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James P. Rust
Director, Facilities

Sarnoff Corporation
201 Washington Road
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jrust@sarnoff.com

June 25, 2009

J-6
MS-16

Dennis R. Lawyer
Health Physicist
Commercial and R&D Branch
Division of Nuclear Materials Safety
U.S. Nuclear Regulatory Commission, Region I
475 Allendale Road
King of Prussia, PA 19406-1415

SUBJECT: THE SARNOFF CORPORATION, REQUEST FOR ADDITIONAL INFORMATION CONCERNING APPLICATION FOR AMENDMENT TO LICENSE, CONTROL NO. 143652

NRC License Number: 29-28005-01 03029879

RECEIVED REGION 1 2009 JUN 29 PM 12:22

Dear Mr. Lawyer:

This is in response to your letter of 27 April 2009 requesting additional information related to our recent radioactive material license amendment request. Numbers items below correspond to the numbered requests in your letter.

1. You have requested surveys of the areas in which hydrogen-3, carbon-14, and calcium-45 were used. We have never used carbon-14 or calcium-45. However, we have used hydrogen-3 (tritium).

   Hydrogen-3 was used for bench top laboratory studies in room EN-307. Hydrogen-3 was used to a much lesser extent in rooms EN-302 and EN-310 where sealed liquid scintillation vials were brought for analysis on a liquid scintillation counter. In addition, the Pond Building (a one-room building) had been used for storage of containers of radioactive waste, including hydrogen-3.

   Attached are final contamination surveys for rooms EN-307, EN-302, EN-310, and Pond Building that were conducted after all hydrogen-3 was removed from the room and no hydrogen-3 was brought back to the room.

2. Per your direction, we request a partial building release of the rooms in which we had used hydrogen-3 and no longer need to use those rooms for other unsealed isotopes. As such we list the following rooms as requested.

   A. Rooms where we no longer need to store or use licensed material:

      EN-116 (only used for nuclides with half lives less than 120 days)
      EN-302
      EN-307
      EN-308 (never used for unsealed materials)
      EN-309 (never used for unsealed materials)
      EN-314 (never used for unsealed materials)
      EN-317 (only used for nuclides with half lives less than 120 days)

      E-324 (never used for unsealed materials)
      E-326 (never used for unsealed materials)
      E-331 (never used for unsealed materials)

SARNOFF® Corporation

143652
NMSS/RGN1 MATERIALS-002

SW-220 (never used for unsealed materials)

W-225, W-227, W-229, W-231, W-233 (Clean room facility. Used for sealed sources only. Never used for unsealed materials.)

W-402B (former radioactive waste storage)

Pond Building (former radioactive waste storage)

B. Rooms in which we used hydrogen-3 and where we no longer need to store or use licensed material.

EN-307
EN-302
Pond Building

C. Rooms in which we used hydrogen-3, and will still need to use licensed material.

EN-310

In summary, if the above described partial building release is approved by the NRC, and our license amendment is granted, the following remaining rooms would continue to be approved for licenses materials:

EN-306 (general biochemistry and molecular biology laboratory, not yet used for unsealed materials)
EN-310 (general biochemistry and molecular biology laboratory)
SW-040 (ground level, Radiation Safety Lab, approx. 540 sq. ft., radioactive waste storage, sealed source storage)
W-306 (for use with sealed sources only)
W-310 (for use with sealed sources only)
W-312 (for use with sealed sources only)

In addition, we request the following rooms be added to our license for use with sealed sources only:

W-210 (for use with sealed sources only)
W-212 (for use with sealed sources only)

3. In support of an environmental assessment related to the release a portion our facility, we provide the following information as requested:

A. The name of the facility is The Sarnoff Corporation.

B. The size of the complex (in Acres) is 254.
The size of the building in square feet is 600,000.
The area to be released in square feet is 1,413.
The total area in square feet in which hydrogen-3, carbon-14, or calcium-45 was stored or used is 1,413.

C. The type of building use is general office and research and development laboratory.

D. The surrounding area is described as residential.

E. The general type of activities authorized on the license are laboratory procedures typically performed on bench tops.

4. We have records as follows:

   A. For unsealed materials with half-lives greater than 120 days, records for disposal made pursuant to 10 CFR 20.2002 (alternate disposal procedures, including burial authorized prior to January 28, 1981) [no alternate disposals have been done], 20.2003 (disposals to the sanitary sewerage system) [no disposals to the sanitary sewer system have been done], 20.2004 (incineration of wastes) [no incineration of wastes have been done], 20.2005 (disposal of specific wastes including liquid scintillation cocktail and animal tissue), and 20.2103(b)(4), evaluations of effluent releases.

   B. Records important for decommissioning as described in 30.35(g), 40.36(f) and 70.25(g). Examples of such records include but are not limited to: records of contamination, identifying the radionuclides, quantities and concentrations; asbuilt drawings and modifications of structures and equipment in restricted areas and locations of inaccessible contamination such as buried pipes; a single list, updated at least every 2 years, of areas to which access is limited for the purpose of radiation protection (restricted areas); and records related to the provision of financial assurance.

5. For areas that are partially released, we will take steps to prevent recontamination and not use this area for licensed material in the future.

Feel free to contact me at 609-734-3008 if you have any questions.

Very truly yours,
Sarnoff Corporation

James P. Rust
Director, Facilities

cc: Wesley R. Van Pelt, PhD, CIH, CHP, Radiation Safety Officer

Attachments:
Survey of Room EN-307
Survey of Room EN-310
Survey of Room EN-302
Survey of Pond Building

Survey of Room EN-307

WESLEY R. VAN PELT ASSOCIATES, INCORPORATED

WESLEY R. VAN PELT, PH.D.
President
CERTIFIED HEALTH PHYSICIST
CERTIFIED INDUSTRIAL HYGIENIST
Consulting in Environmental & Radiological Health & Safety

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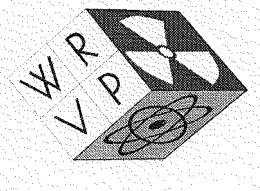


24 July 1998

Dr. James Matey
Radiation Safety Officer
Sarnoff Corporation
201 Washington Rd.
Princeton, NJ 08543-5300
609-734-2868

Subject: Final Radiation Survey of Room EN-307

Dear Jim,

On 15 July 1998 I did a final radiation contamination survey of room EN-307. This room had been used by Dr. Paul Mitsis of seQ Ltd until about two weeks prior to the survey. He used only H-3 and P-32. No other radionuclides were used in this room. At the time of the survey, all of seQ's equipment, supplies, radioactive reagents, radioactive waste, etc. had been removed from the room. No normal cleaning had been done yet.

Survey Meter Survey for P-32

I did a radiation survey meter scan of all surfaces in the lab, including floors, benches, shelves, drawers (inside and outside), cabinets (inside and outside), door, lab hood (including inside, outside and sink), sink and walls. The scan involved slowly moving the probe about 1 cm above the surface. The survey meter is a Ludlum Model 16 Ratemeter, Serial No. 54796, with Model 44-9 pancake style Geiger probe, Serial No. PR044692, calibrated 9 September 1997. The background reading was 20 to 40 counts per minute (cpm). For the Model 44-9 pancake GM probe, Ludlum Measurements Inc., gives the 4π geometry counting efficiency for P-32 as 32%.

Recent US multi-agency radiation survey procedures[1] give the Minimum Detectable Count Rate (MDCR) of 50 net cpm for a 45 cpm background. That is, one can detect 50 cpm

[1]Multi-Agency Radiation Survey and Site Investigational Manual (MARSSIM), NUREG-1575, EPA 402-R-97-016, final, December 1997.

above a background of 45 cpm when scanning a surface. The MARSSIM gives the Minimum Detectable Concentration (in dpm/100 cm^2) when scanning a surface as

$$Scan\ MDC = \frac{MDCR}{\sqrt{p}\ e_i\ e_s \frac{probe\ area}{100\ cm^2}}$$

where,

Scan MDC = Minimum Detectable surface Concentration, dpm/100 cm^2
p = surveyor efficiency = 0.5
e_i = instrument efficiency = 0.32
e_s = surface efficiency = 0.70
probe area = active area of detector probe = 15 cm^2

The Scan MDC = 2100 dpm/100 cm^2.

No area showed any surface contamination above the background reading of the survey meter. Therefore, all surveyed surfaces are reported as less than 2100 dpm/100 cm^2.

Swipe Survey for Removable H-3 and P-32

I also did a survey for removable contamination by wiping surfaces with cotton swabs and analyzing them for H-3 and P-32 with Sarnoff's Beckman LS6500 liquid scintillation counter (lsc). Each wipe covered 200 cm^2 or more. The lsc internal protocol reports activity in dpm units (i.e., corrected for background and efficiency) using its Auto-DPM method, and gross cpm in the P-32 channel. None of the samples showed any counts above background in the P-32 channel. The output of the lsc is attached. The highest Auto-DPM value reported was for sample number 10 (the sink in the hood) which was 35 dpm of H-3. Since all swipes were at least 200 cm^2, swipe number 10 is therefore reported as 17.5 dpm/100 cm^2.

Evaluation of Results

Evaluation of the results of the survey is best done by comparing the detected contamination levels with the levels allowed for release for unrestricted use by an NRC guidance document.[1] This NRC document indicates that facilities and equipment may be released for unrestricted use if the removable H-3 and P-32 contamination is below 1,000 dpm/100 cm^2. Thus, even the highest measured swipe value of 17.5 dpm/100 cm^2 for removable contamination is well below the acceptable release limit of 1,000 dpm/100 cm^2.

The acceptable levels for unrestricted release for surface contamination (fixed plus removable) is 5,000 dpm/100 cm^2 as an average and 15,000 dpm/100 cm^2 maximum. It is clear that since all areas are below 2100 dpm/100 cm^2, the room is acceptable for unrestricted use.

In conclusion, it is my opinion that room EN-307 and its associated closet may be released for unrestricted use. You should keep this survey report in your permanent files.

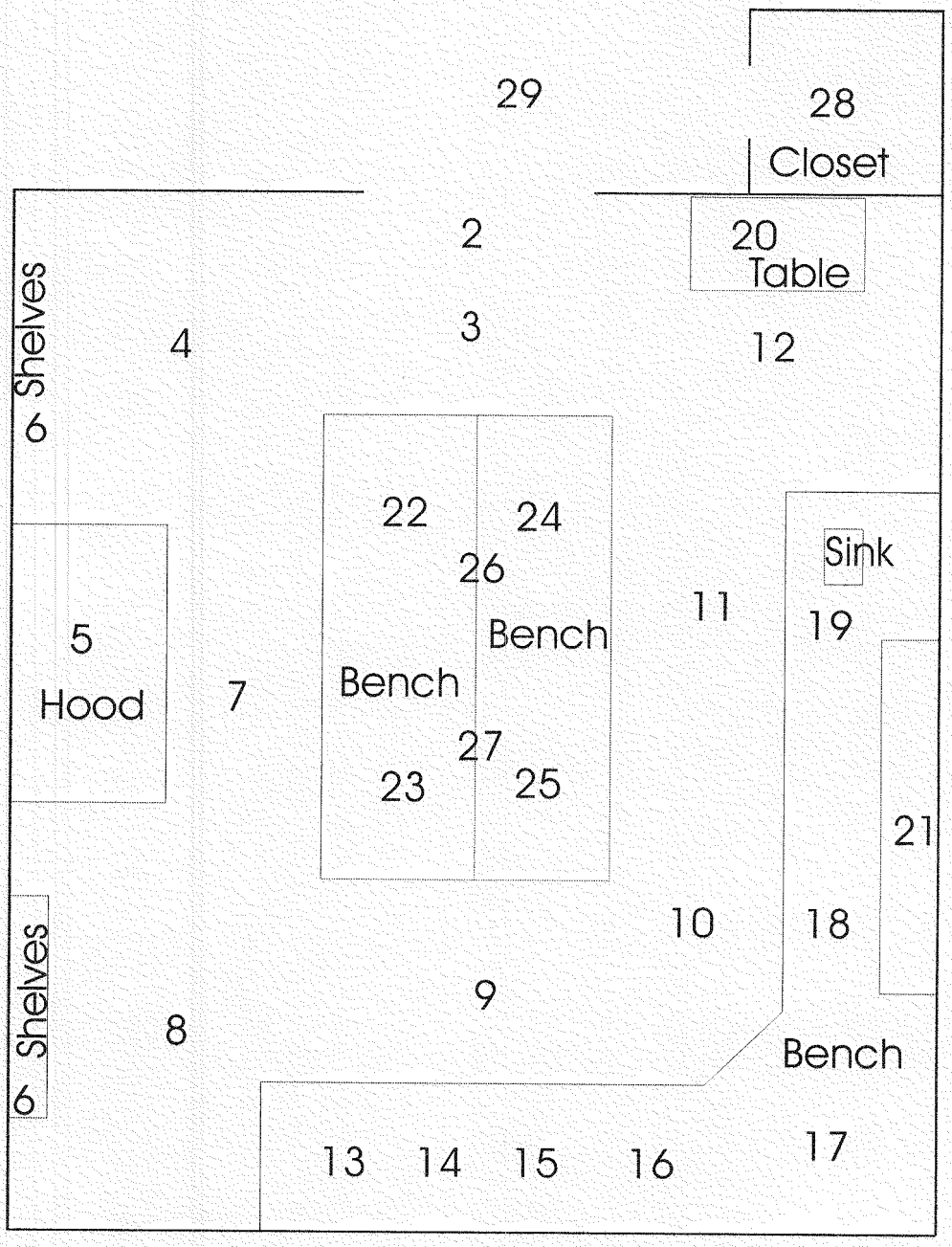
Very truly yours,
WESLEY R. VAN PELT ASSOCIATES, Inc.

Wesley R. Van Pelt, Ph.D.
President

attachments:
- Floor plan, Room EN-307
- Swipe Locations
- Ludlum specification sheet for Model 44-9 GM probe
- lsc printout

[1] "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," US Nuclear Regulatory Commission, May 1987.

Floor Plan, Room EN-307



Swipe Locations

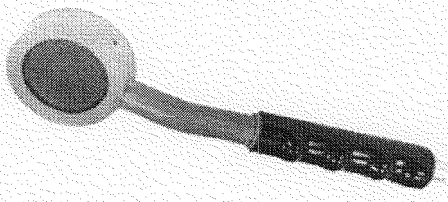
Swipe No.	Location No. (see floor plan)	Description
1	na	blank (clean cotton swab)
2	2	door, outside
3	2	door, inside
4	3	floor
5	4	floor
6	4	shelves
7	5	hood, outside
8	5	hood, bench, right
9	5	hood, bench, left
10	5	hood, sink
11	5	hood, rear plenum, lower
12	5	hood, cabinets, outside
13	5	hood, cabinets, inside
14	6	shelves
15	7	floor
16	8	floor
17	9	floor
18	10	floor
19	11	floor
20	12	floor
21	13	drawers, outside
22	13	drawers, inside
23	14	drawers, outside

Swipe No.	Location No. (see floor plan)	Description
24	14	drawers, inside
25	15	drawers, outside
26	15	drawers, inside
27	16	drawers, outside
28	16	drawers, inside
29	17	cabinet, outside
30	17	cabinet, inside
31	18	drawers, outside
32	18	drawers, inside
33	19	cabinets under sink, outside
34	19	cabinets under sink, inside
35	13-16	bench top
36	17-19	bench top
37	19	sink
38	20	table
39	21	cabinets on wall, outside
40	21	cabinets on wall, inside
41	22	bench top
42	23	bench top
43	24	bench top
44	25	bench top
45	26	shelves over bench
46	27	shelves over bench
47	26	shelves under bench

Swipe No.	Location No. (see floor plan)	Description
48	27	shelves under bench
49	28	closet, floor
50	28	closet, walls
51	28	closet, mop
52	28	closet, black metal waste cans, outside
53	28	closet, plastic and styrofoam containers
54	29	floor outside of closet

MODEL 44-9
PANCAKE GEIGER-MULLER DETECTOR

PART NUMBER:47-1539



INDICATED USE: Alpha beta gamma survey; Frisking
DETECTOR: Pancake type halogen quenched G-M
WINDOW: 1.7 plus or minus 0.3 mg/cm squared mica
WINDOW AREA:
Active - 15 cm squared
Open - 12 cm squared
EFFICIENCY(4pi geometry): Typically 5%-C-14; 22%-Sr-90/Y-90;
19%-Tc-99; 32%-P-32; 15%-Pu-239
SENSITIVITY: Typically 3300 cpm/mR/hr (*Cs-137 gamma*)
ENERGY RESPONSE: Energy dependant
DEAD TIME: Typically 80 microseconds
COMPATIBLE INSTRUMENTS: General purpose survey meters, ratemeters, and scalers
OPERATING VOLTAGE: 900 volts
CONNECTOR: Series "C" (*others available*)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: 5 degrees F(-15 degrees C) to 122 degrees F(50 degrees C)
May be certified to operate from -40 degrees F(-40 degrees C) to 150 degrees F(65 degrees C)
SIZE: 1.8" (4.6 cm)H X 2.7" (6.9 cm)W X 10.7" (27.2 cm)L
WEIGHT: 1 lb (0.5kg)

Source: http://ludlums.com/product/dets/m44-9.htm

201-445-6400

Wes - Has a LSC Output
- Lydd Has Made Other Adjustments for Demo.

J. Mc

ID:AUTO DPM 5MIN 16 JUL 1998 15:17

USER: 4 COMMENT:WES

PRESET TIME :	5.00						
DATA CALC :	AUTO DPM	H# :YES	SAMPLE REPEATS:	1	PRINTER	: STD	
COUNT BLANK :	YES	IC# : NO	REPLICATES :	1	RS232	: OFF	
TWO PHASE :	NO	AQC :YES	CYCLE REPEATS :	1	DISK	: OFF	
SCINTILLATOR:	LIQUID	LUMEX:YES	LOW SAMPLE REJ:	0	RWM LIST	: OFF	
LOW LEVEL :	NO	HALF LIFE CORRECTION DATE:			none		

ISOTOPE 1: 3H %ERROR: 0.00 FACTOR: 1.000000 BKG. SUB: 0
ISOTOPE 2: 32P %ERROR: 0.00 FACTOR: 1.000000 BKG. SUB: 0

SAM NO	POS	TIME MIN	H#	#	3H CPM	3H %ERROR	32P CPM	32P %ERROR	3H DPM	3H EFF-1	LUMEX %	ELAPSED TIME
B1	**-1	5.00	80.0	1	8.20	37.80	22.00	19.07	34.29	23.91	10.77	5.59
	Blank Average DPM for 3H = 34.29 COEF. OF VAR: 0.000											
1	**-3	5.00	98.6	2	9.20	39.87	20.40	19.80	8.60	21.45	20.12	11.41
2	**-4	5.00	89.0	3	10.00	34.42	18.60	20.74	7.45	23.96	14.68	17.19
3	**-5	5.00	101.1	4	10.20	36.39	19.40	20.31	13.38	21.40	18.85	22.99
4	**-6	5.00	102.4	5	13.20	32.23	19.00	20.52	24.14	22.59	21.48	28.78
5	**-7	5.00	91.4	6	9.60	36.82	17.20	21.57	-2.51	30.21	18.19	34.58
6	**-8	5.00	100.8	7	9.00	40.52	19.00	20.52	7.94	21.31	20.85	40.38
7	**-9	5.00	90.0	8	9.40	35.36	21.00	19.52	10.98	20.76	12.86	46.19
8	**-10	5.00	95.7	9	11.80	30.14	21.00	19.52	20.33	21.60	11.07	51.95
9	**-11	5.00	91.0	10	22.60	21.32	18.00	21.08	34.68	32.76	14.23	57.79
10	**-12	5.00	105.9	11	7.80	51.59	17.20	21.57	1.37	21.87	30.99	63.62
11	**-13	5.00	95.6	12	8.60	40.03	16.40	22.09	1.69	23.90	19.07	69.45
12	**-14	5.00	141.8	13	10.80	46.33	17.80	21.20	18.59	20.42	39.90	75.33
13	**-15	5.00	90.9	14	9.80	35.60	18.60	20.74	14.36	20.14	15.61	81.16
14	**-16	5.00	107.5	15	6.80	54.60	22.80	18.73	********	0.00	24.12	86.99
	COUNT RATE TOO LOW OR TOO COMPRESSED											
15	**-17	5.00	113.2	16	5.80	57.75	17.80	21.20	1.06	16.41	24.51	92.81
16	**-18	5.00	106.5	17	10.80	39.05	19.80	20.10	12.43	23.11	26.39	98.68
17	**-1	5.00	96.6	18	11.40	35.11	17.00	21.69	12.37	24.43	23.09	104.60
18	**-2	5.00	107.9	19	7.40	45.90	17.00	21.69	-0.92	22.17	21.23	110.42
19	**-3	5.00	122.6	20	8.20	52.83	19.00	20.52	0.29	23.71	33.86	116.29
20	**-4	5.00	88.8	21	10.20	33.97	21.20	19.43	9.55	23.27	13.92	122.07
21	**-5	5.00	95.4	22	7.40	42.92	22.20	18.98	1.99	20.40	13.74	127.84
22	**-6	5.00	82.0	23	8.80	36.37	21.60	19.25	4.23	22.84	11.87	133.65
23	**-7	5.00	93.1	24	6.20	51.65	21.00	19.52	1.43	17.36	18.85	139.48
24	**-8	5.00	84.1	25	9.00	38.77	18.40	20.85	6.83	21.89	18.12	145.30
25	**-9	5.00	93.8	26	8.60	40.57	20.60	19.71	3.88	22.53	17.39	151.10
26	**-10	5.00	93.9	27	7.40	43.60	16.00	22.36	-4.67	24.98	18.65	156.91
27	**-11	5.00	93.3	28	7.00	52.11	17.80	21.20	3.56	18.50	26.20	162.72
28	**-12	5.00	85.8	29	9.00	34.72	16.20	22.22	1.49	25.15	12.33	168.50
29	**-13	5.00	92.8	30	8.00	45.86	19.00	20.52	6.65	19.54	23.34	174.35
30	**-14	5.00	92.9	31	11.20	30.73	18.40	20.85	7.28	26.94	12.23	180.15
31	**-15	5.00	94.5	32	5.60	52.03	18.40	20.85	-8.09	21.37	16.68	185.94
32	**-16	5.00	88.5	33	9.80	39.39	21.00	19.52	11.09	21.59	21.75	191.77
33	**-17	5.00	110.2	34	6.40	48.03	16.20	22.22	-1.52	19.53	19.05	197.57
34	**-18	5.00	94.6	35	10.20	33.97	21.00	19.52	12.31	21.89	12.87	203.40
35	**-1	5.00	87.7	36	11.00	33.84	21.40	19.33	6.83	24.78	14.88	209.38

	**-4	5.00	92.9	39	6.40	46.37	16.60	21.95	-7.60	23.98	16.87	226.77
39	**-5	5.00	89.2	40	10.40	35.27	22.60	18.81	16.27	20.57	16.22	232.57
40	**-6	5.00	99.7	41	7.40	50.75	18.20	20.97	-3.16	23.77	27.95	238.39
41	**-7	5.00	93.9	42	5.80	50.23	18.20	20.97	*********	0.00	16.33	244.17

SAM NO	POS	TIME MIN	H#	3H CPM	3H %ERROR	32P CPM	32P %ERROR	3H DPM	3H EFF-1	LUMEX %	ELAPSED TIME
		COUNT RATE TOO LOW OR TOO COMPRESSED									
42	**-8	5.00	92.0	43 9.20	37.16	14.60	23.41	6.08	22.79	16.65	249.98
43	**-9	5.00	92.7	44 8.00	43.04	18.40	20.85	-1.22	24.19	20.90	255.79
44	**-10	5.00	110.7	45 11.80	31.99	16.20	22.22	15.79	23.56	16.31	261.61
45	**-11	5.00	114.2	46 6.80	45.97	15.60	22.65	-8.49	26.36	18.09	267.41
46	**-12	5.00	195.2	47 7.00	69.88	21.20	19.43	18.40	13.28	41.71	273.29
47	**-13	5.00	105.7	48 8.40	50.00	19.40	20.31	4.12	21.87	31.75	279.14
48	**-14	5.00	107.2	49 8.40	42.62	21.20	19.43	9.27	19.29	20.31	284.95
49	**-15	5.00	82.9	50 7.80	47.87	19.00	20.52	2.42	21.24	24.95	290.79
50	**-16	5.00	88.4	51 8.00	45.86	17.20	21.57	1.57	22.31	22.65	296.60
51	**-17	5.00	96.2	52 8.00	43.90	18.40	20.85	3.06	21.42	20.86	302.41
52	**-18	5.00	90.9	53 7.20	45.84	19.40	20.31	-4.49	24.16	18.49	308.22
53	**-1	5.00	104.3	54 9.80	46.05	15.40	22.79	5.10	24.88	35.88	314.19
	MISSING SAMPLE										
blank 55	**-3	5.00	113.1	8.40	49.54	18.20	20.97	4.36	21.73	31.74	320.08
lss 56	**-4	5.00	62.9	7.20	34.70	14.60	23.41	-2.49	22.64	3.44	325.81
bkg 57	**-5	5.00	3.9	18.40	21.19	10.80	27.22	9.46	42.06	2.23	331.54
H-3 58	**-6	5.00	6.0	62727.80	0.36	583.80	3.70	94176.22	66.58	0.01	337.42
C-14 59	**-7	5.00	4.2	10831.80	0.86	48327.80	0.41	60781.24	17.81	0.00	343.32

→ Beckman standards

TO W. VAN PELT.
201-445-6488

WES - HERE IS LSC OUTPUT
- LADD HAS MADE OTHER ARRANGEMENTS FOR DEMO.

J. Mc

ID:AUTO DPM 5MIN 16 JUL 1998 15:17
USER: 4 COMMENT:WES

PRESET TIME :	5.00						
DATA CALC :	AUTO DPM	H# :YES	SAMPLE REPEATS:	1	PRINTER	: STD	
COUNT BLANK :	YES	IC# : NO	REPLICATES :	1	RS232	: OFF	
TWO PHASE :	NO	AQC :YES	CYCLE REPEATS :	1	DISK	: OFF	
SCINTILLATOR:	LIQUID	LUMEX:YES	LOW SAMPLE REJ:	0	RWM LIST	: OFF	
LOW LEVEL :	NO	HALF LIFE CORRECTION DATE:			none		

ISOTOPE 1: 3H %ERROR: 0.00 FACTOR: 1.000000 BKG. SUB: 0
ISOTOPE 2: 32P %ERROR: 0.00 FACTOR: 1.000000 BKG. SUB: 0

SAM NO	POS	TIME MIN	H#	3H CPM	3H %ERROR	32P CPM	32P %ERROR	3H DPM	3H EFF-1	LUMEX %	ELAPSED TIME
B1	**-1	5.00	80.0	8.20	37.80	22.00	19.07	34.29	23.91	10.77	5.59
		Blank Average DPM for 3H : 34.29 COEF. OF VAR: 0.000									
1	**-3	5.00	98.6	9.20	39.87	20.40	19.80	8.60	21.45	20.12	11.41
2	**-4	5.00	89.0	10.00	34.42	18.60	20.74	7.45	23.96	14.68	17.19
3	**-5	5.00	101.1	10.20	36.39	19.40	20.31	13.38	21.40	18.85	22.99
4	**-6	5.00	102.4	13.20	32.23	19.00	20.52	24.14	22.59	21.48	28.78
5	**-7	5.00	91.4	9.60	36.82	17.20	21.57	-2.51	30.21	18.19	34.58
6	**-8	5.00	100.8	9.00	40.52	19.00	20.52	7.94	21.31	20.85	40.38
7	**-9	5.00	90.0	9.40	35.36	21.00	19.52	10.98	20.76	12.86	46.19
8	**-10	5.00	95.7	11.80	30.14	21.00	19.52	20.33	21.60	11.07	51.95
9	**-11	5.00	91.0	22.60	21.32	18.00	21.08	34.68	32.76	14.23	57.79
10	**-12	5.00	105.9	7.80	51.59	17.20	21.57	1.37	21.87	30.99	63.62
11	**-13	5.00	95.6	8.60	40.03	16.40	22.09	1.69	23.90	19.07	69.45
12	**-14	5.00	141.8	10.80	46.33	17.80	21.20	18.59	20.42	39.90	75.33
13	**-15	5.00	90.9	9.80	35.60	18.60	20.74	14.36	20.14	15.61	81.16
14	**-16	5.00	107.5	6.80	54.60	22.80	18.73	********	0.00	24.12	86.99
		COUNT RATE TOO LOW OR TOO COMPRESSED									
15	**-17	5.00	113.2	5.80	57.75	17.80	21.20	1.06	16.41	24.51	92.81
16	**-18	5.00	106.5	10.80	39.05	19.80	20.10	12.43	23.11	26.39	98.68
17	**-1	5.00	96.6	11.40	35.11	17.00	21.69	12.37	24.43	23.09	104.60
18	**-2	5.00	107.9	7.40	45.90	17.00	21.69	-0.92	22.17	21.23	110.42
19	**-3	5.00	122.6	8.20	52.83	19.00	20.52	0.29	23.71	33.86	116.29
20	**-4	5.00	88.8	10.20	33.97	21.20	19.43	9.55	23.27	13.92	122.07
21	**-5	5.00	95.4	7.40	42.92	22.20	18.98	1.99	20.40	13.74	127.84
22	**-6	5.00	82.0	8.80	36.37	21.60	19.25	4.23	22.84	11.87	133.65
23	**-7	5.00	93.1	6.20	51.65	21.00	19.52	1.43	17.36	18.85	139.48
24	**-8	5.00	84.1	9.00	38.77	18.40	20.85	6.83	21.89	18.12	145.30
25	**-9	5.00	93.8	8.60	40.57	20.60	19.71	3.88	22.53	17.39	151.10
26	**-10	5.00	93.9	7.40	43.60	16.00	22.36	-4.67	24.98	18.65	156.91
27	**-11	5.00	93.3	7.00	52.11	17.80	21.20	3.56	18.50	26.20	162.72
28	**-12	5.00	85.8	9.00	34.72	16.20	22.22	1.49	25.15	12.33	168.50
29	**-13	5.00	92.8	8.00	45.86	19.00	20.52	6.65	19.54	23.34	174.35
30	**-14	5.00	92.9	11.20	30.73	18.40	20.85	7.28	26.94	12.23	180.15
31	**-15	5.00	94.5	5.60	52.03	18.40	20.85	-8.09	21.37	16.68	185.94
32	**-16	5.00	88.5	9.80	39.39	21.00	19.52	11.09	21.59	21.75	191.77
33	**-17	5.00	110.2	6.40	48.03	16.20	22.22	-1.52	19.53	19.05	197.57
34	**-18	5.00	94.6	10.20	33.97	21.00	19.52	12.31	21.89	12.87	203.40
35	**-1	5.00	93.7	11.00	32.94	21.40	19.33	6.82	26.75	14.89	209.32

	5.00	101.9	8.20	45.54	21.40	19.33	0.81	23.36	22.97	220.99
	5.00	92.9	6.40	46.37	16.60	21.95	-7.60	23.98	16.87	226.77
-5	5.00	89.2	10.40	35.27	22.60	18.81	16.27	20.57	16.22	232.57
**-6	5.00	99.7	7.40	50.75	18.20	20.97	-3.16	23.77	27.95	238.39
+1 **-7	5.00	93.9	5.80	50.23	18.20	20.97	********	0.00	16.33	244.17

SAM NO	POS	TIME MIN	H#	3H CPM	3H %ERROR	32P CPM	32P %ERROR	3H DPM	3H EFF-1	LUMEX %	ELAPSED TIME
		COUNT RATE TOO LOW OR TOO COMPRESSED									
42	**-8	5.00	92.0	9.20	37.16	14.60	23.41	6.08	22.79	16.65	249.98
43	**-9	5.00	92.7	8.00	43.04	18.40	20.85	-1.22	24.19	20.90	255.79
44	**-10	5.00	110.7	11.80	31.99	16.20	22.22	15.79	23.56	16.31	261.61
45	**-11	5.00	114.2	6.80	45.97	15.60	22.65	-8.49	26.36	18.09	267.41
46	**-12	5.00	195.2	7.00	69.88	21.20	19.43	18.40	13.28	41.71	273.29
47	**-13	5.00	105.7	8.40	50.00	19.40	20.31	4.12	21.87	31.75	279.14
48	**-14	5.00	107.2	8.40	42.62	21.20	19.43	9.27	19.29	20.31	284.95
49	**-15	5.00	82.9	7.80	47.87	19.00	20.52	2.42	21.24	24.95	290.79
50	**-16	5.00	88.4	8.00	45.86	17.20	21.57	1.57	22.31	22.65	296.60
51	**-17	5.00	96.2	8.00	43.90	18.40	20.85	3.06	21.42	20.86	302.41
52	**-18	5.00	90.9	7.20	45.84	19.40	20.31	-4.49	24.16	18.49	308.22
53	**-1	5.00	104.3	9.80	46.05	15.40	22.79	5.10	24.88	35.88	314.19
	MISSING SAMPLE										
55	**-3	5.00	113.1	8.40	49.54	18.20	20.97	4.36	21.73	31.74	320.08
56	**-4	5.00	62.9	7.20	34.70	14.60	23.41	-2.49	22.64	3.44	325.81
57	**-5	5.00	3.9	18.40	21.19	10.80	27.22	9.46	42.06	2.23	331.54
58	**-6	5.00	6.0	62727.80	0.36	583.80	3.70	94176.22	66.58	0.01	337.42
59	**-7	5.00	4.2	10831.80	0.86	48327.80	0.41	60781.24	17.81	0.00	343.32

Survey of Room EN-310

SARNOFF Corporation

Internal Memo

From: James R. Matey
SW-220
734-2868
Date: 6/11/99

To: Distribution
Subject: Decommissioning of EN-116 and EN-310 (revised 6/11/99)

EN-116 and EN-310 have been used for experiments with P-33 and the –80 freezer in EN-310 has been used for storage of P-32. Work with these materials ceased in February 1999 (EN-116) and April 1999 (EN-310). At those times, surveys and swipe tests were performed, several areas of low level contamination were identified and cleaned, and surveys and swipes were repeated in those areas. The results of the surveys and swipe tests were reported in the Radiation Safety Officer's Semi-Annual Audit, April 1999.

This report is a follow-up to the audit, to provide documentation for release of EN-310 and EN-116 to general use, as discussed with the users of those rooms. According to the NRC, facilities and equipment can be released for unrestricted use if the levels of removable and fixed surface contamination are below NRC defined levels, which vary depending on the isotope.

According to the NRC, the acceptable level of removable contamination of pure beta emitters such as P-32 and P-33 is 1000 dpm/100 cm^2. The highest swipe value, after decontamination, in EN-310 and EN-116 was 20 dpm for swipes, which covered in excess of 100 cm^2. Hence, the level of removable contamination in both of these rooms is acceptable for unrestricted use.

The acceptable level of fixed contamination of pure beta emitters such as P-32 and P-33 is 5000 dpm/100 cm^2 on the average and 15,000 dpm/100 cm^2 maximum. Our survey meter reports in cpm. In order to convert from cpm to dpm/100 cm^2 we can use the algorithms laid out in MARSSIM[1] section 6.7.2. For a background of 50 cpm, we interpolate Table 6.6 to get a MDCR (minimum detectable count rate) of 54 cpm. Using an instrument efficiency[2] of 9% for our Ludlum Model 3/44-9 survey meter and pancake probe, a surface efficiency of 54%, a probe area of 12 cm^2 and a surveyor efficiency of 50%, we obtain a minimum detectable concentration (MDC) of ~ 14,000 dpm/100 cm^2. Since none of the survey areas were above background, the maximum level of fixed contamination at the time of the surveys was 14,000 dpm/100 cm^2. In the time since the surveys were taken, a fixed contamination of 14,000 dpm/100 cm^2 would have decayed to less than 500 dpm/100 cm^2 for EN-116 and 1900 dpm/100 cm^2 for EN-310. Hence, at this time, the level of fixed contamination is acceptable for unrestricted use.

Since P-32 has a higher detection efficiency and a shorter half life, the same arguments apply for any fixed contamination of P-32.

In short, EN-116 and EN-310 meet NRC recommendations for release to unrestricted use. I will remove the signage on these rooms. The closet for EN-310 will remain restricted, since we are storing contaminated fixtures there – until the contamination has decayed.

The only other areas in which we are using or storing licensed materials are the radiation safety lab in W402B and the radioactive waste storage area in the Pond Building.

At present, there are no plans for further work with loose, licensed, radioactive materials. Should plans change, I need 2 months notice for resumption of radioactive materials work in EN-116 or EN-310.

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1 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575 (US Government Printing Office, 1997)

2 Interpolated from the manufacturer's specifications.

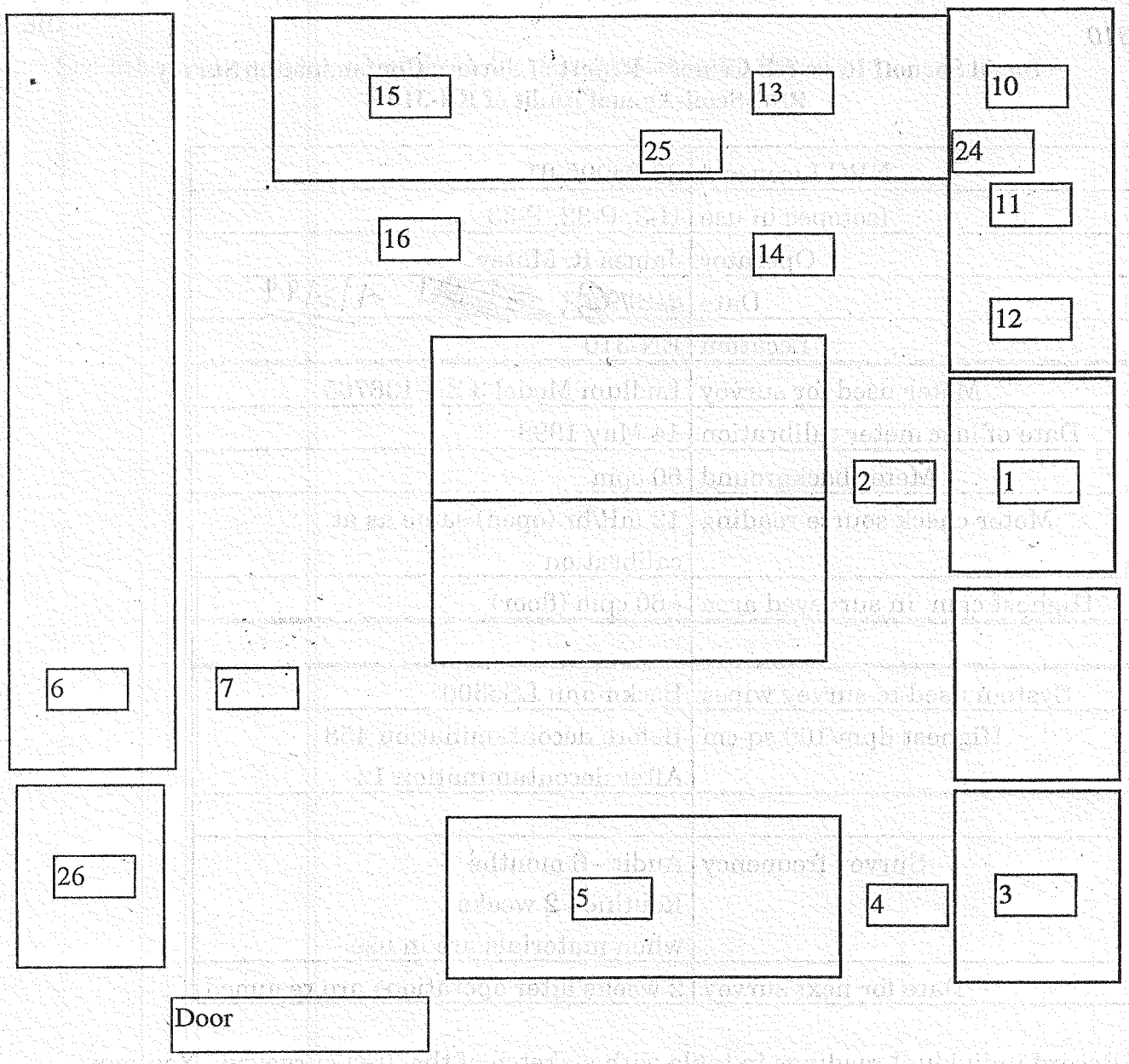
EN-310

David Sarnoff Research Center – Report of Surface Contamination Survey
RSO Semi-Annual Audit of EN-310

NRC License #	29-28005-01
Isotopes in use	H-3, P-32, P-33
Operator	James R. Matey
Date	~~2/19/99~~ 4/2/99
Location	EN-310
Meter used for survey	Ludlum Model 3 SN 136765
Date of last meter calibration	14 May 1998
Meter background	60 cpm
Meter check source reading	12 mR/hr (open) same as at calibration
Highest cpm in surveyed area	~60 cpm (floor)
System used to survey wipes	Beckmann LS6500
Highest dpm/100 sq-cm	Before decontamination 458 After decontamination 12
Survey frequency	Audit - 6 months Routine - 2 weeks when materials are in use
Date for next survey	2 weeks after operations are resumed

1.) Record individual readings in table with a sketch of the area surveyed. You may want to keep a partly filled out form on hand to duplicate for future surveys.
2.) Note any special conditions below
3.) If contamination levels require a decontamination to be done (200 dpm or higher/100 cm^2), repeat the survey after decontamination, recording the results in the table, with appropriate annotation.

Notes: Hot spots on tools, the electrophoresis unit and on the floor in front of the hot bench have been cleaned and retested. All cleaned up except for a pipette which will be done.


15
13
10
25
24
11
16
14
12
2
1
6
7
26
5
4
3
Door

#	Description	Survey (fixed/removable CPM)	Isotope	Swipe Counts (removable dpm)
1	Work surface	60	P33	8
2	Floor	60	P33	109 before cleaning; 0 after
3	-80 freezer	60	P33	13
4	Floor	60	P33	111 before cleaning; 5 after
5	LSC	60	P33	1
6	Sink	60	P33	0
7	Floor	60	P33	32
8	None	--	--	--
9	Waste container	60	P33	0
10	Gel dryer	60	P33	2
11	Thermocycler	60	P33	458 before cleaning, 0 after
12	Centrifuge	60	P33	9
13	Gel bench	60	P33	3
14	Floor	60	P33	107 before cleaning, 8 after
15	Microscale bench	60	P33	0
16	Floor	60	P33	39
17	Gel rack #1	60	P33	7
18	Gel rack #2	60	P33	2
19	Shield & tray	60	P33	1
20	Pipette carousel	60	P33	6
21	Smart Power 4000	60	P33	17
22	Universal Vacuum System	60	P33	9
23	Small centrifuge	60	P33	25
24	Bench	60	P33	0
25	Drawer	60	P33	3
26	Desk	60	P33	0
27	Door handles	60	P33	0
28	Background	60	P33	4

NOTE: Swipes below background are listed as 0.

Survey of Room EN-302

FEB - 9 1996

David Sarnoff Research Center *a subsidiary of SRI International*

Internal Correspondence **Thursday, February 08, 1996**

To: Radiation Safety Files

From: J. R. Matey **Location:** E-321 **Phone:** 2868

Subject: Decommissioning of EN-302 Radiation Lab

EN-302 had been used as the site of the Liquid Scintillation System (LSC). The LSC was moved to EN-310 on 7 February 1996. Paul Mitsis performed wipe tests on the bench used for the LSC in EN-302 after the LSC was moved. The wipes were counted twice and analyzed in the attached spreadsheet.

There is no evidence for any residual contamination – nor did we expect any. Hence, I have removed the radiation warning signs from EN-302 and returned it to normal use.

EN-310 has been posted as a controlled area. NRC-3 and radiation warning signs are in place. I have advised J. Eldridge and Jim Rust that

> Custodians, facilities staff and guards should not enter EN-310, EN-307 or any other room posted with a radioactive materials sign unless accompanied by the radiation safety officer (Jim Matey) or a person authorized to use the radioactive materials.

Copies to

Facilities
T. Bordieri
J. Eldridge
J. Rust
W. Schmidlin
D. Tamutus

Radiation Safety Committee
Rhoda Brown
Fred Dixon
P. N. Yocom

	A	B	C	D	E	F	G
1	Title:	Analysis of Wipe Test Data					
2							
3	Authors:	J. R. Matey					
4		David Sarnoff Research Center, CN 5300 Princeton, NJ 08543					
5		609-734-2868					
6							
7	Description:	Analysis of wipe test data. Based on					
8							
9		"The Minimum Detectable Activity Concept"					
10		EG&G Ortec System Applications Study PSD #17					
11		by Joseph C. Lochamy					
12							
13		Also published in NBS Special Publication 456					
14		Measurements for the Safe Use of Radiation (1976)					
15		page 169					
16							
17	Constants:						
18							
19	Number of measurements	2					
20	Confidence factor (95%)	1.65					
21							
22	Measurement	Background	Wipe 1	Wipe 2	Background	Wipe 1	Wipe 2
23	Number	H-3 DPM	H-3 DPM	H-3 DPM	P-32 DPM	P-32 DPM	P-32 DPM
24							
25	1	39	40	20	22	19	24
26	2	27	24	21	19	12	15
27							
28	Average	33	32	21	21	16	20
29	Std. Dev.	8	11	1	2	5	6
30	Expected Std. Dev.	6	6	5	5	4	4
31	Standard error of average	6	8	1	2	4	5
32	Pooled Standard Error of Average	8					
33							
34	Net (compared to background)		-1	-13		-18	-14
35	Net + confidence level		13	1		-4	0
36							
37	Lower Limit of Detection(net DPM)		19				

ID:WIPE TESTS 7 FEB 1996 14:21

USER: 9 COMMENT:

PRESET TIME :	1.00						
DATA CALC :	DL DPM	H# :YES	SAMPLE REPEATS:	1	PRINTER	: STD
COUNT BLANK :	NO	IC# : NO	REPLICATES :	1	RS232	: OFF
TWO PHASE :	NO	AQC :YES	CYCLE REPEATS :	2	DISK	: STD
SCINTILLATOR:	LIQUID	LUMEX: NO	LOW SAMPLE REJ:	0		
LOW LEVEL :	NO	HALF LIFE CORRECTION DATE:			none	

ISOTOPE 1: 3H %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0
ISOTOPE 2: 32PCUT %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

BACKGROUND QUENCH CURVE: Off COLOR QUENCH CORRECTION: Off

Quench Limits Low:20.000 High:323.70

Duplicate Wipe Tests For EW302 — Former Scintillation Counter Bench.

SAM NO	POS	TIME MIN	H#	3H CPM	3H %ERROR	32PCUT CPM	32PCUT %ERROR	3H DPM	32PCUT DPM	3H EFF-1	3H EFF-2	32PCUT EFF-1	32PCUT EFF-2	RATIO	LUMEX %	ELAPSED TIME	
1	**-1	1.00	39.0	25.00	40.00	17.00	48.51	39.60	19.03	62.75	0.00	0.79	89.33	2.081	3.25	1.47	wipe
2	**-2	1.00	39.7	13.00	55.47	21.00	43.64	20.46	23.51	62.61	0.00	0.79	89.33	0.870	3.65	2.99	wipe
3	**-3	1.00	44.3	24.00	40.82	20.00	44.72	38.62	22.39	61.68	0.00	0.80	89.31	1.725	3.49	4.53	Bkg
Cycle 2 of 2																	
1	**-1	1.00	39.5	15.00	51.64	11.00	60.30	23.79	12.31	62.64	0.00	0.79	89.33	1.932	4.97	6.52	wipe
2	**-2	1.00	40.1	13.00	55.47	13.00	55.47	20.61	14.55	62.53	0.00	0.79	89.32	1.416	4.41	8.06	wipe
3	**-3	1.00	43.7	17.00	48.51	17.00	48.51	27.26	19.04	61.80	0.00	0.80	89.31	1.432	4.13	9.57	Bkg

	A	B	C	D	E	F	G	H
1	Title:	Analysis of Wipe Test Data						
2								
3	Authors:	J. R. Matey						
4		David Sarnoff Research Center, CN 5300 Princeton, NJ 08543						
5		609-734-2868						
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15		page 169						
16								
17	Constants:							
18								
19	Number of measurements	2						
20	Confidence factor (95%)	1.65						
21								
22	Measurement	Background	Wipe 1	Wipe 2	Background	Wipe 1	Wipe 2	
23	Number	H-3 DPM	H-3 DPM	H-3 DPM	P-32 DPM	P-32 DPM	P-32 DPM	
24								
25	1	39	40	20	22	19	24	
26	2	27	24	21	19	12	15	
27								
28	Average	33	32	21	21	16	20	
29	Std. Dev.	8	11	1	2	5	6	
30	Expected Std. Dev.	6	6	5	5	4	4	
31	Standard error of average	6	8	1	2	4	5	
32	Pooled Standard Error of Average	8						
33								
34	Net (compared to background)		-1	-13		-18	-14	
35	Net + confidence level		13	1		-4	0	
36								
37	Lower Limit of Detection(net DPM)		19					

	A	B	C	D	E	F	G	H
38								
39	Model 3 Ludlum with model 44-9 pancake probe							
40								
41	Tc-99 calibration strength	11700	dpm	293 keV beta				
42	Meter cpm	2000						
43	Efficiency	17%		Since P-32 is at 1708 keV, the Tc-99 calibration is conservative				
44								
45			DPM/100 cm^2		DPM/100 cm^2			
46	Surface Survey	CPM	P-32		H-3			
47	Efficiency		17%		NA			
48	Probe area(cm^2)		15.5		NA			
49	Background	50						
50	Highest reading	60			NA			
51	Net	10	377					
52	Net + Confidence Level	23						
53								
54	Lower Limit of Detection	18	682					
55								
56								
57	Acceptable Contamination Levels from Table I, USNRC Guidelines for Decontamination of Facilities and Equipment Prior to							
58	Release for Unrestricted Use or termination of Licenses for Byproduct, Source or Special Nuclear Material							
59								
60								
61								
62			Limits in dpm/100 cm^2					
63	Nuclides		Average		Maximum		Removable	
64	U-nat, U-235, U-238 and decay products		5000	alpha	15000	alpha	1000	alpha
65								
66	Transuranics, Ra-226, Ra-228, Th-230		100		300		20	
67	Th-228, Po-231, Ac-227, I-125, I-129							
68								
69	Th-nat, Th-232, Sr-90, Ra-223, Ra-224,		1000		3000		200	
70	U-232, I-126, I-131, I-133							
71								
72	beta-gamma emitters (non-alpha/non-fission)		5000		15000		1000	
73	except Sr-90 and others noted above							

Survey of Pond Building

WESLEY R. VAN PELT ASSOCIATES, INCORPORATED

WESLEY R. VAN PELT, PH.D.
President
CERTIFIED HEALTH PHYSICIST
CERTIFIED INDUSTRIAL HYGIENIST
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E-MAIL WESVANPELT@ATT.NET

15 June 2002

Dr. James Matey
Radiation Safety Officer
Sarnoff Corporation
201 Washington Road
Princeton, NJ 08543-5300
(609) 734-2868

Subject: **Final Radiological Contamination Survey of Room W402B and the Pond Building**

Dear Dr. Matey:

This is a report of the radiological decommissioning survey of two distinct areas at Sarnoff Corporation (the Pond Building and Room W402B in the main building) which had stored or used licensed radioactive material in the past and will no longer be used for radioactive material.

NRC License

Sarnoff holds Nuclear Regulatory Commission license number 29-28005-01, currently on Amendment No. 11, a specific license which permits the possession and use of radioactive materials for research and development. Expiring on 31 July 2005, this license allows the possession of the following radionuclides with the associated maximum possession limit.

Radio-nuclide	Chemical and/or Physical Form	Maximum amount that may be possessed at any time under this license
H-3	Any	100 mCi
C-14	Any	30 mCi
P-32	Any	100 mCi
P-33	Any	100 mCi
S-35	Any	100 mCi
Ca-45	Any	5 mCi

Radio-nuclide	Chemical and/or Physical Form	Maximum amount that may be possessed at any time under this license
I-125	Bound to nonvolatile compounds	10 mCi
H-3	Sealed sources (Saunders-Roe or SRB Technologies Type Glass Capsules)	not to exceed 10 Ci per source and 100 Ci total
Mn-54	Sealed sources	Not to exceed 25 microcuries per source and 50 microcuries total
Fe-55	Sealed sources (NEN Model NER9041)	Not to exceed 10 mCi per source and 20 mCi total
Co-60	Sealed sources	Not to exceed 25 microcuries per source and 50 microcuries total
Ba-133	Sealed sources	Not to exceed 25 microcuries per source and 50 microcuries total
Cs-137	Sealed sources	Not to exceed 25 microcuries per source and 50 microcuries total
Cs-137	Sealed source (Amersham Model CDC-803)	3 mCi
Hg-203	Sealed sources	Not to exceed 25 microcuries per source and 50 microcuries total
Am-241	Sealed sources	Not to exceed 25 microcuries per source and 50 microcuries total
Am-241	Sealed sources (Amersham Models AMC-21 and AMC-2084)	Not to exceed 10 mCi per source and 12 mCi total.

The H-3 sealed sources listed on the license were never received, stored or used by the licensee. The only unsealed radionuclides ever used at Sarnoff were P-32, P-33, H-3 and I-125. A small amount of C-14 was found among some very old materials in a lab at Sarnoff, presumably from some very early experiments. It was placed with other radioactive waste and disposed thru a licensed radioactive waste contractor.

History of Pond Building

The Pond Building is a small 12 feet by 16 feet one-room brick building located next to a small deep pond whose use dates back to World War II when devices were tested under water.

Sarnoff operated a cobalt-60 (Co-60) sealed source self-contained irradiator in the Pond building for many years. This irradiator, with its source, was transferred to another licensee

in 1997. The source never leaked and no Co-60 was ever detected as contamination in the building or as a result of semiannual sealed source leak tests.

Radioactive waste from two to three lab rooms in the main building was stored in the Pond building from about 1997 to 2001. Waste consisted of microcurie quantities of P-23, P-33, H-3 and I-125 stored in metal or plastic drums. Other than transferring sealed plastic bags of waste from one container to another, no "loose" radioactive material was ever used in this building.

Assorted sealed sources were stored in a supply cabinet in the Pond Building from about 1997 to 2001. These sources consisted of about a dozen small gamma check sources typically a few microcuries each or less and three to five larger sealed sources (about 10-100 mCi each) containing either Am-241, Cs-137 or Fe-55. These sources were wipe tested semiannually as required by the licensee's license condition and never found to be leaking.

Prior to the survey, all sealed sources and radioactive waste containers were removed from the Pond Building and relocated to the main building. At the time of the survey the Pond Building was completely empty except for two fixed carbon dioxide cylinders for the fire suppression system.

History of Room W402B

This very small room (7 feet by 12 feet) located off the machine room on the fourth floor was used as a storage room by the Radiation Safety Officer for various radiation safety related purposes including storage of sealed sources and radioactive waste. In 2001 the sealed source storage and radioactive waste storage functions moved from the Pond Building to Room W402B.

Radioactive waste from two to three lab rooms in the main building was stored in Room W402B from about 2001 to 2002. Waste consisted of microcurie quantities of P-23, P-33, ~~H-3~~ and I-125 stored in metal or plastic drums. Other than transferring sealed plastic bags of waste from one container to another, no "loose" radioactive material was ever used in this building.

MMP 9 Jun 09

Assorted sealed sources were stored in a supply cabinet in Room W402B from about 2001 to 2002. These sources consisted of about a dozen small gamma check sources typically a few microcuries each or less and three to five larger sealed sources (about 10-100 mCi each) containing either Am-241, Cs-137 or Fe-55. These sources were wipe tested semiannually as required by the licensee's license condition and never found to be leaking.

Prior to the survey, all sealed sources and radioactive waste containers were removed from the room and relocated elsewhere in the building.

At the time of the survey, the room was empty except for fixed lab furniture such as the sink, lab bench, drawers and cabinets.

Survey Objective

The objective of the survey was to demonstrate that the Pond Building and room W402B were suitable for release for unrestricted use under NRC regulations. The survey focuses on detecting any trace contamination of P-32, P-33, H-3, C-14 and I-125 since these were the only unsealed radionuclides ever possessed by the licensee. However, the portable survey meters and nuclear counting instrumentation used will detect virtually any alpha, beta or gamma emitting radionuclides.

Survey Equipment

Scintillation Survey Meter. Bicron MicroRem meter was used to measure the radiation levels in mrem/hr. The Bicron MicroRem meter, Serial No. C246J, was calibrated on 20 September 2001 by Bicron Saint-Gobain in Solon, Ohio. The background dose rate was 0.005 mrem/hr. The Bicron MicroRem meter is a portable survey meter for applications where accurate dose rate measurements of low gamma or x-ray radiation levels are required. It reads absorbed dose rate directly, eliminating the need for conversion from mR/h. The tissue-equivalent scintillator provides flat photon energy response calibrated in rem from 17 keV to 1200 keV. This rem response is based on the deep dose equivalent index for 1 cm depth, uniparallel directional beam as calculated on the ICRU standard sphere. The instrument gives tissue-equivalent photon response for x-ray and gamma radiation from environmental levels of 0-20 microrem/h full scale up to normal survey levels of 200 mrem/h full scale. This wide range is achieved by use of five positions on the eight-position control switch, giving factors from 0.1 to 1000 times the scale reading.

GM Thin Window Survey Meter. Ludlum Model 16 Ratemeter, Serial No. 54796, with Model 44-9 thin pancake Geiger-Mueller (GM) probe, Serial No. PR044692, calibrated 1 November 2001. Background reading = 0.015 - 0.025 mR/hr. Used for finding radiation and contamination and localizing points of maximum dose rate.

Beckman Automatic Liquid Scintillation Counter. The counter was set to count in the tritium channel and the P-32 channel. Since the P-32 channel is set to count a full energy spectrum, it will encompass all beta emitters used at Sarnoff. Counting efficiencies for each isotope of interest is conservatively estimated as follows.

Estimated Beckman Liquid Scintillation Counter Efficiency		
Radionuclide	**Tritium Channel (channel 0.0 to 400.0)**	**P-32 Channel (channel 0.0 to 945.0)**
H-3	.50	na
C-14	.20	.60

Estimated Beckman Liquid Scintillation Counter Efficiency		
Radionuclide	**Tritium Channel (channel 0.0 to 400.0)**	**P-32 Channel (channel 0.0 to 945.0)**
P-32	na	.80
P-33	na	.60
I-125	.33	.33

Minimum Detectable Activities and Levels

Each swipe was counted for five minutes on the Beckman liquid scintillation counter. The minimum detectable activity is estimated as 30 dpm for a 5-minute count based on reference analysis methods listed in MARSSIM.[1]

The minimum detectable dose rate for the Bicron MicroRem meter is conservatively estimated at four times its background dose rate of 0.005 mrem/h (Pond Building) and 0.010 mrem/h (Room W402B). That is, the minimum detectable dose rate is 0.02 mrem/h (Pond) and 0.04 mrem/h (W402B).

For surface contamination, the scanning minimum detectable concentration (scanMDC) in units of dpm/100cm^2 is given in MARSSIM (page 6-43) as

$$scanMDC = \frac{MDCR}{\sqrt{p}\; e_i\; e_s \dfrac{probe\ area}{100\ cm^2}}$$

where,

MDCR = minimum delectable count rate, cpm
e_i = instrument efficiency
e_s = surface efficiency
p = surveyor efficiency

The MDCR is given in MARSSIM (page 6-41) as

[1] Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), December 1997, NUREG-1575, EPA 402-R-97-016, page 7-20.

$$MDCR = d' \sqrt{b_i}\ (60 / i)$$

where,

d' = 1.38 (a value providing for statistical 0.95 true positive)
i = observation interval, sec (typically 1 or 2 sec)
bi = background counts during observation intervals

Using the survey meter backgrounds in the Pond Building and Room W402B, the following MDCRs are calculated.

Survey Meter Background cpm	Scan Interval sec	MDCR net cpm
30	2	41
50	2	53

The 4-pi beta counting efficiencies of the Ludlum pancake GM probe as given by Ludlum are .05 for C-14, 0.19 for Tc-99 and 0.32 for P-32. Higher counting efficiencies are associated with higher beta energies. MARSSIM recommends using a surveyor efficiency of between 0.5 and 0.75. The area of the probe is 15 cm^2. (It is appropriate to use the gross area of the probe, not the "active area" since the loss in efficiency due to the protective screen grid is accounted for in the 4-pi counting efficiency.) Surface efficiency is given as 1 since the 4-pi counting efficiency already takes account of the particles which do not leave the surface of the source. Therefore, the Minimum Detectable Concentration is between 1000 and 9000 dpm/100cm^2 depending on the beta energy of the radionuclide and the local background.

MDCR net cpm	Instrument Efficiency	Surface Efficiency	Surveyor Efficiency	Probe Area cm^2	MCD dpm/100cm^2
41	0.05	1	0.65	15	6847
41	0.19	1	0.65	15	1802
41	0.32	1	0.65	15	1070
53	0.05	1	0.65	15	8839
53	0.19	1	0.65	15	2326
53	0.32	1	0.65	15	1381

Survey Protocol

Each room was divided into logical zones and a swipe taken in each zone. Structures such as windows, bench tops, drawers, cabinets and door knobs were also swiped. Swipes were 1.5 cm diameter No. 413 VWR filter papers and each was counted in liquid scintillation

solution in a liquid scintillation vial on a Beckman counter. Each swipe was wet with water to enhance the pick up of material. At least 100 cm^2 of area was swiped.

Both survey meters were scanned over all surfaces (floors, walls, bench tops, drawers, cabinets, etc.) at a distance of about 5 centimeters to detect any reading above background. Observation time at each point was about 2 seconds.

Survey Results

Locations where swipes were taken are given in the table below. Background with the two survey meters in the Pond Building was 0.003-0.007 mrem/h (MicroRem meter) and 0.015 mR/h (Ludlum GM) and in Room W402B was 0.008-0.012 mrem/h (MicroRem meter) and 0.025 mR/h (Ludlum GM).

Location No.	Room	Location	Result with survey meters
1	Pond	windows	background
2	Pond	windows	background
3	Pond	door knob	background
4	Pond	floor	background
5	Pond	floor	background
6	Pond	floor	background
78	Pond	floor	background
9	Pond	floor	background
10	Pond	floor	background
11	Pond	floor	background
12	Pond	floor	background
13	Pond	transformer	background
14	W402B	window ledge	background
15	W402B	bench and sink	background
16	W402B	bench	background
17	W402B	bench	background
18	W402B	bench	background

Location No.	Room	Location	Result with survey meters
19	W402B	floor	background
20	W402B	floor	background
21	W402B	floor	background
22	W402B	floor	background
23	W402B	door knobs	background
24	W402B	drawers left bench (2)	background
25	W402B	cabinet left bench	background
26	W402B	drawer right bench (1)	background
27	W402B	cabinet right bench	background
28	W402B	A/C unit in door	background
29	W402B	electrical box along wall	background
30	na	blank (clean filter swipe)	na
31	na	blank (clean filter swipe)	na
32	na	blank (clean filter swipe)	na

Since both survey meters reported no measurable dose rate or surface activity above background, the results are reported as less than the minimum detectable dose rates and surface concentrations as determined for the instrumentation.

Location	Minimum Detectable Dose Rate, mrem/h	Minimum Detectable Surface Concentration, dpm/100cm^2
Pond Building	<0.02	<7000
Room W402B	<0.04	<9000

All swipes were counted with the liquid scintillation counter for removable radioactivity with the results of a 5-minute count per sample run reproduced as Appendix 2. All results were within background except location 24 which showed a 12.8 cpm in the P-32 channel. (This result was repeatable upon counting the set of vials two more times.) Using a conservative value of 0.60 for the counting efficiency, this gives 21 dpm/100cm^2. Although repeatable, this result is somewhat below the estimated minimum detectable activity for liquid scintillation counting of 30 dpm/100cm^2.

Evaluation of Results

The only positive result obtained is the removable activity of 21 dpm/100cm^2 at Location 24 in Room W402B.

Average surface building and equipment contamination levels suitable for release for unrestricted use under NRC regulations are reproduced in Appendix 3. These are average allowable limits for surfaces such as floors and walls. The only long-lived radionuclides handled in these rooms were H-3 and C-14. NRC limit for the more restrictive of these (C-14) is 3.7x10^6 dpm/100cm^2 (i.e., 3,700,000 dpm/100cm^2). Obviously, 21 dpm/100cm^2 is very much lower than 3,700,000 dpm/100cm^2 and therefore within the allowable surface concentrations for release for unrestricted use.

Conclusions

1. The methods, techniques, minimum detectable dose rates and minimum detectable surface concentrations were sensitive enough to detect radiation and radioactivity well below the surface concentrations allowable for release for unrestricted use.

2. All results show that the residual radioactivity, if any, is well below levels allowable for release for unrestricted use.

Best regards.

Very truly yours,
WESLEY R. VAN PELT ASSOCIATES, Inc.

Wesley R. Van Pelt, Ph.D., CIH, CHP
President

Appendix 1
Beckman Liquid Scintillation Counter Setup

ISOTOPE LIBRARY SUMMARY
LIQUID SCINTILLATOR

ISOTOPE	HALF-LIFE	COUNT WINDOW (channels) Lower	Upper
3H	12.330 Y	0.0	400.0
125I	60.248 D	0.0	567.0
14C	5730.0 Y	0.0	670.0
35S	87.368 D	0.0	688.0
32P	14.281 D	0.0	945.0
33P	25.340 D	0.0	750.0

Apr 17 02 01:40p

INSTRUMENT CALIBRATION: Mini 16 APR 2002 14:31
Calibration successful

Calibrating Auto DPM
Counting Standard for 14C
Calibration Complete: 14C
Counting Standard for 3H
Calibration Complete: 3H
Calibration Successful

Appendix 2
Beckman Liquid Scintillation Counter Results

PAGE: 1

ID:H3 P32 SWIPES 16 APR 2002 14:

USER: 3 COMMENT:WES VANPELT

PRESET TIME :	5.00						
DATA CALC :	CPM	H# :YES	SAMPLE REPEATS:	1	PRINTER	: S	
COUNT BLANK :	YES	IC# : NO	REPLICATES :	1	RS232	: O	
TWO PHASE :	NO	AQC :YES	CYCLE REPEATS :	3	DISK	: O	
SCINTILLATOR:	LIQUID	LUMEX:YES	LOW SAMPLE REJ:	0	RWM LIST	: O	
LOW LEVEL :	NO	HALF LIFE CORRECTION DATE:			none		

ISOTOPE 1:	3H	%ERROR: 0.00	FACTOR:	1.000000	BKG. SUB:	0
ISOTOPE 2:	32P	%ERROR: 0.00	FACTOR:	1.000000	BKG. SUB:	0

SAM NO	POS	TIME MIN	H#	3H CPM	3H %ERROR	32P CPM	32P %ERROR	LUMEX %	ELAPSED TIME
B1	**-1	5.00	38.3	11.80	26.91	18.80	20.63	3.61	5.55
B2	**-2	5.00	36.8	14.00	24.07	16.00	22.36	1.38	11.17
		Blank Average CPM for		3H	12.90	COEF. OF VAR:			12.0
		Blank Average CPM for		32P	17.40	COEF. OF VAR:			11.3
1	**-4	5.00	83.7	2.10	533.37	-1.00	1.E+06	80.10	17.26
2	**-5	5.00	44.9	0.10	4261.9	0.00	1.E+06	9.55	22.93
3	**-6	5.00	43.6	2.50	178.54	0.20	2293.5	8.19	28.59
4	**-7	5.00	80.6	-2.50	1.E+06	1.60	294.21	38.68	34.39
5	**-8	5.00	78.6	-1.30	1.E+06	0.40	1151.1	28.75	40.26
6	**-9	5.00	65.1	2.30	216.97	-0.40	1.E+06	21.70	45.98
7	**-10	5.00	81.5	-3.10	1.E+06	-1.00	1.E+06	24.45	51.71
8	**-11	5.00	72.4	0.50	955.39	-0.80	1.E+06	20.61	57.44
9	**-12	5.00	71.5	-5.90	1.E+06	0.60	770.28	31.07	63.19
10	**-13	5.00	72.4	-1.90	1.E+06	3.60	135.40	29.97	68.94
11	**-14	5.00	73.9	-3.50	1.E+06	1.00	465.62	33.62	74.72
12	**-15	5.00	65.3	-1.90	1.E+06	-0.80	1.E+06	28.00	80.48
13	**-16	5.00	65.0	2.90	217.30	0.80	579.87	42.58	86.30
14	**-17	5.00	56.2	6.90	96.88	1.20	389.44	42.07	92.13
15	**-18	5.00	44.8	-0.30	1.E+06	-3.40	1.E+06	13.84	97.83
16	**-1	5.00	52.9	7.30	97.34	-1.20	1.E+06	48.50	103.78
17	**-2	5.00	62.6	1.70	855.11	1.20	389.44	86.61	110.04
18	**-3	5.00	61.6	-7.70	1.E+06	-0.80	1.E+06	86.16	116.15
19	**-4	5.00	81.3	5.50	225.57	4.00	122.68	79.06	122.28
20	**-5	5.00	63.5	-0.30	1.E+06	1.60	294.21	76.26	128.32
21	**-6	5.00	99.2	-10.10	1.E+06	1.20	389.44	93.42	134.82
22	**-7	5.00	65.7	-2.30	1.E+06	-2.40	1.E+06	83.53	141.04
23	**-8	5.00	41.6	-0.90	1.E+06	0.00	1.E+06	12.16	146.74
24	**-9	5.00	56.4	0.10	6676.0	12.80	43.58	44.82	152.60
25	**-10	5.00	77.4	-11.90	1.E+06	-1.00	1.E+06	91.66	158.79
26	**-11	5.00	56.0	-1.90	1.E+06	-1.60	1.E+06	49.75	164.63
27	**-12	5.00	74.4	0.30	2762.0	1.60	294.21	64.88	170.59
28	**-13	5.00	64.5	1.50	426.93	0.00	1.E+06	46.49	176.41
29	**-14	5.00	67.1	2.70	258.16	-2.80	1.E+06	52.82	182.29
30	**-15	5.00	45.6	6.90	70.41	0.20	2293.5	7.25	187.98
31	**-16	5.00	42.8	1.90	240.54	0.80	579.87	12.52	193.68
32	**-17	5.00	39.3	0.70	578.53	-0.20	1.E+06	1.53	199.34
	Cycle	2 of	3						
B1	**-1	5.00	39.6	14.20	24.88	17.00	21.69	5.43	205.59
B2	**-2	5.00	37.6	15.20	22.94	15.60	22.65	1.08	211.21

Appendix 3
Surface Contamination Levels Suitable for Unrestricted Use

(Taken from NRC Regulatory Document Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope, NUREG-1556, Volume 7)

Table Q.3 Screening Values for Building Surface Contamination1

Radionuclide	Symbol	Screening levels for unrestricted release (dpm/100 cm^2)
Hydrogen-3 (Tritium)	H-3	1.2 x 108
Carbon-14	C-14	3.7 x 106
Sodium-22	Na-22	9.5 x 103
Sulfur-35	S-35	1.3 x 107
Chlorine-36	Cl-36	5.0 x 105
Manganese-54	Mn-54	3.2 x 104
Iron-55	Fe-55	4.5 x 106
Cobalt-60	Co-60	7.1 x 103
Nickel-63	Ni-63	1.8 x 106
Strontium-90	Sr-90	8.7 x 103
Technetium-99	Tc-99	1.3 x 106
Iodine-129	I-129	3.5 x 104
Cesium-137	Cs-137	2.8 x 104
Iridium-192	Ir-192	7.4 x 104

1 Screening levels are based on the assumption that the fraction of removable surface contamination is equal to 0.1. For cases when the fraction of removable contamination is undetermined or higher than 0.1, users may assume, for screening purposes, that 100% of surface contamination is removable; and therefore the screening levels should be decreased by a factor of 10. Alternatively, users having site-specific data on the fraction of removable contamination (e.g., within 10% to 100% range) may calculate site-specific screening levels using DandD Version 1.

Table Q.3 does not include screening values for radionuclides that emit alpha particles, or for soil contamination. The NRC staff is assessing current screening approaches for sites with alpha emitters and for soil contamination. For such sites, licensees are encouraged to use, in the interim period, site-specific dose assessment based on actual site physical and

environmental conditions.

Units are disintegrations per minute per 100 square centimeters (dpm/100 cm^2). 1 dpm is equivalent to 0.0167 becquerel (Bq). The screening values represent surface concentrations of individual radionuclides that would be deemed in compliance with the 0.25 mSv/yr (25 mrem/yr) unrestricted release dose limit in 10 CFR 20.1402. For radionuclides in a mixture, the "sum of fractions" rule applies; see 10 CFR Part 20, Appendix B, Note 4. Refer to NRC Draft Guidance DG-4006 for further information on application of the values in this table.

Table Q.3 was derived using the DandD screening code, Version 1, and its default input parameters. Table Q.3 provides criteria which permit licensees to demonstrate compliance with the unrestricted release dose criterion in the License Termination Rule. The values correspond to screening "derived concentration guidelines" for each specific radionuclide based on the methodology described in Draft Regulatory Guide DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Termination," dated August 1998. Sites with building surface contamination levels below those listed in Table Q.3 would be deemed acceptable for release for unrestricted use in accordance with the dose criteria in 10CFR 20.1402, provided that residual radioactivity has been reduced to ALARA levels. The table is intended for use as criteria to facilitate license termination for many simple routine decommissioning cases without a site-specific dose assessment. For facilities with contamination levels above those in Table Q.3, additional site-specific dose assessments may be necessary, and licensees should refer to DG-4006 regarding acceptable methods for conducting the appropriate dose assessment.

The DandD code can be installed by downloading the self-extracting program file, setup.exe, accessed through the web site: <http://techconf.llnl.gov/radcri/java.html>.

DG-4006, NUREG - 1549, "Decision Methods for Dose Assessment to Comply With Radiological Criteria for License Termination," dated July 1998, and NUREG/CR - 5512, Vol. #3, "Residual Radioactive Contamination From Decommissioning, Parameter Analysis," dated April 25, 1996, can also be accessed through the above web site.