

**Nemours** Alfred I. duPont  
Hospital for Children

Nemours Biomedical Research  
1600 Rockland Road  
Wilmington, DE 19803  
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Phone: 302-651-4000

July 8, 2013

September 23, 2013 ✓

Ms Betsy Ulrich  
Senior Health Physicist  
Commercial and R&D Branch  
Division of Nuclear Materials Safety  
U.S. Nuclear Regulatory Commission – Region 1  
2100 Renaissance Boulevard, Suite 100  
King of Prussia, PA 19406-2713

Q5  
03010568  
License Renewal 07-16199-01  
Docket No. 03010568  
Control No. 581038  
License renewal

REC'D 10927 13 AM 10:26 ✓

Dear Ms Ullrich:

This is in reference to your letter dated July 24, 2013 requesting additional information. Note that an extension of 30 days was granted for submitting a response.

1. We used the "Simple Approaches for Conducting Final Radiological Surveys" described in NUREG-1757, Volume 2, Appendix B, B2. Table 1 lists all of the rooms determined to require surveys and/or wipe tests, radionuclide used in each room, area of the rooms, and number of surveys and/or wipe tests required for the size of the room based on 30 samples per 100 m<sup>2</sup> in Appendix B, B2. Note that some rooms did not require scan surveys because H-3 only was used there. There was no use of radioactive materials in four rooms that were tested for our initial submission, so we did not include these rooms: ARB274, ARB278, ARB286, and ARB307. Note that ARB270 was remodeled except for the hoods, so only the hoods were tested and ARB321 was renovated except for floor, so only the floor was tested. In some rooms, lab benches were coated with resin in 2002 after long-lived radioisotope use ended, so the benches were not surveyed. Rooms that have been completely remodeled since radioactive materials were used in them are not included on the table. These are: ARB254/256 (last used for long-lived radioactive materials by Hobson in early 1990s; renovated in 1996), ARB272 (last used by Schroedl and Nadkarni early 1990s; renovated in 2011), ARB282 (may have been used by Koszalka in early 1990s; renovated after 1999), ARB295 (last used by Funanage early 1990s; renovated in 2012), ARB320 (last used by Mason prior to 2009; renovated 2012). Responses to the points raised in the letter dated July 24, 2013 are as follows:

- a. Measurement of total residual radioactivity is not required when using the simple approach in NUREG-1757, Volume 2, Appendix B, B2.
- b. Scan surveys were performed with Ludlum Model 26, SN PF001167 survey meters. The surfaces diagrammed on the survey maps were probed at a rate of 2 inches per 4 seconds with the survey instrument in NORMAL mode. Low and high readings

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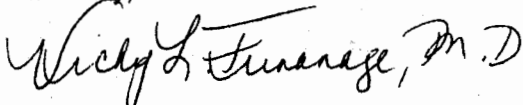
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(Split out of NC No. 581038)

were noted during the scanning and the ranges are recorded on the maps. Background for each room was determined by using the instrument in ratemeter mode for 1 minute. Measurements were all less than the minimum detectable count rate.

- c. Results of removable contamination surveys of 100 cm<sup>2</sup> area each are given in Table 2.
    - i. The minimum number of surveys based on 30 samples per 100 m<sup>2</sup> is given for each room in Table 1.
    - ii. Counting efficiency determined by counting H-3 and C-14 standards is given at the top of Table 1 and results are converted to DPM for both H-3 and C-14 on the table. The blanks are for each room; however, when several rooms were counted at the same time, only one blank was used.
    - iii. The last use of radioactive materials in each room is noted in Table 1. All wipe tests were taken after the last use of radioactive materials.
  - d. Wipe test measurements were indistinguishable from background, so we are well within the most restrictive screening value of 211,000 dpm/100 cm<sup>2</sup>.
2. Calcium-45 was used one time (1 millicurie) in 1993 in the Administration Research Building (ARB) at 1600 Rockland Road. It was used in ARB 270 which has been renovated except for the hoods. The hoods were tested by wipe tests and by scan surveys and no contamination was found. Ca-45 would have a higher efficiency than C-14, so the efficiency of C-14 was used as a conservative measure to ensure compliance. With a half-life of 162.7 days, any contamination would be gone. Calcium-45 has not been used at Rockland 1 Center, 1701 Rockland Road.
  3. Cobalt-57 and other accelerator-produced radionuclides do not need to be included in our current license.
  4. Records important for decommissioning for the Research and Administration building that will be required to be submitted to the NRC at the time our license is terminated will be maintained.

Thank you, and let me know if you require any additional information.

Sincerely,



Vicky L. Funanage, Ph.D.  
Director of Biomedical Research, Nemours  
Director, Molecular Diagnostic Laboratory  
Head, Musculoskeletal Inherited Disease Research Lab  
Associate Professor of Pediatrics, Jefferson Medical College  
Adjunct Professor, College of Health Sciences, University of Delaware

Enclosures

cc: Grace M. Hobson, Ph.D., Radiation Safety Officer  
Gunsel Acikgoz, M.D., Chair, Radiation Safety Committee  
Marc Felice, Consultant

Table 1. Rooms

Room	Use	C-14 last used (by)	H-3 last used (by)	Co-57 last used (by)	Ca-45 last used (by)	Renovated	Benches coated	Needs to be done	Area - sq ft	Area - sq m	Number of wipes	Date of wipes	Surveys	Date of surveys
ARB268	Lab	Early 1990s (Hartzell)	Early 1990s (Hartzell)					wipes and surveys	350	32.5	10	5/7/2013	yes	9/20/2013
ARB270	Lab	2010 (He)	2010 (He)		1993 (Akins)	2012 - renovated except for hoods		wipes and surveys of hoods only	246	22.9	7	1/6/2011	Hoods only	9/20/2013
ARB271	Centrifuge room	Prior to early 1990s if at all	Prior to early 1990s if at all					wipes and surveys	70	6.5	2	5/9/2013	yes	9/19/2013
ARB273	Coldrooms	Prior to early 1990s if at all	Prior to early 1990s if at all					wipes and surveys	165	15.3	5	5/7/2013	yes	9/19/2013
ARB275	Lab	Early 1990s (Hartzell)	Early 1990s (Hartzell)				2002 - Benches coated	wipes and surveys excluding benches	330	30.7	9	5/9/2013	yes	9/20/2013
ARB327	Lab	Not used	Late 1990s (Beckman)					wipes (H-3 only)	382	35.5	11	5/7/2013	No	
ARB330	Lab	2005 (Dodge)	1999 (Nadkarni)	1998 (Lloyd)		2012 - painted cabinets,walls		wipes and surveys of bench tops and floor	596	55.4	17	5/7/2013	yes	9/20/2013
ARB264	Lab	Not used	Early 1990s (Norman)				2002 - Benches coated	wipes (H-3 only) excluding benches	628	58.3	18	9/20/2013	No	
ARB246	Lab	Not used	2008 (McGeady)					wipes (H-3 only)	96	8.9	3	9/20/2013	No	
ARB260	Lab	Not used	Early 1990s (Norman)				2002 - Benches coated	wipes (H-3 only) excluding benches	117	10.9	3	9/20/2013	No	
ARB321	Scint counter room					2012 - counter removed; room renovated except floor		wipes and surveys of floor	95	8.8	3	9/20/2013	yes	9/20/2013
ARB250	Lab	2000 (M Schwartz)	Not used					wipes and surveys	760	70.6	21	9/20/2013	yes	9/19/2013
ARB311	Lab	2005 (L Fawcett)	2005 (L Fawcett)					wipes and surveys	292	27.1	8	9/20/2013	yes	9/20/2013
Waste shed	Waste storage	Radwaste stored	Radwaste stored	Radwaste stored	Radwaste stored			wipes and surveys	95	8.8	3	9/20/2013	yes	9/20/2013

**Table 2. NRC wipe test data**

3H efficiency:	67.6%	minimum detectable activity: 35.3dpm	67.6%
14C efficiency:	98.2%	minimum detectable activity: 25.2dpm	98.2%

ARB 268

Sample	cpm	3H dpm	14C dpm
1	21.33	31.55	21.72
2	18.67	27.62	19.01
3	28.67	42.41	29.20
4	19.00	28.11	19.35
5	24.67	36.49	25.12
6	26.67	39.45	27.16
7	20.67	30.58	21.05
8	23.00	34.02	23.42
9	19.00	28.11	19.35
10	21.33	31.55	21.72
11	24.00	35.50	24.44
12	21.00	31.07	21.38
13	23.33	34.51	23.76
14	17.33	25.64	17.65
15	23.00	34.02	23.42
16	19.67	29.10	20.03
17	22.67	33.54	23.09
18	22.33	33.03	22.74
19	16.33	24.16	16.63
20	19.67	29.10	20.03
21	26.33	38.95	26.81
22	24.67	36.49	25.12
23	21.33	31.55	21.72
24	20.33	30.07	20.70
25	20.33	30.07	20.70
26	17.67	26.14	17.99
27	28.00	41.42	28.51
28	19.67	29.10	20.03
29	19.67	29.10	20.03
30	20.33	30.07	20.70
31	22.00	32.54	22.40
32	19.67	29.10	20.03
33	21.67	32.06	22.07
34	18.00	26.63	18.33
35	20.33	30.07	20.70
36	16.67	24.66	16.98
37	25.00	36.98	25.46
38	19.33	28.59	19.68
39	22.00	32.54	22.40
40	22.67	33.54	23.09
41	23.33	34.51	23.76
42	20.67	30.58	21.05
43	19.00	28.11	19.35
44	24.67	36.49	25.12
45	16.67	24.66	16.98
46	21.00	31.07	21.38
47	25.67	37.97	26.14
48	23.67	35.01	24.10
49	24.00	35.50	24.44
50	24.33	35.99	24.78
51	24.67	36.49	25.12
52	23.33	34.51	23.76
53	22.00	32.54	22.40
54	23.33	34.51	23.76
55	19.00	28.11	19.35
56	21.00	31.07	21.38

ARB 270

Sample	cpm	3H dpm	14C dpm
1	27.33	40.43	27.83
2	26.33	38.95	26.81
3	27.00	39.94	27.49
4	42.67	63.12	43.45
5	26.33	38.95	26.81
6	23.00	34.02	23.42
7	25.00	36.98	25.46
8	28.00	41.42	28.51
9	34.00	50.30	34.62
10	32.67	48.33	33.27
11	20.67	30.58	21.05
12	29.33	43.39	29.87
13	28.33	41.91	28.85
14	26.00	38.46	26.48
15	27.00	39.94	27.49
16	44.67	66.08	45.49
17	29.00	42.90	29.53
18	42.67	63.12	43.45
19	26.67	39.45	27.16
20	62.00	91.72	63.14
21	30.33	44.87	30.89
22	24.33	35.99	24.78
23	44.00	65.09	44.81
23 (2nd)	27.33	40.43	27.83
24	29.00	42.90	29.53

ARB 271

Sample	cpm	3H dpm	14C dpm
1	24.33	35.99	24.78
2	30.00	44.38	30.55
3	23.67	35.01	24.10
4	24.00	35.50	24.44
5	24.33	35.99	24.78
6	26.00	38.46	26.48
7	27.33	40.43	27.83
8	29.00	42.90	29.53
9	20.67	30.58	21.05
10	21.67	32.06	22.07
11	25.00	36.98	25.46
12	23.00	34.02	23.42
13	27.00	39.94	27.49
14	24.67	36.49	25.12
15	28.33	41.91	28.85
16	24.00	35.50	24.44
17	21.00	31.07	21.38
18	26.00	38.46	26.48
19	23.33	34.51	23.76
20	23.67	35.01	24.10
blank	19.67	29.10	20.03

ARB 273

Sample	cpm	3H dpm	14C dpm
1	21.67	32.06	22.07
2	22.67	33.54	23.09
3	18.33	27.12	18.67
4	20.00	29.59	20.37
5	24.00	35.50	24.44
6	22.33	33.03	22.74
7	22.67	33.54	23.09
8	21.33	31.55	21.72
9	18.00	26.63	18.33
10	20.00	29.59	20.37
11	19.67	29.10	20.03
12	19.33	28.59	19.68
13	24.33	35.99	24.78
14	22.00	32.54	22.40
15	27.33	40.43	27.83
16	22.33	33.03	22.74
17	20.00	29.59	20.37
18	22.00	32.54	22.40
19	21.33	31.55	21.72
20	21.00	31.07	21.38
21	22.00	32.54	22.40
22	19.67	29.10	20.03
23	18.00	26.63	18.33
24	21.00	31.07	21.38
25	22.67	33.54	23.09
26	18.67	27.62	19.01
27	18.67	27.62	19.01
28	24.33	35.99	24.78
29	19.00	28.11	19.35
30	25.00	36.98	25.46
31	23.33	34.51	23.76
32	24.67	36.49	25.12
33	21.33	31.55	21.72
34	20.00	29.59	20.37
35	20.67	30.58	21.05
36	21.67	32.06	22.07
37	20.67	30.58	21.05
38	18.33	27.12	18.67
39	22.67	33.54	23.09
40	20.00	29.59	20.37
41	20.00	29.59	20.37
42	22.00	32.54	22.40
43	21.00	31.07	21.38
44	13.00	19.23	13.24
45	21.33	31.55	21.72
46	19.67	29.10	20.03
47	18.67	27.62	19.01
48	23.33	34.51	23.76
49	23.00	34.02	23.42
50	20.00	29.59	20.37
blank	21.33	31.55	21.72

ARB 275

Sample	cpm	3H dpm	14C dpm
1	29.67	43.89	30.21
2	21.00	31.07	21.38
3	22.33	33.03	22.74
4	24.33	35.99	24.78
5	20.33	30.07	20.70
6	21.00	31.07	21.38
7	19.67	29.10	20.03
8	24.00	35.50	24.44
9	23.33	34.51	23.76
10	22.37	33.09	22.78
11	26.33	38.95	26.81
12	21.00	31.07	21.38
13	24.67	36.49	25.12
14	23.00	34.02	23.42
15	27.67	40.93	28.18
16	22.67	33.54	23.09
17	23.33	34.51	23.76
18	21.00	31.07	21.38
19	21.67	32.06	22.07
20	26.00	38.46	26.48
21	30.00	44.38	30.55
22	27.33	40.43	27.83
23	23.67	35.01	24.10
24	21.67	32.06	22.07
25	23.00	34.02	23.42
26	27.00	39.94	27.49
27	27.00	39.94	27.49
28	24.33	35.99	24.78
29	25.00	36.98	25.46
30	21.33	31.55	21.72
blank	19.67	29.10	20.03

Table 2

blank 21.33 31.55 21.72

ARB 327				ARB 330				ARB 264				ARB 246				ARB 250				ARB 311			
Sample	cpm	3H dpm	14C dpm	Sample	cpm	3H dpm	14C dpm	Sample	cpm	3H dpm	14C dpm	Sample	cpm	3H dpm	14C dpm	Sample	cpm	3H dpm	14C dpm	Sample	cpm	3H dpm	14C dpm
1	26.00	38.46	26.48	94	25.33	37.47	25.79	1	23.67	35.01	24.10	1	24.33	35.99	24.78	1	26.67	39.45	27.16	1	22.33	33.03	22.74
2	28.33	41.91	28.85	95	24.67	36.49	25.12	2	20.00	29.59	20.37	2	26.00	38.46	26.48	2	22.67	33.54	23.09	2	22.67	33.54	23.09
3	25.00	36.98	25.46	96	25.00	36.98	25.46	3	22.00	32.54	22.40	3	26.00	38.46	26.48	3	22.67	33.54	23.09	3	24.33	35.99	24.78
4	27.33	40.43	27.83	97	20.33	30.07	20.70	4	21.00	31.07	21.38	4	28.33	41.91	28.85	4	29.00	42.90	29.53	4	23.33	34.51	23.76
5	27.33	40.43	27.83	98	23.33	34.51	23.76	5	21.67	32.06	22.07	5	23.00	34.02	23.42	5	22.33	33.03	22.74	5	21.33	31.55	21.72
6	19.67	29.10	20.03	99	22.00	32.54	22.40	6	20.33	30.07	20.70	ARB 260				6	21.00	31.07	21.38	6	24.33	35.99	24.78
7	21.00	31.07	21.38	100	23.00	34.02	23.42	7	23.00	34.02	23.42	1	24.00	35.50	24.44	7	24.67	36.49	25.12	7	24.00	35.50	24.44
8	21.00	31.07	21.38	101	25.33	37.47	25.79	8	24.33	35.99	24.78	2	17.00	25.15	17.31	8	18.67	27.62	19.01	8	25.33	37.47	25.79
9	24.67	36.49	25.12	blank	25.33	37.47	25.79	9	21.33	31.55	21.72	3	28.00	41.42	28.51	9	23.00	34.02	23.42	9	29.00	42.90	29.53
10	21.33	31.55	21.72					10	26.33	38.95	26.81	4	21.67	32.06	22.07	10	27.00	39.94	27.49	10	23.67	35.01	24.10
11	20.33	30.07	20.70					11	26.67	39.45	27.16	5	22.00	32.54	22.40	11	26.00	38.46	26.48	11	17.67	26.14	17.99
12	19.00	28.11	19.35					12	28.00	41.42	28.51	ARB 321				12	22.00	32.54	22.40	12	22.00	32.54	22.40
13	19.67	29.10	20.03					13	23.33	34.51	23.76	1	23.67	35.01	24.10	13	24.00	35.50	24.44	13	24.33	35.99	24.78
14	25.00	36.98	25.46					14	24.00	35.50	24.44	2	21.67	32.06	22.07	14	19.67	29.10	20.03	14	23.00	34.02	23.42
15	18.00	26.63	18.33					15	19.67	29.10	20.03	3	23.00	34.02	23.42	15	29.00	42.90	29.53	15	19.00	28.11	19.35
16	19.33	28.59	19.68					16	22.33	33.03	22.74	4	19.00	28.11	19.35	16	24.67	36.49	25.12	16	24.33	35.99	24.78
17	17.67	26.14	17.99					17	27.00	39.94	27.49	5	22.33	33.03	22.74	17	21.67	32.06	22.07	17	21.33	31.55	21.72
18	25.00	36.98	25.46					18	22.67	33.54	23.09	Blank				18	26.00	38.46	26.48	18	25.00	36.98	25.46
19	16.00	23.67	16.29					Blank	26.00	38.46	26.48	Blank	26.00	38.46	26.48	19	26.67	39.45	27.16	19	24.33	35.99	24.78
20	24.00	35.50	24.44													20	27.00	39.94	27.49	20	22.33	33.03	22.74
21	23.67	35.01	24.10													21	17.33	25.64	17.65	Blank	26.00	38.46	26.48
22	23.33	34.51	23.76													22	21.33	31.55	21.72				
23	17.00	25.15	17.31													Blank	26.00	38.46	26.48				
24	22.67	33.54	23.09																				
25	21.00	31.07	21.38																				
blank	25.33	37.47	25.79																				

ARB 330			
Sample	cpm	3H dpm	14C dpm
1	22.33	33.03	22.74
2	22.67	33.54	23.09
3	24.33	35.99	24.78
4	23.33	34.51	23.76
5	21.33	31.55	21.72
6	24.33	35.99	24.78
7	24.00	35.50	24.44
8	25.33	37.47	25.79
9	29.00	42.90	29.53
10	23.67	35.01	24.10
11	17.67	26.14	17.99
12	22.00	32.54	22.40
13	24.33	35.99	24.78
14	23.00	34.02	23.42
15	19.00	28.11	19.35
16	24.33	35.99	24.78
17	21.33	31.55	21.72
18	25.00	36.98	25.46
19	24.33	35.99	24.78
20	22.33	33.03	22.74
Blank	26.00	38.46	26.48

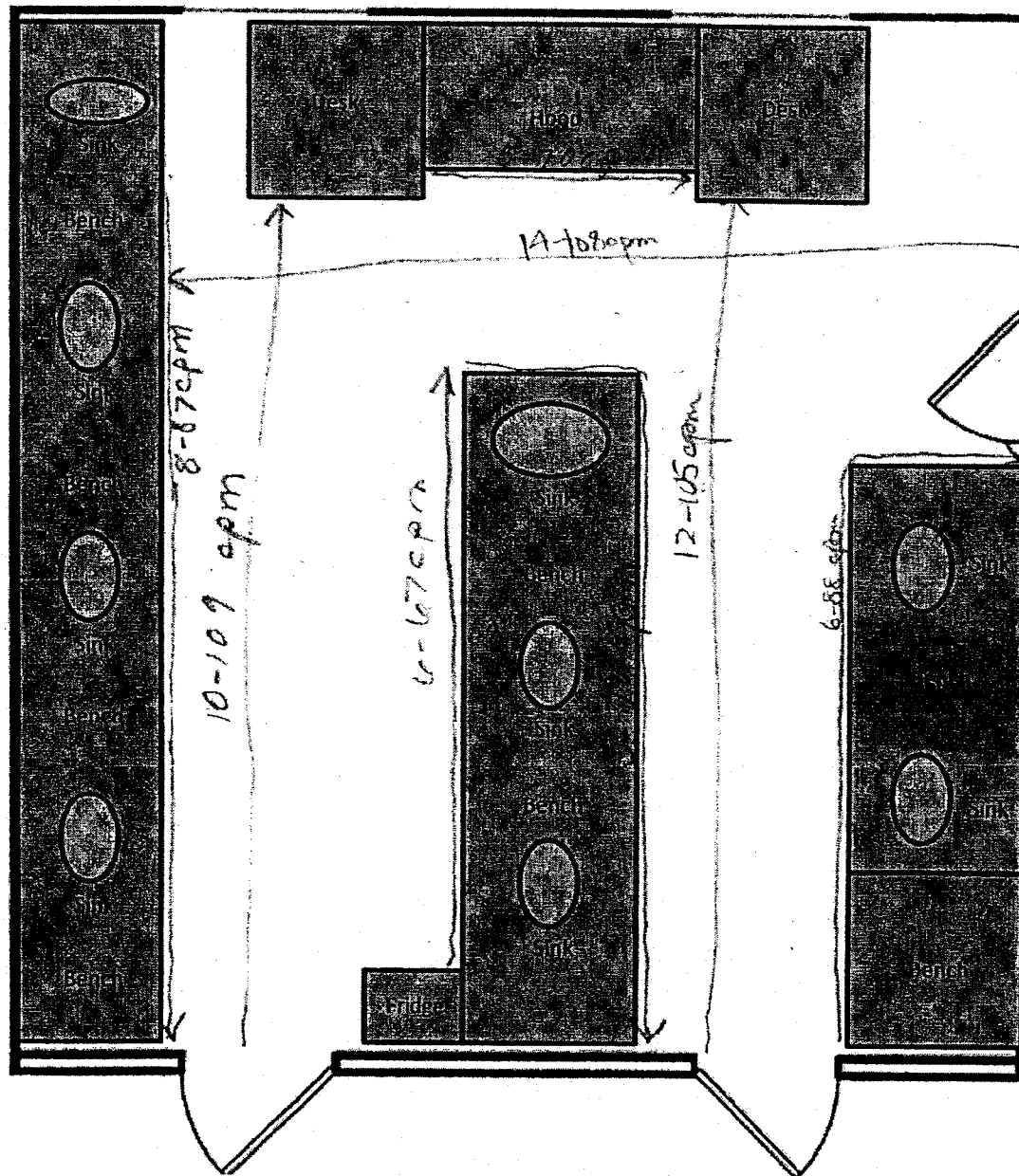
Waste Shed			
Sample	cpm	3H dpm	14C dpm
1	24.67	36.49	25.12
2	20.67	30.58	21.05
3	25.00	36.98	25.46
4	26.67	39.45	27.16
5	24.33	35.99	24.78
6	26.00	38.46	26.48
7	24.33	35.99	24.78
Blank	26.00	38.46	26.48

Lab ARB 268

4-4-13 Dave

Scan  
Surveys

Background  
34 cpm



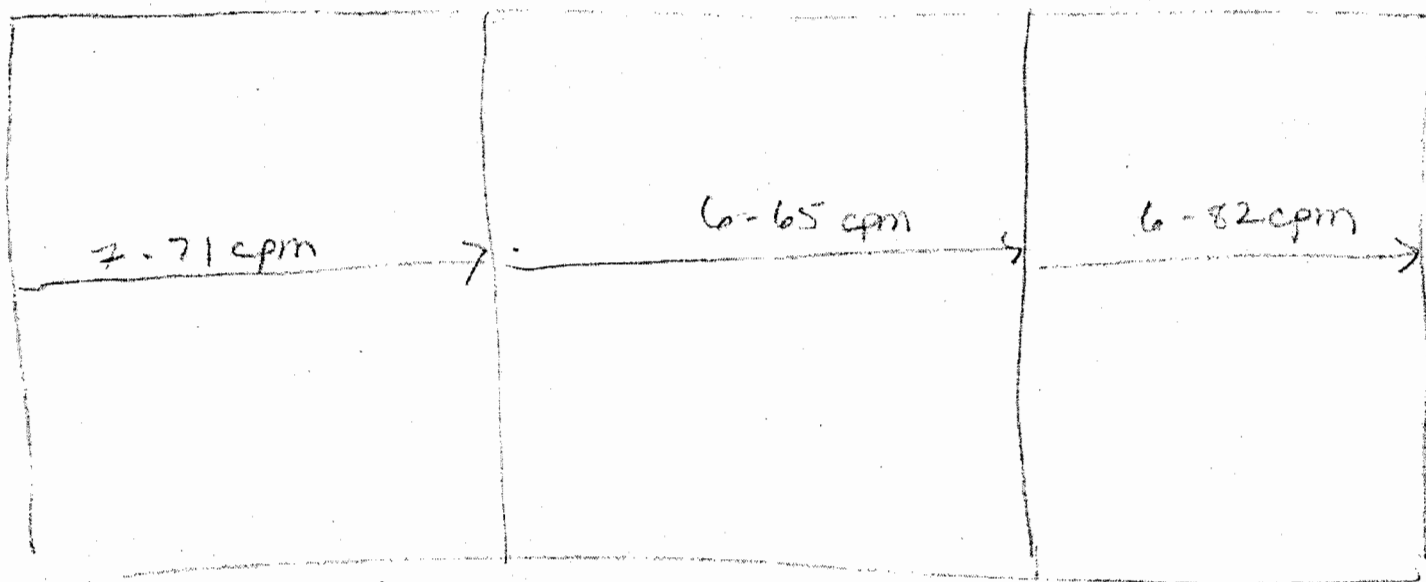
Room 270

Hoods

#1

#2

#3



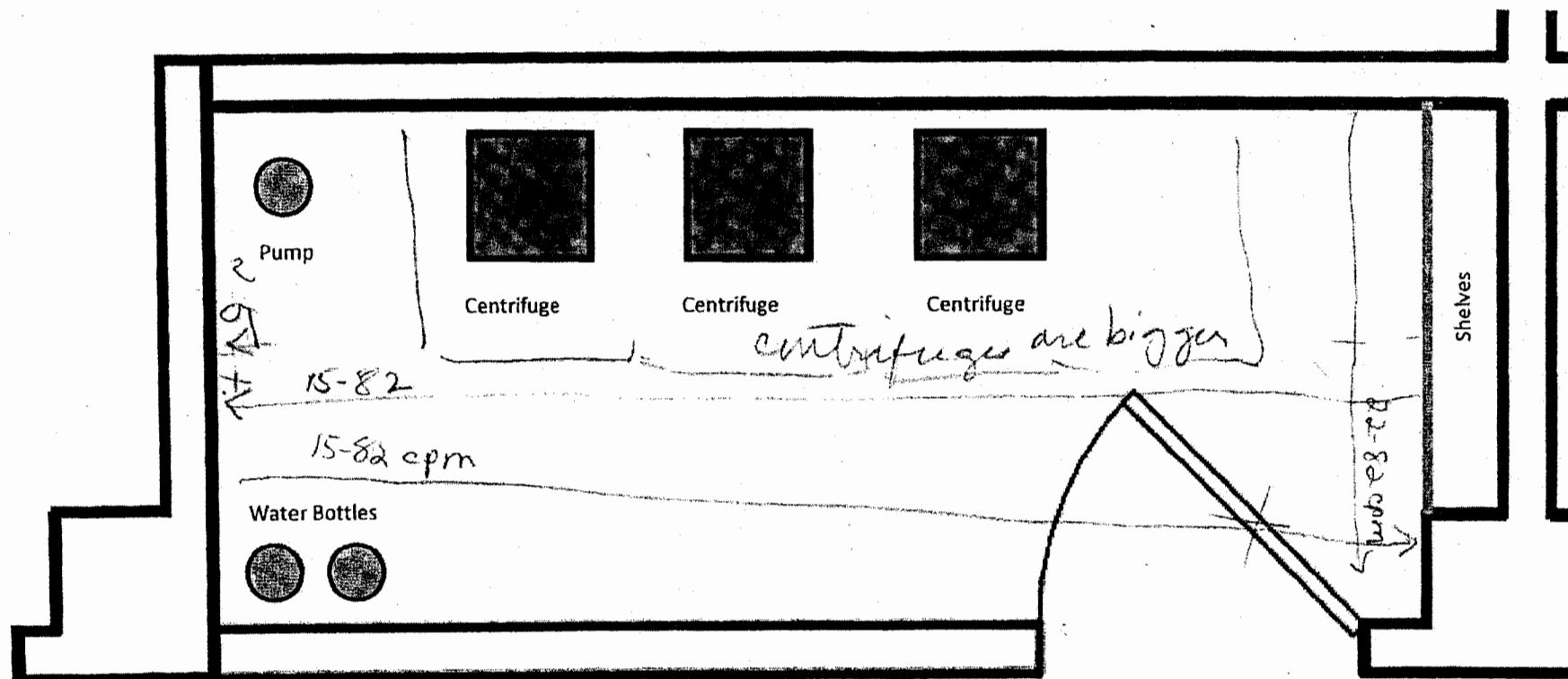
Surveys were made across  
the work area.

Background 33 cpm

ARB 271

# Centrifuge Room

4-4-13 Dave



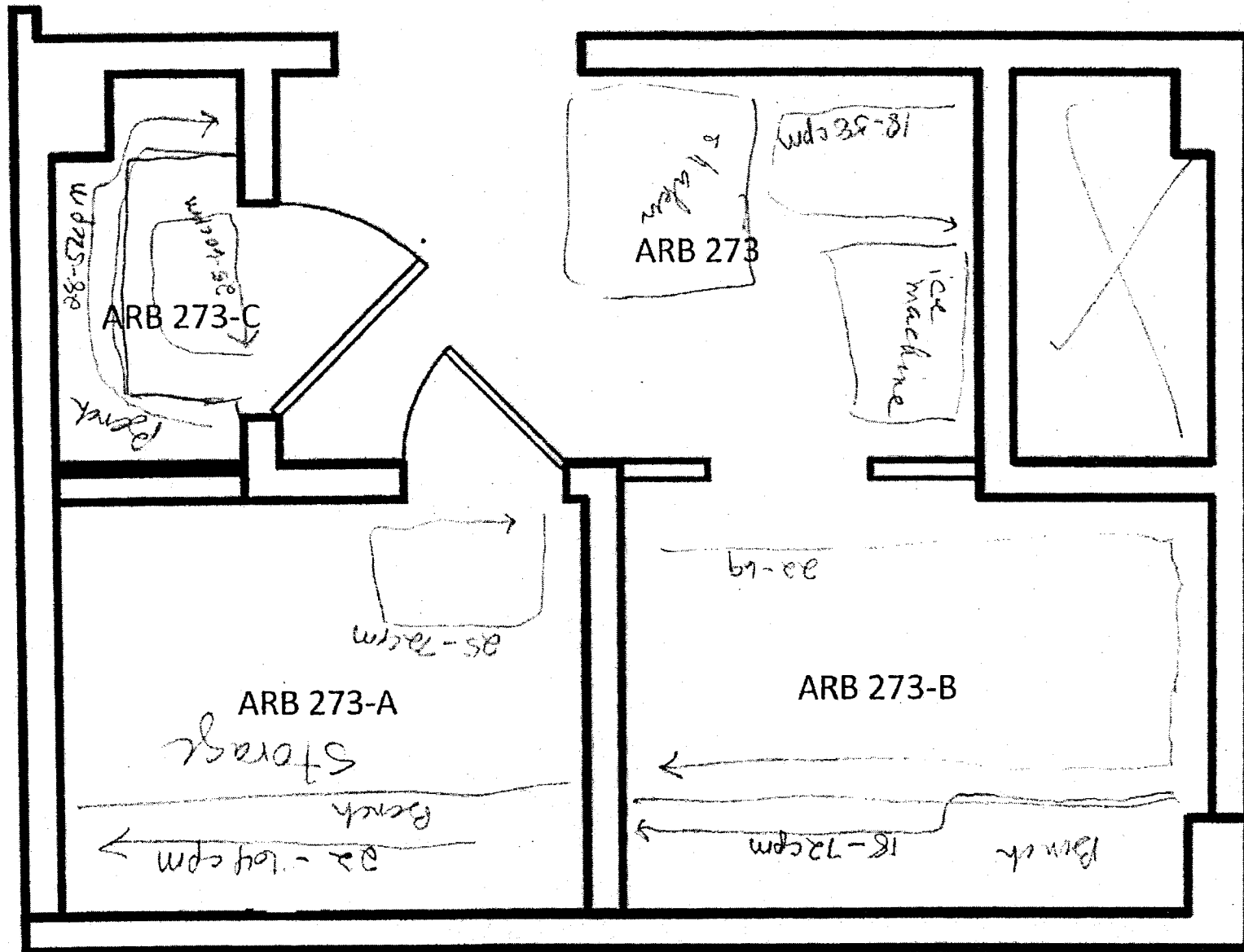
Background 33 cpm



Background 33cpm

Storage ARB 273 A- B -C

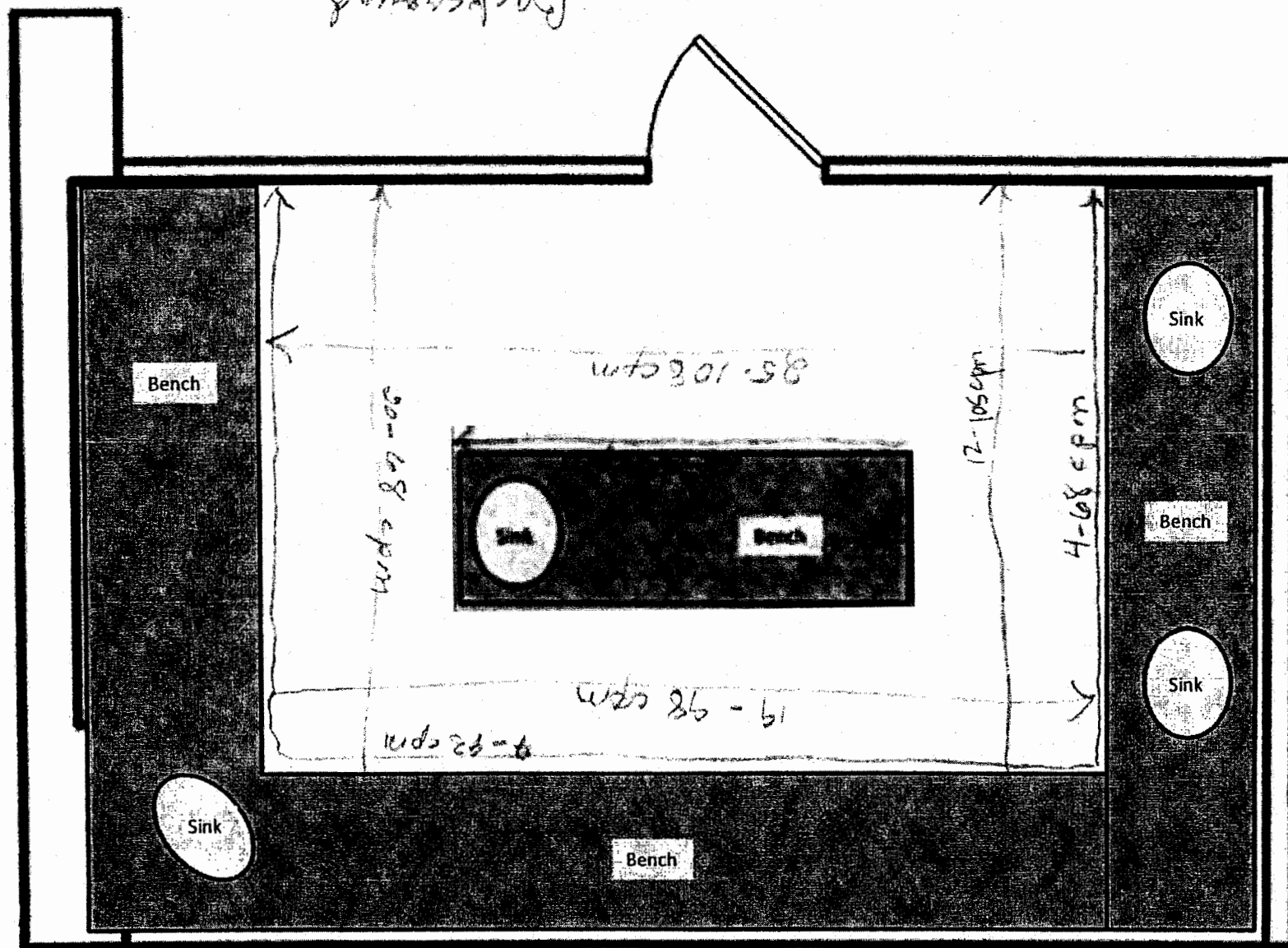
4-4-13 Dave



Backround  
37 apm

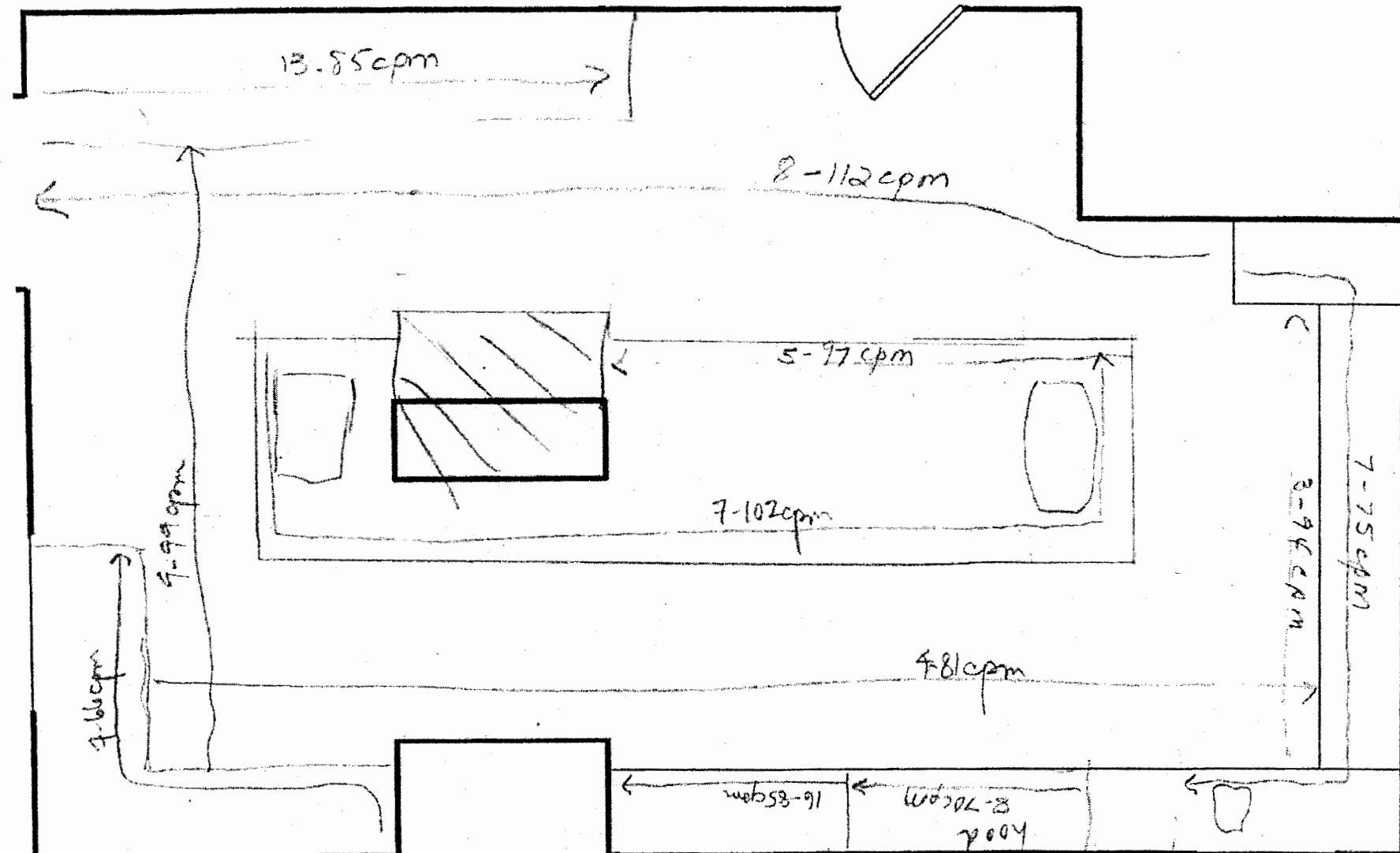
Lab ARB 275

4-4-13 Dave



Lab ARB 330

9-16-13 Dave

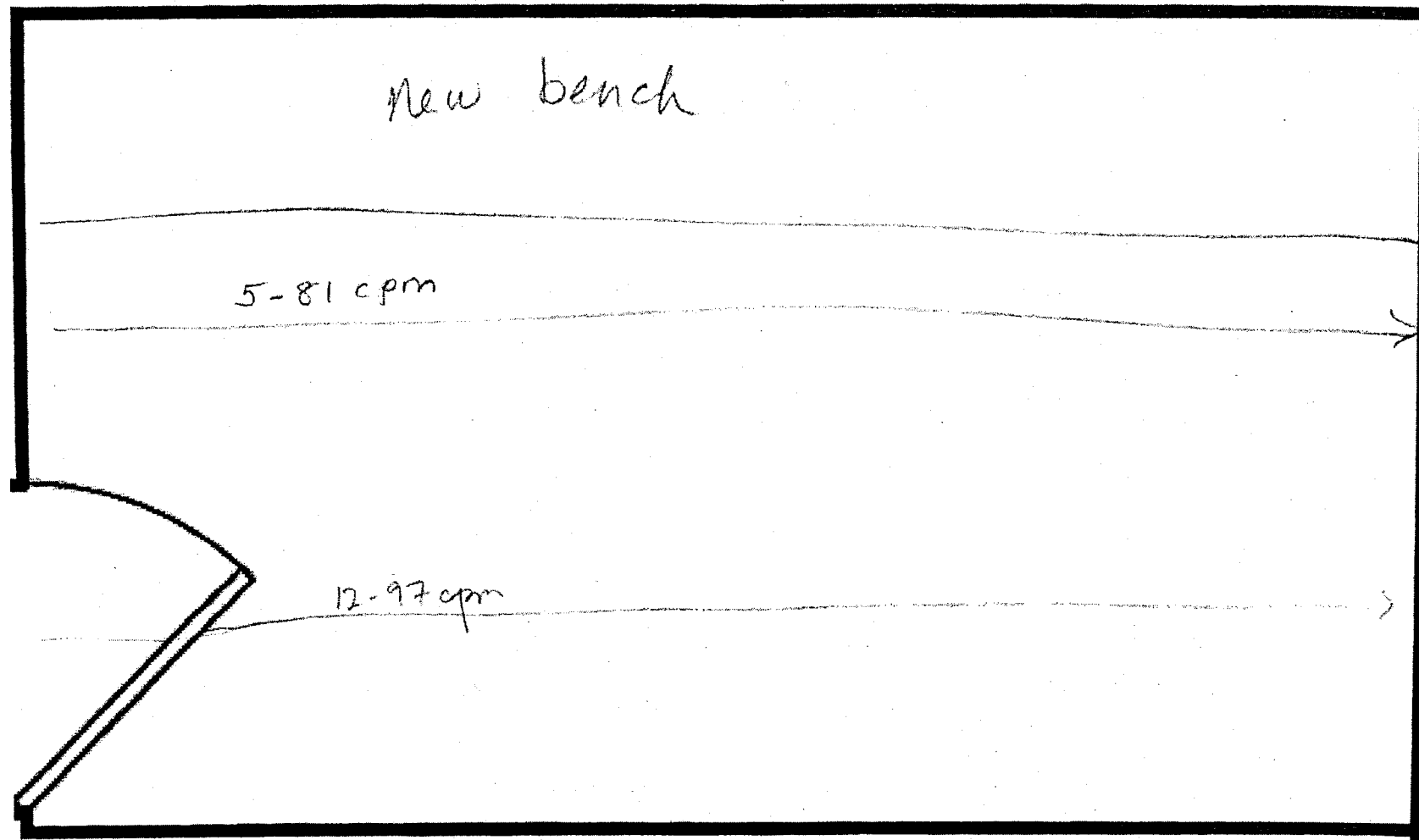


Background for cpm

Everything new except floor

Lab ARB 321

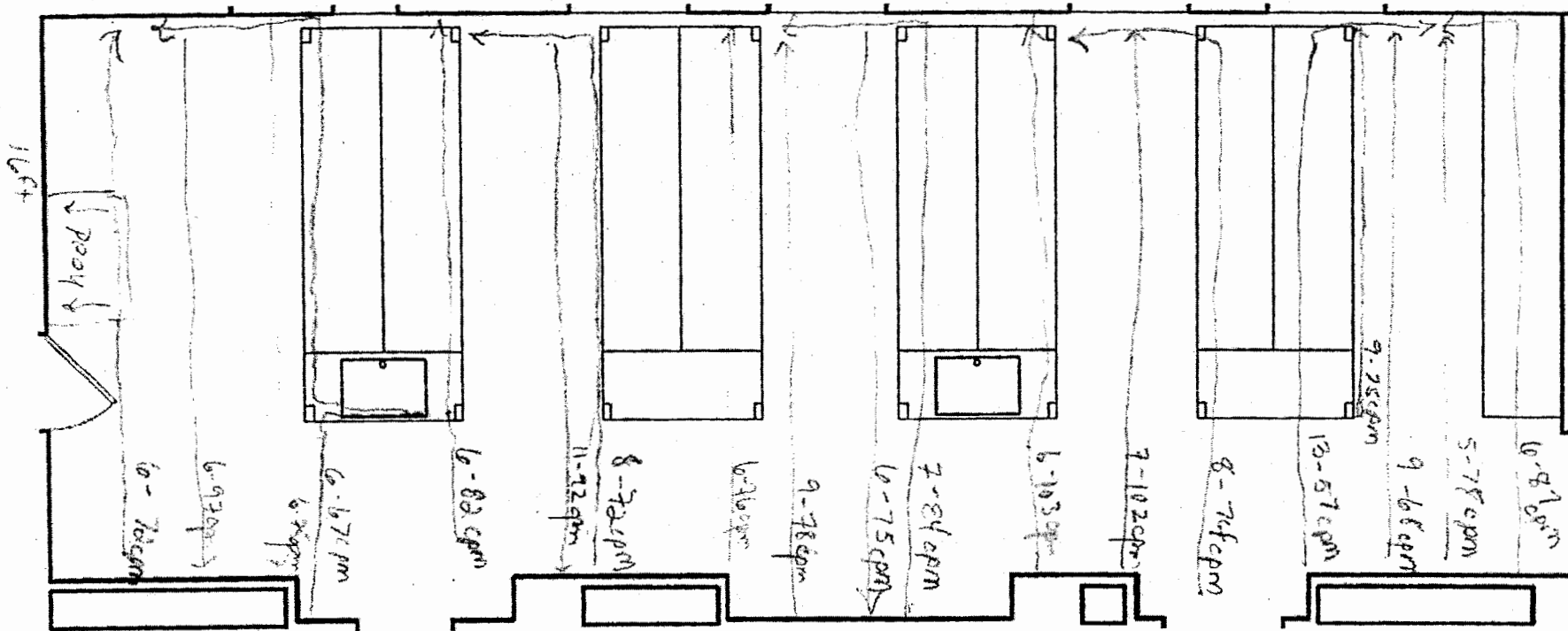
9-13-13 Dave



Background 33 cpm

# Lab ARB 250

9-13-13 Dave

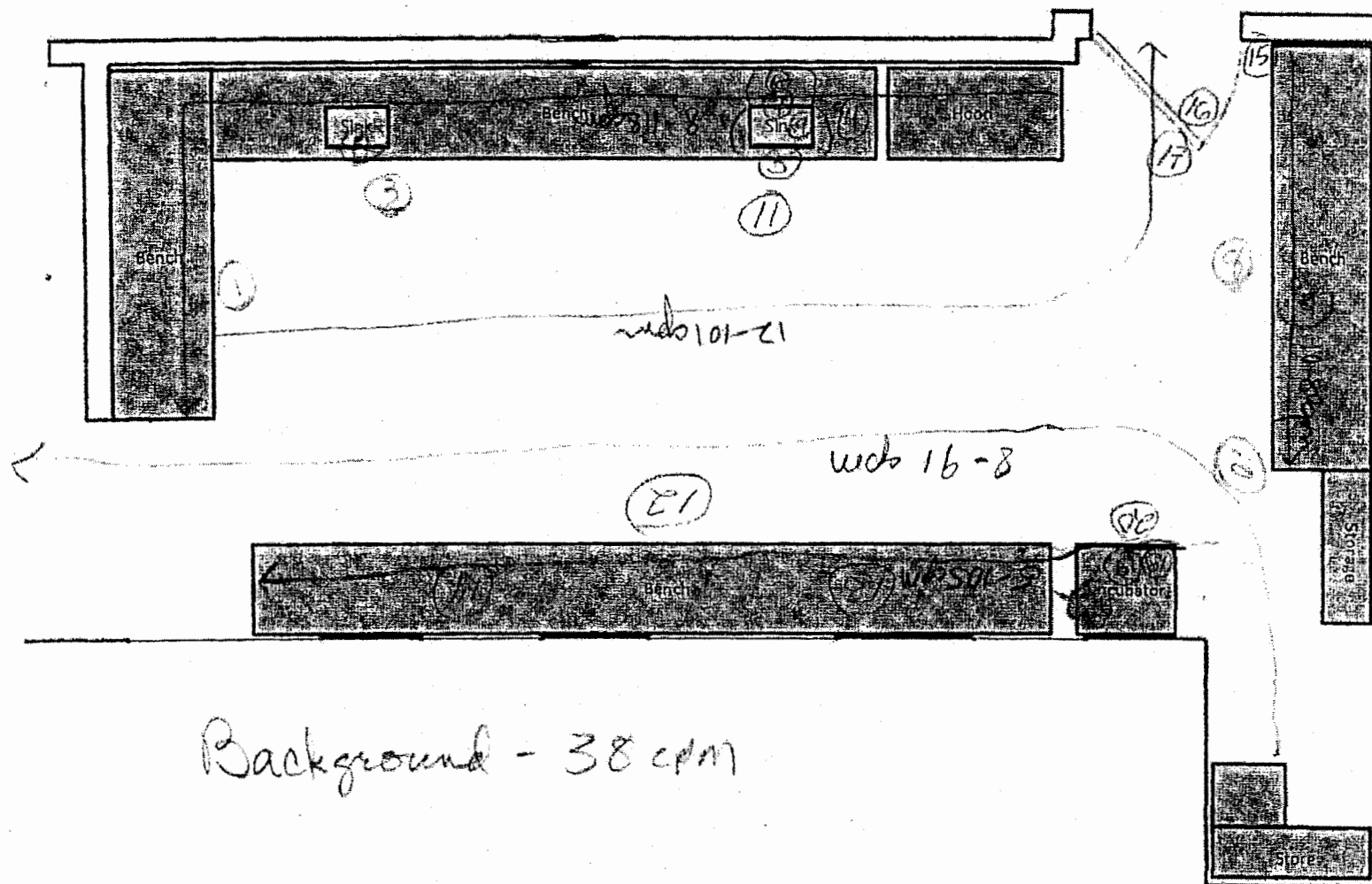


Background - 46 cpm

Lab ARB 311

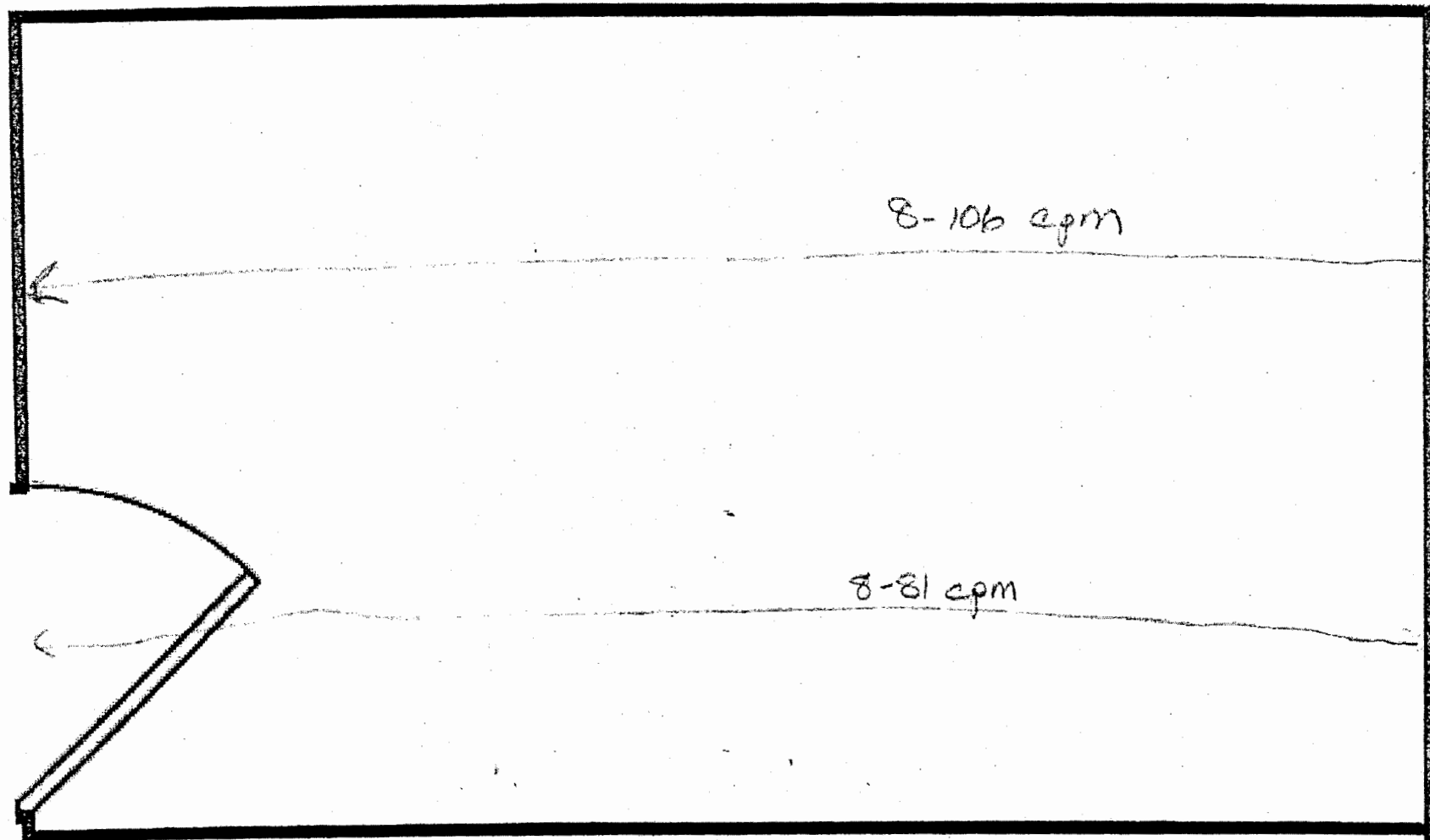
4-16-13 Dave

27.153.271

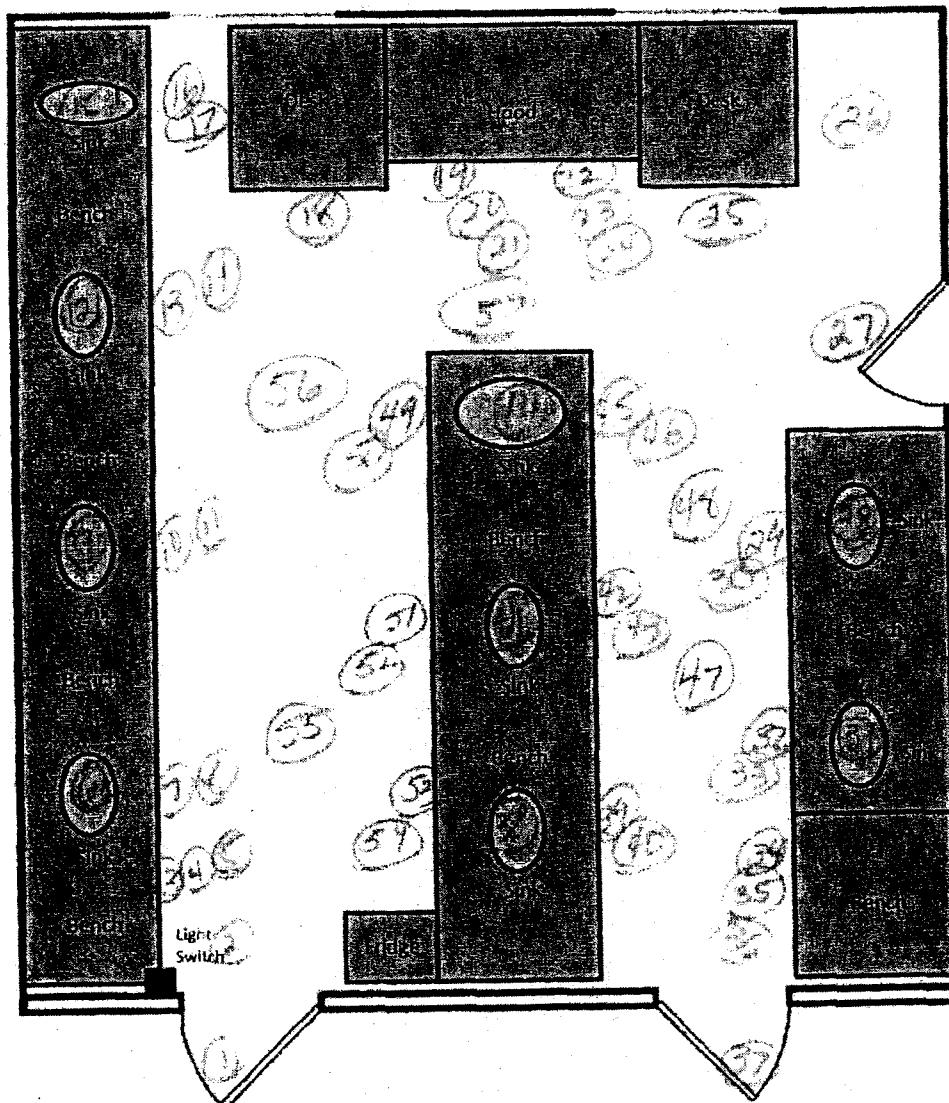


Rad waste shed

9-13-13 Dave



Background 34



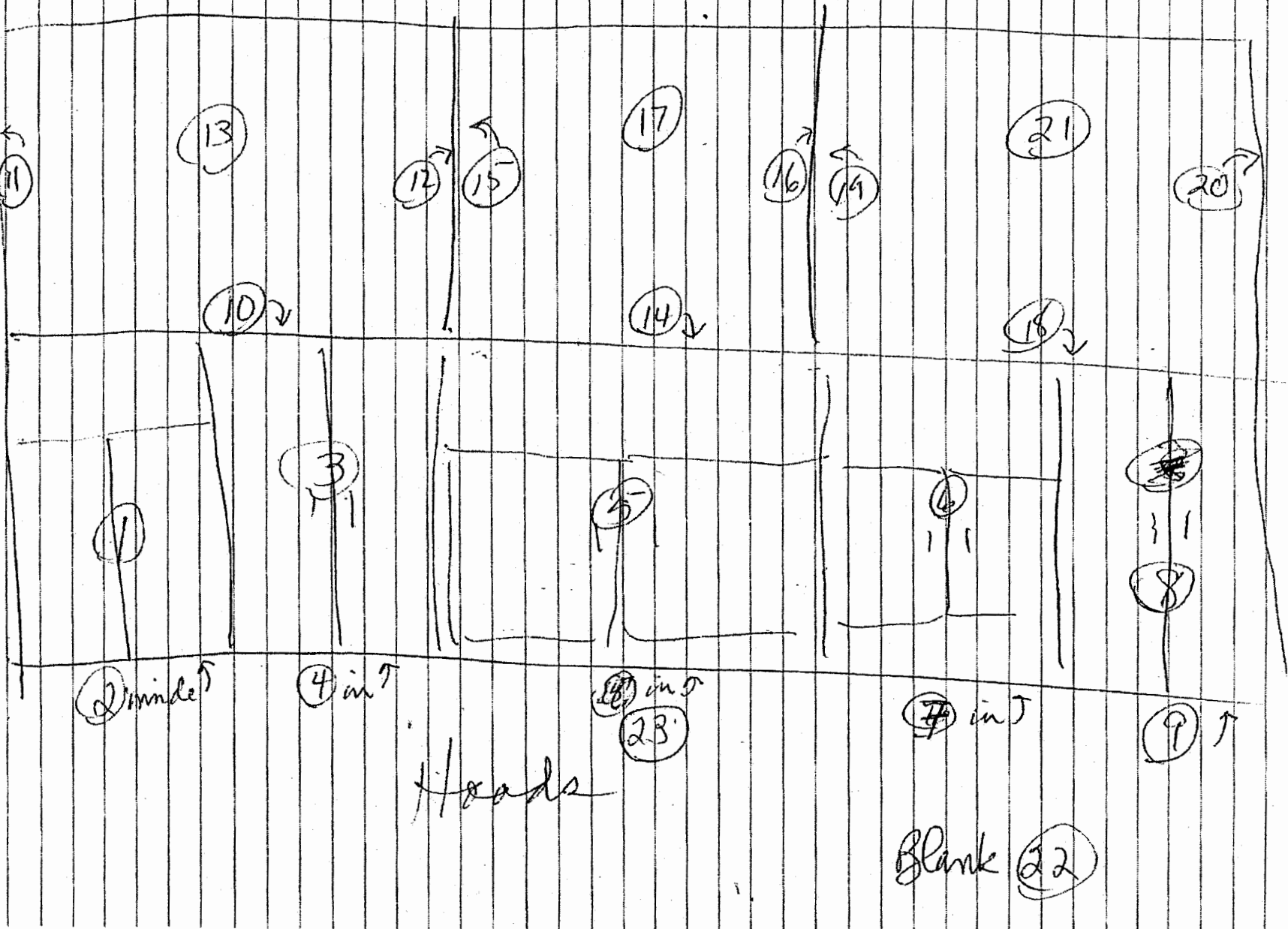
Lab ARB 268

4-4-13 Dave

*Wipe  
tests*



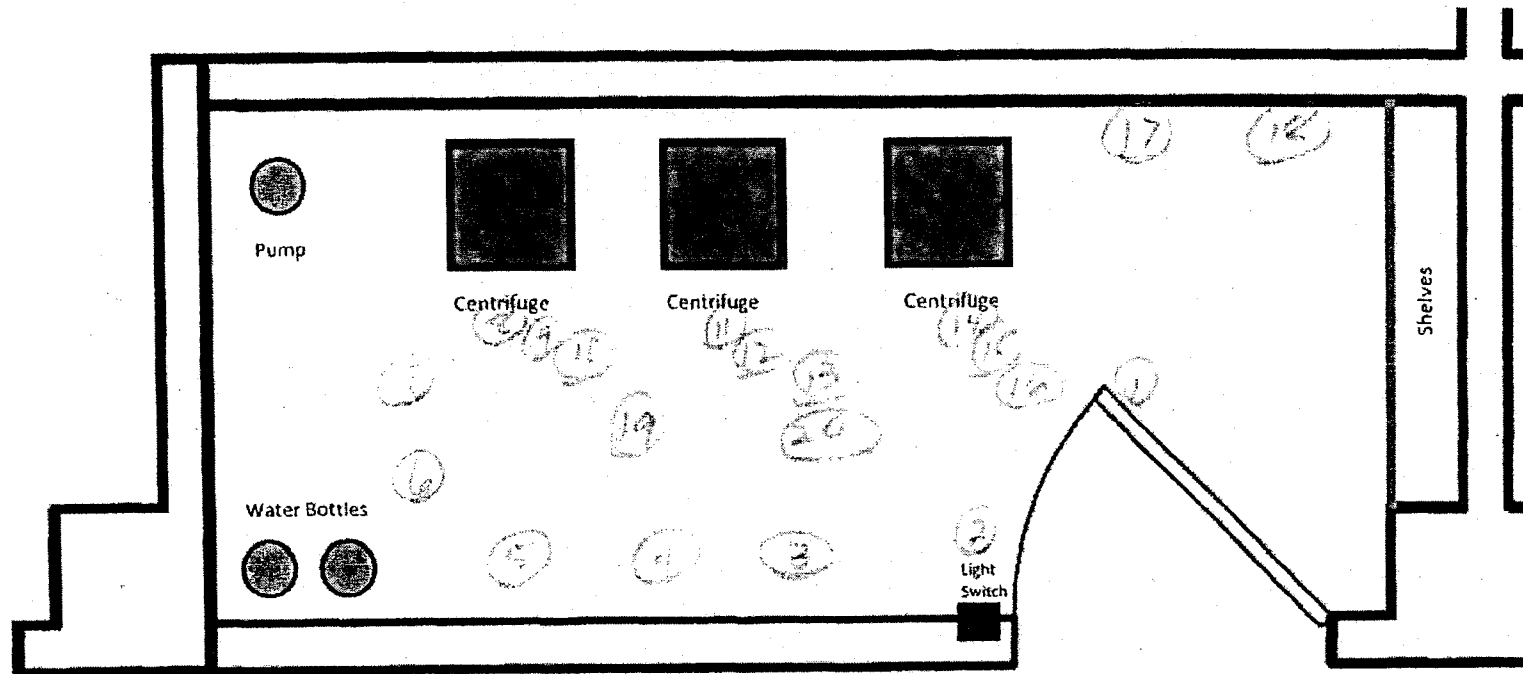
1/5/2011  
ARB270



ARB 271

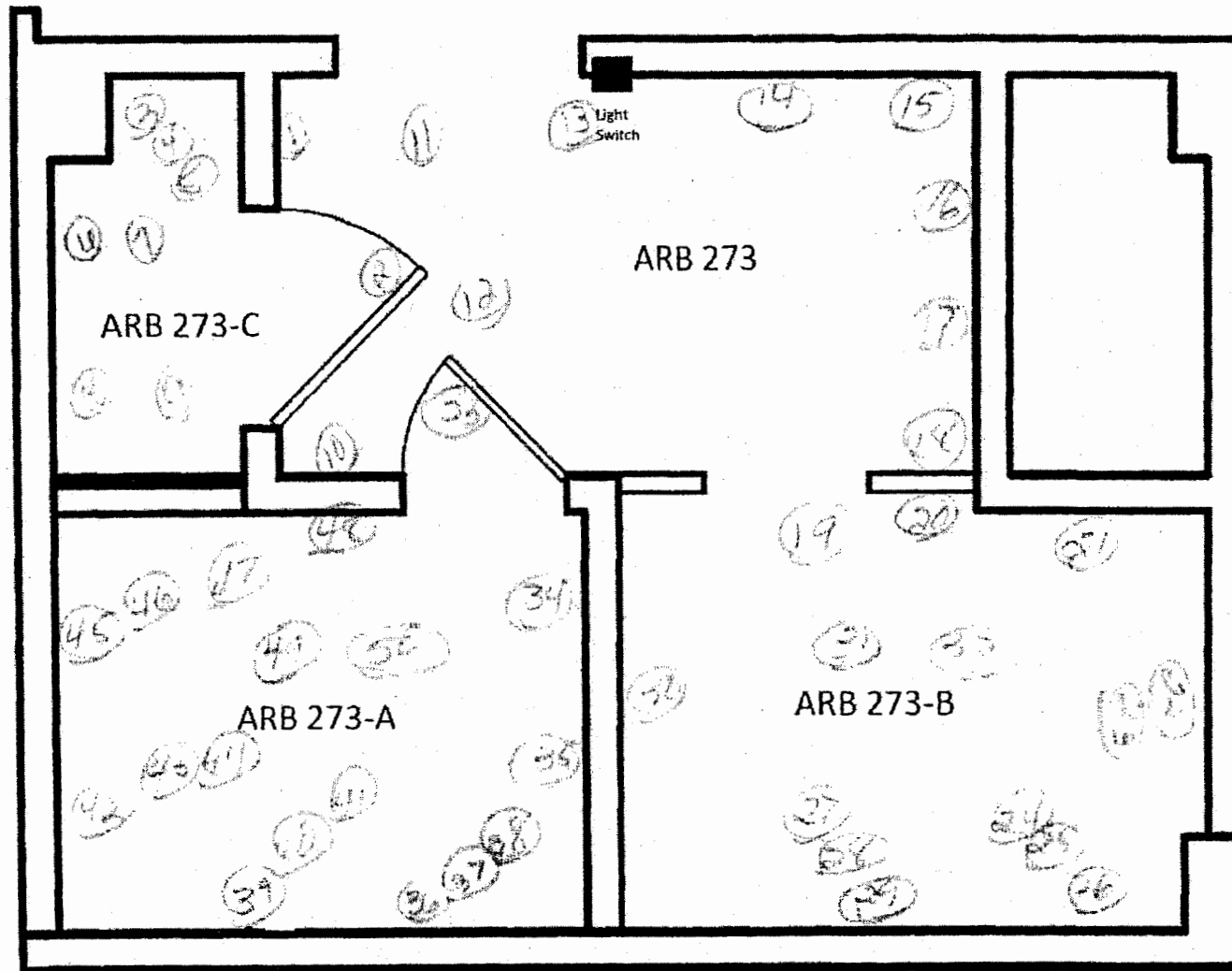
# Centrifuge Room

4-4-13 Dave



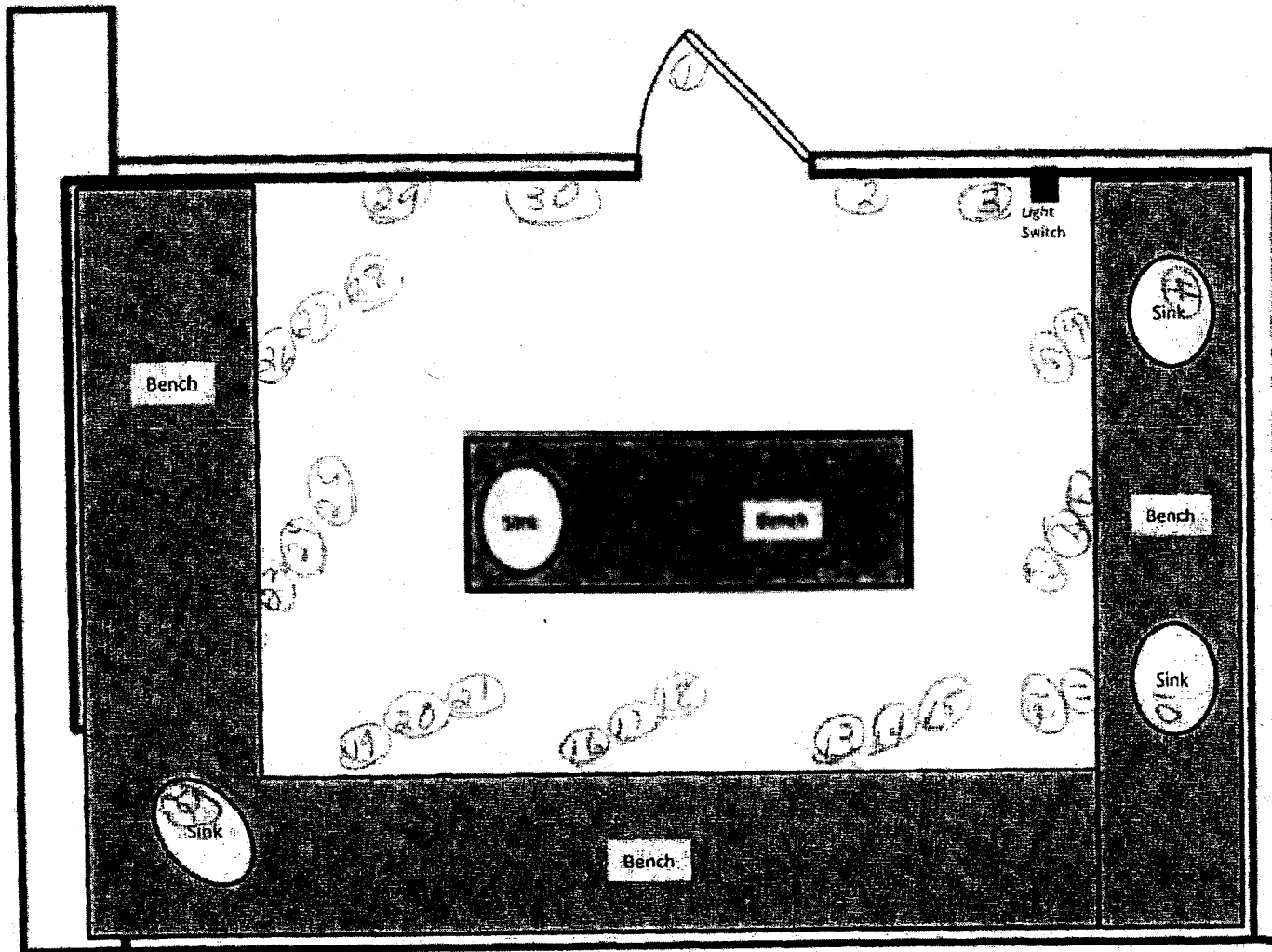
Storage ARB 273 A- B -C

4-4-13 Dave

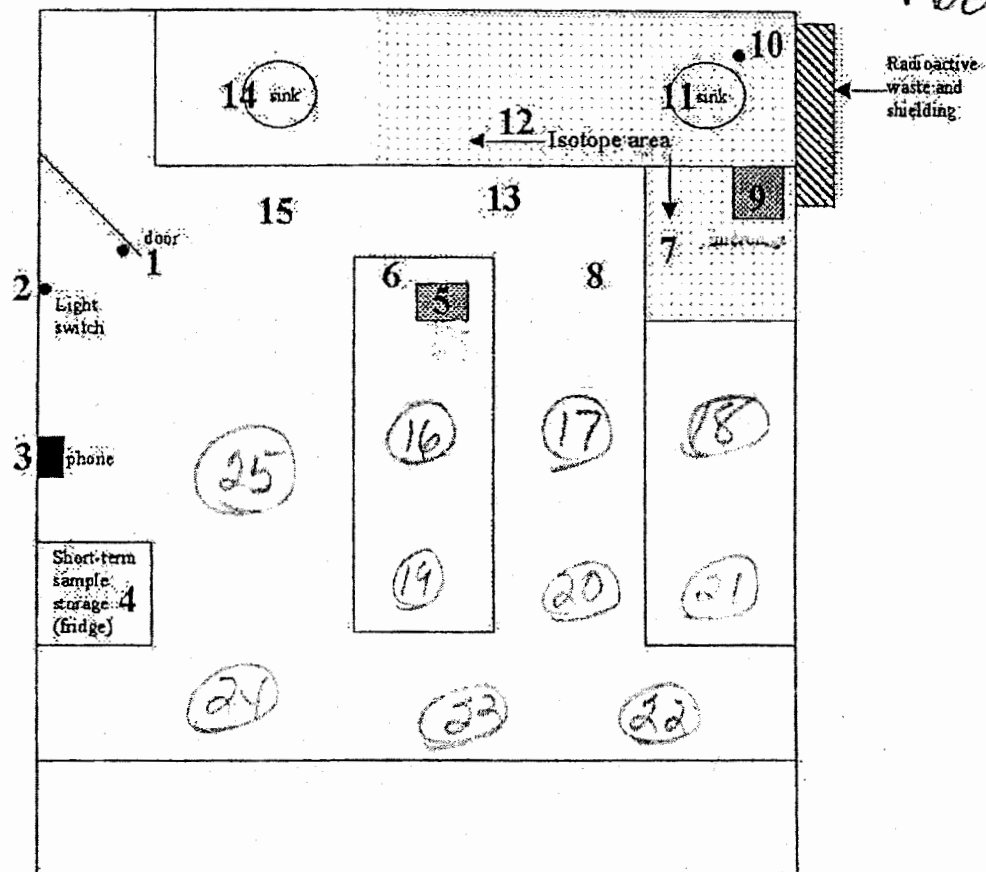


Lab ARB 275

4-4-13 Dave



# Room 327I

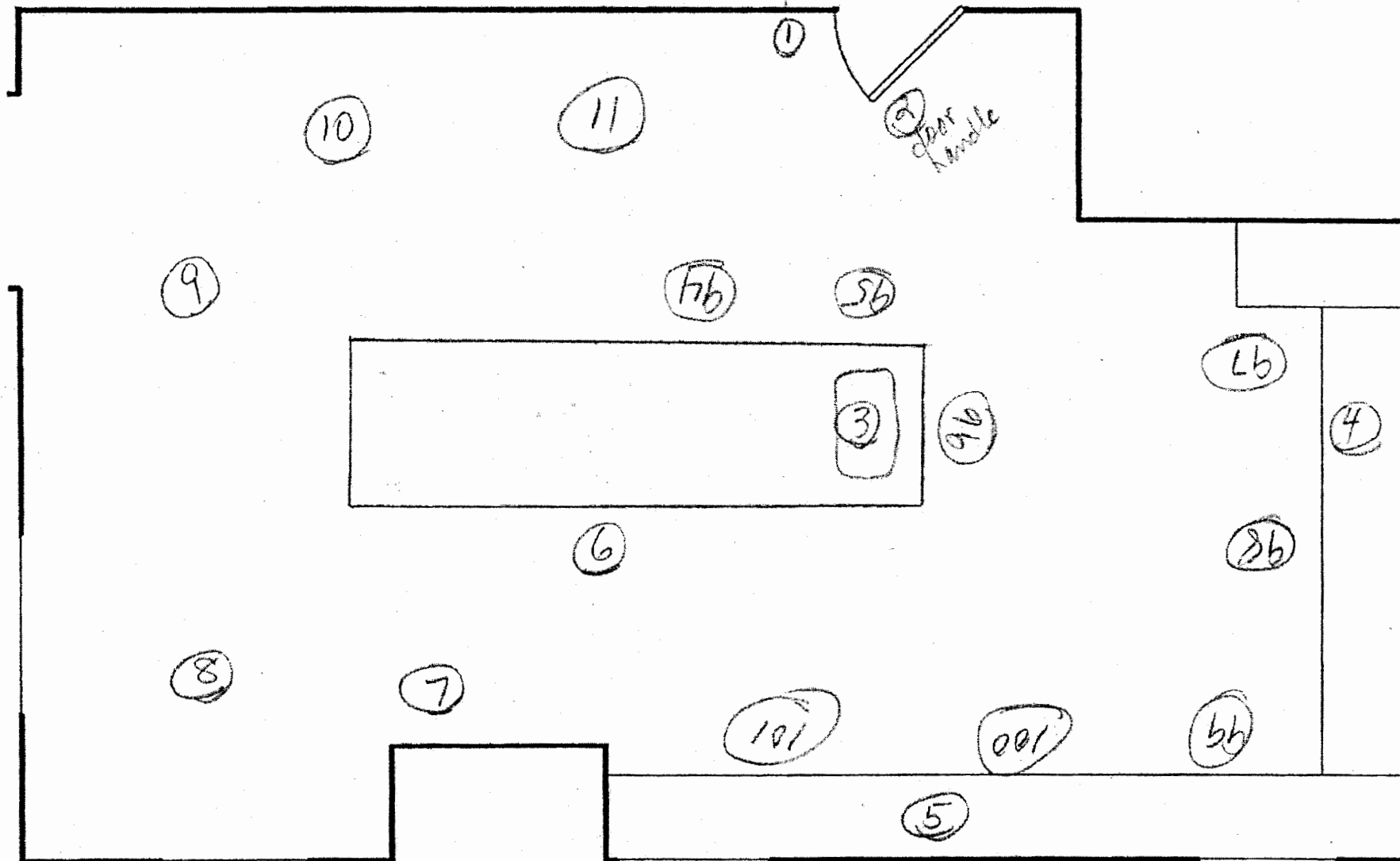


Type of flooring	Vinyl tile
Type of walls and ceiling	Plaster, ceiling tile
Bench top material	Epoxy

T  
1-11

Lab ARB 330

9-16-13 Dave

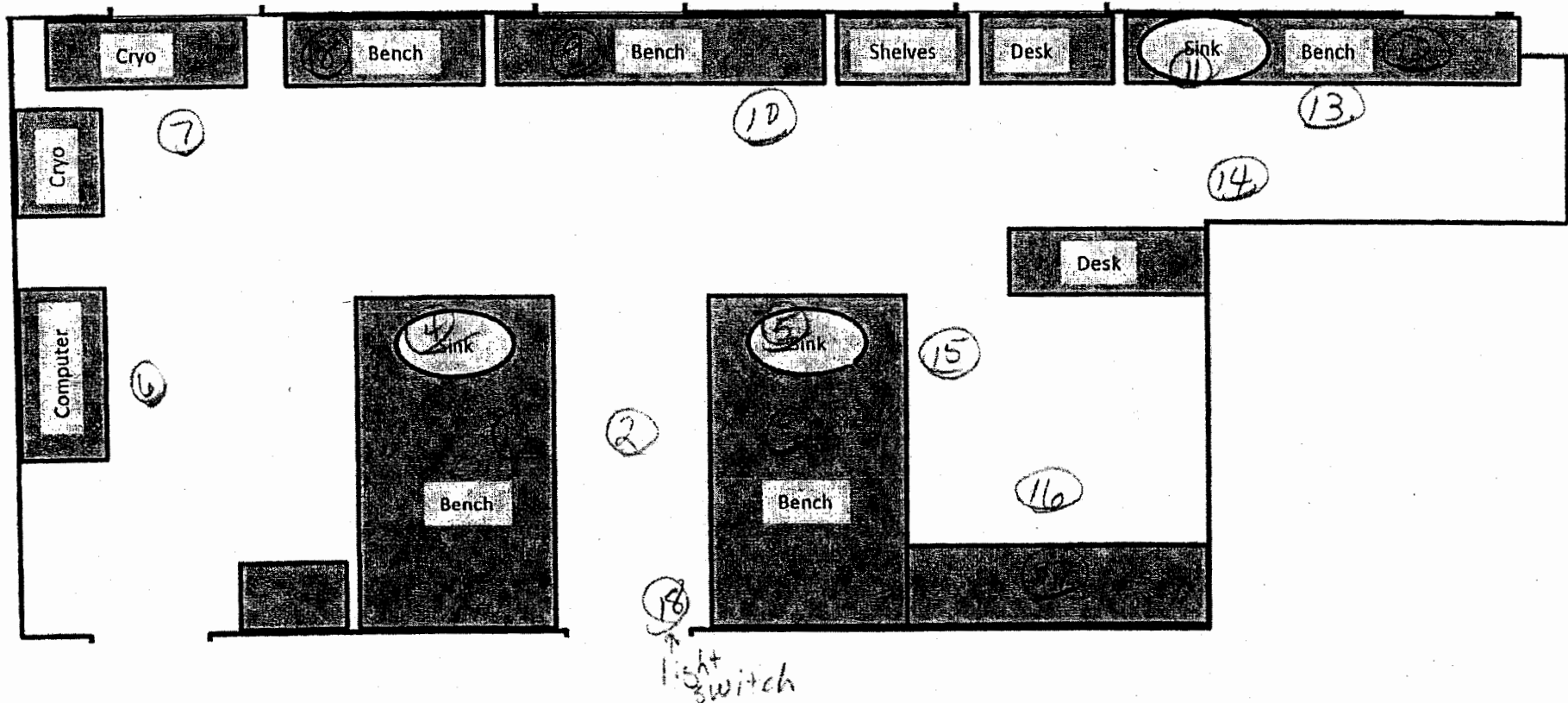


Lab ARB 264

9-13-13 Dave

58.3 sq. m.

1-18

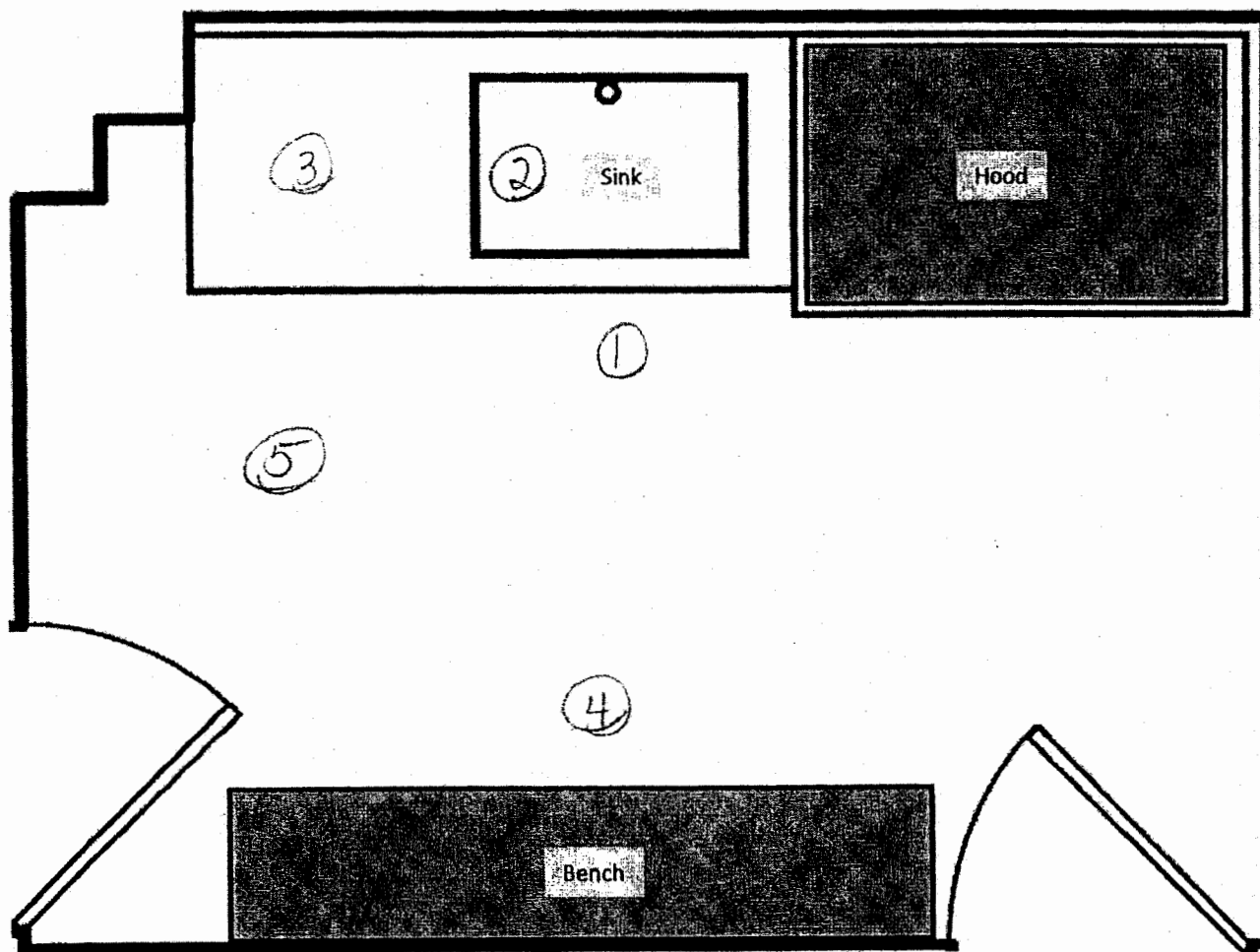


L  
1-5

# Biosafety Level 2 Lab ARB 246

9-13-13 Dave

8, 9 Aug. m.





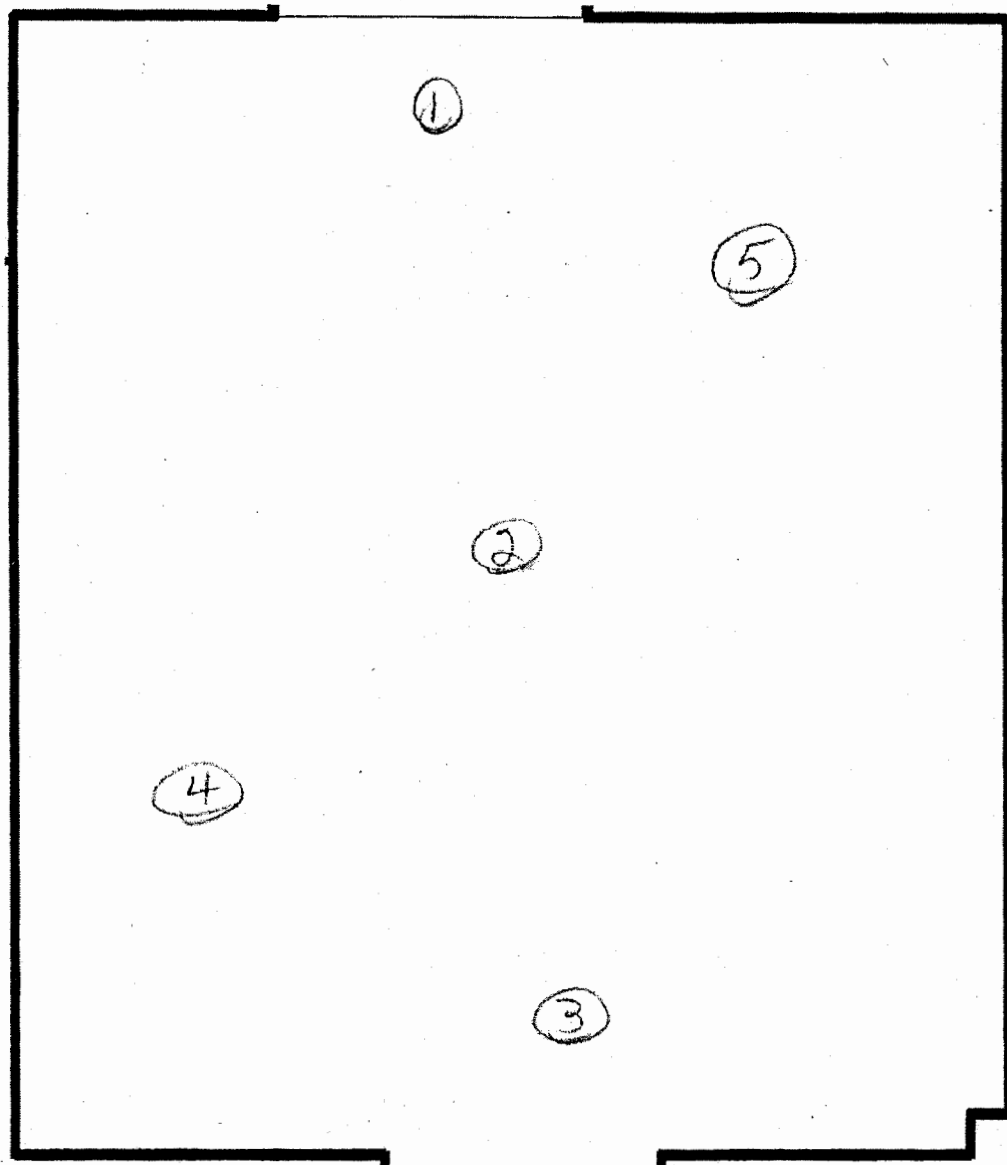
N

1-5

Lab ARB 260

9-13-13 Dave

10.9 sq. m.



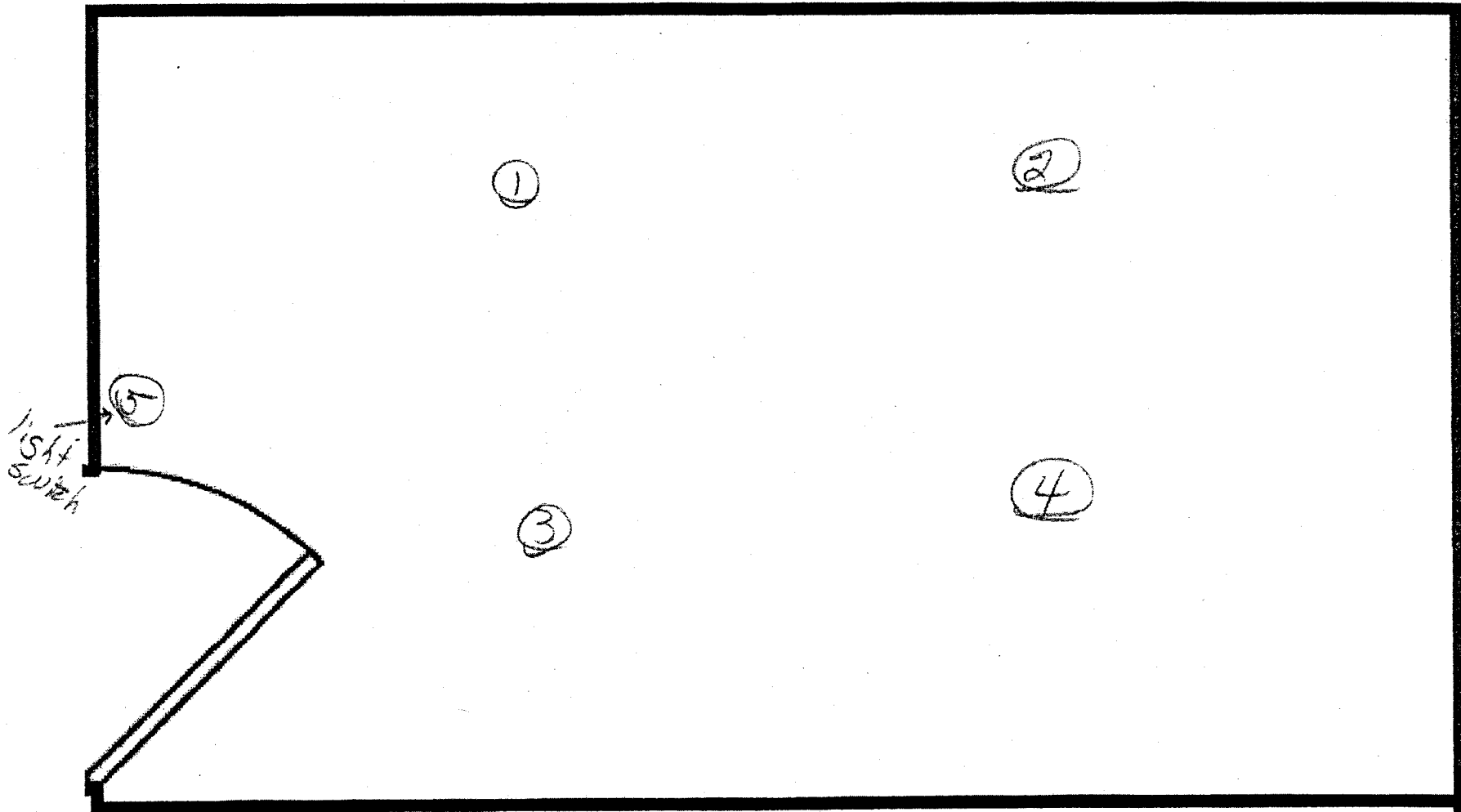
8.8 sq. m.

S

1-5

Lab ARB 321

9-13-13 Dave



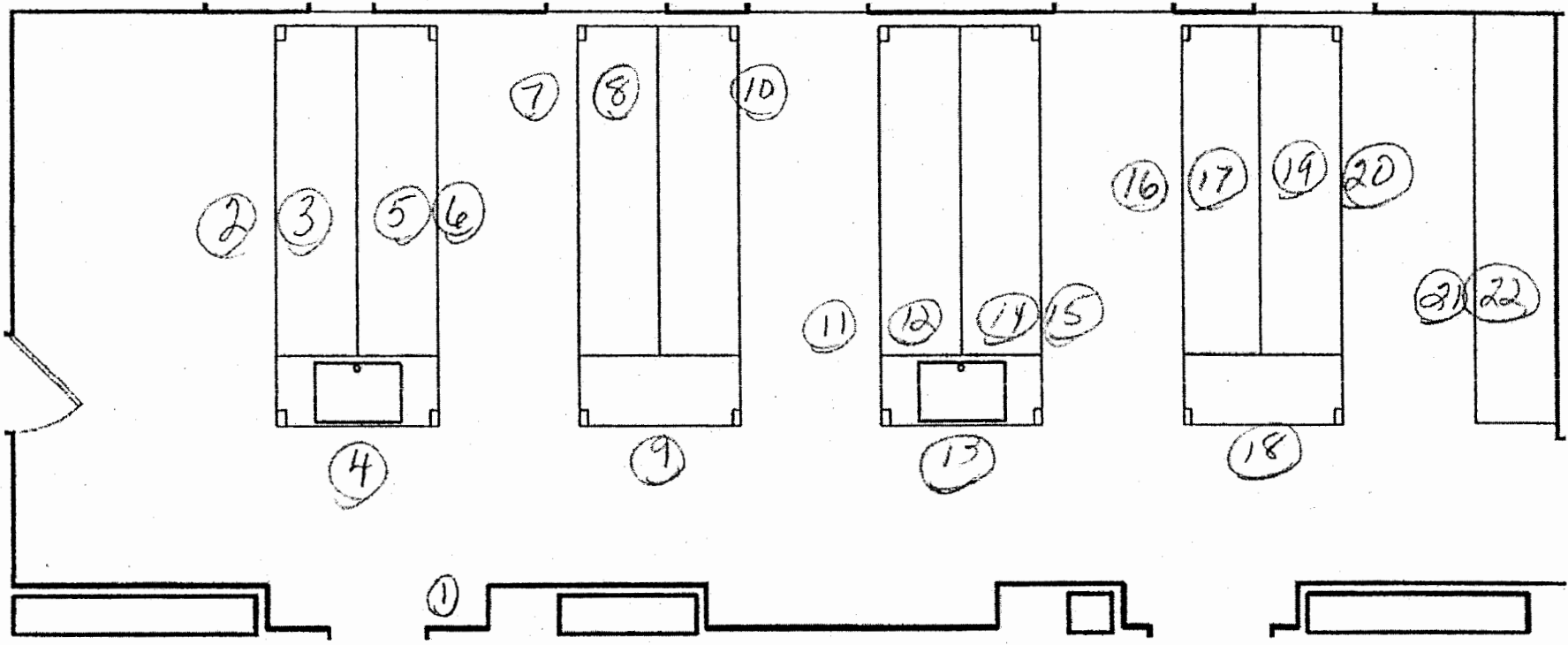
M

1-22

Lab ARB 250

9-13-13 Dave

70.6 sq. m.

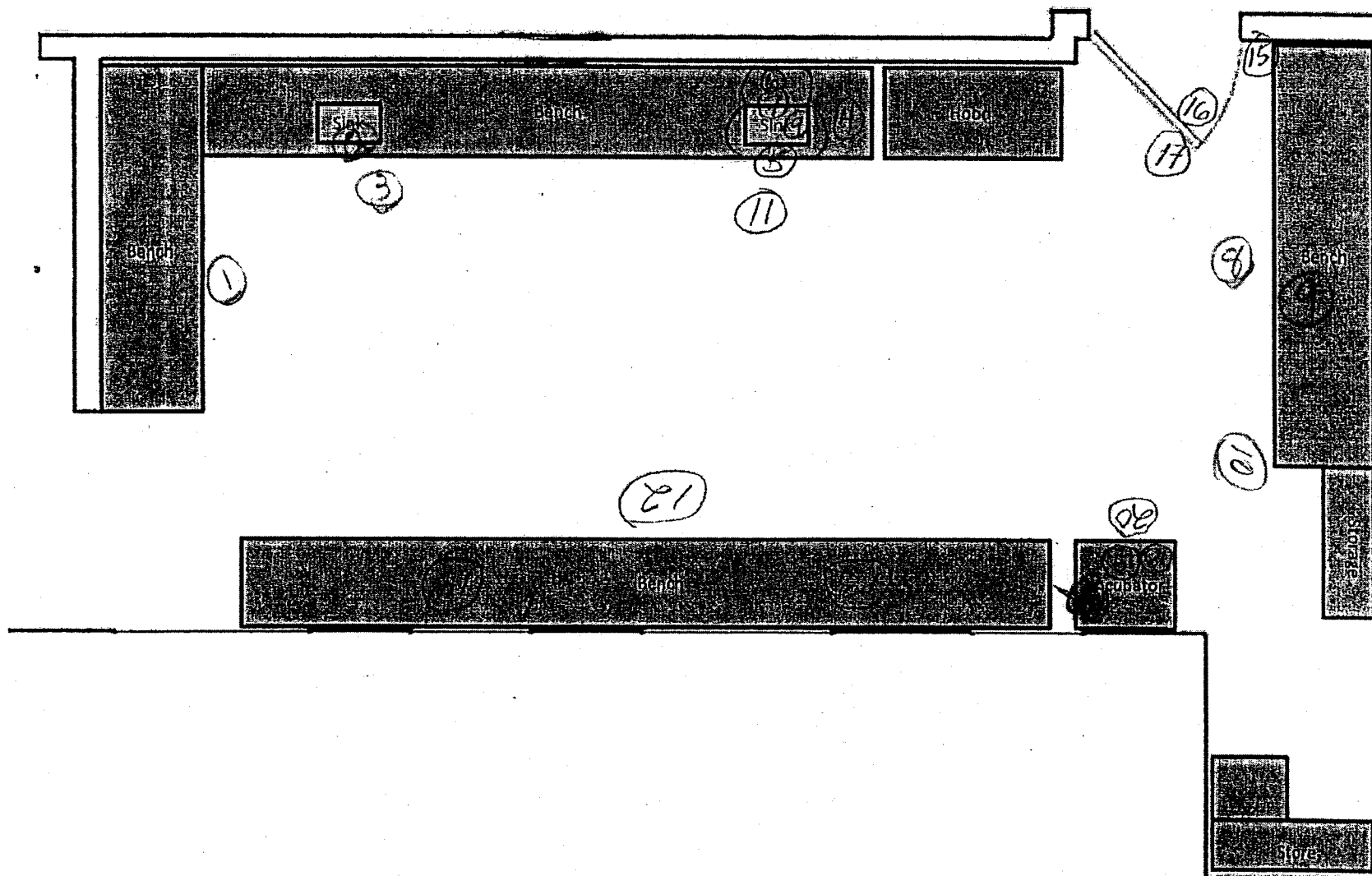


P  
1-20

Lab ARB 311

4-16-13 Dave

27.15g.m.



# Rad waste Shed

9-13-13 Dave

