

**Calculation Settings**

Number of iterations: 1001

Results calculated using sampled PDFs

Full Calculation

Clay Liner:

Retarded values used for simulation

Biodegradation

Unsaturated Pathway:

Retarded values used for simulation

Biodegradation

Saturated Vertical Pathway:

No Vertical Pathway

Aquifer Pathway:

Retarded values used for simulation

Biodegradation

Timeslices at: 30, 100, 300, 1000

**Decline in Contaminant Concentration in Leachate**

Ammoniacal\_N

c (kg/l): 0.59

Non-Volatile

m (kg/l): 0

Cadmium

c (kg/l): 0.1589

Non-Volatile

m (kg/l): 0.0823

Chloride

c (kg/l): 0.2919

Non-Volatile

m (kg/l): 0.0298

Copper

c (kg/l): -0.0488

Non-Volatile

m (kg/l): 0.0664

Mercury

c (kg/l): 0.1643

Non-Volatile

m (kg/l): 0.0767

Naphthalene

Half life (years): 10

Volatile

Toluene

Half life (years): 10

Volatile

Zinc

c (kg/l): 0.0561

Non-Volatile

m (kg/l): 0.0403

**Contaminant Half-lives (years)**

## Clay Liner:

Ammoniacal_N	SINGLE(6)
Cadmium	SINGLE(1e+009)
Chloride	SINGLE(1e+009)
Copper	SINGLE(1e+009)
Mercury	SINGLE(1e+009)
Naphthalene	SINGLE(0.69)
Toluene	UNIFORM(0.16,0.57)
Zinc	SINGLE(1e+009)

## Unsaturated Pathway:

Ammoniacal_N	SINGLE(6)
Cadmium	SINGLE(1e+009)
Chloride	SINGLE(1e+009)
Copper	SINGLE(1e+009)
Mercury	SINGLE(1e+009)
Naphthalene	SINGLE(0.06)
Toluene	UNIFORM(0.14,1.5)
Zinc	SINGLE(1e+009)

## Aquifer Pathway:

Ammoniacal_N	SINGLE(6)
Cadmium	SINGLE(6e-005)
Chloride	SINGLE(1e+009)
Copper	LOGTRIANGULAR(0.009,0.02125,0.076)
Mercury	SINGLE(1e+009)
Naphthalene	SINGLE(0.387)
Toluene	UNIFORM(0.1,0.2)
Zinc	SINGLE(1e+009)

### Background Concentrations of Contaminants

Justification for Contaminant Properties

WAC Soil Testing and Leachate tests at Chadwich Lane

All units in milligrams per litre

Ammoniacal_N	SINGLE(0.06)
Chloride	UNIFORM(29,31.4)
Mercury	UNIFORM(5e-005,0.00024)
Zinc	UNIFORM(0.03,0.145)

**Phase: Phase 1****Infiltration Information**

Cap design infiltration (mm/year):	SINGLE(50)
Infiltration to waste (mm/year):	SINGLE(160)
Infiltration to grassland (mm/year):	SINGLE(50)
End of filling (years from start of waste deposit):	10
Start of cap degradation (years from end of waste deposit):	100
End of cap degradation (years from end of waste deposit):	1000

Justification for Specified Infiltration

Based on ESID and Met Office Data

Duration of management control (years from the start of waste disposal): 18

**Cell dimensions**

Cell width (m):	500
Cell length (m):	750
Cell top area (ha):	39.375
Cell base area (ha):	37.5
Number of cells:	1
Total base area (ha):	37.5
Total top area (ha):	39.375
Head of Leachate when surface water breakout occurs (m)	SINGLE(17)
Waste porosity (fraction)	SINGLE(0.1)
Final waste thickness (m):	TRIANGULAR(17,30,43)
Field capacity (fraction):	SINGLE(0.3)
Waste dry density (kg/l)	SINGLE(2)

Justification for Landfill Geometry

Based on HRA 2 and HRA 3

**Source concentrations of contaminants***All units in milligrams per litre*

Declining source term

Ammoniacal_N	LOGTRIANGULAR(0.11,0.66,1.76) <i>Data are spot measurements of Leachate Quality</i>
Cadmium	LOGTRIANGULAR(0.00011,0.00176,0.0044) <i>Substance to be treated as List 1</i>
Chloride	LOGTRIANGULAR(0.011,21.01,176) <i>Data are spot measurements of Leachate Quality</i>
Copper	LOGTRIANGULAR(0.0099,0.0176,0.0836) <i>Data are spot measurements of Leachate Quality</i>
Mercury	LOGTRIANGULAR(1.1e-005,4.95e-005,0.00011) <i>Substance to be treated as List 1</i>
Naphthalene	LOGTRIANGULAR(0.011,0.11,0.22) <i>Substance to be treated as List 1</i>
Toluene	LOGTRIANGULAR(0.011,0.055,0.165) <i>Substance to be treated as List 1</i>
Zinc	LOGTRIANGULAR(0.011,0.0253,0.44) <i>Data are spot measurements of Leachate Quality</i>

Justification for Species Concentration in Leachate  
Concentrations 1 plus 10%

**Drainage Information**

Fixed Head.

Head on EBS is given as (m):

SINGLE(1)

Justification for Specified Head

1metre limit assumed above geological barrier

## Barrier Information

There is a single clay barrier

Justification for Engineered Barrier Type

1 metre geological barrier

Design thickness of clay (m):	SINGLE(1)
Density of clay (kg/l):	SINGLE(1.9)
Pathway moisture content (fraction):	UNIFORM(0.19,0.2)

Justification for Clay: Liner Thickness

CQA Design Specification

Hydraulic conductivity of liner (m/s):	TRIANGULAR(1e-009,1e-008,1e-007)
Pathway longitudinal dispersivity (m):	SINGLE(0.1)

Justification for Clay: Hydraulics Properties

Source Evaluation Testing on adjoining phase

*Retardation parameters for clay liner*

Uncertainty in Kd (l/kg):

Ammoniacal_N	UNIFORM(7.3,8.5)
Cadmium	SINGLE(222.2)
Chloride	SINGLE(0)
Copper	SINGLE(126.8)
Mercury	SINGLE(3835.5)
Naphthalene	LOGTRIANGULAR(488,1102,2309)
Toluene	LOGTRIANGULAR(57,130,272)
Zinc	SINGLE(20.7)

Justification for Liner Kd Values by Species

EA 2003 and USEPA1999

**Sherwood Sandstone pathway parameters***Modelled as unsaturated pathway*

Pathway length (m):	TRIANGULAR(1,6,10)
Flow Model:	porous medium
Pathway moisture content (fraction):	UNIFORM(0.15,0.2)
Pathway Density (kg/l):	SINGLE(1.9)

Justification for Unsat Zone Geometry

Based on groundwater level monitoring Appendix HRA 4 and Drawing HRA 3 [CHANGED]

Pathway hydraulic conductivity values (m/s):	TRIANGULAR(1.95e-005,2.46e-005,0.0001007)
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Justification for Unsat Zone Hydraulics Properties

Site investigations Appendices 1-3

Pathway longitudinal dispersivity (m):	UNIFORM(0.05,0.13)
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Justification for Unsat Zone Dispersion Properties

10% of pathway length

*Retardation parameters for Sherwood Sandstone pathway**Modelled as unsaturated pathway*

Uncertainty in Kd (l/kg):

Ammoniacal_N	LOGUNIFORM(0.43,1.79)
Cadmium	SINGLE(240)
Chloride	SINGLE(0)
Copper	SINGLE(295)
Mercury	SINGLE(450)
Naphthalene	LOGTRIANGULAR(488,1102,2309)
Toluene	LOGTRIANGULAR(57,130,272)
Zinc	LOGTRIANGULAR(1.1,200,600)

Justification for Kd Values by Species

EA2003 and USEPA 1999

**Aquifer Pathway Dimensions for Phase**

Pathway length (m):	UNIFORM(1000,1200)
Pathway width (m):	SINGLE(200)

**pathway parameters**

No Vertical Pathway

**Sherwood Sandstone pathway parameters***Modelled as aquifer pathway.*

Mixing zone (m): SINGLE(50)

Justification for Aquifer Geometry

HRA 2

Pathway regional gradient (-): SINGLE(0.0235)

Pathway hydraulic conductivity values (m/s): LOGTRIANGULAR(1.95e-005,2.46e-005,0.0001007)

Pathway porosity (fraction): SINGLE(0.28)

Justification for Aquifer Hydraulics Properties

Appendices HRA1-3

Pathway longitudinal dispersivity (m): SINGLE(60)

Pathway transverse dispersivity (m): SINGLE(18)

Justification for Aquifer Dispersion Details

10% of pathway length and 3% transverse [CHANGED]

*Retardation parameters for Sherwood Sandstone pathway**Modelled as aquifer pathway.*

Uncertainty in Kd (l/kg):

Ammoniacal\_N UNIFORM(0.43,1.79)

Cadmium LOGTRIANGULAR(3.7,74,1500)

Chloride SINGLE(0)

Copper SINGLE(295)

Mercury SINGLE(450)

Naphthalene LOGTRIANGULAR(488,1102,2309)

Toluene LOGTRIANGULAR(57,130,272)

Zinc LOGTRIANGULAR(1.1,200,600)

Justification for Aquifer Kd Values by Species

EA 2003 and USEPA 1999

Pathway Density (kg/l): SINGLE(1.9)