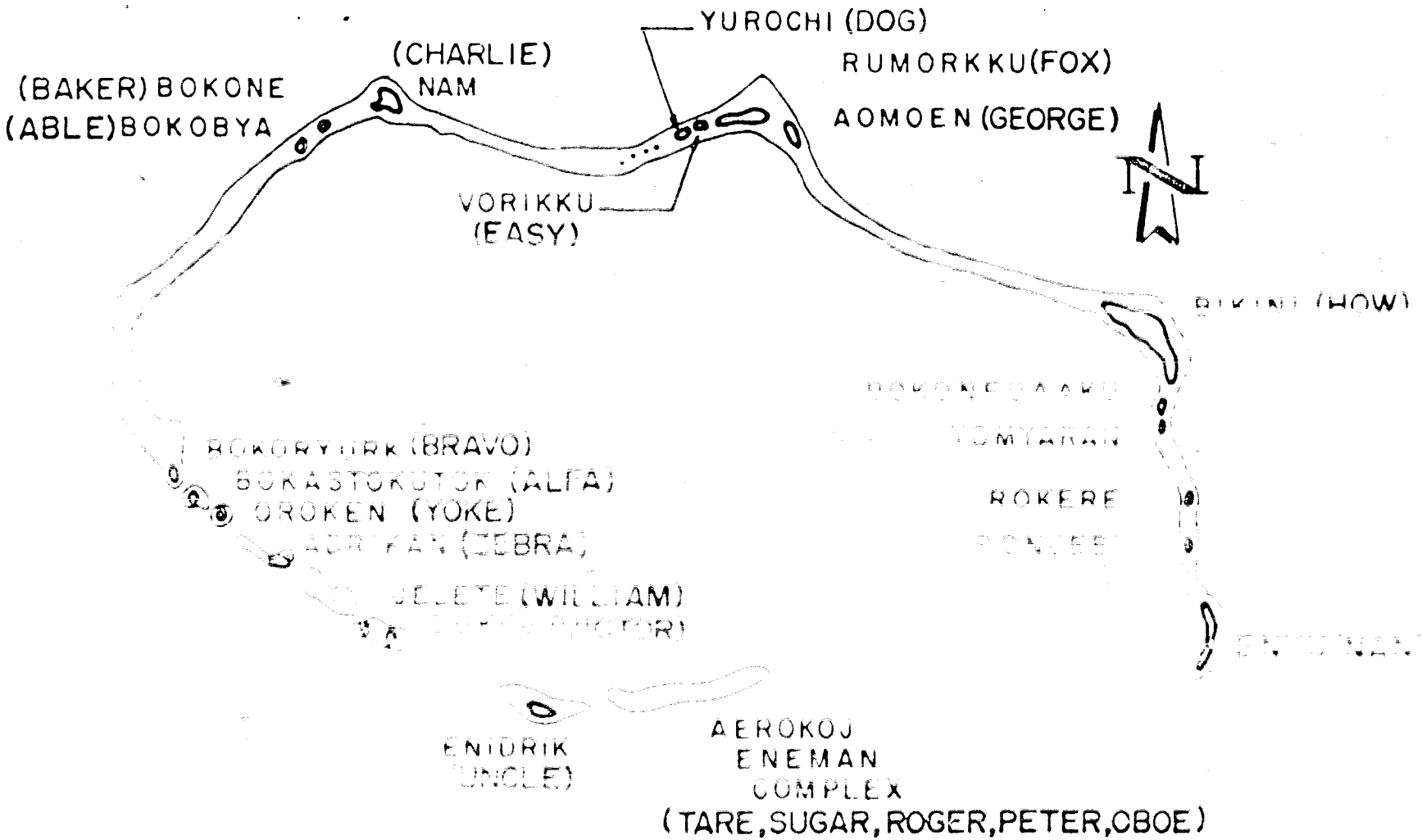

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1974 MARSHALL ISLANDS SURVEY

Bikini and Enewetak Separate Soil Survey Program

Purpose: Soil Survey

The soil sampling program is designed to quantify the primary radionuclides contributing to the external gamma exposure and to determine the geographical distribution of these radionuclides in the soil on Bikini and Enewetak Islands of the Pacific Ocean. Every effort will be made to integrate this sampling program with previous programs to avoid undue duplication of effort. The actual number of samples and their specific collection sites will be a function of (1) the expected activity levels, (2) future land use considerations, (3) land ownership patterns, and (4) the needs and techniques of actual soil samples collected by other programs.

Methods and Materials

Two types of soil samples will be collected for analysis: (1) a 15-cm-deep surface soil sample of 60 cm² area, and (2) a profile collection based upon sieving all samples from a 30-cm² area soil sample of 100 cm² area are collected at 15-cm depth intervals to a total depth of 90 cm. For purposes of discussing the survey, Bikini Island may be divided into the north, central, and south sections by the approximate sand baseline roads. Bikini is also divided into the north and south sections divided by the runway. It appears necessary to collect surface and profile samples to be analyzed within these sections separately to fully determine the major fraction of the radiation hazards will be contained within the central portion of Bikini Island, but in which relatively higher and more variable gamma exposure rates are found due to the fact that a major fraction of the activity is still likely to reside within this portion. Only a few profile samples will be used in this area because several of these have already been collected during previous surveys. The north and south sections of Bikini Island are not as heavily exhibit relatively lower contamination levels, hence the sampling density is lower. Specific sampling locations will be given on the figures and in both surface and profile locations may be changed as these areas.

Table 1. Number of soil sample locations to each island

	No. of Sample Locations	
	Surface (0-15 cm)	Profiles (0-90 cm)
Bikini		
North of Second Runway	25	2
Central Section	200	7
South of Second Runway	25	2

Table ... Number of soil sample locations for each subarea (continued).

	No. of Sample Locations	
	Surface (0-15 cm)	Profiles (0-90 cm)
Eneu		
North of Runit	68	4
South of Runit	40	2
TOTAL	350	12 (6 samples each)

The exact soil sampling locations will actually be determined by a random selection process to obtain statistically meaningful and unbiased results. Special samples will also be collected within "hot spot" areas or other areas of special interest. The samples will be placed in plastic bags with appropriate identification tags and readied for shipment to LLL, where they will undergo preparation and gamma spectral analysis. It is anticipated that analyses for other radionuclides of interest, such as plutonium 239 and strontium 90, will be performed by a contractor laboratory.

Purposes of Soil Survey

The primary purpose of the soil survey is to conduct on the ground measurements to provide detailed evaluations of the geographical variability of the exposure rates on Eneu and Bogon Islands, and to provide overall verification of exposure rate measurements made during previous visits.

Methods and Materials

The program utilizes the Eberline Model E-520 survey meter which consists of a 2-liter chamber filled with argon gas under pressure. The instrument is specifically designed for measuring gamma exposure rates in the 1 μR/hr to 2 R/hr range. It is calibrated annually at the primary calibration range of the Nuclear Radiation Development Laboratory, Las Vegas, Nevada. Until the completion of the soil sample analyses, our experience is basically based upon Cesium and Plutonium radiation because of the dominance of these two radionuclides in the Pacific. We will also utilize the Bendix Model 1023 portable ionization chamber. The current produced by the radiation is collected within the chamber is measured by a vacuum-tube electrometer and digital readout. The instrument exhibits a flat energy response over all gamma ray energies of interest to this survey. It is capable of measuring exposure rates from about 1 μR/hr to 200 μR/hr with an accuracy of about 5%. Thus, the results derived from this instrument can be readily used as reference to which measurements obtained by other instruments can be compared.

Measurements of the exposure rate at 1 m above the ground will be made with the NaI radiation meter at each of the vegetation locations on both islands. The location number will be permanently marked for re-measurement within the initial session of field investigations. Additional measurements to be made at selected areas. Thus, these programs a comprehensive picture of the present gamma exposure rates will be available for both islands.

Subsurface Water Survey

Purpose: To drill a network of well locations on Eilson and Lacy Islands in order to analyze the groundwater geology and to systematically study the hydrology and movement of radionuclides, major ion and trace elements in the ground water system. Both seasonal and multiyear time will be examined to determine the transport of the radionuclides deposited in the soil zone due to rainfall percolation.

Methods and Procedures

Approximately 7 holes will be drilled with a power auger at selected locations from the centerline to both ends of each island. Pits will be dug with a backhoe to penetrate deeply into the ground water reservoir. Water will be encountered by 2 m (6 ft) below the ground surface. It must be noted that the progress of this program will be seriously hampered if a backhoe is not available to support our effort. The auger will penetrate the ground water to a depth of approximately 3 to 5 feet. Each hole will be cased with 6" (15.2 cm) diameter PVC pipe and the pipe will be extended to the soil surface. The pit will be back-filled to ensure that any groundwater sample is representative of the water.

The first hole will be located near the island center. The outfall of the water will be measured with an instantaneous probe. Two holes will then be drilled to locate the water table and the salinity will be measured by each. We will continue drilling up to 7 holes on each island proceeding in the direction of the freshest indicated ground water. The well providing the maximum yield of water having the freshest water is designated as the well. Water will be pumped from the well, filtered, and treated. Radioactivity, major elements, nutrients, and bacteria concentrations will be made at the laboratory to provide data for water use. Specific wells (to be defined by the field) will be pumped continuously over a 30 day period carefully sampled to follow the changes in water quality as a function of time. Recommendations will be made on the potential usefulness of the ground water resources for agriculture, domestic, or fishing purposes. Two closely spaced wells, located in Sites 6 & 7 designated soil coupons on the local groundwater quality. Soil boring and hydrologic experiments are also planned. The well location, drilling, and sampling, however, are the final tasks during the two weeks allotted for this program.

Methods and Measurements

The sampling program will therefore consist of [illegible] series composed of food species and soil and water samples which will be obtained on and [illegible] species available on [illegible]. A broader sampling program which will be based upon widely available species, probably Messerschmidia or Scaevola, will also be carried out to determine the intra-island variations in specific radionuclides. These data will be valuable in assessing [illegible] and to correlate with the broad soil radioactivity survey for the whole island.

An attempt will be made to correlate the sampling site soil, the ground water survey to provide data on the [illegible] at the given site. All food species, especially coconut and fruiting [illegible] Bikini will be sampled to [illegible] if the availability of weather permits. Soil profiles (0/15 cm) will be obtained [illegible] sampled to determine the concentration of radionuclides in the soil, the soil water, and the organic fraction. A large [illegible] of soil (3 kg.) from the organic zone of the soil (0-30 cm. deep) will be taken to [illegible] leaching measurements of soil retention under shading. Both leaves and fruit will be sampled to permit [illegible] coefficients to be calculated. Control species will also be [illegible] to the vicinity of the food species to provide information on species variation in radionuclide uptake, and to evaluate the use of [illegible] concentrations in predictive assessment of human intake where no food products are available for analysis. This approach was used in the [illegible] survey because of the paucity of food species on the atoll.

This program [illegible] will be proved quite [illegible] and will supply the database for assessing the long-term [illegible] on the food chains upon rehabitation of the atoll and inclusion of coconut, [illegible] fruit, bananas, and papayas in the diet.

Aerial Air Sampling Program

Due to limited support facilities, personnel, and time, and due to other program demands for ship time required as a result of the delay in fielding the previous survey, there will be no attempt to establish and air sampling program during this survey.

Assessment of the fresh water residence time will be made from the data. The well network, once established, will be available for resampling on subsequent trips we plan to the atoll to thoroughly assess the dynamics of radionuclide cycling in the ground water reservoir and to maintain a surveillance on the water quality. The program operation will be fashioned after our Enewetak ground water study and comparison of the data from both atolls should be especially valuable for predicting the mechanism and rates of constituents in ground water at Pacific atolls. The U. of Hawaii (Dr. R. Buddemeier) will have the analytical responsibility for major element analysis and LLL (V. E. Noshkin) will have the responsibility for radionuclide assessment. We will determine the concentrations of Cs137, Sr90, and plutonium in all samples by radio chemical techniques. Gamma emitters present in a ferric hydroxide precipitate will be identified and the levels assessed from the spectrometry data. Tritium will be measured on selected samples.

Plant/Soil Sampling Program

Purpose: The main thrust of the program will be to determine radionuclide concentrations in food species, to correlate these with soil concentrations at various depths, to determine nuclide availability to plants in the coral soils, and to relate the food-species radioactivity to other indigenous nonfood species which may have indicator species potential. The unique information that this survey will provide is:

1. Soil-to-plant and soil-to-fruit concentration factors for detectable radionuclides.

2. The relationship between food species and nonfood species at the same location.

3. The relationship between total soil radioactivity and the radioactivity which is available to the plant in the soil solution at the time of sampling.

4. The relationship of vegetation, soil, soil water, litter, and humus in the overall cycling of radionuclides in mature food crops.

5. The relationship of lens water radioactivity to that in soil water and plants growing above the lens zone in order to determine the rate of loss (time dependent information) from the coral atoll environment.

6. Intra-island variability in vegetation radionuclide concentrations.

7. Supply the data base for assessment of terrestrial food chain transfer of radioactivity from the soil to man for long-term dose evaluation upon rehabiliation of the atoll.