

APPENDIX H

Human Health Risk Assessment

Client/client ref	Lidl UK GmbH
Project ref	J-B0756.00
Site ref	Briton Ferry Road, Neath
Data description	Made Ground and Natural Strata directly beneath
Contaminant(s)	Metals & Cyanide
Test scenario	Planning: is true mean lower than critical concentration ($\mu < C_c$)? ▼
Date	18 December 2015
User details	C Charlton

Statistics calculator (version 1)



Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

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Easting	Northing	Sample ID	Arsenic (As)	W/S Boron	Cadmium (Cd)	Hexavalent Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Nickel (Ni)	Selenium (Se)	Zinc (Zn)	Cyanide
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
		WS1 (0.60m)	17	<1	<0.2	<2	88	80	<1	26	<3	246	<2
		WS2 (0.70m)	20	<1	<0.2	<2	60	95	1.6	23	<3	153	<2
		WS3 (1.40m)	17	<1	<0.2	<2	54	78	<1	22	<3	143	<2
		WS3 (2.00m)	37	<1	0.5	<2	89	164	<1	19	<3	408	<2
		WS3 (3.00m)	15	<1	0.8	<2	43	70	<1	19	<3	248	<2
		WS3 (4.80m)	14	<1	0.4	<2	34	85	<1	16	<3	153	<2
		WS4A (0.20m)	15	<1	0.6	<2	15	95	<1	17	<3	165	<2
		WS5 (0.60m)	15	1.4	<0.2	<2	63	90	<1	14	<3	159	<2
		WS6 (0.40m)	17	<1	<0.2	<2	52	84	<1	14	<3	179	<2
		WS7 (0.30m)	4	<1	0.3	<2	12	7	<1	<3	<3	13	<2

Client/client ref: Lidl UK GmbH
Project ref: J-B0756.00
Site ref: Briton Ferry Road, Neath
Data description: Made Ground and Natural
Strata directly beneath
Contaminant(s): Metals & Cyanide
Test scenario: Planning
Date: 18 December 2015
User details: C Charlton

	Arsenic (As) (mg/kg)	W/S Boron (mg/kg)	Cadmium (Cd) (mg/kg)	Hexavalent Chromium (Cr) (mg/kg)	Copper (Cu) (mg/kg)	Lead (Pb) (mg/kg)	Mercury (Hg) (mg/kg)	Nickel (Ni) (mg/kg)	Selenium (Se) (mg/kg)	Zinc (Zn) (mg/kg)	Cyanide (mg/kg)
Critical concentration, C _c	640	59	410	49	8340	2330	3600	980	13000	38000	50
Notes	C4SL	Opus IHSV (Commercial)	C4SL	C4SL	Opus IHSV (Commercial)	C4SL	SGV	LQM/CIEH S4ULs	SGV	Opus IHSV (Commercial)	Opus IHSV (Commercial)
Sample size, n	10	10	10	10	10	10	10	10	10	10	10
Sample mean, $\bar{x}$	17.1	0.59	0.31	1	51	84.8	0.61	17.15	1.5	186.7	1
Standard deviation, s	8.15747782	0.28460499	0.25582112	0	26.2847653	37.7853587	0.34785054	6.7414555	0	101.048998	0
Number of non-detects	0	9	5	10	0	0	9	1	10	0	10
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	Yes	Yes	No	No	No	No	Yes	No	No	Yes	No
Distribution	Non-normal	Non-normal	Non-normal	Single value	Normal	Non-normal	Non-normal	Normal	Single value	Normal	Single value
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev

Test scenario:	Planning: is true mean lower than critical concentration ($\mu < C_c$)?				Evidence level required:		95%	Use Normal distribution to test for outliers			
t statistic, t ₀ (or k ₀)	-241.4695813	-649	-5064.294709	N/A	-997.2362008	-187.9020352	-32721.72727	-451.6530661	N/A	-1183.348239	N/A
Upper confidence limit (on true mean concentration, μ)	28.3443072	0.9823009	0.66262508	1	66.2367845	136.883523	1.08947888	21.0578951	1.5	245.276205	1
Evidence level	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$
Select dataset	☐ Y	☐ Y	☐ Y	☒ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y

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Client/client ref	Lidl UK GmbH
Project ref	J-B0756.00
Site ref	Briton Ferry Road, Neath
Data description	Made Ground and Natural Strata directly beneath
Contaminant(s)	PAH & Phenol
Test scenario	Planning: is true mean lower than critical concentration ($\mu < C_c$)? ▼
Date	18 December 2015
User details	C Charlton

Statistics calculator (version 1)



Input data

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Easting	Northing	Sample ID	Naphthalene mg/kg	Acenaphthylene mg/kg	Acenaphthene mg/kg	Fluorene mg/kg	Phenanthrene mg/kg	Anthracene mg/kg	Fluoranthene mg/kg	Pyrene mg/kg	Benzo(a)anthracene mg/kg	Chrysene mg/kg	Benzo(b)fluoranthene mg/kg	Benzo(k)fluoranthene mg/kg	Benzo(a)pyrene mg/kg	Indeno(1,2,3-cd)pyrene mg/kg	Dibenz(a,h)anthracene mg/kg	Benzo(ghi)perylene mg/kg	Phenol mg/kg
		WS1 (0.60m)	<0.1	<0.1	0.19	0.12	0.79	0.18	1.74	1.26	1.17	1.26	1.96	0.63	1.24	1.15	0.24	1.08	<2
		WS2 (0.70m)	<0.1	<0.1	0.11	<0.1	0.63	0.14	1.1	0.85	0.65	0.67	0.99	0.33	0.67	0.52	0.11	0.45	<2
		WS3 (1.40m)	<0.1	<0.1	0.24	0.22	1.11	0.26	1.9	1.35	1.3	1.3	2.12	0.65	1.43	1.14	0.28	0.97	<2
		WS3 (2.00m)	<0.1	<0.1	<0.1	<0.1	0.28	<0.1	0.94	0.99	0.47	0.47	0.58	0.18	0.31	0.22	<0.1	0.17	<2
		WS3 (3.00m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<2
		WS3 (4.80m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<2
		WS4A (0.20m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.19	0.13	<0.1	0.12	0.16	<0.1	<0.1	<0.1	<0.1	<0.1	<2
		WS5 (0.60m)	0.39	<0.1	0.42	0.39	1.01	0.3	0.95	0.63	0.29	0.3	0.35	<0.1	0.21	0.15	<0.1	0.13	<2
		WS6 (0.40m)	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.41	0.32	0.29	0.32	0.55	0.18	0.39	0.36	<0.1	0.34	<2
		WS7 (0.30m)	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.15	0.12	<0.1	0.16	<0.1	0.14	<0.1	<0.1	0.1	<2

Client/client ref: Lidl UK GmbH Project ref: J-B0756.00 Site ref: Briton Ferry Road, Neath Data description: Made Ground and Natural Strata directly beneath Contaminant(s): PAH & Phenol Test scenario: Planning Date: 18 December 2015 <i>Use of data for C_c Check only</i>		Naphthalene (mg/kg)	Acenaphthylene (mg/kg)	Acenaphthene (mg/kg)	Fluorene (mg/kg)	Phenanthrene (mg/kg)	Anthracene (mg/kg)	Fluoranthene (mg/kg)	Pyrene (mg/kg)	Benzo(a)anthracene (mg/kg)	Chrysene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Benzo(a)pyrene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	Dibenz(a,h)anthracene (mg/kg)	Benzo(ghi)perylene (mg/kg)	Phenol (mg/kg)
Critical concentration, C _c	220	97000	9.2	72000	22000	530000	72600	54500	140	14000	140	1430	76	140	14	4000	3200	
Notes	Opus IHSV (Commercial 3% SOM)	LOM/CIEH S4ULs (Commercial 2.5% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	LOM/CIEH S4ULs (Commercial 2.5% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	C4SL adjusted for %SOM (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	Opus IHSV (Commercial 3% SOM)	LOM/CIEH S4ULs (Commercial 2.5% SOM)	Opus IHSV (Commercial 3% SOM)
Sample size, n	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Sample mean, $\bar{x}$	0.084	0.05	0.126	0.108	0.427	0.118	0.768	0.588	0.444	0.459	0.697	0.222	0.454	0.374	0.098	0.339	1	
Standard deviation, s	0.10751744	7.3142E-18	0.12402509	0.11341174	0.41976316	0.09738811	0.66851078	0.49653913	0.46200529	0.47782958	0.7656232	0.23869087	0.50438521	0.43515514	0.0879141	0.38578779	0	
Number of non-detects	9	10	6	7	3	6	1	1	3	3	2	5	3	4	7	3	10	
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	
Outliers?	Yes	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	
Distribution	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Normal	Normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Single value	
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: One-sample t	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	

Test scenario:	Planning: is true mean lower than critical concentration ($\mu < C_c$)		Evidence level required: 95%		Use Normal distribution to test for outliers	
t statistic, t ₀ (or k ₀)	-6468.117647	-4.19375E+22	-231.3605107	-2007584.531	-165733.3581	-17209562.28
Upper confidence limit (on true mean concentration, μ)	0.23220256	0.05	0.29695678	0.26432729	1.00560359	0.25224025
Evidence level	100%	100%	100%	100%	100%	100%
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$
Select dataset	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y

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