



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aliphatic 5-6		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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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



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

Calculate for non-polar organic chemicals

Contaminant	Aliphatic 5-6
Target concentration	0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity θ_a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant H	3.40E+01	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient Koc	7.90E+02	l/kg	TPH Working group data for hydrocarbon bands

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	4.58E+00	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	6.53E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aliphatic 6-8		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	Aliphatic 6-8
Target concentration	C _T 0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H	5.10E+01	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	4.00E+03	l/kg	TPH Working group data for hydrocarbon bands

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	K _d	2.32E+01	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	2.60E-01	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aliphatic 8-10		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	Aliphatic 8-10
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a 1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H 8.20E+01	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	3.20E+04	l/kg	TPH Working group data for hydrocarbon bands

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	K _d	1.86E+02	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	1.90E+00	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aliphatic 10-12		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	Aliphatic 10-12
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H	1.30E+02	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	2.50E+05	l/kg	TPH Working group data for hydrocarbon bands

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	K _d	1.45E+03	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	1.46E+01	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aliphatic 12-16		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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Remedial Targets Worksheet , Release 3.1

Level 1 - Soil



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

Calculate for non-polar organic chemicals

Contaminant	Aliphatic 12-16
Target concentration	C _T 0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H	5.40E+02	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	5.00E+06	l/kg	TPH Working group data for hydrocarbon bands

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	K _d	2.90E+04	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	2.90E+02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
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Details to be completed for each assessment

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Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aliphatic 16-35		
Target Concentration (C _T)	0.01	mg/l	Origin of C _T : mrv

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Remedial Targets Worksheet , Release 3.1

Level 1 - Soil



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

Calculate for non-polar organic chemicals

Contaminant	Aliphatic 16-35
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a 1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H 6.40E+03	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc} 5.80E-03	fraction	f _{oc} =0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc} 1.00E+09	l/kg	TPH Working group data for hydrocarbon bands

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)	f _{oc}	fraction	

Soil water partition coefficient used in Level Assessment	K _d	5.80E+06	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	5.80E+04	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
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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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aromatics 5-7		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	Aromatics 5-7
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H	2.30E-01	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc}	5.80E-03	fraction	f _{oc} =0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	7.90E+01	l/kg	TPH Working group data for hydrocarbon bands

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)	f _{oc}		fraction	

Soil water partition coefficient used in Level Assessment	K _d	4.58E-01	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	6.28E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aromatic7-8		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	Aromatic7-8
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a 1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H 2.70E-01	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc} 5.80E-03	fraction	f _{oc} =0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc} 2.50E+02	l/kg	TPH Working group data for hydrocarbon bands

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)	f _{oc}	fraction	

Soil water partition coefficient used in Level Assessment	K _d	1.45E+00	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	1.62E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aromatic8-10		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	Aromatic8-10
Target concentration	C _T 0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H	4.90E-01	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
----------------------------------	----------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	1.60E+03	l/kg	TPH Working group data for hydrocarbon bands

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	K _d	9.28E+00	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	9.46E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aromatic10-12		
Target Concentration (C _T)	0.01	mg/l	Origin of C _T : mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	Aromatic10-12
Target concentration	C _T 0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H	1.40E-01	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
----------------------------------	----------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	2.50E+03	l/kg	TPH Working group data for hydrocarbon bands

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	K _d	1.45E+01	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	1.47E-01	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



Hydrogeological risk assessment for land contamination Remedial Targets Worksheet , Release 3.1

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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aromatic12-16		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	Aromatic12-16
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a 1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H 5.40E-02	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc} 5.80E-03	fraction	f _{oc} =0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc} 5.00E+03	l/kg	TPH Working group data for hydrocarbon bands

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)	f _{oc}	fraction	

Soil water partition coefficient used in Level Assessment	K _d	2.90E+01	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	2.92E-01	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	28-May-09	Version:	V1.0
Contaminant	Aromatic16-21		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	Aromatic16-21
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a 1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H 1.30E-02	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
----------------------------------	----------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc}	5.80E-03	fraction	f _{oc} =0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	1.60E+04	l/kg	TPH Working group data for hydrocarbon bands

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)	f _{oc}		fraction	

Soil water partition coefficient used in Level Assessment	K _d	9.28E+01	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	9.30E-01	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



Hydrogeological risk assessment for land contamination Remedial Targets Worksheet , Release 3.1

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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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC	Version:	V1.0
Date:	28-May-09		
Contaminant	Aromatic 21-35		
Target Concentration (C_T)	0.01 mg/l	Origin of C_T:	mrν (10 ug/l)

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	Aromatic 21-35
Target concentration	C _T 0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity	0 _a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant	H	6.80E-04	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
----------------------------------	----------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	5.80E-03	fraction	foc=0.0058(1% SOM-based on site data)
Organic carbon partition coefficient	K _{oc}	1.30E+05	l/kg	TPH Working group data for hydrocarbon bands

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	K _d	7.54E+02	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	7.54E+00	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	28-May-09
Version:	V1.0



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	2,4 DNT		
Target Concentration (C_T)	0.002	mg/l	Origin of C_T: long term PNEC(peak associates)

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	2,4 DNT
Target concentration	C _T 0.002 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 1.00E-01	fraction	site testing
Air filled soil porosity	0 _a 3.00E-01	fraction	site testing
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	site testing
Henry's Law constant	H 4.10E-06	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
----------------------------------	----------------	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc} 5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient	K _{oc} 3.00E+02	l/kg	EA P5-036/01

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)	f _{oc}	fraction	

Soil water partition coefficient used in Level Assessment	K _d	1.74E+00	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	3.59E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.002	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	2,6 DNT		
Target Concentration (C_T)	0.0012	mg/l	Origin of C_T: long term PNEC(peak associates)

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	2,6 DNT
Target concentration	C _T 0.0012 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 1.00E-01	fraction	site testing
Air filled soil porosity	0 _a 3.00E-01	fraction	site testing
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	site testing
Henry's Law constant	H 1.50E-05	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
----------------------------------	----------------	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc} 5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient	K _{oc} 1.50E+02	l/kg	EA P5-036/01

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)	f _{oc}	fraction	

Soil water partition coefficient used in Level Assessment	K _d	8.70E-01	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	1.11E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.0012	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	EGDN		
Target Concentration (C _T)	0.05	mg/l	Origin of C _T : Short term PNEC (Peak associates)

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	EGDN
Target concentration	C _T 0.05 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 1.00E-01	fraction	site testing
Air filled soil porosity	0 _a 3.00E-01	fraction	site testing
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	site testing
Henry's Law constant	H 1.16E-04	dimensionless	Peak report

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
----------------------------------	----------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc}	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient	K _{oc}	1.00E+02	l/kg	Peak report

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)	f _{oc}		fraction	

Soil water partition coefficient used in Level Assessment	K _d	5.80E-01	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	3.16E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.05	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	HMX		
Target Concentration (C_T)	1.5	mg/l	Origin of C_T: short term PNEC(peak associates)

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	HMX
Target concentration	C _T 1.5 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value	
Water filled soil porosity	0 _w	1.00E-01	fraction	site testing
Air filled soil porosity	0 _a	3.00E-01	fraction	site testing
Bulk density of soil zone material	ρ	1.90E+00	g/cm ³	site testing
Henry's Law constant	H	6.60E-14	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
----------------------------------	----------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc}	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient	K _{oc}	2.50E+00	l/kg	EA P5-036/01

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)	f _{oc}		fraction	

Soil water partition coefficient used in Level Assessment	K _d	1.45E-02	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	1.01E-01	mg/kg	(for comparison with soil analyses)
	or		
	1.5	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	HNS		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	HNS
Target concentration	0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	1.00E-01	fraction	site testing
Air filled soil porosity θ_a	3.00E-01	fraction	site testing
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	site testing
Henry's Law constant H	1.10E-07	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd		l/kg	
-------------------------------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) foc	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient Koc	8.60E+01	l/kg	EA P5-036/01

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	4.99E-01	l/kg	Calculated value
---	----	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	5.51E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	NG		
Target Concentration (C_T)	0.003	mg/l	Origin of C_T: Long term PNEC (Peak associates)

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 comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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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



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

Calculate for non-polar organic chemicals

Contaminant	NG
Target concentration	0.003 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	1.00E-01	fraction	site testing
Air filled soil porosity θ_a	3.00E-01	fraction	site testing
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	site testing
Henry's Law constant H	1.02E-05	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) foc	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient Koc	5.60E+02	l/kg	EA P5-036/01

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	3.25E+00	l/kg	Calculated value
---	----	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	9.90E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.003	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	PETN		
Target Concentration (C_T)	3.2	mg/l	Origin of C_T: short term PNEC(peak associates)

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	PETN
Target concentration	C _T 3.2 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 1.00E-01	fraction	site testing
Air filled soil porosity	0 _a 3.00E-01	fraction	site testing
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	site testing
Henry's Law constant	H 4.40E-08	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc} 5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient	K _{oc} 2.50E+03	l/kg	EA P5-036/01

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)	f _{oc}	fraction	

Soil water partition coefficient used in Level Assessment	K _d	1.45E+01	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	4.66E+01	mg/kg	(for comparison with soil analyses)
	or		
	3.2	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	picric acid		
Target Concentration (C_T)	0.1	mg/l	Origin of C_T: long term PNEC(peak associates)

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	picric acid
Target concentration	0.1 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	1.00E-01	fraction	site testing
Air filled soil porosity θ_a	3.00E-01	fraction	site testing
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	site testing
Henry's Law constant H	3.65E-10	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) foc	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient Koc	6.50E+01	l/kg	EA P5-036/01

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	3.77E-01	l/kg	Calculated value
---	----	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	4.30E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.1	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	picrite		
Target Concentration (C_T)	5.2	mg/l	Origin of C_T: long term PNEC(peak)

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	picrite
Target concentration	5.2 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	1.00E-01	fraction	site testing
Air filled soil porosity θ_a	3.00E-01	fraction	site testing
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	site testing
Henry's Law constant H	1.80E-10	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd		l/kg	
-------------------------------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) foc	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient Koc	4.40E-01	l/kg	EA P5-036/01

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	2.55E-03	l/kg	Calculated value
---	----	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	2.87E-01	mg/kg	(for comparison with soil analyses)
	or		
	5.2	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



Hydrogeological risk assessment for land contamination Remedial Targets Worksheet , Release 3.1

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Details to be completed for each assessment

Site Name:	Bishopton			
Site Address:	Bishopton			
Completed by:	DC			
Date:	02-Jun-09	Version:	v.01	
Contaminant	RDX			
Target Concentration (C_T)	0.047	mg/l	Origin of C_T:	Long term PNEC (Peak associates)

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	RDX
Target concentration	C _T 0.047 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 1.00E-01	fraction	site testing
Air filled soil porosity	0 _a 3.00E-01	fraction	site testing
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	site testing
Henry's Law constant	H 2.80E-10	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	l/kg	
----------------------------------	----------------	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc} 5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient	K _{oc} 1.00E+02	l/kg	EA P5-036/01

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)	f _{oc}	fraction	

Soil water partition coefficient used in Level Assessment	K _d 5.80E-01	l/kg	Calculated value
---	-------------------------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	2.97E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.047	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.1

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Details to be completed for each assessment

Site Name:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	Tetryl		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv (no PNEC derived)

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 comparison 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

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

Calculate for non-polar organic chemicals

Contaminant	Tetryl
Target concentration	C _T 0.01 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 1.00E-01	fraction	site testing
Air filled soil porosity	0 _a 3.00E-01	fraction	site testing
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	site testing
Henry's Law constant	H 8.30E-11	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
----------------------------------	----------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc}	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient	K _{oc}	1.35E+03	l/kg	EA P5-036/01

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)	f _{oc}		fraction	

Soil water partition coefficient used in Level Assessment	K _d	7.83E+00	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	7.88E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	02-Jun-09	Version:	v.01
Contaminant	TNT		
Target Concentration (C_T)	0.0005	mg/l	Origin of C_T: Long term PNEC (Peak associates)

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	TNT
Target concentration	0.0005 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	1.00E-01	fraction	site testing
Air filled soil porosity θ_a	3.00E-01	fraction	site testing
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	site testing
Henry's Law constant H	2.40E-07	dimensionless	P5-036/01

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd		l/kg	
-------------------------------------	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) foc	5.80E-03	fraction	1% SOM- 15%le
Organic carbon partition coefficient Koc	5.60E+02	l/kg	EA P5-036/01

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	3.25E+00	l/kg	Calculated value
---	----	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	1.65E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.0005	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	02-Jun-09
Version:	v.01



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.

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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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	8th July 2009	Version:	V1.0
Contaminant	Aliphatic 16-35		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T: mrv

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant: Aliphatic 16-35
 Target concentration C_T : 0.01 mg/l

Input Parameters
 Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	3.00E-01	fraction	guide value of site soil testing
Air filled soil porosity θ_a	1.00E-01	fraction	guide value from soil testing data
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	guide value from soil testing data
Henry's Law constant H	6.40E+03	dimensionless	TPH Working group data for hydrocarbon bands

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d : [Redacted] l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) f_{oc} : 5.80E-03 fraction
 Organic carbon partition coefficient K_{oc} : 1.00E+09 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for neutral species $K_{oc,n}$: [Redacted] l/kg
 Sorption coefficient for ionised species $K_{oc,i}$: [Redacted] l/kg
 pH value pH: [Redacted] pH units
 Acid dissociation constant pKa: [Redacted]
 Fraction of organic carbon (in soil) f_{oc} : [Redacted] fraction

Soil water partition coefficient used in Level Assessment K_d : 5.80E+06 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	5.80E+04 mg/kg	(for comparison with soil analyses)
	or	
	0.01 mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	8th July 2009
Version:	V1.0

Remedial Targets Worksheet , Release 3.1



Level 2 - Soil

Contaminant Aliphatic 16-35 from Level 1
Target concentration C_T 0.01 mg/l from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamination' (Environment Agency 2006)

Input Parameters Variable Value Unit Source of parameter value

Standard entry

Infiltration	Inf	1.30E-04	m/d	assume degrre of final cover	
Area of contaminant source	A	7.74E+02	m ²	measured from GIS	Not used in calculation

Entry for groundwater flow below site

Length of contaminant source in direction of groundwater flow	L	1.80E+01	m	measured from GIS	
Saturated aquifer thickness	da	1.00E+01	m	from borehole BH 2573 (silt)	
Hydraulic Conductivity of aquifer in which dilution occurs	K	8.64E-03	m/d	avearge value for linwood and paisley	
Hydraulic gradient of water table	i	3.47E-03	fraction	measured from groundwater contour plan	
Width of contaminant source perpendicular to groundwater flow	w	4.50E+01	m	measured from GIS	Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
		Specify			
Enter mixing zone thickness	Mz	5.00E+00	m	BH 2537 third staured thickness	
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	DF	1.06E+00		
Level 2 Remedial Target		1.06E-02	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration
		or		
		6.17E+04	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Bishopton
Completed by:	DC
Date:	8th July 2009
Version:	V1.0



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.

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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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	08-Jul-09	Version:	v.01
Contaminant	B(a)P		
Target Concentration (C _T)	0.00003	mg/l	Origin of C _T : EQS

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 comparison 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.

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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



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

Calculate for non-polar organic chemicals

Contaminant	B(a)P
Target concentration	0.00003 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	3.00E-01	fraction	site testing
Air filled soil porosity θ_a	1.00E-01	fraction	site testing
Bulk density of soil zone material ρ	1.90E+00	g/cm ³	site testing
Henry's Law constant H	1.97E+00	dimensionless	EA-SR7

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) foc	5.80E-03	fraction	foc= 1%SOM 10-15%le of site data.
Organic carbon partition coefficient Koc	1.29E+05	l/kg	SR7

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	7.47E+02	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	2.24E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.00003	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	08-Jul-09
Version:	v.01

Remedial Targets Worksheet , Release 3.1



Level 2 - Soil

Contaminant
Target concentration C_T **B(a)P** from Level 1
0.00003 mg/l from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamination' (Environment Agency 2006)

Input Parameters Variable Value Unit Source of parameter value

Standard entry

Infiltration	Inf	1.30E-04	m/d	50 mm/yr(some cover)	
Area of contaminant source	A	2.10E+04	m ²	measured	Not used in calculation

Entry for groundwater flow below site

Length of contaminant source in direction of groundwater flow	L	2.10E+02	m	measured	
Saturated aquifer thickness	da	5.60E+00	m	from borehole BH2711	
Hydraulic Conductivity of aquifer in which dilution occurs	K	8.64E-02	m/d	linwood and Paisley BH2671	
Hydraulic gradient of water table	i	5.30E-03	fraction	measured	
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m	measured	Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		Specify			
Enter mixing zone thickness	Mz	2.50E+00	m	0.5 saturated depth	
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	DF	1.04E+00		
Level 2 Remedial Target		3.13E-05	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration
		or		
		2.34E-02	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Bishopton
Completed by:	DC
Date:	08-Jul-09
Version:	v.01

Remedial Targets Worksheet , Release 3.1



Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant	B(a)P			from Level 1
Target Concentration	Ct	0.00003	mg/l	from Level 1
Dilution Factor	DF	1.04E+00		from Level 2

Enter method of defining partition co-efficient (using pull down list)
Calculate for ionic organic chemicals (acids)

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

Enter source concentration

Determine remedial target based on assumed concentration

Variable	Value	Unit	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	3.65E+03 days	(10 years)
Calculated decay rate	λ	1.90E-04 days ⁻¹	calculated
Width of plume in aquifer at source	Sz	1.00E+02 m	from Level 2
Plume thickness in aquifer at source	Sy	2.50E+00 m	from Level 2
Bulk density of aquifer materials	ρ	1.90E+00 g/cm ³	site data
Effective porosity of aquifer	n	3.00E-01 fraction	site data
Hydraulic gradient	i	1.32E-01 fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	8.84E-02 m/d	from Level 2
Distance to compliance point	x	5.00E+00 m	measured
Distance (lateral) to compliance point perpendicular to flow direction	z		
Distance (depth) to compliance point perpendicular to flow direction	y		
Time since pollutant entered groundwater	t	1.00E+99 days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	0.00E+00 l/kg	see options
Longitudinal dispersivity	ax	0.350 m	see options
Transverse dispersivity	az	0.035 m	see options
Vertical dispersivity	ay	0.003 m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	3.79E-02 m/d
Retardation factor	Rf	1.00E+00 fraction
Decay rate used	λ	1.90E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	1.32E-01 fraction
Rate of contaminant flow due to retardation	u	3.79E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	9.75E-01 fraction
Attenuation factor (C _{CP} /C ₀)	AF	1.03E+00 fraction

Remedial Targets

Level 3 Remedial Target	3.20E-05	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	5	m	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	9.75E-01	fraction Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd 0.00E+00 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 0.00E+00 fraction

Organic carbon partition coefficient K_{oc} 0.00E+00 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{oc,rel} 0.00E+00 l/kg

Sorption coefficient for ionised species K_{oc,i} 0.00E+00 l/kg

pH value pH 0.00E+00

Acid dissociation constant pKa 0.00E+00

Fraction of organic carbon in aquifer f_{oc} 0.00E+00 fraction

Soil water partition coefficient Kd 0.00E+00 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

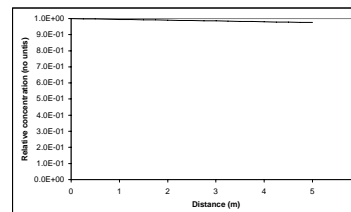
Variable	Value	Unit
Longitudinal dispersivity	ax	3.50E-01 m
Transverse dispersivity	az	3.50E-02 m
Vertical dispersivity	ay	3.50E-03 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{2.14}; az = ax/10, ay = ax/100 are assumed

Note

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentration at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Distance	Relative concentration
0	1.0E+00
0.3	9.99E-01
0.5	9.98E-01
0.8	9.96E-01
1.0	9.95E-01
1.3	9.94E-01
1.5	9.93E-01
1.8	9.91E-01
2.0	9.90E-01
2.3	9.89E-01
2.5	9.88E-01
2.8	9.86E-01
3.0	9.85E-01
3.3	9.84E-01
3.5	9.83E-01
3.8	9.81E-01
4.0	9.80E-01
4.3	9.79E-01
4.5	9.78E-01
4.8	9.77E-01
5.0	9.75E-01

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks. By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Bishopton
Completed by:	DC
Date:	#####
Version:	v.01



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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	8th July 2009	Version:	v.01
Contaminant	Flouarnthene		
Target Concentration (C_T)	0.00002	mg/l	Origin of C_T: EQS

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 comparison 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.

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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



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

Calculate for non-polar organic chemicals

Contaminant	Flouarathene
Target concentration	C _T 0.00002 mg/l

Input Parameters
Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity (θ _w)	3.00E-01	fraction	site testing
Air filled soil porosity (θ _a)	1.00E-01	fraction	site testing
Bulk density of soil zone material (ρ)	1.90E+00	g/cm ³	site testing
Henry's Law constant (H)	4.13E+01	dimensionless	EA-SR7

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient (K _d)		l/kg	
--	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) (f _{oc})	5.80E-03	fraction	foc= 1%SOM 10-15%le of site data.
Organic carbon partition coefficient (K _{oc})	1.82E+04	l/kg	SR7

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) (f _{oc})		fraction	

Soil water partition coefficient used in Level Assessment	K _d	1.06E+02	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	2.16E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.00002	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	8th July 2009
Version:	v.01

Remedial Targets Worksheet , Release 3.1



Level 2 - Soil

Contaminant **Flouarnthene** from Level 1
 Target concentration C_T **0.00002** mg/l from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamination' (Environment Agency 2006)

Input Parameters Variable Value Unit Source of parameter value

Standard entry

Infiltration	Inf	1.30E-04	m/d	50 mm/yr(some cover)	
Area of contaminant source	A	5.99E+04	m ²	measured	Not used in calculation

Entry for groundwater flow below site

Length of contaminant source in direction of groundwater flow	L	6.30E+02	m	measured	
Saturated aquifer thickness	da	7.00E+00	m	from borehole BH2675	
Hydraulic Conductivity of aquifer in which dilution occurs	K	8.64E-02	m/d	average k value-in-situ	
Hydraulic gradient of water table	i	6.90E-03	fraction	measured	
Width of contaminant source perpendicular to groundwater flow	w	9.50E+01	m	measured	Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		Specify			
Enter mixing zone thickness	Mz	3.00E+00	m	0.5 saturated depth	
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	DF	1.02E+00		
Level 2 Remedial Target		2.04E-05	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration
		or		
		2.20E-03	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Bishopton
Completed by:	DC
Date:	8th July 2009
Version:	v.01

Remedial Targets Worksheet , Release 3.1



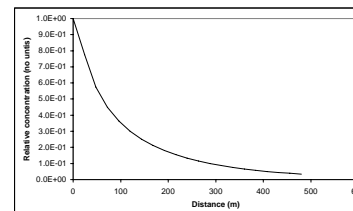
Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Flouranthene		from Level 1
Target Concentration	Ct	0.00002	mg/l	from Level 1
Dilution Factor	DF	1.02E+00		from Level 2

Enter method of defining partition co-efficient (using pull down list)
Calculate for ionic organic chemicals (acids)

Soil water partition coefficient	Kd		l/kg
Organic carbon partition coefficient	Koc		l/kg
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Sorption coefficient for related species	K _{oc,r}	0.00E+00	l/kg
Sorption coefficient for ionised species	K _{oc,i}	0.00E+00	l/kg
pH value	pH	0.00E+00	
Acid dissociation constant	pKa	0.00E+00	
Fraction of organic carbon in aquifer	foc	0.00E+00	fraction
Soil water partition coefficient	Kd	0.00E+00	l/kg



Note: 'Relative concentration' is the ratio of calculated concentration at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Distance	Relative concentration	(No units)
0	1.0E+00	
24.0	7.75E-01	
48.0	5.74E-01	
72.0	4.49E-01	
96.0	3.63E-01	
120.0	3.00E-01	
144.0	2.51E-01	
168.0	2.13E-01	
192.0	1.81E-01	
216.0	1.55E-01	
240.0	1.34E-01	
264.0	1.15E-01	
288.0	1.00E-01	
312.0	8.69E-02	
336.0	7.55E-02	
360.0	6.60E-02	
384.0	5.77E-02	
408.0	5.05E-02	
432.0	4.42E-02	
456.0	3.88E-02	
480.0	3.41E-02	

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

Enter source concentration

Determine remedial target based on assumed concentration

Variable	Value	Unit	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.83E+03 days	Consim 1132-2847days, (5 years)
Calculated decay rate	λ	3.80E-04 days ⁻¹	calculated
Width of plume in aquifer at source	Sz	9.50E+01 m	from Level 2
Plume thickness in aquifer at source	Sy	3.00E+00 m	from Level 2
Bulk density of aquifer materials	ρ	1.90E+00 g/cm ³	Site data
Effective porosity of aquifer	n	3.00E-01 fraction	Site data
Hydraulic gradient	i	3.23E-01 fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	8.64E-02 m/d	from Level 2
Distance to compliance point	x	4.80E+02 m	Measured in GIS
Distance (lateral) to compliance point perpendicular to flow direction	z		
Distance (depth) to compliance point perpendicular to flow direction	y		
Time since pollutant entered groundwater	t	1.00E+99 days	time variant options only
Partition coefficient	Kd	0.00E+00 l/kg	see options
Longitudinal dispersivity	ax	8.976 m	see options
Transverse dispersivity	az	0.898 m	see options
Vertical dispersivity	ay	0.090 m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	9.30E-02 m/d
Retardation factor	Rf	1.00E+00 fraction
Decay rate used	λ	3.80E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	3.23E-01 fraction
Rate of contaminant flow due to retardation	u	9.30E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{cp} /C ₀	3.41E-02 fraction
Attenuation factor (C ₀ /C _{cp})	AF	2.93E+01 fraction

Remedial Targets

Level 3 Remedial Target	5.99E-04	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	480	m	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{cp} /C ₀	3.41E-02	fraction

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99

Entry if specify partition coefficient (option)

Entry for non-polar organic chemicals (option)

Entry for ionic organic chemicals (option)

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity ax

Transverse dispersivity az

Vertical dispersivity ay

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{2.14}; az = ax/10, ay = ax/100 are assumed

Note

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Bishopton
Completed by:	DC
Date:	8th July 2009
Version:	v.01



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.

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The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.
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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:	Bishopton		
Site Address:	Bishopton		
Completed by:	DC		
Date:	1st July 2009	Version:	v.01
Contaminant	Flouarnthene		
Target Concentration (C_T)	0.00002	mg/l	Origin of C_T: EQS

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 comparison 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



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

Calculate for non-polar organic chemicals

Contaminant	Flouarathene
Target concentration	C _T 0.00002 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity	0 _w 3.00E-01	fraction	site testing
Air filled soil porosity	0 _a 1.00E-01	fraction	site testing
Bulk density of soil zone material	ρ 1.90E+00	g/cm ³	site testing
Henry's Law constant	H 4.13E+01	dimensionless	EA-SR7

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.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d		l/kg	
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc}	5.80E-03	fraction	foc= 1%SOM 10-15%le of site data.
Organic carbon partition coefficient	K _{oc}	1.82E+04	l/kg	SR7

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)	f _{oc}		fraction	

Soil water partition coefficient used in Level Assessment	K _d	1.06E+02	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	2.16E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.00002	mg/l	(for comparison with leachate test results)

Site being assessed:	Bishopton
Completed by:	DC
Date:	1st July 2009
Version:	v.01

Remedial Targets Worksheet , Release 3.1



Level 2 - Soil

Contaminant **Flouarnthene** from Level 1
 Target concentration C_T **0.00002** mg/l from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamination' (Environment Agency 2006)

Input Parameters Variable Value Unit Source of parameter value

Standard entry

Infiltration	Inf	1.30E-04	m/d	50 mm/yr(some cover)	
Area of contaminant source	A	4.82E+03	m ²	measured	Not used in calculation

Entry for groundwater flow below site

Length of contaminant source in direction of groundwater flow	L	7.00E+01	m	measured	
Saturated aquifer thickness	da	6.00E+00	m	from borehole BH2711	
Hydraulic Conductivity of aquifer in which dilution occurs	K	8.64E-02	m/d	linwood and Paisley BH2671	
Hydraulic gradient of water table	i	8.00E-05	fraction	measured	
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m	measured	Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		Specify			
Enter mixing zone thickness	Mz	3.00E+00	m	0.5 saturated depth	
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	DF	1.00E+00		
Level 2 Remedial Target		2.00E-05	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration
		or		
		2.16E-03	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Bishopton
Completed by:	DC
Date:	1st July 2009
Version:	v.01

Remedial Targets Worksheet , Release 3.1



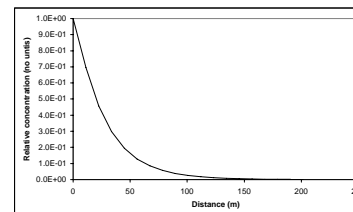
Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Flouarnthene		from Level 1
Target Concentration	Ct	0.00002	mg/l	from Level 1
Dilution Factor	DF	1.00E+00		from Level 2

Enter method of defining partition co-efficient (using pull down list)
Calculate for ionic organic chemicals (acids)

Soil water partition coefficient	Kd		l/kg
Organic carbon partition coefficient	Koc		l/kg
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Sorption coefficient for related species	K _{oc,r}	0.00E+00	l/kg
Sorption coefficient for ionised species	K _{oc,i}	0.00E+00	l/kg
pH value	pH	0.00E+00	
Acid dissociation constant	pKa	0.00E+00	
Fraction of organic carbon in aquifer	foc	0.00E+00	fraction
Soil water partition coefficient	Kd	0.00E+00	l/kg



Calculated (relative) concentrations for distance-concentration graph

Distance	Relative concentration
0	1.0E+00
11.2	6.9E-01
22.4	4.5E-01
33.6	2.9E-01
44.8	1.9E-01
56.0	1.2E-01
67.2	8.4E-02
78.4	5.6E-02
89.6	3.8E-02
100.8	2.5E-02
112.0	1.7E-02
123.2	1.1E-02
134.4	7.9E-03
145.6	5.4E-03
156.8	3.6E-03
168.0	2.5E-03
179.2	1.7E-03
190.4	1.1E-03
201.6	8.0E-04
212.8	5.5E-04
224.0	3.7E-04

Note: 'Relative concentration' is the ratio of calculated concentration at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

Enter source concentration

Determine remedial target based on assumed concentration

Variable	Value	Unit	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.83E+03	days Consim 1132-2847/days, (5 years)
Calculated decay rate	λ	3.80E-04	days ⁻¹ calculated
Width of plume in aquifer at source	Sz	7.00E+01	m from Level 2
Plume thickness in aquifer at source	Sy	3.00E+00	m from Level 2
Bulk density of aquifer materials	ρ	1.90E+00	g/cm ³ Site data
Effective porosity of aquifer	n	3.00E-01	fraction Site data
Hydraulic gradient	i	3.52E-02	fraction from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	8.84E-02	m/d from Level 2
Distance to compliance point	x	2.24E+02	m Measured in GIS
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	1.00E+99	days time variant options only
Parameters values determined from options			
Partition coefficient	Kd	0.00E+00	l/kg see options
Longitudinal dispersivity	ax	6.531	m see options
Transverse dispersivity	az	0.653	m see options
Vertical dispersivity	ay	0.065	m see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	1.01E-02 m/d
Retardation factor	Rf	1.00E+00
Decay rate used	λ	3.80E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	3.52E-02
Rate of contaminant flow due to retardation	u	1.01E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{cp} /C ₀	3.77E-04
Attenuation factor (C ₀ /C _{cp})	AF	2.65E+03

Remedial Targets

Level 3 Remedial Target	5.32E-02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	224	m	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{cp} /C ₀	3.77E-04	fraction Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Variable	Value	Unit
Longitudinal dispersivity	ax	6.53E+00 m
Transverse dispersivity	az	0.65E+00 m
Vertical dispersivity	ay	0.06E+00 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{2.14}; az = ax/10, ay = ax/100 are assumed

Note
 This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

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