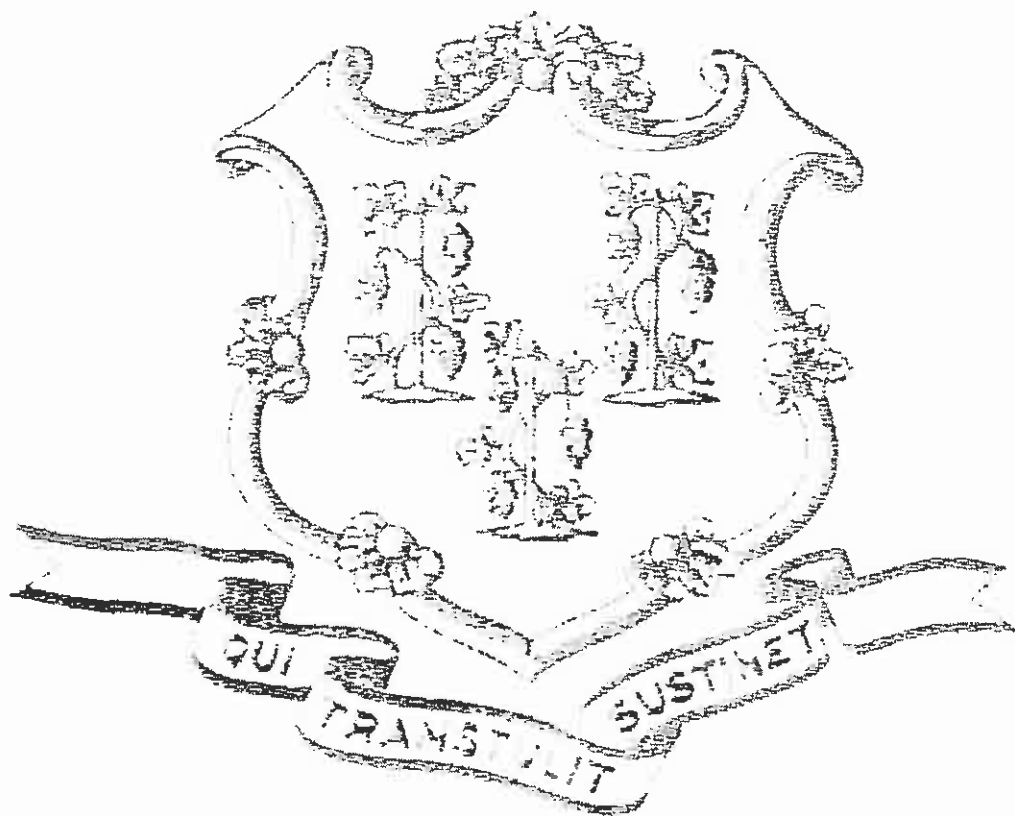


Radium Contamination at Former Watch Manufacturers in Waterbury, CT

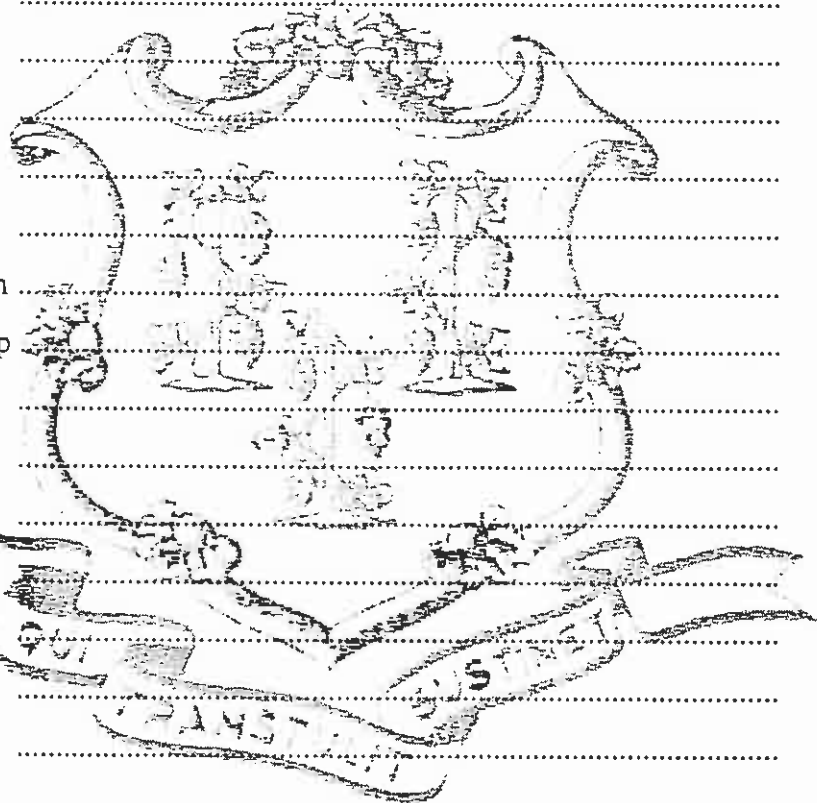


April 4, 1998

Abstract: From approximately 1900 until 1965, an entire industrial complex, on the corner of Cherry Avenue and Cherry Street in Waterbury, CT, was utilized by the former Waterbury Clock Company to manufacture time pieces painted with ^{226}Ra . Current uses of the complex include residential apartments, industrial manufacturing, storage and office activities. Radium contamination has been found in all of the buildings and is detailed herein.

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BELCO

Address: 39 Cherry Ave.
Waterbury, CT

Contact: Laurie Stevens, General Manager

Approximate Size: 200,000 ft²

Site Description: This facility is currently being used as a manufacturing site for belts, ties, handbags, and leatherworks. The building consists of six (6) floors on which office work, industrial production, and storage takes place. There are approximately 60 employees in the building during normal work hours. This site is very similar to the conditions at the time of the original radium dial painting. The floors and support pillars are all original. Smearable contamination is shown in various areas of the building. The primary location of the activity is where the wall and floor meet and where the pillars join the floor.

Areas of Building:	Basement	Staging Zone	Not Affected
	Second Floor	Belt Production	Not Affected
		Cutting Room	Affected
		Machine Shop	Affected
		Storage Room	Not Affected
	Third Floor	Tie Production	Not Affected
		Store Room	Affected
		Hallway	Affected
		Liba	Affected
		Leatherworks	Not Affected
	Fourth Floor	Tie Cutting	Not Affected
		Tie Mat.	Not Affected
		Store Room	Affected
		Leatherworks	Not Affected
	Fifth Floor	Belt Storage	Not Affected
		Rental Area	Affected
		Storage	Not Affected
	Sixth Floor	Leather	Not Affected
		NB	Not Affected
		Loft Machines	Not Affected

Notes:

The survey maps are unavailable at this time. The grid designations used were based on the position of the support pillars in the building. Typical grid spacing is 10 feet by 20 feet, however these spacings do vary. The only areas of the buildings that are detailed in this document have been shown to be affected. An affected grid is one that has any reading of over 30 $\mu\text{R/hr}$. The smear results are only being reported for "affected areas". The results of the smears for unaffected areas will be counted and reported on at a later date.

BUILDING:	BELCO	No. of People in the Area:	5
FLOOR:	Second	Average Occupancy:	45 hours/wk
AREA:	Cutting Room	Total No. Of Grids:	27
Background:	20 μ R/hr	Total No. Of Affected Grids:	4

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
23	2	2	40	40	
			45	45	
24	4	2	32	32	
			42	42	
26	2	2	50	50	No
			55	55	
27	4	4	50	50	No
			46	46	
			38	38	
			50	50	

BUILDING:	BELCO	No. of People in the Area:	2
FLOOR:	Second	Average Occupancy:	10 hours/wk
AREA:	Machine Shop	Total No. Of Grids:	9
Background:	20 μ R/hr	Total No. Of Affected Grids:	9

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
1	4	4	50	50	No
			50	50	
			50	50	
			50	50	
2	2	2	70	70	No
			80	80	
3	2	2	70	70	Yes
			70	70	
4	3	3	85	85	Yes
			70	70	
			70	70	
5	2	2	100	100	
			100	100	
6	5	5	90	90	Yes
			90	90	
			100	100	
			90	90	
			70	70	
7	3	3	70	70	No
			70	70	
			100	100	
8	5	5	100	100	Yes
			100	100	

BUILDING:	BELCO	No. of People in the Area:	2
FLOOR:	Second	Average Occupancy:	10 hours/wk
AREA:	Machine Shop - Cont.	Total No. Of Grids:	9
Background:	20 μ R/hr	Total No. Of Affected Grids:	9

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
8			140	140	
			120	120	
			100	100	
9	4	4	100	100	Yes
			100	100	
			90	90	
			90	90	

BUILDING:	BELCO	No. of People in the Area:	1
FLOOR:	Third	Average Occupancy:	1 hour/wk
AREA:	Store Room	Total No. Of Grids:	13
Background:	20 μ R/hr	Total No. Of Affected Grids:	13

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
1	1	1	30	40	Yes
2	2	2	160	110 225	
3	1	1	80	150	
4	1	1	45	70	
5	2	2	40 30	45 40	
6	3	3	200	150 105 120	
7	5	5	3200 80 1200 1500 55	250 150 100	Yes
8	2	2	1000 450		Yes
9	3	3	125 110 45	70 50 45	
10	2	2	1000 220	250 180	

BUILDING:	BELCO	No. of People in the Area:	1
FLOOR:	Third	Average Occupancy:	1 hour/wk
AREA:	Store Room - Cont.	Total No. Of Grids:	13
Background:	20 μ R/hr	Total No. Of Affected Grids:	13

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
11	2	2	2200		Yes
			380	120	
12	2	2	80	90	
			110	90	
13	3	3	85	40	
			80	60	
			30	30	

BUILDING:	BELCO	No. of People in the Area:	n/a
FLOOR:	Third	Average Occupancy:	n/a
AREA:	Hallway	Total No. Of Grids:	1
Background:	15 μ R/hr	Total No. Of Affected Grids:	1

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
1	24	20	25	32	Yes
			50	50	
			100	100	
			150	170	
			130	150	
			320	250	
			1000	1500	
			900	320	
			450	380	
			5000	1000	
			400	350	
			150	240	
			110	200	
			150	235	
			100	190	
			1000	800	
			300	250	
			150	200	
			1000	400	
			450	200	

BUILDING:	BELCO	No. of People in the Area:	4
FLOOR:	Third	Average Occupancy:	40 hours/wk
AREA:	Liba Room	Total No. Of Grids:	28
Background:	20 μ R/hr	Total No. Of Affected Grids:	22

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
1	4	4	130	35	
				40	
			200		
				40	
2	3	1	100		Yes
4	2	2	100	35	Yes
			50		
5	2	2	150		Yes
				40	
6	3	1	45	38	
7	5	1	35	22	
8	3	1	35		
10	4	1	120	24	
11	2	1	70	22	Yes
13	4	1	50		Yes
15	3	1	35		
16	4	1	100	25	Yes
17	3	1	40	22	
18	3	1	35	25	
19	4	1	90	24	Yes
21	3	1	50		
22	3	1	60	26	Yes
24	3	1	100	35	Yes

BUILDING:	BELCO	No. of People in the Area:	4
FLOOR:	Third	Average Occupancy:	40 hours/wk
AREA:	Liba Room - Cont.	Total No. Of Grids:	28
Background:	20 μ R/hr	Total No. Of Affected Grids:	22

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
25	4	2	130	30	Yes
			120	30	
26	4	3	40		Yes
			35	30	
				40	
27	6	4	100		No
				52	
				52	
				45	
28	7	5	300		Yes
			70	40	
				50	
				36	
				32	

BUILDING:	BELCO	No. of People in the Area:	1
FLOOR:	Fourth	Average Occupancy:	4 hours/wk
AREA:	Store Room	Total No. Of Grids:	18
Background:	15 μ R/hr	Total No. Of Affected Grids:	10

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
9	1	1	40	35	No
10	1	1	35	35	No
11	1	1	41	41	
12	2	2	45	45	
			40	45	
13	1	1	45	50	Yes
14	1	1	60	60	Yes
15	2	2	80	50	No
			70	50	
16	2	2	70	50	
			120	70	
17	1	1	95	65	No
18	2	2	70	50	No
			80	60	

BUILDING:	BELCO	No. of People in the Area:	0
FLOOR:	Fifth	Average Occupancy:	0 hours/wk
AREA:	Rental Area	Total No. Of Grids:	36
Background:	15 μ R/hr	Total No. Of Affected Grids:	9

<i>Grid Number</i>	<i>Number of Measurements</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
12	2	1	140	140	Yes
18	3	2	250	150	Yes
			45	45	
21	1	1	45	45	
24	3	3	600	600	Yes
			800	800	
			50	50	
27	1	1	450	450	Yes
30	2	2	450	450	Yes
				40	
33	1	1	800	45	Yes
34	2	1	100	100	Yes
36	2	1	140	35	Yes

SMEAR RESULTS

Floor: <i>Second</i>		Area: <i>Cutting Room</i>	
Grid Number	Smear Number	α Activity (dpm / 100 cm ²)	$\beta\gamma$ Activity (dpm / 100 cm ²)
25	1	ND	ND
26	2	ND	ND
27	3	ND	ND

SMEAR RESULTS

Floor: <i>Second</i>		Area: <i>Machine Shop</i>	
Grid Number	Smear Number	α Activity (dpm / 100 cm ²)	$\beta\gamma$ Activity (dpm / 100 cm ²)
1	2	ND	ND
2	5	ND	ND
3	8	13	ND
	11	113	232
4	12	6	ND
6	10	25	ND
7	3	ND	ND
8	4	150	147
9	9	38	ND

SMEAR RESULTS

Floor: <i>Third</i>		Area: <i>Store Room</i>	
Grid Number	Smear Number	α Activity (dpm / 100 cm ²)	$\beta\gamma$ Activity (dpm / 100 cm ²)
1	10	94	263
7	15	4,438	9,242
	14	469	1,021
	13	794	1,316
8	11	269	495
11	12	1,125	2,979

SMEAR RESULTS

Floor: <i>Third</i>		Area: <i>Hallway</i>	
Grid Number	Smear Number	α Activity (dpm / 100 cm ²)	$\beta\gamma$ Activity (dpm / 100 cm ²)
1	1	34	ND
	2	234	232
	3	297	958
	4	7,985	16,636
	5	41	147
	6	25	53
	7	22	63
	8	56	158
	9	16	63

SMEAR RESULTS

Floor: <i>Third</i>		Area: <i>Liba</i>	
Grid Number	Smear Number	α Activity (dpm / 100 cm ²)	$\beta\gamma$ Activity (dpm / 100 cm ²)
1	1		
	2		
	3		
	4		
2	11	13	84
3	12	328	695
4	13	69	21
	17	3	ND
5	10	13	63
11	9	88	189
12	16	25	ND
13	18	6	21
15	B5	106	147
16	B4	6	42
21	15	ND	ND
22	19	13	21
	20	ND	63
24	A2	32	126
25	8	294	316
	B2	32	ND
26	14	ND	295
27	A1	ND	ND
28	B1	22	147

SMEAR RESULTS

Floor: <i>Fourth</i>		Area: <i>Store Room</i>	
Grid Number	Smear Number	α Activity (dpm / 100 cm ²)	$\beta\gamma$ Activity (dpm / 100 cm ²)
2	12	13	63
6	11	13	63
	9	ND	ND
7	8	6	ND
9	10	ND	ND
10	1	ND	ND
13	2	6	ND
14	7	19	ND
15	6	ND	ND
17	3	ND	ND
18	4	ND	ND
	5	ND	ND

SMEAR RESULTS

Floor: <i>Fifth</i>		Area: <i>Rental Area</i>	
Grid Number	Smear Number	α Activity (dpm / 100 cm ²)	$\beta\gamma$ Activity (dpm / 100 cm ²)
2	18	6	ND
3	10	13	13
7	19	13	337
9	11	119	336
11	17	63	242
12	9	19	ND
13	20	106	232
18	12	106	358
	8	6	ND
20	16	94	189
22	21	31	295
24	7	6	105
27	13	88	316
	6	6	84
29	15	63	189
30	5	ND	105
31	22	50	137
33	14	44	189
	23	247	516
34	1	25	147
	2	6	21
35	3	100	179
36	4	56	189

ENTERPRISE APARTMENTS

Address: 13 Cherry Ave.
Waterbury, CT

Contact: Carol Greenspan, Property Manager

Approximate Size: 500,000 ft²

Site Description: These buildings are currently being used as apartments which house the elderly and the handicapped. There are 137 apartments in the 5 story complex. The apartments house from one to four people ranging in age from newborns to the elderly. The buildings were renovated in 1983 so as to convert them into apartments. Based on the activities found in the apartment complex, it is evident that the building was not completely "gutted". The radium most likely resides on the original flooring covered by new sub-flooring and new carpeting. This has greatly limited the possibility of ingesting the radium.

Areas of Building:	First Floor	Not Affected
	Second Floor	Not Affected
	Third Floor	Not Affected
	Fourth Floor	Affected (1 apartment)
	Fifth Floor	Affected (11 apartments)

Notes: The survey maps are unavailable at this time. All 137 apartments including hallways were surveyed. Any apartment with an exposure rate exceeding 30 $\mu\text{R/hr}$, on contact was considered affected.

<i>Room No.</i>	<i>Room or Area</i>	<i>BKG ($\mu R/hr$)</i>	<i>Occupancy (hrs/day)</i>	<i>Contact Exposure Rate ($\mu R/hr$)</i>	<i>Waist Level Exposure Rate ($\mu R/hr$)</i>	<i>Smearable Contamination</i>
417	Living Rm	10		240	15	
505	Living Rm	7		30	11	
				25	12	
507	Living Rm	10		90	30	
	Living Rm	10		70	10	
	Bedroom	10		45	15	
	Bedroom			35	15	
	Bedroom			70	20	
508	Kitchen	8		28	12	
512	Dining Rm	7		30	15	
	Bedroom	7		30	15	
513	Bedroom	8	Vacant	45	15	
514	Bedroom	10		100	30	
	Living Rm	10		70	25	
	Living Rm	10		20	15	
515	Living Rm	8		110	20	
516	Living Rm	12		25	15	
517	Bedroom	10		120	18	
520	Bedroom	10		30	15	
525	Bathroom	8		70	12	
	5th Floor Hallway	8		800	80	

NEW OPPORTUNITIES FOR WATERBURY (NOW)

Address: 232 North Elm St.
Waterbury, CT

Contact: Dr. James Gaitlin

Approximate Size: 250,000 ft²

Site Description: These buildings are currently being used for offices by NOW. Activities on the second through the fifth floor are typical office work. On the first floor however, there is a health clinic and a day care center. The buildings were renovated in 1983 so as to convert them into offices. Based on the activities found in the complex, it is evident that the building was not completely "gutted". The radium most likely resides on the original flooring covered by new sub-flooring and new carpeting. This has greatly limited the possibility of ingesting the radium.

Areas of Building:	First Floor	Not Affected
	Second Floor	Not Affected
	Third Floor	Affected (1 Office)
	Fourth Floor	Affected (8 Offices)
	Fifth Floor	Affected (4 Offices)

Notes: The survey maps are unavailable at this time. The entire building including hallways were surveyed. Any office with an exposure rate exceeding 30 $\mu\text{R/hr}$, on contact are considered affected.

<i>Floor</i>	<i>Room or Area</i>	<i>BKG (μR/hr)</i>	<i>Occupancy (hrs/day)</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contam.</i>
3	RS Office	10	7	60	18	
4	Waiting Rm	12		120	18	
4	FN Office	12	7	55	15	
4	Computer Rm	12		120	15	
4	Family Prev.	12		50	12	
4	NL Office	12	7	22	13	
4	Kitchen	12		35	13	
4	Head Start Rm	12		180	35	
				80	35	
				45	15	
4	DK Office	12	7	35	20	
5	CH Office	10	7	320	60	
				420	60	
5	Copy Rm	8	0.5	180	40	
				160	40	
5	Store Rm	8	0.5	360	100	
				380	60	
5	Rec. Area	12	3	4000	125	

VILLE AUTOMATICS

Address: 205 Cherry St.
Waterbury, CT

Contact: John Petro, Owner

Approximate Size: 50,000 ft²

Site Description: This 5 story building is currently being used for storing industrial sewing machine supplies. This site is very similar to the conditions at the time of the original radium dial painting. The floors and support pillars are all original. Currently, Ville employees 12 people.

Areas of Building:	First Floor	Not Affected
	Second Floor	Not Affected
	Third Floor	Affected
	Fourth Floor	Affected
	Fifth Floor	Affected

Notes: The survey maps are unavailable at this time. The entire building was surveyed. Any floor with an exposure rate exceeding 30 μ R/hr, on contact was considered affected.

<i>Floor</i>	<i>BKG</i> ($\mu\text{R/hr}$)	<i>Occupancy</i> (hrs/day)	<i>Contact</i> <i>Exposure Rate</i> ($\mu\text{R/hr}$)	<i>Waist Level</i> <i>Exposure Rate</i> ($\mu\text{R/hr}$)	<i>Smearable</i> <i>Contamination</i>
3	20		30 65 100	13 18 20	
4	20		40 30	20 16	
5	13		40	13	

BENDER PLUMBING

Address: Cherry St.
Waterbury, CT

Contact: Dave Bender, Owner

Approximate Size: 80,000 ft²

Site Description: This seven story building is being used as a warehouse for plumbing supplies. The building has not been renovated as appears to be in similar conditions to that of the original watch factory. The only exception to this is the addition put on the first floor for offices.

Areas of Building:	First Floor	Not Affected
	Second Floor	Not Affected
	Third Floor	Affected
	Fourth Floor	Affected
	Fifth Floor	Affected
	Sixth Floor	Not Affected
	Seventh Floor	Not Affected

Notes: The survey maps are unavailable at this time. The entire building including hallways were surveyed. Any area with an exposure rate exceeding 30 $\mu\text{R/hr}$, on contact was considered affected.

BUILDING:	Bender Plumbing	Total No. Of Grids:	252
Background:	5 - 10 μ R/hr	Total No. Of Affected Grids:	10

<i>Floor</i>	<i>Number of Grids</i>	<i>Number of Affected Grids</i>	<i>Number of Hot Spots</i>	<i>Contact Exposure Rate (μR/hr)</i>	<i>Waist Level Exposure Rate (μR/hr)</i>	<i>Smearable Contamination</i>
1	36	0	0			
2	36	0	0			
3	36	0	0			
4	36	2	6	100		
				120	26	
				100		
				70	22	
				80		
				90	23	
5	36	1	1	40	15	
6	36	0	0			
7	36	7	10			
					35	
					70	
					40	
				600	100	
				300	60	
					55	
				48	22	
				70	18	
				120	15	
				100	15	

Instrumentation: All surveys were performed with a Ludlum Model 19 - μ R meter.

An isotopic analysis was performed in the field with a NaI multi-channel analyzer, called a Scout and confirmed in the State Lab with a Canberra Gamma Spectroscopy system. The material identified was ^{226}Ra .

The smears were counted with a Ludlum Model 2200 Scaler with Ludlum Model 44-40 Beta - Gamma Probe and Model 43-10 Alpha Probe. The MDA of the instrument for the Beta-Gamma is 29 dpm / 100 cm^2 and for the Alpha it is 11 dpm / 100 cm^2 .