

RESULTS OF 1992
ENVIRONMENTAL RADIOACTIVITY SURVEY
AT BRANDEIS-BARDIN INSTITUTE
BRANDEIS, CALIFORNIA

by

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JANUARY 1993

Results of Environmental Radioactivity Survey
at Brandeis-Bardin Institute

A. INTRODUCTION

The Brandeis-Bardin Institute is located on 3000 acres in Brandeis (Simi Valley), California. The property borders the Rockwell Rocketdyne Field Laboratory, to the south. The Rockwell property has been contaminated with radioactive materials. A 1991 survey, performed at the Institute, found slightly elevated radioactivity levels near the Rockwell property line¹. In 1992, Rockwell conducted a comprehensive study of adjacent properties². The Institute decided to cooperate in this survey by accompanying the field teams, and taking duplicate samples of environmental media (referred to as, "split samples.") These samples were analyzed for radioactivity, under Institute direction. These splits would be used to validate the data from the Rockwell study. The U.S. Environmental Protection Agency (Las Vegas Facility), and the California Dept. of Health Services, cooperated in the Rockwell study, in a like manner.

B. FIELD SAMPLING

Nineteen areas on Institute property were sampled for soil and other media. This sampling is described more fully in Reference 2. Thirteen of these were selected for

1. Environmental Radiation Survey at Brandeis-Bardin Institute, Brandeis, California 93064, July 1991.

2. Multi-Media Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy, McLaren/Hart Environmental Engineering Corp., Irvine, Calif., December 1992.

split sampling, by the Institute. These are listed in Table 1. The sampling was done in two campaigns: March 18-20, and April 21-23. Soil samples, split with Rockwell, were taken at all selected locations. In addition, several moss samples were taken in wet locations. It was suspected that moss might scavenge radioactivity from the surface water. However, tests of the moss proved mostly negative.

C. RESULTS

Soils and moss were analyzed at the Barringer Laboratories in Denver, Colorado for strontium-90, cesium-137 and other gamma emitting nuclides. Some samples were also analyzed for tritium. Results of the analyses are given in Table 2. Most, but not all, of the radioactivity detected is naturally-occurring. Laboratory reports are appended to this report.

D. CONCLUSIONS

These samples, plus those of EPA and DHS, duplicate over 20% of the samples taken by Rockwell. When the analytical results of the splits are compared to Rockwell's results, relatively good agreement is found. This tends to validate the Rockwell data.

The Rockwell study found elevated radioactivity levels in several locations:

- #15 - RD-51 watershed
- #16 - RMDF watershed
- #17 - Building 59 watershed
- #19 - SRE watershed

Elevated radioactivity levels detected at these locations are discussed in Reference 2.

The elevated tritium levels at location 17 were also detected in our samples, with good agreement (see Table 2). Our analysis of splits taken at locations 16, 17 and 19 lacked the sensitivity to see strontium-90 and cesium-137 at the levels detected by Rockwell. Also, we did not analyze samples for plutonium-238, which was found by Rockwell at locations 15 and 17.

Table 1
SAMPLING LOCATIONS

Number	Location	Sampling Date
01	Playground	3/18/92
02	Dormitory	3/19/92
07	CIT Area	3/19/92
08	Devel. Site 1	3/19/92
09	Devel. Site 2	3/19/92
10	Devel. Site 3	3/19/92
11	Veg. Garden	3/18/92
12	Orchard	3/18/92
15	RD-51 Watershed	4/22/92
16	RMDF Watershed	4/22/92
17	Bldg.59 W'shed	4/21/92
18	Burn Pit W'shed	4/21/92
19	SRE Watershed	4/23/92

Table 2. Results of Analyses

Tritium Results

<u>Loc'n/Block #</u>	<u>pCi/g</u>	<u>pCi/l*</u>	<u>yield %*</u>
17/004 (Soil)	3.7 ± 1.2	12,800 ± 4300	29.0
19/004 (Soil)	<1.1	<4500	25.1
17 (Moss)	1.3 ± 1.1	7,500 ± 6700	16.9

Notes: *Water extracted by simple distillation.
Block # refers to specific point at sampling location.

Gamma Scan Results
pCi/gm-wet

<u>Locn/Blk</u>	<u>K-40</u>	<u>Pb-212</u>	<u>Bi-214</u>	<u>Pb-214</u>	<u>Tl-208</u>	<u>Ac-228</u>
01/027	20±1	0.9±.1	0.7±.1	0.6±.1	1.1±0.2	1.1±0.2
02/071	21±2	0.7±.1	0.7±.1	0.7±.1	1.0±0.2	1.1±0.2
07/035	18±2	0.8±.1	0.6±.1	0.6±.1	1.0±0.2	1.0±0.3
08/022	18±2	0.9±.1	0.6±.1	0.7±.1	1.0±0.2	1.0±0.3
09/092	17±1	0.7±.1	0.7±.1	0.7±.1	1.0±0.2	0.9±0.2
10/081	15±1	0.8±.1	0.7±.1	0.8±.1	0.7±0.2	0.9±0.3
11/018	18±2	0.7±.1	0.9±.1	0.7±.1	1.0±0.2	0.9±0.3
12/023	17±1	0.7±.1	0.9±.1	0.8±.1	0.7±0.2	1.0±0.2
15/004	20±3	0.6±.1	0.3±.2	0.5±.2	0.2±0.1	0.6±0.3
16/005	17±1	0.4±.1	0.5±.1	0.4±.1	0.2±0.1	0.6±0.2
17/004	12±1	0.7±.1	0.1±.1	0.8±.1	0.3±0.1	0.9±0.2
18/001	17±1	0.6±.1	0.4±.1	0.4±.1	0.3±0.4	0.7±0.2
19/004	12±1	0.6±.1	0.5±.1	0.5±.1	0.2±0.4	0.7±0.1

Notes: Soil samples. Only nuclides detected are shown, others <0.3.
Block # refers to specific point at sampling location.

Table 2. Cont'd.

Gamma Scan Results - pCi/gm-wet

<u>Location</u>	<u>K-40</u>	<u>Pb-212</u>	<u>Bi-214</u>	<u>Pb-214</u>	<u>Tl-208</u>	<u>Ac-228</u>
12	14±1	0.6±.1	0.6±.1	0.7±.1	0.7±0.2	0.7±0.2
16	12±2	1.4±.2	1.4±.2	1.0±.2	1.5±0.3	1.4±0.5
17	16±1	1.0±.2	0.8±.2	0.8±.2	0.5±0.1	1.5±0.5
18	17±2	0.7±.1	0.5±.2	0.8±.2	1.0±0.2	0.7±0.3
18	18±2	2.2±.2	1.7±.2	1.5±.2	0.9±0.1	2.4±0.5
19	13±3	1.2±.3	0.7±.4	0.9±.4	0.5±0.2	1.7±0.6

Notes: Moss samples. Only nuclides detected are shown, others <0.3.

Strontium-90 Results
pCi/gm-wet

	<u>Location/Block</u>	<u>Results</u>
Soils:	01/027	<0.7
	02/071	<1.2
	07/035	<1.2
	08/022	<1.3
	09/092	<1.4
	10/081	<0.6
	11/018	<1.0
	12/019	<1.1
	15/004	<0.6
	16/005	<0.6
	18/001	<0.6
	19/004	<0.6
	Moss:	12
16		<1.4
17		<0.6
18		<1.3
18		<0.6
19		<0.6

APPENDIX

LABORATORY REPORTS



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Sample Type: Soil

Gamma Spec Error Sr-90 Error

Sample	pCi/g	2σ	pCi/g	2σ
BBB12019			0.3 ±1.1	
B01027B			0.2 ±0.7	✓
B11018B			0.1 ±1.0	

Moss

WR1A (18)			0.0 ±1.3	
CR4A (16)			0.6 ±1.4	

Sample Type: Soil

B07035B			0.1 ±1.2	✓
B08022B			0.0 ±1.3	✓
B09092B			0.0 ±1.4	✓
B10081B			0.3 ±0.6	✓
B02071B			0.1 ±1.2	✓

Moss

MH01 (12)			0.5 ±0.6	
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GAMMA SPECTROSCOPY

Sample Type: Soil

Sample	Ac-228	Error	Bi-214	Error	K-40	Error	Pb-212	Error
	pCi/g	2σ	pCi/g	2σ	pCi/g	2σ	pCi/g	2σ
BBB12023	1.0	±0.2	0.91	±0.13	17	±1	0.72	±0.09
B01027A	1.1	±0.2	0.72	±0.11	20	±1	0.85	±0.09
B11018A	0.88	±0.25	0.85	±0.14	18	±2	0.65	±0.10
WR1A (18)	0.74	±0.32	0.54	±0.16	17	±2	0.72	±0.12
CR4A (14)	1.4	±0.5	1.4	±0.2	12	±2	1.4	±0.2
B07035A	0.98	±0.26	0.61	±0.12	18	±2	0.82	±0.10
B08022A	0.97	±0.29	0.56	±0.14	18	±2	0.85	±0.11
B09092A	0.88	±0.24	0.72	±0.12	17	±1	0.74	±0.09
B10081A	0.92	±0.27	0.74	±0.12	15	±1	0.76	±0.10
B02071A	1.1	±0.2	0.71	±0.11	21	±2	0.69	±0.09
MH01 (12)	0.74	±0.23	0.59	±0.12	14	±1	0.61	±0.09

Pb-214 Error Th-232* Error

Sample	pCi/g	2σ	pCi/g	2σ
BBB12023	0.83	±0.13	0.7	±0.2
B01027A	0.58	±0.12	1.1	±0.2
B11018A	0.66	±0.13	1.0	±0.2
WR1A (18)	0.76	±0.17	1.0	±0.2
CR4A (14)	1.0	±0.2	1.5	±0.3
B07035A	0.58	±0.13	0.96	±0.17
B08022A	0.66	±0.14	0.97	±0.20
B09092A	0.67	±0.12	0.96	±0.18
B10081A	0.77	±0.13	0.69	±0.18
B02071A	0.66	±0.12	0.96	±0.18
MH01 (12)	0.69	±0.13	0.71	±0.16



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GAMMA SPECTROSCOPY

Abbreviations:

Parameters:

Gamma Spec	: Gamma Spectralanalysis
Sr-90	: Strontium -90
Ac-228	: Actinium-228
Bi-214	: Bismuth-214
K-40	: Potassium-40
Pb-212	: Lead-212
Pb-214	: Lead-214
Th-232*	: Thorium-232 by Tl-208

Units:

pCi/g	: picoCuries per gram
2σ	: Counting error at the 95% confidence level, 2σ

Job approved by:

Signed:

Margie Kudruek for Ellen La Riviere.....
Ellen La Riviere
Radiochemistry Laboratory Manager



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QUALITY CONTROL REPORT

Sample Type: Soil

Gamma Spec Error Sr-90 Error

Sample Id	pCi/g	2 σ	pCi/g	2 σ
Duplicate			0.4	± 0.6
Duplicate			0.6	± 0.6
Duplicate % diff.			20	
Std (found value)	18	± 1	21	± 2
Std (true value)	19		20	
Std % rec.	5.3		105	
Blank			0.6	± 0.7
Spike % rec.			100	



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QUALITY CONTROL REPORT

Sample Type: Soil

Sample Id	Ac-228 Error	Bi-214	Error	K-40	Error
	pCi/g 2σ	pCi/g	2σ	pCi/g	2σ
Duplicate	1.1 ±0.2	0.71	±0.11	21	±2
Duplicate	0.95 ±0.23	0.60	±0.11	22	±2
Duplicate % diff.	7.3	8.4		2.3	
Std (found value)					
Std (true value)					
Std % diff.					

Sample Id	Pb-212	Error	Pb-214	Error	Th-232*	Error
	pCi/g	2σ	pCi/g	2σ	pCi/g	2σ
Duplicate	0.69	±0.09	0.66	±0.12	0.96	±0.18
Duplicate	0.69	±0.09	0.63	±0.12	0.81	±0.18
Duplicate % diff.	0.0		2.3		8.5	
Std (found value)						
Std (true value)						
Std % diff.						



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QUALITY CONTROL REPORT

Abbreviations:

Parameters:

Gamma Spec	: Gamma Spectralanalysis
Sr-90	: Strontium -90
Ac-228	: Actinium-228
Bi-214	: Bismuth-214
K-40	: Potassium-40
Pb-212	: Lead-212
Pb-214	: Lead-214
Th-232*	: Thorium-232 by Tl-208

Units:

pCi/g	: picoCuries per gram
2 σ	: Counting error at the 95% confidence level, 2 σ

Job approved by:

Signed:

.....*Am314*.....
 Approved
 Quality Assurance Department



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QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: patty Via: Fedex

Sample Container Type: 500ml pl, ziplock bag
Sample Type: Soil/Moss
Preservative When Received: none
Additional Lab Preparation: none

Parameter	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Gamma Spec	901.1	---	pCi/g	none La Riviere	4/16
Sr-90	901.1	---	pCi/g	none Kidwell	4/22- 5/13
Ac-228	901.1	---	pCi/g	none La Riviere	4/16
Bi-214	901.1	---	pCi/g	none La Riviere	4/16
K-40	901.1	---	pCi/g	none La Riviere	4/16
Pb-212	901.1	---	pCi/g	none La Riviere	4/16
Pb-214	901.1	---	pCi/g	none La Riviere	4/16
Th-232*	901.1	---	pCi/g	none La Riviere	4/16



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Status: Final

AMENDED REPORT

Sample Type: Soil

Sr-90 Error Tritium Error Tritium Error % Moisture

Sample Id	pCi/g 2σ	pCi/g* 2σ	pCi/l 2σ	%
BBB17001SA*	0.0 ±0.6	a4.0 ±1.3	13200 ±4100	30.5
BBB16005SC	NR NR	NR NR	NR NR	NR
BBB16005SA	0.3 ±0.6	NR NR	NR NR	NR
BBB18001BSC	NR NR	NR NR	NR NR	NR
BBB19004SC	NR NR	NR NR	NR NR	NR
BBB17004SC	NR NR	a3.7 ±1.2	12800 ±4300	29.0
BBB15004SA	0.0 ±0.6	NR NR	NR NR	NR
BBB19004SA	0.1 ±0.6	a0.9 ±1.1	3500 ±4500	25.1
BBB15004SC	NR NR	NR NR	NR NR	NR
BBB18001BSA	0.0 ±0.6	NR NR	NR NR	NR

Sample Type: Vegetation

RD51 (19)	0.4 ±0.6	NR NR	NR NR	NR
WR1B (18)	0.0 ±0.6	NR NR	NR NR	NR
WR3A (17)	0.3 ±0.6	a1.3 ±1.1	7500 ±6700	16.9

* Correct ID is in question. Data not used. JZ



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Sample Type: Soil

Sample Id	Bi-214	Error	K-40	Error	Pb-212	Error
	as received		as received		as received	
	pCi/g	2σ	pCi/g	2σ	pCi/g	2σ
BBB16005SC	0.5	±0.1	17	±1	0.4	±0.1
BBB18001BSC	0.4	±0.1	17	±1	0.6	±0.1
BBB19004SC	0.5	±0.1	12	±1	0.6	±0.1
BBB17004SC	0.1	±0.1	12	±1	0.7	±0.1
BBB15004SC	0.3	±0.2	20	±3	0.6	±0.1
RD51 (14)	0.7	±0.4	13	±3	1.2	±0.3
WR1B (12)	1.7	±0.2	18	±2	2.2	±0.2
WR3A (17)	0.8	±0.2	16	±2	1.0	±0.2

Sample Id	Pb-214	Error	Tl-208	Error	Ac-228	Error
	as received		as received		as received	
	pCi/g	2σ	pCi/g	2σ	pCi/g	2σ
BBB16005SC	0.4	±0.1	0.2	±0.1	0.6	±0.2
BBB18001BSC	0.4	±0.1	0.3	±0.4	0.7	±0.2
BBB19004SC	0.5	±0.1	0.2	±0.4	0.7	±0.1
BBB17004SC	0.8	±0.1	0.3	±0.1	0.9	±0.2
BBB15004SC	0.5	±0.2	0.2	±0.1	0.6	±0.3
RD51	0.9	±0.4	0.5	±0.2	1.7	±0.6
WR1B	1.5	±0.2	0.9	±0.1	2.4	±0.5
WR3A	0.8	±0.2	0.5	±0.1	1.5	±0.5

Sample Id	Th-234	Error
	as received	
	pCi/g	2σ
BBB16005SC	<0.4	---
BBB18001BSC	<0.4	---
BBB19004SC	0.3	±0.2
BBB17004SC	0.4	±0.2
BBB15004SC	<0.6	---



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Sample Type: Soil

Sample Id	Th-234 as received pCi/g	Error 2σ
RD51 (f)	<1.2	---
WR1B (ii)	<0.7	---
WR3A (i7)	0.9 ±0.6	



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AMENDED REPORT

Abbreviations:

Parameters:

Sr-90	: Strontium -90
Gamma Spec*	: Gamma Spectralanalysis-MDA'S Reported at 1.645 sigma
Bi-214	: Bismuth-214
K-40	: Potassium-40
Pb-212	: Lead-212
Pb-214	: Lead-214
Tl-208	: Thallium-208
Ac-228	: Actinium-228
Th-234	: Thorium-234

Units:

pCi/g	: picoCuries per gram
2σ	: Counting error at the 95% confidence level, 2σ
pCi/g*	: picoCuries per gram as received
pCi/l	: picoCuries per liter
%	: percent

Quality codes:

<	: Not Detected- below detection limit.
NR	: Not Requested
a	: Amended Value



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QUALITY CONTROL REPORT

Sample Type: Soil

Sample Id	Sr-90	Error	Tritium	Error	Tritium	Error	% Moisture
	pCi/g	2σ	pCi/g*	2σ	pCi/l	2σ	%
Duplicate	0.1	±0.6	a4.0	±1.3	---	---	---
Duplicate	0.1	±0.6	a3.6	±1.2	---	---	---
Duplicate % diff.	0.0	---	a5.3	---	---	---	---
Std (found value)	22	±1	9939	±509	---	---	---
Std (true value)	20	---	9889	---	---	---	---
Std % diff.	---	---	---	---	---	---	---
Std % rec.	110	---	100	---	---	---	---
Blank	0.0	±0.6	10	±256	---	---	---
Spike % rec.	92	---	---	---	---	---	---



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QUALITY CONTROL REPORT

Sample Type: Soil

Sample Id	Gamma Spec* Error as received	
	pCi/g	2σ
Std (found value)	19	±1
Std (true value)	19	---
Std % rec.	100	---



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QUALITY CONTROL REPORT

Sample Type: Soil

Sample Id	Bi-214 as received pCi/g	Error 2 σ	K-40 as received pCi/g	Error 2 σ
Duplicate	0.5	± 0.1	12	± 1
Duplicate	0.5	± 0.1	13	± 1
Duplicate % diff.	0.0	---	4.0	---

Sample Id	Pb-212 as received pCi/g	Error 2 σ	Pb-214 as received pCi/g	Error 2 σ
Duplicate	0.6	± 0.1	0.5	± 0.1
Duplicate	0.6	± 0.1	0.5	± 0.1
Duplicate % diff.	0.0	---	0.0	---

Sample Id	Tl-208 as received pCi/g	Error 2 σ	Ac-228 as received pCi/g	Error 2 σ
Duplicate	0.2	± 0.4	0.7	± 0.1
Duplicate	0.3	± 0.1	0.7	± 0.1
Duplicate % diff.	20	---	0.0	---

Sample Id	Th-234 as received pCi/g	Error 2 σ
Duplicate	0.3	± 0.2
Duplicate	<0.3	---
Duplicate % diff.	0.0	---



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QUALITY CONTROL REPORT

Abbreviations:

Parameters:

Sr-90	: Strontium -90
Gamma Spec*	: Gamma Spectralanalysis-MDA'S Reported at 1.645 sigma
Bi-214	: Bismuth-214
K-40	: Potassium-40
Pb-212	: Lead-212
Pb-214	: Lead-214
Tl-208	: Thallium-208
Ac-228	: Actinium-228
Th-234	: Thorium-234

Units:

pCi/g	: picoCuries per gram
2σ	: Counting error at the 95% confidence level, 2σ
pCi/g*	: picoCuries per gram as received
pCi/l	: picoCuries per liter
%	: percent

Quality codes:

<	: Not Detected- below detection limit.
a	: Amended Value



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QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: jdr

Via: Fedex

Sample Container Type: ziplock bag
Sample Type: Soil/Moss
Preservative When Received: none
Additional Lab Preparation: none

Parameter	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Sr-90	901.1	---	pCi/g	none Hebel	5/31- 6/ 2
Tritium	906.0	460	pCi/g	none Eggleston	7/20- 7/22
Gamma Spec*	901.1	---	pCi/g	none Kidwell	7/ 7- 7/17



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QUALITY CONTROL REPORT

Signed:

[Signature]
.....
Laboratory Manager(s)

Signed:

[Signature]
.....
Quality Assurance Department

Signed:

[Signature]
.....
David Lasher
Acting Laboratory Director