Advisian

WorleyParsons Group

BACKGROUND DATA

How to get more “bang for your buck”?

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Remediation Technologies Symposium,
Banff, October 2015

Overview

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2 Proposed Approach

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Introduction

Definition and Considerations

Common Approach

Limitations

Definition and Considerations

CCME : “background concentration – representative ambient level for a contaminant in soil or water.” (CCME, 2006)

- Difficult to predict due to spatial variations in background concentrations (variation in soil parent material, soil depth, and hydrologic regime)

- Importance of assessment: Possibility of naturally elevated concentrations (above guidelines) of some chemicals that should not be treated as contaminated

Background Assessment: Common Approach

Obtain "sufficient representative samples from soils with similar characteristics to the affected site, but which are taken from outside the area affected by contamination".
(ESRD, 2014)

No defined methodology from regulators in Alberta

- Number of representative samples?
- Outliers?
- Representative value?

Limitations of Common Approach

- Numbers of background samples (time and cost constraints)
- Site conditions (up gradient locations inaccessible, blowout site, other potential sources in the vicinity, *etc*.)
- Missing information on former activities (unknown location of flare pit/sump, unknown spill, unexpected landfill, *etc*.)
- "Consistently variable" compounds (metals) with no correlation to main contaminants

Advantages of the Proposed Approach

- Include un-impacted boreholes (e.g. delineation boreholes) in background assessment
- Back up professional judgement when exceedances are naturally occurring
- Improve background assessment without increasing sampling

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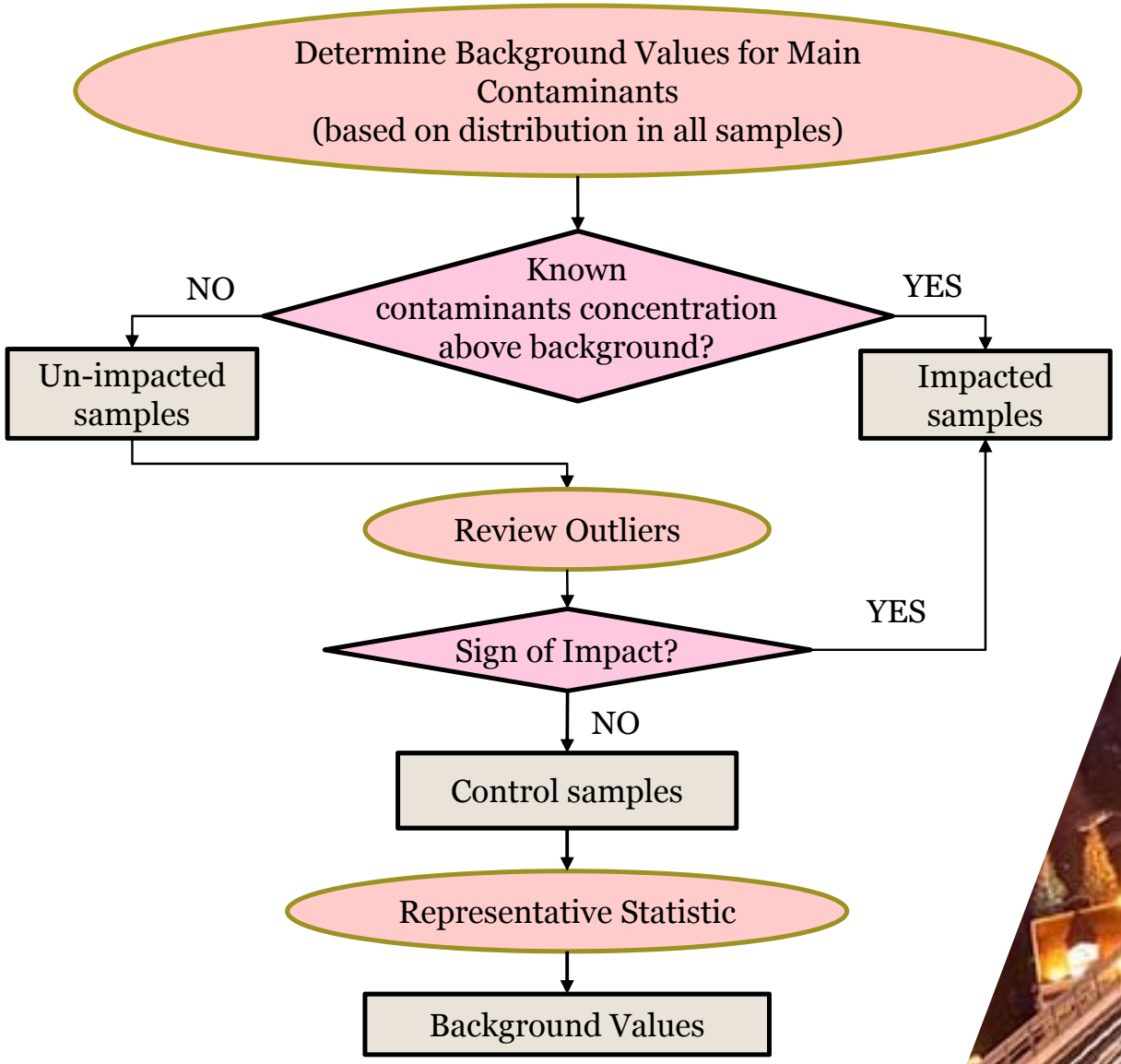
Proposed Approach

Methodology Overview
Step 1 - Background Values for COPCs
Step 2 - Background Samples Selection
Step 3 - Background Samples Review
Step 4 - Representative Statistic

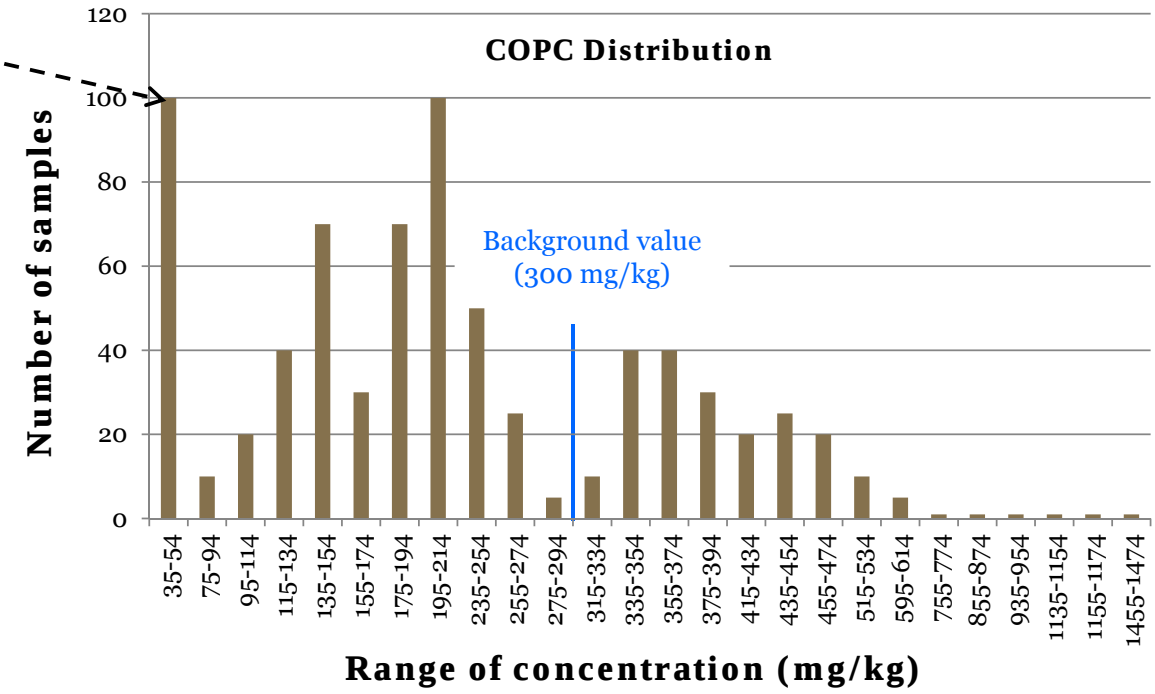
Method Overview



Background Values for COPCs

- Anthropogenic contaminants (e.g. BTEX, F1 PHC, hexavalent chromium) should be below detection limit.
- For contaminants naturally occurring (e.g. F3 PHC, barium, chloride, etc.) background values are based on their distribution in all samples.

conservative approach using non-detect concentrations as detection limit value

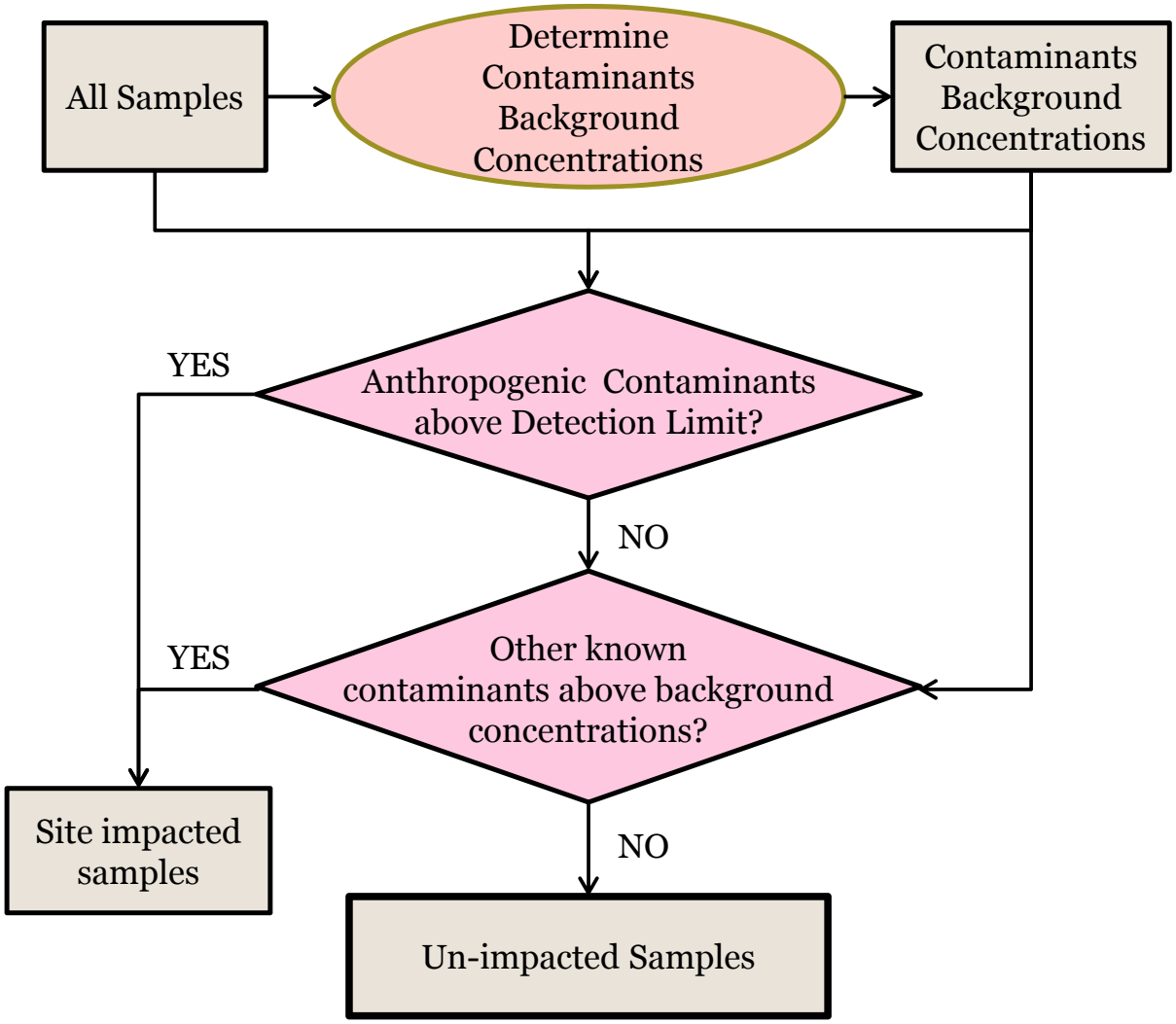


Background Samples Selection

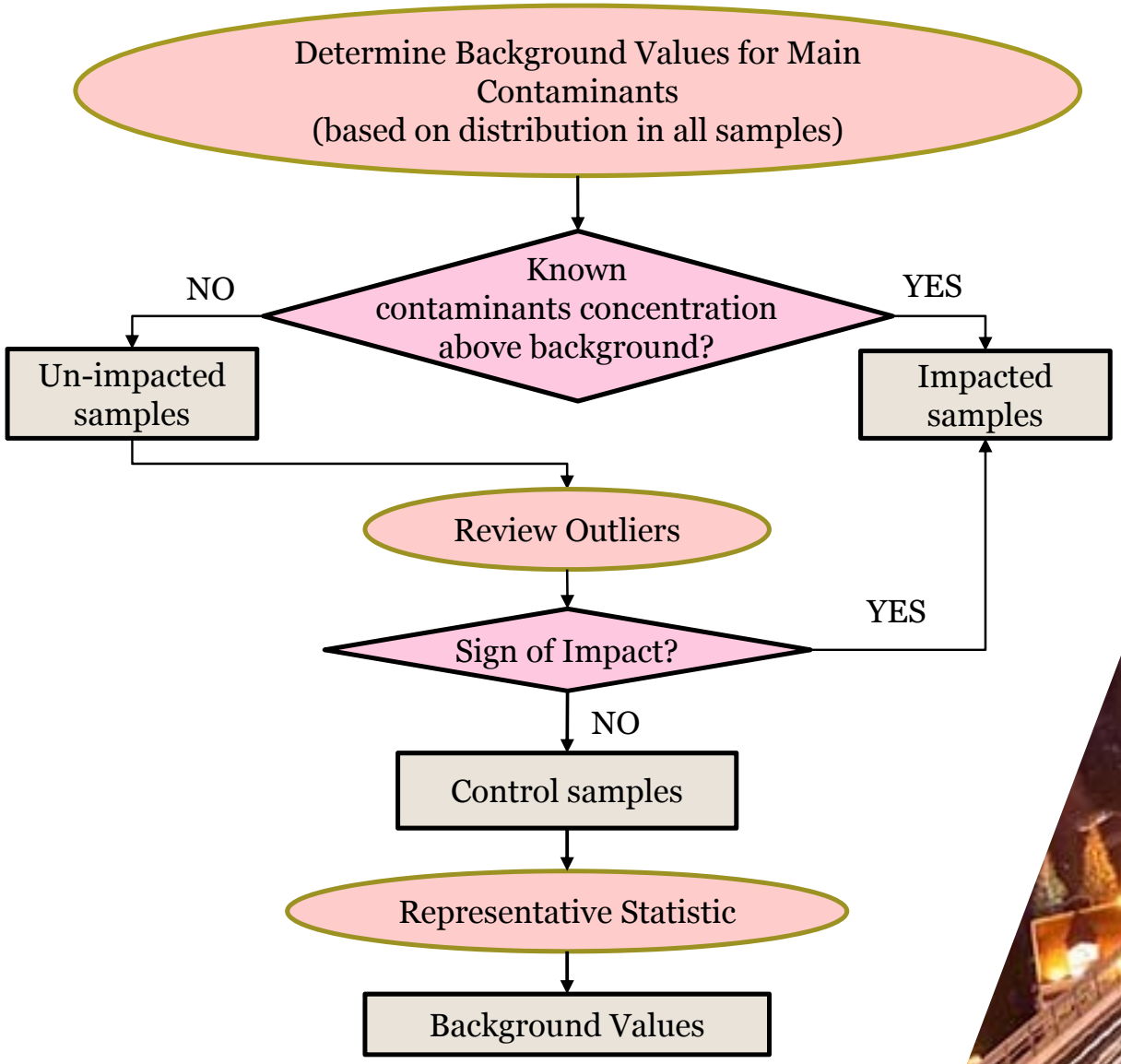
Samples with **no sign of impact** are considered as representing **natural conditions**.

Sign of impact:

- Anthropogenic contaminant above detection limit
- Contaminants naturally occurring above background



Method Overview



Background Samples Review

Assessment for outliers based on metals concentrations:

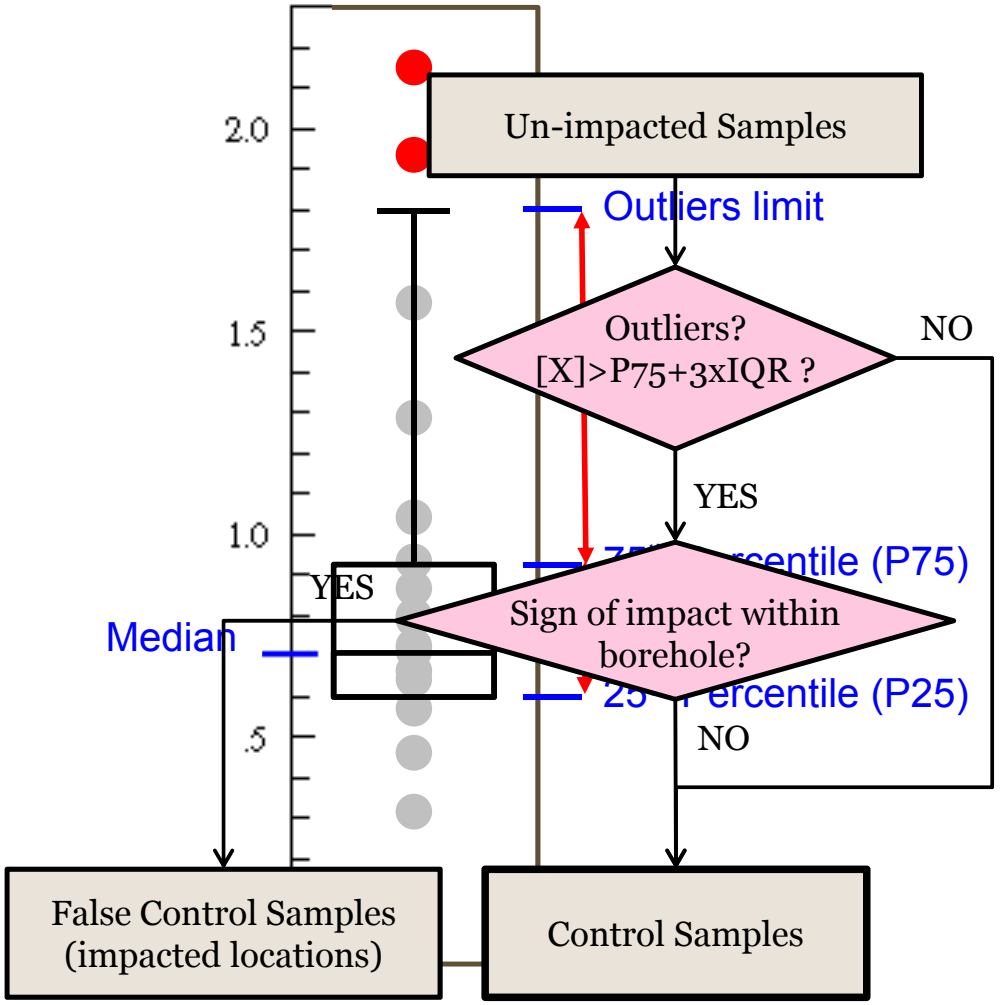
samples with **[X] > P75 + 3 x IQR** where:

P75: 75th percentile

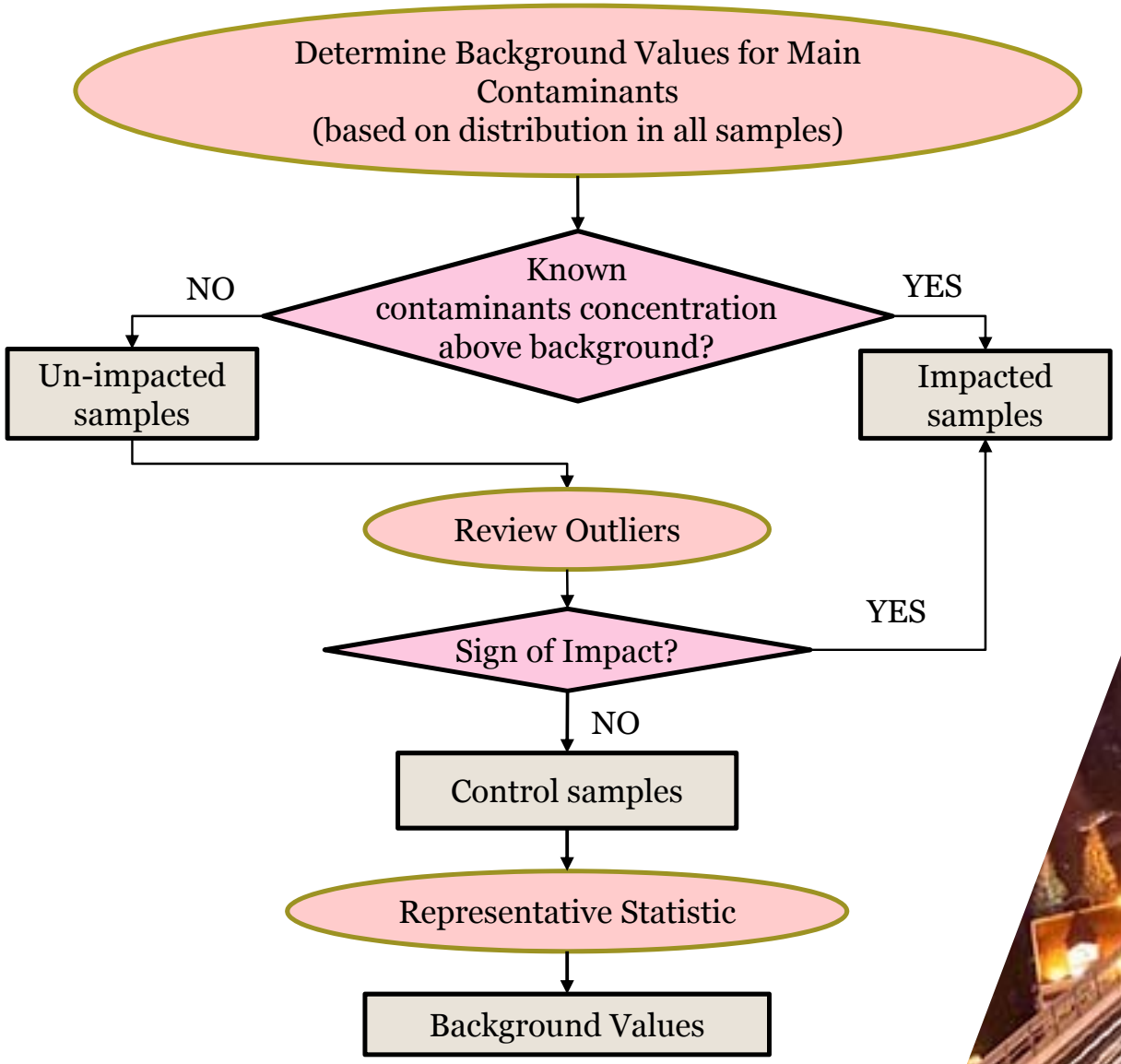
IQR: Interquartile Range (P75-P25)

Outliers further assessed against borehole logs, location, other samples at the same location, laboratory errors, etc.

False Outliers kept for background values.



Method Overview



Representative Statistic

Background values = **95% upper confidence limit of the 95th percentile** (P95/95) :

95% chance that concentrations of 95% of the samples from background are below P95/95.

$$P95/95 = \mu + Z\,\sigma = np + Z\,\sqrt{(np(1-p))}$$

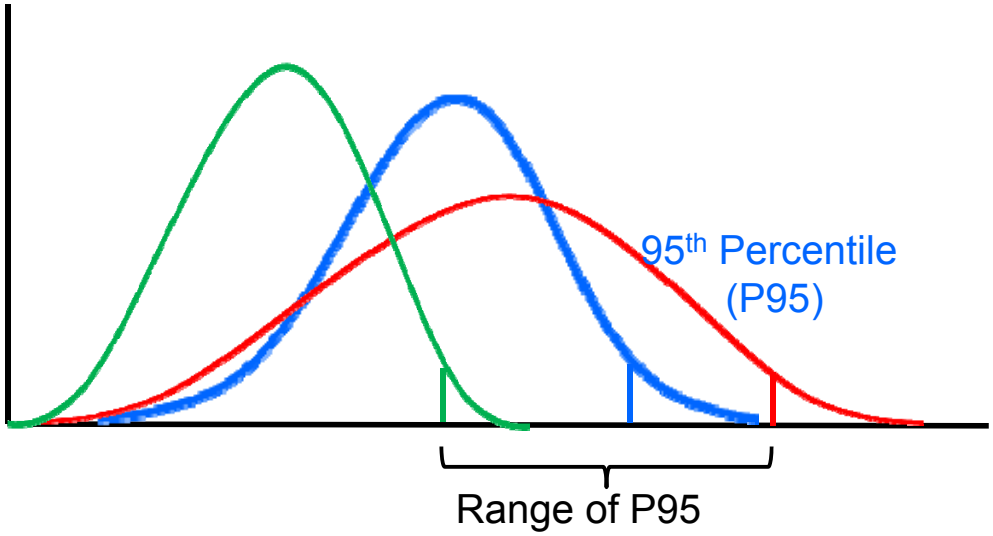
where μ : mean

Z: binomial variable from standard cumulative normal table (Z = 1.65 for a probability of 0.95053).

σ^2: variance

n: number of samples.

p: probability of success (p=0.95)



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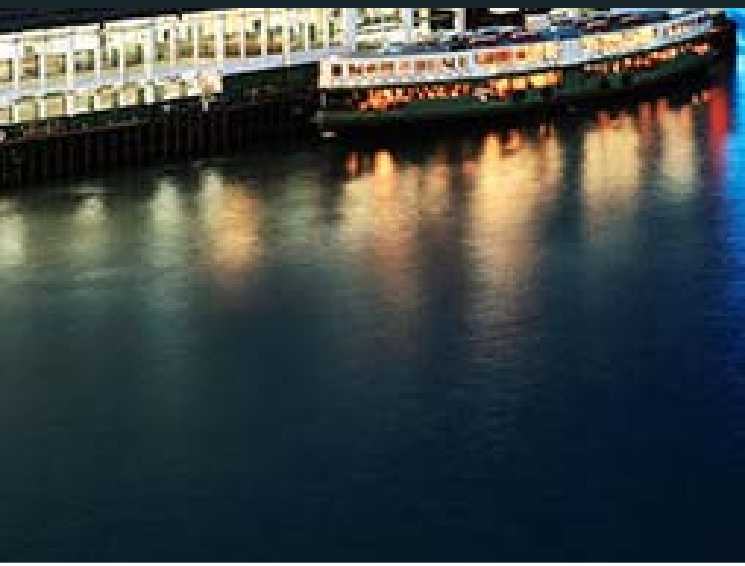
Case Study #1



Site Presentation

Decommissioned gas plant with associated sites (well sites and airstrip) developed in the 1960's

Difficulty to select background locations due to:

- **significant gaps in historical activities**
- **up-gradient locations difficult to access (mountainous environment)**

Main Contaminants : chloride, barium and hydrocarbons (BTEX and F1-F2 PHC)

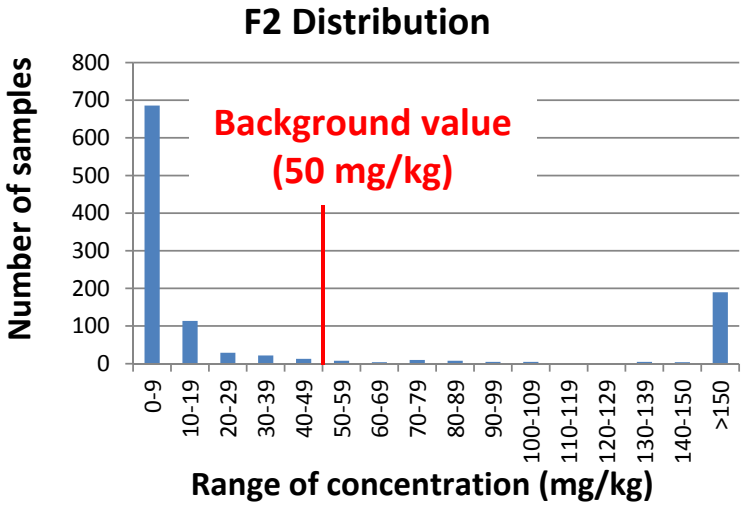
Total of 1,107 soil samples (including 51 background samples from 14 background locations)

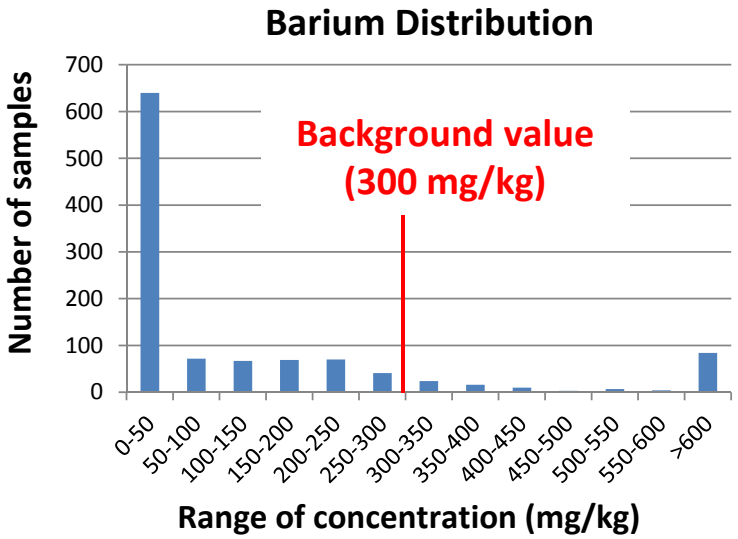
Metals concentrations "consistently variable" with sporadic guideline exceedances (arsenic, cadmium, molybdenum, nickel and zinc)

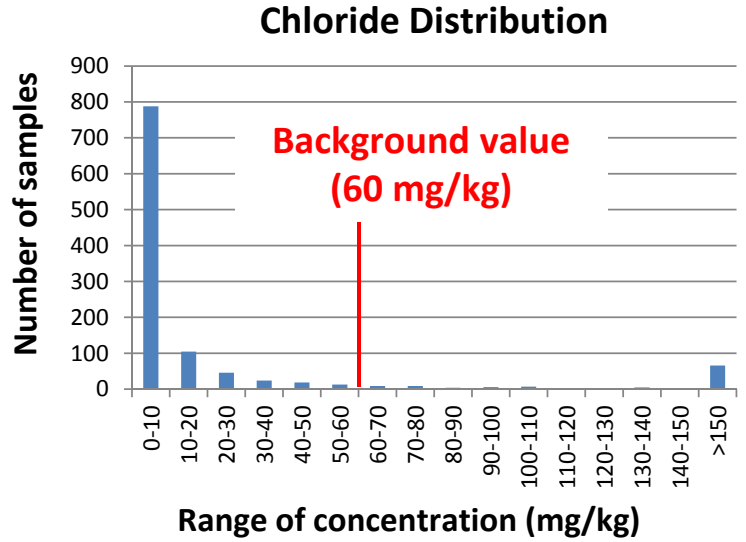
Metals Distribution

Sampling Location	Date	Sample Depth	Antimony	Arsenic	Barium	Barium - Extractable	Barium - Total Fusion	Beryllium	Boron - Hot Water Soluble	Cadmium	Chromium (Total)	Chromium (hexavalent)	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tin	Uranium	Vanadium	Zinc
	(dd-mmm-yyyy)		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Coarse_Excluding FWAL and Wildlife Watering Pathways			**20**	**12**	**750**	**750**	**10000**	**4**	**2**	**1.4**	**64**	**0.4**	**40**	**63**	**70**	**6.6**	**5**	**50**	**1**	**20**	**1**	**5**	**23**	**130**	**200**
A1 - Soil																									
A1 PH07-01	14-Sep-2007	0.0 - 0.5m	< 1	12	190	---	---	0.5	0.36	0.8	61	< 0.15	7	19	9	0.06	4.1	41	2.4	1	< 0.3	< 1	---	34	140
A1 PH07-02	14-Sep-2007	0.0 - 0.5m	< 1	10	120	---	---	0.6	0.26	0.6	44	< 0.15	6	13	8	< 0.05	3.3	31	2.4	1	< 0.3	< 1	---	31	100
A1 PH07-03	15-Sep-2007	0.0 - 0.5m	< 1	11	180	---	---	0.6	0.29	0.6	52	< 0.15	7	20	11	0.06	3.2	36	1.8	< 1	< 0.3	< 1	---	34	130
A1 PH07-05	15-Sep-2007	0.0 - 0.4m	< 1	11	220	---	---	0.6	0.20	1.4	69	< 0.15	6	28	12	0.07	4.3	49	2.1	2	< 0.3	< 1	---	38	170
A1-14-BH03	14-Aug-2014	0.6 - 1.0m	0.8	5.3	201	---	---	0.7	< 0.5	1.4	79.2	< 0.3	3.7	18.7	7.5	< 0.5	**6.3**	38.5	1.6	< 0.5	< 0.5	0.8	2.4	36.5	145
	14-Aug-2014	3.0 - 3.75m	0.7	**15.3**	91.9	---	---	0.7	< 0.5	**2.4**	59.4	< 0.3	6.5	16.6	9.7	< 0.5	3.1	**68.5**	0.6	< 0.5	< 0.5	0.5	3.0	22.2	**212**
A1-14-BH04	14-Aug-2014	0.2 - 0.5m	1.4	**14.4**	149	---	---	0.6	< 0.5	**3.6**	**206**	< 0.3	4.1	37.5	8.5	< 0.5	**9.2**	**83.7**	2.7	4.0	0.5	0.7	5.3	61.3	**274**
	14-Aug-2014	2.25 - 3.0m	0.6	4.8	111	---	---	< 0.5	< 0.5	0.8	38.5	< 0.3	2.5	11.4	4.7	< 0.5	4.1	19.6	1	< 0.5	< 0.5	< 0.5	2.4	22.4	86
A1-14-BH05	14-Aug-2014	0.1 - 0.8m	0.8	9.1	134	---	---	< 0.5	< 0.5	**1.5**	84.1	< 0.3	4.4	17.8	6.7	< 0.5	4.0	41.4	1.4	1.5	< 0.5	0.5	2.7	34.6	144
	14-Aug-2014	3.0 - 3.6m	< 0.5	2.1	60.1	---	---	< 0.5	< 0.5	**1.7**	57.0	< 0.3	1.5	7.6	2.7	< 0.5	2.5	23.2	< 0.5	0.6	< 0.5	< 0.5	4.8	13.5	89
	14-Aug-2014	3.6 - 4.5m	1.7	**14.0**	62.9	---	---	0.6	< 0.5	**4.9**	**144**	< 0.3	16.1	23.2	7.5	< 0.5	**6.5**	**153**	1.7	1.9	0.6	< 0.5	3.9	32.9	**374**
A1-14-BH06	15-Aug-2014	1.5 - 1.7m	< 0.5	1.2	54.6	---	---	< 0.5	< 0.5	1.1	56.2	< 0.3	2.0	7.0	2.4	< 0.5	**6.8**	19.4	< 0.5	< 0.5	< 0.5	< 0.5	2.2	9.7	65.2
	15-Aug-2014	2.8 - 3.0m	1.9	**20.5**	124	---	---	< 0.5	< 0.5	**8.7**	**639**	< 0.3	1.9	**65.9**	11.3	< 0.5	**12.6**	**122**	2.1	11.2	0.9	1.0	14.4	118	**573**
A1-14-BH07	15-Aug-2014	1.5 - 2.0m	< 0.5	2.1	135	---	---	< 0.5	< 0.5	1.3	48.9	< 0.3	2.6	7.5	2.7	< 0.5	4.8	27.4	0.6	< 0.5	< 0.5	< 0.5	2.5	14.0	95
	15-Aug-2014	2.5 - 3.0m	2.0	**14.8**	104	---	---	< 0.5	< 0.5	**6.6**	**469**	< 0.3	3.7	53.0	10.2	< 0.5	**19.5**	**137**	2.8	5.6	**1.1**	0.8	14.9	114	**705**
A1-14-BH08	15-Aug-2014	0.25 - 0.5m	< 0.5	7.7	172	---	---	< 0.5	< 0.5	0.7	57.9	< 0.3	5.1	11.3	9.3	< 0.5	3.0	23.3	1.6	0.5	< 0.5	< 0.5	3.8	37.5	108
	15-Aug-2014	1.5 - 2.0m	1.5	**21.0**	144	---	---	< 0.5	< 0.5	**8.3**	**614**	< 0.3	11.6	43.9	9.3	< 0.5	**8.9**	**133**	2.7	6.2	0.9	0.9	14.8	92.0	**439**
	15-Aug-2014	2.5 - 3.0m	2.2	**32.7**	104	---	---	< 0.5	< 0.5	**10.6**	**281**	< 0.3	1.3	**63.1**	8.1	< 0.5	**9.4**	**174**	2.7	4.3	0.7	0.7	7.8	78.1	**631**
A1-14-BH09	15-Aug-2014	1.5 - 2.25m	0.7	6.1	140	---	---	< 0.5	< 0.5	1.0	75.7	< 0.3	2.7	17.2	6.1	< 0.5	**8.5**	43.0	1.9	< 0.5	< 0.5	< 0.5	2.7	43.8	166
	15-Aug-2014	2.25 - 3.0m	< 0.5	3.0	37.9	---	---	< 0.5	< 0.5	0.7	22.9	< 0.3	2.0	6.0	4.5	< 0.5	1.4	16.0	< 0.5	< 0.5	< 0.5	< 0.5	1.2	11.5	62
A1-14-BH10	15-Aug-2014	1.5 - 2.25m	< 0.5	3.8	154	---	---	< 0.5	< 0.5	**2.9**	**124**	< 0.3	2.6	12.3	3.7	< 0.5	3.8	**62.7**	0.9	0.9	< 0.5	< 0.5	7.7	24.3	165
	15-Aug-2014	2.25 - 3.0m	2.5	**19.0**	96.5	---	---	< 0.5	< 0.5	**7.2**	**530**	< 0.3	1.5	61.8	11.1	< 0.5	**23.0**	**146**	3.0	11.7	1	0.9	11.2	123	**743**
A1-14-BH13	15-Aug-2014	3.0 - 3.75m	0.6	8.0	454	---	---	< 0.5	< 0.5	1.0	69.4	< 0.3	3.7	12.8	17.7	< 0.5	**7.3**	28.3	1.6	0.7	< 0.5	0.5	2.9	32.6	123
(Duplicate)	15-Aug-2014	3.0 - 3.75m	---	---	**1990** [#1]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	15-Aug-2014	4.5 - 5.25m	0.6	5.6	160	---	---	< 0.5	< 0.5	0.9	69.1	< 0.3	4.0	13.9	5.8	< 0.5	**9.6**	23.9	1.1	< 0.5	< 0.5	< 0.5	5.8	38.2	97
A1-14-BH14	15-Aug-2014	6.0 - 6.75m	< 0.5	4.1	218	---	---	< 0.5	< 0.5	0.9	63.3	< 0.3	1.7	13.3	9.5	< 0.5	4.1	27.3	0.9	< 0.5	< 0.5	< 0.5	7.3	32.2	128
	15-Aug-2014	6.75 - 7.5m	< 0.5	4.2	189	---	---	< 0.5	< 0.5	1.0	65.5	< 0.3	1.7	11.4	7.3	< 0.5	4.0	28.2	0.9	< 0.5	< 0.5	< 0.5	7.0	30.6	110
A1-14-BH15	16-Aug-2014	0.0 - 1.0m	< 0.5	7.0	344	---	---	< 0.5	< 0.5	0.6	79.1	< 0.3	4.6	19.5	8.1	< 0.5	3.6	29.1	1.7	0.6	< 0.5	0.7	2.2	27.2	83
	16-Aug-2014	3.2 - 4.0m	< 0.5	12	136	---	---	0.6	< 0.5	0.6	43.5	< 0.3	8.7	14.1	52.6	< 0.5	3.8	33.0	1.5	< 0.5	< 0.5	0.6	1.6	21.6	88
	16-Aug-2014	5.25 - 6.0m	0.8	11.6	127	---	---	0.9	< 0.5	**2.0**	84.8	**2.0**	6.2	27.0	9.0	< 0.5	**9.3**	**87.1**	2.4	< 0.5	< 0.5	0.5	4.7	24.3	**211**
A1-14-BH16	16-Aug-2014	0.0 - 1.0m	1.5	**14.6**	646	41	858	0.8	< 0.5	**2.2**	**106**	< 0.3	8.6	30.9	12.9	< 0.5	**13.0**	**75.6**	3.9	1.6	< 0.5	0.8	4.2	52.2	**213**
	16-Aug-2014	3.75 - 4.5m	< 0.5	2.7	88.1	---	---	< 0.5	< 0.5	< 0.5	24.5	**0.7**	1.9	9.1	3.1	< 0.5	2.1	16.3	0.7	< 0.5	< 0.5	< 0.5	3.0	12.9	51
A1-14-BH17	16-Aug-2014	5.25 - 6.0m	< 0.5	5.3	112	---	---	< 0.5	< 0.5	0.5	49.2	**0.7**	2.6	13.0	4.2	< 0.5	5	23.4	1.1	< 0.5	< 0.5	< 0.5	3.1	18.7	71
A1-14-BH18	16-Aug-2014	1.5 - 2.25m	0.6	12	131	---	---	0.6	< 0.5	0.9	40.4	< 0.3	5.6	13.8	9.2	< 0.5	**6.6**	40.1	3.8	0.8	< 0.5	< 0.5	2.3	27.3	134
	16-Aug-2014	5.5 - 6.0m	< 0.5	5.1	254	---	---	< 0.5	< 0.5	< 0.5	60.1	**1.2**	2.1	14.0	2.8	< 0.5	4.8	24.0	1.1	< 0.5	< 0.5	0.6	4.2	19.4	82
A1-14-BH19	16-Aug-2014	1.5 - 2.25m	0.6	5.4	207	---	---	< 0.5	< 0.5	< 0.5	79.8	**0.9**	2.8	21.3	3.6	< 0.5	**7.0**	45.6	2.7	< 0.5	< 0.5	0.7	3.5	28.8	136
	16-Aug-2014	3.75 - 4.5m	< 0.5	4.8	234	---	---	< 0.5	< 0.5	< 0.5	65.9	**1.2**	1.2	13.0	3.6	< 0.5	**5.2**	20.9	1.6	< 0.5	< 0.5	0.6	3.8	24.1	54
A1-14-BH20	16-Aug-2014	5.25 - 6.0m	< 0.5	3.5	64.0	---	---	< 0.5	< 0.5	< 0.5	30.0	< 0.3	2.8	11.1	3.5	< 0.5	2.0	16.7	0.6	< 0.5	< 0.5	< 0.5	3.0	15.2	84
	16-Aug-2014	12.0 - 12.5m	0.6	8.8	196	---	---	0.6	< 0.5	1.1	**109**	< 0.3	6.5	18.6	9.2	< 0.5	**8.3**	47.0	2.0	0.5	< 0.5	0.6	4.2	28.7	144
A1-14-BH30	*17-Aug-2014*	*0.0 - 0.75m*	*< 0.5*	*2.3*	*29.3*	---	---	*< 0.5*	*< 0.5*	*1.0*	*37.5*	*< 0.3*	*1.5*	*2.4*	*1.5*	*< 0.5*	*0.6*	*6.7*	*1*	*< 0.5*	*< 0.5*	*< 0.5*	*1.7*	*9.4*	*32*
	17-Aug-2014	*0.75 - 1.5m*	*0.9*	***14.7***	*284*	---	---	*1.4*	*< 0.5*	*1.3*	***174***	*< 0.3*	*10.1*	*27.5*	*10.3*	*< 0.5*	***8.7***	***68.6***	***4.4***	*1.7*	*0.6*	*0.8*	*7.5*	*89.1*	*193*
	17-Aug-2014	*2.25 - 3.0m*	*2.3*	***26.3***	*110*	---	---	*0.7*	*< 0.5*	***5.9***	***112***	*< 0.3*	*8.2*	*46.3*	*10.1*	*< 0.5*	***18.4***	***128***	***4.6***	*6.4*	*0.9*	*0.6*	*5.3*	*50.6*	***426***
	17-Aug-2014	*3.75 - 4.5m*	*1.3*	***33.7***	*283*	---	---	*1.0*	*< 0.5*	***7.4***	***222***	*< 0.3*	*7.0*	*60*	*10.0*	*< 0.5*	***17.9***	***92.6***	*4.0*	*11.2*	***1.1***	*1.0*	*4.9*	*73.4*	***327***
	17-Aug-2014	*5.25 - 6.0m*	*1.5*	***21.3***	*210*	---	---	*1.1*	*< 0.5*	***18.1***	***451***	*< 0.3*	*7.0*	***69***	*7.9*	*< 0.5*	***21.2***	***170***	***5.6***	*3.7*	***1.2***	*0.8*	*7.9*	*87.7*	***562***
A1-14-TP01	12-Aug-2014	0.0 - 0.5m	0.9	8.3	260	---	---	0.8	< 0.5	< 0.5	64.6	**0.8**	8.3	17.1	7.6	< 0.5	**5.2**	18.8	1.4	< 0.5	< 0.5	0.7	2.3	50.8	68
	12-Aug-2014	1.5 - 1.75m	0.6	9.9	191	---	---	1.3	< 0.5	< 0.5	61.0	**1.7**	7.9	16.6	8.5	< 0.5	**6.6**	20.0	1.5	< 0.5	< 0.5	1.2	4.7	53.2	60
	12-Aug-2014	3.5 - 4.0m	0.5	5.5	294	---	---	1.2	< 0.5	< 0.5	71.3	**1.0**	5.5	17.6	10.1	< 0.5	**5.2**	31.6	1.5	< 0.5	< 0.5	1.6	3.9	48.5	99

Background Values for Contaminants

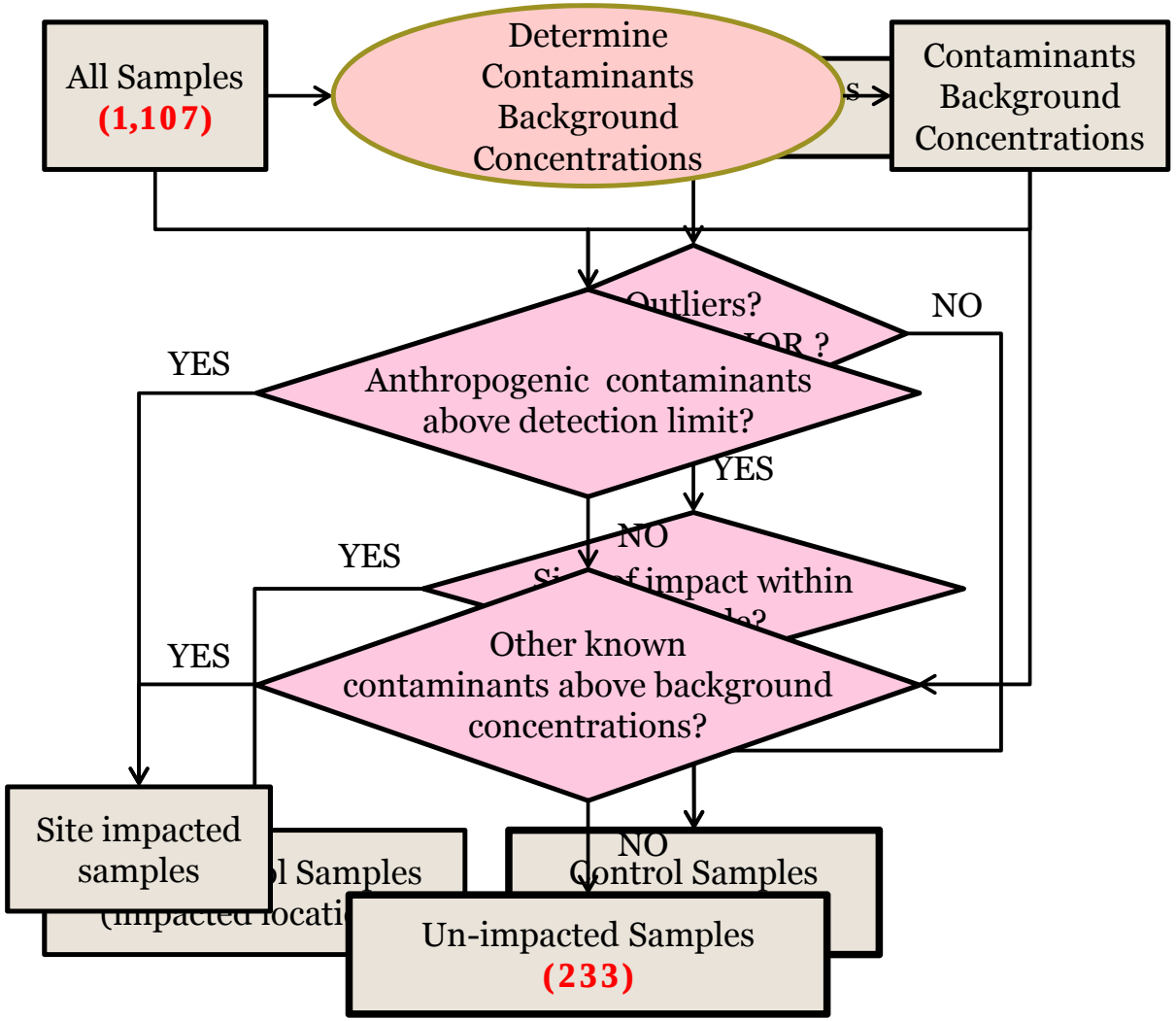






- Distribution of F2 PHC, barium and chloride in **all samples** to determine background concentrations
- BTEX, F1 PHC and Cr (VI) not expected in background

Background Samples Selection



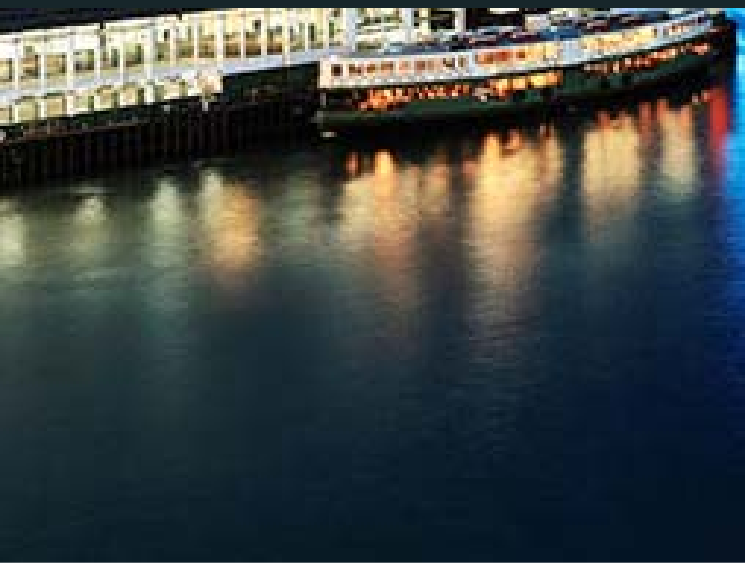
Background Values

Monitoring Group		Antinomy (Sb)	Arsenic (As)	Boron (B)	Beryllium (Be)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Lead (Pb)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thalium (Tl)	Tin (Sn)	Uranium (U)	Vanadium (V)	Zinc (Zn)	Sulphate	Electrical Conductivity (EC)
Units		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(uS/cm)
SOIL - A1-A3-A4 Group (mg/kg)	# samples[1]	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	89	92	92	84	84
	95th percentile upper confidence	1.15	15.32	0.55	0.82	4.76	187.75	6.42	31.86	10.34	8.89	68.81	2.65	3.89	0.72	0.86	5.37	51.79	239.22	132.46	0.94
SOIL - A2-Airstrip-Plant Site Group	# samples[1]	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	91	93	93	83	84
	95th percentile upper confidence	0.87	14.42	2.16	0.82	0.64	32.55	15.37	32.01	20.90	3.39	42.68	1.59	0.84	0.58	0.95	2.53	49.77	123.11	2044.71	4.89
SOIL - B1-B2 Group (mg/kg)	# samples[1]	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	25	25
	95th percentile upper confidence	0.59	15.63	0.98	0.50	0.90	52.04	6.58	23.34	23.29	4.08	47.68	2.41	1.17	0.56	0.63	3.83	28.00	167.72	447.56	1.27

- Samples grouped per sites with similar geology
- Background values based on 203 samples calculated for 18 metals, sulphate and EC
- Between 2 and 7 background values above (8 to 240%) the applicable guidelines (CCME)
- Between 6 and 13 background values above (2 to 725%) the background values from previous consultant (95^{th} percentile approach)

4

Case Study #2



Site Presentation

Blowout well site in Northern Alberta

Contaminants of Concern: chloride, barium and hydrocarbons

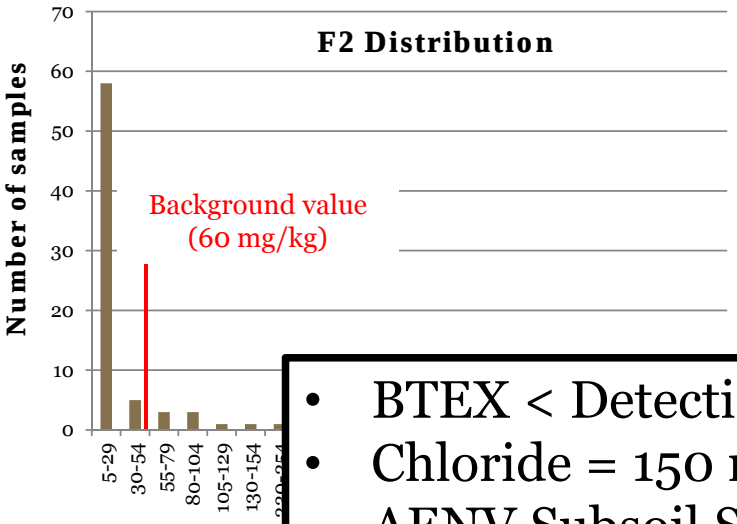
Limited background locations:

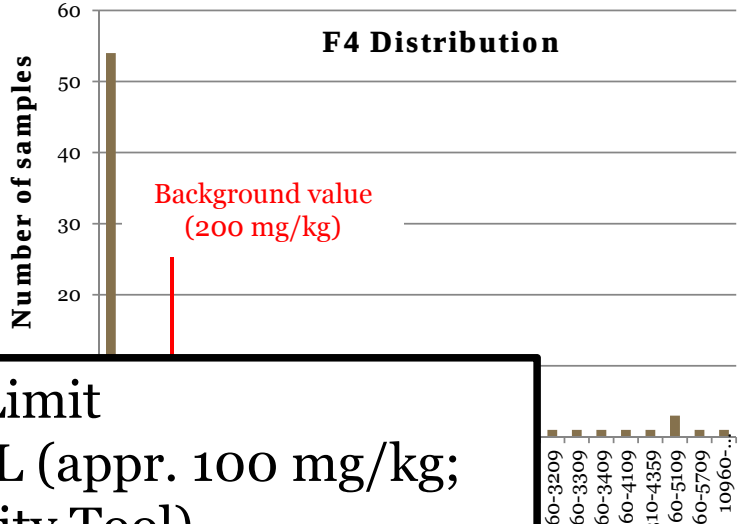
- **Radial groundwater flow from well head**
- **Adjacent well sites and pipelines**
- **Uncertainty on contamination extend (blowout and extensive remediation with farming)**

Total of 255 soil samples (one defined background location only)

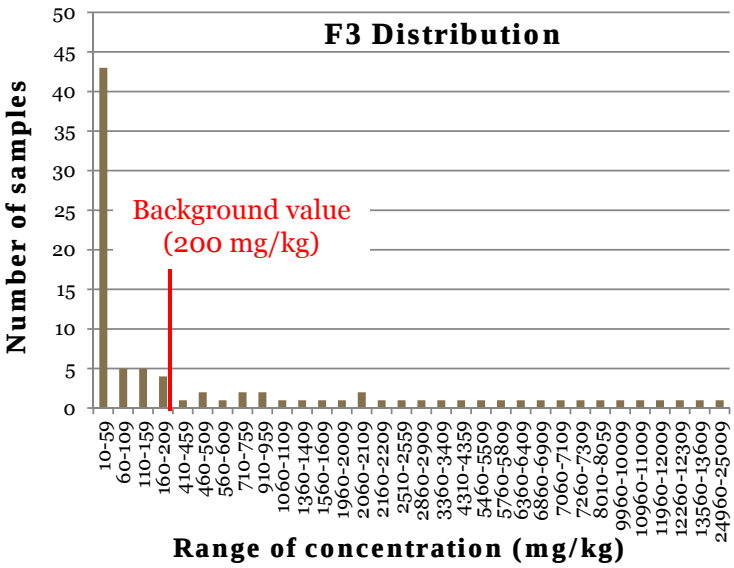
Guideline exceedances for boron, molybdenum and selenium with no clear correlation to main contaminants

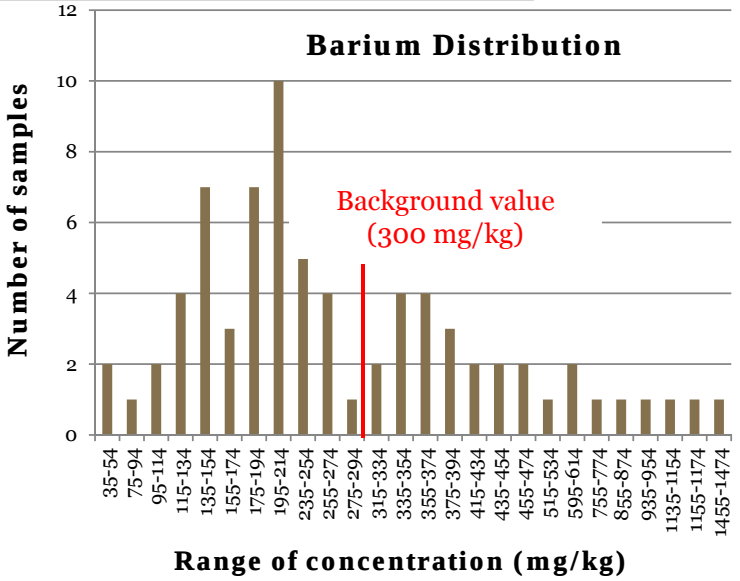
Background Values for COPCs



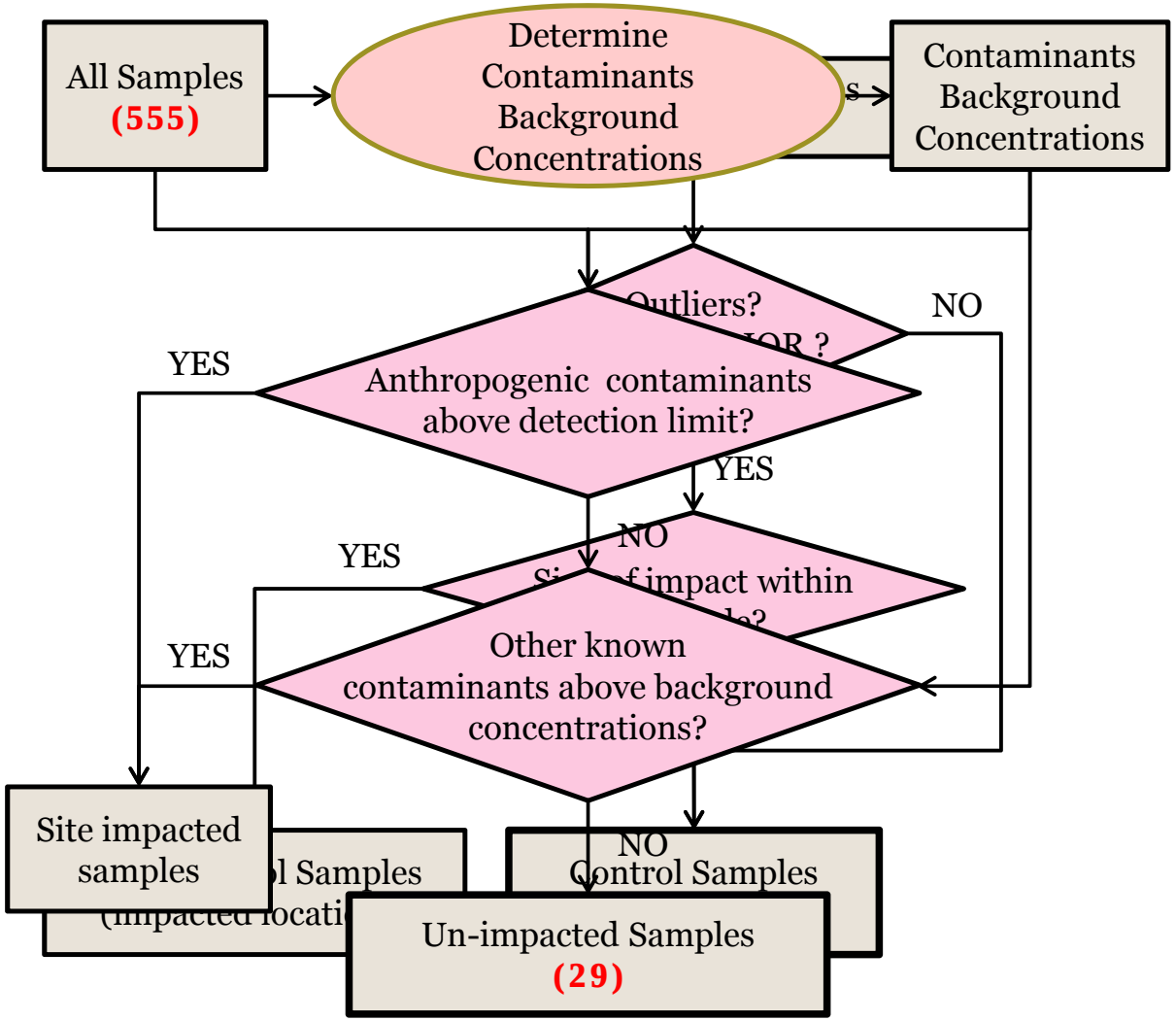


- BTEX < Detection Limit
- Chloride = 150 mg/L (appr. 100 mg/kg; AENV Subsoil Salinity Tool)





Background Samples Selection



Background Values

	Arsenic (As)	Boron (B)	Beryllium (Be)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Lead (Pb)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thalium (Tl)	Tin (Sn)	Uranium (U)	Vanadium (V)	Zinc (Zn)	Sulphate	Sodium	Electrical Conductivity (EC)
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/L)	(uS/cm)
# samples[1]	28	28	28	28	28	28	28	28	28	28	28	25	28	25	25	28	28	21	21	24
Maximum	17.0	13.0	1.2	7.4	36.0	14.2	37.0	15.0	13.0	39.0	3.0	2.0	0.6	2.0	8.5	61.0	190.0	5700.0	970.0	6.3
Mean	9.2	1.9	0.7	1.2	17.8	9.2	23.7	11.6	4.4	25.9	1.2	1.1	0.3	1.1	3.4	30.1	102.5	1357.1	181.8	2.7
99th percentile	16.7	12.0	1.2	6.9	33.8	14.1	35.7	15.0	12.1	38.5	3.0	2.0	0.6	2.0	7.9	57.2	179.2	5500.0	936.0	5.9
95th percentile	16.0	7.6	1.1	4.2	27.7	13.8	32.0	14.7	9.6	36.7	2.9	2.0	0.6	2.0	5.7	46.0	143.0	4700.0	800.0	4.5
95th percentile upper confidence limit ($P_{95/95}$)	16.8	6.5	1.0	3.7	27.9	14.6	33.5	16.1	10.1	38.3	2.4	1.7	0.5	1.7	6.1	47.9	148.9	3726.2	602.2	5.3

- Background calculated based on 28 samples for 17 metals, sulphate, sodium and EC
- Three background values above (approximately 60%) the applicable guidelines (ESRD)

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Conclusions

Conclusions

Background values for main contaminants based on general distribution (all samples)

More accurate background assessment for compounds with inconsistent distribution

Applicable to all parameters and all sites with significant number of soil samples

Provide additional weight of evidence to identify naturally occurring compounds without increasing the number of background samples

Advisian

WorleyParsons Group

Acknowledgements

Emily BAULK - Ph.D., P.Biol.

Louise BURDEN - MSc., P.Geo.

Khalid LEMZOUJI - MSc, P.Stat

Brandon SMITH - M.Sc., P.Biol.

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