



Radon Info Package for Baumholder Elementary School BLDG 8033

05 June 2019

Installation Management Command integrates and delivers base support to enable readiness for a globally-responsive Army

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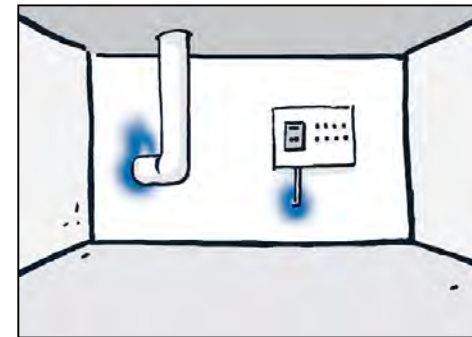
Serving the Rugged Professional

Radon Sampling Baumholder

Radon gas background info

- Radon is a naturally occurring tasteless, colorless gas
- Generated by the natural breakdown of soil, rocks, and sediments all over the world.
- BMC geologically a known radon prone area
- Radon enters the building through small cracks of building soil slabs & walls
- In excessive levels with consistent and prolonged exposure, Radon has been linked to severe health issues.

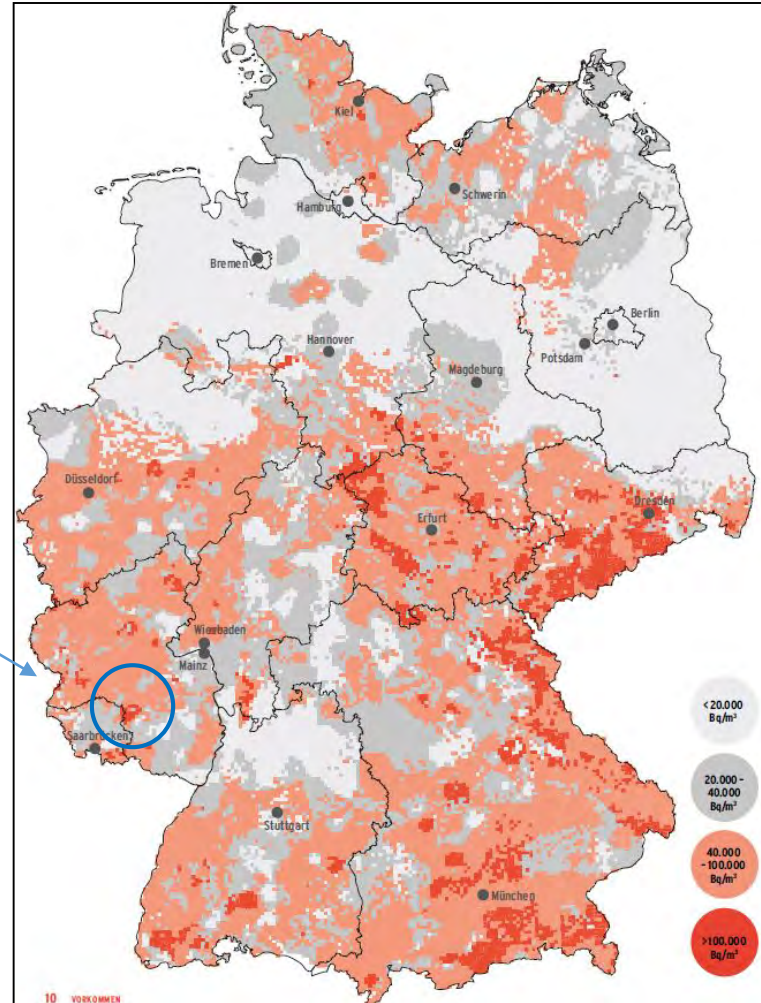
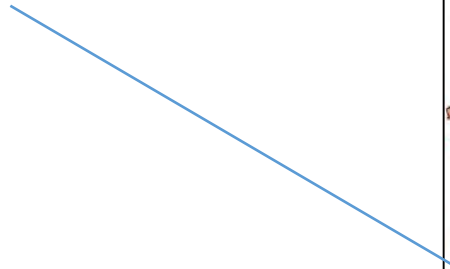
Note – while USAG-RP has verified higher than normal levels that require air exchange and mediation they are not high risk.



Radon Sampling Baumholder

Radon concentrations in soil gas in Germany

Baumholder Military Community



Source: BUNDESAMT FÜR STRAHLENSCHUTZ 2019



Radon Sampling Baumholder

Legal background

Radon is no longer regulated in German Final Governing Standards (FGS) nor in Army Regulation 200-1

■ Germany

- Radon monitoring is not regulated under the German Final Governing Standards (FGS)
- COUNCIL DIRECTIVE 2013/59/EURATOM was implemented on the national level on 27 Jun 2017 and effective as of Dec 2018.
 - Identifies 8,1 pCi/L (300 Bq/m³) as a generally safe level for work places and buildings with public access

■ USA

- US Environmental Protection Agency established a reference value of 4 pCi/L (148 Bq/m³)
- USACE Public Works Technical Bulletin 200-1-144 (appendix E: radon control), released on 30 Oct 2014, provides additional general guidance.



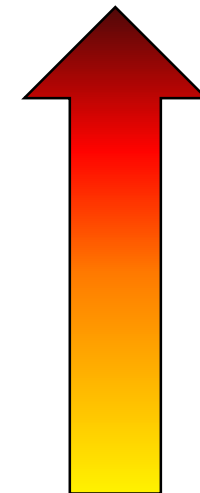
Radon Sampling Baumholder

Legal background

- Radon is not in the FGS for Germany.
- U.S. DEPARTMENT OF THE ARMY (2002): Department of the Army Pamphlet 200-1, Environmental Quality, Environmental Protection and Enhancement, Washington.

	Radon in pCi/L	Radon in Bq/m ³	Mitigation required within
	<4	<148	No action required
	≥4 bis <8	≥148 bis <296	5 years
	≥8 bis <20	≥296 bis <740	1-4 years
	20 bis <200	≥740 bis <7400	6 months
	≥200	≥7400	1 month or move the occupants

Mitigation Priority



Daycare centers,
hospitals, schools,
living areas, billets

Areas having 24-
hour operations

All other routinely
occupied structures

Source: Haid, data basis: U.S. DA PAM 200-1, 2002

< 4 pCi/L considered as low risk threshold by US Environmental Protection Agency

< 8 pCi/L considered low risk threshold by Germany per COUNCIL Directive 2013/59/EURATOM



Results of Radon Sampling requested by DODEA

Previous Baumholder Radon Sampling Data (2016)

BLDG	Floor	Room	Comments	LTM #	Deployment	Retrieval	Result (pCi/l)	Result (Bq/m ³)
8801	B	12	Class Room	522536-2	28-Oct-15	22-Nov-16	1.3	48
8801	B	11	Class Room	561056-3	28-Oct-15	22-Nov-16	1.1	41
8801	B	14	Office	433927-1	28-Oct-15	22-Nov-16	7.8	289
8801	B	15	Class Room	536818-8	28-Oct-15	22-Nov-16	4.4	163
8801A	1	16	Class Room	496506-7	28-Oct-15	22-Nov-16	0.7	26
8801A	1	19	Class Room	562872-2	28-Oct-15	22-Nov-16	0.7	26
8801A	1	20	Class Room	675205-9	28-Oct-15	22-Nov-16	0.6	22
8801A	1	22	Class Room	670424-1	28-Oct-15	22-Nov-16	0.8	30
8802	1	26-27	Class Room	614722-7	28-Oct-15	22-Nov-16	0.8	30
8802	1	24	Class Room	539705-4	28-Oct-15	22-Nov-16	2.4	89
8033	1	106	Supply, Office	676196-9	28-Oct-15	22-Nov-16	6.4	237
8033	1	103	Class Room	616473-5	28-Oct-15	22-Nov-16	7.8	289
8033	1	108	Class Room	688947-1	28-Oct-15	22-Nov-16	4.6	170
8033	1	Library	Library	599419-9	28-Oct-15	22-Nov-16	1.3	48
8033A	1	401	CDC	606692-2	28-Oct-15	22-Nov-16	0.8	30
8033A	1	404	CDC	570971-2	28-Oct-15	22-Nov-16	1.3	48

**2016 Baumholder
Smith Elementary
School Data**

Remediation actions, for areas with results of above 4.0 and less than 8.0, is to increase frequency of ventilation and resample in 5 years.



Radon Sampling Baumholder

Radon sampling evaluation and recommendations

- Radon sampling report provided to DODEA in Jan 2017
 - Efficiency of technical solutions (e.g. technical ventilation) limited at low concentrations
 - Efficient and recommended approach:
 - Periodical cross-ventilation (several times a day for 3-5 minutes) allowing regular air exchanges (quasi radon-free atmospheric air)
- Retesting in 2018-19 (3-months and 1-year monitoring)
 - Predominantly low concentrations identified during 2018 resampling
 - Further long-term monitoring on-going (until end of Apr 2019)
 - On-going testing in further 20 rooms as requested by DODEA (until end of April 2019)
 - Reevaluation pending (May/June 2019)

**2018 Smith Elementary
School Data
3 months testing**

BLDG	Floor	Room	Comments	LTM #	Deployment	Retrieval	Result (pCi/l)	Result (Bq/m ³)
8033	1	106	Supply, Office	137643-3	25-Apr-18	06-Aug-18	1.1	41
8033	1	103	Class Room	136083-3	25-Apr-18	06-Aug-18	4.0	148
8033	1	108	Class Room	206359-2	25-Apr-18	06-Aug-18	2.7	100



Radon Sampling Baumholder

Radon sampling evaluation and recommendations

- Retesting in 2018-19 (1 year monitoring)
 - Predominantly low concentrations identified during 2018-19 resampling
 - Lower concentration than in 2015-16
 - Room 103 still has radon concentrations >4 pCi/L

BLDG	Floor	Room	Comments	LTM #	Deployment	Retrieval	Result (pCi/l)	Result (Bq/m ³)
8033	1	106	Supply, Office	137643-3	25-Apr-18	17-Apr-19	0.4	15
8033	1	103	Class Room	136083-3	25-Apr-18	17-Apr-19	5.3	196
8033	1	108	Class Room	206359-2	25-Apr-18	17-Apr-19	2.1	78

**2018-19 Smith
Elementary School Data
1 year testing**



Radon Sampling Baumholder

Radon sampling evaluation and recommendations

- Further testing of other rooms in 2019 (3 months monitoring)
 - 8 of 17 rooms (47%) show radon concentrations >4 pCi/L
 - 2 of 17 rooms show radon concentrations >8 pCi/L, 1 reading requires a verification

BLDG	Floor	Room	Comments	LTM #	Deployment	Retrieval	Result (pCi/l)	Result (Bq/m ³)
8033	1	101	Speaker next to board	136219-3	16-Jan-19	17-Apr-19	7.8	289
8033	1	103	Speaker next to board	137548-4	16-Jan-19	17-Apr-19	6.8	252
8033	1	105	Speaker next to board	137691-2	16-Jan-19	17-Apr-19	6.1	226
8033	1	107	Speaker next to board	136988-3	16-Jan-19	17-Apr-19	8.5	315
8033	1	109	Speaker next to board	137737-3	16-Jan-19	17-Apr-19	5.9	218
8033	1	108	Speaker next to board	137338-0	16-Jan-19	17-Apr-19	4.5	167
8033	1	113	Speaker next to board	137426-3	16-Jan-19	17-Apr-19	3.1	115
8033	1	110	Library	136976-8	16-Jan-19	17-Apr-19	1.8	67
8033	1	110	TV in library	136478-5	16-Jan-19	17-Apr-19	2.0	74
8033	1	110A	Cabinet	136136-3	16-Jan-19	17-Apr-19	4.0	148
8033	1	110B	Board	136458-7	16-Jan-19	17-Apr-19	2.2	81
8033	1	110C	Speaker next to board	136158-3	16-Jan-19	17-Apr-19	1.9	70
8033	1	106	Power distribution	136130-2	16-Jan-19	17-Apr-19	1.0	37
8033	1	139	Office gym	108495-3	16-Jan-19	17-Apr-19	19.8	733
8033	1	104	Housekeeping	206449-1	16-Jan-19	17-Apr-19	0.3	11
8033	1	102	Teachers lounge	137505-4	16-Jan-19	17-Apr-19	1.9	70
8033	1		Cafeteria power distr.	108306-2	16-Jan-19	17-Apr-19	1.4	52

**2019 Smith Elementary
School Data
3 months testing**



Radon Sampling Baumholder

Radon sampling evaluation and recommendations

- Further testing of one year monitoring 2018/2019
 - 9 of 24 rooms show radon concentrations >4 pCi/L
 - 2 of 24 rooms show radon concentrations >8 pCi/L, 1 reading requires a verification

BLDG #	Room	LTM #	Deployment	Retrieval	Result (pCi/l)	Result (Bq/m ³)	Comments	Floor Average (pCi/l)	Floor Average (Bq/m ³)
Radon Investigation on Smith Elementary School April 2019									
BLDG's 8033 & 8033A									
8033	101	136219-3	16-Jan-19	17-Apr-19	7.8	289	Speaker next to board	4.6	172
8033	103	137548-4	16-Jan-19	17-Apr-19	6.8	252	Speaker next to board	incl. LTM 108495-3	
8033	105	137691-2	16-Jan-19	17-Apr-19	6.1	226	Speaker next to board		
8033	107	136988-3	16-Jan-19	17-Apr-19	8.5	315	Speaker next to board	3.7	137
8033	109	137737-3	16-Jan-19	17-Apr-19	5.9	218	Speaker next to board	excl. LTM 108495-3	
8033	108	137338-0	16-Jan-19	17-Apr-19	4.5	167	Speaker next to board		
8033	113	137426-3	16-Jan-19	17-Apr-19	3.1	115	Speaker next to board		
8033	110	136976-8	16-Jan-19	17-Apr-19	1.8	67	Library		
8033	110	136478-5	16-Jan-19	17-Apr-19	2.0	74	TV in library		
8033	110A	136136-3	16-Jan-19	17-Apr-19	4.0	148	Cabinet		
8033	110B	136458-7	16-Jan-19	17-Apr-19	2.2	81	Board		
8033	110C	136158-3	16-Jan-19	17-Apr-19	1.9	70	Speaker next to board		
8033	106	136130-2	16-Jan-19	17-Apr-19	1.0	37	Power distribution		
8033	139	108495-3	16-Jan-19	17-Apr-19	19.8	733	Office gym		
8033	104	206449-1	16-Jan-19	17-Apr-19	0.3	11	Housekeeping		
8033	102	137505-4	16-Jan-19	17-Apr-19	1.9	70	Teachers lounge		
8033		108306-2	16-Jan-19	17-Apr-19	1.4	52	Cafeteria power distribution		
8033A	401	137063-4	16-Jan-19	17-Apr-19	1.6	59	Speaker next to board	1.7	63
8033A	402	137284-6	16-Jan-19	17-Apr-19	2.1	78	Speaker next to board		
8033A	403	136817-4	16-Jan-19	17-Apr-19	1.2	44	Speaker next to board		
8033A	404	137549-2	16-Jan-19	17-Apr-19	1.9	70	Speaker next to board		
8033	103	135988-4	25-Apr-18	17-Apr-19	5.3	196	Speaker next to board	2.6	96
8033	106	137491-7	25-Apr-18	17-Apr-19	0.4	15	Speaker next to board		
8033	108	206341-0	25-Apr-18	17-Apr-19	2.1	78	Speaker next to board		

Mitigation time frames from receipt of test results IAW DA PAM 200-1, Environmental Protection and Enhancement, 17 Jan 02

Radon concentration <4 pCi/l	No action required
Radon concentration ≥4 pCi/l to <8 pCi/l	Mitigation required within 5 years
Radon concentration ≥8 pCi/l to <20 pCi/l	Mitigation required within 1-4 years
Radon concentration ≥20 pCi/l to <200 pCi/l	Mitigation required within 6 months
Radon concentration ≥200 pCi/l	Mitigation required within 1 month or move occupants

Status: 5-Jun-19



Radon Investigation on Smith Elementary School April 2019									
BLDG's 8033 & 8033A									
BLDG #	Room	LTM #	Deployment	Retrieval	Result (pCi/l)	Result (Bq/m ³)	Comments	Floor Average (pCi/l)	Floor Average (Bq/m ³)
8033	101	136219-3	16-Jan-19	17-Apr-19	7.8	289	Speaker next to board	4.6	172
8033	103	137548-4	16-Jan-19	17-Apr-19	6.8	252	Speaker next to board	incl. LTM 108495-3	
8033	105	137691-2	16-Jan-19	17-Apr-19	6.1	226	Speaker next to board		
8033	107	136988-3	16-Jan-19	17-Apr-19	8.5	315	Speaker next to board	3.7	137
8033	109	137737-3	16-Jan-19	17-Apr-19	5.9	218	Speaker next to board	excl. LTM 108495-3	
8033	108	137338-0	16-Jan-19	17-Apr-19	4.5	167	Speaker next to board		
8033	113	137426-3	16-Jan-19	17-Apr-19	3.1	115	Speaker next to board		
8033	110	136976-8	16-Jan-19	17-Apr-19	1.8	67	Library		
8033	110	136478-5	16-Jan-19	17-Apr-19	2.0	74	TV in library		
8033	110A	136136-3	16-Jan-19	17-Apr-19	4.0	148	Cabinet		
8033	110B	136458-7	16-Jan-19	17-Apr-19	2.2	81	Board		
8033	110C	136158-3	16-Jan-19	17-Apr-19	1.9	70	Speaker next to board		
8033	106	136130-2	16-Jan-19	17-Apr-19	1.0	37	Power distribution		
8033	139	108495-3	16-Jan-19	17-Apr-19	19.8	733	Office gym		
8033	104	206449-1	16-Jan-19	17-Apr-19	0.3	11	Housekeeping		
8033	102	137505-4	16-Jan-19	17-Apr-19	1.9	70	Teachers lounge		
8033		108306-2	16-Jan-19	17-Apr-19	1.4	52	Cafeteria power distribution		
8033A	401	137063-4	16-Jan-19	17-Apr-19	1.6	59	Speaker next to board	1.7	63
8033A	402	137284-6	16-Jan-19	17-Apr-19	2.1	78	Speaker next to board		
8033A	403	136817-4	16-Jan-19	17-Apr-19	1.2	44	Speaker next to board		
8033A	404	137549-2	16-Jan-19	17-Apr-19	1.9	70	Speaker next to board		
8033	103	135988-4	25-Apr-18	17-Apr-19	5.3	196	Speaker next to board	2.6	96
8033	106	137491-7	25-Apr-18	17-Apr-19	0.4	15	Speaker next to board		
8033	108	206341-0	25-Apr-18	17-Apr-19	2.1	78	Speaker next to board		
Mitigation time frames from receipt of test results IAW DA PAM 200-1, Environmental Protection and Enhancement, 17 Jan 02									
	Radon concentration <4 pCi/l			No action required					
	Radon concentration ≥4 pCi/l to <8 pCi/l			Mitigation required within 5 years					
	Radon concentration ≥8 pCi/l to <20 pCi/l			Mitigation required within 1-4 years					
	Radon concentration ≥20 pCi/l to <200 pCi/l			Mitigation required within 6 months					
	Radon concentration ≥200 pCi/l			Mitigation required within 1 month or move occupants					
Status:	5-Jun-19								



Radon Sampling Baumholder

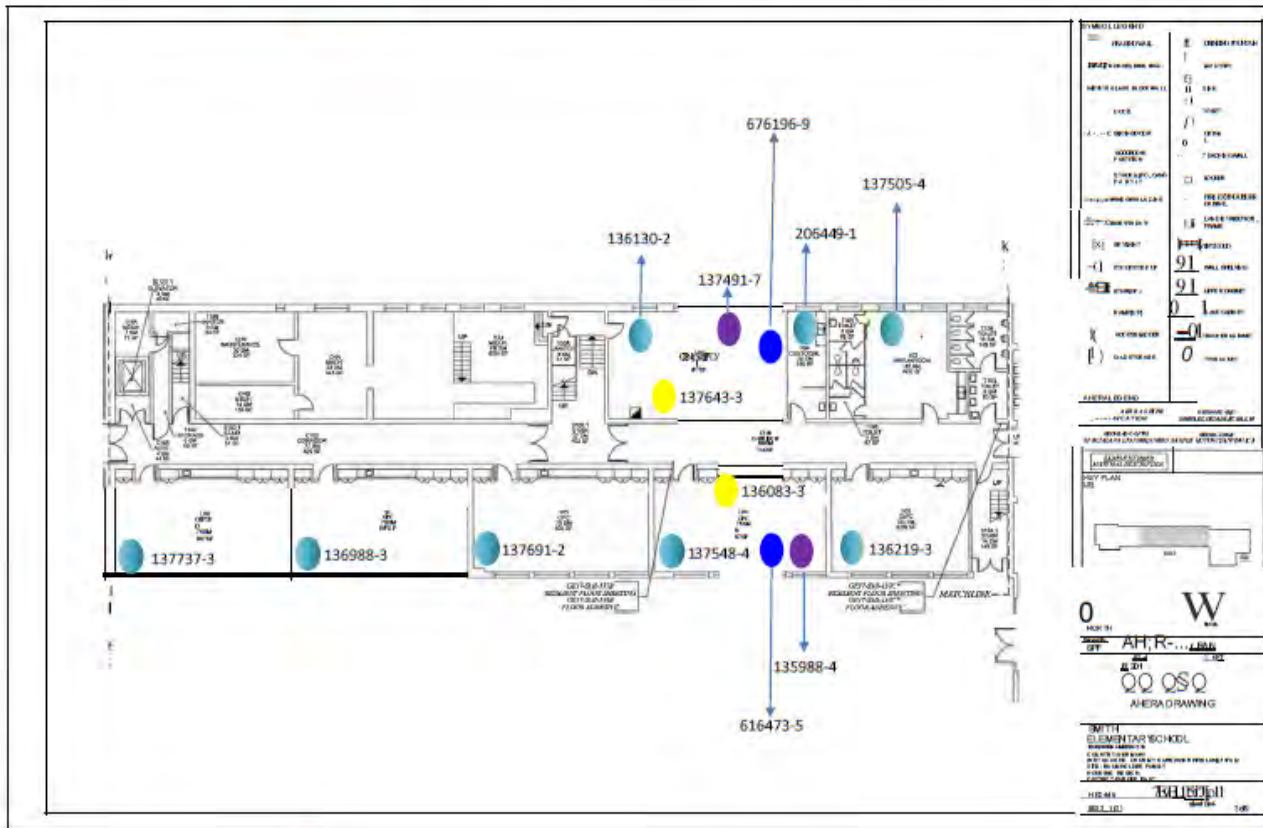
Radon sampling evaluation and recommendations

- Floor plans from Baumholder Elementary School Bldg. 8033 and Bldg. 8033 A including current sample location and historical sample locations.



Radon Sampling Baumholder

Priority	Mitigation time frames from receipt of test results IAW DA PAM 200-1, Environmental Protection and Enhancement, 17 Jan 02
5	Radon concentration <4 pCi/l No action required
4	Radon concentration ≥4 pCi/l to <8 pCi/l Mitigation required within 5 years
3	Radon concentration ≥8 pCi/l to <20 pCi/l Mitigation required within 1-4 years
2	Radon concentration ≥20 pCi/l to <200 pCi/l Mitigation required within 6 months
1	Radon concentration ≥200 pCi/l Mitigation required within 1 month or move occupants



Sampling Location for Sampling 2019 (Period 16 Jan 2019 till 17 April 2019)

136130-2 Inside Room 106	1,0 (pCi/l)
206449-1 Inside Room 104	< 0,3 (pCi/l)
137505-4 Inside Room 102	1,9 (pCi/l)
136219-3 Inside Room 101	7,8 (pCi/l)
137548-4 Inside Room 103	6,8 (pCi/l)
137691-2 Inside Room 105	6,1 (pCi/l)
136988-3 Inside Room 107	8,5 (pCi/l)
137737-3 Inside Room 109	5,9 (pCi/l)

Sampling location for one Year Sampling 25 April 2018 till 17 April 2019

135988-4 Inside Room 103	5,3 (pCi/l)
137491-7 Inside Room 106	0,4 (pCi/l)

Sampling Location for Sampling 2015 (Period 28 Oct 2015 till 22 Nov 2016)

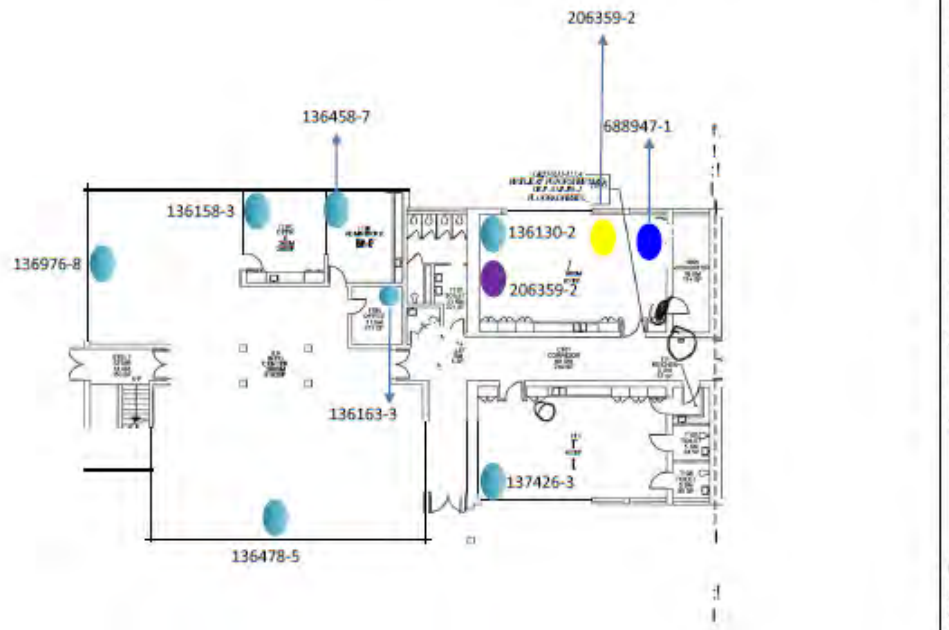
676196-9 Inside Room 106	6,4 (pCi/l)
616473-5 Inside Room 103	7,8 (pCi/l)

Sampling Location for Sampling 2018 (Period 25 April 2018 till 06 Aug 2016)

136083-3 Inside Room 103	4,0 (pCi/l)
137643-3 Inside Room 106	1,1 (pCi/l)

Radon Sampling Baumholder

Priority	Mitigation time frames from receipt of test results IAW DA PAM 200-1, Environmental Protection and Enhancement, 17 Jan 02
5	Radon concentration <4 pCi/l No action required
4	Radon concentration ≥4 pCi/l to <8 pCi/l Mitigation required within 5 years
3	Radon concentration ≥8 pCi/l to <20 pCi/l Mitigation required within 1-4 years
2	Radon concentration ≥20 pCi/l to <200 pCi/l Mitigation required within 6 months
1	Radon concentration ≥200 pCi/l Mitigation required within 1 month or move occupants



● Sampling Location for Sampling 2019 (Period 16 Jan 2019 till 17 April 2019)

136976-8 Inside Room 110	1,8 (pCi/l)
136478-5 Inside Room 110	2,0 (pCi/l)
136163-3 Inside Room 110A	4,0 (pCi/l)
136458-7 Inside Room 110B	2,2 (pCi/l)
136158-3 Inside Room 110C	1,9 (pCi/l)
137426-3 Inside Room 113	3,1 (pCi/l)
137338-0 Inside Room 108	4,5 (pCi/l)

● Sampling location for one Year Sampling 25 April 2018 till 17 April 2019

206341-0 Inside Room 108	2,1 (pCi/l)
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● Sampling Location for Sampling 2015 (Period 28 Oct 2015 till 22 Nov 2016)

688947-1 Inside Room 108	4,6 (pCi/l)
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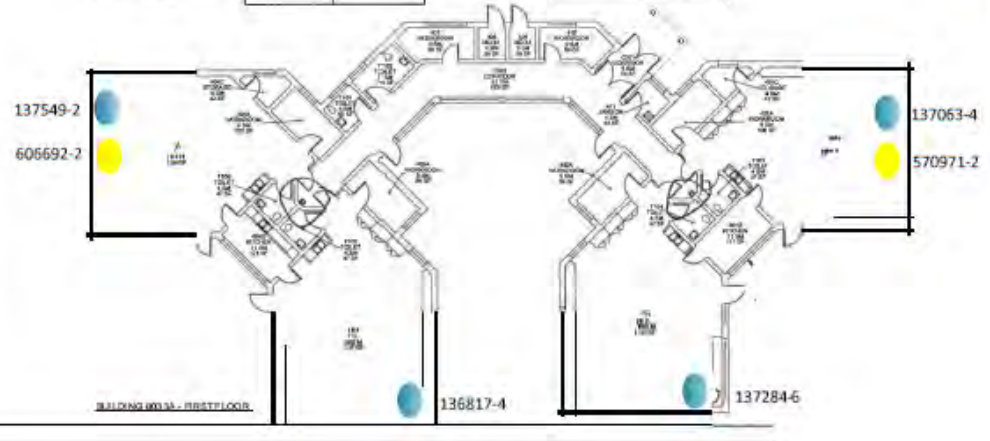
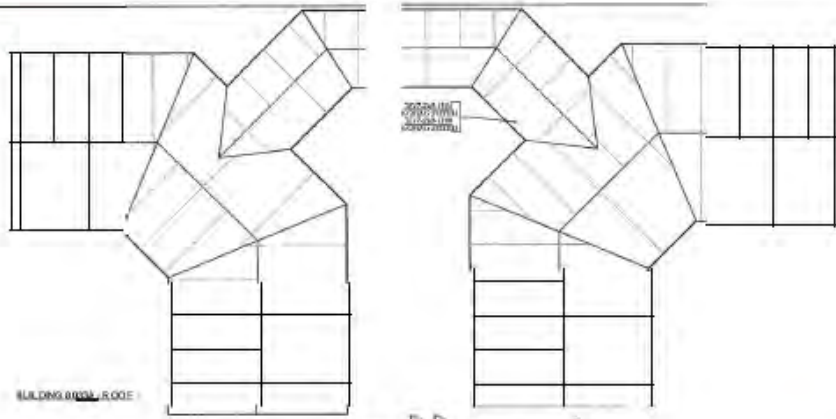
● Sampling Location for Sampling 2018 (Period 25 April 2018 till 06 Aug 2016)

206359-2 Inside Room 108	2,7 (pCi/l)
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Radon Sampling Baumholder

Priority	Mitigation time frames from receipt of test results IAW DA PAM 200-1, Environmental Protection and Enhancement, 17 Jan 02
5	Radon concentration ≤ 4 pCi/l No action required
4	Radon concentration 24 pCi/l to <math>< 48</math> pCi/l Mitigation required within 5 years
3	Radon concentration 28 pCi/l to <math>< 200</math> pCi/l Mitigation required within 1-4 years
2	Radon concentration ≥ 20 pCi/l to <math>< 200</math> pCi/l Mitigation required within 6 months
1	Radon concentration ≥ 200 pCi/l Mitigation required within 1 month or move occupants



● Sampling Location for Sampling 2019 (Period 16 Jan 2019 till 17 April 2019)

- 137063-4 Inside Room 401 1,6 (pCi/l)
- 137284-6 Inside Room 402 2,1 (pCi/l)
- 136817-4 Inside Room 403 1,2 (pCi/l)
- 137549-2 Inside Room 404 1,9 (pCi/l)

● Sampling Location for Sampling 2016 (Period 28 Oct 2015 till 22 Nov 2016)

- 606692-2 Inside Room 401 0,8 (pCi/l)
- 570971-2 Inside Room 404 1,3 (pCi/l)



Radon Sampling Baumholder

Radon sampling evaluation and recommendations

- Further testing of other rooms in 2019 (3 months monitoring)
 - No rooms show radon concentrations >4 pCi/L

BLDG	Floor	Room	Comments	LTM #	Deployment	Retrieval	Result (pCi/l)	Result (Bq/m ³)
8033A	1	401	Speaker next to board	137063-4	16-Jan-19	17-Apr-19	1.6	59
8033A	1	402	Speaker next to board	137284-6	16-Jan-19	17-Apr-19	2.1	78
8033A	1	403	Speaker next to board	136817-4	16-Jan-19	17-Apr-19	1.2	44
8033A	1	404	Speaker next to board	137549-2	16-Jan-19	17-Apr-19	1.9	70

**2019 Smith Elementary
School Data
3 months testing**



Radon Sampling Baumholder

Radon sampling evaluation and recommendations

- No further action needed in B8033A
- Verification (building inspection and radon sniffing) required for B8033 R139
- Periodical cross-ventilation (several times a day for 3-5 minutes) to ensure regular air exchanges (quasi radon-free atmospheric air) as overall approach



Behavior change.

- Technical ventilation for concerned rooms that remain high after air exchanges. While not an immediate health risk we should provide a mechanical ventilation system



Project.



Radon Sampling Baumholder

Back-up slide ventilation effects



Source: BUNDESAMT FÜR STRAHLENSCHUTZ 2019

