# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Benzo(a)pyrene | | from Level 1 |
| Target Concentration | $C_T$ | 1.70E-07 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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 pollutants in all phases (e.g. field derived value.

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 4.00E-05 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.55E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.67E+00 | fraction |
| Decay rate used | λ | 7.70E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.01E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.10E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **3.24E-06** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **2.10E-06** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 5.11E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.55E-02 | l/kg |

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

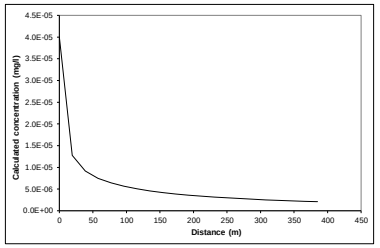
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 4.0E-05 |
| 19.3 | 1.27E-05 |
| 38.5 | 9.13E-06 |
| 57.8 | 7.46E-06 |
| 77.0 | 6.40E-06 |
| 96.3 | 5.64E-06 |
| 115.5 | 5.06E-06 |
| 134.8 | 4.59E-06 |
| 154.0 | 4.21E-06 |
| 173.3 | 3.88E-06 |
| 192.5 | 3.60E-06 |
| 211.8 | 3.36E-06 |
| 231.0 | 3.15E-06 |
| 250.3 | 2.96E-06 |
| 269.5 | 2.80E-06 |
| 288.8 | 2.65E-06 |
| 308.0 | 2.52E-06 |
| 327.3 | 2.40E-06 |
| 346.5 | 2.29E-06 |
| 365.8 | 2.19E-06 |
| 385.0 | 2.10E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Benzo(b)fluoranthene | | from Level 1 |
| Target Concentration | $C_T$ | 1.70E-07 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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 pollutants in all phases (e.g. field derived value.

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 8.00E-06 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.52E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.66E+00 | fraction |
| Decay rate used | λ | 7.70E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.06E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 4.20E-07 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 5.02E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.52E-02 | l/kg |

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

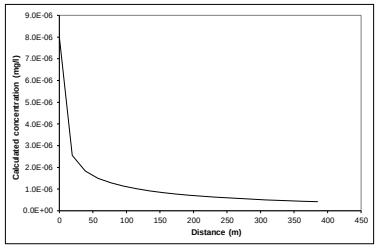
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 8.0E-06 |
| 19.3 | 2.55E-06 |
| 38.5 | 1.83E-06 |
| 57.8 | 1.49E-06 |
| 77.0 | 1.28E-06 |
| 96.3 | 1.13E-06 |
| 115.5 | 1.01E-06 |
| 134.8 | 9.18E-07 |
| 154.0 | 8.41E-07 |
| 173.3 | 7.76E-07 |
| 192.5 | 7.20E-07 |
| 211.8 | 6.72E-07 |
| 231.0 | 6.30E-07 |
| 250.3 | 5.93E-07 |
| 269.5 | 5.60E-07 |
| 288.8 | 5.31E-07 |
| 308.0 | 5.04E-07 |
| 327.3 | 4.80E-07 |
| 346.5 | 4.58E-07 |
| 365.8 | 4.38E-07 |
| 385.0 | 4.20E-07 |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **3.24E-06** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **4.20E-07** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Benzo(g,h,i)perylene | | from Level 1 |
| Target Concentration | $C_T$ | 1.70E-07 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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 pollutants in all phases (e.g. field derived value.

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 3.00E-05 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 2.06E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.89E+00 | fraction |
| Decay rate used | λ | 7.70E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 6.18E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.57E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 6.81E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 2.06E-02 | l/kg |

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

Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed

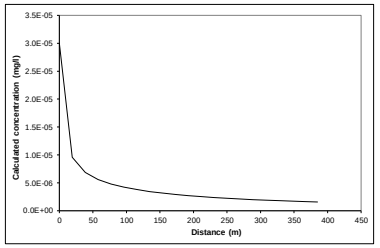
**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **3.24E-06** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **385** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.57E-06** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

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By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 3.0E-05 |
| 19.3 | 9.56E-06 |
| 38.5 | 6.85E-06 |
| 57.8 | 5.59E-06 |
| 77.0 | 4.80E-06 |
| 96.3 | 4.23E-06 |
| 115.5 | 3.80E-06 |
| 134.8 | 3.44E-06 |
| 154.0 | 3.15E-06 |
| 173.3 | 2.91E-06 |
| 192.5 | 2.70E-06 |
| 211.8 | 2.52E-06 |
| 231.0 | 2.36E-06 |
| 250.3 | 2.22E-06 |
| 269.5 | 2.10E-06 |
| 288.8 | 1.99E-06 |
| 308.0 | 1.89E-06 |
| 327.3 | 1.80E-06 |
| 346.5 | 1.72E-06 |
| 365.8 | 1.64E-06 |
| 385.0 | 1.57E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Benzo(k)fluoranthene | | from Level 1 |
| Target Concentration | $C_T$ | 1.70E-07 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 3.00E-05 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH Specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH Specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH Specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH Specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.29E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.56E+00 | fraction |
| Decay rate used | λ | 4.94E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.51E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.57E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **3.24E-06** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **385** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.57E-06** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 4.26E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.29E-02 | l/kg |

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

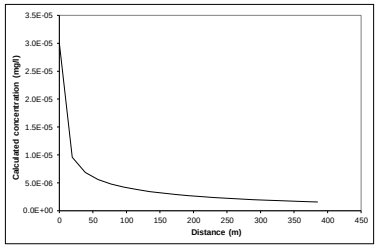
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 3.0E-05 |
| 19.3 | 9.56E-06 |
| 38.5 | 6.85E-06 |
| 57.8 | 5.59E-06 |
| 77.0 | 4.80E-06 |
| 96.3 | 4.23E-06 |
| 115.5 | 3.80E-06 |
| 134.8 | 3.44E-06 |
| 154.0 | 3.15E-06 |
| 173.3 | 2.91E-06 |
| 192.5 | 2.70E-06 |
| 211.8 | 2.52E-06 |
| 231.0 | 2.36E-06 |
| 250.3 | 2.22E-06 |
| 269.5 | 2.10E-06 |
| 288.8 | 1.99E-06 |
| 308.0 | 1.89E-06 |
| 327.3 | 1.80E-06 |
| 346.5 | 1.72E-06 |
| 365.8 | 1.64E-06 |
| 385.0 | 1.57E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chromium | | from Level 1 |
| Target Concentration | $C_T$ | 4.70E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 5.40E-03 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH101 source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 4.80E+03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 2.07E+05 | fraction |
| Decay rate used | λ | 3.71E-106 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 5.64E-09 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.83E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **8.95E-02** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **2.83E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |

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

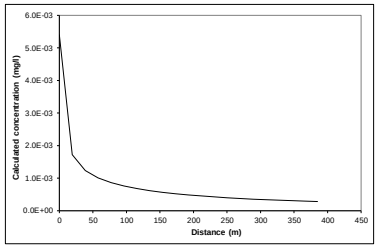
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 5.4E-03 |
| 19.3 | 1.72E-03 |
| 38.5 | 1.23E-03 |
| 57.8 | 1.01E-03 |
| 77.0 | 8.64E-04 |
| 96.3 | 7.62E-04 |
| 115.5 | 6.83E-04 |
| 134.8 | 6.20E-04 |
| 154.0 | 5.68E-04 |
| 173.3 | 5.24E-04 |
| 192.5 | 4.86E-04 |
| 211.8 | 4.54E-04 |
| 231.0 | 4.25E-04 |
| 250.3 | 4.00E-04 |
| 269.5 | 3.78E-04 |
| 288.8 | 3.58E-04 |
| 308.0 | 3.40E-04 |
| 327.3 | 3.24E-04 |
| 346.5 | 3.09E-04 |
| 365.8 | 2.96E-04 |
| 385.0 | 2.83E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Copper | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.20E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH101 source,* |
| Plume thickness at source | Sy | 1.90E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.97E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 4.32E+03 | fraction |
| Decay rate used | $\lambda$ | 1.78E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 2.71E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.18E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.87E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **1.87E-02** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.18E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |

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

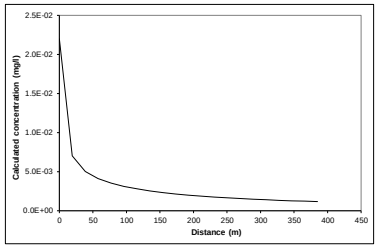
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.2E-02 |
| 19.3 | 7.01E-03 |
| 38.5 | 5.02E-03 |
| 57.8 | 4.11E-03 |
| 77.0 | 3.53E-03 |
| 96.3 | 3.12E-03 |
| 115.5 | 2.80E-03 |
| 134.8 | 2.55E-03 |
| 154.0 | 2.33E-03 |
| 173.3 | 2.16E-03 |
| 192.5 | 2.00E-03 |
| 211.8 | 1.87E-03 |
| 231.0 | 1.76E-03 |
| 250.3 | 1.65E-03 |
| 269.5 | 1.56E-03 |
| 288.8 | 1.48E-03 |
| 308.0 | 1.41E-03 |
| 327.3 | 1.34E-03 |
| 346.5 | 1.28E-03 |
| 365.8 | 1.23E-03 |
| 385.0 | 1.18E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Fluoranthene | | from Level 1 |
| Target Concentration | $C_T$ | 6.30E-06 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.79E-04 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.29E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.56E+00 | fraction |
| Decay rate used | λ | 4.94E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.51E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 9.40E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **1.20E-04** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **9.40E-06** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 4.26E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.29E-02 | l/kg |

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

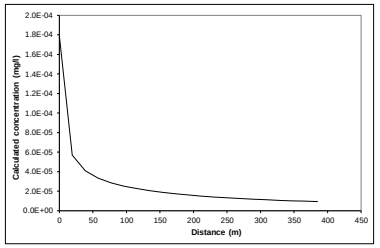
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.8E-04 |
| 19.3 | 5.70E-05 |
| 38.5 | 4.09E-05 |
| 57.8 | 3.34E-05 |
| 77.0 | 2.86E-05 |
| 96.3 | 2.53E-05 |
| 115.5 | 2.26E-05 |
| 134.8 | 2.05E-05 |
| 154.0 | 1.88E-05 |
| 173.3 | 1.74E-05 |
| 192.5 | 1.61E-05 |
| 211.8 | 1.50E-05 |
| 231.0 | 1.41E-05 |
| 250.3 | 1.33E-05 |
| 269.5 | 1.25E-05 |
| 288.8 | 1.19E-05 |
| 308.0 | 1.13E-05 |
| 327.3 | 1.07E-05 |
| 346.5 | 1.03E-05 |
| 365.8 | 9.80E-06 |
| 385.0 | 9.40E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Cyanide | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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 pollutants in all phases (e.g. field derived value.

| | Variable | Value | Unit | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.50E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 4.50E-03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.19E+00 | fraction |
| Decay rate used | λ | 7.70E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 9.79E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.31E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **1.91E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **385** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.31E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for ionic organic chemicals (acids)

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | 1.40E+00 | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | 1.40E+00 | l/kg |
| pH value | pH | 5.50E+00 | |
| acid dissociation constant | pKa | 9.24E+00 | |
| Fraction of organic carbon in aquifer | foc | 3.03E-03 | fraction |
| Soil water partition coefficient | Kd | 4.50E-03 | l/kg |

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

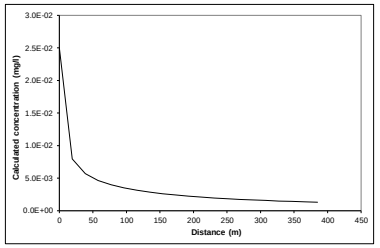
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.5E-02 |
| 19.3 | 7.97E-03 |
| 38.5 | 5.71E-03 |
| 57.8 | 4.66E-03 |
| 77.0 | 4.00E-03 |
| 96.3 | 3.53E-03 |
| 115.5 | 3.16E-03 |
| 134.8 | 2.87E-03 |
| 154.0 | 2.63E-03 |
| 173.3 | 2.42E-03 |
| 192.5 | 2.25E-03 |
| 211.8 | 2.10E-03 |
| 231.0 | 1.97E-03 |
| 250.3 | 1.85E-03 |
| 269.5 | 1.75E-03 |
| 288.8 | 1.66E-03 |
| 308.0 | 1.57E-03 |
| 327.3 | 1.50E-03 |
| 346.5 | 1.43E-03 |
| 365.8 | 1.37E-03 |
| 385.0 | 1.31E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Indeno(1,2,3-c,d)pyrene | | from Level 1 |
| Target Concentration | $C_T$ | 1.70E-07 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 3.00E-05 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.29E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.56E+00 | fraction |
| Decay rate used | λ | 4.94E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.51E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.57E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **3.24E-06** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **1.57E-06** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 4.26E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.29E-02 | l/kg |

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

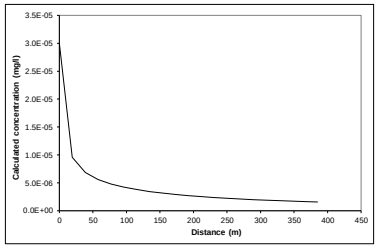
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 3.0E-05 |
| 19.3 | 9.56E-06 |
| 38.5 | 6.85E-06 |
| 57.8 | 5.59E-06 |
| 77.0 | 4.80E-06 |
| 96.3 | 4.23E-06 |
| 115.5 | 3.80E-06 |
| 134.8 | 3.44E-06 |
| 154.0 | 3.15E-06 |
| 173.3 | 2.91E-06 |
| 192.5 | 2.70E-06 |
| 211.8 | 2.52E-06 |
| 231.0 | 2.36E-06 |
| 250.3 | 2.22E-06 |
| 269.5 | 2.10E-06 |
| 288.8 | 1.99E-06 |
| 308.0 | 1.89E-06 |
| 327.3 | 1.80E-06 |
| 346.5 | 1.72E-06 |
| 365.8 | 1.64E-06 |
| 385.0 | 1.57E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Iron | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E+00 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.68E+00 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Source is BH101, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 2.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.08E+03 | fraction |
| Decay rate used | $\lambda$ | 7.12E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.08E-06 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 8.80E-02 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **1.91E+01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **8.80E-02** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

***Entry if specify partition coefficient (option)***

| | | | |
|---|---|---|---|
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |

***Entry for non-polar organic chemicals (option)***

| | | | |
|---|---|---|---|
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |

***Entry for ionic organic chemicals (option)***

| | | | |
|---|---|---|---|
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |

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

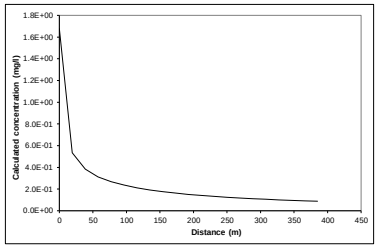
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.7E+00 |
| 19.3 | 5.34E-01 |
| 38.5 | 3.83E-01 |
| 57.8 | 3.13E-01 |
| 77.0 | 2.68E-01 |
| 96.3 | 2.37E-01 |
| 115.5 | 2.12E-01 |
| 134.8 | 1.93E-01 |
| 154.0 | 1.76E-01 |
| 173.3 | 1.63E-01 |
| 192.5 | 1.51E-01 |
| 211.8 | 1.41E-01 |
| 231.0 | 1.32E-01 |
| 250.3 | 1.24E-01 |
| 269.5 | 1.17E-01 |
| 288.8 | 1.11E-01 |
| 308.0 | 1.06E-01 |
| 327.3 | 1.01E-01 |
| 346.5 | 9.60E-02 |
| 365.8 | 9.19E-02 |
| 385.0 | 8.80E-02 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Lead | | from Level 1 |
| Target Concentration | $C_T$ | 1.20E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 5.24E-02 | mg/l | *Highest BH concentration* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 0.00E+00 | m | *Assume BH101 source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average site value* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 9.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 3.89E+04 | fraction |
| Decay rate used | $\lambda$ | 1.98E-105 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.01E-08 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 0.00E+00 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | breakthrough at compliance point | |

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{sc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{sc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |

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

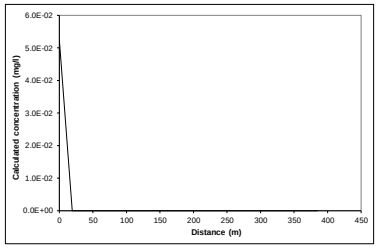
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. 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 concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 5.2E-02 |
| 19.3 | 0.00E+00 |
| 38.5 | 0.00E+00 |
| 57.8 | 0.00E+00 |
| 77.0 | 0.00E+00 |
| 96.3 | 0.00E+00 |
| 115.5 | 0.00E+00 |
| 134.8 | 0.00E+00 |
| 154.0 | 0.00E+00 |
| 173.3 | 0.00E+00 |
| 192.5 | 0.00E+00 |
| 211.8 | 0.00E+00 |
| 231.0 | 0.00E+00 |
| 250.3 | 0.00E+00 |
| 269.5 | 0.00E+00 |
| 288.8 | 0.00E+00 |
| 308.0 | 0.00E+00 |
| 327.3 | 0.00E+00 |
| 346.5 | 0.00E+00 |
| 365.8 | 0.00E+00 |
| 385.0 | 0.00E+00 |

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Remedial Targets**

| Remedial Target | | No impact | mg/l | For comparison with measured groundwater concentration. |
|---|---|---|---|---|
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **0.00E+00** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Manganese | | from Level 1 |
| Target Concentration | $C_T$ | 1.23E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.26E-01 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH101 is source, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average site value* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 6.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 2.81E+03 | fraction |
| Decay rate used | $\lambda$ | 2.74E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 4.16E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.19E-02 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **2.34E+00** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **385** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.19E-02** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{sc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{sc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |

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

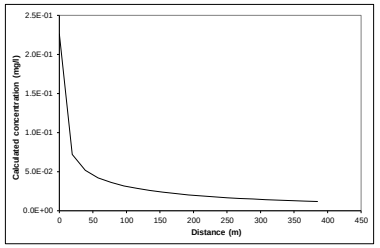
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.3E-01 |
| 19.3 | 7.21E-02 |
| 38.5 | 5.16E-02 |
| 57.8 | 4.21E-02 |
| 77.0 | 3.62E-02 |
| 96.3 | 3.19E-02 |
| 115.5 | 2.86E-02 |
| 134.8 | 2.60E-02 |
| 154.0 | 2.38E-02 |
| 173.3 | 2.19E-02 |
| 192.5 | 2.04E-02 |
| 211.8 | 1.90E-02 |
| 231.0 | 1.78E-02 |
| 250.3 | 1.68E-02 |
| 269.5 | 1.58E-02 |
| 288.8 | 1.50E-02 |
| 308.0 | 1.42E-02 |
| 327.3 | 1.36E-02 |
| 346.5 | 1.29E-02 |
| 365.8 | 1.24E-02 |
| 385.0 | 1.19E-02 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Zinc | | from Level 1 |
| Target Concentration | $C_T$ | 1.09E-02 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.49E-01 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Source is BH101, 5m either side* |
| Plume thickness at source | Sy | 1.85E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.91E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 9.20E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 3.85E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 3.80E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 3.85E+01 | m | *see options* |
| Transverse dispersivity | az | 3.85E+00 | m | *see options* |
| Vertical dispersivity | ay | 3.85E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.17E-03 | m/d |
| Retardation factor | Rf | 1.64E+03 | fraction |
| Decay rate used | λ | 4.69E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.12E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 7.79E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.91E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **2.08E-01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **385** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **7.79E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |

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

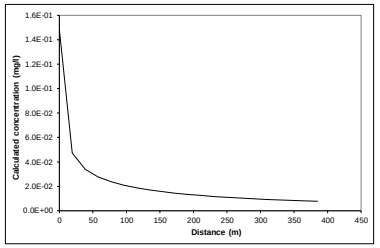
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 3.85E+01 | 8.22E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 3.85E+00 | 8.22E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 3.85E-01 | 8.22E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.5E-01 |
| 19.3 | 4.73E-02 |
| 38.5 | 3.39E-02 |
| 57.8 | 2.77E-02 |
| 77.0 | 2.38E-02 |
| 96.3 | 2.10E-02 |
| 115.5 | 1.88E-02 |
| 134.8 | 1.70E-02 |
| 154.0 | 1.56E-02 |
| 173.3 | 1.44E-02 |
| 192.5 | 1.34E-02 |
| 211.8 | 1.25E-02 |
| 231.0 | 1.17E-02 |
| 250.3 | 1.10E-02 |
| 269.5 | 1.04E-02 |
| 288.8 | 9.85E-03 |
| 308.0 | 9.36E-03 |
| 327.3 | 8.91E-03 |
| 346.5 | 8.50E-03 |
| 365.8 | 8.13E-03 |
| 385.0 | 7.79E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Nitrate | | from Level 1 |
| Target Concentration | $C_T$ | 4.00E+00 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.07E+01 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.05E+01 | m | *Average site value* |
| Saturated aquifer thickness | da | 1.11E+01 | m | *Average site value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.03E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 5.00E-01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.31E-03 | m/d |
| Retardation factor | Rf | 2.26E+01 | fraction |
| Decay rate used | λ | 3.41E-102 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 5.79E-05 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 6.77E-01 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.58E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **6.32E+01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **6.77E-01** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 5.00E-01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 5.00E-01 | l/kg |

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

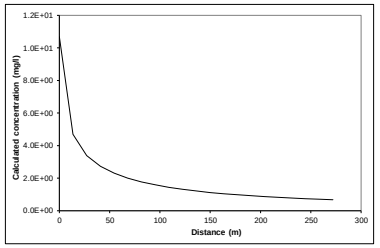
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | SB |
| Date: | ######## |
| Version: | 2 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.1E+01 |
| 13.6 | 4.69E+00 |
| 27.2 | 3.39E+00 |
| 40.8 | 2.74E+00 |
| 54.4 | 2.31E+00 |
| 68.0 | 2.01E+00 |
| 81.6 | 1.77E+00 |
| 95.2 | 1.59E+00 |
| 108.8 | 1.44E+00 |
| 122.4 | 1.32E+00 |
| 136.0 | 1.21E+00 |
| 149.6 | 1.12E+00 |
| 163.2 | 1.05E+00 |
| 176.8 | 9.80E-01 |
| 190.4 | 9.21E-01 |
| 204.0 | 8.69E-01 |
| 217.6 | 8.22E-01 |
| 231.2 | 7.80E-01 |
| 244.8 | 7.42E-01 |
| 258.4 | 7.08E-01 |
| 272.0 | 6.77E-01 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Zinc | | from Level 1 |
| Target Concentration | $C_T$ | 1.09E-02 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.26E-02 | mg/l | *Highest concentration within CPBH212* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assumed source is CPBH212, with 5m either side* |
| Plume thickness at source | Sy | 1.10E+01 | m | *Less than Saturated aquifer thickness* |
| Saturated aquifer thickness | da | 1.11E+01 | m | *Average for the site as BH specific data not a* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average of on-site data* |
| Hydraulic gradient | i | 1.03E-02 | fraction | *Calculated from on-site data* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 2.72E+02 | m | *On-site data* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Calculated from on-site data* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 3.80E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 7.11E+00 | m | *see options* |
| Transverse dispersivity | az | 7.11E-01 | m | *see options* |
| Vertical dispersivity | ay | 7.11E-02 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.31E-03 | m/d |
| Retardation factor | Rf | 1.64E+03 | fraction |
| Decay rate used | $\lambda$ | 4.69E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.97E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.33E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **5.40E+00** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **5.88E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **272** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **2.33E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |

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

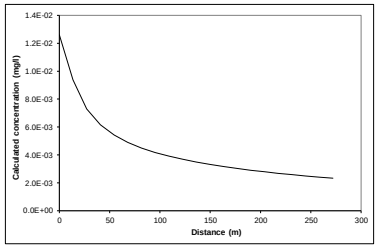
Dispersivity based on Xu & Eckstein (1995)

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.3E-02 |
| 13.6 | 9.38E-03 |
| 27.2 | 7.29E-03 |
| 40.8 | 6.15E-03 |
| 54.4 | 5.42E-03 |
| 68.0 | 4.90E-03 |
| 81.6 | 4.50E-03 |
| 95.2 | 4.18E-03 |
| 108.8 | 3.91E-03 |
| 122.4 | 3.69E-03 |
| 136.0 | 3.49E-03 |
| 149.6 | 3.32E-03 |
| 163.2 | 3.17E-03 |
| 176.8 | 3.03E-03 |
| 190.4 | 2.90E-03 |
| 204.0 | 2.79E-03 |
| 217.6 | 2.68E-03 |
| 231.2 | 2.59E-03 |
| 244.8 | 2.50E-03 |
| 258.4 | 2.41E-03 |
| 272.0 | 2.33E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chromium | | from Level 1 |
| Target Concentration | $C_T$ | 4.70E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 7.40E-03 | mg/l | *Highest concentration detected in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH202 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.94E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.19E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.56E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 4.80E+03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.56E+01 | m | *see options* |
| Transverse dispersivity | az | 1.56E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.56E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.51E-03 | m/d |
| Retardation factor | Rf | 2.07E+05 | fraction |
| Decay rate used | $\lambda$ | 3.71E-106 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.29E-09 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.07E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **6.95E+00** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **3.26E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **156** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.07E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |

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

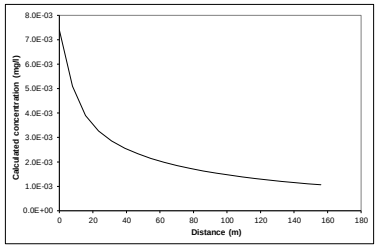
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.56E+01 | 5.53E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.56E+00 | 5.53E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.56E-01 | 5.53E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 7.4E-03 |
| 7.8 | 5.10E-03 |
| 15.6 | 3.90E-03 |
| 23.4 | 3.26E-03 |
| 31.2 | 2.86E-03 |
| 39.0 | 2.56E-03 |
| 46.8 | 2.33E-03 |
| 54.6 | 2.14E-03 |
| 62.4 | 1.99E-03 |
| 70.2 | 1.85E-03 |
| 78.0 | 1.73E-03 |
| 85.8 | 1.63E-03 |
| 93.6 | 1.54E-03 |
| 101.4 | 1.46E-03 |
| 109.2 | 1.39E-03 |
| 117.0 | 1.32E-03 |
| 124.8 | 1.26E-03 |
| 132.6 | 1.20E-03 |
| 140.4 | 1.15E-03 |
| 148.2 | 1.11E-03 |
| 156.0 | 1.07E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Copper | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 4.00E-03 | mg/l | *highest concentration in RBBH202* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH202 is source with 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *Less than saturated aquifer thickness* |
| Saturated aquifer thickness | da | 9.94E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *On-site data* |
| Hydraulic gradient | i | 1.19E-02 | fraction | *Calculated from on-site data* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.56E+02 | m | *On-site data* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.56E+01 | m | *see options* |
| Transverse dispersivity | az | 1.56E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.56E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.51E-03 | m/d |
| Retardation factor | Rf | 4.32E+03 | fraction |
| Decay rate used | $\lambda$ | 1.78E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.50E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 5.76E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **6.95E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **6.95E-03** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **156** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **5.76E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |

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

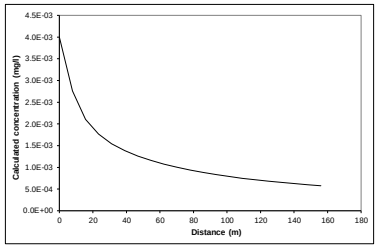
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.56E+01 | 5.53E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.56E+00 | 5.53E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.56E-01 | 5.53E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 4.0E-03 |
| 7.8 | 2.76E-03 |
| 15.6 | 2.11E-03 |
| 23.4 | 1.76E-03 |
| 31.2 | 1.54E-03 |
| 39.0 | 1.38E-03 |
| 46.8 | 1.26E-03 |
| 54.6 | 1.16E-03 |
| 62.4 | 1.07E-03 |
| 70.2 | 1.00E-03 |
| 78.0 | 9.37E-04 |
| 85.8 | 8.82E-04 |
| 93.6 | 8.32E-04 |
| 101.4 | 7.88E-04 |
| 109.2 | 7.49E-04 |
| 117.0 | 7.13E-04 |
| 124.8 | 6.81E-04 |
| 132.6 | 6.51E-04 |
| 140.4 | 6.24E-04 |
| 148.2 | 5.99E-04 |
| 156.0 | 5.76E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Iron | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E+00 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.12E+00 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH202 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.94E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.19E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.56E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 2.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.56E+01 | m | *see options* |
| Transverse dispersivity | az | 1.56E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.56E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.51E-03 | m/d |
| Retardation factor | Rf | 1.08E+03 | fraction |
| Decay rate used | λ | 7.12E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.40E-06 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.61E-01 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **6.95E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **6.95E+00** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **156** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.61E-01** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |

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

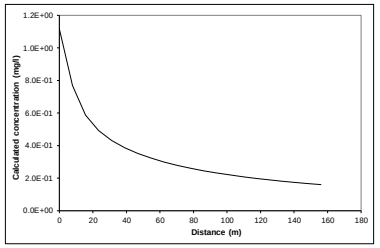
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.56E+01 | 5.53E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.56E+00 | 5.53E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.56E-01 | 5.53E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.1E+00 |
| 7.8 | 7.70E-01 |
| 15.6 | 5.88E-01 |
| 23.4 | 4.93E-01 |
| 31.2 | 4.31E-01 |
| 39.0 | 3.87E-01 |
| 46.8 | 3.52E-01 |
| 54.6 | 3.24E-01 |
| 62.4 | 3.00E-01 |
| 70.2 | 2.79E-01 |
| 78.0 | 2.62E-01 |
| 85.8 | 2.46E-01 |
| 93.6 | 2.32E-01 |
| 101.4 | 2.20E-01 |
| 109.2 | 2.09E-01 |
| 117.0 | 1.99E-01 |
| 124.8 | 1.90E-01 |
| 132.6 | 1.82E-01 |
| 140.4 | 1.74E-01 |
| 148.2 | 1.67E-01 |
| 156.0 | 1.61E-01 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Lead | | from Level 1 |
| Target Concentration | $C_T$ | 1.20E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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 pollutants in all phases (e.g. field derived value.

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.80E-03 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH202 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.94E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.19E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.56E+02 | m | |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 9.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.56E+01 | m | *see options* |
| Transverse dispersivity | az | 1.56E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.56E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.51E-03 | m/d |
| Retardation factor | Rf | 3.89E+04 | fraction |
| Decay rate used | $\lambda$ | 7.70E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.89E-08 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 4.03E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **6.95E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **8.34E-03** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **156** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **4.03E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{sc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{sc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |

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

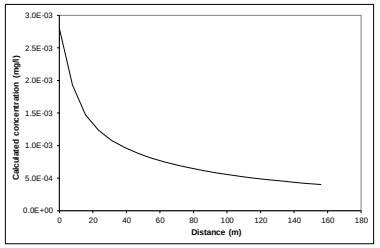
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.56E+01 | 5.53E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.56E+00 | 5.53E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.56E-01 | 5.53E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.8E-03 |
| 7.8 | 1.93E-03 |
| 15.6 | 1.47E-03 |
| 23.4 | 1.24E-03 |
| 31.2 | 1.08E-03 |
| 39.0 | 9.69E-04 |
| 46.8 | 8.82E-04 |
| 54.6 | 8.11E-04 |
| 62.4 | 7.51E-04 |
| 70.2 | 7.00E-04 |
| 78.0 | 6.56E-04 |
| 85.8 | 6.17E-04 |
| 93.6 | 5.83E-04 |
| 101.4 | 5.52E-04 |
| 109.2 | 5.24E-04 |
| 117.0 | 4.99E-04 |
| 124.8 | 4.77E-04 |
| 132.6 | 4.56E-04 |
| 140.4 | 4.37E-04 |
| 148.2 | 4.19E-04 |
| 156.0 | 4.03E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Manganese | | from Level 1 |
| Target Concentration | $C_T$ | 1.23E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.79E-01 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH202 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.94E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.19E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.56E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 6.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.56E+01 | m | *see options* |
| Transverse dispersivity | az | 1.56E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.56E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.51E-03 | m/d |
| Retardation factor | Rf | 2.81E+03 | fraction |
| Decay rate used | $\lambda$ | 2.74E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 5.38E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.57E-02 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **6.95E+00** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **8.54E-01** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **156** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **2.57E-02** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |

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

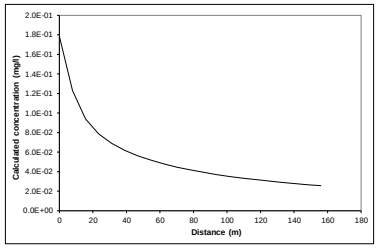
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.56E+01 | 5.53E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.56E+00 | 5.53E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.56E-01 | 5.53E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.8E-01 |
| 7.8 | 1.23E-01 |
| 15.6 | 9.40E-02 |
| 23.4 | 7.88E-02 |
| 31.2 | 6.90E-02 |
| 39.0 | 6.18E-02 |
| 46.8 | 5.63E-02 |
| 54.6 | 5.17E-02 |
| 62.4 | 4.79E-02 |
| 70.2 | 4.47E-02 |
| 78.0 | 4.18E-02 |
| 85.8 | 3.94E-02 |
| 93.6 | 3.72E-02 |
| 101.4 | 3.52E-02 |
| 109.2 | 3.34E-02 |
| 117.0 | 3.18E-02 |
| 124.8 | 3.04E-02 |
| 132.6 | 2.91E-02 |
| 140.4 | 2.79E-02 |
| 148.2 | 2.67E-02 |
| 156.0 | 2.57E-02 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chromium | | from Level 1 |
| Target Concentration | $C_T$ | 4.70E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.01E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH203 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH Specific value* |
| Saturated aquifer thickness | da | 9.48E+00 | m | *BH Specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.16E-02 | fraction | *BH Specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.62E+02 | m | *BH Specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 4.80E+03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.62E+01 | m | *see options* |
| Transverse dispersivity | az | 1.62E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.62E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.47E-03 | m/d |
| Retardation factor | Rf | 2.07E+05 | fraction |
| Decay rate used | λ | 3.71E-106 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 7.11E-09 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.37E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.37E+00** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **3.46E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **162** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.37E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |

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

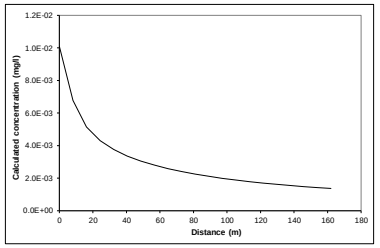
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.62E+01 | 5.63E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.62E+00 | 5.63E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.62E-01 | 5.63E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.0E-02 |
| 8.1 | 6.78E-03 |
| 16.2 | 5.15E-03 |
| 24.3 | 4.31E-03 |
| 32.4 | 3.76E-03 |
| 40.5 | 3.36E-03 |
| 48.6 | 3.06E-03 |
| 56.7 | 2.80E-03 |
| 64.8 | 2.59E-03 |
| 72.9 | 2.41E-03 |
| 81.0 | 2.26E-03 |
| 89.1 | 2.12E-03 |
| 97.2 | 2.00E-03 |
| 105.3 | 1.89E-03 |
| 113.4 | 1.79E-03 |
| 121.5 | 1.71E-03 |
| 129.6 | 1.63E-03 |
| 137.7 | 1.55E-03 |
| 145.8 | 1.49E-03 |
| 153.9 | 1.43E-03 |
| 162.0 | 1.37E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Copper | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 8.00E-03 | mg/l | *Highest concentration within BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH203 source, with 5m* |
| Plume thickness at source | Sy | 9.00E+00 | m | *Calculated from BH specific data* |
| Saturated aquifer thickness | da | 9.48E+00 | m | *Calculated from BH specific data* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average of on-site data* |
| Hydraulic gradient | i | 1.16E-02 | fraction | *Calculated from BH specific data* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.62E+02 | m | |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.62E+01 | m | *see options* |
| Transverse dispersivity | az | 1.62E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.62E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.47E-03 | m/d |
| Retardation factor | Rf | 4.32E+03 | fraction |
| Decay rate used | $\lambda$ | 1.78E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.41E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.09E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.37E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **7.37E-03** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **162** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.09E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |

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

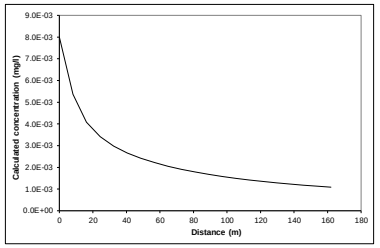
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.62E+01 | 5.63E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.62E+00 | 5.63E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.62E-01 | 5.63E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 8.0E-03 |
| 8.1 | 5.37E-03 |
| 16.2 | 4.08E-03 |
| 24.3 | 3.41E-03 |
| 32.4 | 2.98E-03 |
| 40.5 | 2.67E-03 |
| 48.6 | 2.42E-03 |
| 56.7 | 2.22E-03 |
| 64.8 | 2.05E-03 |
| 72.9 | 1.91E-03 |
| 81.0 | 1.79E-03 |
| 89.1 | 1.68E-03 |
| 97.2 | 1.58E-03 |
| 105.3 | 1.50E-03 |
| 113.4 | 1.42E-03 |
| 121.5 | 1.35E-03 |
| 129.6 | 1.29E-03 |
| 137.7 | 1.23E-03 |
| 145.8 | 1.18E-03 |
| 153.9 | 1.13E-03 |
| 162.0 | 1.09E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Iron | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E+00 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.08E+00 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH203 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.48E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site data* |
| Hydraulic gradient | i | 1.16E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site data* |
| Distance to compliance point | x | 1.62E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 2.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.62E+01 | m | *see options* |
| Transverse dispersivity | az | 1.62E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.62E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.47E-03 | m/d |
| Retardation factor | Rf | 1.08E+03 | fraction |
| Decay rate used | $\lambda$ | 7.12E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.36E-06 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.47E-01 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.37E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **7.37E+00** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **162** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.47E-01** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |

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

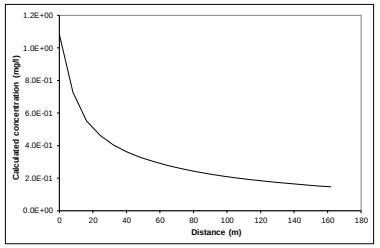
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.62E+01 | 5.63E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.62E+00 | 5.63E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.62E-01 | 5.63E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.1E+00 |
| 8.1 | 7.27E-01 |
| 16.2 | 5.52E-01 |
| 24.3 | 4.62E-01 |
| 32.4 | 4.03E-01 |
| 40.5 | 3.61E-01 |
| 48.6 | 3.28E-01 |
| 56.7 | 3.01E-01 |
| 64.8 | 2.78E-01 |
| 72.9 | 2.59E-01 |
| 81.0 | 2.42E-01 |
| 89.1 | 2.27E-01 |
| 97.2 | 2.14E-01 |
| 105.3 | 2.03E-01 |
| 113.4 | 1.92E-01 |
| 121.5 | 1.83E-01 |
| 129.6 | 1.74E-01 |
| 137.7 | 1.67E-01 |
| 145.8 | 1.60E-01 |
| 153.9 | 1.53E-01 |
| 162.0 | 1.47E-01 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Lead | | from Level 1 |
| Target Concentration | $C_T$ | 1.20E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 4.90E-03 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH203 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | |
| Saturated aquifer thickness | da | 9.48E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site data* |
| Hydraulic gradient | i | 1.16E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site data* |
| Distance to compliance point | x | 1.62E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 9.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.62E+01 | m | *see options* |
| Transverse dispersivity | az | 1.62E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.62E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.47E-03 | m/d |
| Retardation factor | Rf | 3.89E+04 | fraction |
| Decay rate used | $\lambda$ | 1.98E-105 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.79E-08 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 6.65E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.37E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **8.84E-03** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **162** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **6.65E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |

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

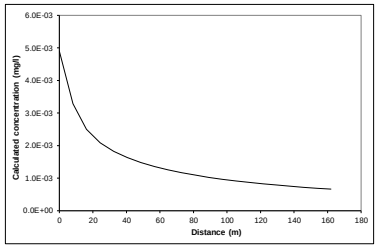
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.62E+01 | 5.63E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.62E+00 | 5.63E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.62E-01 | 5.63E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 4.9E-03 |
| 8.1 | 3.29E-03 |
| 16.2 | 2.50E-03 |
| 24.3 | 2.09E-03 |
| 32.4 | 1.82E-03 |
| 40.5 | 1.63E-03 |
| 48.6 | 1.48E-03 |
| 56.7 | 1.36E-03 |
| 64.8 | 1.26E-03 |
| 72.9 | 1.17E-03 |
| 81.0 | 1.09E-03 |
| 89.1 | 1.03E-03 |
| 97.2 | 9.69E-04 |
| 105.3 | 9.17E-04 |
| 113.4 | 8.70E-04 |
| 121.5 | 8.27E-04 |
| 129.6 | 7.89E-04 |
| 137.7 | 7.54E-04 |
| 145.8 | 7.22E-04 |
| 153.9 | 6.92E-04 |
| 162.0 | 6.65E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Manganese | | from Level 1 |
| Target Concentration | $C_T$ | 1.23E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.69E-01 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH203 source, 5m eitehr side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.94E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.19E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average site value* |
| Distance to compliance point | x | 1.56E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 6.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.56E+01 | m | *see options* |
| Transverse dispersivity | az | 1.56E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.56E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.51E-03 | m/d |
| Retardation factor | Rf | 2.81E+03 | fraction |
| Decay rate used | $\lambda$ | 2.74E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 5.38E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.43E-02 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **6.95E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **8.54E-01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **156** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **2.43E-02** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |

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

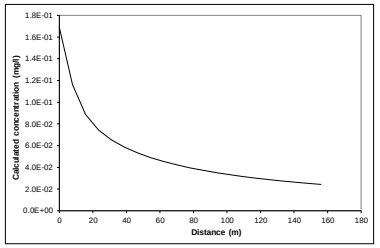
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.56E+01 | 5.53E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.56E+00 | 5.53E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.56E-01 | 5.53E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.7E-01 |
| 7.8 | 1.16E-01 |
| 15.6 | 8.89E-02 |
| 23.4 | 7.45E-02 |
| 31.2 | 6.52E-02 |
| 39.0 | 5.84E-02 |
| 46.8 | 5.32E-02 |
| 54.6 | 4.89E-02 |
| 62.4 | 4.53E-02 |
| 70.2 | 4.22E-02 |
| 78.0 | 3.95E-02 |
| 85.8 | 3.72E-02 |
| 93.6 | 3.51E-02 |
| 101.4 | 3.33E-02 |
| 109.2 | 3.16E-02 |
| 117.0 | 3.01E-02 |
| 124.8 | 2.87E-02 |
| 132.6 | 2.75E-02 |
| 140.4 | 2.63E-02 |
| 148.2 | 2.53E-02 |
| 156.0 | 2.43E-02 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Zinc | | from Level 1 |
| Target Concentration | $C_T$ | 1.09E-02 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 3.03E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH203 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.48E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 1.16E-02 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.62E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 3.80E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.62E+01 | m | *see options* |
| Transverse dispersivity | az | 1.62E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.62E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 1.47E-03 | m/d |
| Retardation factor | Rf | 1.64E+03 | fraction |
| Decay rate used | $\lambda$ | 4.69E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 8.98E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 4.11E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.37E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **8.03E-02** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **162** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **4.11E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |

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

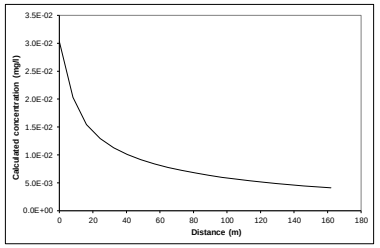
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.62E+01 | 5.63E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.62E+00 | 5.63E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.62E-01 | 5.63E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 3.0E-02 |
| 8.1 | 2.03E-02 |
| 16.2 | 1.54E-02 |
| 24.3 | 1.29E-02 |
| 32.4 | 1.13E-02 |
| 40.5 | 1.01E-02 |
| 48.6 | 9.17E-03 |
| 56.7 | 8.41E-03 |
| 64.8 | 7.77E-03 |
| 72.9 | 7.23E-03 |
| 81.0 | 6.77E-03 |
| 89.1 | 6.35E-03 |
| 97.2 | 5.99E-03 |
| 105.3 | 5.67E-03 |
| 113.4 | 5.38E-03 |
| 121.5 | 5.12E-03 |
| 129.6 | 4.88E-03 |
| 137.7 | 4.66E-03 |
| 145.8 | 4.46E-03 |
| 153.9 | 4.28E-03 |
| 162.0 | 4.11E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chloroform | | from Level 1 |
| Target Concentration | $C_T$ | 2.50E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 3.00E-03 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.67E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 6.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.61E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 5.15E-03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.61E+01 | m | *see options* |
| Transverse dispersivity | az | 1.61E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.61E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 7.76E-04 | m/d |
| Retardation factor | Rf | 1.22E+00 | fraction |
| Decay rate used | λ | 6.30E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 6.34E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 4.11E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.29E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **1.82E-02** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **161** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **4.11E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for ionic organic chemicals (acids)

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | 1.70E+00 | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | 1.70E+00 | l/kg |
| pH value | pH | 7.25E+00 | |
| acid dissociation constant | pKa | 1.36E+01 | |
| Fraction of organic carbon in aquifer | foc | 3.03E-03 | fraction |
| Soil water partition coefficient | Kd | 5.15E-03 | l/kg |

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

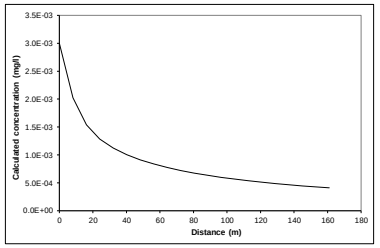
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.61E+01 | 5.61E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.61E+00 | 5.61E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.61E-01 | 5.61E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 3.0E-03 |
| 8.1 | 2.02E-03 |
| 16.1 | 1.54E-03 |
| 24.2 | 1.29E-03 |
| 32.2 | 1.12E-03 |
| 40.3 | 1.01E-03 |
| 48.3 | 9.14E-04 |
| 56.4 | 8.38E-04 |
| 64.4 | 7.76E-04 |
| 72.5 | 7.22E-04 |
| 80.5 | 6.75E-04 |
| 88.6 | 6.34E-04 |
| 96.6 | 5.98E-04 |
| 104.7 | 5.66E-04 |
| 112.7 | 5.37E-04 |
| 120.8 | 5.11E-04 |
| 128.8 | 4.87E-04 |
| 136.9 | 4.66E-04 |
| 144.9 | 4.46E-04 |
| 153.0 | 4.28E-04 |
| 161.0 | 4.11E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chromium | | from Level 1 |
| Target Concentration | $C_T$ | 4.70E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.11E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH205 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.67E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average value on site* |
| Hydraulic gradient | i | 6.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.61E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 4.80E+03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.61E+01 | m | *see options* |
| Transverse dispersivity | az | 1.61E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.61E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 7.76E-04 | m/d |
| Retardation factor | Rf | 2.07E+05 | fraction |
| Decay rate used | λ | 3.71E-106 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.74E-09 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.52E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.29E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **3.43E-02** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **161** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **1.52E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |

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

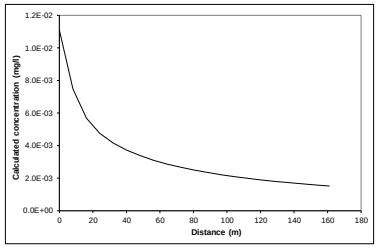
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.61E+01 | 5.61E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.61E+00 | 5.61E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.61E-01 | 5.61E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. 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 concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.1E-02 |
| 8.1 | 7.48E-03 |
| 16.1 | 5.69E-03 |
| 24.2 | 4.76E-03 |
| 32.2 | 4.16E-03 |
| 40.3 | 3.72E-03 |
| 48.3 | 3.38E-03 |
| 56.4 | 3.10E-03 |
| 64.4 | 2.87E-03 |
| 72.5 | 2.67E-03 |
| 80.5 | 2.50E-03 |
| 88.6 | 2.35E-03 |
| 96.6 | 2.21E-03 |
| 104.7 | 2.09E-03 |
| 112.7 | 1.99E-03 |
| 120.8 | 1.89E-03 |
| 128.8 | 1.80E-03 |
| 136.9 | 1.72E-03 |
| 144.9 | 1.65E-03 |
| 153.0 | 1.58E-03 |
| 161.0 | 1.52E-03 |

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Copper | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.10E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH205 is source , with 5 metres either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | |
| Saturated aquifer thickness | da | 9.67E+00 | m | *BH specific data* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site value* |
| Hydraulic gradient | i | 6.10E-03 | fraction | *BH specific data* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.61E+02 | m | |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.61E+01 | m | *see options* |
| Transverse dispersivity | az | 1.61E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.61E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 7.76E-04 | m/d |
| Retardation factor | Rf | 4.32E+03 | fraction |
| Decay rate used | $\lambda$ | 1.78E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.79E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.51E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.29E+00** | |

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |

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

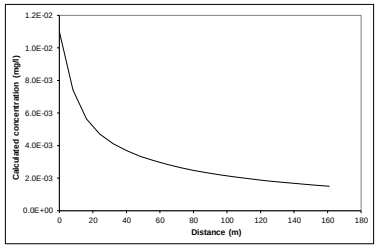
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | ax | 0.00E+00 | 1.61E+01 | 5.61E+00 | m |
| **Transverse dispersivity** | az | 0.00E+00 | 1.61E+00 | 5.61E-01 | m |
| **Vertical dispersivity** | ay | 0.00E+00 | 1.61E-01 | 5.61E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. 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 concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.1E-02 |
| 8.1 | 7.41E-03 |
| 16.1 | 5.64E-03 |
| 24.2 | 4.72E-03 |
| 32.2 | 4.12E-03 |
| 40.3 | 3.69E-03 |
| 48.3 | 3.35E-03 |
| 56.4 | 3.07E-03 |
| 64.4 | 2.84E-03 |
| 72.5 | 2.65E-03 |
| 80.5 | 2.48E-03 |
| 88.6 | 2.33E-03 |
| 96.6 | 2.19E-03 |
| 104.7 | 2.08E-03 |
| 112.7 | 1.97E-03 |
| 120.8 | 1.87E-03 |
| 128.8 | 1.79E-03 |
| 136.9 | 1.71E-03 |
| 144.9 | 1.64E-03 |
| 153.0 | 1.57E-03 |
| 161.0 | 1.51E-03 |

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **7.29E-03** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **161** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.51E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Fluoranthene | | from Level 1 |
| Target Concentration | $C_T$ | 6.30E-06 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.60E-05 | mg/l | *highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.67E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average of on-site data* |
| Hydraulic gradient | i | 6.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.61E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.29E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.61E+01 | m | *see options* |
| Transverse dispersivity | az | 1.61E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.61E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 7.76E-04 | m/d |
| Retardation factor | Rf | 1.56E+00 | fraction |
| Decay rate used | λ | 4.94E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 4.98E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.19E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.29E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **4.60E-05** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **161** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **2.19E-06** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 4.26E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.29E-02 | l/kg |

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

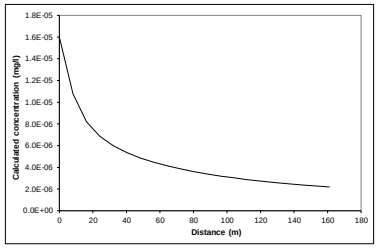
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.61E+01 | 5.61E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.61E+00 | 5.61E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.61E-01 | 5.61E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.6E-05 |
| 8.1 | 1.08E-05 |
| 16.1 | 8.20E-06 |
| 24.2 | 6.86E-06 |
| 32.2 | 5.99E-06 |
| 40.3 | 5.36E-06 |
| 48.3 | 4.87E-06 |
| 56.4 | 4.47E-06 |
| 64.4 | 4.14E-06 |
| 72.5 | 3.85E-06 |
| 80.5 | 3.60E-06 |
| 88.6 | 3.38E-06 |
| 96.6 | 3.19E-06 |
| 104.7 | 3.02E-06 |
| 112.7 | 2.86E-06 |
| 120.8 | 2.73E-06 |
| 128.8 | 2.60E-06 |
| 136.9 | 2.48E-06 |
| 144.9 | 2.38E-06 |
| 153.0 | 2.28E-06 |
| 161.0 | 2.19E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Lead | | from Level 1 |
| Target Concentration | $C_T$ | 1.20E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 4.10E-03 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH205 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.67E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site* |
| Hydraulic gradient | i | 6.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site* |
| Distance to compliance point | x | 1.61E+02 | m | |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 9.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.61E+01 | m | *see options* |
| Transverse dispersivity | az | 1.61E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.61E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 7.76E-04 | m/d |
| Retardation factor | Rf | 3.89E+04 | fraction |
| Decay rate used | $\lambda$ | 1.98E-105 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.99E-08 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 5.62E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.29E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **8.75E-03** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **161** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **5.62E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |

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

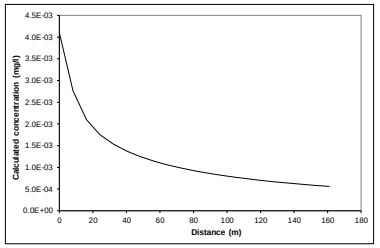
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.61E+01 | 5.61E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.61E+00 | 5.61E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.61E-01 | 5.61E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 4.1E-03 |
| 8.1 | 2.76E-03 |
| 16.1 | 2.10E-03 |
| 24.2 | 1.76E-03 |
| 32.2 | 1.54E-03 |
| 40.3 | 1.37E-03 |
| 48.3 | 1.25E-03 |
| 56.4 | 1.15E-03 |
| 64.4 | 1.06E-03 |
| 72.5 | 9.86E-04 |
| 80.5 | 9.23E-04 |
| 88.6 | 8.67E-04 |
| 96.6 | 8.18E-04 |
| 104.7 | 7.74E-04 |
| 112.7 | 7.34E-04 |
| 120.8 | 6.98E-04 |
| 128.8 | 6.66E-04 |
| 136.9 | 6.37E-04 |
| 144.9 | 6.10E-04 |
| 153.0 | 5.85E-04 |
| 161.0 | 5.62E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Manganese | | from Level 1 |
| Target Concentration | $C_T$ | 1.23E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.25E-01 | mg/l | *Maximum concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH205 source, 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.67E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 6.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average site value* |
| Distance to compliance point | x | 1.61E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 6.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.61E+01 | m | *see options* |
| Transverse dispersivity | az | 1.61E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.61E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 7.76E-04 | m/d |
| Retardation factor | Rf | 2.81E+03 | fraction |
| Decay rate used | λ | 2.74E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 2.76E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 3.09E-02 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.29E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **8.97E-01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **161** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **3.09E-02** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |

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

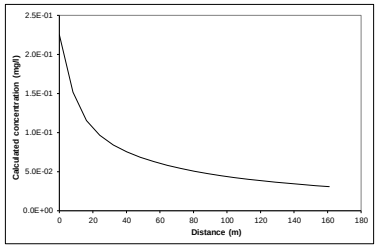
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.61E+01 | 5.61E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.61E+00 | 5.61E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.61E-01 | 5.61E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.3E-01 |
| 8.1 | 1.52E-01 |
| 16.1 | 1.15E-01 |
| 24.2 | 9.65E-02 |
| 32.2 | 8.43E-02 |
| 40.3 | 7.55E-02 |
| 48.3 | 6.85E-02 |
| 56.4 | 6.29E-02 |
| 64.4 | 5.82E-02 |
| 72.5 | 5.42E-02 |
| 80.5 | 5.07E-02 |
| 88.6 | 4.76E-02 |
| 96.6 | 4.49E-02 |
| 104.7 | 4.25E-02 |
| 112.7 | 4.03E-02 |
| 120.8 | 3.83E-02 |
| 128.8 | 3.66E-02 |
| 136.9 | 3.50E-02 |
| 144.9 | 3.35E-02 |
| 153.0 | 3.21E-02 |
| 161.0 | 3.09E-02 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Zinc | | from Level 1 |
| Target Concentration | $C_T$ | 1.09E-02 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.99E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommendeed value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH205 source, with 5m either side* |
| Plume thickness at source | Sy | 9.00E+00 | m | *BH specific value* |
| Saturated aquifer thickness | da | 9.67E+00 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 6.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.61E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommendeed value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommendeed value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 3.80E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.61E+01 | m | *see options* |
| Transverse dispersivity | az | 1.61E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.61E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 7.76E-04 | m/d |
| Retardation factor | Rf | 1.64E+03 | fraction |
| Decay rate used | $\lambda$ | 4.69E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 4.72E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 4.10E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.29E+00** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **7.95E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **161** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **4.10E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |

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

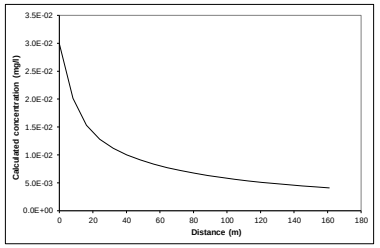
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.61E+01 | 5.61E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.61E+00 | 5.61E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.61E-01 | 5.61E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 3.0E-02 |
| 8.1 | 2.02E-02 |
| 16.1 | 1.53E-02 |
| 24.2 | 1.28E-02 |
| 32.2 | 1.12E-02 |
| 40.3 | 1.00E-02 |
| 48.3 | 9.11E-03 |
| 56.4 | 8.36E-03 |
| 64.4 | 7.73E-03 |
| 72.5 | 7.19E-03 |
| 80.5 | 6.73E-03 |
| 88.6 | 6.32E-03 |
| 96.6 | 5.96E-03 |
| 104.7 | 5.64E-03 |
| 112.7 | 5.35E-03 |
| 120.8 | 5.09E-03 |
| 128.8 | 4.86E-03 |
| 136.9 | 4.64E-03 |
| 144.9 | 4.45E-03 |
| 153.0 | 4.27E-03 |
| 161.0 | 4.10E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Aliphatic >EC10-EC12 | | from Level 1 |
| Target Concentration | $C_T$ | 3.00E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 4.38E-01 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site data* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site data* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.64E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.71E+00 | fraction |
| Decay rate used | λ | 4.51E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.20E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 3.06E-02 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **4.29E+00** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **3.06E-02** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 5.40E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.64E-02 | l/kg |

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

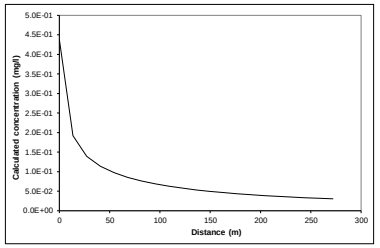
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 4.4E-01 |
| 13.6 | 1.92E-01 |
| 27.2 | 1.39E-01 |
| 40.8 | 1.14E-01 |
| 54.4 | 9.74E-02 |
| 68.0 | 8.55E-02 |
| 81.6 | 7.63E-02 |
| 95.2 | 6.89E-02 |
| 108.8 | 6.28E-02 |
| 122.4 | 5.78E-02 |
| 136.0 | 5.35E-02 |
| 149.6 | 4.98E-02 |
| 163.2 | 4.65E-02 |
| 176.8 | 4.37E-02 |
| 190.4 | 4.12E-02 |
| 204.0 | 3.89E-02 |
| 217.6 | 3.69E-02 |
| 231.2 | 3.51E-02 |
| 244.8 | 3.35E-02 |
| 258.4 | 3.20E-02 |
| 272.0 | 3.06E-02 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Aliphatic >EC16-EC35 | | from Level 1 |
| Target Concentration | $C_T$ | 3.00E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.40E+00 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site data* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site data* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 2.03E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.88E+00 | fraction |
| Decay rate used | λ | 4.10E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 2.91E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.68E-01 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **4.29E+00** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.68E-01** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 6.70E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 2.03E-02 | l/kg |

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

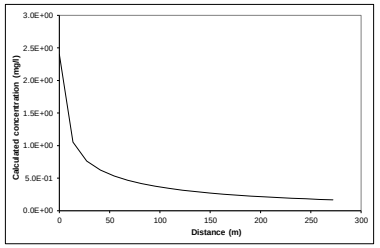
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.4E+00 |
| 13.6 | 1.05E+00 |
| 27.2 | 7.64E-01 |
| 40.8 | 6.24E-01 |
| 54.4 | 5.34E-01 |
| 68.0 | 4.68E-01 |
| 81.6 | 4.18E-01 |
| 95.2 | 3.78E-01 |
| 108.8 | 3.44E-01 |
| 122.4 | 3.17E-01 |
| 136.0 | 2.93E-01 |
| 149.6 | 2.73E-01 |
| 163.2 | 2.55E-01 |
| 176.8 | 2.39E-01 |
| 190.4 | 2.26E-01 |
| 204.0 | 2.13E-01 |
| 217.6 | 2.02E-01 |
| 231.2 | 1.93E-01 |
| 244.8 | 1.84E-01 |
| 258.4 | 1.75E-01 |
| 272.0 | 1.68E-01 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Benzo(b)fluoranthene | | from Level 1 |
| Target Concentration | $C_T$ | 1.70E-07 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 6.00E-05 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site data* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site data* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.52E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.66E+00 | fraction |
| Decay rate used | λ | 4.65E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.30E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 4.20E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **2.43E-06** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **272** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **4.20E-06** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 5.02E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.52E-02 | l/kg |

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

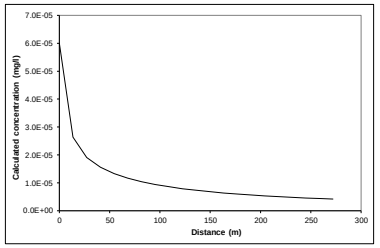
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 6.0E-05 |
| 13.6 | 2.63E-05 |
| 27.2 | 1.91E-05 |
| 40.8 | 1.56E-05 |
| 54.4 | 1.33E-05 |
| 68.0 | 1.17E-05 |
| 81.6 | 1.04E-05 |
| 95.2 | 9.44E-06 |
| 108.8 | 8.61E-06 |
| 122.4 | 7.91E-06 |
| 136.0 | 7.32E-06 |
| 149.6 | 6.82E-06 |
| 163.2 | 6.37E-06 |
| 176.8 | 5.99E-06 |
| 190.4 | 5.64E-06 |
| 204.0 | 5.34E-06 |
| 217.6 | 5.06E-06 |
| 231.2 | 4.81E-06 |
| 244.8 | 4.59E-06 |
| 258.4 | 4.38E-06 |
| 272.0 | 4.20E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Benzo(k)fluoranthene | | from Level 1 |
| Target Concentration | $C_T$ | 1.70E-07 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.00E-05 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site value* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.57E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.68E+00 | fraction |
| Decay rate used | $\lambda$ | 4.59E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.26E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 6.99E-07 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 5.17E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.57E-02 | l/kg |

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

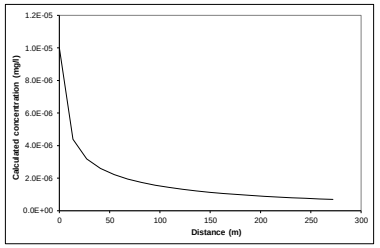
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.0E-05 |
| 13.6 | 4.39E-06 |
| 27.2 | 3.18E-06 |
| 40.8 | 2.60E-06 |
| 54.4 | 2.22E-06 |
| 68.0 | 1.95E-06 |
| 81.6 | 1.74E-06 |
| 95.2 | 1.57E-06 |
| 108.8 | 1.43E-06 |
| 122.4 | 1.32E-06 |
| 136.0 | 1.22E-06 |
| 149.6 | 1.14E-06 |
| 163.2 | 1.06E-06 |
| 176.8 | 9.98E-07 |
| 190.4 | 9.40E-07 |
| 204.0 | 8.89E-07 |
| 217.6 | 8.43E-07 |
| 231.2 | 8.02E-07 |
| 244.8 | 7.65E-07 |
| 258.4 | 7.30E-07 |
| 272.0 | 6.99E-07 |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **2.43E-06** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **272** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **6.99E-07** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chloroform | | from Level 1 |
| Target Concentration | $C_T$ | 2.50E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.90E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 5.15E-03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.22E+00 | fraction |
| Decay rate used | λ | 6.30E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 4.47E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.33E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **3.58E-02** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.33E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for ionic organic chemicals (acids)

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | 1.70E+00 | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | 1.70E+00 | l/kg |
| pH value | pH | 7.93E+00 | |
| acid dissociation constant | pKa | 1.36E+01 | |
| Fraction of organic carbon in aquifer | foc | 3.03E-03 | fraction |
| Soil water partition coefficient | Kd | 5.15E-03 | l/kg |

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

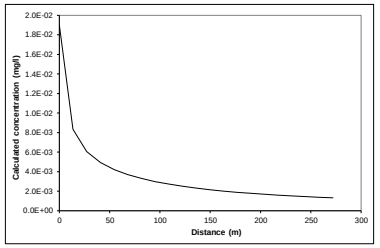
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.9E-02 |
| 13.6 | 8.34E-03 |
| 27.2 | 6.05E-03 |
| 40.8 | 4.94E-03 |
| 54.4 | 4.23E-03 |
| 68.0 | 3.71E-03 |
| 81.6 | 3.31E-03 |
| 95.2 | 2.99E-03 |
| 108.8 | 2.73E-03 |
| 122.4 | 2.51E-03 |
| 136.0 | 2.32E-03 |
| 149.6 | 2.16E-03 |
| 163.2 | 2.02E-03 |
| 176.8 | 1.90E-03 |
| 190.4 | 1.79E-03 |
| 204.0 | 1.69E-03 |
| 217.6 | 1.60E-03 |
| 231.2 | 1.52E-03 |
| 244.8 | 1.45E-03 |
| 258.4 | 1.39E-03 |
| 272.0 | 1.33E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chromium | | from Level 1 |
| Target Concentration | $C_T$ | 4.70E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.32E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average value for site* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average value for site* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 4.80E+03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 2.07E+05 | fraction |
| Decay rate used | λ | 3.71E-106 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 2.64E-09 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 9.23E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **6.72E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **272** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **9.23E-04** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |

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

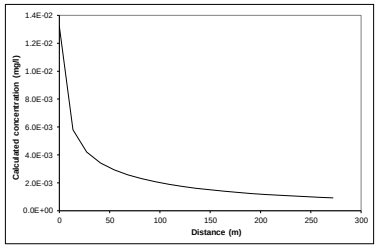
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.3E-02 |
| 13.6 | 5.79E-03 |
| 27.2 | 4.20E-03 |
| 40.8 | 3.43E-03 |
| 54.4 | 2.94E-03 |
| 68.0 | 2.58E-03 |
| 81.6 | 2.30E-03 |
| 95.2 | 2.08E-03 |
| 108.8 | 1.89E-03 |
| 122.4 | 1.74E-03 |
| 136.0 | 1.61E-03 |
| 149.6 | 1.50E-03 |
| 163.2 | 1.40E-03 |
| 176.8 | 1.32E-03 |
| 190.4 | 1.24E-03 |
| 204.0 | 1.17E-03 |
| 217.6 | 1.11E-03 |
| 231.2 | 1.06E-03 |
| 244.8 | 1.01E-03 |
| 258.4 | 9.64E-04 |
| 272.0 | 9.23E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Copper | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.20E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 is source, 5m eitehr side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH Specific data* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH Specific data* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average of on-site data* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH Specific data* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 2.72E+02 | m | *BH Specific data* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 4.32E+03 | fraction |
| Decay rate used | $\lambda$ | 1.78E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.26E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 8.39E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |

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

Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed

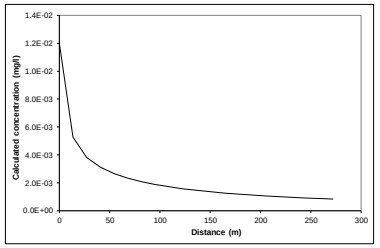
**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **1.43E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **272** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **8.39E-04** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.2E-02 |
| 13.6 | 5.27E-03 |
| 27.2 | 3.82E-03 |
| 40.8 | 3.12E-03 |
| 54.4 | 2.67E-03 |
| 68.0 | 2.34E-03 |
| 81.6 | 2.09E-03 |
| 95.2 | 1.89E-03 |
| 108.8 | 1.72E-03 |
| 122.4 | 1.58E-03 |
| 136.0 | 1.46E-03 |
| 149.6 | 1.36E-03 |
| 163.2 | 1.27E-03 |
| 176.8 | 1.20E-03 |
| 190.4 | 1.13E-03 |
| 204.0 | 1.07E-03 |
| 217.6 | 1.01E-03 |
| 231.2 | 9.63E-04 |
| 244.8 | 9.18E-04 |
| 258.4 | 8.77E-04 |
| 272.0 | 8.39E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Fluoranthene | | from Level 1 |
| Target Concentration | $C_T$ | 6.30E-06 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 3.50E-05 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume BH source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *Average site value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *Average site value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *BH specific value* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.29E-02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.56E+00 | fraction |
| Decay rate used | λ | 4.94E-101 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.51E-04 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.45E-06 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **9.01E-05** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **2.45E-06** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

Calculate for non-polar organic chemicals

| | | | |
|---|---|---|---|
| ***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 aquifer | foc | 3.03E-03 | fraction |
| Organic carbon partition coefficient | Koc | 4.26E+00 | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.29E-02 | l/kg |

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

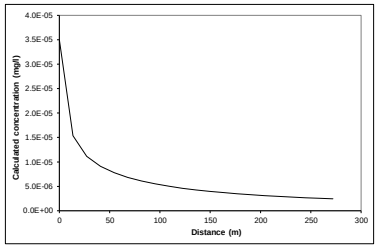
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 3.5E-05 |
| 13.6 | 1.54E-05 |
| 27.2 | 1.11E-05 |
| 40.8 | 9.10E-06 |
| 54.4 | 7.78E-06 |
| 68.0 | 6.83E-06 |
| 81.6 | 6.09E-06 |
| 95.2 | 5.51E-06 |
| 108.8 | 5.02E-06 |
| 122.4 | 4.62E-06 |
| 136.0 | 4.27E-06 |
| 149.6 | 3.98E-06 |
| 163.2 | 3.72E-06 |
| 176.8 | 3.49E-06 |
| 190.4 | 3.29E-06 |
| 204.0 | 3.11E-06 |
| 217.6 | 2.95E-06 |
| 231.2 | 2.81E-06 |
| 244.8 | 2.68E-06 |
| 258.4 | 2.56E-06 |
| 272.0 | 2.45E-06 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Iron | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E+00 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.01E+00 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site data* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site data* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 2.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.08E+03 | fraction |
| Decay rate used | $\lambda$ | 7.12E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 5.06E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.41E-01 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **1.43E+01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.41E-01** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |

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

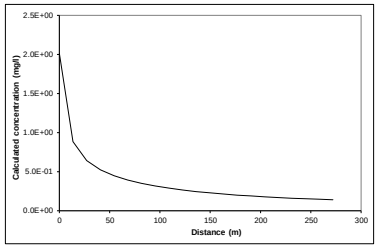
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.0E+00 |
| 13.6 | 8.84E-01 |
| 27.2 | 6.41E-01 |
| 40.8 | 5.24E-01 |
| 54.4 | 4.48E-01 |
| 68.0 | 3.93E-01 |
| 81.6 | 3.51E-01 |
| 95.2 | 3.17E-01 |
| 108.8 | 2.89E-01 |
| 122.4 | 2.66E-01 |
| 136.0 | 2.46E-01 |
| 149.6 | 2.29E-01 |
| 163.2 | 2.14E-01 |
| 176.8 | 2.01E-01 |
| 190.4 | 1.89E-01 |
| 204.0 | 1.79E-01 |
| 217.6 | 1.70E-01 |
| 231.2 | 1.62E-01 |
| 244.8 | 1.54E-01 |
| 258.4 | 1.47E-01 |
| 272.0 | 1.41E-01 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Lead | | from Level 1 |
| Target Concentration | $C_T$ | 1.20E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 5.30E-03 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average value* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 2.72E+02 | m | |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 9.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 3.89E+04 | fraction |
| Decay rate used | $\lambda$ | 1.98E-105 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.41E-08 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 3.71E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **1.72E-02** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **3.71E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |

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

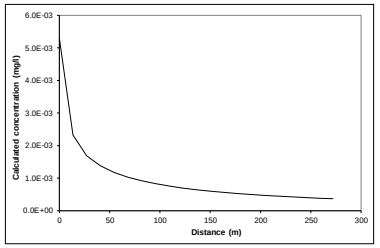
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 5.3E-03 |
| 13.6 | 2.33E-03 |
| 27.2 | 1.69E-03 |
| 40.8 | 1.38E-03 |
| 54.4 | 1.18E-03 |
| 68.0 | 1.03E-03 |
| 81.6 | 9.23E-04 |
| 95.2 | 8.34E-04 |
| 108.8 | 7.60E-04 |
| 122.4 | 6.99E-04 |
| 136.0 | 6.47E-04 |
| 149.6 | 6.02E-04 |
| 163.2 | 5.63E-04 |
| 176.8 | 5.29E-04 |
| 190.4 | 4.98E-04 |
| 204.0 | 4.71E-04 |
| 217.6 | 4.47E-04 |
| 231.2 | 4.25E-04 |
| 244.8 | 4.05E-04 |
| 258.4 | 3.87E-04 |
| 272.0 | 3.71E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Manganese | | from Level 1 |
| Target Concentration | $C_T$ | 1.23E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.34E-01 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 is source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average site value* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 6.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 2.81E+03 | fraction |
| Decay rate used | $\lambda$ | 2.74E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 1.95E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 9.38E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **1.76E+00** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **272** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **9.38E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |

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

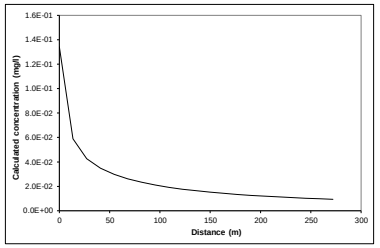
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.3E-01 |
| 13.6 | 5.89E-02 |
| 27.2 | 4.27E-02 |
| 40.8 | 3.49E-02 |
| 54.4 | 2.98E-02 |
| 68.0 | 2.62E-02 |
| 81.6 | 2.34E-02 |
| 95.2 | 2.11E-02 |
| 108.8 | 1.93E-02 |
| 122.4 | 1.77E-02 |
| 136.0 | 1.64E-02 |
| 149.6 | 1.52E-02 |
| 163.2 | 1.43E-02 |
| 176.8 | 1.34E-02 |
| 190.4 | 1.26E-02 |
| 204.0 | 1.19E-02 |
| 217.6 | 1.13E-02 |
| 231.2 | 1.08E-02 |
| 244.8 | 1.03E-02 |
| 258.4 | 9.80E-03 |
| 272.0 | 9.38E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Zinc | | from Level 1 |
| Target Concentration | $C_T$ | 1.09E-02 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 4.91E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH206 source, 5m either side* |
| Plume thickness at source | Sy | 1.20E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.25E+01 | m | *BH specific value* |
| Bulk density of aquifer materials | $\rho$ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average on-site data* |
| Hydraulic gradient | i | 4.30E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average on-site data* |
| Distance to compliance point | x | 2.72E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 3.80E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 2.72E+01 | m | *see options* |
| Transverse dispersivity | az | 2.72E+00 | m | *see options* |
| Vertical dispersivity | ay | 2.72E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 5.47E-04 | m/d |
| Retardation factor | Rf | 1.64E+03 | fraction |
| Decay rate used | $\lambda$ | 4.69E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.33E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 3.43E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **1.43E+01** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **1.56E-01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **272** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **3.43E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 3.80E+01 | l/kg |

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

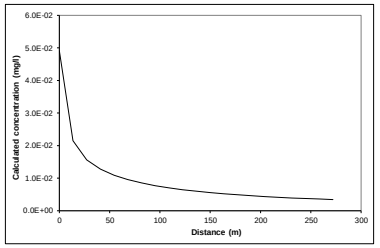
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 2.72E+01 | 7.11E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 2.72E+00 | 7.11E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 2.72E-01 | 7.11E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 4.9E-02 |
| 13.6 | 2.16E-02 |
| 27.2 | 1.56E-02 |
| 40.8 | 1.28E-02 |
| 54.4 | 1.09E-02 |
| 68.0 | 9.58E-03 |
| 81.6 | 8.55E-03 |
| 95.2 | 7.72E-03 |
| 108.8 | 7.05E-03 |
| 122.4 | 6.48E-03 |
| 136.0 | 5.99E-03 |
| 149.6 | 5.58E-03 |
| 163.2 | 5.22E-03 |
| 176.8 | 4.90E-03 |
| 190.4 | 4.62E-03 |
| 204.0 | 4.37E-03 |
| 217.6 | 4.14E-03 |
| 231.2 | 3.94E-03 |
| 244.8 | 3.75E-03 |
| 258.4 | 3.59E-03 |
| 272.0 | 3.43E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Chromium | | from Level 1 |
| Target Concentration | $C_T$ | 4.70E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.50E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH209 source, 5m eitehr side* |
| Plume thickness at source | Sy | 1.09E+01 | m | *Average value for site* |
| Saturated aquifer thickness | da | 1.11E+01 | m | *Average value for site* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average value for site* |
| Hydraulic gradient | i | 7.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.77E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 4.80E+03 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.77E+01 | m | *see options* |
| Transverse dispersivity | az | 1.77E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.77E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 9.03E-04 | m/d |
| Retardation factor | Rf | 2.07E+05 | fraction |
| Decay rate used | λ | 3.71E-106 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 4.35E-09 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.97E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.60E+00** | |

**Remedial Targets**

| | | | |
|---|---|---|---|
| **Remedial Target** | | **3.57E-02** | **mg/l** |
| Ogata Banks | | | |
| **Distance to compliance point** | | **177** | **m** |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.97E-03** | **mg/l** |
| **after** | | **1.0E+100** | **days** |

For comparison with measured groundwater concentration.

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 4.80E+03 | l/kg |

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

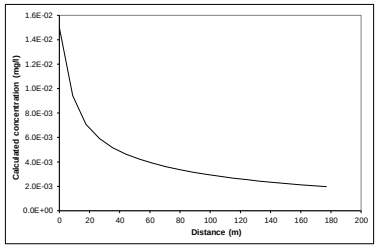
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.77E+01 | 5.87E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.77E+00 | 5.87E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.77E-01 | 5.87E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.5E-02 |
| 8.9 | 9.42E-03 |
| 17.7 | 7.09E-03 |
| 26.6 | 5.91E-03 |
| 35.4 | 5.16E-03 |
| 44.3 | 4.63E-03 |
| 53.1 | 4.22E-03 |
| 62.0 | 3.89E-03 |
| 70.8 | 3.61E-03 |
| 79.7 | 3.37E-03 |
| 88.5 | 3.16E-03 |
| 97.4 | 2.98E-03 |
| 106.2 | 2.82E-03 |
| 115.1 | 2.68E-03 |
| 123.9 | 2.55E-03 |
| 132.8 | 2.43E-03 |
| 141.6 | 2.32E-03 |
| 150.5 | 2.22E-03 |
| 159.3 | 2.13E-03 |
| 168.2 | 2.05E-03 |
| 177.0 | 1.97E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Copper | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.10E-02 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | $\lambda$ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assumed source, 5m either side of BH* |
| Plume thickness at source | Sy | 1.09E+01 | m | *Average value for site* |
| Saturated aquifer thickness | da | 1.11E+01 | m | *Average value for site* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average value for site* |
| Hydraulic gradient | i | 7.10E-03 | fraction | *BH specfic value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average value for site* |
| Distance to compliance point | x | 1.77E+02 | m | *BH specfic value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 1.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.77E+01 | m | *see options* |
| Transverse dispersivity | az | 1.77E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.77E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 9.03E-04 | m/d |
| Retardation factor | Rf | 4.32E+03 | fraction |
| Decay rate used | λ | 1.78E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 2.09E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.76E-03 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.60E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **7.60E-03** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **177** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **2.76E-03** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 1.00E+02 | l/kg |

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

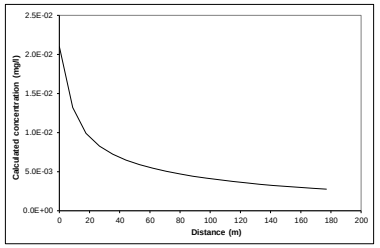
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.77E+01 | 5.87E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.77E+00 | 5.87E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.77E-01 | 5.87E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.1E-02 |
| 8.9 | 1.32E-02 |
| 17.7 | 9.92E-03 |
| 26.6 | 8.27E-03 |
| 35.4 | 7.23E-03 |
| 44.3 | 6.48E-03 |
| 53.1 | 5.91E-03 |
| 62.0 | 5.44E-03 |
| 70.8 | 5.05E-03 |
| 79.7 | 4.72E-03 |
| 88.5 | 4.43E-03 |
| 97.4 | 4.18E-03 |
| 106.2 | 3.95E-03 |
| 115.1 | 3.75E-03 |
| 123.9 | 3.57E-03 |
| 132.8 | 3.40E-03 |
| 141.6 | 3.25E-03 |
| 150.5 | 3.11E-03 |
| 159.3 | 2.99E-03 |
| 168.2 | 2.87E-03 |
| 177.0 | 2.76E-03 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Iron | | from Level 1 |
| Target Concentration | $C_T$ | 1.00E+00 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 2.12E+00 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH209 source, 5m either side* |
| Plume thickness at source | Sy | 1.09E+01 | m | *Average site value* |
| Saturated aquifer thickness | da | 1.11E+01 | m | *Average site value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 7.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.77E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 2.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.77E+01 | m | *see options* |
| Transverse dispersivity | az | 1.77E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.77E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 9.03E-04 | m/d |
| Retardation factor | Rf | 1.08E+03 | fraction |
| Decay rate used | λ | 7.12E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 8.35E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 2.79E-01 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.60E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **7.60E+00** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **177** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **2.79E-01** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 2.50E+01 | l/kg |

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

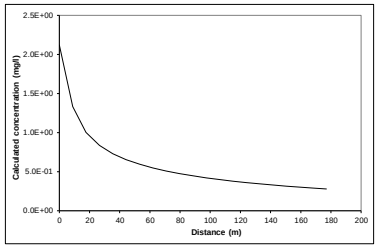
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.77E+01 | 5.87E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.77E+00 | 5.87E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.77E-01 | 5.87E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 2.1E+00 |
| 8.9 | 1.33E+00 |
| 17.7 | 1.00E+00 |
| 26.6 | 8.35E-01 |
| 35.4 | 7.30E-01 |
| 44.3 | 6.54E-01 |
| 53.1 | 5.96E-01 |
| 62.0 | 5.49E-01 |
| 70.8 | 5.10E-01 |
| 79.7 | 4.76E-01 |
| 88.5 | 4.47E-01 |
| 97.4 | 4.22E-01 |
| 106.2 | 3.99E-01 |
| 115.1 | 3.78E-01 |
| 123.9 | 3.60E-01 |
| 132.8 | 3.43E-01 |
| 141.6 | 3.28E-01 |
| 150.5 | 3.14E-01 |
| 159.3 | 3.02E-01 |
| 168.2 | 2.90E-01 |
| 177.0 | 2.79E-01 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Lead | | from Level 1 |
| Target Concentration | $C_T$ | 1.20E-03 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 4.40E-03 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH209 is source, 5m either side* |
| Plume thickness at source | Sy | 1.00E+01 | m | *BH Specific value* |
| Saturated aquifer thickness | da | 1.09E+01 | m | *BH Specific value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average site value* |
| Hydraulic gradient | i | 7.10E-03 | fraction | *BH Specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *Average site value* |
| Distance to compliance point | x | 1.77E+02 | m | *BH Specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 9.00E+02 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.77E+01 | m | *see options* |
| Transverse dispersivity | az | 1.77E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.77E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 9.03E-04 | m/d |
| Retardation factor | Rf | 3.89E+04 | fraction |
| Decay rate used | λ | 1.98E-105 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 2.32E-08 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 5.53E-04 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.96E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **9.55E-03** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **177** | **m** | |
| **Concentration of contaminant at compliance point** | **$C_{ED}/C_0$** | **5.53E-04** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 9.00E+02 | l/kg |

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

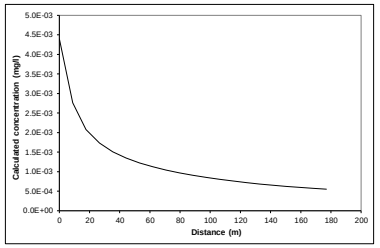
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.77E+01 | 5.87E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.77E+00 | 5.87E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.77E-01 | 5.87E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

Ogata Banks
From calculation sheet

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 4.4E-03 |
| 8.9 | 2.76E-03 |
| 17.7 | 2.08E-03 |
| 26.6 | 1.73E-03 |
| 35.4 | 1.51E-03 |
| 44.3 | 1.35E-03 |
| 53.1 | 1.23E-03 |
| 62.0 | 1.13E-03 |
| 70.8 | 1.04E-03 |
| 79.7 | 9.69E-04 |
| 88.5 | 9.06E-04 |
| 97.4 | 8.52E-04 |
| 106.2 | 8.03E-04 |
| 115.1 | 7.60E-04 |
| 123.9 | 7.21E-04 |
| 132.8 | 6.87E-04 |
| 141.6 | 6.55E-04 |
| 150.5 | 6.26E-04 |
| 159.3 | 6.00E-04 |
| 168.2 | 5.75E-04 |
| 177.0 | 5.53E-04 |

# R&D Publication 20 Remedial Targets Worksheet, Release 3.2

## Level 3 - Groundwater

See Note

**Input Parameters (using pull down menu)**

| | Variable | Value | Unit | Source |
|---|---|---|---|---|
| Contaminant | | Manganese | | from Level 1 |
| Target Concentration | $C_T$ | 1.23E-01 | mg/l | from Level 1 |

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

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

**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

| | | | | Source of parameter value |
|---|---|---|---|---|
| Initial contaminant concentration in groundwater at plume core | $C_0$ | 1.41E+00 | mg/l | *Highest concentration in BH* |
| Half life for degradation of contaminant in water | $t_{1/2}$ | 9.00E+99 | days | *Recommended value* |
| Calculated decay rate | λ | 7.70E-101 | $days^{-1}$ | |
| Width of plume in aquifer at source (perpendicular to flow) | Sz | 1.00E+01 | m | *Assume RBBH209 source, 5m either side* |
| Plume thickness at source | Sy | 1.09E+01 | m | *BH specific value* |
| Saturated aquifer thickness | da | 1.11E+01 | m | *Average sie value* |
| Bulk density of aquifer materials | ρ | 1.21E+00 | $g/cm^3$ | *SR3* |
| Effective porosity of aquifer | n | 2.80E-02 | fraction | *Average sie value* |
| Hydraulic gradient | i | 7.10E-03 | fraction | *BH specific value* |
| Hydraulic conductivity of aquifer | K | 3.56E-03 | m/d | *SR3* |
| Distance to compliance point | x | 1.77E+02 | m | *BH specific value* |
| Distance (lateral) to compliance point perpendicular to flow direction | z | 0.00E+00 | m | *Recommended value* |
| Distance (depth) to compliance point perpendicular to flow direction | y | 0.00E+00 | m | *Recommended value* |
| Time since pollutant entered groundwater | t | 1.00E+100 | days | *time variant options only* |
| *Parameters values determined from options* | | | | |
| Partition coefficient | Kd | 6.50E+01 | l/kg | *see options* |
| Longitudinal dispersivity | ax | 1.77E+01 | m | *see options* |
| Transverse dispersivity | az | 1.77E+00 | m | *see options* |
| Vertical dispersivity | ay | 1.77E-01 | m | *see options* |

**Calculated Parameters**

| | Variable | | |
|---|---|---|---|
| Groundwater flow velocity | v | 9.03E-04 | m/d |
| Retardation factor | Rf | 2.81E+03 | fraction |
| Decay rate used | λ | 2.74E-104 | $d^{-1}$ |
| Rate of contaminant flow due to retardation | u | 3.21E-07 | m/d |
| Contaminant concentration at distance x, assuming one-way vertical dispersion | $C_{ED}$ | 1.86E-01 | mg/l |
| **Attenuation factor (one way vertical dispersion, CO/CED)** | **AF** | **7.60E+00** | |

**Remedial Targets**

| | | | | |
|---|---|---|---|---|
| **Remedial Target** | | **9.34E-01** | **mg/l** | For comparison with measured groundwater concentration. |
| Ogata Banks | | | | |
| **Distance to compliance point** | | **177** | **m** | |
| **Concentration of contaminant at compliance point** | $C_{ED}/C_0$ | **1.86E-01** | **mg/l** | Ogata Banks |
| **after** | | **1.0E+100** | **days** | |

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.

**Select Method for deriving Partition Co-efficient (using pull down menu)**

User specified value for partition coefficient

| | | | |
|---|---|---|---|
| ***Entry if specify partition coefficient (option)*** | | | |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |
| ***Entry for non-polar organic chemicals (option)*** | | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Organic carbon partition coefficient | Koc | | l/kg |
| ***Entry for ionic organic chemicals (option)*** | | | |
| Sorption coefficient for related species | $K_{oc,n}$ | | l/kg |
| Sorption coefficient for ionised species | $K_{oc,i}$ | | l/kg |
| pH value | pH | | |
| acid dissociation constant | pKa | | |
| Fraction of organic carbon in aquifer | foc | | fraction |
| Soil water partition coefficient | Kd | 6.50E+01 | l/kg |

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

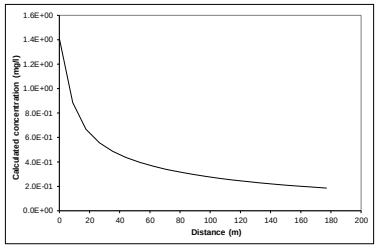
Dispersivities 10%, 1%, 0.1% of pathway length

| | | Enter value | Calc value | Xu & Eckstein | |
|---|---|---|---|---|---|
| **Longitudinal dispersivity** | **ax** | 0.00E+00 | 1.77E+01 | 5.87E+00 | m |
| **Transverse dispersivity** | **az** | 0.00E+00 | 1.77E+00 | 5.87E-01 | m |
| **Vertical dispersivity** | **ay** | 0.00E+00 | 1.77E-01 | 5.87E-02 | |

**Note values of dispersivity must be > 0**

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$ ; az = ax/10, ay = ax/100 are assumed




Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, 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 it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater 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 9.0E+99.

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

| | |
|---|---|
| Site being assessed: | Taff's Well |
| Completed by: | Jonathon Parr |
| Date: | ######## |
| Version: | 1 |

**Calculated concentrations for distance-concentration graph**

**Ogata Banks**
**From calculation sheet**

| Distance | Concentration |
|---|---|
| | mg/l |
| 0 | 1.4E+00 |
| 8.9 | 8.87E-01 |
| 17.7 | 6.67E-01 |
| 26.6 | 5.56E-01 |
| 35.4 | 4.86E-01 |
| 44.3 | 4.35E-01 |
| 53.1 | 3.97E-01 |
| 62.0 | 3.66E-01 |
| 70.8 | 3.39E-01 |
| 79.7 | 3.17E-01 |
| 88.5 | 2.98E-01 |
| 97.4 | 2.81E-01 |
| 106.2 | 2.65E-01 |
| 115.1 | 2.52E-01 |
| 123.9 | 2.40E-01 |
| 132.8 | 2.29E-01 |
| 141.6 | 2.19E-01 |
| 150.5 | 2.09E-01 |
| 159.3 | 2.01E-01 |
| 168.2 | 1.93E-01 |
| 177.0 | 1.86E-01 |