NVO-158

NVO-158

PLANNING AND OPERATIONS DIRECTIVE 1975 BIKINI RADIOLOGICAL SURVEY

JUNE 1975

DOE/PASO
DOE/NV
1234
BIKINI MISC CORRESPONDENCE/RPTS
9/74-12/75

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

M. B. Biles, Dir., DOS, ERDA/HQ
T. F. McCraw, DOS, ERDA/HQ
H. V. Brown, OTA, Dept. of Interior, Wash, DC
A. H. Seymour, Lab. of Rad. Ecology, Univ. of Wash., Seattle, WA
W. B. Hills, Dir., PASO, Honolulu, HI
S. V. Smith, Dir. MPML, Kaneohe, HI
N. A. Greenhouse, BNL, Upton, NY
Lt. Col. Meyers, McClellan Central Laboratory, McClellan AFB, CA
W. L. Robison, LLL, Livermore, CA
C. F. Costa, EPA/NERC, Las Vegas, NV
Leon Silverstrom, Ch. Counsel, NV
Roger Ray, Asst. Mgr., for Operations, NV
R. W. Taft, Asst. Mgr., for PE&B, NV
R. D. Duncan, Asst. Mgr., for Adm., NV
R. H. Thalgott, Asst. Mgr., for SS&E
J. D. Stewart, Dir., OSD, NV
D. G. Jackson, Dir., Office of Public Affairs, NV
P. B. Dunaway, EED, NV
B. W. Church, Ch., Rad. Br., NV
R. C. Keller, Operations Br., OSD, NV

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

PART	TITLE	PAGE
I	BACKGROUND	1
II	PURPOSE	1
III	AUTHORITY	1
IV	CONCEPT OF OPERATIONS	1
V	ORGANIZATION	2
VI	RESPONSIBILITIES	2
	A. DEPARTMENT OF INTERIOR	2
	B. DIVISION OF OPERATIONAL SAFETY, ERDA/HQ	3
	C. NEVADA OPERATIONS OFFICE	3
	D. TECHNICAL DIRECTOR	4
	E. LAWRENCE LIVERMORE LABORATORY	4
	F. ENVIRONMENTAL PROTECTION AGENCY	4
	G. UNIVERSITY OF WASHINGTON	4
	H. BROOKHAVEN NATIONAL LABORATORY	4
	I. EG&G, INC.	4
VII	SCHEDULE	5
VIII	FUNDING	5
IX	REPORTS	5

APPENDIX	TITLE
A.	DELEGATION OF AUTHORITY
B.	SURVEY LOCATION
C.	TECHNICAL PLAN

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 contract [illegible] will be via commercial aircraft and military [illegible] from various CONUS points to Kwajalein. [illegible] and equipment assemble at Kwajalein and continue [illegible] the Kwajalein Missile Range (KMR) U-54 and the Marshall Islands Research Vessel (MIRV). Upon completion of the survey, personnel will return to Kwajalein via KMR U-54 [illegible]. [illegible] shipments will be handled by military aircraft. The [illegible] survey itself will be followed by analysis of samples by [illegible] laboratories and Lawrence Livermore Laboratory.

V. ORGANIZATION

Management of the survey operations will be the responsibility of the NV Blow Survey Board. The [illegible] Director (LLL) will advise and support the NV Blow Survey Board and has full authority and responsibility for the [illegible] plan (see Appendix [illegible]).

The survey party is expected to include representatives of:

A. Division of [illegible] Safety (DOE), [illegible]

B. Office of the Assistant Manager for Operations (AMO), [illegible]

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 [illegible] Survey to the Division of Operational Safety (DOE) [illegible].

VI. RESPONSIBILITIES (Cont'd)

2. Assure that the Trust Territory of the Pacific Islands Administration and other appropriate agencies in cooperation are aware of the responsibilities and guidelines of the survey.

B. Division of Operational Safety (DOS/B)

The Division of Operational Safety (DOS/B) is responsible for coordination with the Director and all other Washington level agencies and offices.

DOS will also be responsible for program guidance, evaluation of survey data and for preparation of report concerning plans for further development of Bikini Atoll.

C. Nevada Operations Office

1. Assistant Manager for Operations, NV

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

b. Is responsible for liaison with Trust Territory and Bikini Island Office and with other concerned field agencies.

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

d. Will assist Washington in establishing the Bikini Atoll survey team.

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

2. Assistant Manager for Planning, Engineering and Budget, NV

NV is responsible for the Atomic Energy Commission of field support and survey findings.

D. Technical Director

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

1. Preparation of a detailed technical plan.

2. Direction of the recorder, a team to the field.

3. Preparation of the final survey report.

E. Lawrence Livermore Laboratory (LLL)

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

1. Providing a recorder [illegible].

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 included [illegible] in radiation measurement, and soil sampling protocols.

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 requested.

I. EG&G, Inc.

EG&G will provide aerial photography and mapping of Bikini and Enewetak to facilitate positive location in the ground survey (photographic [illegible] completed May 20, 1978).

VII. SCHEDULE

The schedule for the 1978 Bikini/Eniwetok Radiological Survey is:

June 13 All survey teams arrive and begin on location at Kwajalein.

[illegible] Personnel and gear prepare for departure.

[illegible] 0800 LCU departs Kwajalein for Bikini.

[illegible] LCU arrives Bikini; personnel depart Kwajalein by flight via C-54.

[illegible] Survey conducted.

[illegible] Personnel depart Bikini via C-54, LCU depart Bikini for Kwajalein.

[illegible] Personnel depart for Honolulu.

VIII. FUNDING

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

IX. REPORTS

Survey reports from field personnel will be submitted to the Technical Director for [illegible].

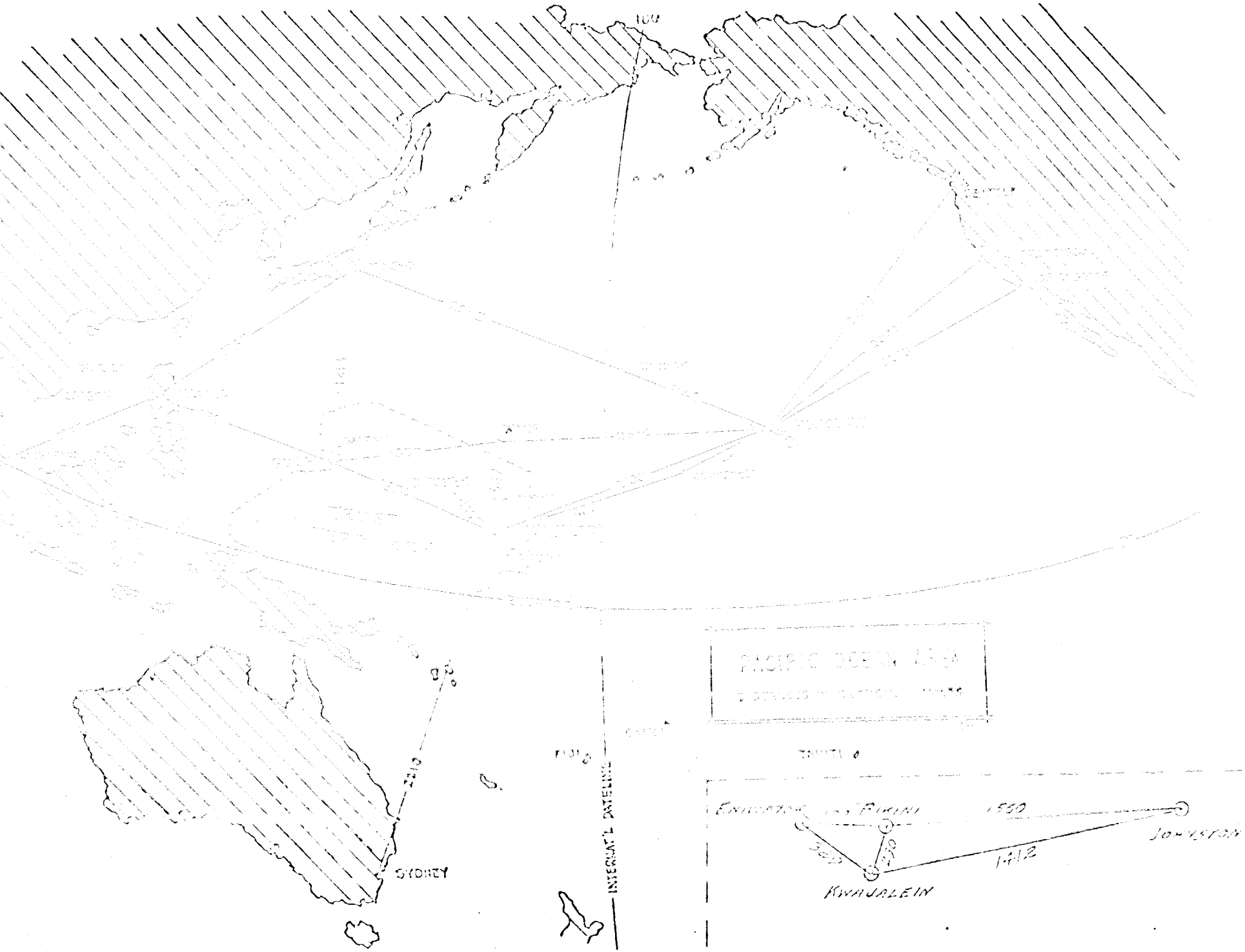
The final survey report will be prepared by BV and submitted to DOE, [illegible] for evaluation.

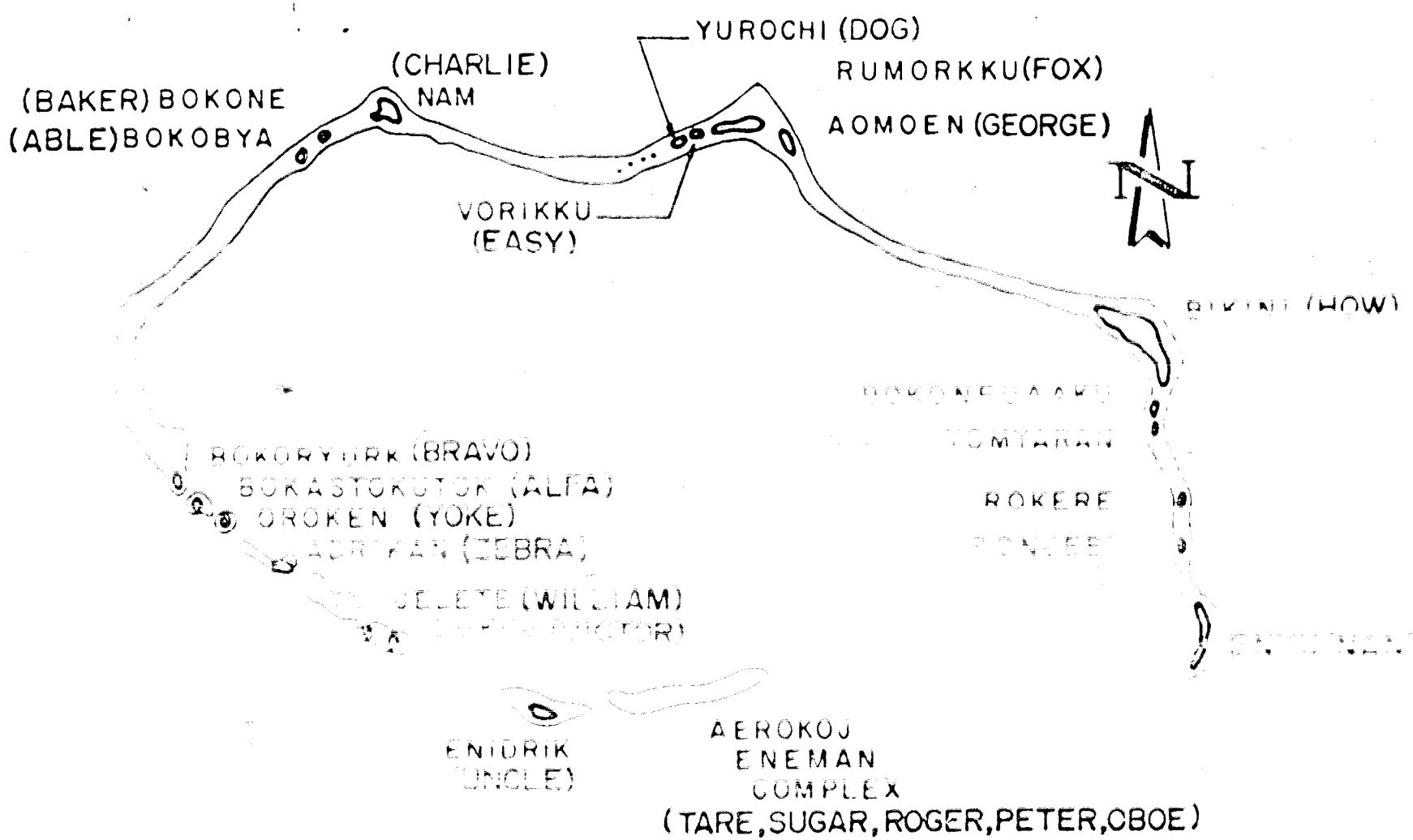
[illegible]

[illegible]

[illegible]

APPENDIX


100
SYDNEY
INTERNAT'L DATELINE
BIKINI
1550
JOHNSTON
1412
KWAJALEIN



BIKINI ATOLL

0 1 2 3
NAUTICAL MILES

APPENDIX

"G"

[illegible] BELLA [illegible] YEAR

[illegible] Division	[illegible]
[illegible] Program	[illegible]
[illegible] Program	[illegible]
Plant/Soil Program	[illegible]

June [illegible], [illegible]

1975 BIKINI SURVEY PROGRAM

Alpha, Beta and Gamma Exposure Rate Survey Program

Purpose: Soil Survey

The soil sampling program is designed to identify the primary radionuclides contributing to the external gamma exposure and to determine the geographical distribution of these radioactive nuclides in the soil on Bikini and Eneu Islands of the Bikini Atoll. 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 reconstruction plans, (3) land application plans, and (4) the number and locations of actual soil samples collected by other programs.

Methods and Procedures

Two types of soil samples will be collected for analysis: (1) a 15-cm-deep surface soil sample of 66 cm² area, and (2) a profile collection based upon sliced sampling to a depth in solid samples of 100 cm² area are collected at 15-cm depth intervals to a total depth of 90 cm. For purposes of planning the survey, Bikini Island may be divided into the north, central, and south sections along the approximate sand baseline north. Bikini is also divided into the north and south sections divided by the narrows. It appears necessary to restrict surface and profile samples to be collected within these sections as shown in Table 1. Note that a major fraction of the surface samples will be collected within the central portion of Bikini Island, but in the north, a relatively higher and more variable gamma exposure rate is indicated, mainly because the fact that a major fraction of the surface soil is very well likely reside within this portion. Deep profile samples are also need in this area because lower, or other, levels likely have resulted during previous surveys. The north and south sections of Bikini Island are of low exhibit relatively low contribution levels, hence the sampling density is lower. Profile sampling, however, will be given to the bigger side of both sections since future uses may be related to these areas.

Table 1. Number of soil sample locations in each region

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

Table [illegible] Number of soil sample locations for [illegible] (continued).

	No. of Sample Locations	
	Surface (0-15 cm)	Profiles (0-90 cm)
Eneu		
North of [illegible]	60	2
South of [illegible]	40	2
TOTAL	150	12 (6 samples each)

The exact sampling locations will initially 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 sample will be placed in plastic bags with appropriate identification tags and loaded for shipment to [illegible] 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 at a contractor laboratory.

Purpose: Summary of Soil Survey

The purpose of exposure measurements made on or connected to the ground is twofold: to provide detailed characterization of the geographic variability of the exposure rate on [illegible] and Bare Islands, and to provide overall verification of exposure rate measurements made during previous visits.

Methods and Measurements

The program utilizes the Wide Area Scintillation Detector which consists of a 2.5 cm diameter x 2.5 cm long NaI crystal with integral readout. The instrument is equipped with a [illegible] mount so that primary calibration range of the Hot Spot Facility at Research Center, Las Vegas, Nevada. While the response of this instrument is energy-dependent, our experience at Bikini showed that there is not a serious limitation because of the dominance of [illegible] in the order for [illegible] on the Atoll. We will also utilize the Reuter Stokes high pressure ionization chamber. The current produced by the radiation [illegible] within the chamber is measured by a microprocessor [illegible] 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 [illegible]. The results derived from both instruments will be compared to a sample measurement obtained by other techniques to be compared.

Measurements of the exposure rate at 1 m above the ground will be made with the NaI scintillation at each of the soil sampling locations on both islands. The ionization chamber will be only used for measurements within the central section of Bikini Island with additional measurements to be made at selected areas. Thus, from this program a comprehensive picture of the gross gamma exposure rates will be available for both islands.

Installation of Water Sampling

Purpose: To establish a network of well locations on Bikini and Eneu Islands in order to assess the ground water hydrology and to systematically study the hydrology and geochemistry of radionuclides, major and trace elements in the ground water system. Both seasonal and residence times will be measured to define the transport rates and mechanisms for radionuclides deposited in the soil zone or in the upper aquifer.

Methods and Procedures:

Approximately 7 holes will be drilled with a ground power auger at selected locations along the centerline on Bikini and Eneu Islands. Pits will be dug with a backhoe to a maximum depth where the ground water reservoir surface will be approximately 2 m from below the ground surface. It must emphasize 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 lens to a depth of approximately 3 to 5 feet. Each hole will be cased with the 2" diameter PVC pipe and the pipe will be extended to the soil surface. The rest will be back filled to ensure proper performance and support to the pipe.

The first hole will be located near the Bikini center. The outlet of the water will be measured with an inline electrical probe. Ten holes will then be drilled in Bikini Island and the salinity will be measured in each. A well cluster drilling up to 7 holes on each island proceeding in the direction away the freshest indicated ground water; the well pattern depends on well water having the freshest water to accomodate a limited water will be pumped from the wells, filtered, and treated. Radioactivity, major elements, nutrients, and bacteria measurements will be made in the laboratory to provide data for entire analysis. Specific wells (to be defined in the field) will be pumped continuously over a day and carefully sampled to follow the changes in water quality as a function of depth. Recommendations will be made on the potential usefulness of the ground water reservoir for agriculture, housing, or drinking purposes. Two closely spaced wells, located in Bikini Island on natural soil contrast on the local ground water quality. Soil leaching and hydrologic experiments are also planned. The well locations, drilling, and sampling, however, are not final yet. This during the two weeks planned for this program.

Methods and Measurements

The sampling program will therefore consist of integrated sample series composed of food species and soil samples which will be obtained on and of Bikini Atoll. A broader sampling program which will be based upon widely available species, probably Messerschmidia or Tree Heliotrope, will also be carried out to determine the intra-island variations in radioactivity. These data will be valuable in assessing the overall radiological risk and to correlate with the broad soil radioactivity survey of the atoll survey.

An attempt will be made to establish one sampling site and the ground water survey to provide data on the uptake of radionuclides at the given site. All food species, coconuts, pandanus and fishing on Bikini will be sampled to indicate if the consumption of meteoroid permits. Soil profiles (2/1.5 m) will be obtained in the vicinity of the food sampled to determine the concentration of radioactivity in the soil, the soil water, and the exchange fraction. A large sample of soil (3 kg.) from the organic zone of the soil (0-20 cm. depth) will be taken to study a leaching measurement of soil solution under steady. Both leaves and fruit will be sampled to provide food to the [illegible] sufficient to be calculated. Nearby species will also be [illegible] in the vicinity of the food species to provide information on species variation in radionuclide uptake, and to evaluate the use of measured species concentrations in predictive assessment of human intake when no food products are available for analysis. This approach was used in the previous survey because of the paucity of food species on the atoll.

This program coupled with the proposed water map survey will supply the data base for assessing the hypothetical dose consequences to the food chains upon rehabitation of the atoll and the consumption of coconuts, breadfruit, bananas, and papayas in the diet.

Marine Air Sampling Program

Due to limited support facilities, manpower, and time, and due to other program demands, the sampling equipment as a result of the delay in fielding the marine 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.