Project: Chadwich Lane Quarry Extension

Project Number: Risk 0058

Customer: Chadwich Lane Quarry Ltd

Write Project Notes Here

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

Toluene	Volatile
Half life (years): 10	
Zinc	Non-Volatile
c (kg/l): 0.0561	m (kg/l): 0.0403

Contaminant Half-lives (years)

Clay Liner:

Ammoniacal_N	SINGLE(6)
Cadmium	SINGLE(1e+009)
Chloride	SINGLE(1e+009)
Chromium	SINGLE(1e+009)
Copper	SINGLE(1e+009)
Mercury	SINGLE(1e+009)
Phenols	UNIFORM(0.02,0.07)
Sulphate	SINGLE(1e+009)
Toluene	UNIFORM(0.16,0.57)
Zinc	SINGLE(1e+009)

Unsaturated Pathway:

Ammoniacal_N	SINGLE(6)
Cadmium	SINGLE(1e+009)
Chloride	SINGLE(1e+009)
Chromium	SINGLE(1e+009)
Copper	SINGLE(1e+009)
Mercury	SINGLE(1e+009)
Phenols	UNIFORM(0.02,0.07)
Sulphate	SINGLE(1e+009)
Toluene	UNIFORM(0.14,1.5)
Zinc	SINGLE(1e+009)

Aquifer Pathway:

Ammoniacal_N	SINGLE(6)
Cadmium	SINGLE(1e+009)
Chloride	SINGLE(1e+009)
Chromium	SINGLE(1e+009)
Copper	SINGLE(1e+009)
Mercury	SINGLE(1e+009)
Phenols	UNIFORM(0.02,0.53)
Sulphate	SINGLE(1e+009)
Toluene	UNIFORM(0.14,0.57)
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	UNIFORM(0.05,0.09)
Chloride	UNIFORM(13.1,28.5)
Mercury	UNIFORM(0.0003,0.00034)
Sulphate	UNIFORM(44.8,158)
Zinc	UNIFORM(0.018,0.113)

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):	0
Start of cap degradation (years from end of waste deposit):	100
End of cap degradation (years from end of waste deposit):	200

Justification for Specified Infiltration
Based on ESID

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

Cell dimensions

Cell width (m):	190
Cell length (m):	270
Cell top area (ha):	5.3865
Cell base area (ha):	5.13
Number of cells:	1
Total base area (ha):	5.13
Total top area (ha):	5.3865
Head of Leachate when surface water breakout occurs (m)	SINGLE(13)
Waste porosity (fraction)	SINGLE(0.1)
Final waste thickness (m):	TRIANGULAR(12,18,23)
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(0.1,0.6,1.6)
	Data are spot measurements of Leachate Quality
Cadmium	LOGTRIANGULAR(0.0001,0.0019,0.0077)
	Substance to be treated as List 1
Chloride	LOGTRIANGULAR(0.01,10.81,160)
	Data are spot measurements of Leachate Quality
Chromium	LOGTRIANGULAR(0.01,0.012,0.05)
	Data are spot measurements of Leachate Quality
Copper	LOGTRIANGULAR(0.01,0.012,0.2)
	Data are spot measurements of Leachate Quality
Mercury	LOGTRIANGULAR(0.0005,0.0009,0.001)
	Substance to be treated as List 1
Phenols	LOGTRIANGULAR(0.05,0.1,0.256)
	Data are spot measurements of Leachate Quality
Sulphate	LOGTRIANGULAR(24,117,280)
	Data are spot measurements of Leachate Quality
Toluene	LOGTRIANGULAR(0.01,0.05,0.1)
	Substance to be treated as List 1
Zinc	LOGTRIANGULAR(0.01,0.022,0.4)
	Data are spot measurements of Leachate Quality

Justification for Species Concentration in Leachate

Based on WAC testing and leachate sample from Chadwich Lane and Pinches 2. Half life degreadtion ratesas per EA report on ammonia and Howard et al Phenol and Toluene

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 Spacification

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)
Chromium	SINGLE(965)
Copper	SINGLE(126.8)
Mercury	SINGLE(3835.5)
Phenols	SINGLE(0)
Sulphate	SINGLE(0)
Toluene	SINGLE(140)
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(8.5,13.5,18.5)
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

Pathway hydraulic conductivity values (m/s):	TRIANGULAR(5.03e-007,3.99e-006,8.8e-006)

Justification for Unsat Zone Hydraulics Properties
Site investigations Appendices 1-3

Pathway longitudinal dispersivity (m):	UNIFORM(0.04,0.16)

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)
Chromium	LOGTRIANGULAR(1,67,4400)
Copper	SINGLE(295)
Mercury	SINGLE(450)
Phenols	SINGLE(0)
Sulphate	SINGLE(0)
Toluene	SINGLE(140)
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(1400,1600)
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(0.0143)
Pathway hydraulic conductivity values (m/s):	UNIFORM(2e-006,8e-006)
Pathway porosity (fraction):	SINGLE(0.2)

Justification for Aquifer Hydraulics Properties
Appendices HRA1-3

Pathway longitudinal dispersivity (m):	SINGLE(20)
Pathway transverse dispersivity (m):	SINGLE(6)

Justification for Aquifer Dispersion Details
10% of pathway length and 3% transverse

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)
Chromium	LOGTRIANGULAR(1,67,4400)
Copper	SINGLE(295)
Mercury	SINGLE(450)
Phenols	SINGLE(0)
Sulphate	SINGLE(0)
Toluene	SINGLE(140)
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)