MEMORANDUM OF UNDERSTANDING
AMONG
THE UNITED STATES DEPARTMENT OF ENERGY
AND
THE GOVERNMENT OF THE REPUBLIC OF THE MARSHALL ISLANDS
AND
THE RONGELAP ATOLL LOCAL GOVERNMENT

This Memorandum of Understanding ("MOU") is entered into among the United States Department of Energy ("DOE"), the Government of the Republic of the Marshall Islands ("RMI Government"), and the Rongelap Atoll Local Government ("RALGOV") (collectively the "Parties").

Article 1
Purpose

The purpose of this MOU is to establish a framework for cooperation among the Parties to foster the timely and effective coordination of DOE's environmental monitoring support activities with RALGOV's phased resettlement of Rongelap Island.

Article 2
DOE Undertakings

2.1 To assist RALGOV to achieve the objectives of its resettlement program, DOE will undertake the following activities, as set forth in the recommendations of the "Department of Energy Environmental Monitoring Support Plan for Rongelap Resettlement Activities" (hereinafter "DOE Support Plan"):

Soil Remediation

(1) Recommend depth of soil excavation and removal in the proposed housing and village area of Rongelap Island.

(2) Conduct sampling and analysis of surface soils in the housing and village area, following scraping of the area and before application of coral fill, to determine concentrations of plutonium 239+240, americium 241, and other radionuclides attributable to the U.S. nuclear testing program.

(3) Recommend amount, rate, and frequency of application of potassium chloride (KCl) fertilizer to agricultural areas.

(4) Conduct *in situ* gamma spectrometry (ISGS) to confirm effectiveness of soil removal in the housing and village area.

(5) Observe application of KCl.

(6) Collect and analyze samples of food crops after application of KCl.

(7) Conduct ISGS after application of coral fill.

Monitoring of Workers

(8) Monitor the exposure of construction and other workers directly involved in resettlement activities to gamma rays, and conduct plutonium bioassay (via urine sampling). DOE will pay one-half the cost of plutonium bioassay analysis, and will report the results of all testing.

(9) Recommend the use of, and provide technical information to RALGOV's contractor(s) regarding, half-face disposable respirator masks.

Training and Employment

(10) Conduct training of selected Rongelapese in whole body counting, health risk communication, dietary survey techniques, and KCl fertilizer application.

(11) Hire two technically-qualified Rongelapese to perform, whole body counting and related health physics tasks under DOE supervision and in accordance with written DOE protocols.

Well Water Sampling/Analysis

(12) Collect groundwater samples from wells and analyze for cesium-137, strontium-90, plutonium-239+240, americium-241, and other radionuclides attributable to the U.S. nuclear testing program.

Utility Usage and Fuel Purchases

(13) Pay RALGOV (a) on a monthly billing basis, for metered electricity usage at the rate of $0.47 per kilowatt/hour, and for metered water usage at the rate of $110.00 per 1000 gallons of water used; and (b) within thirty (30) days of receipt of invoice, $2.50 per gallon for motor gasoline and $1.95 per gallon for diesel fuel.

Communications

(14) Maintain close communication with RALGOV and RALGOV contractor(s), to ensure effective coordination of DOE's activities under the DOE Support Plan with the Rongelap resettlement program.

(15) At the request of, and with reasonable advance written notice from the RMI Government and RALGOV, participate in community meetings to keep RALGOV and the Rongelapese people apprised of DOE's activities under the DOE Support Plan.

(16) Report promptly the results of gamma ray exposure monitoring and urine bioassay testing, in writing and in easy-to-understand terms, to construction and other resettlement workers and, subject to the protection of monitored individuals' privacy, to the RMI Government, RALGOV, and RALGOV's contractor.

(17) Cooperate with the RMI Government to establish a publicly-available database of the testing and monitoring data reported by DOE in connection with the DOE Support Plan.

(18) Provide RALGOV the recommended agricultural procedures document developed by DOE.

Other DOE Activities

(19) Conduct resuspension studies to determine aerial distribution of plutonium-239+240.

(20) Place thermoluminescent dosimeters (TLDs) in and around buildings in the housing and village area after resettlement, for the one-time measurement of external gamma levels.

(21) Subject to (a) RALGOV's performance of the undertaking in Article 3(1), and (b) DOE's selection of qualified Rongelapese to receive whole body counting training, DOE will install a whole body counter and associated computer-based electronics and software at Rongelap Island. DOE will maintain the counter in good operating condition, maintain quality assurance and quality control of the whole body counting data, and will specify the data to be retrieved and reported.

(22) Assist in the conduct of a dietary survey of the resettled Rongelapese population.

(23) Provide recommendations concerning the application of KCl on islands of Rongelap Atoll, other than Rongelap Island, where food gathering may be conducted.

2.2 DOE will undertake such other or additional environmental monitoring activities in support of the Rongelap resettlement program as the Parties may agree in writing.

Article 3
RALGOV Undertakings

To assist in the implementation of the DOE Support Plan, RALGOV will:

(1) Establish an air-conditioned facility on Rongelap Island suitable to house a whole body counter and store supplies, and pay for the utilities necessary to maintain and operate the counter.

(2) Be responsible for obtaining any licenses or other approvals from the RMI Government for any material and equipment required for any DOE-assisted radiological monitoring, including equipment that emits low levels of ionizing radiation.

(3) Assist DOE with respect to the control and custody of any DOE equipment that is a radioactive source.

(4) Maintain close communication with DOE and DOE contractors to ensure effective coordination of DOE's activities under the DOE Support Plan with the Rongelap resettlement program.

(5) Permit DOE to place up to four (4) trailers at a suitable location(s) on Rongelap Island, for use by DOE and its contractor.

(6) Provide DOE's Field Operations Manager six (6) weeks' written notice in advance of the commencement of each of the following: (i) soil removal from the village and housing area; (ii) application of KCl fertilizer; (iii) construction of housing; and (iv) application of crushed coral in housing/village area.

(7) Provide DOE's Field Operations Manager with reasonable advance written request(s) to participate in community meetings to keep RALGOV and the Rongelapese people apprised of DOE's activities under the DOE Support Plan.

(8) Cooperate with DOE's urine collection protocol for workers involved in resettlement activities, and pay one-half the cost of plutonium bioassay analysis.

(9) Provide such other logistical support and/or operations and maintenance assistance to DOE as the Parties may agree to in writing.

Article 4
RMI Government Undertakings

To assist in the implementation of the DOE Support Plan, the RMI Government will:

(1) Facilitate the grant of any licenses or other approvals for any material and equipment required for any DOE-assisted radiological monitoring, including equipment that emits low levels of ionizing radiation.

(2) Provide DOE with reasonable advance written request(s) to participate in community or other meetings to keep the RMI Government, RALGOV, and the Rongelapese people apprised of DOE's activities under the DOE Support Plan.

(3) Cooperate with DOE to establish a publicly-available database of the testing and monitoring data reported by DOE in connection with the DOE Support Plan.

(4) Provide such other assistance to DOE as the Parties may agree to in writing.

Article 5
General Conditions

5.1 Any notice or other communication in connection with this MOU will be in writing. All notices, requests, and other communications under this MOU will be given to or made upon the respective Parties as follows:

If to the RMI Government:
Minister of Foreign Affairs and Trade
P.O. Box 1349
Majuro, Republic of the Marshall Islands 96960
Facsimile: 011-692-625-4979

If to RALGOV:
Rongelap Atoll Local Government
Office of the Mayor
P.O. Box 1766
Majuro, Republic of the Marshall Islands 96960
Facsimile: 011-692-626-5400

with copy to:

Howard L. Hills, Esq.
5035 MacArthur Boulevard, N.W.
Washington, D.C. 20016
Telephone: 202-363-8436
Facsimile: 202-363-8476

If to DOE:

Mr. Frank Hawkins
U.S. Department of Energy
Office of International Health Programs
Attn: EH-63/GTN/270 Corporate Center
19901 Germantown Road
Germantown, MD 20874-1290
Telephone: 301-903-3148
Facsimile: 301-903-1413

If to DOE's Field Operations Manager:

Mr. William D. Jackson
U.S. Department of Energy
Pacific Area Support Office
P.O. Box 29939
Honolulu, HI 96820-2339
Telephone: 808-422-9211
Facsimile: 808-422-9217

5.2 Governing law: The laws and regulations of the United States will govern this MOU, as set forth in the Compact of Free Association between the RMI Government and the United States of America and in the Federal Programs and Services Agreement concluded pursuant thereto. All questions relating to the MOU arising during its term will be settled by the Parties by mutual agreement.

5.3 It is understood that the ability of DOE to carry out its undertakings under the MOU and the DOE Support Plan is subject to the availability of appropriated funds.

Article 6
Commencement, Amendment, Renewal and Termination

6.1 Cooperation under this MOU will commence on the date that the last signatory signs the MOU, and will continue for three (3) years.

6.2 By written agreement of the Parties, and with the concurrence of the U.S. Department of the Interior, this MOU may be amended at any time, and may be renewed for additional periods.

6.3 This MOU may be terminated by written agreement of the Parties, or may be terminated by any Party upon ninety (90) days written notice to the other Parties.

ACCEPTANCE:

Date: 4/9/99

Phillip Muller
Minister of Foreign Affairs and Trade
Republic of the Marshall Islands

Date: 4/1/99

James Matayoshi
Mayor
Rongelap Atoll Local Government

Date: 2/19/99

Paul J. Seligman, M.D., M.P.H.
Deputy Assistant Secretary
for Health Studies
U.S. Department of Energy

ACKNOWLEDGED BY:

Date: 6/3/99

Allen P. Stayman
Director
Office of Insular Affairs
U.S. Department of the Interior

Department of Energy Environmental Monitoring Support Plan for Rongelap Resettlement Activities*

Coordination of the Government of the Republic of the Marshall Islands (RMI Government), Rongelap Atoll Local Government (RALGOV), and RALGOV Contractor(s) with the Department of Energy (DOE).

Recommendation: An official designated by the RMI Government and the Mayor of Rongelap will coordinate the phased resettlement activities at Rongelap Island with DOE's Field Operations Manager, in order to insure that DOE can schedule and perform its recommended activities under the DOE Support Plan in a timely manner.

* In conjunction with the Memorandum of Understanding among the Government of the Republic of the Marshall Islands, the Rongelap Atoll Local Government, and the Department of Energy, this Plan provides recommendations and associated recommended DOE actions that form the basis for DOE support for Rongelap resettlement.

Use of Respirator Masks

Recommendation: DOE recommends that half-face disposable respirator masks be provided for all workers directly involved in dust producing operations, and for other personnel who may be downwind during these activities. The purpose of the mask is to reduce inhalation of dust and resuspended radionuclides that are suspended in the air during activities such as soil scraping and back hoe operations.

Masks used in the medical field for controlling tuberculosis transmission have provided adequate protection in similar locations and activities. These half-face disposable masks are lightweight and cool, and are much more likely to be worn by the workers than full respirators.

The RALGOV's contractor in charge of resettlement operations is responsible for ordering and providing adequate masks to all construction operators involved in dust producing activities on Rongelap Island and to those downwind. The masks will deteriorate with frequent use, and adequate supplies should be maintained to provide replacement masks.

DOE will provide technical information to RALGOV's contractor regarding the use of half-face respirator masks.

Monitoring of Workers

Monitor Construction and Other Workers with Thermoluminescent Dosimeters (TLDs)

Recommendation: DOE recommends that thermoluminescent dosimeters (TLDs) be provided for all construction workers and other personnel while on Rongelap Island to provide personnel monitoring during construction activities on Rongelap Island. The TLDs provide a continuous record of exposures to gamma rays on the island.

DOE, through its contractor, will be responsible for providing: the TLDs to the workers and other personnel present on Rongelap Island during construction activities; advice to all personnel regarding the correct use of these dosimeters; and the TLD results to the workers upon return of the dosimeters. An employee of DOE's contractor will distribute the TLDs, and maintain all records of name and associated TLD number. These will be collected and analyzed by DOE's contractor at 6 month exchange cycle intervals, or when the worker leaves the island.

Plutonium Bioassay

Recommendation: DOE recommends that all heavy equipment operators currently on Rongelap Island submit urine samples for plutonium bioassay testing. DOE further recommends that all future heavy equipment operators and 50 percent of all other workers involved in resettlement activities undergo plutonium bioassay testing in Majuro before commencing work and after the conclusion of their employment on Rongelap Island.

DOE will collect urine samples of all resettlement workers, DOE and RALGOV will each pay one-half the cost of plutonium bioassay analysis, and DOE will report the results thereof expeditiously to the individuals concerned and, subject to protection of those individuals' privacy, to the RMI Government, RALGOV, and RALGOV's contractor.

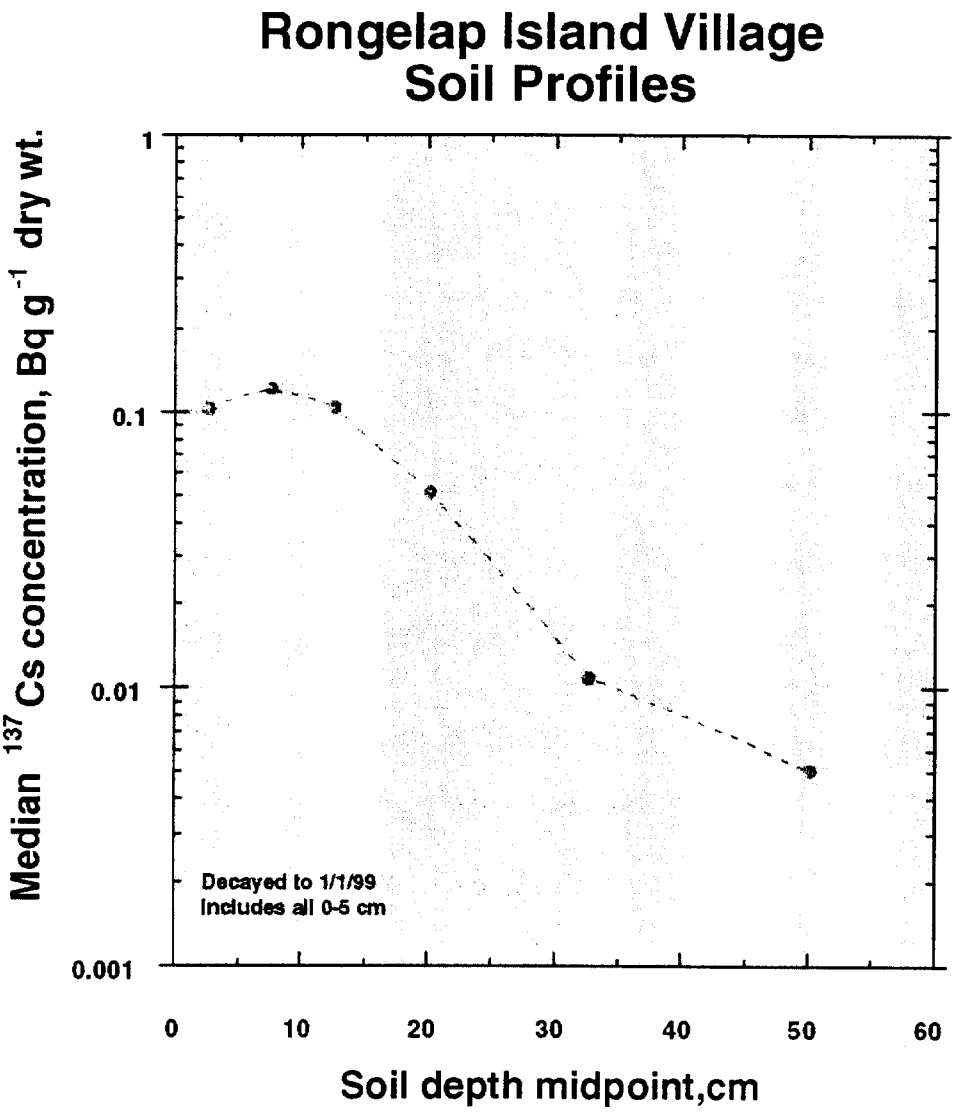
RALGOV and RALGOV's contractor will facilitate workers' compliance with DOE's urine collection protocol by providing DOE reasonable advance notice of the names and Majuro arrival/departure dates of resettlement workers beginning and ending their employment at Rongelap Island.

Soil Removal in the Proposed Housing and Village Area of Rongelap Island

Recommendation: Soil removal in the housing and village area to a depth of 25 centimeters (cm). This is based on DOE's soil profile data shown in Figure 1, and will result in a reduction of about a factor of 10 in the radioactive cesium (^{137}Cs) gamma exposure. The goal is to reduce the external gamma exposure to a dose of 0.01 millisievert (mSv) or less in the housing and village area. This requires an external exposure equal to or less than 0.16 micro-roentgen/hour or about 19 becquerel per kilogram of ^{137}Cs in the soil. The confirmation of this result will be made by *in situ* gamma spectrometry (see page 10).

The soil removal to 25 cm will essentially eliminate radioactive plutonium-239 and 240, americium-241, and strontium-90 from the housing and village area. Again, this will be verified by soil sampling and analysis.

RALGOV will provide at least six weeks' written notice to the DOE Field Operations Manager prior to the commencement of RALGOV's soil removal in the housing and village area, in order to permit DOE to schedule and perform gamma spectrometry and soil sampling and analysis in a timely manner.


Rongelap Island Village
Soil Profiles
Median 137Cs concentration, Bq g-1 dry wt.
1
0.1
0.01
0.001
Decayed to 1/1/99
Includes all 0-5 cm
0
10
20
30
40
50
60
Soil depth midpoint,cm

Amount, Rate, and Frequency of Potassium Chloride Fertilizer (KCl) Application to the Coconut Grove and other Agricultural Areas of Rongelap Island

Recommendation: The initial amount of KCl applied by RALGOV to the agricultural areas of the island should be 1000 kilograms per hectare applied in two equal amounts with a 3-month interval. The first application (500 kilograms per hectare) should be applied in May or June at the start of the rainy season. The second 500 kilograms per hectare application could then be in August or September in the middle of the rainy season. Splitting the application of the potassium chloride is recommended to protect against a heavy rain storm immediately after application that could wash a lot of the potassium through to the ground water before the plants could absorb it.

A second application, applied in the same manner, should be made 2 years after the initial application. Coarse-crystal potassium fertilizer can be purchased to supply the required potassium.

Subsequent applications could be at 5 or 6 year intervals until year 2030.

Community Meetings to Keep RALGOV and the Rongelapese People Apprised of DOE's Activities under the DOE Support Plan

Recommendation: Upon reasonable advance written request of the RMI Government and/or RALGOV, DOE will participate in community meetings to inform RALGOV and the Rongelapese people about the results of the external gamma measurements, soil crops, agricultural survey, potassium chloride treatments, radionuclide concentrations in terrestrial food crops, agricultural practices, and the level of radiation dose to resettled residents of Rongelap. The community meetings may also include discussion of worker thermoluminescent (TLD) monitoring, the use of half-mask respirators, and reports on plutonium bioassay results. Community meetings may be used as a forum to discuss the implementation of local whole body counting and to stimulate interest of the Rongelapese people in learning the technology of whole body counting.

Community meetings may include poster displays, reports, and perhaps video presentations on these subjects.

Data Collection and Reporting

Recommendation: DOE will provide, expeditiously and in easy-to-understand written terms to the individuals concerned, the results of their whole body counting and plutonium bioassay testing. Subject to protection of individual privacy, DOE will also provide these data to the RMI Government, RALGOV, and RALGOV's contractor.

Following the completion of analytical work and quality control, DOE will provide to the RMI Government and RALGOV all environmental monitoring data collected by DOE in conjunction with the DOE Support Plan.

DOE and the RMI Government will cooperate in establishing a publicly-available database of the testing and monitoring data reported by DOE in connection with the DOE Support Plan.

Collection and Analysis of Surface Soil Samples for Concentration of $^{239+240}Pu$, ^{241}Am, and ^{90}Sr following the Scraping of the Proposed Housing and Village Area

DOE, through its contractor, will collect surface soil samples (0–5 centimeters (cm)) and soil profile samples (0–5 cm, 5–10 cm, 10–15 cm, 15–25 cm) will be collected in the housing and village area after soil removal, and analyzed for for radioactive cesium, strontium, plutonium and americium. The soil surface samples (0-5 cm only) will be collected on a 75 meter (m) grid throughout the housing and village area. This will provide a series of samples that, when analyzed, will give additional data on the radioactive strontium, plutonium and americium concentrations to supplement the detailed gamma spectrometry results for ^{137}Cs. Soil profiles (0-40 cm) will be collected on a 150 m grid. This will provide a set of samples to evaluate the remaining radionuclide concentration subsequent to the soil removal in the housing and village area, and to confirm the depth distribution based on current DOE soil profile data.

RALGOV will provide at least six weeks' written notice to the DOE Field Operations Manager prior to the commencement of RALGOV's scraping of the housing and village area following soil removal, in order to permit DOE to schedule and perform surface soil collection and analysis in a timely manner.

***In Situ* Gamma Spectrometry to Confirm the Effectiveness of Soil Removal in the Housing and Village Area**

Field-adapted gamma spectrometers will be used by DOE's contractor to measure the gamma exposure rate from ^{137}Cs after soil removal to 25 centimeter (cm) depth before any construction begins or crushed coral is added. This will provide the necessary data to evaluate the effectiveness of the soil removal.

The measurement will be made on a 25 meter (m) grid throughout the housing and village area. This will provide nearly overlapping coverage within the area. The data points will be averaged over approximately 0.5 hectare area increments to estimate the external gamma exposure rate throughout the village area.

External gamma measurements for ^{137}Cs also will be made after the housing and other infrastructure construction is complete, and crushed coral has been placed around the houses and village area. Again, the measurements will be made on a 25 m grid and in addition on the 4 sides of each house. This will provide an initial assessment of the external gamma exposure rate at the time of resettlement.

RALGOV will provide at least six weeks' written notice to the DOE Field Operations Manager prior to the commencement of any construction or application of crushed coral in the housing and village area, in order to permit DOE to schedule and perform *in situ* gamma spectrometry in a timely manner.

Collect Groundwater Samples from Wells and Analyze for Radioactive Cesium, Strontium, Plutonium and Americium (^{137}Cs, ^{90}Sr, $^{239+240}Pu$, and ^{241}Am)

DOE, through its contractor, will provide well water sampling and analysis when the wells are first established. The water samples will be analyzed for radioactive cesium, strontium, americium and plutonium to provide a baseline for the levels of these radionuclides in the groundwater prior to resettlement.

Four years post resettlement, DOE will once again sample these wells and analyze for the same radionuclides, to establish the radionuclide concentrations under resettlement steady-state conditions.

Observe Application of KCl

DOE, through its contractor, will observe the actual quantity of potassium chloride fertilizer dispersed per square meter of ground surface to ensure that the appropriate deposition of 1000 kilograms per hectare of potassium is attained. The deposition rate is dependent on the equipment and method used for dispersal so this will have to be addressed in real time when this process is ready to begin.

RALGOV will provide at least six weeks' written notice to the DOE Field Operations Manager prior to the commencement of RALGOV's application of KCl fertilizer, in order to permit DOE to schedule the presence of technical personnel in a timely manner.

Collect and Analyze Food Crops for ^{137}Cs after the Application of KCl

Coconuts, breadfruit, and *Pandanus* and other foods locally grown and consumed on Rongelap Island will be collected 1 year after the first KCl application. It will take this long to go from the inflorescence bud to the drinking stage in coconuts (one complete cycle), and to go through one cycle of *Pandanus* and breadfruit development. DOE, through its contractor, will collect samples from trees for which previous data exists (i.e., before KCl treatment). Coconuts will be collected from trees on the 100 meter (m) grid previously established on the island and for which DOE has data. Breadfruit and *Pandanus* will be collected from those trees DOE has previously sampled. All of these samples will be analyzed for ^{137}Cs. This will document the initial reduction in ^{137}Cs in the fruits.

A second collection will be made 2 years after the initial application to determine the steady state conditions resulting from the first application.

Additional collections will be made in the first and second years after the second application of potassium chloride fertilizer. These results will indicate the final reduction that will be achieved for the ^{137}Cs in food crops.

Provide RALGOV with a Recommended Agricultural Procedures Document Developed by DOE.

DOE will provide an agricultural practices document that states the planting and harvesting methods that have been found successful in growing local products. It will include information on optimal soil preparation techniques, planting depths, trace mineral applications, and major nutrient fertilizer for coconut, breadfruit, *Pandanus,* and other foods locally grown and consumed at Rongelap Island. Where possible, the difference between recommended practices and historic methods will be illustrated.

Whole Body Counting and Health Physics Issues Relevant to the Resettlement of Rongelap

To improve understanding of local radiological conditions, to address public safety concerns, and to permit whole body counting on demand, DOE will assist the Rongelap community to establish a whole body counting (WBC) facility on Rongelap Island. DOE will maintain quality assurance and quality control of the WBC data and will specify the data to be retrieved and reported.

DOE will also implement a training and education program for Rongelapese who have suitable qualifications. This could be coordinated with DOE's environmental missions to the Marshall Islands and through the existing Technical Cooperation Program with IAEA.

Training and technical assistance will be focused on four main topics, to include:

(1) Operation and maintenance of a WBC facility;
(2) Evaluation and interpretation of WBC data;
(3) Environmental radioactivity, health physics, and dosimetry; and
(4) Development of agricultural practices to minimize the uptake of ^{137}Cs in locally grown produce.

Two individuals who meet DOE-established technical qualifications will be hired, for up to 20 hours per week each, at a salary of $5.00 per hour.

The Rongelap technical assistance program will be coordinated through DOE's contractor. A strong emphasis will be placed on practical instruction, data interpretation, and some basic underlying theory. More advanced training could be offered through the International Atomic Energy Agency (IAEA) fellowship program should funding become available and trainees meet educational requirements. This would allow trainees to work at a suitable facility outside the Marshall Islands for extended periods of time. In the longer term, it may be possible to request IAEA assistance in organizing and funding a national radiological training course.