

BIOLOGY AND MEDICINE  
PROGRAM BUDGET

728227

May 1972

CONTRACT W-31-109-ENG-38  
SUPPLEMENT NO. 16

1. TITLE  
Biology and Medicine Program -  
Assessment, Evaluation and Control of Radiation Exposure  
to Man and His Environment



2. BUDGET ACTIVITY NO.  
AEC 06-02 Summary  
ANL 63100 through 67400 Summary (BIM, CHM, RPY, EL)

U of C-AUA-USAEC

3. SCIENTIST RESPONSIBLE  
R. E. Rowland and W. K. Sinclair

4. WORK STARTED  
FY Continuing

5. RELATED WORK (With Same Contractor or Others)  
Numerous other studies at universities and work sponsored by various  
governmental agencies.

6. MANPOWER AND COST DATA

ESTIMATED FOR FISCAL YEARS

	FY 1972	FY 1973 PRESIDENT'S BUDGET	FY 1973*		FY 1974
			INCREMENTAL REQUIREMENTS (A)	(B)	
<b>6a. <u>DIRECT MANPOWER (Man Years)</u></b>					
<b>SCIENTIFIC</b>					
REGULAR	64.4	81.2	1.0	-	95.2
TEMPORARY PAID BY ANL	5.7	7.1	-	1.0	13.0
TEMPORARY PAID BY OTHERS	3.3	0.4	-	-	0.4
<b>TOTAL SCIENTIFIC</b>	<b>73.4</b>	<b>88.7</b>	<b>1.0</b>	<b>1.0</b>	<b>108.6</b>
<b>OTHER TECHNICAL</b>					
REGULAR	7.4	5.1	-	-	7.2
TEMPORARY PAID BY ANL	0.4	-	-	-	0.4
TEMPORARY PAID BY OTHERS	4.9	3.5	-	-	3.5
<b>TOTAL OTHER TECHNICAL</b>	<b>12.7</b>	<b>8.6</b>	<b>-</b>	<b>-</b>	<b>11.1</b>
<b>TOTAL MAN YEARS</b>	<b>86.1</b>	<b>97.3</b>	<b>1.0</b>	<b>1.0</b>	<b>119.7</b>
<b>6b. <u>OPERATING COSTS (In Thousands)</u></b>					
EFFORT-RELATED COSTS	\$2,272	\$2,979	\$ 28	\$ 9	\$3,664
MATERIALS AND SERVICES	953	827	365	10	1,392
MAJOR PROCUREMENTS	391	268	67	-	355
<b>TOTAL COST</b>	<b>\$3,616</b>	<b>\$4,074</b>	<b>\$460</b>	<b>\$19</b>	<b>\$5,411</b>

6c. Cost (Recap of Subactivities) (In Thousands)

See next page

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(over)

(Continuation)

6c. Cost (Recap of Subactivities) (In Thousands) (Contd.)

	<u>FY 1972</u>	<u>FY 1973 Pres. Bud.</u>	<u>FY 1973 Inc. Req.</u>		<u>FY 1974</u>
			(A)	(B)	
06-02					
-01 Exposure to External and Internal Radiation	\$2,141	\$2,382	\$367	\$19	\$3,232
-02 Combating Detrimental Effects of Radiation	253	257	-	-	284
-04 Land and Fresh Water Environmental Sciences	436	525	80	-	826
-06 Atmospheric Sciences	417	485	-	-	546
-08 Radiological and Health Physics and Instrumentation	369	425	13	-	523
Total 06-02	<u>\$3,616</u>	<u>\$4,074</u>	<u>\$460</u>	<u>\$19</u>	<u>\$5,411</u>

6d. Major Procurements (In Thousands)

06-02					
-01 Exposure to External and Internal Radiation	\$ 331	\$ 260	-	-	\$ 275
-04 Land and Fresh Water Environmental Sciences	60	-	\$ 60	-	60
-08 Radiological and Health Physics and Instrumentation	-	8	7	-	20
Total 06-02	<u>\$ 391</u>	<u>\$ 268</u>	<u>\$ 67</u>	<u>-</u>	<u>\$ 355</u>

See individual 189's for detail.

6e. Equipment Obligations (In Thousands)

06-02					
-01 Exposure to External and Internal Radiation	\$ 86	\$ 64	-	-	\$ 180
-02 Combating Detrimental Effects of Radiation	-	2	-	-	2
-04 Land and Fresh Water Environmental Sciences	33	64	-	-	145
-06 Atmospheric Sciences	13	30	-	-	69
-08 Radiological and Health Physics and Instrumentation	50	39	-	-	66
Total 06-02	<u>\$ 182</u>	<u>\$ 199</u>	<u>-</u>	<u>-</u>	<u>\$ 462</u>

See individual 189's for detail.

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6d. Major Procurements (In Thousands)

	FY 1973		
	FY 1972	Pres. Bud.	FY 1974
63300 Radium Studies	\$331	\$260	\$275

See individual 189's for detail.

6e. Equipment Obligations (In Thousands)

63100 Metabolism and Toxicity of Fission Products in Dogs	\$ 6	\$ 23	\$ 60
63200 Radioactive and Trace Element Metabolism	3	6	10
63300 Radium Studies	77	35	110
Total 06-02-01	\$ 86	\$ 64	\$180

See individual 189's for detail.

7. Description

Metabolism and Toxicity of Fission Products in Dogs. The original goals of research in this area were to establish the effects of raw fission product mixtures in biological systems which can be related to man. Dogs have been injected with  $^{144}\text{Ce}$ ,  $^{137}\text{Cs}$ , and  $^{131}\text{I}$ , and effects are being observed. However, internally deposited radionuclides are nonuniformly deposited and it is difficult to determine meaningful radiation doses and the relationship of specific biological changes to the doses. With external radiation, however, the dosimetry is more precise and the doses responsible for biological changes, such as tumor induction, can be more realistically determined. Therefore, continuous exposure of dogs to  $^{60}\text{Co}$   $\gamma$  rays was begun four years ago so that the response of the beagle to protracted, uniform, whole-body irradiation at various exposure rates and total doses could be determined. The comparison of biological effects of protracted, uniform, whole-body irradiation to the effects of internally deposited radionuclides will allow an interpretation of the relative effects of total dose and dose rate.

Furthermore, the external exposure of dogs to daily doses of  $^{60}\text{Co}$   $\gamma$  radiation has assumed a new importance, always envisaged but fully appreciated only recently. Low level late effects studies with ionizing radiation that can be related to man still rely primarily on the mouse as the experimental animal. The importance of interspecies comparison before any program of understanding or predicting effects in man could be considered complete is obvious. The beagle dog, with a lifespan intermediate between mouse and man (and in about the same relative ratio), and a growing history of knowledge as an experimental animal, is emerging as a vital intermediary. Already some interesting data have been obtained in the first four years of the program and important results are beginning to be published. Furthermore the added value of such a program operating side by side with an extensive mouse program (see earlier, "Neutron and Gamma-Ray Toxicity Studies") in the late effects of low level neutron and gamma irradiation is unquestioned and the interaction between the two is extensive and developing further. Now, with this toxicity program reoriented to emphasize the external exposure series specifically, it is necessary to carry the program to lower daily dose

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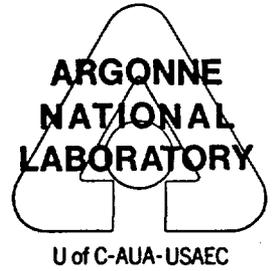
BIOLOGY AND MEDICINE  
PROGRAM BUDGET

May 1972

CONTRACT W-31-109-ENG-38  
SUPPLEMENT NO. 16

1. TITLE  
Assessment, Evaluation and Control of Radiation Exposure  
to Man and His Environment -  
Exposure to External and Internal Radiation

2. BUDGET ACTIVITY NO.  
AEC 06-02-01 Summary  
ANL 63100 through 63300 Summary (BIM, RPY)



7. Description (Contd.)

levels and to expand the range of studies associated with the radiation protocols, including new efforts in the area of fetal irradiation. The total effort should now be expanded slowly in order to achieve these important goals.

Radioactive and Trace Element Metabolism. This activity in the Radiological Physics Division will continue in the general field of radioactive and trace element metabolism, but with increased emphasis on the development of concepts and models for use in evaluating the toxicity of internal emitters in man. The work is now concentrated into only two items. The first deals primarily with the retention and distribution of internal emitters. The other item deals with the tissues exposed to internal emitters: properties affecting detailed estimate of dose and properties which may elucidate mechanisms of radiation damage. Almost without exception, personnel in this activity devote time to the Radium Studies. This is natural, for in many respects it is difficult to separate the effort applied to the programmatic aspects of the Radium Studies from related efforts to generalize on the problems of localization, identification, and evaluation of the toxicity of internal emitters in man.

Radium Studies. This program in the Radiological Physics Division has been organized as the Center for Human Radiobiology to study the long-term effects of radium and other internal emitters in man. It includes specific responsibility for locating humans with significant body burdens of radium, evaluating radiation doses, and accumulating pertinent medical data during their entire lifespans. Responsibility for radium cases located and studied by the Radiation Center of MIT, and ANL-Argonne Cancer Research Hospital project and the New Jersey Radium Research Project have been transferred to this Center.

The program set up around these radium cases includes clinical, biological and physical studies on the living cases, a search for new cases, acquisition and study of autopsy material and willed bodies, exhumations and epidemiology. It is hoped that these studies will eventually include many other bone-seeking isotopes in man. During FY 1972, a comprehensive new computer system for storing and processing data on radium cases was designed; the present system will be phased out as the new system becomes operational.

A field office in Orange, New Jersey, maintains contact with radium cases and searches for new cases along the east coast of the United States.

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8003235

7. Description (Contd.)

A satellite laboratory is operated in Cambridge, Mass., under a subcontract with MIT. This laboratory is equipped to make whole-body radium measurements and radon breath measurements on the patients in this area. Personnel also contribute vigorously to locating radium patients and obtaining willed and exhumed bodies. Medical examinations, including X-rays, are made on the patients under study by cooperating physicians in the area. During FY 1972, 100 patients were examined at this laboratory. At the start of FY 1973, administration and operation of this satellite laboratory will be transferred from the Physics Department to the Medical Department of MIT.

The case records from the former New Jersey Radium Research Project, the MIT Radiation Laboratory, and (with only a few exceptions) the ANL-ACRH Radium Studies have been copied and are in the possession of the Center for Human Radiobiology. During FY 1972, the entire collection of original files, X-rays, specimens, and microscopic slides of the New Jersey Radium Research Project was acquired.

We now have the names of 2800 persons who have had industrial or medical exposure to radium. Of these, 2000 persons have been positively identified and located and 800 of these are now known to be dead. Estimates of body burdens, while alive or after death, have been made on 1200 of the 2000 persons. Including 150 new cases discovered during the past year, we now have 1100 living radium persons under active study and are trying to obtain information on the 800 "name only" cases and to determine the present status of 100 persons who had once been located.

An urgent need for a medical staff within the Center for Human Radiobiology has now been met. The Health Division of the Argonne National Laboratory, under the direction of Dr. Francis W. Strehl, performs the necessary physical examinations on the patients who come to the Argonne Site. Reading of X-rays is done by radiologists in private practice and consulting contracts have been made with a pathologist and other physicians. All medical work of the Center is under the direction of Dr. Austin M. Brues, who joined the Center in FY 1972. Establishment of cooperative arrangements with a major medical center is expected in FY 1973.

8003236

**BIOLOGY AND MEDICINE  
PROGRAM BUDGET**

May 1972

CONTRACT W-31-109-ENG-38  
SUPPLEMENT NO. 16

**1. TITLE**  
Assessment, Evaluation and Control of Radiation Exposure  
to Man and His Environment -  
Atmospheric Sciences

**2. BUDGET ACTIVITY NO.**  
AEC 06-02-06 Summary  
ANL 66100 through 66300 Summary (CHM, RPY)



**3. SCIENTIST RESPONSIBLE**  
P. F. Fields and R. E. Rowland

**4. WORK STARTED**  
FY Continuing

**5. RELATED WORK (With Same Contractor or Others)**  
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**ESTIMATED FOR FISCAL YEARS**

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<b>SCIENTIFIC</b>				
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TEMPORARY PAID BY OTHERS	0.6	-	-	-
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<b>OTHER TECHNICAL</b>				
REGULAR	2.2	1.0	-	1.0
TEMPORARY PAID BY ANL	0.4	-	-	-
TEMPORARY PAID BY OTHERS	0.9	0.4	-	0.4
<b>TOTAL OTHER TECHNICAL</b>	<u>3.5</u>	<u>1.4</u>	<u>-</u>	<u>1.4</u>
<b>TOTAL MAN YEARS</b>	11.9	13.2	-	14.4

**6b. OPERATING COSTS (In Thousands)**

EFFORT-RELATED COSTS	\$280	\$388	-	\$429
MATERIALS AND SERVICES	137	97	-	117
MAJOR PROCUREMENTS	-	-	-	-
<b>TOTAL COST</b>	<u>\$417</u>	<u>\$485</u>	<u>-</u>	<u>\$546</u>

**6c. Cost (Recap of Subactivities) (In Thousands)**

66100 Meteorological Studies	\$385	\$444	-	\$495
66300 Properties of Molecular Sieves	32	41	-	51
<b>Total 06-02-06</b>	<u>\$417</u>	<u>\$485</u>	<u>-</u>	<u>\$546</u>

**6d. Major Procurements (In Thousands)**

None

(over)

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6e. Equipment Obligations (In Thousands)

	<u>FY 1972</u>	<u>FY 1973 Pres. Bud.</u>	<u>FY 1974</u>
66100 Meteorological Studies	\$13	\$30	\$69
66300 Properties of Molecular Sieves	-	-	-
Total 06-02-06	<u>\$13</u>	<u>\$30</u>	<u>\$69</u>

See individual 189's for detail.