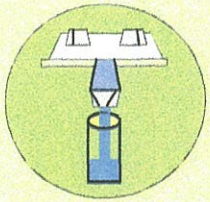
Exposure Factors and Target Risk Limits

Site Name: Townsend Lane
Location: Harpenden
Compl. By: A Prince
Job ID: Date: 20-Oct-15

1. Exposure Parameters

	Residential Receptors			Commerical Receptors		User Defined
	Child	Adolescent	Adult	Adult	Construc.	
Averaging time, carcinogens (yr)	70					6
Averaging time, non-carcinogens (yr)	6	12	30	25	1	-
Body weight (kg)	15	35	70	70	70	-
Exposure duration (yr)	6	12	30	25	1	-
Averaging Time for Vapor Flux (yr)	30			30	30	-
Exposure frequency (d/yr)	350			250	180	-
Dermal exposure freq. (d/yr)	350			250	180	-
Seasonal-avg skin surface area (cm^2/d)	2023	2023	3160	3160	3160	-
Soil dermal adherence factor (mg/cm^2)	0.5	0.5	0.5	0.5	0.5	-
Water ingestion rate (L/d)	1	1	2	1	1	-
Soil ingestion rate (mg/d)	200	200	100	50	100	-
Swimming exposure time (hr/event)	1	3	3			
Swimming event frequency (events/yr)	12	12	12			
Swimming water ingestion rate (L/hr)	0.5	0.5	0.05			
Skin surface area, swimming (cm^2)	3500	8100	23000			
Fish consumption rate (kg/d)	0.025	0.025	0.025			
Vegetable ingestion rate (kg/d)						
Above-ground vegetables	0.002	0.002	0.006			
Below-ground vegetables	0.001	0.001	0.002			
Contaminated fish fraction (-)	1					



2. Age Adjustment for Carcinogens

(residential receptor only)

	Adjustment Factor	
☑ Seasonal skin surface area, soil contact	1022.26	(cm^2-yr/kg)
☑ Water ingestion	1.08571	(mg-yr/L-day)
☑ Soil ingestion	165.714	(mg-yr/kg-day)
☑ Swimming water ingestion	4.56	(L/kg)
☑ Skin surface area, swimming	80640	(cm^2-yr/kg)
☑ Fish consumption	0.02286	(kg-yr/kg-day)
☑ Below-ground vegetable ingestion	0.38	(kg-yr/kg-day)
☑ Above-ground vegetable ingestion	0.88	(kg-yr/kg-day)

3. Non-Carcinogenic Receptor

(residential receptor only)

Child

4. Target Health Risk Limits

	Individual	Cumulative
Target Cancer Risk (Carcinogens)	1.0E-5	1.0E-5
Target Hazard Quotient/Index (non-Carc.)	1.0E+0	1.0E+0

5. Commands and Options

Return to Exposure Pathways

Use/Set Default

Print Sheet

Help

RBCA SITE ASSESSMENT

Input Parameter Summary

Site Name: Townsend Lane
Site Location: Harpenden

Completed By: A Prince
Date Completed: 20-Oct-15

Surface Soil Column Parameters		Value			(Units)
h_{cap}	Capillary zone thickness	NA			(m)
h_v	Vadose zone thickness	NA			(m)
ρ_s	Soil bulk density	NA			(g/cm^3)
f_{oc}	Fraction organic carbon	NA			(-)
θ_T	Soil total porosity	NA			(-)
		capillary	vadose	foundation	
θ_w	Volumetric water content	NA	NA	NA	(-)
θ_a	Volumetric air content	NA	NA	NA	(-)
K_{vs}	Vertical hydraulic conductivity	NA			(cm/d)
k_v	Vapor permeability	NA			(m^2)
L_{gw}	Depth to groundwater	NA			(m)
pH	Soil/groundwater pH	NA			(-)
W	Length of source-zone area parallel to wind	NA			(m)
W_{gw}	Length of source-zone area parallel to GW flow	NA			(m)
L_{ss}	Thickness of affected surface soils	NA			(m)
A	Source zone area	NA			(m^2)
L_s	Depth to top of affected soils	NA			(m)
L_{base}	Depth to base of affected soils	NA			(m)
L_{subs}	Thickness of affected soils	NA			(m)

Outdoor Air Parameters		Value	(Units)
U_{air}	Ambient air velocity in mixing zone	NA	(m/s)
δ_{air}	Air mixing zone height	NA	(m)
Q/C	Inverse mean concentration at the center of source	NA	
P_a	Areal particulate emission rate	NA	(g/cm^2/s)
V	Fraction of vegetative cover	NA	
U_m	Mean annual airvelocity at 7m	NA	
U_t	Equivalent 7m air velocity threshold value	NA	
F(x)	Windspeed function dependant on Um/Ut	NA	
PEF	Partculate Emission Factor	NA	

Building Parameters		Residential	Commercial	(Units)
L_b	Building volume/area ratio	NA	NA	(m)
A_b	Foundation area	NA	NA	(m^2)
X_{crk}	Foundation perimeter	NA	NA	(m)
ER	Building air exchange rate	NA	NA	(1/s)
L_{crk}	Foundation thickness	NA	NA	(m)
Z_{crk}	Depth to bottom of foundation slab	NA	NA	(m)
η	Foundation crack fraction	NA	NA	(-)
dP	Indoor/outdoor differential pressure	NA	NA	(g/cm/s^2)
Q_s	Convective air flow through slab	NA	NA	(m^3/s)
θ_{wcrack}	Volumetric water content of cracks	NA	NA	(-)
θ_{acrack}	Volumetric air content of cracks	NA	NA	(-)
BV	Building Volume	NA	NA	(m^3)
w	Building Width Perpendicular to GW flow	NA	NA	(m)
L	Building Length Parallel to GW flow	NA	NA	(m)
v	Saturated Soil Zone Porosity	NA	NA	(-)

Groundwater Parameters		Value	(Units)
δ_{gw}	Groundwater mixing zone depth	NA	(m)
I_f	Net groundwater infiltration rate	NA	(cm/yr)
U_{gw}	Groundwater Darcy velocity	NA	(cm/d)
V_{gw}	Groundwater seepage velocity	NA	(cm/d)
K_s	Saturated hydraulic conductivity	NA	(cm/d)
i	Groundwater gradient	NA	(-)
S_w	Width of groundwater source zone	NA	(m)
S_d	Depth of groundwater source zone	NA	(m)
θ_{eff}	Effective porosity in water-bearing unit	NA	(-)
$f_{oc\text{-}sat}$	Fraction organic carbon in water-bearing unit	NA	(-)
pH_{sat}	Groundwater pH	NA	(-)
	Biodegradation considered?	NA	

Transport Parameters		Off-site 1	Off-site 2	Off-site 1	Off-site 2	(Units)
Lateral Groundwater Transport		Groundwater Ingestion		Groundwater to Indoor Air		
α_x	Longitudinal dispersivity	NA	NA	NA	NA	(m)
α_y	Transverse dispersivity	NA	NA	NA	NA	(m)
α_z	Vertical dispersivity	NA	NA	NA	NA	(m)
Lateral Outdoor Air Transport		Soil to Outdoor Air Inhal.		GW to Outdoor Air Inhal.		
σ_y	Transverse dispersion coefficient	NA	NA	NA	NA	(m)
σ_z	Vertical dispersion coefficient	NA	NA	NA	NA	(m)
ADF	Air dispersion factor	NA	NA	NA	NA	(-)

Surface Water Parameters		Off-site 2	(Units)
Q_{sw}	Surface water flowrate	NA	(m^3/s)
W_{pl}	Width of GW plume at SW discharge	NA	(m)
δ_{pl}	Thickness of GW plume at SW discharge	NA	(m)
DF_{sw}	Groundwater-to-surface water dilution factor	NA	(-)

NOTE: NA = Not applicable

RBCA SITE ASSESSMENT

Input Parameter Summary

Site Name: Townsend Lane
Site Location: Harpenden

Completed By: A Prince
Date Completed: 20-Oct-15

Exposure Parameters		Residential				Commercial/Industrial		User Defined
		Child*	Adolescent	Adult	Age Adjusted**	Adult	Construct.	
ATc	Averaging time for carcinogens (yr)	70	70	70	NA	70	70	6
ATn	Averaging time for non-carcinogens (yr)	6	12	30	NA	25	1	-
BW	Body weight (kg)	15	35	70	NA	70	70	-
ED	Exposure duration (yr)	6	12	30	NA	25	1	-
τ	Averaging time for vapor flux (yr)	30	30	30	NA	30	30	-
EF	Exposure frequency (days/yr)	350	350	350	NA	250	180	-
EFD	Exposure frequency for dermal exposure	350	350	350	NA	250	180	-
IRw	Ingestion rate of water (L/day)	1	1	2	2.5	1	NA	-
IRs	Ingestion rate of soil (mg/day)	200	200	100	387	50	100	-
SA	Skin surface area (dermal) (cm^2)	2023	2023	3160	4771	3160	3160	-
M	Soil to skin adherence factor	0.5	0.5	0.5	NA	0.5	0.5	-
ETswim	Swimming exposure time (hr/event)	1	3	3	NA	NA	NA	NA
EVswim	Swimming event frequency (events/yr)	12	12	12	NA	NA	NA	NA
IRswim	Water ingestion while swimming (L/hr)	0.5	0.5	0.05	0.3	NA	NA	NA
SAswim	Skin surface area for swimming (cm^2)	3500	8100	23000	15680	NA	NA	NA
IRfish	Ingestion rate of fish (kg/yr)	0.025	0.025	0.025	0.053	NA	NA	NA
Flfish	Contaminated fish fraction (unitless)	1	1	1	NA	NA	NA	NA
IRbg	Below-ground vegetable ingestion	0.002	0.002	0.006	2.053	NA	NA	NA
IRabg	Above-ground vegetable ingestion	0.001	0.001	0.002	0.887	NA	NA	NA
VGbg	Above-ground Veg. Ingest. Correction Factor	0.01	0.01	0.01	NA	NA	NA	NA
VGabg	Below-ground Veg. Ingest. Correction Factor	0.01	0.01	0.01	NA	NA	NA	NA

* = Child Receptor used for Non-Carcinogens

** = Age-adjusted rate is effective value corresponding to adult exposure factors.

Complete Exposure Pathways and Receptors	On-site	Off-site 1	Off-site 2
Groundwater:			
Groundwater Ingestion	None	None	None
Soil Leaching to Groundwater Ingestion	None	None	None
Apply MCL Values	No	No	No
Applicable Surface Water Exposure Routes:			
Swimming	NA	NA	None
Fish Consumption	NA	NA	None
Aquatic Life Protection	NA	NA	None
Soil:			
Direct Contact: Ingestion, Dermal, Vegetable	Res./Constr.	NA	NA
Apply CLEA- UK SGV levels		Yes	
Outdoor Air:			
Particulates from Surface Soils	None	None	None
Volatilization from Soils	None	None	None
Volatilization from Groundwater	None	None	None
Indoor Air:			
Volatilization from Soils	None	NA	NA
Volatilization from Groundwater	None	None	None
Soil Leaching to Groundwater Volatilization	None	None	None

Receptor Distance from Source Media	On-site	Off-site 1	Off-site 2	(Units)
Groundwater receptor	NA	NA	NA	(m)
Outdoor air inhalation receptor	NA	NA	NA	(m)
Indoor air inhalation receptor	NA	NA	NA	(m)

Target Health Risk Values		Individual	Cumulative
TR	Target Risk (carcinogens)	1.0E-5	1.0E-5
THQ	Target Hazard Quotient (non-carcinogenic risk)	1.0E+0	1.0E+0

Modeling Options	
RBCA tier	Tier 2
Outdoor air volatilization model	NA
Indoor air volatilization model	NA
Soil leaching model	NA
Use soil attenuation model (SAM) for leachate?	NA
Use dual equilibrium desorption model?	NA
Apply Mass Balance Limit for Soil Volatilization?	NA
Apply UK (CLEA) SGV as soil concentration limit	Yes
Vegetable calculation options	Below ground only for organics
Air dilution factor	NA
Groundwater dilution-attenuation factor	NA

NOTE: NA = Not applicable

Orange = Site-specific value (different from current default value)

RBCA SITE ASSESSMENT	Cumulative Risk Worksheet

Site Name: Townsend Lane | Completed By: A Prince | Job ID:

Site Location: Harpenden | Date Completed: 20-Oct-15 |

CUMULATIVE RISK WORKSHEET

CONSTITUENTS OF CONCERN		Representative Concentration		Proposed CRF		Resultant Target Concentration	
CAS No.	Name	Soil (mg/kg)	Groundwater (mg/L)	Soil	GW	Soil (mg/kg)	Groundwater (mg/L)
7440-38-2	Arsenic	3.1E+1		NA	NA	3.1E+1	

Cumulative Values:

Appendix I

Environment Agency *"Remedial Targets Methodology 2006"* Data Sheets

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

Date of Workbook Issue: October 2006

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions

Details to be completed for each assessment				
Site Name:	Townsend Lane			
Site Address:	Harpenden			
Completed by:	A Prince			
Date:	20-Oct-15		Version:	1
Contaminant	Arsenic			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	Drinking Water Standards

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.1

Level 1 - Soil

Environment Agency

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		Arsenic	
Target concentration	C_T	0.01	mg/l

Input Parameters	Variable	Value	Unit	Source of parameter value
Standard entry				
Water filled soil porosity	θ_W	5.00E-02	fraction	Estimated
Air filled soil porosity	θa	1.80E-01	fraction	Estimated
Bulk density of soil zone material	ρ	1.70E+00	g/cm^3	Estimated
Henry's Law constant	H	2.29E-01	dimensionless	*EPA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	3.40E+03	l/kg	*EPA*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.40E+03**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**3.40E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Townsend Lane
Completed by:	A Prince
Date:	20-Oct-15
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

Date of Workbook Issue: October 2006

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Details to be completed for each assessment				
Site Name:	Townsend Lane			
Site Address:	Harpenden			
Completed by:	A Prince			
Date:	20-Oct-15		Version:	1
Contaminant	Chromium			
Target Concentration (C_T)	0.05	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
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Remedial Targets Worksheet , Release 3.1

Level 1 - Soil

Environment Agency

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		Chromium		
Target concentration	C_T	0.05	mg/l	

Input Parameters	Variable	Value	Unit	Source of parameter value
Standard entry				
Water filled soil porosity	θ_W	5.00E-02	fraction	Estimated
Air filled soil porosity	θa	1.80E-01	fraction	Estimated
Bulk density of soil zone material	ρ	1.70E+00	g/cm^3	Estimated
Henry's Law constant	H	0.00E+00	dimensionless	*EPA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.49E+04	l/kg	*Suave et al 2000*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.49E+04**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**7.45E+02**	**mg/kg**	(for comparison with soil analyses)
	or		
	0.05	**mg/l**	(for comparison with leachate test results)

Site being assessed:	Townsend Lane
Completed by:	A Prince
Date:	20-Oct-15
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

Date of Workbook Issue: October 2006

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions

Details to be completed for each assessment				
Site Name:	Townsend Lane			
Site Address:	Harpenden			
Completed by:	A Prince			
Date:	20-Oct-15		Version:	1
Contaminant	Copper			
Target Concentration (C_T)	2	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
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Remedial Targets Worksheet , Release 3.1

Level 1 - Soil

Environment Agency

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		Copper		
Target concentration	C_T	2	mg/l	

Input Parameters	Variable	Value	Unit	Source of parameter value
Standard entry				
Water filled soil porosity	θ_W	5.00E-02	fraction	Estimated
Air filled soil porosity	θa	1.80E-01	fraction	Estimated
Bulk density of soil zone material	ρ	1.70E+00	g/cm^3	Estimated
Henry's Law constant	H	0.00E+00	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	4.00E+03	l/kg	*EPA*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**4.00E+03**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**8.00E+03**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	2	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Townsend Lane
Completed by:	A Prince
Date:	20-Oct-15
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

Date of Workbook Issue: October 2006

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions

Details to be completed for each assessment				
Site Name:	Townsend Lane			
Site Address:	Harpenden			
Completed by:	A Prince			
Date:	20-Oct-15		Version:	1
Contaminant	Lead			
Target Concentration (C_T)	0.025	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
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Remedial Targets Worksheet , Release 3.1

Level 1 - Soil

Environment Agency

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		Lead		
Target concentration	C_T	0.025	mg/l	

Input Parameters	Variable	Value	Unit	Source of parameter value
Standard entry				
Water filled soil porosity	θ_W	5.00E-02	fraction	Estimated
Air filled soil porosity	θa	1.80E-01	fraction	Estimated
Bulk density of soil zone material	ρ	1.70E+00	g/cm^3	Estimated
Henry's Law constant	H	0.00E+00	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.71E+04	l/kg	*Suave et al 2000*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Soil water partition coefficient used in Level Assessment	**Kd**	**1.71E+04**	**l/kg**	*Specified value*

Level 1 Remedial Target

Level 1 Remedial Target	**4.28E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.025	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Townsend Lane
Completed by:	A Prince
Date:	20-Oct-15
Version:	1

Environment Agency

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

Date of Workbook Issue: October 2006

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions

Details to be completed for each assessment				
Site Name:	Townsend Lane			
Site Address:	Harpenden			
Completed by:	A Prince			
Date:	20-Oct-15		Version:	1
Contaminant	Nickel			
Target Concentration (C_T)	0.02	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.1

Level 1 - Soil

Environment Agency

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		Nickel		
Target concentration	C_T	0.02	mg/l	

Input Parameters	Variable	Value	Unit	Source of parameter value
Standard entry				
Water filled soil porosity	θ_W	5.00E-02	fraction	Estimated
Air filled soil porosity	θa	1.80E-01	fraction	Estimated
Bulk density of soil zone material	ρ	1.70E+00	g/cm^3	Estimated
Henry's Law constant	H	2.29E-01	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.68E+04	l/kg	*EPA*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.68E+04**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**3.36E+02**	**mg/kg**	(for comparison with soil analyses)
	or		
	0.02	**mg/l**	(for comparison with leachate test results)

Site being assessed:	Townsend Lane
Completed by:	A Prince
Date:	20-Oct-15
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

Date of Workbook Issue: October 2006

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions

Details to be completed for each assessment				
Site Name:	Townsend Lane			
Site Address:	Harpenden			
Completed by:	A Prince			
Date:	20-Oct-15		Version:	1
Contaminant	Zinc			
Target Concentration (C_T)	0.5	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.1

Level 1 - Soil

Environment Agency

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		Zinc		
Target concentration	C_T	0.5	mg/l	

Input Parameters	Variable	Value	Unit	Source of parameter value
Standard entry				
Water filled soil porosity	θ_W	5.00E-02	fraction	Estimated
Air filled soil porosity	θa	1.80E-01	fraction	Estimated
Bulk density of soil zone material	ρ	1.70E+00	g/cm^3	Estimated
Henry's Law constant	H		dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	4.20E+02	l/kg	*EPA*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**4.20E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.10E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.5	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Townsend Lane
Completed by:	A Prince
Date:	20-Oct-15
Version:	1

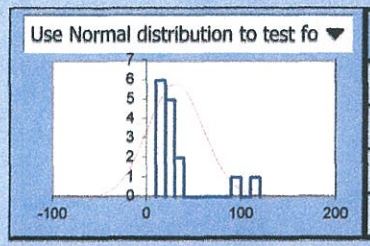
Appendix J

Statistics

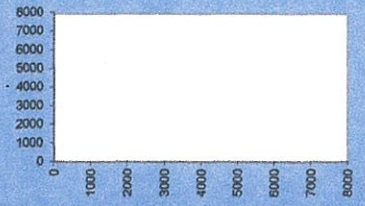
Test Results

Client/client ref: Harpenden
Project ref:
Site ref:
Data description:
Date: 17-Oct-2015
User details: A Prince

Dataset:	Arsenic (mg/kg)
Sample mean, $\bar{x}$ (mg/kg)	30.8
Sample standard deviation, s	29.537
Sample size, n	15
Critical concentration, Cc (mg/kg)	37

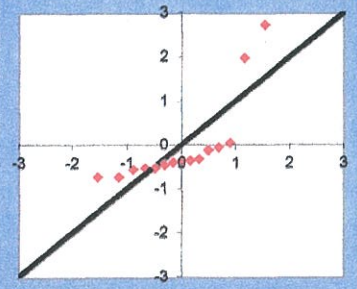


Outliers & non-detects	
Outliers present?	YES
Significance level	5%
Outliers removed?	0
Non-detects	0

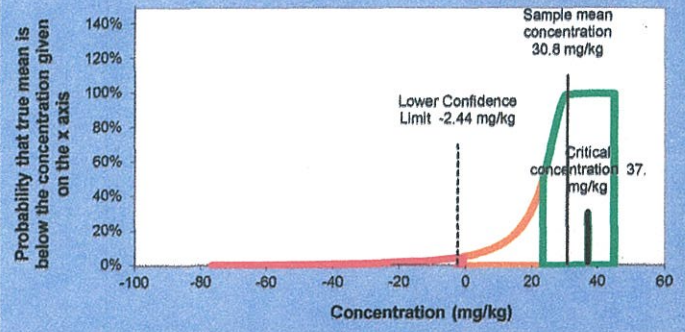


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Part 2A: is true mean higher than critical concentration (μ > Cc)?
Null hypothesis:	The true mean concentration is equal to or less than the critical concentration: μ ≤ Cc
Alternative hypothesis:	The true mean concentration is greater than the critical concentration: μ > Cc



Evidence against Null hypothesis:	upper bound	21%
	lower bound	0%
Base decision on:	lower bound	
Evidence level required:		95%
Balance of probability?		51%
Reject Null Hypothesis?		No

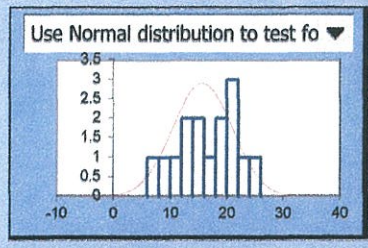
μ ≤ Cc

Back to data | Back to summary | Go to outlier test | Go to normality test

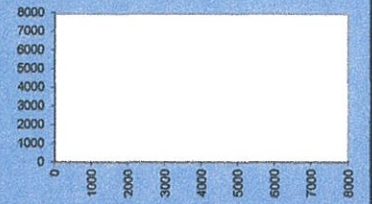
Test Results

Client/client ref: Harpenden
Project ref:
Site ref:
Data description:
Date: 17-Oct-2015
User details: A Prince

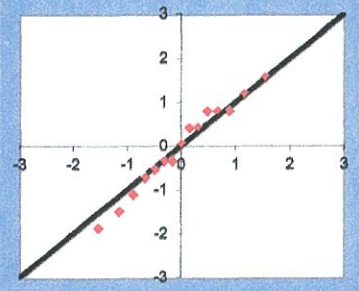
Dataset:	Copper (mg/kg)
Sample mean, $\bar{x}$ (mg/kg)	15.667
Sample standard deviation, s	5.2599
Sample size, n	15
Critical concentration, Cc (mg/kg)	2400



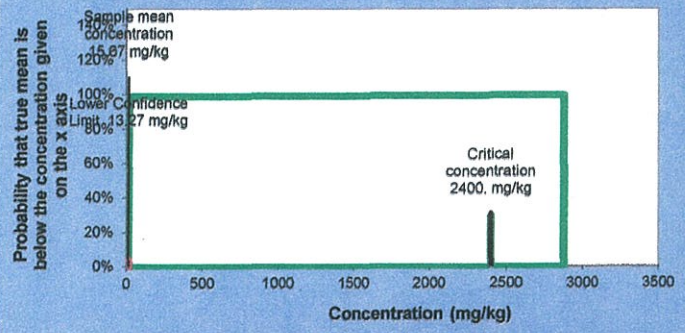
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Part 2A: is true mean higher than critical concentration (μ > Cc)?
Null hypothesis:	The true mean concentration is equal to or less than the critical concentration: μ ≤ Cc
Alternative hypothesis:	The true mean concentration is greater than the critical concentration: μ > Cc



Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	51%
Reject Null Hypothesis?	No
μ ≤ Cc	

Back to data | Back to summary | Go to outlier test | Go to normality test

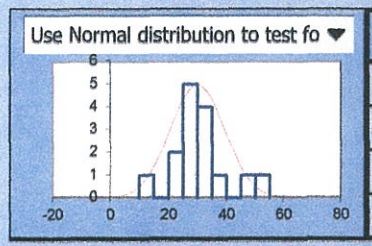
Test Results

Client/client ref: Harpenden
Project ref:

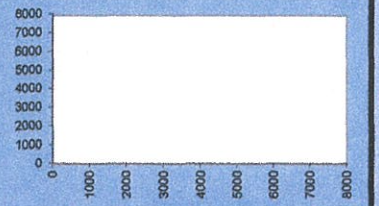
Site ref:
Data description:

Date: 17-Oct-2015
User details: A Prince

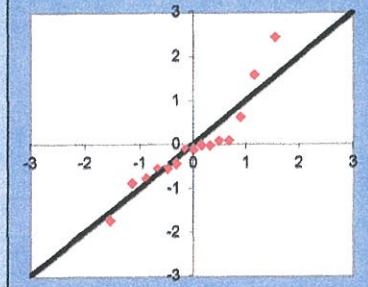
Dataset:	Chromium total (mg/kg)
Sample mean, $\overline{x}$ (mg/kg)	29.933
Sample standard deviation, s	9.3691
Sample size, n	15
Critical concentration, Cc (mg/kg)	910



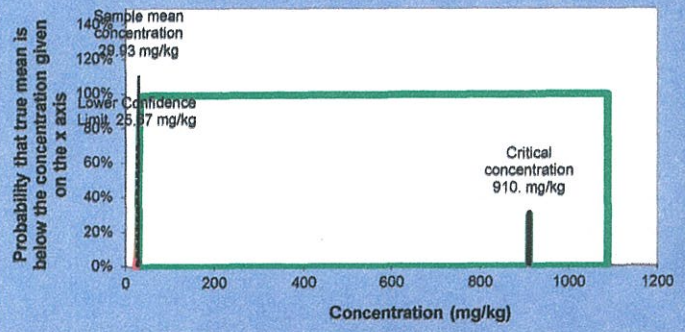
Outliers & non-detects	
Outliers present?	YES
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Part 2A: is true mean higher than critical concentration (μ > Cc)?
Null hypothesis:	The true mean concentration is equal to or less than the critical concentration: μ ≤ Cc
Alternative hypothesis:	The true mean concentration is greater than the critical concentration: μ > Cc



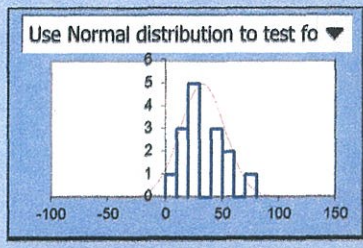
Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	51%
Reject Null Hypothesis?	No
μ ≤ Cc	

Back to data | Back to summary | Go to outlier test | Go to normality test

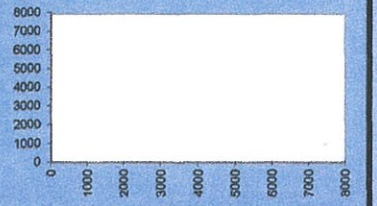
Test Results

Client/client ref: Harpenden
Project ref:
Site ref:
Data description:
Date: 17-Oct-2015
User details: A Prince

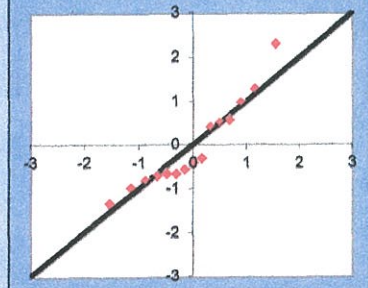
Dataset:	Lead (mg/kg)
Sample mean, $\bar{x}$ (mg/kg)	32.467
Sample standard deviation, s	19.53
Sample size, n	15
Critical concentration, Cc (mg/kg)	250



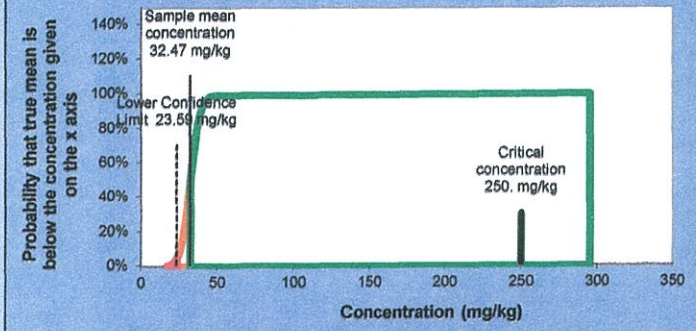
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Part 2A: is true mean higher than critical concentration (μ > Cc)?
Null hypothesis:	The true mean concentration is equal to or less than the critical concentration: μ ≤ Cc
Alternative hypothesis:	The true mean concentration is greater than the critical concentration: μ > Cc



Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	51%
Reject Null Hypothesis?	No

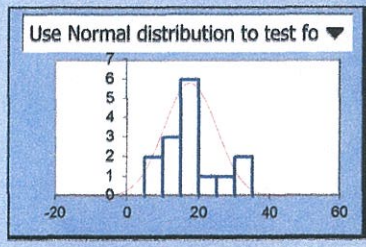
μ ≤ Cc

Back to data | Back to summary | Go to outlier test | Go to normality test

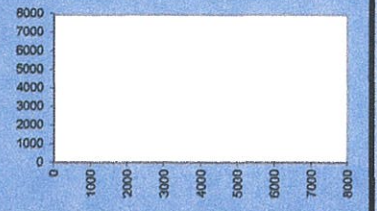
Test Results

Client/client ref: Harpenden
Project ref:
Site ref:
Data description:
Date: 17-Oct-2015
User details: A Prince

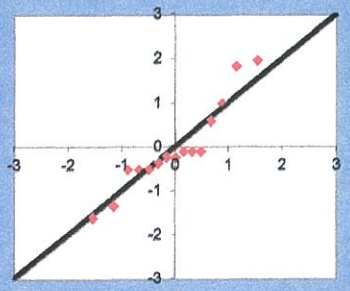
Dataset:	Nickel (mg/kg)
Sample mean, $\overline{x}$ (mg/kg)	17.6
Sample standard deviation, s	7.2683
Sample size, n	15
Critical concentration, Cc (mg/kg)	180



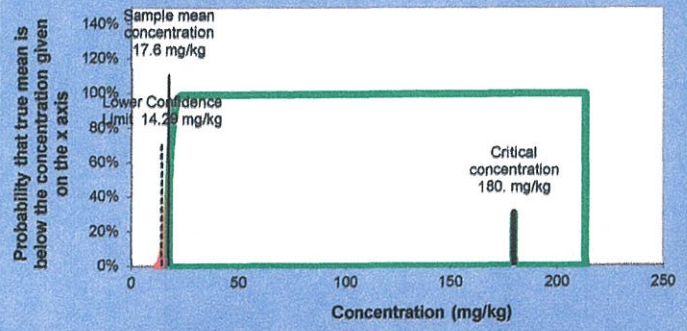
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Part 2A: is true mean higher than critical concentration (μ > Cc)?
Null hypothesis:	The true mean concentration is equal to or less than the critical concentration: μ ≤ Cc
Alternative hypothesis:	The true mean concentration is greater than the critical concentration: μ > Cc



Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	51%
Reject Null Hypothesis?	No
μ ≤ Cc	

Back to data | Back to summary | Go to outlier test | Go to normality test

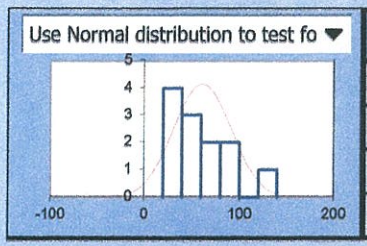
Test Results

Client/client ref: Harpenden
Project ref:

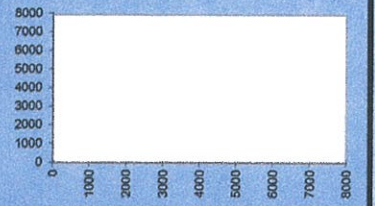
Site ref:
Data description:

Date: 17-Oct-2015
User details: A Prince

Dataset:	Vanadium (mg/kg)
Sample mean, $\bar{x}$ (mg/kg)	61
Sample standard deviation, s	29.894
Sample size, n	12
Critical concentration, Cc (mg/kg)	410

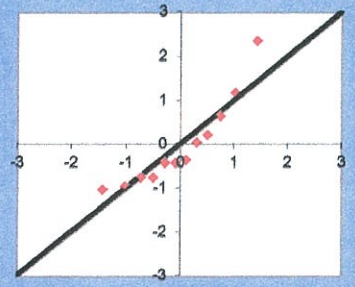


Outliers & non-detects	
Outliers present?	YES
Significance level	5%
Outliers removed?	0
Non-detects	0

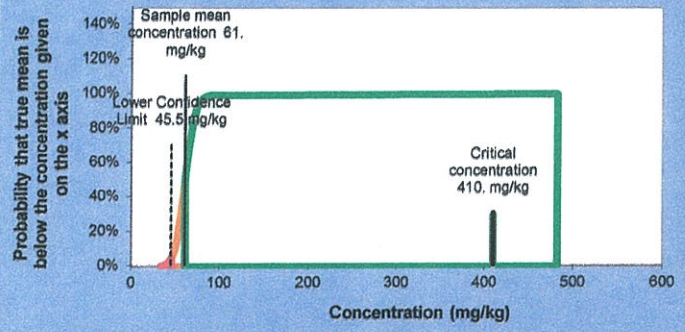


Normality test

Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Part 2A: is true mean higher than critical concentration (μ > Cc)?
Null hypothesis:	The true mean concentration is equal to or less than the critical concentration: μ ≤ Cc
Alternative hypothesis:	The true mean concentration is greater than the critical concentration: μ > Cc



Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	51%
Reject Null Hypothesis?	No
μ ≤ Cc	

Back to data | Back to summary | Go to outlier test | Go to normality test

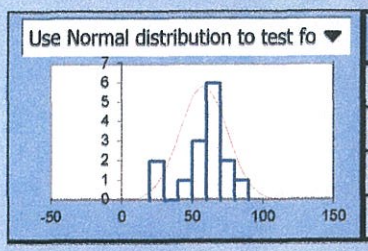
Test Results

Client/client ref: Harpenden
Project ref:

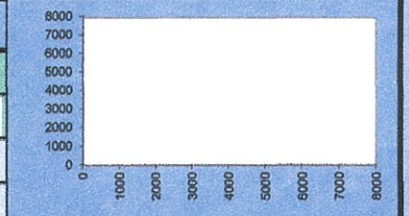
Site ref:
Data description:

Date: 17-Oct-2015
User details: A Prince

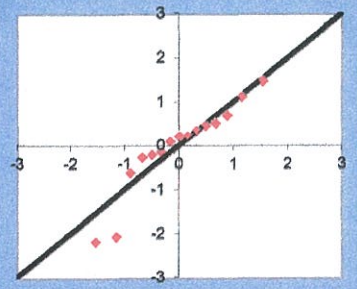
Dataset:	Zinc (mg/kg)
Sample mean, $\bar{x}$ (mg/kg)	58
Sample standard deviation, s	16.75
Sample size, n	15
Critical concentration, Cc (mg/kg)	3700



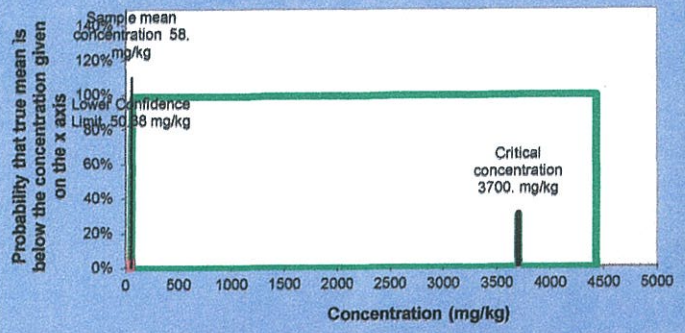
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Part 2A: is true mean higher than critical concentration (μ > Cc)?
Null hypothesis:	The true mean concentration is equal to or less than the critical concentration: μ ≤ Cc
Alternative hypothesis:	The true mean concentration is greater than the critical concentration: μ > Cc



Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	51%
Reject Null Hypothesis?	No
μ ≤ Cc	

Back to data | Back to summary | Go to outlier test | Go to normality test

Development zone

Tree lined avenue to entrance with buildings set back from highway

Housing separated from highway by green space

Road crosses raised table to slow traffic speeds

Building as visual 'Stop'

Site Access

Views to open countryside to the West

Shared surface to central route giving priority to pedestrians

PUBLIC OPEN SPACE 'Pocket Park'

Gaps created between houses to provide visual link to open countryside

TOWNSEND LANE

Housing set back from highway to create a green avenue to site entrance

Building as visual 'Stop'

Site Access

Road crosses raised tables to slow traffic speeds

Building set back from highway with green avenue to front elevations

Hill

RESIDENTIAL DEVELOPMENT

LAND AT TOWNSEND LANE HARPENDEN

CONCEPTUAL SITE LAYOUT

1:500 @A3
SK002
23.08.16.

LAND ON TOWNSEND LANE, HARPENDEN

LANDSCAPE AND VISUAL APPRAISAL
FOR SHLAA SUBMISSION
HILL LTD.
MARCH 2016

TERENCE O'ROURKE

LAND ON TOWNSEND LANE, HARPENDEN

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TERENCE O'ROURKE

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Landscape and visual appraisal

1. Introduction

Background

1.1. This Landscape and Visual Appraisal (LVA) has been prepared by Terence O'Rourke Ltd. to support a SHLAA submission on behalf of Hill Ltd. This appraisal identifies, describes and assesses the likely effects of residential development on the landscape and visual amenity of the site and its surroundings. A number of assumptions about the nature and scale of potential residential development have been defined to enable such an appraisal with the understanding that any potential application would not alter significantly. This is discussed further in section 1.5.

Field work

1.2. The site and surrounding area were visited on 8th March 2016 to obtain familiarity with the landscape and to perform a landscape appraisal and photographic report. Field studies and desk based studies of photographs, map information, character assessments and statutory and emerging planning policy documents have enabled the recording of landscape elements such as topography, land use, development, vegetation and other features. This has allowed an evaluation of the existing landscape features and characteristics, the way the landscape is experienced and the value of the landscape and visual resources in and around the site. An analysis of any possible effects resulting from the proposals was undertaken in consideration of these baseline characteristics.

Visual envelope (Refer to figure 5)

1.3. A preliminary computerised visual envelope was created using specialist computer software based on the height of the existing land using topographic data and a digital surface model (DSM, source; Terrain 5), to establish the extent of the existing visual amenity. This plan illustrates the extent to which the site or any part of the site is potentially visible from the surrounding area based on the existing topographic features. This data helped to define the study area, a 2.5km zone in which the development is considered to have potential landscape and visual effects. Beyond this area, and due to scale of the development and landscape characteristics, it is considered that only negligible effects will be experienced. A preliminary zone of visual influence (ZVI) for the proposals was produced based on a height of 11m. The ZVI defines the area within which the proposed development may have an influence or effect on visual amenity (see figure 5).

References and data sources

1.4. In preparing this chapter the published documents and plans set out in table 1.1 have been referred to.

Table 1.1: References and data sources
Countryside Agency, 2002, Landscape Character Assessment Guidance for England and Scotland
Landscape Institute and Institute of Environmental Management and Assessment, 2013, Guidelines for Landscape and Visual Assessment (3rd edition)
Department for Communities and Local Government (DCLG), March 2012, The National Planning Policy Framework
St Albans City and District Local Plan, saved policies (adopted 1994) and Strategic Local Plan 2011-2031 (emerging).
Natural England Character Areas Profiles, Internet resource
Hertfordshire Landscape Character Assessment (online resource) A

2. Planning Policy

Relevant Planning Policy Documents

2.1. The key planning documents applicable to the study area are, on the national scale, the National Planning Policy Framework (NPPF) and National Planning Policy Guidance (NPPG) and, on the local scale, St Albans City and District Local Plan and the emerging Strategic Local Plan. A broad appraisal of these documents has been carried out identifying the key landscape related planning designations, as well as relevant nature conservation and cultural heritage designations that will also have an impact in terms of the landscape. These are illustrated on Figures 3 and 4 and summarised below. A full list of policy criteria can be found in annex 3.

National Planning Policy and Guidance

2.2. National Planning Policy Framework (NPPF) sets out the government's planning policies for England and how these are expected to be applied. The most relevant policy statements are summarised below.

- **Paragraph 17** – the core planning principles relating to the roles and character of different areas and the effective use of land and conservation of heritage assets;
- **Paragraphs 109,111 and 117** – conserving and enhancing the natural environment;
- **Paragraphs 128 and 131** – conserving and enhancing the historic environment.

2.3. Of particular relevance is paragraph 93 that deals with meeting the challenge of climate change, flooding and coastal change and states: 'Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure.

St Albans City and District Local Plan, saved policies (adopted 1994) and Strategic Local Plan 2011-2031 (emerging).

2.4. The site lies within the administrative area of St Albans City and District Council. The principal development plan document guiding development in Harpenden and the local area to 2031 is the St Albans City and District Local Plan, saved policies (adopted 1994) and St Albans City and District Strategic Local Plan 2011-2031

(emerging). Those policies which are directly relevant to the landscape strategy of the development proposals are:

St Albans City and District Local Plan, saved policies (adopted 1994)

- **Policy 74** – Landscaping and tree preservation
- **Policy 85** – Development in Conservation areas
- **Policy 102** – Loss of agricultural land

St Albans City and District Strategic Local Plan 2011-2031 (2016, emerging)

- **Policy SLP2** – Metropolitan Green Belt (reference is made to this policy in the merging local plan as a key principle of the policy is to 'protect and create attractive landscapes and countryside'. The appraisal seeks to comment on the existing physical and perceptual characteristics of the landscape and the effects of the potential development on it. In this sense it is relevant to understand the contribution of the site to this single purpose. However, the Green Belt policy is, in the strictest sense, a planning consideration of which landscape is a singular consideration of many. This appraisal does not therefore seek to comment on the existing and future contribution of this site to the Green Belt.
- **Policy SLP4** – Urban Design
- **Policy SLP26** – Natural Environment

3. Landscape baseline

3.1. As part of the desktop study, previous classifications and evaluations of the surrounding landscape within the study area have been examined. The purpose of this was to assess whether the application site shares any of these common landscape characteristics and to assess how typical or unique the application site is within the landscape context. It also helps to understand the landscape characteristics of the study area and how the application site interacts with them.

National Landscape character areas

3.2. With reference to the Natural England's National Character Area Profiles, the site lies within Character Area 110, The Chilterns. The information contained within the National Landscape Character Assessment provides a broad and useful context at a large scale.

Local landscape character areas (Refer to figure 4.)

3.3. The Hertfordshire Landscape Character Assessment (2001-2005) provides a description of the physical and perceptual characteristics of the landscape. The document has been reviewed and the key characteristics that are most relevant to the development proposals have been drawn out in the following paragraphs.

3.4. The site covers the landscape character area of the Rothamsted Plateau and Kinsbourne Green. The following paragraph summarises the relevant parts of the character area. Through field testing the direct and indirect effects of the potential development on the site have been identified at a very local level and limited to the landscape defined as the Rothamsted Plateau and Kinsbourne Green only. The adjacent character areas identified on figure 4 therefore will not be altered by development of the site. To understand the wider context, a fuller description of

adjacent character areas can be found in the Hertfordshire Landcsape Character Assessment.

3.5. The site is located on a broad plateau in an area of uplands divided by the river valleys of the Lea and Ver (refer to figure 2). The landscape, as a result, is characterised by an undulating landform overlain on a varied base stratum. Historical patterns of settlement and agricultural practices shaped by the underlying geology are still evident to a small degree. However, the study area is relatively well settled and largely comprising 2oth century development, interconnected by a network of trunk roads and motorways.

3.6. Equally, the landscape structure is large in scale, characterised by a series of small woodland copses and groups, high hedgerows, veteran hedgerow trees and a medium-large scale field pattern. The sense of enclosure is strong. The experiential value of the landscape reflects both the pattern of development, road network and landscape structure. Small pockets of distinctly rural landscape can therefore be found adjacent to urban developments due to the highly treed nature of the settlement fringe and more isolated pockets of agricultural land are partly characterised by low-level road noise.

Rothamsted Plateau and Kinsbourne Green

3.7. Within the study area, the Rothamsted Plateau and Kinsbourne Green comprises a broad plateau utilised, predominantly, for arable cultivation and contained within a medium to large scale field pattern. Most locally to the site, Rothamsted Research (Rothamsted) is a key characteristic, both in the prominence of the buildings, and its influence on the surrounding land use. Small, geometric plots form clusters distributed throughout the local fields. Interpretation boards, outlining the nature of the crop testing practices are located along the public right of way network. Despite the scale of the operation, it is relatively unobtrusive and wholly appropriate in context. The buildings themselves are, however, a prominent and degrading feature locally.

3.8. Throughout the area, the M1 motorway is audible and so, despite the distinct rural nature of the landscape, the sense of tranquility is reduced. Further, Harpenden, despite its proximity, is well contained. For the majority of the character area, the settlement edge of Harpenden is well contained and softened by significant groups of trees and hedgerows. Indeed, the majority of Harpenden to the west of the A1301 is located on an eastern slope and so falls away into the middle distance, disguising its scale and limiting any negative effects on the landscape. The scale and extent of the town is not perceived from the local landscape and limited to the western edge only.

3.9. Woodlands are, broadly absent on the plateau but a key characteristic within adjoining river valley landscapes. The result is that, despite the openness of the landscape, the plateau is contained by surrounding tree cover and so long distance views are limited.

3.10. The Rothamsted Plateau and Kinsbourne Green character area are not covered by any national or local landscape designation. There are a number of public rights of way which intersect the character area, including The Nickey Line (a disused railway line) and the Chiltern Way. These routes appear well used.

The site

3.11. The site, approximately 1.654ha in size, is in a semi urban location adjacent to the south western edge of the town of Harpenden (as illustrated in figure 1). The site

consists of a single, small arable field contained by suburban development (to the north east and south east) farm track (to the north west) and open agricultural land (to the south west). The south western boundary of the site is defined by a hedgerow approximately 3m in height.

3.12. The site has a gentle north easterly aspect, sloping towards the built development to the north and east. The landform continues to rise to the south west to an ultimate height of 130m AOD and a broad plateau that lies between Harpenden and the River Ver.

3.13. The site has a distinctly urban fringe character and contains limited landscape features of particular note. The sites south eastern and south western boundary's are defined by a number of significant oak and pine. The site itself has no public amenity value and is not covered by any environmental designation (refer to figure 3) but is contained within the Metropolitan Green Belt.

4. Visual baseline

Local views of the site

4.1. Views from a range of visual receptors within the study area have been identified. A number of representative viewpoints have been selected that best demonstrate how the site is experienced by identified visual receptors. The viewpoints chosen provide a representative selection of views from locations where the site is visible and cover a range of receptors from varying directions. Views 1 to 6, and viewpoint location plan are illustrated in figures 7 to 12. The findings of the visual baseline studies are set out in the following paragraphs.

4.2. At a broad level, field studies have identified the local pattern of topography, vegetation and development as the key limiters to the extent of inter-visibility between the application site and the local landscape.

4.3. The site is located on the eastern slopes of a broad plateau, its aspect facing the settlement of Harpenden to the east. In addition, the site is contained on three sides by built development and dense vegetation belts. These two factors in particular limit inter-visibility significantly such that the site is not visible from the landscape to the east, north, north east or south east, with the exception of adjacent residential properties. This limits theoretical visibility to the open landscape to the south west and south.

4.4. Further, to the south and south west of the site, the landform falls to the River Ver Valley, a wooded landscape which permits limited long distance views. The result is that theoretical inter-visibility is constrained to a small area between The Nickey Line, Knott Wood and Rothamsted Research. Views are therefore limited to locations within 1km of the site boundary. From within this pocket of the landscape, the extent to which the site is perceived is further moderated by small scale landscape features such as hedgerows, small tree groups and individual buildings.

4.5. A detailed description of these visual receptors and the extent to which they perceive the site is given below:

Residential properties and road users in Redbourne

4.6. Redbourne is located at an elevation of approximately 100-110m AOD, 20-30m below the site and 2-2.5km from the site boundary. The cumulative screening effect of Intervening woodland on the western slope of the river valley is significant.

Woodland at Knott Wood, Northfield Spring, Scout Spring and smaller groups within Redbourn Golf Club and tree belts adjacent to the A5183 and The Nickey Line screen any potential views from residential properties within Redbourn.

Users of the A5183, north of Meadow View and Redbourne

4.7. The raised elevation of a short section of the A5183, between Redding Lane and the M1 motorway provides long distance views over the landscape which are filtered by intervening field boundary hedgerows and trees. Field tests have confirmed that the layering effect of intervening field boundary hedgerows and hedgerow trees, in addition to the easterly aspect of the site, screens any views of the site or potential development from this location.

Luton Hoo Registered Park and Garden

4.8. There are no views from the registered park and gardens to the north west of the site due to intervening built development.

Users of public rights of way in excess of 1km from the site boundary

4.9. There are now views from public rights of way in excess of 1km from the site boundary. The key factors limiting inter-vsibility is the intervening landform and heavily treed nature of the surrounding landscape.

Views from residential properties and public roads within Harpenden

4.10. Intervening built development limits any potential views from existing residential and commercial areas to streets and properties adjacent to the site boundary only.

Residential properties adjacent to the site on Townsend Lane and Claygate Avenue (refer to Figure 8, VP2 for representative views)

4.11. A small number of residential properties on Townsend Lane and Claygate Avenue (approximately 8 and 5 respectively) experience views over the site. Due to the easterly aspect of the site and hedgerow on the south western boundary, views terminate on this boundary and so do not extend in to the open countryside beyond. The large majority of residential properties on both streets do not experience views of the site. The existing hedgerow adjacent to Townsend Lane on the sites north eastern boundary screens a certain amount of the existing site. Although an agricultural field, there is a strong perception of being within the urban environment, albeit on the settlement edge.

Users of Townsend Lane adjacent to the sites north western boundary

4.12. The north western boundary is currently defined with a high hedgerow, approximately 3-5m in height, which serves to screen the site entirely during the summer months. During the winter months, the vegetation is more transparent, and allows filtered views of the site, perceived with a backdrop of residential properties on Hartwell Gardens and Towsend Lane.

Residential properties on the north western edge of Hartwell Gardens

4.13. There are short distance views of the site from residential properties on the north western edge of Hartwell Gardens only (approximately 6 properties). Views are filtered by mature vegetation and so restricted to first storey windows at the rear of the properties. From these locations, the site is located centrally to oblique views which extend to the open countryside in the west and north west. Built

development is also clearly visible to the east and north which, on balance, results in a semi-urban visual experience.

Residential properties on Park Avenue North (refer to Figure 11, VP5) for representative view)

4.14. There are possible views of the site from the first storey windows of a small number (no. 3) of houses located on the western edge of Park Avenue North within the Harpenden Conservation Area. There are no views from public roads or footpaths on Park Avenue North or the wider conservation area. In this sense, the residential amenity of a small number receptors is effected but the distinctive features of this sector, its setting and the wider conservation area will not be effected.

4.15. Oblique views of a small proportion of the site are possible in the context of a much wider expanse of open countryside to the west, partly screened by residential properties on Hartwell Gardens.

Users of The Nickey Line national cycle network route

4.16. The Nickey Line stretches between Hollybush Lane to Hemel Hempstead, passing to the north of the site, approximately 50m from the site boundary and separated by small landholdings, commercial units and vegetation. Theoretical visibility is possible for a section of the trail between the south western tip of Townsend Lane and Redbourn Golf Course. Inter-visibility between the site and the remainder of The Nickey Line is screened by intervening built development, woodland and landform.

4.17. This short section of the Nickey Line is bounded by high hedgerows and hedgerow trees which contain predominantly deciduous and a small proportion of evergreen native shrubs and trees. During the winter months, the hedgerow permits filtered views to the adjacent open fields. Built development is not visible at these locations and, despite the proximity of Harpenden, there is a sense of being within the open countryside. The site itself is not visible from these locations which is located at an oblique angle to the trail and so screened by the perceived depth of the vegetation.

4.18. At the south western tip of Townsend Lane, a break in vegetation permits open views to the surrounding countryside including residential properties on Park Avenue North and the adjacent field on the sites south western boundary. The site itself is again screened from view by vegetation on Townsend Lane.

Users of The Chiltern Way national trail

4.19. The Chiltern Way follows The Nickey Line for approximately 475m between the south western tip of Townsend Lane and Redbourn Golf Course. As such, the extent of nature of views is as discussed for The Nickey Line. There are also no views from the remainder of The Chiltern Way.

Users of a public right of way (Harpenden 013) / Rothamsted Park Trail approximately 200-300m to the south of the site (refer to VP4 and VP5, figures 10 and 11 for representative views)

4.20. A short section of the public right of way between The Nickey Line and the rear of residential properties on Park Avenue North allows local views of the site to the north separated by a medium size arable field in the immediate foreground. The site is currently partially screened by the high hedgerow on the south western boundary although it is anticipated that built development will be visible above this vegetation in the middle distance. The site is visible as a small open field contained on three