U.S. EPA Vapor Intrusion Workshop

How Vapor Intrusion Data Measured by Communities and Supported by Regulators can Create "Soil Gas Safe Communities"

Methods and Approach for Equivalent Protection Cost Effectiveness analysis of I&T vs. traditional sampling, screening & mitigation approaches

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Evaluating Options for Equal Protection

Goal:

Assess the difficulty and costs of providing “equivalent protection”

Sampling can be expensive

- Ensure we focus testing on observing problematic levels if they exist at a site with a defined minimal risk of false negative
- Mechanism to stop sampling when tested levels are far below problematic concentrations
- Mitigation where issues are found to make sure everyone is equivalently protected

Sampling Strategies:

1) Conventional sampling strategies (random or seasonal)
2) I&T guided sampling, and
3) Mitigation guided directly by radon observations.

Equivalent protection: Accept only 5% false negative rate per building.

Calculate how many samples and the cost to confidently observe risk screening level exceedances

- Non-cancer hazard quotient (HQ): HQ= 0.1, 1 or 3 and
- Total Cancer Risk = 10^{-6}, 10^{-5}, 10^{-4}

Risk screening levels

Our goal with this analysis is to see how many samples we'll need to collect to observe:

1. the non-cancer risk level once (if it exceeds more than 5% of the time)

2. the mean of collected samples exceed the 10^{-6} cancer risk level

Assumptions: a mean of a minimum of four short term samples will be needed to estimate long term exposure. A single exceedance of HQ=1 will be interpreted as exceeding the noncancer screening level.

We use DTSC and EPA residential risk based indoor screening levels for the residential sites in current

Analyte	Cancer risk screening level based on 10^{-6} TCR	Non-cancer risk based screening level based on HQ = 1	Units
TCE	0.48	2.1	ug/m^3
PCE	0.46	42	ug/m^3
CHCl3	0.12	100	ug/m^3

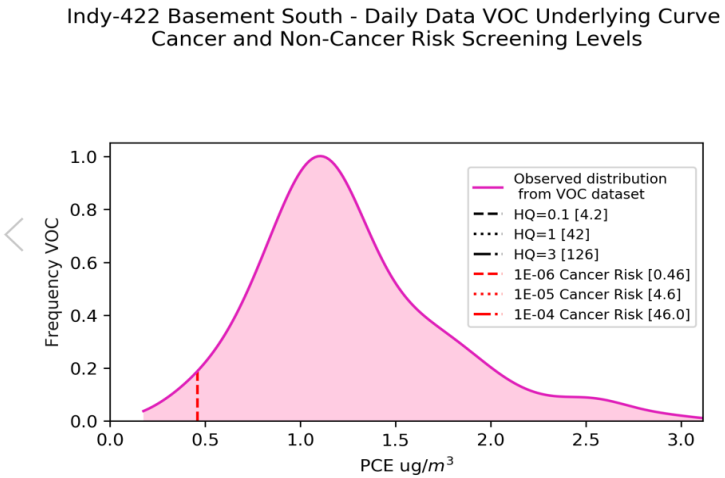
Risk based screening levels from:
DTSC, 2020. Human Health Risk Assessment (HHRA) Note 3, DTSC-modified Screening Levels (DTSC-SLs). April 2019.
Available online: http://www.dtsc.ca.gov/AssessingRisk/upload/HERO_HHRA_Note_3_June_2018.pdf
USEPA, 2021. Regional Screening Level (RSL) Table. Nov 2021.
Available online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

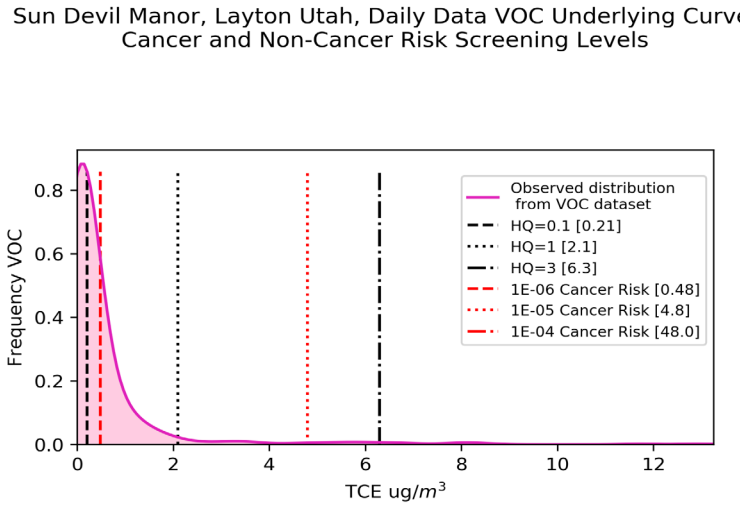
Risk screening levels

To evaluate sensitivity around the action levels, we include a higher and lower risk based action level for both noncancer and cancer based screening levels with the same two criteria:

1. the non-cancer risk level once (HQ = 0.1, HQ = 1, HQ =3)

2. the mean of collected samples exceed the 10^{-6} (and 10^{-4} and 10^{-5}) cancer risk level

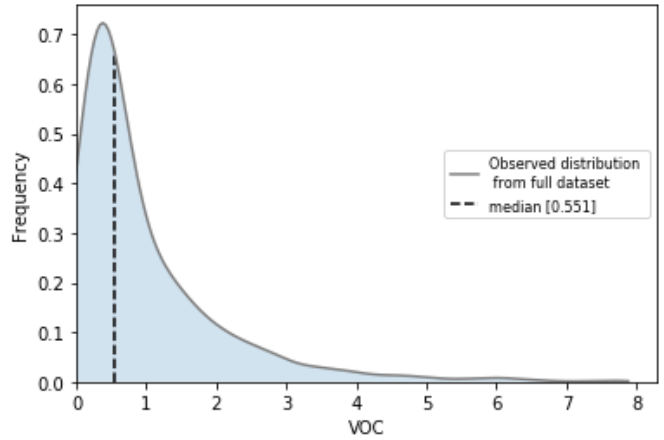




CVOC	Risk Level	Cancer or Non-Cancer	Residential screening level (µg/m³)	Commercial screening level (µg/m³)
TCE	10^{-6}	Cancer	0.48	3
	10^{-5}		4.8	30
	10^{-4}		48	300
	HQ = 0.1	non-cancer	0.21	0.88
	HQ = 1		2.1	8.8
	HQ = 3		6.3	26.4
PCE	10^{-6}	Cancer	0.46	2
	10^{-5}		4.6	20
	10^{-4}		46	200
	HQ = 0.1	non-cancer	4.2	18
	HQ = 1		42	180
	HQ = 3		126	540

Sampling for Non-Cancer based risk (HQ)

Observed Distribution
VA Site A Supply Room



100 random draws from observed distribution

<u>First Step:</u>

Conduct random sampling until we observe an exceedance of HQ = 1 once.

To simulate random sampling, we randomly select samples from the observed distribution

Using our random draws, we'll count how many draws we observed before we exceeded the residential non-cancer screening level (TCE, 2.1 ug/m^3) the first time

In this case the 7th sample was an exceedance.

Draw	VOC Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	2.8904	Y
8	3.4979	Y

98	0.2974	N
99	2.1027	N
100	4.1215	Y

Key Assumptions/Procedures Noncancer

- We seek to evaluate whether the noncancer action level is exceeded more than 5% of the time.
  - We stop sampling and mitigate after the first exceedance of the non-cancer action level (and assume that this suggests >5% exceedance).
  - We evaluate how many samples are required from a particular distribution to exceed the non-cancer screening level once with 95% certainty.
  - But if we have not seen an exceedance in 58 samples we stop sampling and don't mitigate, since probability theory tells us that this is sufficient to see the 95th percentile once with 95 confidence – no distribution assumptions needed.

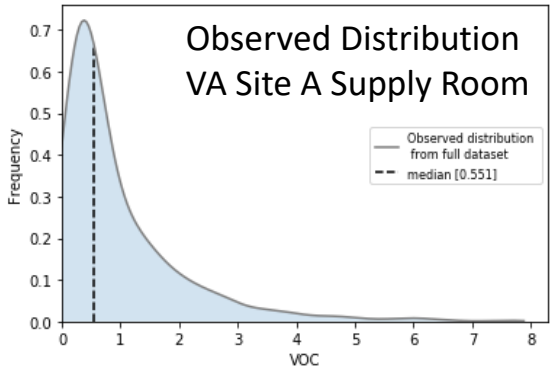
Draw	TCE Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	2.8904	Y
8	3.4979	Y

Draw	TCE Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	0.8904	N
8	1.4979	N

56	0.2974	N
57	1.587	N
58	0.1215	N

Sampling for Non-Cancer based risk (HQ)

From the previous step, we have a distribution of 100 draws with the number of random samples until we saw an exceedance of HQ = 1



random draws from observed distribution

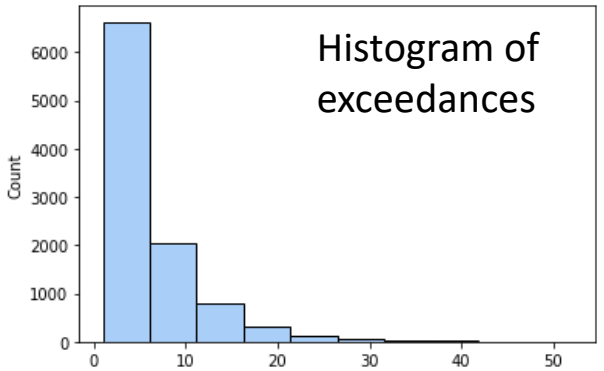
Draw	VOC Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	2.8904	Y
8	3.4979	Y

Samples until HQ=1 Exceeded: 7

Then we repeat the process of drawing 100 random samples 10,000 times, recording the number of samples before an exceedance each time.

Repeat x10,000 times

Calculate the number samples needed to satisfy our desired false negative and false positive rates



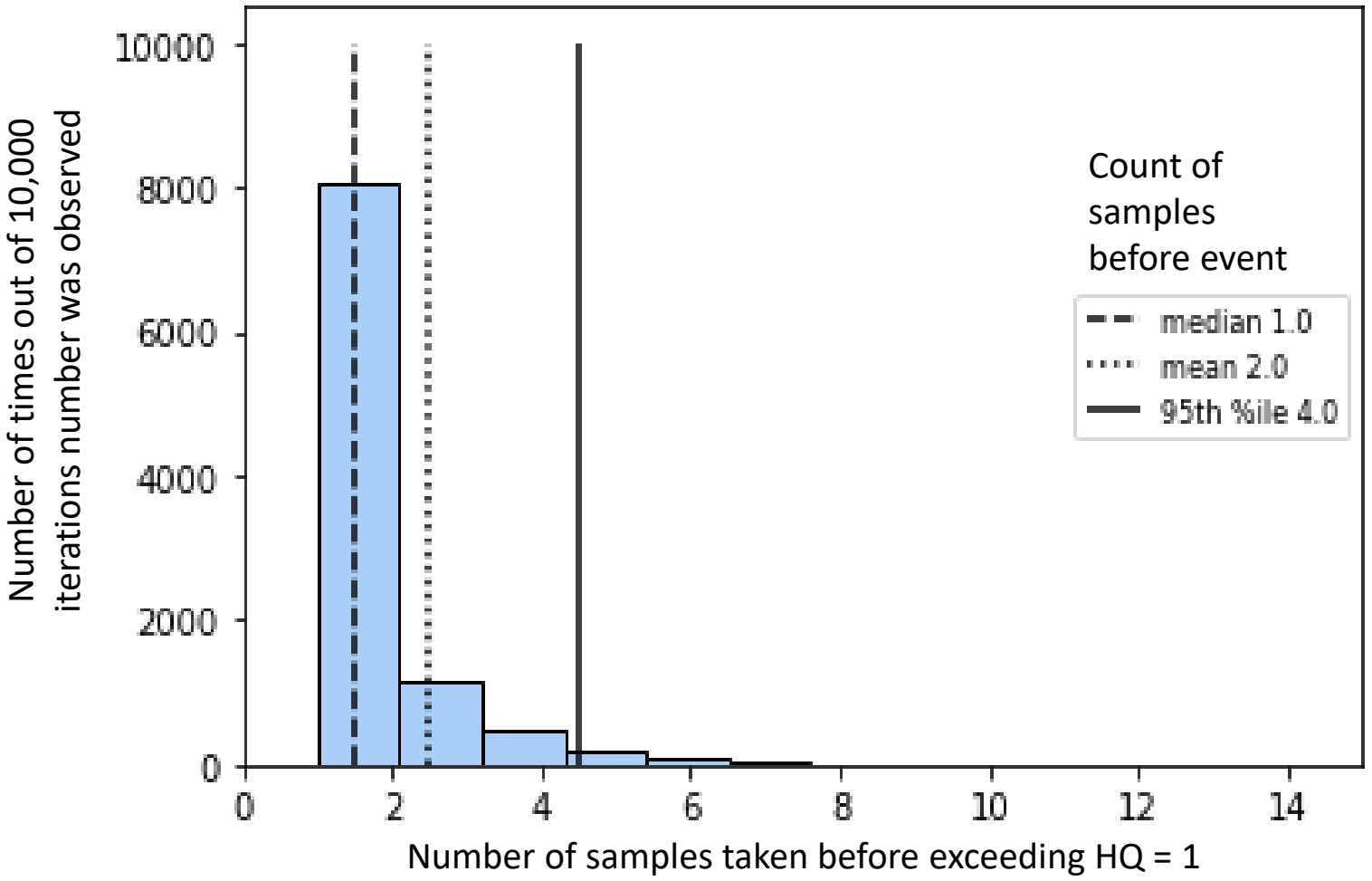
Number of samples taken before exceeding HQ = 1

Samples until HQ=1 Exceeded: 7, 5, 6, 2, 4, 13, ….

Sampling for Non-Cancer based risk (HQ)

Evaluate the distribution for each sampling strategy based on non-cancer

Sample using only random or convenience scheduled indoor air sampling



Repeat the above analysis for each sampling strategy

Sampling for cancer based risk

For cancer based risk screening level, we draw 1 sample randomly from our distribution

Draw	VOC Concentration	Mean	Cancer Risk Level?
1	0.52	0.13	N
1a	0	-	-
1b	0	-	-
1c	0	-	-

If it is not, we draw 1 additional sample randomly from our distribution

Draw	VOC Concentration	Mean	Cancer Risk Level?
1	0.52	0.13	N
2	0.61	0.28	N
2a	0	-	-
2b	0	-	-

If it still is not, we draw 1 additional sample randomly from our distribution and re-evaluate our sample mean each time until our sampling mean exceeds the cancer risk level or we've drawn 100 samples without exceeding the mean

Draw	VOC Concentration	Mean	Cancer Risk Level?
1	0.52	0.13	N
2	0.61	0.28	N
3	0.28	0.35	N
4	0.12	0.38	N
5	0.41	0.39	N
6	0.37	0.39	N
7	0.89	0.49	Y

Then evaluate if the mean of the collected samples will be above the cancer risk level. When we've drawn less than 4 samples, we will count the remaining samples as 0 and take the mean of the first 4 samples to determine if the one sample is sufficiently high enough that we should stop sampling and mitigate on the basis of long-term exposure.

Again, after second sample, we evaluate if the mean of all collected samples is above the cancer risk level

In this case it took us 7 samples until the mean of our dataset exceeded the TCE 10^{-6} cancer risk level of 0.48 ug/m^3

Key Assumptions/Procedures Cancer

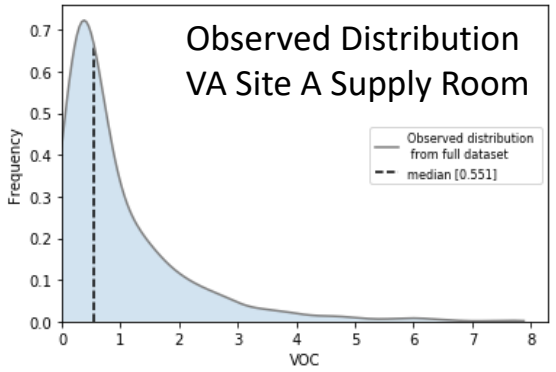
- We evaluate after every sampling round whether the cancer action level is exceeded as a long- term average:
  - Presumption that calculating a long-term average requires a minimum of four samples
  - But the first three samples evaluated using dummy values for the untaken samples, so if first sample is 4x the action level, action is taken immediately since any possible subsequent results will still give a 4 sample exceedance.
  - If long-term average exceeds action level at any time, we stop sampling and mitigate
  - After 12 samples we evaluate whether the 95% UCL on the mean is below the action level, if yes, then we stop sampling.

Draw	TCE Concentration	Mean	Cancer Risk Level?
1	1.93	0.482	Y
1a	0	-	-
1b	0	-	-
1c	0	-	-

Samples until mean of samples exceeds 10^{-6} level 0.48 µg/m^3:
1 in this example

Sampling for cancer based risk

Distribution from our first sampling simulation



random draws from observed distribution

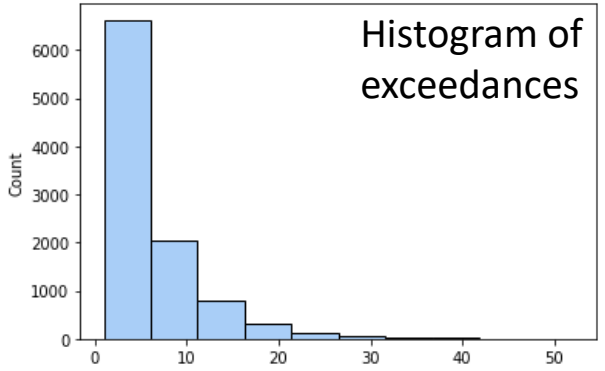
Simulate process of drawing random samples 10,000 times until during each sampling the sampled mean is over the cancer risk level or we've drawn 100 samples recording the number of samples until the mean is over the cancer risk level each time.

Draw	VOC Concentration	Mean	Cancer Risk Level?
1	0.52	0.13	N
2	0.61	0.28	N
3	0.28	0.35	N
4	0.12	0.38	N
5	0.41	0.39	N
6	0.37	0.39	N
7	0.89	0.49	Y

Samples until mean of samples exceeds 10^{-6} level: 7

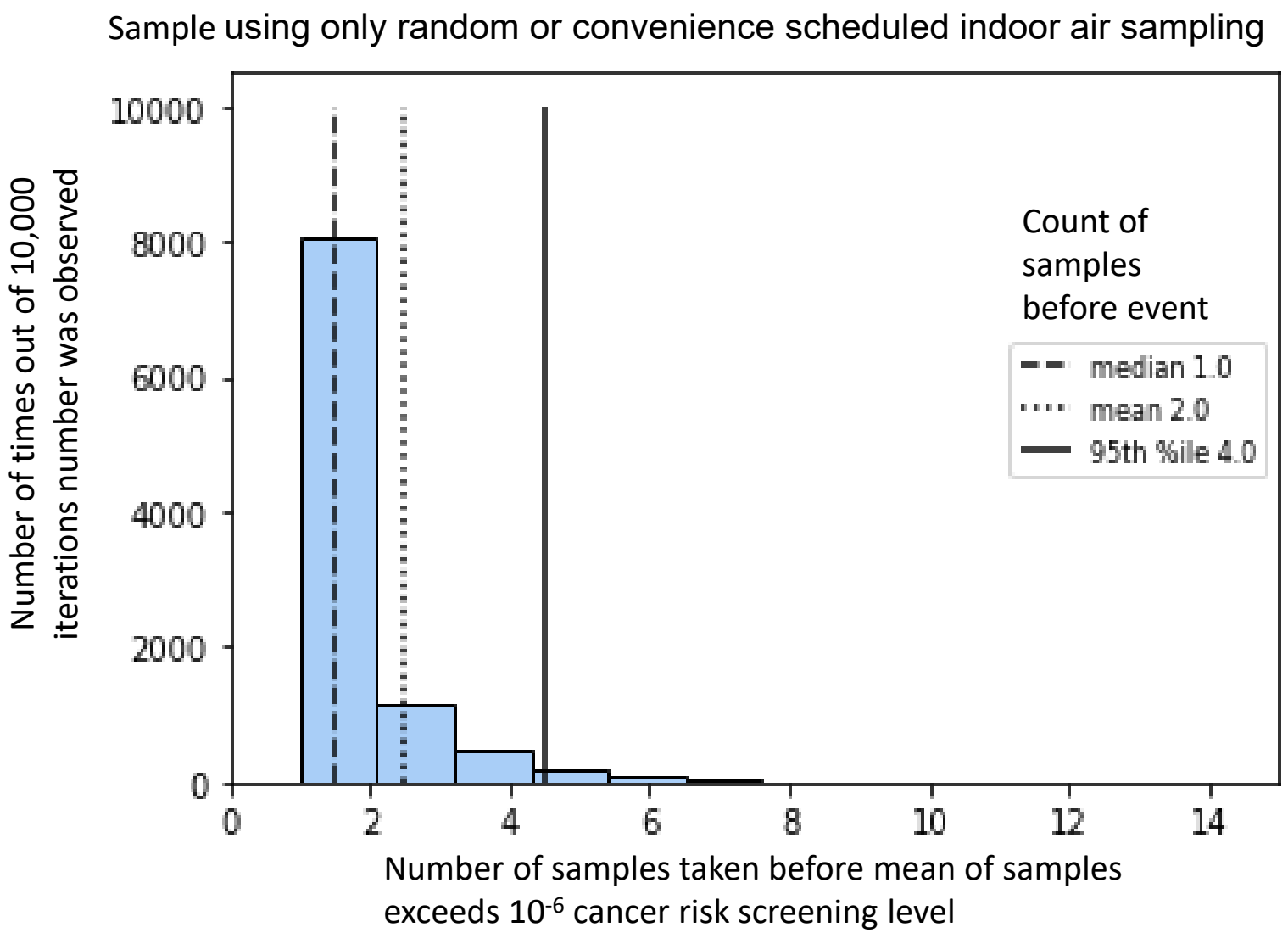
Repeat x10,000 times

Calculate the number samples needed of exceedances needed to satisfy our desired false negative and false positive values



Samples until 10^{-6} level exceeded: 7, 8, 4, 12…

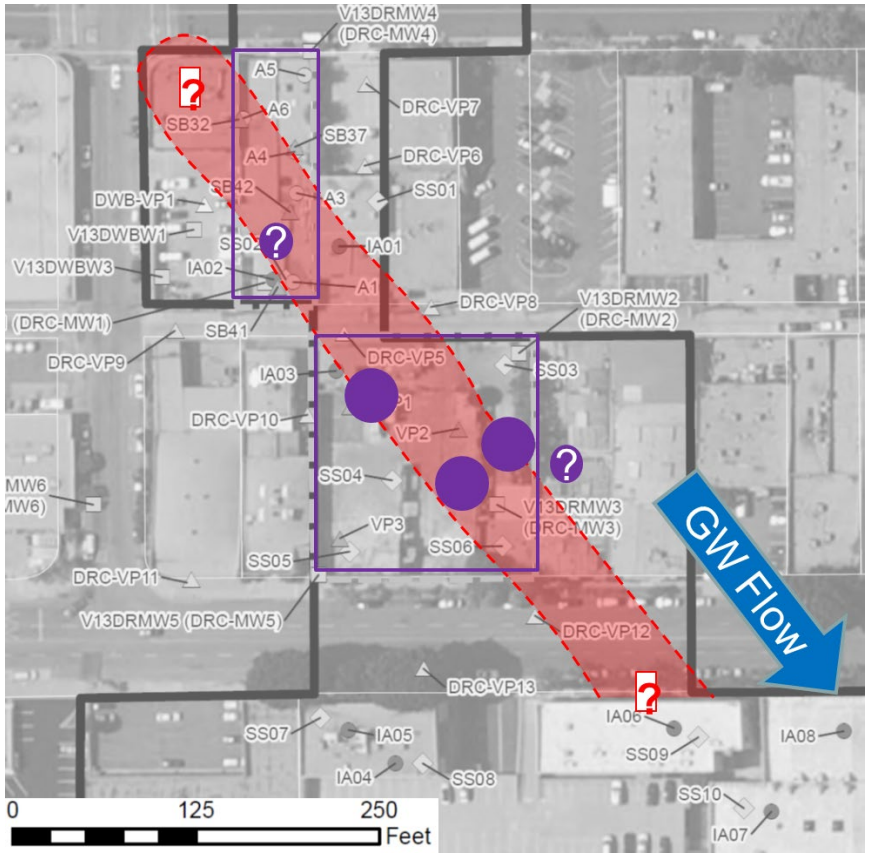
Sampling for cancer based risk



Repeat the above analysis for each sampling strategy

Sampling – Radon Monitoring

- Assume we can use radon as a proxy for CVOCs when we have a site in a known plume



Sampling – Radon Monitoring

- Weekly average radon concentrations compared to a local estimate of the upper limit of ambient data. One week exceeding used as trigger for mitigation.

Upper end of outdoor radon 2.46 pCi/L

Week	Average Radon Concentration	Exceeds Ambient?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	0.8904	N
8	3.4979	Y

Key Assumptions/Procedures

When there is an exceedance of the risk level

We mitigate

Week	Average Radon Concentration	Exceeds Ambient?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	0.8904	N
8	3.4979	Y

Draw	TCE Concentration	Mean	Cancer Risk Level?
1	1.93	0.482	Y
1a	0	-	-
1b	0	-	-
1c	0	-	-

Draw	TCE Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	2.8904	Y
8	3.4979	Y

When we didn't find an exceedance of the risk level

We do not mitigate

Draw	TCE Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	0.3738	N
5	1.3966	N
6	1.2040	N
7	0.8904	N
8	1.4979	N

56	0.2974	N
57	1.587	N
58	0.1215	N

Key Assumptions/Procedures Costs

The total cost per site is a function of:

- The type of building (residential or commercial)
- the cost per sample
- mitigation cost
- decision to mitigate or not
- For I&T the cost of collecting that data
- for radon, the cost for monitoring and interpreting data

Target	Monitoring vs. Mitigation	Residential Cost	Commercial Cost
CVOCs	Monitoring ($ / sampling round):	$5,400	$11,232
	Mitigation (capital + annual $):	$11,500	$76,939
Radon	Monitoring ($ / analysis):	$1,800	$2,800

Key Assumptions/Procedures Costs

Monitoring Cost Justification:

Target	Monitoring vs. Mitigation	Residential Cost	Commercial Cost
CVOCs	Monitoring ($ / sampling round):	$5,400	$11,232
	Mitigation (capital + annual $):	$11,500	$76,939
Radon	Monitoring ($ / analysis):	$1,800	$2,800

- Hers (2015) estimates the cost of a single sampling round in a house at $3,600 based on one indoor, one outdoor and two sub-slab samples with reporting in a group of at least 5 houses.
- For this analysis, we use the Hers estimate but multiply by 1.5 to assume a somewhat larger number of samples per current regulatory guidance in CA. $3,600*1.5 = $5,400 per sampling round including indoor, ambient and subslab.
- Commercial structure being monitored defined as 7,200 square feet including sub-slab and indoor air with 7 indoor and 4 sub-slab samples per round for a three suite multitenant building.
- Monitoring costs are then per sample location from Lutes (2015). The per round cost estimate is $11,232.

Lutes C., K. Hallberg, L Lund, M. Novak, P. Venable, T. Chaudhry, I. Rivera-Duarte and D. Caldwell *A survey of vapor intrusion characteristics of nonresidential buildings –are industrial buildings different?* Poster and introductory presentation given at AEHS/EPA 2015 workshop on *Long-Term Evidence-Based Protection & Sustainability; in Residential, Commercial and Industrial Buildings;* San Diego.

Hers, I. "Residential Building Lifecycle Cost Evaluation for natural and controlled conditions" Presented at 25th Annual International Conference on Soil, Water, Energy and Air March 23-26, 2015, San Diego, California

Key Assumptions/Procedures Costs

Mitigation Cost Justification:

Target	Monitoring vs. Mitigation	Residential Cost	Commercial Cost
CVOCs	Monitoring ($ / sample):	$5,400	$$11,232
	Mitigation (capital + annual $):	$11,500	$76,939
Radon	Monitoring ($ / analysis):	$1,800	$2,800

- The cost analysis focuses just on the first year of the project; it is assumed that long term stewardship costs including VOC monitoring while the soil gas plume is in place are approximately the same for all alternatives.
- Mitigation costs assume that just standard pressure field extension measurement, fan inspection and ongoing monitoring of radon would be sufficient to provide equivalent protection in long-term stewardship. Although long term stewardship costs have not yet been analyzed in detail it has been assumed that unmitigated buildings will require some periodic resampling for confirmation.
- The $11,500 residential mitigation cost is based on Hers (2015) estimates with the above monitoring assumptions.
- The commercial mitigation base case first year cost is around $76,939. This is based on the Lutes (2015) costs for the full 7,200 square foot multi suite building, but reduced based on the monitoring assumptions given above.

Lutes C., K. Hallberg, L Lund, M. Novak, P. Venable, T. Chaudhry, I. Rivera-Duarte and D. Caldwell *A survey of vapor intrusion characteristics of nonresidential buildings –are industrial buildings different?* Poster and introductory presentation given at AEHS/EPA 2015 workshop on *Long-Term Evidence-Based Protection & Sustainability; in Residential, Commercial and Industrial Buildings;* San Diego.

Hers, I. "Residential Building Lifecycle Cost Evaluation for natural and controlled conditions" Presented at 25th Annual International Conference on Soil, Water, Energy and Air March 23-26, 2015, San Diego, California

Key Assumptions/Procedures Costs

Radon Cost Justification:

Target	Monitoring vs. Mitigation	Residential Cost	Commercial Cost
CVOCs	Monitoring ($ / sample):	$5,400	$$11,232
	Mitigation (capital + annual $):	$11,500	$76,939
Radon	Monitoring ($ / analysis):	$1,800	$2,800

- We assume $200 to purchase a monitoring system
- $2000 for labor for arrangements, installation, data downloading and interpretation in a commercial structure
- For commercial sites, we assume 4 locations for detectors and a total cost of 4 x $200 = $800 per location for detectors and $2000 for labor and analysis.
- For residential sites, we assume only 3 detectors are needed at $200 per and only $1,200 for labor for arrangements, installation, data downloading and interpretation for a total of $1,800 for a residential structure.

Lutes C., K. Hallberg, L Lund, M. Novak, P. Venable, T. Chaudhry, I. Rivera-Duarte and D. Caldwell *A survey of vapor intrusion characteristics of nonresidential buildings –are industrial buildings different?* Poster and introductory presentation given at AEHS/EPA 2015 workshop on *Long-Term Evidence-Based Protection & Sustainability; in Residential, Commercial and Industrial Buildings;* San Diego.

Hers, I. "Residential Building Lifecycle Cost Evaluation for natural and controlled conditions" Presented at 25th Annual International Conference on Soil, Water, Energy and Air March 23-26, 2015, San Diego, California

Putting it all together – an example

Target	Monitoring vs. Mitigation	Residential Cost	Commercial Cost
CVOCs	Monitoring ($ / sample round):	$5,400	$11,232
	Mitigation (capital + annual $):	$11,500	$76,939
Radon	Monitoring ($ / analysis):	$1,800	$2,800

Here we have data from a residential building

Draw	TCE Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	2.9854	Y

Total number of samples: 4

Cost per sample round: $5,400

Site sampling cost: $21,600

Decision to mitigate: Yes
(sample 4 is over the noncancer risk level)

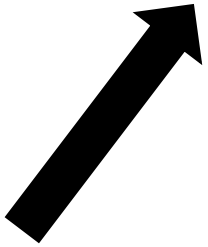
Mitigation cost: $11,500

Total cost: $21,600 + $11,500 = $33,100

Putting it all together

Here we have data from a residential building

Draw	TCE Concentration	Noncancer Risk Level?
1	0.4617	N
2	0.3286	N
3	1.2875	N
4	2.9854	Y



We fill the table with results from each of the sampling rules and risk screening metrics

Risk Screening Metric	Sampling Rule	Samples	Sample Cost	Mitigate?	Mitigation Cost	Total Cost
HQ=1	Random	4	$21,600	Yes	$11,500	$33,100
1e-6canrisk	Random	4	$21,600	Yes	$11,500	$33,100
HQ=0.1	Random	58	$313,200	No	$0	$313,200
1e-5canrisk	Random	12	$64,800	No	$0	$64,800
HQ=3	Random	58	$313,200	No	$0	$313,200
1e-4canrisk	Random	12	$64,800	No	$0	$64,800
HQ=1	ITS Triggered	58	$315,000	No	$0	$315,000
1e-6canrisk	ITS Triggered	4	$23,400	Yes	$11,500	$34,900
HQ=0.1	ITS Triggered	58	$315,000	No	$0	$315,000
1e-5canrisk	ITS Triggered	12	$66,600	No	$0	$66,600
HQ=3	ITS Triggered	58	$315,000	No	$0	$315,000
1e-4canrisk	ITS Triggered	12	$66,600	No	$0	$66,600
HQ=1	Seas	58	$313,200	No	$0	$313,200
1e-6canrisk	Seas	4	$21,600	Yes	$11,500	$33,100
HQ=0.1	Seas	58	$313,200	No	$0	$313,200
1e-5canrisk	Seas					
HQ=3	Seas	58	$313,200	No	$0	$313,200
1e-4canrisk	Seas					
Radon Over Ambient	Radon Over Ambient	2	$1,800	Yes	$11,500	$13,300

Putting it all together

Sampling Metrics

Random sampling:
Pick a random date and sample
Continue until we reach our metric or have collected 100 samples

ITS triggered sampling:
sample when radon exceeded the 90th percentile of the full underlying distribution.
(sample cost includes radon monitoring cost)

Seasonal sampling:
Pull 1 sample at random - Pull next sample form the next season - Repeat pulling 1 sample per season until we reach our metric or have collected 100 samples

Radon sampling:
One time cost to analyze radon data

Risk Screening Metric	Sampling Rule	Samples	Sample Cost	Mitigate?	Mitigation Cost	Total Cost
HQ=1	Random	58	$313,200	No	$0	$313,200
1e-6canrisk	Random	4	$21,600	Yes	$11,500	$33,100
HQ=0.1	Random	58	$313,200	No	$0	$313,200
1e-5canrisk	Random	12	$64,800	No	$0	$64,800
HQ=3	Random	58	$313,200	No	$0	$313,200
1e-4canrisk	Random	12	$64,800	No	$0	$64,800
HQ=1	ITS Triggered	58	$315,000	No	$0	$315,000
1e-6canrisk	ITS Triggered	4	$23,400	Yes	$11,500	$34,900
HQ=0.1	ITS Triggered	58	$315,000	No	$0	$315,000
1e-5canrisk	ITS Triggered	12	$66,600	No	$0	$66,600
HQ=3	ITS Triggered	58	$315,000	No	$0	$315,000
1e-4canrisk	ITS Triggered	12	$66,600	No	$0	$66,600
HQ=1	Seas	58	$313,200	No	$0	$313,200
1e-6canrisk	Seas	4	$21,600	Yes	$11,500	$33,100
HQ=0.1	Seas	58	$313,200	No	$0	$313,200
1e-5canrisk	Seas					
HQ=3	Seas	58	$313,200	No	$0	$313,200
1e-4canrisk	Seas					
Radon Over Ambient	Radon Over Am	2	$1,800	Yes	$11,500	$13,300

Putting it all together

Results from this analysis are coming in the next talks

<u>Summary:</u>

We have developed a methodology to compare the cost of sampling and mitigation to achieve equivalent levels of protection.

Virginia

Risk Screening Metric	Sampling Rule	Samples	Sample Cost	Mitigate?	Mitigation Cost	Total Cost
HQ=1	Random	58	$93,065	No	$0	$93,065
1e-6canrisk	Random	12	$19,255	No	$0	$19,255
HQ=0.1	Random	9	$14,441	Yes	$76,939	$91,380
1e-5canrisk	Random	12	$19,255	No	$0	$19,255
HQ=3	Random	58	$93,065	No	$0	$93,065
1e-4canrisk	Random	12	$19,255	No	$0	$19,255
HQ=1	ITS Triggered	58	$95,865	No	$0	$95,865
1e-6canrisk	ITS Triggered	12	$22,055	No	$0	$22,055
HQ=0.1	ITS Triggered	4	$9,218	Yes	$76,939	$86,157
1e-5canrisk	ITS Triggered	12	$22,055	No	$0	$22,055
HQ=3	ITS Triggered	58	$95,865	No	$0	$95,865
1e-4canrisk	ITS Triggered	12	$22,055	No	$0	$22,055
HQ=1	Seas	58	$93,065	No	$0	$93,065
1e-6canrisk	Seas	96	$154,039	No	$0	$154,039
HQ=0.1	Seas	7	$11,232	Yes	$76,939	$88,171
1e-5canrisk	Seas	96	$154,039	No	$0	$154,039
HQ=3	Seas	58	$93,065	No	$0	$93,065
1e-4canrisk	Seas	96	$154,039	No	$0	$154,039
Radon Over Ambient	Radon Over Am	58	$2,800	No	$0	$2,800

Indianapolis

Risk Screening Metric	Sampling Rule	Samples	Sample Cost	Mitigate?	Mitigation Cost	Total Cost
HQ=1	Random	58	$313,200	No	$0	$313,200
1e-6canrisk	Random	2	$10,800	Yes	$11,500	$22,300
HQ=0.1	Random	58	$313,200	No	$0	$313,200
1e-5canrisk	Random	12	$64,800	No	$0	$64,800
HQ=3	Random	58	$313,200	No	$0	$313,200
1e-4canrisk	Random	12	$64,800	No	$0	$64,800
HQ=1	ITS Triggered	58	$315,000	No	$0	$315,000
1e-6canrisk	ITS Triggered	2	$12,600	Yes	$11,500	$24,100
HQ=0.1	ITS Triggered	58	$315,000	No	$0	$315,000
1e-5canrisk	ITS Triggered	12	$66,600	No	$0	$66,600
HQ=3	ITS Triggered	58	$315,000	No	$0	$315,000
1e-4canrisk	ITS Triggered	12	$66,600	No	$0	$66,600
HQ=1	Seas	58	$313,200	No	$0	$313,200
1e-6canrisk	Seas	2	$10,800	Yes	$11,500	$22,300
HQ=0.1	Seas	58	$313,200	No	$0	$313,200
1e-5canrisk	Seas					
HQ=3	Seas	58	$313,200	No	$0	$313,200
1e-4canrisk	Seas					
Radon Over Ambient	Radon Over Am	1	$1,800	Yes	$11,500	$13,300

Sun Devil Manor

Risk	Rule	Samples	SampleCost	Mitigate?	Mitigation Cost	TotalCost
HQ=1	Random	58	$313,200	No	0	$313,200
1e-6canrisk	Random	12	$64,800	No	0	$64,800
HQ=0.1	Random	8	$43,200	Yes	11500	$54,700
1e-5canrisk	Random	12	$64,800	No	0	$64,800
HQ=3	Random	58	$313,200	No	0	$313,200
1e-4canrisk	Random	12	$64,800	No	0	$64,800
HQ=1	ITS Triggered	12	$66,600	No	0	$66,600
1e-6canrisk	ITS Triggered	4	$23,400	Yes	11500	$34,900
HQ=0.1	ITS Triggered	2	$12,600	Yes	11500	$24,100
1e-5canrisk	ITS Triggered	12	$66,600	No	0	$66,600
HQ=3	ITS Triggered	58	$315,000	No	0	$315,000
1e-4canrisk	ITS Triggered	12	$66,600	No	0	$66,600
HQ=1	Seas	58	$313,200	No	0	$313,200
1e-6canrisk	Seas	96	$518,400	No	0	$518,400
HQ=0.1	Seas	8	$43,200	Yes	11500	$54,700
1e-5canrisk	Seas	96	$518,400	No	0	$518,400
HQ=3	Seas	58	$313,200	No	0	$313,200
1e-4canrisk	Seas	96	$518,400	No	0	$518,400
Radon Over Ambient	Radon Over Am	58	$1,800	No	0	$1,800