

## SCHEDULE 189

## ADDITIONAL EXPLANATION FOR OPERATING COSTS

Brookhaven National Laboratory  
Laboratory

RZ-Operational Safety  
Program

1. Contractor:  
Associated Universities, Inc.

Contract No.:  
AT(30-1)-16

Task No.:

2. Project Title:  
Safety Studies and Development of Operational Guidelines  
Marshall Islands Radiological Safety Program

189 No.:  
RZ-1

3. Budget Activity No.:  
RZ-03

4. Date Prepared:  
May 1974

5. Method of Reporting:  
Annual report to Division of Operational  
Safety

6. Working Location:  
Brookhaven National Laboratory

7. Person in Charge:  
C. B. Meinhold

8. Project Term:

Principal Investigator:  
N. Greenhouse  
F. Haughey  
A. Hull

From:                      To:  
Project will be initiated in  
FY 1975.

9. Man-Years:

	<u>FY 1974</u>	<u>FY 1975</u>	<u>FY 1976</u>
Sci., Res. Assoc. (Ph.D. or Equiv.)	---	1.0	1.0
Prof. (B.S. or Equiv.)	---	0.5	0.5
Sci. & Prof. - Total	---	1.5	1.5
Others	---	1.0	1.0
Guests & Research Collaborators	---	---	---
<b>Total</b>	---	2.5	2.5

10. Costs (In Thousands of Dollars):

	<u>FY 1974</u>	<u>FY 1975</u>	<u>FY 1976</u>
Labor (including benefits)	0	30	66
Mats., Trav., Dev. Subcont., Spec'l Proc.	0	75	37
Reactor, Accel., and/or Computer Usage	0	2	1
Allocated Technical Services	0	3	1
Gen. & Adm. Overhead	0	15	32
<b>Total Research Cost</b>	0	125	137
Equipment Obligations	0	20	0

11. Reactor Concept:

12. Materials:

13. Publications:

None

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14. Scope:

Now that Micronesians are returning to the islands affected by weapons testing, a comprehensive, continuing radiation safety program is required. Such a program would be developed for the Division of Operational Safety using the facilities and personnel of the Brookhaven National Laboratory Health Physics and Safety Division. This project is intended to provide Operational Safety with a single focal point for their needs in this area. Areas needing scientific investigation will be suggested to the Division of Biomedical and Environmental Research, and other support activities to the Division of Operational Safety.

The specific goal of this project is to gather and evaluate previous and current data on the radiological situation as they relate to actual and projected land use. Significant exposure pathways will be identified as a basis for establishing a continuing environmental monitoring program. Using this information, annual surveys in the islands will be designed and performed in conjunction with the Brookhaven Medical Survey. Environmental samples will be returned to Brookhaven National Laboratory for analysis. In addition to those samples required to estimate the accuracy of the dose predictions, specific samples relating to the Medical Survey Group's interest will be collected and analyzed. Our close relationship with the Medical Survey Group will permit us to respond rapidly to their needs.

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15. Relationship to Other Projects:

a) The facilities and personnel of the Brookhaven National Laboratory Health Physics and Safety Division Environmental Monitoring Group will be the basic element in the project.

b) Mutual assistance will exist with the Brookhaven Medical Survey Team. The annual radiological survey would be conducted during their visits to the islands when possible.

c) Extensive use will be made of the data and experience of previous studies in the islands. This will include consultation as needed with the personnel from the Lawrence Livermore Laboratory, Southwest Radiological Health Laboratory, AEC Health and Safety Laboratory, etc. Close cooperation with the University of Washington is anticipated for the radiological analysis of marine biota in the Marshallese diet.

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16. Technical Progress in FY 1974:

Health Physics and Safety Division staff members will assist in the March 1974 medical survey in the islands in order to familiarize these

(See Continuation Sheet)

RZ

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16. Technical Progress in FY 1974: (Cont'd)

personnel with the area and enable them to anticipate technical and administrative difficulties.

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17. Expected Results in FY 1975:

The project will be initiated in FY 1975 when the first detailed surveys in the islands will be designed and performed.

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18. Expected Results in FY 1976:

A radiation protection program for the islands will be fully implemented with the expectation that this project is to be continued for an indefinite period.

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19. Description and Explanation of Major Materials, Equipment and Subcontract Items:

In FY 1975, capital equipment funds of \$20,000 is requested for a 800 channel analyzer and its associated hardware. The equipment is required to bring our environmental monitoring facilities to the "state of the art."

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20. Proposed Obligations for Related Construction Projects:

None

SCHEDULE 189

ADDITIONAL EXPLANATION FOR OPERATING COSTS

Brookhaven National Laboratory  
Laboratory

RW-Operational Safety  
Program

1. Contractor: Contract No.: Task No.:  
Associated Universities, Inc. E(30-1)-16

2. Project Title: 189 No.:  
Safety Studies and Development of Operational Guidelines  
Marshall Islands Radiological Safety Program

3. Budget Activity No.: 4. Date Prepared:  
RW-03-(a) May 1976

5. Method of Reporting: 6. Working Location:  
Annual Report to Division of Operational Safety, monthly visits to DOS, Scientific Meetings and Journals  
Brookhaven National Laboratory

7. Person in Charge: 8. Project Term:  
C. B. Meinhold  
Continuing

Principal Investigator: From: To:  
N. A. Greenhouse  
J. R. Naidu  
A. P. Hull

9. Man-Years:

<u>Direct Man-Years</u>	<u>FY 1976</u>	<u>Transition Period</u>	<u>FY 1977</u>	<u>FY 1978</u>
Scientific & Professional	2.5	0.5	2.0	2.0
Others	1.0	0.3	1.0	1.0
Guests & Research Collaborators	---	---	---	---
Total	3.5	0.8	3.0	3.0

10. Costs (In Thousands of Dollars):

	<u>FY 1976</u>	<u>Transition Period</u>	<u>FY 1977</u>	<u>FY 1978</u>
Research Costs	140	30	140	150
Equipment Obligations	30	10	15	10

11. Reactor Concept:

12. Materials:

13. Publications:

Greenhouse, N. A. and McCraw, T. F. Marshall Islands Radiological Followup. Proc. Ninth Midyear Topical Symposium. Operational Health Physics. Denver. February 1976, P. L. Carson, Ed., pp. 742-7, Health Physics Society, Central Rocky Mountain Chapter, Boulder, Colorado, 1976.

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14. Scope:

A comprehensive and continuing radiological safety program is required for the Bikini and Enewetak people who desire to reinhabit their home atolls. The program includes analyses of external radiation levels, soil and ground water contamination levels, and radioactivity in terrestrial and marine biota which comprise the human food chain. From these data, both external and internal doses and dose commitments will be made. In addition, projections of future radiological conditions will be postulated in order to provide appropriate guidance on projected land use and living patterns. Earlier dose assessments will be revised and updated, and dosimetry models will be refined to reflect actual trends as determined from the monitoring program.

Project personnel will provide a resource of expertise for establishment or independent review of radiation protection programs associated with cleanup and rehabilitation efforts in the northern Marshall Islands, and for related health physics interests of the Division of Operational Safety.

Field operations will be closely coupled with those of Brookhaven Medical Survey in the Marshall Islands, and Radiological Safety Program personnel will be of direct assistance to the Medical Survey whole body counting activities. Ancillary environmental radiological assessments will be made at Rongelap and Utrik atolls on an alternate year basis.

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15. Relationship to Other Projects:

a) Surveys will be made in close conjunction with the BNL Medical Survey Team. Assistance will be given to their effort. The annual survey would be conducted during their visits to the Islands. b) Continued collaboration with the University of Washington, Laboratory for Radiation Ecology (LRE) is anticipated on Division of Operational Safety environmental programs in the Pacific basin. c) Extensive use will be made of prior survey data. Consultations will be held with other participating agencies in developing the bases for the survey requirements.

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16. Technical Progress in FY 1976 and Transition Period:

A major survey was conducted at Bikini and Eneu Islands in February 1975 in response to Department of the Interior's request for guidance on the siting of the second increment of housing construction at Bikini. This survey revealed unacceptable radiation levels at most of the proposed sites, suggested alternate sites, and laid the groundwork for a larger multiagency survey in

16. Technical Progress in FY 1976 and Transition Period: (Cont'd.)

June-July 1975 in which BNL participated. Data from both these surveys are currently being used to refine dose and dose commitment predictions for returning Bikini residents.

BNL collaborated with the University of Washington LRE in a regional radiological background study in Micronesia, November-December 1975. Data from this study will be used as a reference base against which radiological data from the northern Marshall Islands can be compared.

The first routine followup study for Bikini and Eneu is scheduled for April 1976. This survey will include detailed radiological profiles of the Nam-Bokata complex of islands which are the next areas scheduled for agricultural development in the Bikini atoll master plan.

17. Expected Results in FY 1977:

Ground survey support will be provided for a planned interagency aerial radiological survey of all previously unsurveyed atolls in the northern Marshall Islands which may have received local fallout from the U.S. atmospheric nuclear tests.

Enewetak will be visited by the program principals in order to establish a routine environmental monitoring program for that atoll.

Continued technical support will be provided by BNL for the ERDA-funded Pacific Basin radiological program of the University of Washington LRE.

18. Expected Results in FY 1978:

Continuation of programs described in FY 1977.

19. Description and Explanation of Major Materials, Equipment and Subcontract Items:

Capital Equipment Fiscal Year 1977:

Additional memory and an x-y plotter (\$9,000) for the Ge(Li) spectrometer system is needed to improve sample analyses and data processing capabilities on large numbers of environmental samples collected during field surveys.

Peripheral electronics (\$6,000) for a thin intrinsic germanium detector array is needed to process soil samples for heavy elements.

Capital Equipment Fiscal Year 1978:

In FY 1978 a standard compatible magnetic tape unit (\$7,000) will be needed for data storage, which will enable the scientific staff to transfer

Safety Studies and Development of Operational Guidelines  
Project Title: Marshall Islands Radiological Safety Program RW-03-(a)

19. Description and Explanation of Major Materials, Equipment and Subcontract  
Items: (Cont'd.)

Capital Equipment Fiscal Year 1978: (Cont'd.)

spectra data from present analyzer equipment to the Central Scientific Computing Facility.

20. Proposed Obligations for Related Construction Projects:

None

SCHEDULE 189

ADDITIONAL EXPLANATION FOR OPERATING COSTS

Brookhaven National Laboratory  
Laboratory

RK-Environmental Research and Development  
Program

1. Contractor: Contract No.: Task No.:  
Associated Universities, Inc. EY-76-C-02-0016

2. Project Title: 189 No.:  
Surveillance of Facilities and Sites  
Marshall Islands Radiological Safety Program

3. Budget Activity No.: Date Prepared:  
RK-01-05-02-3 May 1977  
(600003)

5. Method of Reporting: Working Location:  
Annual Report to Division of Operational Brookhaven National Laboratory  
Safety, Standards and Compliance (SSC),  
Monthly Visits to SSC, Scientific Meetings and Journals

7. Person in Charge: Project Term:  
C. B. Meinhold Continuing  
Principal Investigator: From: To:  
N. A. Greenhouse (664-4250)

9. Man-Years:

	<u>FY 1977</u>	<u>Pres. Bud. FY 1978</u>	<u>Rev. Req. FY 1978</u>	<u>FY 1979</u>
Sci., Res. Assoc. (Ph.D or Equiv.)	1.0	2.0	2.0	1.0
Prof. (B.S. or Equiv.)	0.5	1.0	1.0	1.0
Sci. & Prof. - Total	1.5	3.0	3.0	2.0
Others	1.0	1.5	1.5	1.5
Guests & Research Collaborators	---	---	---	---
<b>Total</b>	<b>2.5</b>	<b>4.5</b>	<b>4.5</b>	<b>3.5</b>

10. Costs (In Thousands of Dollars):

	<u>FY 1977</u>	<u>Pres. Bud. FY 1978</u>	<u>Rev. Req. FY 1978</u>	<u>FY 1979</u>
Labor (including benefits)	63	79	87	83
Mats., Trav., Dev.				
Subcont., Spec'l. Proc.	44	32	62	67
Reactor, Accel., and/or				
Computer Usage	0	0	0	0
Allocated Technical Services	2	1	1	1
Gen. & Adm. Overhead	31	38	42	60
<b>Total Research Cost</b>	<b>140</b>	<b>150</b>	<b>192</b>	<b>211</b>
Equipment Obligations	10	10	10	5

11. Reactor Concept:

12. Materials:

AK-113

Surveillance of Facilities and Sites

Project Title: Marshall Islands Radiological Safety Program

RK-01-05-01

13. Publications:

Greenhouse, N. A., Levine, G. S., Kraner, H. W. and Naidu, J. R. A thin intrinsic germanium detector array for direct counting of soil samples. Presented at the 21st Annual Meeting of Health Physics Society, San Francisco, California, June 1976.

14. Scope:

(a) 200 Word Summary: Environmental and personnel monitoring programs for the Marshallese people living at Bikini, Rongelap and Utirik Atolls must continue indefinitely in order to assess dose contributions to these people from the residual radioactivity originally produced by U.S. nuclear weapons tests in the Pacific. Detailed assessments of the contributions of external gamma radiation have been made over the past two years, but the identification of internal exposure pathways and determination of their radiological significance are subject to many variables which will require environmental and diet monitoring and bioassay programs for many years. The focal points of the next year's efforts will be quantification of the average annual diet and its radionuclide content of each atoll; determination of the significance of the inhalation pathway for plutonium and other radionuclides resuspended from local soils and establishment of urine excretion rates for plutonium, strontium 90 and cesium 137 for individuals if possible, and the averages for atoll populations.

From these data, assessments of both external and internal doses and dose commitments will be made. In addition, projections of future radiological conditions will be postulated in order to provide appropriate guidance on projected land use and living patterns. Earlier dose assessments will be revised and updated, and dosimetry models will be refined to reflect actual trends as determined from the monitoring program.

Project personnel will provide a resource of expertise for establishment of independent review of radiation protection programs associated with cleanup and rehabilitation efforts in the northern Marshall Islands, and for related health physics interests of the Division of Safety, Standards and Compliance.

15. Relationship to Other Projects:

a. Field surveys will be made in close conjunction with those of the BNL Medical Survey Team, and assistance will be given to their efforts.

b. Continued collaboration with the University of Washington, Laboratory for Radiation Ecology is anticipated in SSC-sponsored environmental programs in the Pacific Basin.

16. Technical Progress in FY 1977:

During a field trip in September-October 1976, visits to Wotje, Ailuk, Utirik, Rongelap, and Bikini provided opportunities to collect urine samples

(See Continuation Sheet)

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Surveillance of Facilities and Sites

Project Title: Marshall Islands Radiological Safety Program

RK-01-05-02-

16. Technical Progress in FY 1977: (Cont'd)

representative of contaminated and uncontaminated locations in the region as part of a plutonium excretion study. Definitive measurements of external exposure rates were made at Utirik and Rongelap, and the incremental exposure rates from Bravo fallout were determined for the village islands and several others at these atolls.

Analyses of environmental samples collected from past surveys are nearly completed, and reports of the results are in progress.

17. Expected Results in FY 1978:

Installations of air sampling stations will be completed at Kwajalein, Bikini, Rongelap, and Utirik; and initial results of air monitoring and intensified urine bioassay programs are expected.

Group survey support will be provided for a planned interagency sponsored aerial radiological survey of all previously unsurveyed atolls in the northern Marshall Islands which may have received local fallout from U.S. atmospheric nuclear tests.

18. Expected Results in FY 1979:

Continuation of programs described for FY 1977 and 1978.

19. Description and Explanation of Major Materials, Equipment and Subcontract Items:

Capital Equipment, FY 1978:

Peripheral electronics (\$10,000) for the Safety and Environmental Protection Division analytical laboratory is needed to process the increasing load of environmental samples collected on field surveys.

Major Subcontract Items, FY 1978:

A supplemental budget request was made for FY 1977 to initiate the air monitoring and expanded urine bioassay program for plutonium. It will be necessary to extend the contracted peak load analyses of these samples into FY 1978 because of the lengthy set up and processing times for amounts of radioactivity which are below conventional limits of detection. Anticipated cost is \$10,000.

Capital Equipment, FY 1979:

Peripheral electronics equipment (\$5,000) is needed to provide depth in the Safety and Environmental Protection Division analytical laboratory to handle peak loads of environmental samples which must otherwise be subcontracted to a commercial laboratory.

(See Continuation Sheet)

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Surveillance of Facilities and Sites

Project Title: Marshall Islands Radiological Safety Program

RK-01-05-02

20. Proposed Obligations for Related Construction Projects:

None

RK-116

DEPARTMENT OF ENERGY  
ENERGY - OPERATING EXPENSES AND CAPITAL ACQUISITION

SCHEDULE 189  
ADDITIONAL EXPLANATION FOR OPERATING OBLIGATIONS

Brookhaven National Laboratory  
Laboratory

GK-Multi-Resource  
Mission Resource

<p>1. <u>Contractor:</u> Associated Universities, Inc.</p>	<p><u>Contract No.:</u> EY-76-C-02-0016</p>	<p><u>Task No.:</u></p>																																
<p>2. <u>Project Title:</u> Surveillance of Facilities and Sites Marshall Islands Radiological Safety Program</p>																																		
<p>3. <u>Budget Activity No.:</u> GK-01-01-52-3-(a) (600003)</p>	<p>4. <u>Date Prepared:</u> March 1978</p>																																	
<p>5. <u>Method of Reporting:</u> Annual Report to Division of Safety Standards and Compliance (SSC) Monthly Visits to SSC Scientific Journals and Meetings</p>	<p>6. <u>Working Location:</u> Brookhaven National Laboratory</p>																																	
<p>7. <u>Person in Charge:</u> C. B. Meinhold  <u>Principal Investigator:</u> N. A. Greenhouse (664-4250)</p>	<p>8. <u>Project Term:</u> Continuing  From:                      To:</p>																																	
<p>9. <u>Person-Years:</u></p> <table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 10%; text-align: center;"><u>FY 1978</u></th> <th style="width: 10%; text-align: center;"><u>Pres. Bud.</u> <u>FY 1979</u></th> <th style="width: 10%; text-align: center;"><u>Rev. Req.</u> <u>FY 1979</u></th> <th style="width: 10%; text-align: center;"><u>FY 1980</u></th> </tr> </thead> <tbody> <tr> <td colspan="5"><u>Direct Person-Years</u></td> </tr> <tr> <td>Scientific &amp; Professional</td> <td style="text-align: center;">2.0</td> <td style="text-align: center;">3.0</td> <td style="text-align: center;">3.0</td> <td style="text-align: center;">3.0</td> </tr> <tr> <td>Others</td> <td style="text-align: center;">2.5</td> <td style="text-align: center;">2.0</td> <td style="text-align: center;">4.0</td> <td style="text-align: center;">4.0</td> </tr> <tr> <td>Guests &amp; Research Collaborators</td> <td style="text-align: center;">---</td> <td style="text-align: center;">---</td> <td style="text-align: center;">---</td> <td style="text-align: center;">---</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: center;">4.5</td> <td style="text-align: center;">5.0</td> <td style="text-align: center;">7.0</td> <td style="text-align: center;">7.0</td> </tr> </tbody> </table>						<u>FY 1978</u>	<u>Pres. Bud.</u> <u>FY 1979</u>	<u>Rev. Req.</u> <u>FY 1979</u>	<u>FY 1980</u>	<u>Direct Person-Years</u>					Scientific & Professional	2.0	3.0	3.0	3.0	Others	2.5	2.0	4.0	4.0	Guests & Research Collaborators	---	---	---	---	Total	4.5	5.0	7.0	7.0
	<u>FY 1978</u>	<u>Pres. Bud.</u> <u>FY 1979</u>	<u>Rev. Req.</u> <u>FY 1979</u>	<u>FY 1980</u>																														
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Guests & Research Collaborators	---	---	---	---																														
Total	4.5	5.0	7.0	7.0																														
<p>10. <u>Costs (In Thousands of Dollars):</u></p> <table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 10%; text-align: center;"><u>FY 1978</u></th> <th style="width: 10%; text-align: center;"><u>Pres. Bud.</u> <u>FY 1979</u></th> <th style="width: 10%; text-align: center;"><u>Rev. Req.</u> <u>FY 1979</u></th> <th style="width: 10%; text-align: center;"><u>FY 1980</u></th> </tr> </thead> <tbody> <tr> <td>Research Costs</td> <td style="text-align: center;">150</td> <td style="text-align: center;">211</td> <td style="text-align: center;">400</td> <td style="text-align: center;">420</td> </tr> <tr> <td>Total Research Obligations</td> <td style="text-align: center;">198</td> <td style="text-align: center;">218</td> <td style="text-align: center;">369</td> <td style="text-align: center;">427</td> </tr> <tr> <td>Equipment Obligations</td> <td style="text-align: center;">11</td> <td style="text-align: center;">20</td> <td style="text-align: center;">20</td> <td style="text-align: center;">50</td> </tr> </tbody> </table>						<u>FY 1978</u>	<u>Pres. Bud.</u> <u>FY 1979</u>	<u>Rev. Req.</u> <u>FY 1979</u>	<u>FY 1980</u>	Research Costs	150	211	400	420	Total Research Obligations	198	218	369	427	Equipment Obligations	11	20	20	50										
	<u>FY 1978</u>	<u>Pres. Bud.</u> <u>FY 1979</u>	<u>Rev. Req.</u> <u>FY 1979</u>	<u>FY 1980</u>																														
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<p>11. <u>Reactor Concept:</u></p>	<p>12. <u>Materials:</u></p>																																	

Surveillance of Facilities and Sites

Project Title: Marshall Islands Radiological Safety Program GK-01-01-52-1

13. Publications:

Greenhouse, N. A. and Miltenberger, R. P. Radiological analyses of Marshall Islands environmental samples from 1974 through 1976. BNL Report (in press).

Greenhouse, N. A. and Miltenberger, R. P. External radiation survey and dose predictions for Rongelap, Utirik, Rongerik, Ailuk, and Wotje Atolls. BNL Report (in press).

14. Scope:

(a) 200 Word Summary: A comprehensive radiological safety program will be maintained for the inhabitants of atolls in the northern Marshall Islands contaminated as a result of the U.S. Pacific Testing programs. The following items and services will be provided:

1. Environmental and personnel monitoring to provide data for BNL dose assessments and determination of radiological trends.
2. Individual and population dosimetry based on actual measurements. These data will be used to modify dose commitment predictive models so that they accurately reflect future trends.
3. Suggestions based on field experience to mitigate doses via the more critical pathways.
4. A flexible resource of radiological expertise to independently review radiation protection programs associated with rehabilitation efforts in the northern Marshalls, and for related health physics interests of OES in the Pacific Basin.

Program activities for the coming fiscal year will emphasize the following:

1. In vivo counting of Bikini and Enewetak residents. These efforts will define baseline body burdens of gamma-emitting nuclides for new residents at both atolls, and will periodically assess changes in body burdens over time which might result from various exposure pathways.
2. Urine bioassay to define radionuclide excretion patterns from individuals, and to estimate  $^{90}\text{Sr}$  and transuranic nuclide burdens.

(See Continuation Sheet)

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Surveillance of Facilities and Sites

Project Title: Marshall Islands Radiological Safety Program JK-01-01-52-3-

14. Scope: (continued)

3. Definition of the annual contributions to dose via the inhalation pathway at Bikini, Rongelap, and Utirik. Special emphasis will be placed on continuous air sampling for wind-mediated resuspension of radionuclides in local soils; and on special measurements to define aerosol contributions resulting from human activity.

4. Development of radiological dose predictive models which involve both human and environmental monitoring data.

(b) Supplement to 200 Word Summary: The FY 1979 budget request contains a significant increase over the FY 1978 allocation. This increase reflects a realistic assessment of operating costs imposed by the in vivo counting, bio-assay, and air monitoring activities begun in FY 1978. Additionally, field trip activities and analytical laboratory services have substantially exceeded original estimates for the basic radiological safety program, and these costs are expected to continue. Finally, there are a number of peripheral programs of mutual interest to BNL and OES which will be cost-effective if included with the basic efforts, manpower and budget permitting. These include in order of importance:

1. Definition of local diet patterns at all atolls of interest, and continuous monitoring of diets for seasonal changes and long-term trends which might impact on realistic dose predictions.

2. Incorporation of public information and education programs into the total BNL effort to minimize the adverse psychological and sociological impacts of local radiological conditions and of our efforts to understand them.

3. Retrospective assessment of the radiological picture in the northern Marshalls prior to the establishment of the BNL program in FY 1975.

4. Continued collaboration with UW/LRE on OES radiological programs.

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15. Relationship to Other Projects:

This program will be logistically coupled wherever possible to the BNL Medical Program in the Marshall Islands. Technical collaboration will continue on matters of mutual interest. The radiological safety program will also bear directly on a retrospective reassessment of thyroid and whole body doses to the BRAVO fallout victims at Rongelap and Utirik, a new program for which funding is expected in FY 1978. The program will also interact cooperatively with related efforts at the University of Washington (LRE) and at Lawrence Livermore Laboratory.

(See Continuation Sheet)

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Surveillance of Facilities and Sites

Project Title: Marshall Islands Radiological Safety Program JK-01-01-52

16. Technical Progress in FY 1978:

Several reports are in press or in progress for publication in FY 1978. These reports will summarize all BNL radiological program activities to date and identify the technical issues to be addressed in FY 1979 and 1980. Two field trips were made in October 1977 to initiate the BNL air monitoring programs at Bikini, Rongelap, and Utirik; and to establish the in vivo counting program. Sufficient field monitoring data will become available to assess average radionuclide body burdens for residents of Bikini, Rongelap, and Utirik, and to make a preliminary analysis of the inhalation pathway at these atolls.

Personnel and analytical laboratory resources are being mobilized to provide technical program support for the "13 Atoll Survey" which is expected during FY 1978.

At least two additional field trips are planned for FY 1978 to continue environmental surveillance programs at Utirik, Rongelap, and Bikini, and the study of trends in <sup>137</sup>Cs body burdens at Bikini. Field trip scheduling continues to be hampered, however, by uncertainties over logistics support.

17. Expected Results in FY 1979:

At least three field trips will be made to Bikini, Rongelap, and Utirik Atolls to conduct routine environmental surveillance and personnel monitoring activities. In addition, two or more field trips will be made to Enewetak to continue baseline in vivo counting and bioassay activities begun in FY 1978, and to initiate a new environmental surveillance program consistent with the return of control of the atoll to the Marshallese.

Average baseline radionuclide body burdens will be established for typical residents of uncontaminated atolls. Additional contributions to body burdens from environmental pathways on contaminated atolls will be determined for individuals and populations at Bikini, Rongelap, and Utirik. Definition of the inhalation pathway at the aforementioned atolls will be completed, and a working predictive model will be developed which incorporates environmental and pathway analyses with actual human uptake experience.

18. Expected Results in FY 1980:

Continuation of programs described in FY 1979.

(See Continuation Sheet)

GK-1181

Surveillance of Facilities and Sites  
Project Title: Marshall Islands Radiological Safety Program GK-01-01-52-3-(a)

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19. Description and Explanation of Major Materials, Equipment and Subcontract Items:

Capital Equipment - FY 1980:

Two phantoms (\$10,000) are required to provide adequate calibrations for the Marshall Islands In Vivo Counting program. A computer-based pulse height analyzer (\$40,000) is needed to maintain the division counting laboratory at state-of-the-art, and to provide independent analytical facilities for ultra-low-level sample counting.

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20. Proposed Obligations for Related Construction Projects:

None.

DEPARTMENT OF ENERGY  
ENERGY - OPERATING EXPENSES AND CAPITAL ACQUISITION  
SCHEDULE 139  
ADDITIONAL EXPLANATION FOR OPERATING OBLIGATIONS

Brookhaven National Laboratory GK-Multi-Resource  
Laboratory Mission Resource

1. Contractor: Contract No.: Task No.:  
Associated Universities, Inc. EY-76-C-02-0016

2. Project Title: 189 No.:  
Surveillance of Facilities and Sites  
Dose Reassessment for Populations on Rongelap and Utirik  
Following Exposure to Fallout

3. Budget Activity No.: Date Prepared:  
GK-01-01-52-3-(b) March 1978  
(600160)

5. Method of Reporting: Working Location:  
Annual Report to Division of Brookhaven National Laboratory  
Biomedical & Environmental Research  
Scientific Meetings and Journals

7. Person in Charge: Project Term:  
C. B. Meinhold  
Principal Investigator: From: To:  
J. R. Naidu (664-4210) Project to be initiated and  
N. A. Greenhouse (664-4250) terminated in FY 1979

9. Person-Years:

	<u>FY 1978</u>	<u>Pres. Bud.</u> <u>FY 1979</u>	<u>Rev. Req.</u> <u>FY 1979</u>	<u>FY 1980</u>
<u>Direct Person-Years</u>				
Scientific & Professional	---	---	0.5	---
Others	---	---	---	---
Guests & Research Collaborators	---	---	---	---
<u>Total</u>	---	---	0.5	---

10. Costs (In Thousands of Dollars):

	<u>FY 1978</u>	<u>Pres. Bud.</u> <u>FY 1979</u>	<u>Rev. Req.</u> <u>FY 1979</u>	<u>FY 1980</u>
Research Costs	0	0	25	0
Total Research Obligations	0	0	25	0
Equipment Obligations	0	0	0	0

11. Reactor Concept: 12. Materials:

GK-12

Surveillance of Facilities and Sites

Dose Reassessment for Populations on Rongelap and Utirik

Project Title: Following Exposure to Fallout

GK-01-01-52-3-

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13. Publications:

None

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14. Scope:

(a) 200 Word Summary: Incidences of thyroid nodules, benign and malignant, in the exposed populations of Utirik and Rongelap have indicated critical differences in correspondence between nodule incidence and thyroid dose for the two populations. The estimated external dose received from the time fallout began to the time of evacuation shows that the Rongelap population received an external dose (175 rads) which was about thirteen times that for the Utirik population (14 rads), and the thyroid dose was about ten times larger, whereas the incidence of thyroid nodules in the two populations were not significantly different.

A preliminary study has indicated that the critical area of investigation that could shed light is the period during fallout and evacuation for both the islands. In addition, the fact that the Utirik population returned within 120 days following evacuation, whereas the Rongelap population returned only after three years, requires that we look closely at the Utirik population in terms of a longer exposure period, both internal and external. Further studies would, therefore, have to concentrate on the re-examination of all available data in reports issued by various agencies during that period, consultations with scientific personnel involved at that time, identifying the areas of uncertainty, and using appropriate computer programs to analyze the data. The end result will enable us to look for correlations between the incidence of thyroid nodules and the reassessed dose estimates.

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15. Relationship to Other Projects:

(a) This study will help establish dose estimates from the time of the incident to the present, and will complement the aerial survey, for external radiation measurements, over these islands, which is scheduled soon. Together they should present a reliable picture of doses received by the populations and also enable dose estimates to be projected into the future.

(b) This study will be in close conjunction with the BNL Radiological Safety Program in the Marshall Islands and with related programs of the BNL Medical Department. Continued collaboration with the University of Washington, Laboratory of Radiation Ecology, in the area of environmental radioactivity will be maintained.

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16. Technical Progress in FY 1973:

Preliminary literature search and consultations with Dr. C. A. Sondhaus, University of California, have been completed. This has resulted in defining areas of uncertainty in information and establishing the procedural steps that should be carried out towards elucidating this problem. Progress is being made

(See Continuation Sheet)

GK-121

Surveillance of Facilities and Sites

Dose Reassessment for Populations on Rongelap and Utirik

Project Title: Following Exposure to Fallout

GK-01-01-52-2

16. Technical Progress in FY 1978: (continued)

in the analysis of historical samples (dated March 1, 1954 from Rongelap and Utirik Islands). However, delay in funding for FY 1978 has caused the project to be set aside until such time that the funding is appropriated. Consequently it is expected that studies will have to be continued into FY 1979.

17. Expected Results in FY 1979:

The literature search, consultations and the analysis of data will be completed, and will lead to comprehensive discussions and final dose assessments for both the islands. These results will be used to test the hypothesis that radiation effects can be translated into meaningful dose estimates. The prognosis of the FY 1978 study should also permit validation of the models used in arriving at the dose estimates in terms of present day exposures.

18. Expected Results in FY 1980:

Program completed.

19. Description and Explanation of Major Materials, Equipment and Subcontract Items:

None.

20. Proposed Obligations for Related Construction Projects:

None.

GK-122

DEPARTMENT OF ENERGY  
ENERGY - OPERATING EXPENSES AND CAPITAL ACQUISITION

SCHEDULE 189

ADDITIONAL EXPLANATION FOR OPERATING OBLIGATIONS

Brookhaven National Laboratory  
Laboratory

GK-Multi-Resource  
Mission Resource

1. Contractor: Contract No.: Task No.:  
Associated Universities, Inc. EY-76-C-02-0016

2. Project Title: 189 No.:

Surveillance of Facilities and Sites--SUMMARY

3. Budget Activity No.: Date Prepared:  
GK-01-01-52-3 March 1978

5. Method of Reporting: Working Location:  
See sub-activities Brookhaven National Laboratory

7. Person in Charge: Project Term:  
See sub-activities Continuing  
Principal Investigator: From: To:  
See sub-activities

9. <u>Person-Years:</u>	Pres. Bud.		Rev. Req.	
	<u>FY 1978</u>	<u>FY 1979</u>	<u>FY 1979</u>	<u>FY 1980</u>
Sci., Res. Assoc. (Ph.D. or Equiv.)	1.0	1.0	1.5	1.0
Prof. (B.S. or Equiv.)	1.0	2.0	2.0	2.0
Sci. & Prof. - Total	2.0	3.0	3.5	3.0
Others	2.5	2.0	4.0	4.0
Guests & Research Collaborators	---	---	---	---
Total	4.5	5.0	7.5	7.0

10. <u>Costs (In Thousands of Dollars):</u>	Pres. Bud.		Rev. Req.	
	<u>FY 1978</u>	<u>FY 1979</u>	<u>FY 1979</u>	<u>FY 1980</u>
Labor (including benefits)	96	116	164	171
Mats., Trav., Dev.				
Subcont., Spec'l Proc.	6	32	135	126
Reactor, Accel., and/or				
Computer Usage	0	0	4	0
Allocated Technical Services	1	5	5	5
Gen. & Adm. Overhead	47	58	117	113
Total Research Cost	150	211	425	420
Total Research Obligations	198	218	394	427
Equipment Obligations	11	20	20	50

11. Reactor Concept: 12. Materials:

SUMMARY

Sub-activity

Title

GK-01-01-52-3-(a)

Marshall Islands Radiological  
Safety Program

GK-01-01-52-3-(b)

Dose Reassessment for Populations  
on Rongelap and Utirik Following  
Exposure to Fallout



External Radiation Measurements and  
"Ground Truth" for Northern Marshall  
Islands Regional Radiological Survey

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13. Publications:

Greenhouse, N.A. and Miltenberger, R.P. Radiological analyses of Marshall Islands environmental samples from 1974 through 1976. BNL Report 50796 in press.

Greenhouse, N.A. and Miltenberger, R.P. External radiation survey and dose predictions for Rongelap, Utirik, Rongerik, Ailuk, and Wotje Atolls. BNL Report 50797 in press.

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14. Scope:

(a) 200 Word Summary: A comprehensive external radiation survey program will be conducted on each of the approximately 13 atolls or islands in the Northern Marshall Islands which could have received tropospheric fallout from U.S. nuclear weapons tests in the Pacific. The surveys will provide "ground truth" data on ambient external gamma radiation levels on-island. This data will be used as the basis for calibration and normalization of aerial radiological monitoring by E.G.&G. Corporation. The program will include detailed external radiation measurements with pressurization chamber and scintillation survey instruments, and in situ gamma spectrometry on all islands of interest. Surface soil samples will be collected and analyzed for significant gamma emitters in order to make decay corrections for long-term dose predictions via the external radiation exposure pathway.

BNL field trip staff and analytical lab facilities will be available for other environmental sample collections and analyses as needed by the overall scientific program.

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15. Relationship to Other Projects:

This program is directly related to our continuing environmental and personnel monitoring efforts under the BNL Marshall Islands Radiological Safety Program. It will also interact cooperatively with related efforts at the University of Washington (LRE) and Lawrence Livermore Laboratory.

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16. Technical Progress in FY 1978:

Personnel and analytical laboratory resources will be mobilized in support of this program. If the regional survey begins on schedule, the first of the three survey legs should be completed by the end of FY 1978.

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17. Expected Results in FY 1979:

The remaining two survey legs will be completed, data analyzed, and a

(See Continuation Sheet)

External Radiation Measurements and  
"Ground Truth" for Northern Marshall  
Project Title: Islands Regional Radiological Survey

GX-01-01-52-3

17. Expected Results in FY 1979: (Continued)

report of BNL activities in support of this effort will be written for inclusion in the overall project report.

18. Expected Results in FY 1980:

Project will be completed in FY 1979.

19. Description and Explanation of Major Materials, Equipment and Subcontract Items:

Capital Equipment, FY 1979:

None required.

Capital Equipment, FY 1980:

None required.

20. Proposed Obligations for Related Construction Projects:

None.

DEPARTMENT OF ENERGY

ENERGY - OPERATING EXPENSES AND CAPITAL ACQUISITION

SCHEDULE 189

ADDITIONAL EXPLANATION FOR OPERATING OBLIGATIONS

<u>Brookhaven National Laboratory</u>		<u>GK-Multi Resource</u>		
<u>Laboratory</u>		<u>Mission Resource</u>		
1. <u>Contractor:</u>	<u>Contract No.:</u>	<u>Task No.:</u>		
Associated Universities, Inc.	EY-76-C-02-0016			
2. <u>Project Title:</u>	<u>189 No.:</u>			
Special In-vivo Counting and Bioassay Program for the Bikini People. Supplement to the BNL Marshall Islands Radiological Safety Program.				
3. <u>Budget Activity No.:</u>	4. <u>Date Prepared:</u>			
GK-01-01-52-3	July 1978			
5. <u>Method of Reporting:</u>	6. <u>Working Location:</u>			
Written report to D.O.E.S.	Brookhaven National Laboratory and Marshall Islands			
7. <u>Person in Charge:</u>	8. <u>Project Term:</u>			
C.B. Meinhold	Continuing			
<u>Principal Investigator:</u>	From: 8/01/78 To: 9/30/78			
N.A. Greenhouse				
9. <u>Person-Years:</u>	<u>FY 1978</u>	<u>Pres. Bud. FY 1979</u>	<u>Rev. Bud. FY 1979</u>	<u>FY 1980</u>
Sci., Res. Assoc. (Ph.D. or Equiv.)	---	---	---	---
Prof. (B.S. or Equiv.)	---	---	---	---
Sci. & Prof. - Total	---	---	---	---
Others	---	---	---	---
Guests & Research Collaborators	---	---	---	---
Total	---	---	---	---
10. <u>Costs (In Thousands of Dollars):</u>	<u>FY 1978</u>	<u>Pres. Bud. FY 1979</u>	<u>Rev. Bud. FY 1979</u>	<u>FY 1980</u>
Labor (including benefits)	0	0	0	0
Mats., Trav., Dev.				
Subcont., Spec'l Proc.	20	0	0	0
Reactor, Accel., and/or				
Computer Usage	0	0	0	0
Allocated Technical Services	0	0	0	0
Gen. & Adm. Overhead	0	0	0	0
Total Research Cost	20	0	0	0
Total Research Obligations	20	0	0	0
Equipment Obligations	0	0	0	0
11. <u>Reactor Concept:</u>	12. <u>Materials:</u>			

13. Publications:

Greenhouse, N.A. and Miltenberger, R.P. Radiological analyses of Marshall Islands environmental samples from 1974 through 1976. BNL Report 50796.

Greenhouse, N.A. and Miltenberger, R.P. External radiation survey and dose predictions for Rongelap, Utirik, Rongerik, Ailuk, and Wotje Atolls. BNL Report 50797.

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14. Scope:

(a) 200 Word Summary: A special field trip will be made in August 1978 to do in-vivo counting and urine bioassay at Kwajalein Atoll on 20 to 30 Bikini residents before their anticipated exodus from Bikini in late August. In addition, a separate field trip party will proceed to Bikini to collect 24 hr urine samples from those Bikini residents who cannot be accommodated on the charter flight which will bring the in-vivo counting subjects to Kwajalein.

The rationale for this effort is as follows:

(1) Accurate internal dosimetry for  $^{137}\text{Cs}$  body burdens in the Bikinians requires an assessment of extant body burdens just prior to the departure of the people from Bikini.

(2) There is evidence that both the short-term and long-term compartment  $^{137}\text{Cs}$  clearance rates from the Bikinians may differ significantly from those for the ICRP standard man. Determination of these parameters is essential to the accurate assessment of total dose commitments.

(3) During the past several years the Bikinians have become apprehensive about potential health effects which they feel might result from their having lived in the contaminated Bikini environment. The personal attention that they will receive in these personnel monitoring activities should help to alleviate some of their fears.

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15. Relationship to other Projects:

This program is directly related to our on-going environmental and personnel monitoring efforts under the BNL Marshall Islands Radiological Safety Program.

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16. Technical Progress in 1978:

Assessments of body burdens and clearance parameters and the determination

Special In-vivo Counting and Bioassay Program for the Bikini  
People. Supplement to the BNL Marshall Islands Radiological  
Project Title: Safety Program. GK-01-01-52-3

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16. Technical Progress in 1978: (Cont'd)

of dose commitments for individuals living on Bikini Atoll will be completed by the end of the FY 1978.

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17. Expected Results in FY 1979:

Project will be completed in FY 1978.

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18. Expected Results in FY 1980:

N/A

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19. Description and Explanation of Major Materials, Equipment and Subcontract Items:

The funding request includes \$8,000 for two round trip charter flights between Bikini and Kwajalein to transport the Bikini people for in-vivo counting.

Capital Equipment, FY 1978:

N/A

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20. Proposed Obligations for Related Construction Projects:

None.



**TASK REQUIREMENTS FOR OPERATING/EQUIPMENT  
COSTS AND OBLIGATIONS**

CONTRACTOR NAME		Associated Universities, Inc.			
BIN NUMBER	TASK NO. REV. NO.	DATE PREPARED		CONTRACTOR NUMBER	
	0	04/02/79			
20. STAFFING (in staff years)	FY 1979 3Y-2	FY 1980 - 3Y-1 PRESIDENT'S REVISED		AUTHORIZED	FY, FY 1981
A. SCIENTIFIC .....	2.7	3.0	3.0		3.0
B. OTHER DIRECT .....	1.7	4.4	4.4		4.4
C. TOTAL DIRECT .....	4.4	7.4	7.4		7.4
21. OBLIGATIONS AND COSTS (in thousands)					
A. TOTAL COSTS .....	211	420	420		465
B. TOTAL OBLIGATIONS .....	211	439	446		480
22. EQUIPMENT (in thousands)					
A. EQUIPMENT COSTS .....	18	38	38		26
B. EQUIPMENT OBLIGATIONS .....	25	50	50		10
23. OTHER COSTS (specify)					
A.					
B.					
C.					
D.					
24. OPTIONAL FIVE YEAR PLAN (in thousands) Constant FY dollars		FY 82-3Y-1	FY 83-3Y-2	FY 84-3Y-3	FY 85-3Y-4
A. TOTAL OPERATING COSTS .....					
B. TOTAL OPERATING OBLIGATIONS .....					
C. TOTAL EQUIPMENT COSTS .....					
D. TOTAL EQUIPMENT OBLIGATIONS .....					
25. MILESTONE SCHEDULE		PROPOSED SCHEDULE	AUTHORIZED SCHEDULE		

TASK TITLE Marshall Islands Radiological Safety Program	BUDGET AND REPORTING CODE GK-01-01-08-4 (600003)	DATE PREPARED 04/02/79		
CONTRACTOR NAME Associated Universities, Inc.	CODE BNL	BIN NUMBER	TASK NO.	REV. NO. 0

17. Task Description (Cont.)

3. Replicate determinations of ultra-low level Pu and Am urinary excretion rates among Northern Marshalls inhabitants and among Marshallese control groups who reside outside the fallout areas.

4. Establishment of  $^{137}\text{Cs}$  and  $^{90}\text{Sr}$  excretion rates among Marshallese control groups.

19a. Facility Requirements.

It is anticipated that work for this proposal will use existing Laboratory facilities and site utility services.

19b. Publications.

Fiscal Year 1978

Greenhouse, N. A., Miltenberger, R. P., and Cua, F. T. External Radiation Survey and Dose Predictions for Rongelap, Utirik, Rongerik, Ailuk and Wotje Atolls. BNL 50797, December 1977.

Greenhouse, N. A., Miltenberger, R. P., and Cua, R. T. Radiological Analyses of Marshall Islands Environmental Samples 1974-1976. BNL 50796, December 1977.

Fiscal Year 1979 - 1st Quarter

Miltenberger, R. P., Greenhouse, N. S., and Cua, F. T. Whole Body Counting Results for Inhabitants of the Northern Marshall Islands: 1974-1978. Health Physics Journal (submitted).

Miltenberger, R. P., Greenhouse, N. A., Cua, F. T., and Lessard, E. T. Dietary Radioactivity Intake from Bioassay Data: A Model Applied to  $^{137}\text{Cs}$  Intake by Bikini Island Residents. Health Physics Journal (submitted).

Greenhouse, N. A. Follow-up Radiological Surveillance, Marshall Islands. Presented at the 1978 Annual Meeting of the Health Physics Society, Minneapolis, Minnesota, June 1978.

TASK TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Marshall Islands Radiological Safety Program	GK-01-01-08-4 (600003)		04/02/79	
CONTRACTOR NAME	CODE	BIN NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

19c. Purpose.

This program is operated to provide continuously updated data on ionizing radiation doses and dose commitments received by the residents of islands in the Northern Marshalls which have been contaminated by U.S. atmospheric nuclear tests. These data will be used to develop predictive dose modelling, and to provide a basis for remedial actions when necessary.

19d. Background.

This work was begun in 1974 to provide radiation safety related information to the A.E.C. concerning the residents of Bikini, Rongelap, and Utirik Atolls, and the impending return of the Enewetak people.

19e. Approach.

Field trips to the Marshall Islands will be conducted two to three times per year to do in vivo counting and urine collections for radioassay and for environmental sampling. Samples and in vivo counting data will be analyzed primarily at BNL. Results will be incorporated into a computerized data base for manipulation, modelling studies, and incorporation into reports for publication.

19f. Technical Progress.

Three field trips were conducted during FY1978 for environmental sampling and personnel monitoring.

The Spring 1977 whole body counting trip to Bikini demonstrated dramatic and unexpected increases in  $^{137}\text{Cs}$  body burdens among the residents. These findings led to a Department of the Interior decision to move the Bikini people off their home atoll. The decline in  $^{137}\text{Cs}$  and  $^{90}\text{Sr}$  body burdens among the Bikinians will be monitored during FY1979. A detailed diet and living pattern study of residents of the Northern Marshalls is expected to improve understanding of internal and external radiation exposure pathways. This study and estimates of radionuclide excretion rates derived from follow-up personnel monitoring on the Bikinians are expected to improve predictive modelling and reduce the probability of unexpected occurrences such as that at Bikini last year.

Emphasis on personnel monitoring is expected to continue through FY1980 and FY1981. Development of ultra-low level analytical capabilities for transuranic radionuclides and the establishment of corroborative bioassay programs in cooperation with other laboratories are expected to clarify and quantitate low level plutonium and americium body burdens among the Bikinians and Rongelapese. Similar determinations among a Marshallese control population are expected to demonstrate differences, if any, between the residents of contaminated atolls and regional background.

TASK TITLE	BUDGET AND REPORTING CODE		DATE PREPARED
Marshall Islands Radiological Safety Program	GK-01-01-08-4 (600003)		04/02/79
CONTRACTOR NAME	CODE	BIN NUMBER	TASK NO. REV. NO.
Associated Universities, Inc.	BNL		0

19f. Technical Progress (cont.)

Systematic personnel and environmental monitoring programs are expected to be initiated at Enewetak in FY 1980 and to be well established by FY 1981.

19g. Future Accomplishments.

These studies are expected to provide a better understanding of the radiological impact on man resulting from habitation in an environment contaminated with man-made radioactive materials. They are further expected to provide a basis for corrective actions where needed and to minimize through better understanding the fears of the people living in these areas.

19h. Relationship to Other Projects.

This program will function in cooperation with the BNL Medical Research Program in the Marshall Islands and will occasionally share the same logistical support resources for field trips. It will also function cooperatively with various Pacific research programs at the Lawrence Livermore Laboratory; and especially with programs to develop predictive dose estimates for present and future residents on contaminated islands. The BNL program will provide retrospective dose information to aid in the development of prospective dose models by LLL.

19i. 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).

19j. Explanation of Milestones.

None

19k. Other.

None

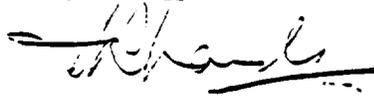
FIELD TASK PROPOSAL/AGREEMENT

1. WP BIN NUMBER	2. TASK NO.	3. REV. NO.	4. PROJECT NO.	5. DATE PREPARED (MM dd yy)	6. CONTRACTOR NUMBER
		0		04/02/79	
7. TASK TITLE			8. WORK PACKAGE TITLE		
Dose Reassessment for Rongelap and Utririk					
9. BUDGET AND REPORTING CODE	10. TASK TERM		11. CONTRACTOR NAME		12. CODE (See instructions)
GX-01-02-01-1-(b) (003010)	Begin: (MM dd yy) 10-01-79	End: (MM dd yy) Open	Associated Universities, Inc.		BNL
13. CONTRACTOR TASK MANAGER (Name, Title, No.)			14. PRINCIPAL INVESTIGATORS		
C. B. Mainhold 666-4209			J. R. Naidu N. A. Greenhouse		
15. WORK LOCATION (See instructions): Name of facility, City, State, ZIP Code					16. Does this task include any management services efforts?
					<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

17. TASK DESCRIPTION (Approved, relation to work package, in 300 words or less)

An in-depth study of all information pertaining to the BRAVO test fallout on Rongelap and Utririk will be made. In addition, using advanced analytical and computer techniques, a comprehensive fallout model will be developed. Using this model in conjunction with dietary and life style patterns prevalent at time of exposure, a reassessed dose estimate—internal and external—will be made for the populations of Rongelap and Utririk. The dose estimates will be evaluated in terms of the thyroid nodule incidences in these populations to test the hypothesis that radiation effects can be translated into meaningful dose estimates.

18. CONTRACTOR TASK MANAGER



J. R. Naidu for J. R. Naidu (Signature) and N. A. Greenhouse

02/05/79  
(Date)

19. DETAIL ATTACHMENTS: (See instructions)

- |  |   |  |   |
|--|---|--|---|
| <input checked="" type="checkbox"/> a. Facility Requirements | <input checked="" type="checkbox"/> d. Background         | <input checked="" type="checkbox"/> g. Future accomplishments          | <input type="checkbox"/> j. Explanation of milestones |
| <input checked="" type="checkbox"/> b. Publications          | <input checked="" type="checkbox"/> e. Approach           | <input checked="" type="checkbox"/> h. Relationships to other projects | <input type="checkbox"/> k. Other (specify):          |
| <input checked="" type="checkbox"/> c. Purpose               | <input checked="" type="checkbox"/> f. Technical progress | <input checked="" type="checkbox"/> i. Environmental assessment        |   |

GK-101

**TASK REQUIREMENTS FOR OPERATING/EQUIPMENT  
COSTS AND OBLIGATIONS**

CONTRACTOR NAME **Associated Universities, Inc.**

BIN NUMBER	TASK NO. REV. NO.	DATE PREPARED		CONTRACTOR NUMBER	
		0	04/02/79		
<b>20. STAFFING (in staff years)</b>	<b>FY 1979</b>	<b>FY 1980 - BY-1</b>		<b>AUTHORIZED</b>	<b>BY-BY</b> <b>1981</b>
	<b>BY-2</b>	<b>PRESIDENT'S</b>	<b>REVISED</b>		
a. SCIENTIFIC .....	0.3	0.3	2.3		0.3
b. OTHER DIRECT .....	---	0.3	0.3		2.3
c. TOTAL DIRECT .....	0.3	0.6	2.6		2.6
<b>21. OBLIGATIONS AND COSTS (in thousands)</b>					
a. TOTAL COSTS .....	50	50	50		53
b. TOTAL OBLIGATIONS .....	50	31	51		54
<b>22. EQUIPMENT (in thousands)</b>					
a. EQUIPMENT COSTS .....	0	0	0		0
b. EQUIPMENT OBLIGATIONS .....	0	0	0		0
<b>23. OTHER COSTS (specify)</b>					
a.					
b.					
c.					
d.					
<b>24. OPTIONAL FIVE-YEAR PLAN (in thousands)</b>		<b>FY 32-BY-1</b>	<b>FY 33-BY-2</b>	<b>FY 34-BY-3</b>	<b>FY 35-BY-4</b>
Comments BY dollars					
a. TOTAL OPERATING COSTS .....					
b. TOTAL OPERATING OBLIGATIONS .....					
c. TOTAL EQUIPMENT COSTS .....					
d. TOTAL EQUIPMENT OBLIGATIONS .....					
<b>25. MILESTONE SCHEDULE</b>		<b>PROPOSED SCHEDULE</b>	<b>AUTHORIZED SCHEDULE</b>		

TASK TITLE	BUDGET AND REPORTING CODE			DATE PREPARED
Dose Reassessment for Rongelap and Utirik	GK-01-02-01-1-(b) (003010)			04/02/79
CONTRACTOR NAME	CODE	BIN NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

19a. Facility Requirements.

It is anticipated that work for this proposal will use existing Laboratory facilities and site utility services.

19b. Publications.

None

19c. Purpose.

To look for correlations between the incidence of thyroid nodules in the inhabitants of Rongelap and Utirik Islands (Marshall Islands) and the reassessed dose estimates.

This study will fuse together all available information on fallout from the BRAVO test and using advanced analytical techniques (now available) derive realistic dose estimates to the inhabitants of Rongelap and Utirik. The results should provide information towards elucidating the whole question of low-level effects of radiation.

19d. Background.

Incidence of thyroid nodules, benign and malignant, in the exposed populations of Utirik and Rongelap has indicated critical differences in correspondence between nodule incidence and thyroid dose for the populations. The estimated external dose received from the time fallout began to the time of evacuation shows that the Rongelap population received an external dose (175 rads) which was about 13 times that for the Utirik population (14 rads), and the thyroid dose was about 10 times larger, whereas the incidence of thyroid nodules in the two populations were not significantly different.

A preliminary study has indicated that the critical area of investigation that could shed light is the period during the fallout and evacuation for both the islands. In addition, the fact that the Utirik population returned within 120 days following evacuation, whereas the Rongelap population returned only after three years, requires that we look closely at the Utirik population in terms of a longer exposure period, both internal and external. Further studies would, therefore, have to concentrate on the re-examination of all available data in reports issued by various agencies during that period, consultations with scientific personnel involved at that time, identifying the areas of uncertainty, and using appropriate computer programs to analyze the data. The end result will enable us to look for correlations between the incidence of thyroid nodules and the reassessed dose estimates.

TASK TITLE	BUDGET AND REPORTING CODE			DATE PREPARED
Dose Reassessment for Rongelap and Utirik	GK-01-02-01-1-(b) (003010)			04/02/79
CONTRACTOR NAME	CODE	BIN NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

19e. Approach.

Fiscal control will be exercised through the use of monthly comparisons between actual expenses incurred and corresponding line items in the budget.

The study will comprise:

- a. Literature search for all available data concerning the BRAVO test, such as, meteorological conditions and radiation measurements. Discussions with scientific and technical personnel involved in the BRAVO test.
- b. Use of historic samples and teeth samples to determine  $^{129}\text{I}$ ,  $^{90}\text{Sr}$ , and  $^{239, 240}\text{Pu}$  concentrations to derive concentrations of other radionuclides.
- c. Diet and life style studies to provide information for dose assessment.
- d. Computer simulation to determine the transport and deposition of radioactive fallout following the BRAVO test.

19f. Technical Progress in BY-3 (FY 1978).

Preliminary literature search and consultations with Dr. C.A. Sondhaus, University of California, has been completed. This has resulted in defining areas of uncertainty in information available and establishing the procedural steps that should be carried out towards elucidating the problem. All available data on external radiation measurements, radionuclide concentrations in soil, water, vegetation, animal and food items have been collated. Historic samples collected from Rongelap and Utirik have been submitted for  $^{129}\text{I}$  analysis. Pertinent meteorological information pertaining to the BRAVO test have been researched and the information provided to Lawrence Livermore Laboratory so that they can go ahead with the computer simulation of the transportation and deposition of fallout.

Technical Progress in BY-2 (FY 1979).

The  $^{129}\text{I}$  determinations of the soil samples will be completed. These samples will also be analyzed for  $^{129}\text{I}$  and  $^{99}\text{Tc}$  if required. In addition, we are exploring the possibility of analyzing "Bikini-Ash" - the fallout that settled on the Japanese fishing vessel. This sample should provide the most accurate description of the fallout. The computer simulation of the transportation and deposition of fallout will also be completed. Final analysis of a recent diet and life style study will on completion provide an internal and external exposure estimate. All the data so gathered will be used to generate a model(s) for arriving at the dose estimate in terms of exposure at time of fallout. Discussions with scientists and technical people who were involved

TASK TITLE	BUDGET AND REPORTING CODE		DATE PREPARED
Dose Reassessment for Rongelap and Utirik	GK-01-02-01-1(b) (003010)		04/02/79
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Associated Universities, Inc.	BNL		
REV. NO.	0		

19f. Technical Progress in 3Y-2 (FY 1979) (cont.)

with the BRAVO test will be continued.

Technical Progress in 3Y-1 (FY 1980).

Dose estimates derived for exposure during fallout, will be extrapolated to present times and the model(s) used will be tested for their validity based on current observed dose determinations.

19g. Future Accomplishments.

The techniques and expertise developed in the course of this study could be used to reassess doses to population in other areas subjected to exposure from fallout or even occupational situations in the past.

19h. Relationship to Other Projects.

- a. This study will help establish dose estimates from the time of the incident to the present, and will complement the aerial survey for external radiation measurements, over these islands, which has been completed. Together they should present a reliable picture of doses received by the populations and also enable dose estimates to be projected into the future.
- b. This study will be in close conjunction with the BNL Radiological Safety Program in the Marshall Islands and with related programs of the BNL Medical Department. Continued collaboration with the University of Washington, Laboratory of Radiation Ecology, and the Battelle Pacific Northwest Laboratory will be maintained in the area of sample analysis and data interpretation.

19i. 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).

19j. Explanation of Milestones.

None

19k. Other.

None

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

1. WORK PACKAGE NUMBER	2. TASK NO.	3. REV. NO. 0	4. PROJECT NO.	5. DATE PREPARED (mm dd yy) 03/31/80	6. CONTRACTOR NUMBER HP 0210 (600003)
7. TASK TITLE Marshall Islands Radiological Safety Program			8. WORK PACKAGE TITLE		
9. BUDGET AND REPORTING CODE HA-02-01-02-0	10. TASK TERM Begin: (mm dd yy) End: (mm dd yy) Continuing Open		11. CONTRACTOR NAME Associated Universities, Inc.		12. CODE (see instructions) BNL
13. CONTRACTOR TASK MANAGER (Name: Last, First, MI) (FTS No.)  C.B. Meinhold 666-4209			14. PRINCIPAL INVESTIGATORS (Name: Last, First, MI)  Greenhouse, N.A. 666-4250 or 4207		
15. WORK LOCATION (See instructions): Name of facility, City, State, Zip Code				16. Is this task included in the Institutional Plan? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	17. Does this task include any management services efforts? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

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

A comprehensive radiological safety program will be maintained for the inhabitants of atolls in the Northern Marshall Islands contaminated as a result of the U.S. Pacific Testing programs. The following items and services will be provided.

- a. Personnel monitoring and environmental sampling to provide data for BNL dose assessments and determination of radiological trends.
- b. Individual and population dosimetry based on actual measurements. The resulting data will be used to modify dose commitment predictive models so that they may more accurately reflect future trends.
- c. Continuation of diet and living pattern assessments to update relevant parameters in long range predictive dose efforts.

Program activities in the coming fiscal year will emphasize the following:

- a. In vivo counting and urine bioassay of Rongelap and Utirik residents to determine dose commitments from environmentally-derived radionuclides at these atolls, and to better understand excretion kinetics among the Marshallese.
- b. Followup personnel monitoring at Enewetak to evaluate any change in radionuclide body burden associated with 1 year of residence on Enewetak Atoll.
- c. A final determination of radionuclide body burdens among the former residents of Bikini Atoll.
- d. Continuation of analyses of transuranic nuclide excretion rates among Northern Marshall Islands residents, and of transuranics and fission and activation products among Marshallese control groups who reside outside of the fallout area.

19. CONTRACTOR TASK MANAGER

*Charles B. Meinhold*  
Charles B. Meinhold

(Signature)

*N.A. Greenhouse*

N.A. Greenhouse

03/31/80

(Date)

20. DETAIL ATTACHMENTS. (See instructions)

- |  |   |  |   |
|--|---|--|---|
| <input checked="" type="checkbox"/> a. Facility Requirements | <input checked="" type="checkbox"/> d. Background         | <input checked="" type="checkbox"/> g. Future accomplishments          | <input type="checkbox"/> j. Explanation of milestones |
| <input type="checkbox"/> b. Publications                     | <input checked="" type="checkbox"/> e. Approach           | <input checked="" type="checkbox"/> h. Relationships to other projects | <input type="checkbox"/> k. ZBB Detail                |
| <input checked="" type="checkbox"/> c. Purpose               | <input checked="" type="checkbox"/> f. Technical progress | <input checked="" type="checkbox"/> i. Environmental assessment        | <input type="checkbox"/> l. Other (Specify):          |

TITLE	BUDGET AND REPORTING CODE			DATE PREPARED
Marshall Islands Radiological Safety Program	HA-02-01-02-0			03/31/80
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

10a. Facility Requirements.

It is anticipated that work for this proposal will use existing Laboratory facilities and site utility services.

10b. Publications.

Greenhouse, N.A., Miltenberger, R.P., Lessard, E.T. External Exposure Measurements at Bikini Atoll, BNL 51003, January 1979.

Greenhouse, N.A. Dosimetry Methods and Results for the Former Residents of Bikini Atoll, BNL 26797, November 1979.

Miltenberger, R.P., Greenhouse, N.A., Lessard, E.T. Whole Body Counting Results for Inhabitants of the Northern Marshall Islands: 1974-1978, Health Physics, in press.

Miltenberger, R.P., Lessard, E.T., Greenhouse, N.A. Dietary Radioactivity Intake from Bioassay Data: A Model Applied to <sup>137</sup>Cs Intake by Bikini Island Residents, Health Physics, in press.

10c. Purpose.

The primary purpose of this program is to measure and evaluate the internal and external doses to people living on those islands in the Marshalls group which were impacted by tropospheric fallout from United States atmospheric nuclear tests in the Pacific. Its objectives are:

- a. Direct or indirect measurement of radionuclide body burdens and resultant doses and dose commitments.
- b. Measurement of external radiation environments and their contributions to the total doses to individuals and island populations.
- c. Evaluation of dietary habits and living patterns insofar as they relate to the elucidation of exposure pathways and the determination of doses.

10d. Background.

This program was initiated in 1974 at the request of the AEC (DOS) in anticipation of potential radiation exposures to the returning Bikini population.

10e. Approach.

Internal and external doses will be measured and evaluated using accepted and up-to-date health physics practices.

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Marshall Islands Radiological - Safety Program	HA-02-01-02-0		03/31/80	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

20e. Approach cont.

Dietary and living pattern information will be derived from direct observations of island residents, and from standardized interviews with island residents during programmatic field trips.

Management Controls

Fiscal control will be exercised in the form of monthly comparisons, over the task term, of actual costs incurred against corresponding line items of the budget. Technical results shall be monitored through a periodic review, by the Contractor Task Manager, of accomplishments by measuring actual performance as compared to expected progress. All work shall be conducted in conformance with generally accepted standards for R&D and other investigative or analytic procedures, as observed by universities and large independent research facilities including Brookhaven National Laboratory (BNL).

20f. Technical Progress.

Technical Progress in BY-3 (FY 1979).

External and internal dose equivalents received during residency on Bikini Island and internal dose equivalents to be received post residency were evaluated for former Bikini residents. Bioassay results from samples collected in January and May 1979 and prior bioassay results were used to construct individual  $^{90}\text{Sr}$ - $^{90}\text{Y}$  body burden histories. Whole body counting results during 1979 and results obtained in prior years were used to establish  $^{137}\text{Cs}$  -  $^{137}\text{mBa}$  individual body burden histories. Daily activity ingestion rates were calculated from the body burden data. Uptake regimes which best fit the activity ingestion rate data were; constant continuous uptake for  $^{90}\text{Sr}$  and stepwise increasing uptake for  $^{137}\text{Cs}$ . Dosimetric models which described the uptake scenario were derived and individual dosimetric results for persons residing on Bikini Island sometime during the years 1969 and 1978 were determined. In addition, doses due to residual radioactivity in persons after departure from Bikini were calculated. Individual body burdens, urine activity concentrations and dose equivalents have been recorded or stored in a computer data base. Publications and reports describing dosimetric methods and results, whole body counting results and biological removal rate constants for Bikinians have been written.

Routine personnel monitoring was provided for Rongelap and Utirik residents. A statistical analysis was performed to determine the minimum sample size needed to establish the mean  $^{137}\text{Cs}$  body burden at the 90% confidence level. Male and female adult, adolescent and child categories were counted at each atoll and many persons who participated in prior whole body counting visits were recounted. In addition, urine bioassay samples were collected from adult and adolescent population groups. Body burden histories and dosimetric results have been completed for half the resident populations for years following rehabilitation of the atolls.

Title Marshall Islands Radiological Safety Program	BUDGET AND REPORTING CODE HA-02-01-02-0		DATE PREPARED 03/31/80	
CONTRACTOR NAME Associated Universities, Inc.	CODE BNL	WP NUMBER	TASK NO.	REV. NO. 0

20f. Technical Progress cont.

Data collection on types and amounts of food consumed by the Marshallese was done by actually living with them. Simultaneous observations on their living patterns were also made. These studies were part of the Northern Marshallese Islands Radiological Survey (13-Atoll Survey)

Expected Progress in BY-2 (FY 1980).

Baseline radionuclide body burdens will be evaluated for the returning Enewetak population. Evaluation of the post residence decline of body burdens among former Bikini residents will continue. The data base on dietary habits and living patterns will be updated for all relevant atolls and/or islands.

Expected Progress in BY-1 (FY 1981).

Personnel monitoring and related demographic assessment activities will continue at Rongelap, Utirik, Enewetak and other areas of interest to DOE. Monitoring of former Bikini residents will be phased out unless circumstances dictate otherwise.

Expected Progress in BY (FY 1982).

Personnel monitoring and related demographic assessment activities will continue in all areas of interest in the Marshall Islands.

20g. Future Accomplishments.

A running account will be maintained of individual and population dosimetric information for the residents of islands affected by the Pacific Testing Programs. These data will provide an empirical basis for improving the accuracy and value of long-range predictive dose assessments from man-made radionuclides in the environment.

20h. Relationship to Other Projects.

This program operates and interacts directly with the Brookhaven Medical Program in the Marshall Islands, and provides contemporary data to be factored into the Retrospective Dose Reassessments for Rongelap and Utirik (and other islands affected by weapons test fallout). It also provides empirical bases for upgrading long range predictive dose modelling activities such as those of the Lawrence Livermore Laboratory. Coordination of this program with related programs within DOE and its contractors will be accomplished through timely exchange of program findings and related information.

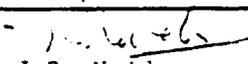
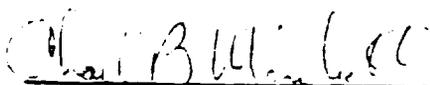
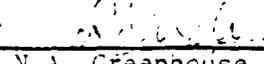
20i. Environmental Assessment.

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).

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

1. WORK PACKAGE NUMBER	2. TASK NO.	3. REV. NO. 0	4. PROJECT NO.	5. DATE PREPARED (mm dd yy) 03/31/80	6. CONTRACTOR NUMBER HP 9510 (003010)
7. TASK TITLE Dose Reassessment for Rongelap and Utirik			8. WORK PACKAGE TITLE		
9. BUDGET AND REPORTING CODE HA-02-01-01-0	10. TASK TERM Begin: (mm dd yy) Continuing Open		11. CONTRACTOR NAME Associated Universities, Inc.		12. CODE (See instructions) BNL
13. CONTRACTOR TASK MANAGER (Name: Last, First, MI) (FTS No.)  C.B. Meinhold 666-4209			14. PRINCIPAL INVESTIGATORS (Name: Last, First, MI)  Naidu, J.R. (666-4263) Greenhouse, N.A. (666-4250)		
15. WORK LOCATION (See instructions): Name of facility, City, State, Zip Code				16. Is this task included in the Institutional Plan? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	17. Does this task include any management services efforts? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

18. TASK DESCRIPTION (Approach, relation to work package, in 200 words or less)  
 An in-depth study of all information pertaining to BRAVO test fallout on Rongelap and Utirik will be made. In addition, using advanced analytical and computer techniques, a comprehensive fallout model will be developed. Using this model in conjunction with dietary and life style patterns prevalent at time of exposure, a reassessed dose estimate--internal and external--will be made for the populations of Rongelap and Utirik. These dose estimates will be evaluated in terms of the thyroid nodule incidences in these populations, and the results obtained will provide information towards correlating doses and radiation effects.

19. CONTRACTOR TASK MANAGER	 J.R. Naidu
 Charles B. Meinhold (Signature)	 N.A. Greenhouse
	03/31/80 (Date)

20. DETAIL ATTACHMENTS: (See instructions)
- |  |   |  |   |
|--|---|--|---|
| <input checked="" type="checkbox"/> a. Facility Requirements | <input checked="" type="checkbox"/> d. Background         | <input checked="" type="checkbox"/> g. Future accomplishments          | <input type="checkbox"/> j. Explanation of milestones |
| <input checked="" type="checkbox"/> b. Publications          | <input checked="" type="checkbox"/> e. Approach           | <input checked="" type="checkbox"/> h. Relationships to other projects | <input type="checkbox"/> k. ZBB Detail                |
| <input checked="" type="checkbox"/> c. Purpose               | <input checked="" type="checkbox"/> f. Technical progress | <input checked="" type="checkbox"/> i. Environmental assessment        | <input type="checkbox"/> l. Other (Specify):          |

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Dose Reassessment for Rongelap and Utirik	HA-02-01-01-0		03/31/30	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV NO
Associated Universities, Inc.	BNL			0

20a. Facility Requirements.

It is anticipated that work for this proposal will use existing Laboratory facilities and site utility services.

20b. Publications.

Data generated in this study has been used in other reports.

20c. Purpose.

To look for correlations between the incidence of thyroid nodules in the inhabitants of Rongelap and Utirik Islands (Marshall Islands) and the reassessed dose estimates.

This study will fuse together all available information on fallout from the BRAVO test and using advanced analytical techniques (now available) derive realistic dose estimates to the inhabitants of Rongelap and Utirik. The results should provide information towards assessment of the risk coefficients for radiation-induced thyroid disease.

20d. Background.

Incidence of thyroid nodules, benign and malignant, in the exposed populations of Utirik and Rongelap has indicated critical differences in correspondence between nodule incidence and thyroid dose for the populations. The estimated external dose received from the time fallout began to the time of evacuation shows that the Rongelap population received an external dose (175 rads) which was about 13 times that for the Utirik population (14 rads), and the thyroid dose was about 10 times larger, whereas the incidences of thyroid nodules in the two populations were not significantly different.

A preliminary study has indicated that the critical area of investigation is the period starting from the beginning of fallout to the completion of evacuation for both the islands. In addition, the fact that the Utirik population returned within 120 days following evacuation, whereas the Rongelap population returned only after three years, requires that we look closely at the Utirik population in terms of a longer exposure period, both internal and external. Further studies would, therefore, have to concentrate on the re-examination of all available data in reports issued by various agencies during that period, consultations with scientific personnel involved at that time, identifying the areas of uncertainty, and using appropriate computer programs to analyze the data. The end result will enable us to look for correlations between the incidence of thyroid nodules and the reassessed dose estimates.

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Dose Reassessment for Rongelap and Utirik	HA-02-01-01-0		03/31/80	
CONTRACTOR NAME Associated Universities, Inc.	CODE BNL	WP NUMBER	TASK NO.	REV. NO. 0

20e. Approach.

The study will comprise:

a. Literature search for all available data concerning the BRAVO test, such as, meteorological conditions and radiation measurements. Discussions with scientific and technical personnel involved in the BRAVO test.

b. Use of historic samples and teeth samples to determine  $^{129}\text{I}$ ,  $^{90}\text{Sr}$ , and  $^{239, 240}\text{Pu}$  concentrations to derive concentrations of other radionuclides. In addition, excised thyroid glands from exposed Marshallese will be analyzed for  $^{129}\text{I}$  and  $^{99}\text{Tc}$  and data so generated will be used to estimate the concentrations of short lived iodine isotopes.

c. Diet and life style studies to provide information for dose assessment.

d. Computer simulation of the BRAVO test fallout to determine the transport and deposition of radionuclides.

Management Controls

Fiscal control will be exercised in the form of monthly comparisons, over the task term, of actual costs incurred against corresponding line items of the budget. Technical results shall be monitored through a periodic review, by the Contractor Task Manager, of accomplishments by measuring actual performance as compared to expected progress. All work shall be conducted in conformance with generally accepted standards for R&D and other investigative or analytic procedures, as observed by universities and large independent research facilities including Brookhaven National Laboratory (BNL).

20f. Technical Progress.

Technical Progress in BY-3 (FY 1979).

A preliminary literature search and consultations with Dr. C.A. Sondhaus, University of California, have been completed. This has resulted in defining areas of uncertainty in information available and establishing the procedural steps that should be carried out to reassess the dose estimates. All available data on external radiation measurements, radionuclide concentrations in soil, water, vegetation, animal and food items have been collated. Historic samples collected from Rongelap and Utirik have been submitted for  $^{129}\text{I}$  analysis. Pertinent meteorological data pertaining to the BRAVO test has been researched and the information supplied to Lawrence Livermore Laboratory so that they can go ahead with the computer simulation of fallout transportation and deposition.

The  $^{129}\text{I}$  determinations of the soil samples have been completed for those historic samples that were available. Some of these samples will also be analyzed for  $^{99}\text{Tc}$ . In addition, we are exploring the possibility of analyzing "Bikini-

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Dose Reassessment for Rongelap and Utirik	HA-02-01-01-0		03/31/80	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV NO.
Associated Universities, Inc.	BNL			0

19f. Technical Progress cont.

"ash" the fallout material that settled on the Japanese fishing vessel. These samples should provide the most accurate characterization of the fallout. Preliminary computer simulations of fallout transportation and deposition have been completed. Data analysis of the recent diet and life style study has been completed. Discussion with scientists and technical people who were involved with the BRAVO test is being continued. Analysis of the Marshallese teeth samples for Pu isotopes is in progress.

Expected Progress in BY-2 (FY 1980).

A final report on the diet and life style for the Marshallese will be completed. The computer simulation of fallout will also be completed. Thyroid glands from the exposed Marshallese will be analyzed for  $^{99}\text{Tc}$  and  $^{129}\text{I}$ . Analysis of the "Bikini-ash" will be done as soon as we get an aliquot of the sample. It is also expected that data on the exposed Japanese fishermen will be made available at that time. Preliminary analysis of the data generated so far will be made using existing models. The results will be extrapolated to present times so as to test the validity of the models used.

Expected Progress in BY-1 (1981).

Final dose estimates to the exposed inhabitants of Utirik and Rongelap should be completed. The methodology developed will be extended to Likiep and other islands which were on the "fringe" of the fallout pattern.

20g. Future Accomplishments.

The techniques and expertise developed in the course of this study could be used to reassess doses to population in other areas subjected to exposure from fallout or even those resulting from occupational situations in the past.

20h. Relationship to Other Projects.

a. This study will help establish dose estimates from the time of the incident to the present, and will complement the aerial survey for external radiation measurements, over these islands, which has been completed. Together they should present a reliable picture of doses received by the populations and also enable dose estimates to be projected into the future.

b. This study will be in close conjunction with the BNL Radiological Safety Program in the Marshall Islands (HA-02-01-02-0) and with related programs of the BNL Medical Department (HA-02-01-01-0). Continued collaboration with the University of Washington, Laboratory of Radiation Ecology, and the Battelle Pacific Northwest Laboratory will be maintained in the area of sample analysis and data interpretation.

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Dose Reassessment for Rongelap and Utirik	HA-02-01-01-0		03/31/80	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

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).

20j. Explanation of Milestones.

None

20l. Other.

None

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		03/31/81	(6000037)
7. TASK TITLE Marshall Islands Radiological Safety Program				8. WORK PACKAGE TITLE	
9. BUDGET AND REPORTING CODE HA-02-01-02		10. TASK TERM Begin: Continuing      End: Open		11. CONTRACTOR NAME Associated Universities, Inc.	12. CODE (see instructions) BNL
13. CONTRACTOR TASK MANAGER (Name: Last, First, MI) (ETS No.)  Meinhold, Charles B. 666--109			14. PRINCIPAL INVESTIGATORS (Name: Last, First, MI)  Lessard, Edward T. 666-1250		
15. WORK LOCATION (See instructions: Name of facility, City, State, Zip Code)				16. Is this task included in the Institutional Plan? <input type="checkbox"/> YES <input type="checkbox"/> NO	17. Does this task include any management services efforts? <input type="checkbox"/> YES <input type="checkbox"/> NO

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

A comprehensive radiological safety program will be maintained for the inhabitants of atolls in the Northern Marshall Islands as a result of the U.S. Pacific Testing programs. The following items and services will be provided:

1. personnel monitoring and environmental sampling to provide data for dose assessments and determination of radiological trends,
2. individual and population dose-equivalent assessment based on measured body burdens, retention functions, and radioactivity uptake patterns. These data will be used to modify predictive dose-equivalent commitment models so they may more adequately reflect future trends, and
3. the collection of physiologic, anthropomorphic, diet and living pattern data to apply accurate parameters to contemporary and predictive dose assessments.

Program activities in the coming fiscal year will emphasize the following:

1. in vivo counting and radiochemical analysis of biological samples for Enewetak Atoll residents,
2. in vivo counting and radiochemical analysis of biological samples for former Bikini Island residents,
3. in vivo counting and radiochemical analysis of biological samples for Marshallese comparison groups who have not subsisted from food grown on Utirik, Rongelap, Bikini or Enewetak Atolls, and
4. sampling and analysis of coconuts and coconut tree food products obtained from Enewetak.

The nuclides of primary dosimetric interest are Cs-137, Sr-90 and Pu 139-240. Personnel monitoring programs will be aimed at measuring these in the Marshallese people.

## 19. CONTRACTOR TASK MANAGER



Charles B. Meinhold

03/31/81

(Signature)

(Date)

## 20. DETAIL ATTACHMENTS. (See instructions)

- |  |   |  |   |
|--|---|--|---|
| <input checked="" type="checkbox"/> a. Facility Requirements | <input checked="" type="checkbox"/> d. Background         | <input checked="" type="checkbox"/> g. Future accomplishments          | <input type="checkbox"/> j. Explanation of milestones |
| <input checked="" type="checkbox"/> b. Publications          | <input checked="" type="checkbox"/> e. Approach           | <input checked="" type="checkbox"/> h. Relationships to other projects | <input type="checkbox"/> k. ZSR Detail                |
| <input checked="" type="checkbox"/> c. Purpose               | <input checked="" type="checkbox"/> f. Technical progress | <input checked="" type="checkbox"/> i. Environmental assessment        | <input type="checkbox"/> l. Other (Specify):          |

Capital Equipment

HA-02-76

**TASK REQUIREMENTS FOR OPERATING EQUIPMENT  
OBLIGATIONS AND COSTS**

<b>CONTRACTOR NAME</b>						
Associated Universities, Inc.						
<b>WORK PACKAGE NUMBER</b>	<b>TASK NO.</b>	<b>REV. NO.</b>	<b>DATE PREPARED</b>		<b>CONTRACTOR NUMBER</b>	
	0		03/31/81		HP-1-E01	
<b>21. STAFFING (in staff years)</b>	<b>PRIOR YEARS</b>	<b>FY 1981 BY-2</b>	<b>FY 1982 - BY-1 PRESIDENTIAL</b>	<b>BY-1 REVISED</b>	<b>AUTHORIZED</b>	<b>BY-FY 1983</b>
a. SCIENTIFIC		3.2	2.3	3.3		3.8
b. OTHER DIRECT		3.1	3.7	3.7		3.7
c. TOTAL DIRECT		<u>6.3</u>	<u>6.0</u>	<u>7.0</u>		<u>7.5</u>
<b>22. OBLIGATIONS AND COSTS (in Thousands)</b>						
a. TOTAL OBLIGATIONS		385	415	623		673
b. TOTAL COSTS		385	415	580		650
<b>23. EQUIPMENT (in Thousands)</b>						
a. EQUIPMENT OBLIGATIONS		13	60	60		195
b. EQUIPMENT COSTS		51	54	54		138
<b>24. OTHER COSTS (in Thousands)</b>						
a.						
b.						
c.						
d.						
<b>25. 5-YEAR PLAN (in Thousands)</b> Constant BY dollars			<b>BY-1</b>	<b>BY-2</b>	<b>BY-3</b>	<b>BY-4</b>
a. TOTAL OPERATING OBLIGATIONS						<b>TOTAL TO COMPLETE</b>
b. TOTAL OPERATING COSTS						
c. TOTAL EQUIPMENT OBLIGATIONS						
d. TOTAL EQUIPMENT COSTS						
<b>26. MILESTONE SCHEDULE</b>			<b>PROPOSED SCHEDULE</b>	<b>AUTHORIZED SCHEDULE</b>		

HP-02-7

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Marshall Islands Radiological Safety Program	HA-02-01-02		03/31/81	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	3NL			0

20. Detail Attachments:

a. Facility Requirements.

It is anticipated that work for this proposal will use existing Laboratory facilities and site utility services.

b. Publications.

Lessard, E.T., Miltenberger, R.P., and Greenhouse, N.A. Dietary radio-activity intake from bioassay data: A model applied to Cs-137 intake by Bikini Island residents. Health Phys. 39, 177-183 (1980).

Miltenberger, R.P., Greenhouse, N.A., and Lessard, E.T. Whole body counting results from 1974 to 1979 for Bikini Island residents. Health Phys. 39, 395-407 (1980).

Miltenberger, R.P., Lessard, E.T., and Greenhouse, N.A. Co-60 and Cs-137 long term biological removal rate constants for the Marshallese population. Health Phys. (in press).

Lessard, E.T., Greenhouse, N.A., and Miltenberger, R.P. A reconstruction of chronic dose equivalents for Rongelap and Utirik residents - 1954 to 1980. BNL-51257, October 1980.

Lessard, E.T. Rate constants for biological elimination of Strontium and Cesium in the Marshallese population. Presented at the 25th Annual Conference on Bioassay, Analytical and Environmental Quality, Las Vegas, Nevada, October, 1979.

Lessard, E.T. Body burden measurements as determined from whole body counting and urine bioassay. Presented at the 25th Annual Conference on Bioassay, Analytical and Environmental Quality, Las Vegas, Nevada, October, 1979.

Lessard, E.T. Dose assessment for Rongelap and Utirik residents 1954 to Present. Presented at the 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July, 1980.

c. Purpose.

The primary purpose of this program is to measure and evaluate the internal and external dose equivalents to persons living on those islands in the Marshall's group which were impacted by tropospheric fallout from United States atmospheric nuclear tests in the Pacific. Its objectives are:

1. direct or indirect measurement of radionuclide body burdens,
2. measurement of the external radiation environment,

HA-02-78

TITLE	BUDGET AND REPORTING CODE	DATE PREPARED		
Marshall Islands Radiological Safety Program	HA-02-01-02	03/31/81		
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	3NL			0

20. Detail Attachments. cont.

c. Purpose cont.

3. evaluation of diet and living patterns insofar as they relate to the identification of exposure pathways and the determination of dose equivalents,

4. assess prospective dose equivalents for persons returning to atolls contaminated during the weapons testing period, and

5. maintain comparison data and personnel monitoring and dose equivalent data for individuals exposed to fission and activation products and transuranic nuclides in the Marshall Islands.

d. Background.

This program was initiated in 1974 at the request of the Atomic Energy Commission (AEC) in anticipation of potential radiation exposures to the returning Bikini population.

e. Approach.

Internal and external dose equivalents will be evaluated using accepted and up-to-date health physics practices.

Dietary and living pattern information will be derived from direct observation and interview with persons residing on atolls of interest. These interviews will be standardized and conducted during whole-body counting field trips.

Analysis of soil and food chain related plants will continue in order to relate radioactivity in food crops with body burdens. Coconuts, soil, sap from coconut trees and other diet items will be collected from residence or food source islands.

Management Controls.

Fiscal control will be exercised in the form of monthly comparisons, over the task term, of actual costs incurred against corresponding line items of the budget. Technical results shall be monitored through a periodic review, by the Contractor Task Manager, of accomplishments by measuring actual performance as compared to expected progress. All work shall be conducted in conformance with generally accepted standards for R&D and other investigative or analytic procedures, as observed by universities and large independent research facilities including Brookhaven National Laboratory (BNL).

HA-02-79

TITLE	BUDGET AND REPORTING CODE	DATE PREPARED		
Marshall Islands Radiological Safety Program	HA-02-01-02	03/31/81		
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

10. Detail Attachments. cont.

f. Technical Progress.

Technical Progress in FY 1980.

In February 1980, a field trip was undertaken to Japtan and Enewetak Islands, Enewetak Atoll and Ujelang Island, Ujelang Atoll to obtain baseline body-burden data on the Enewetak population prior to the repatriation of Enewetak Atoll in April 1980. Personnel monitoring was accomplished through whole-body counting and collection of one liter urine samples from all persons five years of age and older. At Ujelang, nonparticipants in the whole-body counting program were invited to provide urine samples. Approximately 400 urine samples were collected and are currently being spectrometrically analyzed for gamma emitters and radiochemically analyzed for Sr-90. Additionally, participants provided physical and demographic data.

Whole-body counting was conducted with two independent chair counting systems in which a sodium iodide detector was positioned in front of a shielded person. The solid angle of the detector permitted collection of photons emitted from the trunk of an adult body. This geometry allowed safe entry and egress with comparable sensitivity relative to the bed geometry used in prior field trips.

Approximately 400 spectra were obtained from individuals on Japtan, Enewetak and Ujelang Islands. These spectra were analyzed for Cs-137 and K-40 using calibration standards which best matched the sex, height and weight of the person. Additional analyses were performed to determine the frequency distribution statistics for various age and sex subgroupings of the body burdens. Quality assurance was obtained through duplicate whole-body counts and repetitive point source standard counts to determine the precision and accuracy of the system.

During the July and August 1980 field trip, whole-body counts and urine samples were collected at Majuro Atoll and Kili Island from former Bikini Atoll residents and from a comparison population. Approximately 200 spectra were obtained and 100 urine samples collected. Fifty percent of the spectra were from persons who were residents and whole-body counted on Bikini Atoll in April 1980, 10 percent were from former Bikini Atoll residents not counted before and the remaining spectra were from a comparison group who had never resided on Bikini Atoll.

A quality assurance program similar to that employed at Enewetak was used. Review of the historic Bikini whole-body counting data indicated no effects on body-burden assessment due to reconfiguration of the shielding and detector. Consecutive measurements of a former Bikini resident's body burden allowed computation of individual long-term biological removal rate constants. This data along with the methodology were written up and issued in a primary scientific publication.

At Kili Island there were former Bikini residents whose Cs-137 body burden remained unchanged or increased. Reasons for this nuclide being present in their current diet were investigated. This work showed that these burdens were within three standard deviations of the mean burden of the comparison population except in

HA-02-80

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Marshall Islands Radiological Safely Program	HA-02-01-02		03/31/81	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV NO.
Associated Universities, Inc.	BNL			0

20. Detail Attachments. cont.

f. Technical Progress cont.

Technical Progress in FY 1980 cont.

a few cases. Burdens elevated above this level could be attributed to recent ingestion of Bikini Atoll food which had been transported to Kili Island.

Human milk samples had been obtained from four lactating adult former Bikini females whose Cs-137 body burden had been defined by whole-body counting and radiochemical analysis of urine. Milk samples along with Bikini Island coconut tree sap and nuts were analyzed by gamma spectroscopy and atomic absorption to determine the presence of Cs-137 and K-40. Results were used to estimate the Cs-137 body burden for Marshallese infants whose primary food supply was human milk and coconut tree products.

Activity ingestion rates and future body burdens for Cs-137 were estimated for the population who may return to Enue Island, Bikini Atoll. This projection involved a determination of activity transfer factors calculated from Rongelap and Bikini whole-body counting data and from activity concentration analyses of coconut tree products. These factors were comparable for both atolls and dose-equivalent commitments were projected for adults.

Retrospective and contemporary external exposure rate data, whole-body counting data, and radiochemical analysis of urine and blood data were reviewed for the interval June 1954 to December 1980 for the Rongelapese and Utiirikese. Dosimetric models which best described the uptake regime were constructed for the nuclides of interest. Daily activity ingestion rates, whole-body dose-equivalent rates and dose equivalent commitments to various organs were determined. Population dosimetry results and methods were written up and reported in a BNL publication. Individual dosimetric data records are maintained at the Laboratory.

Expected Progress in FY 1981.

Personnel monitoring and related demographic data will be obtained from residents of Rongelap, Utiirik and Enewetak and other areas of interest to DOE. The data base on diet and living patterns will be updated for all relevant atolls and/or islands.

Expected Progress in FY 1982.

Evaluation of the decline of body burdens among former Bikini Island residents will continue for that portion of the population in residence on Majuro Atoll or Kili Island. Personnel monitoring will continue at Enewetak Atoll.

HA-02-81

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Marshall Islands Radiological Safety Program	HA-02-01-02		03/31/81	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV NO
Associated Universities, Inc.	BNL			0

20. Detail Attachments. cont.

f. Technical Progress cont.

Expected Progress in FY 1983.

Radionuclide body burdens will be evaluated for the population in residence at Enue Island, Bikini Atoll. Personnel monitoring and related demographic assessment activities will continue in all areas of interest in the Marshall Islands.

g. Future Accomplishments.

A dosimetric history will be maintained for individual residents of the Marshall Islands affected by the Pacific Testing Programs. These data will provide information regarding the uptake, retention, and excretion of radioactive material and will improve the accuracy and value of long-range predictive dose assessments from man-made radionuclides in the environment.

h. Relationship to Other Projects.

This program operates and interacts directly with the Brookhaven Medical Program in the Marshall Islands, and provides contemporary data to be factored into the Retrospective Dose Reassessments for Rongelap and Utirik (and other islands affected by weapons test fallout). It also provides empirical bases for upgrading long range predictive dose modeling activities such as those of the Lawrence Livermore Laboratory. Coordination of this program with related programs within DOE and its contractors will be accomplished through timely exchange of program findings and related information.

i. 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).

1. Other.

Capital Equipment in FY 1983.

An intrinsic Ge(Li) whole body counting system is needed to provide more efficient and effective operation in the Marshall Islands Radiological Safety Program for counting low energy photons emitted from transuranic nuclides. This system (\$150,000) and associated shielding and bed equipment (\$25,000) will be used to measure body burdens of transuranic nuclides in persons at Enewetak Atoll at levels below the maximum allowable for members of the general public. Prospective dose equivalents for blood forming organs will be assessed based on these measurements.

HA-02-82

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Marshall Islands Radiological Safety Program	HA-02-01-02		03/31/81	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	3NL			0

20. Detail Attachments. cont.

1. Other cont.

Capital Equipment in FY 1983. cont.

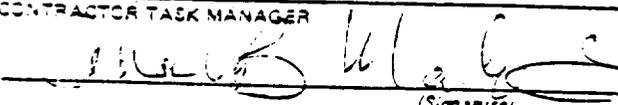
A word processor (\$20,000) for the Marshall Islands Radiological Safety Program to provide more efficient and effective operation will be needed to prepare primary scientific publications and to prepare, modify and store individual dosimetry, body burden, bioassay and demographic records on the inhabitants of the Marshall Islands included in our study. The processor will be used also in the preparation of trip reports, schedules and other administrative writing.

HA-02-83

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		03/31/81	00030105
7. TASK TITLE Dose Reassessment for Rongelap and Utrik			8. WORK PACKAGE TITLE		
9. BUDGET AND REPORTING CODE HA-02-01-01	10. TASK TERM Begin: continuing End: Open		11. CONTRACTOR NAME Associated Universities, Inc.	12. CODE (see instructions) BNL	
13. CONTRACTOR TASK MANAGER (Name, Last, First, MI), (ETS No.) Meinhold, Charles B. 666-4209			14. PRINCIPAL INVESTIGATORS (Name, Last, First, MI) Naidu, Janakiram R. - 666-4263 Lessard, Edward T. - 666-4250		
15. WORK LOCATION (See instructions), Name of Facility, City, State, Zip Code				16. Is this task included in the Institutional Plan? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	17. Does this task include any management services efforts? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
18. TASK DESCRIPTION (Approach, relation to work package, in 200 words or less)					

An in-depth study of information pertaining to BRAVO test fallout on Rongelap and Utrik will be made. In addition, a comprehensive fallout model will be developed using advanced analytical and computer techniques. Using this model in conjunction with dietary and living patterns prevalent during and following the exposure of March 1954, internal and external thyroid absorbed dose estimates will be made for various age and sex groupings of the populations. Two other independent approaches involving calculation of thyroid absorbed dose based on the historical soil sample analysis and based on the radiiodine analysis of the single composited urine sample reported for the Rongelap population are to be undertaken. These results coupled with the Northern Marshall Islands Radiological Survey (NMIRS) and contemporary personnel monitoring activities will provide a technically sound basis for retrospective thyroid absorbed dose estimates for the atoll populations in the Northern Marshall Islands. These estimates will be evaluated in terms of thyroid nodule incidences in these populations, and the results obtained will provide information towards correlating absorbed dose and biological effects.

19. CONTRACTOR TASK MANAGER  
  
 Charles B. Meinhold  
 (Signature) 03/31/81  
(Date)

20. DETAIL ATTACHMENTS. (See instructions)
- |   |  |   |   |
|---|--|---|---|
| <input type="checkbox"/> a. Facility Requirements | <input type="checkbox"/> c. Background         | <input type="checkbox"/> e. Future accomplishments          | <input type="checkbox"/> g. Explanation of milestones |
| <input type="checkbox"/> b. Publications          | <input type="checkbox"/> d. Approach           | <input type="checkbox"/> f. Relationships to other projects | <input type="checkbox"/> h. ZBB Detail                |
| <input type="checkbox"/> e. Purpose               | <input type="checkbox"/> i. Technical progress | <input type="checkbox"/> j. Environmental assessment        | <input type="checkbox"/> k. Other (Specify):          |
- HA-02-3

**TASK REQUIREMENTS FOR OPERATING EQUIPMENT  
OBLIGATIONS AND COSTS**

<b>CONTRACTOR NAME</b>						
Associated Universities, Inc.						
<b>WORK PACKAGE NUMBER</b>		<b>TASK NO.</b>	<b>REV. NO.</b>	<b>DATE PREPARED</b>	<b>CONTRACTOR NUMBER</b>	
		0		03 31 61	HP-2-812	
<b>21 STAFFING (in staff years)</b>	<b>PRIOR YEARS</b>	<b>FY 1981 BY-1</b>	<b>FY 1980 - PRESIDENTIAL</b>	<b>BY-1 REVISED</b>	<b>AUT-OB- RIZED</b>	<b>BY-FY 1983</b>
a. SCIENTIFIC		0.2	1.2	1.2		1.2
b. OTHER DIRECT		---	---	---		---
c. TOTAL DIRECT		0.2	1.2	1.2		1.2
<b>22 OBLIGATIONS AND COSTS (in Thousands)</b>						
a. TOTAL OBLIGATIONS		53	90	97		156
b. TOTAL COSTS		53	90	90		140
<b>23 EQUIPMENT (in Thousands)</b>						
a. EQUIPMENT OBLIGATIONS		0	0	0		0
b. EQUIPMENT COSTS		0	0	0		0
<b>24 OTHER COSTS (specify)</b>						
<b>25 OPTIONAL FIVE YEAR PLAN (in Thousands) Contract by years</b>		<b>BY-1</b>	<b>BY-2</b>	<b>BY-3</b>	<b>BY-4</b>	<b>TOTAL TO COMPLETE</b>
a. TOTAL OPERATING OBLIGATIONS						
b. TOTAL OPERATING COSTS						
c. TOTAL EQUIPMENT OBLIGATIONS						
d. TOTAL EQUIPMENT COSTS						
<b>26 QUESTIONS SCHEDULE</b>	<b>PROPOSED SCHEDULE</b>			<b>AUTHORIZED SCHEDULE</b>		

HA-02-4

TITLE	BUDGET AND REPORTING CODE		DATE PREPARED	
Dose Reassessment for Rongelap and Utirik	NA-02-01-01		05/31/81	
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO	REV NO
Associated Universities, Inc.	BNL			0

20. Detail Attachments:

a. Facility Requirements.

It is anticipated that work for this proposal will use existing Laboratory facilities and site utility services.

b. Publications.

Naidu, J.R., Greenhouse, N.A., and Knight, J. Marshall Islands: A Study of Diet and Living Patterns. BNL 51313, July, 1980.

Lessard, E.T., Greenhouse, N.A., and Miltenberger, R.P. A Reconstruction of Chronic Dose Equivalents for Rongelap and Utirik Residents - 1954 to 1980, BNL 51257, October, 1980.

c. Purpose.

The purpose of this research is to refine the estimated thyroid absorbed doses received by members of the Rongelap and Utirik Atoll populations in the Marshall Islands. These doses will be compared to the thyroid nodule incidence to provide information towards assessment of the risk coefficients for radiation induced thyroid disease.

d. Background.

Incidence of thyroid nodules, benign and malignant, in the exposed populations of Utirik and Rongelap has indicated critical differences in correspondence between nodule incidence and thyroid absorbed dose for these populations relative to that reported by the Japanese Tumor Registry Life Span Study or the other populations under study as reported in BIER III. The estimated external dose received from the time fallout began to the time of evacuation shows that the adult Rongelap population received an external absorbed dose (175 rads) which was about 13 times that for the Utirik population (14 rads). The thyroid absorbed doses were estimated originally to be several times these external doses.

A preliminary study has indicated that the important dosimetric area of investigation is the period starting from the beginning of fallout to the completion of evacuation for both the islands. In addition, the fact that the Utirik population returned within 120 days following evacuation, whereas the Rongelap population returned after three years, requires that the Utirik population be examined dosimetrically in terms of a longer exposure period, both internal and external. Further studies would, therefore, have to concentrate on the reexamination of all available data in reports issued by various agencies during that period, consultations with scientific personnel involved at that time, identifying the areas of uncertainty, and using appropriate computer programs to analyze the data. The end result will enable comparisons between the incidence of thyroid nodules and the reassessed dose estimates.

TITLE Dose Reassessment for Rongelap and Utirik	BUDGET AND REPORTING CODE HA-02-01-01	DATE PREPARED 03/31/81
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CONTRACTOR NAME Associated Universities, Inc.	CODE BNL	WP NUMBER	TASK NO.	REV. NO. 0
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10. Detail Attachments. cont.

e. Approach.

The study will comprise:

1. literature search for all available data concerning the BRAVO test, such as, meteorological conditions and radiation measurements, and discussions with exposed Marshallese and with scientific and technical personnel involved in the BRAVO test,
2. use of historic soil samples, food samples and beach samples to determine I-129, Sr-90, and Pu-239, 240 concentrations to derive concentrations of other radionuclides. In addition, excised thyroid glands from exposed Marshallese will be analyzed for I-129 and Tc-99,
3. diet and life style studies to provide information for dose assessment,
4. computer simulation of the BRAVO test fallout to determine the transport and deposition of radionuclides,
5. use of historic BRAVO fallout radioactivity samples to determine the abundance of I-129 atoms per unit BRAVO activity.

Management Controls.

Fiscal control will be exercised in the form of monthly comparisons, over the task term, of actual costs incurred against corresponding line items of the budget. Technical results shall be monitored through a periodic review, by the Contractor Task Manager, of accomplishments by measuring actual performance as compared to expected progress. All work shall be conducted in conformance with generally accepted standards for R&D and other investigative or analytic procedures, as observed by universities and large independent research facilities including Brookhaven National Laboratory (BNL).

f. Technical Progress.

Technical Progress in FY 1980.

A report on the diet and living pattern of the Rongelapese and Utirikese has been completed. The computer simulation of fallout is being reformulated with additional data that has been acquired. Thyroid glands from the exposed Marshallese have been analyzed for Tc-99 and I-129. Approximately 50 historic soil samples have been analyzed for I-129 and other dosimetrically important nuclides. Preliminary dose assessment for the March 1954 exposed population has been performed by two independent methods (soil analysis and radiochemical analysis of urine) for residents of Rongelap Island, Rongelap Atoll. Additionally, a report has been completed on the dose equivalent following rehabilitation of Rongelap and Utirik Atolls after the March 1954 evacuation. This work involved determination of post return thyroid and other organ dose equivalents for individuals and population groups based on historic and contemporary whole body counting and urine bioassay results.

TITLE	BUDGET AND REPORTING CODE	DATE PREPARED		
Dose Reassessment for Rongelap and Ujae	HA-02-01-01	03/31/81		
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

20. Detail Attachments. cont.

f. Technical Progress cont.

Expected Progress in FY 1981.

Additional samples of soil, food and ash will be analyzed for I-129. Sr-90 and Pu-239, 240 analysis of teeth samples, especially that from exposed individuals, will be done. Data derived from the "Bikini Ash" studies will be factored into the refinement of the dose estimate. Diet and living pattern studies will be updated.

Expected Progress in FY 1982.

Factors such as solubility of iodine isotopes in fallout, the possible contribution from neutron induced activity, the impact of thyroid seekers other than iodine isotopes on dose, and confidence levels for values of derived quantities such as airborne activity concentrations during fallout will be investigated. Diet and living pattern studies will be updated.

Expected Progress in FY 1983.

Diet and living pattern studies and dose reassessment will continue until completed for all areas of interest in the Marshalls.

g. Future Accomplishments.

The techniques and expertise developed in the course of this study could be used to reassess doses to populations in other areas subjected to exposure from fallout or even those resulting from occupational situations in the past. Additionally, this study will provide a better estimate of the true value for thyroid nodule incidence per unit rad enabling technically sound risk factors to be associated with ionizing radiation exposure.

h. Relationship to Other Projects.

1. This study will help establish external and internal dose estimates from the time of the incident to the present, and will complement the aerial survey for external radiation measurements, over these islands, which has been completed. Together they should present a reliable picture of doses received by the populations and also enable dose estimates to be projected into the future.

2. This study will be in close conjunction with the BNL Marshall Islands Radiological Safety Program (HA-02-01-02). Continued collaboration with the University of Washington, Laboratory of Radiation Ecology, and the Battelle Pacific Northwest Laboratory will be maintained in the area of sample analysis and data interpretation.

TITLE	BUDGET AND REPORTING CODE	DATE PREPARED		
Dose Reassessment for Rongelap and Ujae	HA-02-01-01	03/31/81		
CONTRACTOR NAME	CODE	WP NUMBER	TASK NO.	REV. NO.
Associated Universities, Inc.	BNL			0

20. Detail Attachments. cont.

i. 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-02-8