

U.S. DEPARTMENT OF ENERGY
FIELD TASK PROPOSAL/AGREEMENT

1. WORK PACKAGE NUMBER | 2. TASK NO. | 3. REV. NO. | 4. PROJECT NO. | 5. DATE PREPARED | 6. CONTRACTOR NUMBER
 | | | 0 | | 03/31/80 | MO-1 (000032)

7. TASK TITLE Medical Studies of the People of the Marshall Islands Accidentally Exposed. | 8. WORK PACKAGE TITLE

9. BUDGET AND REPORTING CODE 10. TASK TERM 11. CONTRACTOR NAME 12. CODE
 HA-02-01-01 Begin: (mm dd yy) End: (mm dd yy) Associated Universities, Inc. (see instructions)
 Continuing Open BNL

13. CONTRACTOR TASK MANAGER (Name: Last, First, MI) (FTS No.) 14. PRINCIPAL INVESTIGATORS (Name Last, First, MI)
 Pratt, Hugh S. (FTS 666-3577) Pratt, Hugh S. (FTS 666-3577)

15. WORK LOCATION (See instructions): Name of facility, City, State, Zip Code
 Marshall Islands

16. Is this task included in the Institutional Plan? YES NO

17. Does this task include any management services efforts? YES NO

18. TASK DESCRIPTION (Approach, relation to work package, in 200 words or less)

The primary objective is the determination of the life-time effects of fallout radiation on the Marshallese who were accidentally exposed to radioactive fallout on March 1, 1954. Medical Surveys of these people have been conducted at quarterly intervals, and an unexposed Rongelap population is examined for comparison. The surveys, carried out jointly by Brookhaven National Laboratory under the auspices of the Department of Energy, and the Trust Territory of the Pacific Islands, are of great importance in view of the development in this population of growth impairment in some exposed children, thyroid lesions, and one case of acute leukemia.

19. CONTRACTOR TASK MANAGER


 Hugh S. Pratt (Signature)

3/31/80
 (Date)

20. DETAIL ATTACHMENTS (See instructions)

- a. Facility Requirements
- b. Publications
- c. Purpose
- d. Background
- e. Approach
- f. Technical progress
- g. Future accomplishments
- h. Relationships to other projects
- i. Environmental assessment
- j. Explanation of milestones
- k. ZBB Detail
- l. Other (Specify)
 Capital Equipment
 HA02-9

TASK REQUIREMENTS FOR OPERATING/EQUIPMENT
 COSTS AND OBLIGATIONS

CONTRACTOR NAME

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21. STAFFING (in staff years)

	FY 1980	FY 1981 - BY-1	BY-1
	BY-2	PRESIDENT'S	REVISED
a. SCIENTIFIC	3.4	3.5	3.5
b. OTHER DIRECT	7.0	9.2	9.2
c. TOTAL DIRECT	10.4	12.7	12.7

AUTHORIZED	BY-FY
	1982
	4.3
	10.7
	15.0

22. OBLIGATIONS AND COSTS
 (in Thousands)

a. TOTAL COSTS	583	830	830	980
b. TOTAL OBLIGATIONS	583	830	867	1030

23. EQUIPMENT (in Thousands)

a. EQUIPMENT COSTS	7	13	13	60
b. EQUIPMENT OBLIGATIONS	10	16	16	85

24. OTHER COSTS (specify)

- a.
- b.
- c.
- d.

25. OPTIONAL FIVE-YEAR PLAN (in Thousands)

Constant BY dollars	BY + 1	BY + 2	BY + 3	BY + 4
a. TOTAL OPERATING COSTS				
b. TOTAL OPERATING OBLIGATIONS				
c. TOTAL EQUIPMENT COSTS				
d. TOTAL EQUIPMENT OBLIGATIONS				

26 MILESTONE SCHEDULE

PROPOSED SCHEDULE

AUTHORIZED SCHEDULE



5010575

HA-02-1

TITLE Human Health Effects from Energy
Generation: Medical Studies of the
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BNL			0

20a. Facility Requirements.

It is anticipated that work for this proposal will use existing Laboratory facilities and site utility services. In addition a doctor's office and laboratory has been established on Kwajalein and Ebeye Islands in the Marshall Islands and shipboard support for the medical teams will be required as they visit the outlying islands. The ship provided for the previous year has proven to be inadequate for medical purposes and active consideration is being given to the procurement of a different vessel. The currently used ship is 115' long and is prohibited from "carrying passengers", however when a field survey is conducted up to 35 passengers including patients and medical personnel may have to be carried. Consultations with shipping experts have indicated that a ship of approximately 185' in length would provide adequate living space for a party of this size. In addition, the ship requires a double (parallel) multiphasic screening examination facility for male and female patients, laboratory space and x-ray area. Active negotiations are underway with the Department of Energy to provide such a vessel.

20b. Publications.

None in FY 1979. In FY 1980, the 25th year Report now in preparation will be published as well as the 26th year Annual Report.

20c. Purpose.

Post-exposure surveys in the Marshall Islands have been conducted for 25 years. In addition to the 244 persons originally exposed, a group of unexposed Marshallese are examined for a "comparison population" to assess late effects of radiation from fallout.

20d. Background.

The continuing development of thyroid neoplasms, biochemical hypothyroidism and the appearance of one case of acute leukemia, indicate the need for frequent examinations. In addition to routine physical, hematological, and other laboratory examinations, the surveys involve special studies related to aging, malignancy, reproduction, and measurement of body burdens of radionuclides resulting from the slight contamination remaining on the islands. Patients with thyroid nodules are returned to the United States for complete hospitalization and surgical treatment as indicated. In view of the diverse medical problems and their management, a physician, a Marshallese nurse-practitioner, and a laboratory technician are in residence at Kwajalein and make regular trips to Rongelap, Majuro, and Utirik to supervise care and perform interim examinations of the exposed Marshallese.

20e. Approach.

The R&D work contemplated shall be conducted in conformance with generally accepted methodology for scientific investigations of this character, as practiced at universities and large independent laboratories including Brookhaven National Laboratory (BNL).

HA-02-11

5010676

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20e. Approach cont.

Fiscal control will be exercised in the form of monthly comparison of actual costs incurred against corresponding line items in the budget. Substantive progress shall be monitored through a periodic review of accomplishments conducted by the Contract Task Manager.

20f. Technical Progress.

Technical Progress in BY-3 (FY 1979).

In response to requests by the people of Rongelap and Utirik, the Department of Energy agreed in February 1977 to assist the Trust Territory in an expanded health care program for the people living at Rongelap and Utirik Atolls. Accordingly, during the January - February 1979 survey (25 years post-exposure), all Marshallese living on these atolls, who wished it, were given complete medical and laboratory examinations similar to those in the exposed group. Greater physician-patient relationship was attained by lengthening the stay on the islands, which necessitated doubling the size of the medical team by releasing one team after 2 1/2 weeks to return to the United States and utilizing a second team for the second half of the survey. A 2nd survey covering 4 weeks in May and June concentrated primarily on pediatric evaluations and sick call plus a reevaluation of those thyroid nodules found on previous surveys. On the final three days of that survey Dr. Brown Dobyns, thyroid surgeon, flew out to Kwajalein and the entire team evaluated the 14 prospective surgical candidates. All were cleared for transfer to Brookhaven National Laboratory for medical evaluation and then on to Cleveland Western Reserve for definitive surgery. The group was divided into nine patients who underwent surgery in early July, and a group of five who underwent surgery in September. A third survey was conducted in September and October covering a five week period. This survey was directed towards the treatment of dental and ophthalmologic problems and the treatment of intestinal parasites on the major islands.

Thyroid abnormalities continue to be the only definitive findings related to radiation exposure. During the past year, thyroid surgery was done on seven of the exposed group and five of the unexposed comparison group. In addition, surgery was performed on two Marshallese from Wotje Atoll who were not in the long term study groups; one of these lesions turned out to be a carcinoma. There have now been 48 thyroid abnormalities (41 with surgery) among the 246 exposed Marshallese (41% of the Rongelap people and 8% of the Utirik people). The occurrence of three thyroid cancers in the exposed Utirik population (compared with four in the Rongelap group) appears to indicate radiation exposure in the etiology, but the high incidence is puzzling since it is greater than would be predicted based on Rongelap and Japanese data and there does not appear to have been any increase in benign thyroid tumors in the Utirik group compared to the greater prevalence in the Rongelap group. Because of the uncertainty of the incidence of thyroid tumors in unexposed Marshall Islanders and in order to obtain better statistics, thyroid examinations were included for all unexposed Rongelap and Utirik people on any of the Marshall Islands visited. This study has been extended to include thyroid surgery when indicated. Also, in order to help solve

HA-02-01

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WP NUMBER

TASK NO.

REV. NO.
0

20f. Technical Progress cont.

Technical Progress in BY-3 (FY 1979) cont.

the Utirik dilemma, reevaluation of radiation doses from fallout to the Utirik people, including the thyroid, is in progress.

The bill authorizing compensation to certain of the Rongelap and Utirik people for radiation injuries was signed by the President and payments were completed during FY 1979.

A study of diabetes, a serious disease in the Marshall Islands, was initiated several years ago and the data collection has just been completed. A report of the results of this study will be issued shortly. During this fiscal year an intestinal parasite survey was completed on Rongelap Atoll and at Utirik with studies of stool specimens and serologic testing, by immunofluorescence.

Anthelmintic therapy (Vermox) was started on nearly the entire population. A large percentage of the people had positive stools for parasites. The majority of the parasites were eliminated in this island group by the treatment regimen.

As part of the expanded medical studies a trailer was obtained for laboratory purposes at the Hospital at Ebeye and a small clinical laboratory was established to support the resident M.D. A Brookhaven National Laboratory laboratory technician/administrator was transferred to Kwajalein to support this facility.

A program to educate the people of Rongelap and Utirik regarding radiation and its effects was continued during the past year. During the time of the annual surveys lectures were given to the people by members of the medical team and, in addition, Dr. Naidu, of Brookhaven, remained on Rongelap and Utirik for a ten-week period indoctrinating the people about radiation.

The attitudes of the Rongelap and Utirik people towards the examinations improved, due partly to a better understanding of the objectives of the medical team as a result of the increased educational program, and partly to an improved attitude of the Marshallese politicians.

Expected Progress in BY-2 (FY 1980).

Following the September-October survey of 1979 the inadequacies of the support system and the vessel became the controlling factors. Currently, no vessel is available for support of the surveys. Both the Department of Energy and BNL are actively trying to resolve this problem. When a ship is obtained the survey schedule for FY 1980 will be completed. The planning cycle will probably allow time for two full surveys during this period. In addition, an epidemiological survey of Likiep will be performed, under contract with Tabershaw Occupational Medicine Consultants, to assess the validity of a Marshall Island Government medical questionnaire which indicated an unusual incidence of thyroid pathology in that population.

HA-02-13

5010678

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CODE	WP NUMBER	TASK NO	REV. NO
BNL			0

20f. Technical Progress cont.

Expected Progress in BY-2 (FY 1980) cont.

During FY 1980 all research records are being reviewed and condensed for transfer to microfiche and finally for computerization. This process requires restructuring the charts in a problem-oriented format to provide the structure necessary for flexible clinical and research utilization in a computerized format.

During the last two surveys of FY 1979 there was an obligation to examine and care for the people of Bikini. This endeavor greatly expanded the patient load without supplemental funding, and it is anticipated that continuation of these examinations will be required. Funding, responsibility, and authority for this activity has been under discussion at the Department of Interior and the Department of Energy for a number of months but the problem remains unresolved. In addition, if the Likiep survey reveals an increased incidence of thyroid pathology, as is suspected, a medical survey of that island and possibly of Wotje, Ailuk, and Mejit may be required. If these incremental increases occur, the study population would be more than tripled.

Emphasis on health and radiation education will be continued and increased to place radiation in its proper perspective in a matrix of health risk for the Marshallese. Continued monitoring of all populations determined to be at increased risk from radiation-induced diseases will continue, focusing primarily on the thyroid, hematopoietic system, breast, lung, stomach, and colon using suitable screening tests.

Expected Progress in BY-1 (FY 1981).

In view of the serious late effects of fallout exposure, continued medical surveillance of the exposed populations is mandatory as the studies are still in the latent period of a number of significant carcinomas. Special examinations for the thyroid abnormalities, as well as for neoplasia of other organs and tissues and other late effects must be continued. In light of the recent renewal of interest of long term effects of "low level" radiation, the data from this study, even though the population is small, should serve as one of the longest prospective studies of the effects of both acute high level and long term low level external and internal radiation. Other studies to be pursued include: a) thyroid comparison studies--it is hoped that the Department of Energy funds will continue to be approved for carrying out thyroid surgery in the United States on unexposed Rongelap and Utirik people in the extended comparison study where such surgery is indicated; b) reevaluation of dosimetry of the Utirik people, including thyroid doses; c) study of the nature and the treatment of diabetes in Marshallese to include trace element analysis of the people and the echosystem; d) studies with Dr. Raymond A. Popp of Oak Ridge (for frequency of isoleucine substitution in hemoglobin of Marshallese blood as an index of somatic mutations associated with radiation exposure and aging; e) studies of polymorphism and rare protein variance in the blood cells of children of exposed and unexposed parents--Dr. James V. Neel at the University of Michigan has expanded his battery of tests for these variants and has agreed to continue these studies on Marshallese children; and f)

HA-02-14

5010679

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WP NUMBER

TASK NO.

REV. NO
0

20f. Technical Progress cont.

Expected Progress in BY-1 (FY 1981) cont.

the process of reducing old charts to the problem-oriented medical records system and the transfer of records to computer storage.

Expected Progress in BY (FY 1982).

Continuation of the medical surveys and limited primary care of the Marshallese is anticipated on an indefinite basis. Emphasis will be placed on examinations for thyroid abnormalities, the previously mentioned cancers, hematologic disorders and other possible effects of radiation exposure. Coordination with the patient and ecosystem monitoring teams from the Safety and Environmental Protection Division will continue. Chart reduction will be completed and computer storage and medical records will be continued.

20g. Future Accomplishments.

Data obtained from this study will continue to provide baseline statistics for all studies of human health effects of acute high level and long term low level internal and external radiation.

20h. Relationships to Other Projects.

The studies of the exposed Marshallese are closely related to the Radiation Effects Research Foundation studies in Japan and to the studies of the 23 Japanese fishermen exposed at the same time as the Marshallese to fallout. Acute and long term low level radiation ranks as one of the most important hazards that must be considered in the DOE medical programs. The effects of fallout exposure in the Marshallese provides valuable information, particularly with regard to thyroid effects from radioiodine exposure, that may relate to future reactor accidents. The longitudinal Marshallese data have been used in the analysis of such accidents. The data are also quoted in other reports such as those of the NCRP, ICRP, BIER, and the United Nations.

The Safety and Environmental Protection Division of this Laboratory conducts radiological personnel and environmental surveys of contaminated Marshall Islands and their inhabitants. These studies are closely coordinated with the Medical Surveys.

20i. Environmental Assessment.

Work done under this task proposal has either no environmental impact or has impacts similar to those described in and covered by BNL's Environmental Impact Statement (ERDA 1540).

HA-02-15

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REV. NO.
0

201. Other.

Capital Equipment Requirements for BY (FY 1982)

Automation of medical records of Marshall Island patients is required to obtain detailed analyses which must be performed manually and which are sometimes not practical with existing manpower. To use automated equipment for processing data requires purchase of input and output devices (\$10,000) for the recording and retrieval of patient data.

Medical record equipment necessary to automate records includes devices to generate, and read microfiche records, and produce "hard copy" of records from microfiche. The system is estimated to cost \$30,000.

Computer capability within the Medical Department is provided by a Xerox computer that is in excess of 13 years old. Xerox is no longer in the data processing field, spare parts are difficult to obtain, and system hardware changes are all but impossible. To provide computer capability necessary to automate medical data of the Marshall Island patients, this program will share \$10,000 of the total cost for replacing and upgrading the equipment.

A thyroid scanning system for combined x-ray fluorescence and radionuclide imaging studies is necessary to identify nodules of interest. The system employs a large, high-priority germanium detector (6 cm diameter, 2 cm thick) in a vertical mount; the isotope exciting source is ^{170}Tm ($t_{1/2} = 134\text{d}$; 51, 52 + 59 keV x rays) which is produced and available at BNL in high purity and in large amounts. The system uses pulse-stepping motors driving a precision machine tool scanning table, under computer control, acquiring counts from characteristic x and gamma rays in CAMAC scalars and storing these in an LSI-11 in the CAMAC controller. Data can be archived on floppy discs for analysis and image production. A monitor display will be included, but final high quality images will be produced in the nuclear medicine general purpose image analysis computer (PDP 11/34 with a high performance display).

This system will provide high quality diagnostic images that scale precisely to the anatomical size of the neck. Nodules can then be marked on the image to compare precisely what is felt by the physician and what is detected by the imaging procedure. The x-ray fluorescence scan provides information on the iodine content of the thyroid that can be differentiated from findings on solid tumors by ultrasound imaging.

In summary, the x-ray fluorescence method yields data with low false negative rate; conveys very low radiation dose to the subject (< 100 mrem/study--thyroid dose, essentially 0 whole body dose); and should be used in populations in which the risk of thyroid cancer is high and where there is reason to minimize radiation exposure. One-half the cost of the system (\$20,000) is requested for studies of Marshallese patients. The balance of the cost will be borne by the Nuclear Medicine Program.

The Clinical Chemistry Laboratory of the Hospital of the Medical Research Center

HA-02-16

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HA-02-01-01

03/31/80

CODE	WP NUMBER	TASK NO.	REV NO.
BNL			0

201. Other cont.

Capital Equipment Requirements for BY (FY 1982) cont.

requires an instrument that will reduce the labor necessary to generate determinations. A unit, such as a SMA 6+2, will reduce technical effort necessary for the processing of routine requests. This project's share in the cost of this equipment is \$5,000. The total cost of the device will be shared by other research programs and the Industrial Medicine Clinic.

HA-02-17

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