NATIONAL INSTITUTE OF PUBLIC HEALTH AND THE ENVIRONMENT
BILTHOVEN, THE NETHERLANDS

Report no. 711701005

Proposals for Intervention Values for soil and groundwater, including the calculation of the human-toxicological serious soil contamination concentrations: Fourth series of compounds

P. Kreule[*1] and F.A. Swartjes

March 1998

[*1]: at present: Tauw Milieu bv
Postbus 133
7400 AC Deventer

This report was written by the National Institute of Public Health and the Environment (*RIVM*)[*].
The research project has been carried out on commission of the Directorate General of Environment/ Department of Soil Protection; project "Risks related to soil quality", project nos. 715810 and 711701.

* RIVM, P.O. box 1, 3720 BA Bilthoven, the Netherlands; Telno. +31.30.2749111; Faxno. +31.30.2742971

MAILING LIST

1- 6 DGM/Bodem-directeur, Mr. A.B. Holtkamp
7 Plv. Directeur-Generaal Milieubeheer, VROM, Dr.ir. B.C.J. Zoeteman
8 Directoraat-Generaal Milieubeheer, Directie Bodem, Afdeling Integraal Bodembeleid; Dr. J.M. Roels
9 Hoofd Inspectie van de Volksgezondheid voor de Hygiëne van het Milieu, Ir. P.J. Verkerk
10-14 Regionale Inspecties van de Volksgezondheid voor de Hygiëne van het Milieu
15 Mr. A. Gravesteijn (DGM/Bo)
16 Drs. A. Deelen (DGM/Bo)
17 Drs. N. de Wit (DGM/Bo)
18 Drs. C.A.J. Denneman (DGM/Bo)
19 Mw. dr.ir. A.E. Boekhold (DGM/Bo)
20 Dr. C. Plug (DGM/SVS)
21 Dr. J.A. van Zorge (DGM/SVS)
22 Mw. dr. P.M.E.J. van der Weiden (DGM/SVS)
23 Drs. G.J.A. Al (DGM/DWL)
24-40 Leden Werkgroep UI, via Drs. C.A.J. Denneman (DGM/Bo)
41 Dhr. M. Cerutti (Min. van V&W, Hoofddir. vd Waterstaat)
42 Dr. A. Bieber (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Bonn, D)
43 Mrs. ir. C. Cornelis (VITO, Mol, B)
44 Mrs. dr. K. Freier (UmweltBundesAmt, Berlin, D)
45 Mw. drs. M.D. Wallé (Milieudienst Curaçao, Willemstad, NA)
46 Mrs. S. Herbert (Department of the Environment, London, UK)
47 Mrs. I. Edelgaard (Ministry of Environment and Energy, Kopenhagen, DK)
48 Mr. H. Ellis (Ministry for the Environment, Wellington, NZ)
49 Mr. M. Beaulieu (Quebec Min. of the Environment and Wildlife, Quebec, C)
50 Mr. Ph. Sinclair (EPA Victoria, Melbourne, AU)
51 dr. D. Bennett (US-EPA, Washington, USA)
51 Mr. K. Nagata (Japan Association of Industries and Environment, Tokyo, J)
53 Drs. D. Moet (VNG, Den Haag)
54 Dr. J.J. Vegter (TCB, Den Haag)
55 Drs. C. van der Guchte (RIZA, Lelystad)
56 Dr. J.H. van Wijnen (GG&GD, Amsterdam)
57 Dr. W. Veerkamp (Shell, Rotterdam)
58 Dr. W.F. ten Berge (DSM, Heerlen)
59 Ing. P.J. Smit (Van Hall Instituut, Groningen)
60 IPO/ABO, via Ir. P.J.M. Kuijper (Prov. Utrecht, Utrecht)
61 NARIP, via Dr. H. Leenaers (TNO, Apeldoorn)
62 ONRI-werkgroep bodem, via Drs. M.F.X. Veul (Witteveen en Bos, Deventer)
63 Drs. J.W. Gunster (VNO/NCW, Den Haag)
64 Ir. Th. Edelman (Stichting Bodemsanering NS, Utrecht)
65 Dr. T. Assmuth (Finish Environment Agency, Helsinki, F)
66 Prof.dr. C. Ferguson (Nothingham Trent University, Nothingham, UK)
67 Mrs. Dr. A. Urzelai ((IHOBE, Bilbao, E)
68 Dr. A. Langley (South Australian Health Commission, Adelaide, AU)
69 Drs. M.A.W. Waitz (TAUW Milieu, Amsterdam)

70	Mw. drs. J.M. Wezenbeek (Grontmij, De Bilt)
71	Drs. G.J.M. Bockting (IWACO, Rotterdam)
72	Drs. A. van de Haar (A. van de Haar Milieuadviseur, Utrecht)
73	Dhr. Th. Nakken (Arcadis Heidemij, Deventer)
74	Depot van Nederlandse publikaties en Nederlandse bibliografie
75	Directie van het Rijksinstituut voor Volksgezondheid en Milieu
76	Prof.ir. N.D.van Egmond (dir. Milieu)
77	Ir. F. Langeweg (dir. Sector Milieuonderzoek)
78	Dr.ir. G. de Mik (dir. Sector Stoffen en Risico's)
79	Dr. W.H. Könemann (hCSR)
80	Ir. J.J.G. Kliest (hIEM)
81	Drs. L.H.M. Kohsiek (hLAE)
82	Dr. R.C.G.M. Smetsers (hLSO)
83	Dr.ir. D. van Lith (hLLO)
84	Prof.dr. H.J.P. Eijsackers (hECO)
85	Ir. H.A.M. Bresser (hLWD)
86	Ing. P.J.C.M. Janssen (CSR)
87	Mw. dr. G.H. Crommentuijn (CSR)
88	Prof.dr. C.J. van Leeuwen (CSR)
89	Mw. M.E. van Apeldoorn (CSR)
90	Dr. P.C.J.I. Schielen (CSR)
91	Mw. M.F.A. Wouters (CSR)
92	Mw. R. Posthumus (CSR)
93	Drs. M.G. J. Rikken (CSR)
94	Drs. T.G. Vermeire (CSR)
95	Drs. D.T. Jager (CSR)
96	Drs. E. van de Plassche (CSR)
97	Dhr. A.J. Baars (CSR)
98	Ing. H.A.Vissenberg (LLO)
99	Mw. C. Pronk (IEM)
100	Ir. R. van den Berg (hLBG)
101	Drs. A. van der Giessen (LBG)
102	Dr.ir. J.J.M. van Grinsven (LBG)
103	Ir. R.O.G. Franken (LBG)
104	Ir. J.P.A. Lijzen (LBG)
105	Ing. P.F. Otte (LBG)
106	Dr.ir. C.W. Versluijs (LBG)
107	Mw. ir. E.R. Soczó (LBG)
108	Dr.ir J.J.B. Bronswijk (LBG)
109	drs. W.J. Willems (LBG)
110-111	auteurs
112	Hoofd Bureau Voorlichting en Public Relations
113	Bureau Rapportenregistratie
114	Bibliotheek RIVM
115	Bibliotheek RIVM, depot LBG
116	Bibliotheek CSR
117-160	Bureau Rapportenbeheer
160-200	Reserve-exemplaren

PREFACE

The authors would like to thank their RIVM-colleagues P. Otte for assistance in investigating the sensitivity of the HUM-TOX SCC to the input parameters and H. Vissenberg for his assistance in deriving "smart" BioConcentration Factors for the metals. Furthermore the authors are grateful to R. De Wijs-Christensen (RIVM) for editing the report.

CONTENTS

SUMMARY

Proposals for Intervention Values for soil and groundwater were derived for the fourth series of compounds, consisting of 15 additional compounds and compound groups, added to the already formalised first to third series of Intervention Values. To derive these proposals for Intervention Values presented below, both the ecotoxicological (ECOTOX SCC) and human-toxicological serious soil contamination concentrations (HUM-TOX SCC) were calculated for all the compounds. The results of the derivation of the ECOTOX SCC values, extensively described in *Postumus et al. (1998)*[*1], are summarised in this report for the fourth series of compounds. The HUM-TOX SCC values were derived using the CSOIL exposure model, the standard potential exposure data set, selected contaminant specific physicochemical input parameters and the Maximal Permissable Risk levels for human intake (MPR_{human}). The derivation of the MPR_{human} values is extensively described in *Janssen et al. (1998)*[*2]. These results are also summarised in this report for the fourth series of compounds. Relevant unreliable physicochemical input parameters were identified and where possible improved. Indication of the accuracy of the HUM-TOX SCC was dependent on the sensitivity of the HUM-TOX SCC to unreliable input parameters and the uncertainty of the MPR_{human}. In general, the proposals for Intervention Values for groundwater and, to a lesser extent, those for soil are characterised by a limited accuracy.
Because values derived in this study concern *proposals for* Intervention Values, reporting any supplementary data for the crucial and unreliable input parameters is welcome. Adjustment of proposals for Intervention Values is possible, at least during 1998; supplementary data should be offered in writing to the second author of this report.

The proposals for Intervention Values for soil and groundwater (in bold, to two digits significant) are listed below. The ECOTOX and HUM-TOX SCC and their uncertainty scores are also presented.

*1 *Posthumus et al. (1998)*
*2 *Janssen et al. (1998)*

Ecotoxicological Serious Soil Concentration (ECOTOX SCC) and Human Toxicological Serious Soil Concentration (HUM-TOX SCC), with uncertainty scores, and proposals for the Intervention Values for a standard soil (10% organic matter, 25% lutum) and groundwater (the latter in bold)

Compound	ECOTOX SCC [mg.kg^{-1}$_{dry\ weight}$]	US[a)]	HUM-TOX SCC. [mg.kg^{-1}$_{dry\ weight}$]	US[a)]	**Proposed Int.Value soil [mg.kg^{-1}$_{dry\ weight}$]**	**Proposed Int.Value groundwater [µg.l^{-1}]**
I. Metals						
vanadium	250	low	1000	low	**250**	**63**[d)]
selenium	5	low	235	high	**240**	**160**[d)]
tellurium	n.a.	-	588	low	n.a. (590)[b)]	n.a. (63)[b,d)]
thallium	14	low	118	low	**14**	**6.3**[d)]
tin	910	low	324000	low	**910**	**48**
III. Aromatic compounds						
monochloroanilines	46	high	17.8	low	**46**	**28**[d)]
dichloroanilines	43	high	n.a.		n.a. (43)[c)]	n.a.(104)[c,d)]
trichloroanilines	7.8	low	n.a.		n.a. (7.8)[c)]	n.a. (11)[c)]
tetrachloroanilines	27	low	n.a.		n.a. (27)[c)]	n.a. (6.7)[c)]
pentachloroanilines	5.9	low	n.a.		n.a. (5.9)[c)]	n.a. (1.0)[c)]
4-chloro-2-methyl phenol	15	low	39.3	low	**15**	**350**
4-chloro-3 methyl phenol	15	low	589	low	**15**	**350**
V. Chlorinated hydrocarbons						
1,1,2-trichloroethane	460	low	8.38	low	**8.4**	**130**[d)]
dichloropropanes	125	low	1.81[e)]	moderate	**1.8**	**77**
1,1-dichloroethene	130	low	0.216	low	**0.22**	**5.8**
VI. Pesticides						
MCPA	95	low	3.59	low	**3.6**	**47**[d)]
VII. Miscellaneous compounds						
tribromomethane	300	low	74.7	low	**75**	**630**[d)]
isopropanol	220	low	714	moderate	**220**	**31000**[d)]
ethylacetate	68	low	546	moderate	**68**	**15000**
1,2-butylacetate	196	low	469	low	**200**	**6300**[d)]

n.a: not available
a) uncertainty score (higher score, less uncertainty)
b) a proposal for an Intervention Value could not be derived because ECOTOX SCC is not available (in parentheses: value based on HUM-TOX SCC only).
c) a proposal for an Intervention Value could not be derived because HUM-TOX SCC is not available (in parentheses: value based on ECOTOX SCC only).
d) corrected for direct uptake of groundwater as drinking water
e) corrected for exceedance of tolerable concentration in indoor air

SAMENVATTING

In dit rapport worden voorstellen gedaan voor de vierde tranche interventiewaarden voor grond en grondwater. Deze vierde tranche, bestaande uit 15 contaminanten en contaminant groepen, is een uitbreiding op de reeds geformaliseerde eerste t/m derde tranche interventiewaarden. Ter bepaling van deze voorstellen voor interventiewaarden is de ecotoxicologische en humaan-toxicologische ernstige bodemverontreinigingsconcentratie (respectievelijk ECOTOX EBVC en HUM-TOX EBVC) bepaald voor alle contaminanten. De afleiding van de ECOTOX EBVC is uitvoerig beschreven in *Postumus et al. (1998)*[*1]. De resultaten hiervan zijn in de onderhavige rapportage geresumeerd. De HUM-TOX EBVC maakt onderdeel uit van dit rapport en is afgeleid op basis van het CSOIL blootstellingsmodel, de standaard dataset voor potentiele blootstelling, geselecteerde fysisch-chemische contaminant specifieke input parameters en het Maximaal Toelaatbare Risico niveau voor inname (MTR_{humaan}). De afleiding van de MTR_{humaan} waarden is uitvoerig beschreven in *Janssen et al. (1998)*[*2]. De resultaten zijn eveneens in deze rapportage van de vierde tranche interventiewaarden samengevat weergegeven. Relevante niet-nauwkeurige fysisch-chemische input parameters zijn geïdentificeerd en, indien mogelijk, verbeterd. De betrouwbaarheid van de HUM-TOX EBVC is aangegeven, in afhankelijkheid van de gevoeligheid van de HUM-TOX EBVC voor niet-nauwkeurige input parameters en de onzekerheid van de MTR_{humaan}. In het algemeen worden de voorstellen voor interventiewaarden voor grond en met name die voor grondwater, gekenmerkt door een beperkte nauwkeurigheid. Omdat de afgeleide waarden *voorstellen* voor interventiewaarden betreffen wordt melding van toegevoegde gegevens over relevante en zwak onderbouwde input-parameters op prijs gesteld. Aanpassing van de voorgestelde interventiewaarden is tenminste in geheel 1998 mogelijk en toegevoegde gegevens kunnen (schriftelijk) aan de tweede auteur van dit rapport worden toegezonden.

De voorstellen voor interventiewaarden voor grond en grondwater (in vet, twee significante cijfers) zijn in onderstaande tabel weergegeven. De HUM-TOX en ECOTOX EBVC en de hierbij behorende onzekerheidsscores zijn eveneens in de tabel opgenomen.

*1 *Posthumus et al. (1998)*
*2 *Janssen et al. (1998)*

Ecotoxicologische Ernstige BodemVerontreinigingsConcentratie (ECOTOX EBVC), Humaan-toxicologische Ernstige BodemVerontreinigingsConcentratie (HUM-TOX EBVC), met onzekerheidsscores; voorstellen voor interventiewaarden voor een standaardbodem (10% organische stof, 25% lutum) en grondwater (laatste waarden in vet)

Compound	ECOTOX EBVC [mg.kg^{-1}$_{droggewicht}$]	US[a]	HUM-TOX EBVC. [mg.kg^{-1}$_{droggewicht}$]	US[a]	**Voorstel voor int.waarde grond [mg.kg^{-1}$_{drooggewicht}$]**	**Voorstel voor int.waarde grondwater [µg.l^{-1}]**
I. Metalen						
vanadium	250	laag	1000	laag	**250**	**63**[d]
selenium	5	laag	235	hoog	**240**	**160**[d]
tellurium	n.b.	-	588	laag	n.b. (590)[b]	n.b. (63)[b,d]
thallium	14	laag	118	laag	**14**	**6.3**[d]
tin	910	laag	324000	laag	**910**	**48**
III. Aromatische verbindingen						
monochlooranilinen	46	hoog	17.8	laag	**46**	**28**[d]
dichlooranilinen	43	hoog	n.b.		n.b. (43)[c]	n.b.(104)[c,d]
trichlooranilinen	7.8	laag	n.b.		n.b. (7.8)[c]	n.b. (11)[c]
tetrachlooranilinen	27	laag	n.b.		n.b. (27)[c]	n.b. (6.7)[c]
pentachlooranilinen	5.9	laag	n.b.		n.b. (5.9)[c]	n.b. (1.0)[c]
4-chloor-2-methylfenol	15	laag	39.3	laag	**15**	**350**
4-chloor-3 methylfenol	15	laag	589	laag	**15**	**350**
V. Gechloreerde koolwaterstoffen						
1,1,2-trichloorethaan	460	laag	8.38	laag	**8.4**	**130**[d]
dichloorpropanen	125	laag	1.81[e]	gemiddeld	**1.8**	**77**
1,1-dichlooroethenen	130	laag	0.216	laag	**0.22**	**5.8**
VI. Pesticiden						
MCPA	95	laag	3.59	laag	**3.6**	**47**[d]
VII. Overige verbindingen						
tribroommethaan	300	laag	74.7	laag	**75**	**630**[d]
isopropanol	220	laag	714	gemiddeld	**220**	**31000**[d]
ethylacetaat	68	laag	546	gemiddeld	**68**	**15000**
1,2-butylacetaat	196	laag	469	laag	**200**	**6300**[d]

n.b. niet beschikbaar

a) onzekerheidsscore (hogere score, minder onzekerheid)

b) er kon geen voorstel voor een interventiewaarde worden afgeleid, omdat de ECOTOX EBVC niet beschikbaar is (tussen haakjes: de waarde alleen op de HUM-TOX EBVC gebaseerd)

c) er kon geen voorstel voor een interventiewaarde worden afgeleid, omdat de HUM-TOX EBVC niet beschikbaar is (tussen haakjes: de waarde alleen op de ECOTOX EBVC gebaseerd)

d) gecorrigeerd voor directe consumptie van grondwater als drinkwater

e) gecorrigeerd voor overschrijding toelaatbare concentration in binnenlucht

1 INTRODUCTION

1.1 State-of-the-Art

Intervention Values for 70 compounds (first series; *Van den Berg and Roels, 1991)* were implemented in 1994 (Ministerial Circular Intervention Values for soil remediation; *Ministry of VROM, 1994*). In 1997, 24 new Intervention Values or Indicative Levels for serious soil contamination were implemented (Ministerial Circular Intervention Values, second and third series; *Ministry of VROM, 1997*) on the basis of the second series of proposals for Intervention Values (*Van den Berg et al., 1994*) and the third series of proposals for Intervention Values (*Kreule et al., 1995*).

The meaning of the Intervention Values is as follows: if the average total soil content in a soil volume of at least 25 m^3 exceeds the Intervention Value for soil, or when the concentration of the groundwater in a water-saturated soil volume of at least 100 m^3 exceeds the Intervention Value for groundwater, we can speak of *serious soil contamination*, with the following consequences:

- not every type of soil use can be applied on the site without risks for humans and/or the environment; this is called a potential risk;
- the urgency for remediation will have to be determined; this will result in either starting remediation within a period of a generation or no obligation to determine a starting time for remediation and thus no remediation within the period of a generation.

Indicative Levels for serious soil contamination have the same status as Intervention Values. However, these levels are characterised by poor reliability due to limited data to perform a risk assessment, or by the lack of an available standardised analytical procedure to determine the concentration of these compounds in soil and groundwater. Intervention Values and Indicative Levels will be applied to terrestrial soils as well as to sediments.

Appendix VIII lists all relevant RIVM reports in relation to potential risk assessment (and also in relation to actual, i.e. site-specific, risk assessment), including an abstract.

1.2 Fourth series of compounds for proposed Intervention Values

1.2.1 Selection of compounds

This report documents the derivation of *proposals* for Intervention Values for 15 additional compounds or compound groups (the fourth series of compounds) as listed below:

- metals: vanadium, selene, thallium, tellurium, tin;
- aromatic compounds: chloroanilines, 4-chloro-methylphenol;
- chlorinated hydrocarbons: 1,1,2-trichloroethane, 1,2/1,3-dichloropropane, 1,1-dichloroethene;
- pesticides: MCPA (4-chloro-methylphenoxy-acetic acid);
- miscellaneous compounds: tribromomethane, isopropanol, ethylacetate and butylacetate.

The choice of these compounds is based on the combination of the following criteria (*Swartjes, 1997*):

- toxicity of the compound;
- frequency of occurrence of the compound in soil and/or groundwater;
- residence time of a contaminant in the soil and leaching into the groundwater;
- existence of other assessment frameworks.

The availability of data also plays a role and the behaviour of the compound in soil should correspond to the standard procedure for deriving proposals for Intervention Values.

1.2.2 Procedure

In principle, the same procedure as for the second and third series of Intervention Values was followed. For these series, recommendations were incorporated from the discussions of politicians within the Working Groups on the Implementation of the Remedation Regulation, initiated by the Ministry of Housing, Spatial Planning and the Environment) and technical evaluation (*TCB, 1992*) in relation to the first series of Intervention Values. Recommendations that resulted from the political discussion and technical evaluation (*TCB, 1997*) on the second and third series of Intervention Values have been implemented in part only. Because several recommendations concern the general procedure and influence the first to third series as well, these recommendations will be investigated in the framework of the current project "Evaluation of Intervention Values".

To derive a new Intervention Value the *human-toxicological* serious soil contamination concentrations (HUM-TOX SCCs) are derived and combined with the *ecotoxicological* serious soil contamination concentrations (ECOTOX SCCs). The HUM-TOX SCC are derived using the CSOIL-exposure model with the compound-specific physicochemical data and the Maximum Permissible Risk values for intake (MPR_{human} values) as input data. Figure 1 shows the relation between the different steps leading to proposals for Intervention Values for soil and groundwater. These different steps are described in separate reports. The shaded box in Figure 1 is described in the present report. The derivation of the ECOTOX SCC for the compounds of the fourth series of compounds is described in the report of *Posthumus et al. (1998)*, while the derivation of the MPR_{human} values is given in the report of *Janssen et al. (1998)*. All relevant information for the derivation of the HUM-TOX SCC and the integration of the ECOTOX SCC and HUM-TOX SCC has been summarised in the present report.

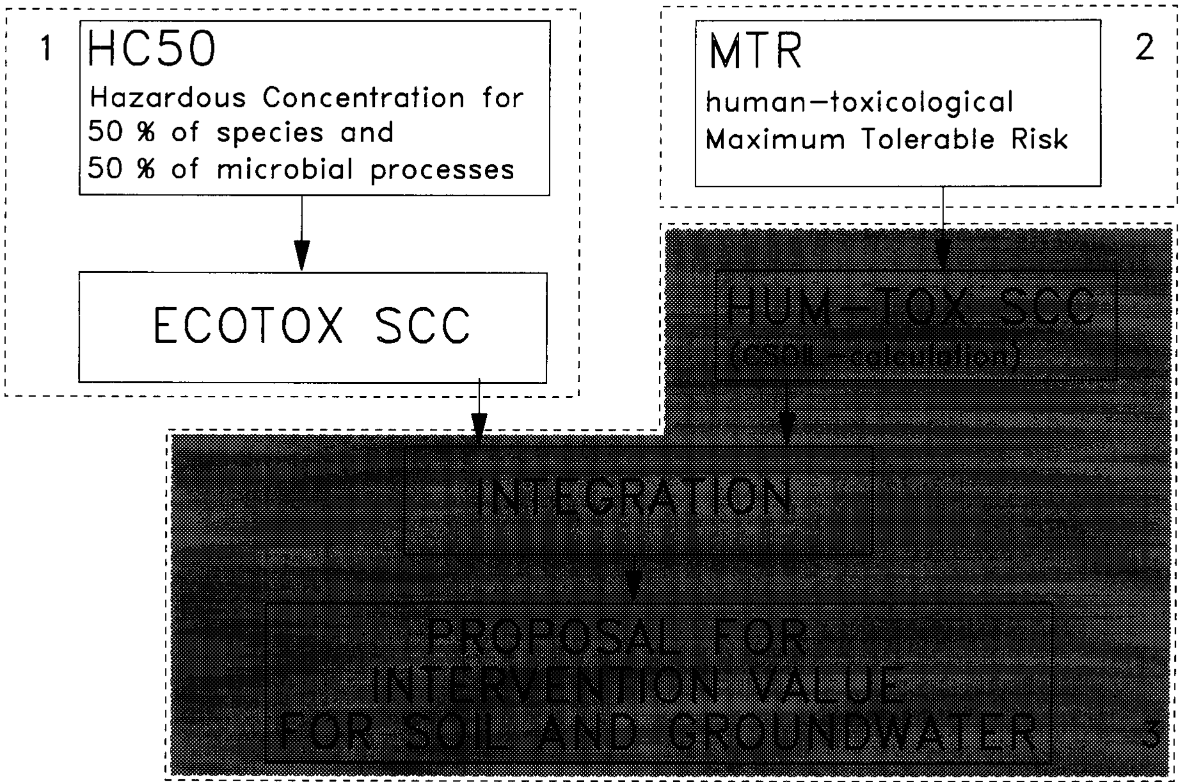

Figure 1. Steps leading to proposals for Intervention Values of soil and groundwater (1. Posthumus et al., 1998; 2. Janssen et al., 1998; 3. this report)

1.2.3 Future developments

The proposals for the Intervention Values will be reviewed in future by the Technical Soil Protection Committee (TCB) and will be subject to a political discussion before they can be implemented as Intervention Values or Indicative Levels for serious soil contamination.

The lack of references for some of the input parameters for several of the compounds considered makes it impossible to derive a reliable value for these input parameters. Where the calculation of a proposal for an Intervention Value is sensitive to such an input parameter, a weakly based proposal for an Intervention Value may well result. Because values derived in this study concern *proposals* for Intervention Values, reporting on supplementary data for the crucial and unreliable input parameters is welcome. Adjustment of Intervention Values is possible, at least during 1998; supplementary data should be offered in writing to the second author of this report.

1.3 The present report

Chapter 2 will generally describe the physicochemical properties used for the calculation of the HUM-TOX SCC, while Chapter 3 will outline the application and occurrence of the compounds in the environment, and the selection of the values for the physicochemical properties for each compound. In this chapter we will also discuss the uncertainty of these parameters and the sensitivity of the HUM-TOX SCCs to the weakly based input parameter. Chapter 4 will present the MPR_{human} values derived by *Janssen et al. (1998)*. The potential exposure and determination of the HUM-TOX SCCs will be described in Chapter 5 and in Chapter 6 the ECOTOX SCCs of the compounds derived by *Posthumus et al. (1998)* will be summarised. Chapter 7 focuses on the integration of the SCCs, resulting in proposals for Intervention Values for soil and groundwater. Finally, a discussion on the accuracy of the Intervention Values will also be given in Chapter 7.

2 Description of the physicochemical properties

2.1 Soil-porewater partition coefficient

The soil-porewater partition coefficient (K_d) is the ratio between the content of a compound in the solid phase of the soil and its equilibrium concentration in the porewater. In general, the K_d for metals is empirically determined. Because K_d is strongly dependent on soil characteristics, environmental conditions and (the resulting) speciation of the metal it is aimed at calculating an average value for Dutch soils and common speciations in Dutch soils.
For organic compounds, K_d is derived from K_{oc} (the organic carbon normalised soil-porewater partition coefficient described in 2.7) and the organic carbon content.

2.2 BioConcentration Factor

If crops grow on contaminated land, accumulation of compounds in the crop may occur due to root uptake and deposition on the crop. The affinity for accumulation of compounds due to root uptake is expressed by the BioConcentration Factor (BCF), defined as the ratio of the mass fraction of a compound per kg crop dry weight and per kg soil dry weight. Because humans can consume the root or the shoot of a crop, a distinction is made between the BioConcentration Factor for roots (BCF_{root}) and for shoots (BCF_{shoot}). Because BCFs are highly dependent on soil characteristics, environmental conditions and crop species, the aim is to calculate an average value for Dutch soils and common crops in the Netherlands.

The BCFs for the metals described in this report are derived from several reviews (*Bockting and Van den Berg, 1992; Baes et al., 1984* and *Kabata-Pendias and Pendias, 1992*) and other sources from the literature. Accumulation of organic compounds in crops is calculated as a function of the K_{ow} according to *Briggs et al. (1982, 1983).*

2.3 Vapour pressure

The vapour pressure of the gas in equilibrium with the liquid or the solid at a given temperature is a measure of the tendency of a substance to pass from a solid or a liquid to a vapour state. Vapour pressures are found in handbooks like *Verschueren (1983)* and *MacKay et al. (1992)* and in review articles like *MacKay and Shiu (1981).* All vapour pressures were corrected for soil temperature (10°C) according to *Lide et al. (1993); Chang (1990)* or *Sawyer and McCarty (1989).* In comparison with the first 92 compounds considered, for which vapour pressures of 20°C or 25°C were used as input parameters, this temperature correction results in more realistic exposure calculations. The temperature correction is implemented in the standard procedure for the derivation of the HUM-TOX SCCs.

2.4 Solubility

Solubility data have been collected from handbooks (*Verschueren, 1983; Chemiekaarten, 1991; MacKay et al. 1992)* and databases (among others *Medchem, 1996*). The compound- specific water solubility is a function of the water temperature. For all compounds, a temperature correction was applied when necessary to obtain the solubility at soil temperature (10°C).

2.5 Henry's law constant

The proportionality constant between the vapour pressure of a solute above an aqueous solution and the concentration in solution is called Henry's law constant (H_c) *(Fetter, 1993)*. The dimensionless H_c (at 20°C) is used in the CSOIL model to calculate the exposure to contaminants during showering (*Van den Berg, 1995*). The H_c is taken from measurements or calculated as the ratio between the vapour pressure and the solubility. If necessary, Henry's law constants (H_c's) at 10°C were obtained by using the temperature correction from *Wolff and Van der Heide (1982)*.

2.6 Octanol-water partition coefficient (K_{ow})

The octanol-water partition coefficient (K_{ow}) is a measure of the hydrophobicity of a compound. The organic compound is shaken with a mixture of n-octanol and water and the proportion dissolving into each phase is measured. The K_{ow} is the ratio of the concentration in the octanol to the concentration in water (*Fetter, 1993*). K_{ow} values were selected from *Verschueren (1983), Chemiekaarten (1991)*, the *Medchem (1996)* and other databases, and some review articles. Some of these K_{ow} s have been calculated by *Leo et al. (1971)* using several equations.

2.7 Organic carbon normalised soil-porewater partition coefficient (K_{oc})

The sorption of organic compounds onto the solid phase of the soil takes place almost exclusively onto the organic carbon matter if the fraction organic carbon (f_{oc}) constitutes at least 1% of the soil on a weight basis (*Karickhoff et al., 1979*). Under these conditions an organic carbon normalised partition coefficient (K_{oc}) can be defined as the K_d divided by f_{oc} *(Fetter, 1993)*. For the compounds considered, K_{oc} values were obtained from *Bockting et al. (1993)* and other studies; *<alt.: researchers>* however, for several compounds reliable K_{oc} was not found in the literature. In such a case the sensitivity of the HUM-TOX SCC to the K_{oc} was considered. Where the calculated HUM-TOX SCC appeared to be very sensitive to the K_{oc}, more effort was made to find a reliable parameter value.

Additional data for K_{oc} were derived from the K_{ow} and/or solubility (S) according to *Karickhoff (1981)* using equations 1 and 2:

$$K_{oc} = 0.411 \times K_{ow} \qquad (1)$$

where K_{oc} = organic carbon normalised soil-porewater partition coefficient ($l.kg^{-1}$)
K_{ow} = octanol-water partition coefficient (-).

$$\log K_{oc} = -0.921 \log S - 0.00953 (MP-25) - 1.405 \qquad (2)$$

where S = molefraction of compound in water (-)
MP = melting point (°C)

In equation 2 the term 0.00953 (MP-25) is a correction for crystal energy for organic compounds (*Karickhoff, 1981*). This correction, a function of the melting point of a compound, is needed to correct for polar functional groups and very high melting points.

Depending on the number and quality of the measured K_{oc}s available, a "smart" average K_{oc} was determined combining the measured and calculated K_{oc} values.

2.8 Permeation coefficient

The permeation coefficient is a measure of the affinity for transport of a compound through a membrane, here specified as a polyethylene tube (expressed in square meters per day). For calculating permeation of an organic compound from water or air into pipelines, compound-specific permeation coefficients are needed. No database exists in which the relevant data are given for the compounds described in this report. Only *Vonk (1985)* and *Van der Heijden* and *Hofman (1986)* provide information for a limited number of compounds. Values for these coefficients were estimated on the basis of data for comparable compounds, with consideration for structure and size. A permeation coefficient of $1.\ 10^{-7}\ m^2.d^{-1}$ has been used for most compounds (*Veenendaal et al., 1985*). Use of other values is motivated in Chapter 3.
It should be mentioned that, in general, the exposure pathways using the drinking-water concentration as a contact medium are of minor importance, so that improvement of the estimation method to assess permeation coefficients is not necessary.

2.9 Acid dissociation

Dissociation of organic acid will result in negatively charged species. These species are more mobile in soil than their parent compounds. As pH increases, the tendency of dissociation increases, especially for organic acids of relatively low pK_a.

For the compounds in this report, acid dissociation may occur for MCPA. At a pH of 6 (for a standard soil) acid dissociation is not found relevant for the other compounds mentioned here. So, for these compounds it is assumed that no negatively charged species are present.

3 OCCURRENCE AND APPLICATION OF THE COMPOUNDS AND SELECTION OF PHYSICOCHEMICAL PROPERTIES

Calculation of the HUM-TOX SCC implies uncertainty, due among other things, to uncertainty in the physicochemical input parameters. When a selected value of an input parameter is not well founded for a compound and the HUM-TOX SCC appears to be (very) sensitive to this input parameter, more effort has been made to find a reliable parameter value. The influence on the HUM-TOX SCC and the selection of these input parameters will be discussed for these compounds in more detail. The final results are summarised in tables where three options are possible:

* No reliable value could be derived and parameter is *no* sensitive input parameter for the calculation of the HUM-TOX SCC.

** No reliable value could be derived and parameter is a sensitive input parameter for the calculation of the HUM-TOX SCC.

*** No reliable value could be derived and parameter is a *very* sensitive input parameter for the calculation of the HUM-TOX SCC.

Where parameter values obtained are relatively reliable, no further investigation of sensitivity for the HUM-TOX SCC was found necessary.

The sensitivity of the HUM-TOX SCC to an input parameter is compound-specific. In general, the BCF and K_{oc} are found to have a large impact on the calculated HUM-TOX SCC. For the volatile compounds, the vapour pressure is also an important parameter. For the fourth series of compounds several BCFs for metals were not well founded. For some organic compounds, it was not possible to derive a reliable K_{oc}. Where possible, input parameters similar to those used for the derivation of the ECOTOX SCC and the derivation of the Target Values were used for the derivation of the HUM-TOX SCC.

First, the physicochemical properties for the metals will be discussed, followed later by physicochemical properties for aromatic compounds, MCPA as a pesticide, chlorinated hydrocarbons and some miscellaneous compounds. Background information will be given per compound on its occurrence or the application.

3.1 Metals

A crucial factor for the calculation of the human exposure to metals is the crop content, calculated on the basis of the BCF. However, metal contents of crops grown on contaminated soil show a large variation for each element, depending on soil, environmental and crop-specific factors. For the calculation of the Intervention Value for groundwater the partition coefficient is a relevant factor: the Intervention Value for groundwater is proportional to this partion coefficient. The spread in this partition coefficient is documented to be huge because of differences in soil and environmental factors, resulting in different metal speciations and differences in metal partition behaviour.

In the framework of calculating potential exposure and Intervention Values for groundwater it is aimed at selecting an "average" crop content for the standard scenario as well as an "average partition coefficient" for Dutch soils and soil conditions.

3.1.1 Vanadium

Occurrence

Industrial processing of certain mineral ores like ore melters, cement and phosphate rock plants, and burning of coals and oils, will increase the deposition of vanadium (V) residues in soils. Combustion of fuel oils is a major source of V in soil (*Kabata-Pendias and Pendias, 1992*).

Vanadium is characterised by four valencies; +2, +3, +4 and +5. The geochemical characteristics of V are strongly dependent on these oxidation states and on the acidity of the soil. The behaviour of V in soil has received little attention. Apparently, the vanadyl cation (VO^+) may be an important form of V in many soils. Vanadium tends to be associated with organic matter and according to *Norrish (1975)* (see *Kabata-Pendias and Pendias, 1992),* Fe oxides hold a reasonable fraction of the soil V. *Berrow et al. (1978)* emphasised that in relation to the V fraction hold in certain horizons of podzols, the role of clay minerals as well as organic acids might be more significant than the role of Fe oxides. *Goodman and Cheshire (1975)* and *Bloomfield (1981)* stated that much of the soil V, mainly the vanadyl cation, is mobilised as complexes with humic acids.

Selected physicochemical properties

Bockting et al. (1992) determined a K_d of 309 $l.kg^{-1}$ for vanadium, based on a review in the literature (11 observations).

Soluble soil V appears to be easily taken up by roots; some crop species show a great ability to accumulate this metal. V is more easily taken up at low pH (VO^{2+}) than at high pH (VO_3^-, HVO_4^{2-}). Further is to be seen that V tends to accumulate more in the shoot than in the root. The soil-bound vanadium that is most readily available to crops is the vanadium adsorbed on clay minerals, while metals fixed by oxides and bound onto micro-organisms are much less readily available (*Kabata-Pendias and Pendias, 1992).* Unfortunately, besides crop contents, no contents in the soil are given, which makes it impossible to calculate BCFs for vanadium from these studies. *Merian (1991)* gives crop content range (non-detectable to 6.6 ppm, dry weight) as well as soil range (0.65 to 98 ppm dry weight), implying that the BCF ranges from 0 to 10. However these ranges are too rough to estimate a reliable BCF.

No measured values are found for the BCF_{root}, therefore the only source for this parameter is the calculated value of *Baes et al. (1984)* of $BCF_{root} = 0.003$. *Kaplan et al. (1990a)* measured 11 BCF_{shoot} values From these data a geometric average of $BCF_{shoot} = 0.006$ is calculated. As a consequence, the BCF_{shoot} would be higher than the BCF_{root}, which is unlikely (*Kaplan et al., 1990a*). Because the value of $BCF_{shoot} = 0.006$ is much more reliable than the value of BCF_{root}

= 0.003, 0.006 can be assumed as a lower limit for the BCF_{root}. For this reason a BCF_{root} = 0.006 is adopted as a selected value in the derivation of the HUM-TOX SCC for vanadium.

3.1.2 Selenium

Occurrence

Environmental selenium (Se) compounds may originate from metal smelting of copper-sulphide ores, coal combustion in the form of fly ash or the disposal of wastes. Selenium is widely employed in industrial products, in processes in the glass industry and in inorganic pigments like plastics, paints, inks, rubber and ceramic (*Kabata-Pendias and Pendias, 1992*).

Selenium shows different valencies of -2 to +6. The mobility of selenium in soils is highly dependent on environmental factors like pH. Lowered pH in soils appears to reduce selenium availability because Se sulphides with a low water solubility dominate at low pH. At a pH higher than 7 and oxidised circumstances selenates dominate. Selenate (SeO_3^{2-}) is the most soluble, mobile and most occurring form of selenium. In soils with high organic matter content and moderate oxidised circumstances, selenides (HSe^-, H_2Se^0) may exist. These selinides are only slightly mobile (*Kabata-Pendias and Pendias, 1992*). In this report Se will be considered as a metal.

Selected physicochemical properties

Bockting et al. (1992) determined a K_d of 20 $l.kg^{-1}$ for selenium, based on a review in the literature (16 observations). In general soil Se uptake by crops depends on climatic conditions, water regime of soil, redox potential, pH and sesquioxide content of the soil. The selenium content of crops differ widely among crop species. Accumulator crops, which are in general non-food crops, can incorporate 1000 to 10000 ppm ($mg.kg^{-1}$) of selenium (dry weight). Secondary selenium absorbing crops contain 50-500 ppm, while most crops, grains and grasses contain more than 30 ppm, the general range being 0.05 to 1 ppm (*Kabata-Pendias and Pendias, 1992*). The normal selenium level in crops is 0.01 to 0.1 $mg.kg^{-1}$. Soil concentrations of 100 $mg.kg^{-1}$ result in crop levels of up to 50 or even 100 $mg.kg^{-1}$ (*Kabata-Pendias and Pendias, 1992*). From these ranges it can be concluded that the BCF range is 0.5 to 1.0. In Merian (1991) it is stated that a soil content of 100 $mg.kg^{-1}$ can result in crop contents up to 1000 or 1500 $mg.kg^{-1}$, which implies BCFs from 10 to 15. Normal contents in crops, however, are contents between 1 and 50 $mg.kg^{-1}$. Finally, *Baes et al. (1984)* give calculated BCFs of 0.025 for BCF_{root} and BCF_{shoot}.

Besides for the BCF_{root}, six measured values are found in the literature (*US EPA, 1996*, one observation; *Cappon, 1987*, one observation and *Wan et al., 1988,* four observations). The geometric mean of 0.20 is used for the derivation of the HUM-TOX SCC for selenium. For the BCF_{shoot}, 31 measured data are available (*US EPA, 1996*, one observation; *Cappon, 1987*, one observation, *Logan et al., 1987*, 14 observations and *Wan et al., 1988*, 15 observations). This results in a geometric average for the BCF_{shoot} of 0.37. Because many measured values are available, the calculated values of *Baes et al. (1984)* are ignored.

3.1.3 Tellurium

Occurrence

Tellurium (Te) and its compounds are mainly used for solid state thermoelectric and electronic applications, as well as microalloying in ferrous and non-ferrous metallurgy. The products may be released in the form of waste. Te is also found in the air as a result of coal combustion and can therefore be deposited from air (*Kabata-Pendias and Pendias, 1992*).

Te shows variable valencies of +2 to +6 and, like selenium, forms divalent and trivalent oxides. The behaviour of Te is closely associated with the behaviour of S and Se. The mobility of Te in soil is highest at higher pH levels. In this study Te will be considered as a metal.

Selected physicochemical properties

Baes et al. (1984) determined a K_d of 300 $l.kg^{-1}$ for tellurium based on model calculations, which implies that this value is not very reliable.

Apparently, Te occurs in crop tissues at concentrations lower than those of Se. *Bowen (1979)* cited high Te accumulation from 2 to 25 ppm dry weight in a few crops from Te-rich soils. *Schroeder et al. (1967)* also reported relatively high Te concentrations in soils (0.5 to 37 ppm) and in crops (0.7 to 6 ppm dry weight). This results in a BCF range of 0.08 to 53.

No detailed information on the accumulation in crops related to the soil contents is found in the literature. For this reason the calculated BCFs of *Baes et al. (1984)* are used: BCF_{root} and BCF_{shoot} = 0.025. This value should be considered as a poor estimate of the BCFs. These values are low in comparison with the BCF ranges as derived from the literature.

3.1.4 Thallium

Occurrence

The largest anthropogenetic source of thallium (Tl) is related to coal combustion; however, heavy metal melting, cement industrial and refining processes may release Tl into the environment (*Kabata-Pendias and Pendias, 1992*).

The geochemical behaviour of thallium is analogous to that of K (*Kabata-Pendias and Pendias, 1992*). Thallium knows three valencies: +1, +2 and +3. Thallium as Tl^{+} is the stable form in soils. Tl is often fixed in situ by clays and gels of Mn and Fe oxides. The sorption of Tl by organic matter, especially under reducing conditions, is also known of.

Selected physicochemical properties

Bockting et al. (1992) estimated a K_d of 158 $l.kg^{-1}$ for thallium, based on comparison with the adsorption behaviour of copper and zinc. For this reason this K_d is supposed to be a weakly based value.

Tl in soils seems to be easily soluble and thus readily available to crops. Herbage and woody crops apparently contain higher amounts of Tl than other crop species. In pine trees the accumulation in needles is higher than in stems.

No data are found in the literature for the BCF_{root}. For this reason the calculated value of *Baes et al. (1984)* of 0.0004, implied as a weakly based value, is adopted. Seven different data are found for the BCF_{shoot} (*Tremel et al., 1997*, five observations; *Kaplan et al., 1990b*, two observations); for this reason the calculated value of *Baes et al. (1984)* is ignored. The high value of BCF > 1 of *Tremel et al.* (1997), which is at least a factor of 20 higher than all other BCF_{shoot}s, is probably derived for a accumulating type of crop or is a measurement error. For this reason this value has been eliminated. This results in a BCF_{shoot} of 0.0045 as a geometric average of the six measured data. Although the BCF_{root} is almost ten times lower than the BCF_{shoot}, no strong indications are found that a higher BCF_{shoot} is unlikely. For this reason the BCF_{root} has not been adjusted.

3.1.5 Tin

Occurrence

Energy consumption and mineral exploration by humans is the main cause of tin (Sn) pollution in the biosphere. Sn is found in sewage sludge (40-700 ppm dry weight) and in manure (3.8 ppm dry weight) (*Kabata-Pendias and Pendias, 1992*).

Tin is characterised by two oxidation states, Sn^{2+} and Sn^{4+}, of which Sn^{4+} is the most important in soils (*Dragun, 1988*). Sn has an ability to form complexes with soluble and insoluble organic substances and forms several complex anions of oxides and hydroxides. The mobility of these Sn-complexes is highly pH-dependent. Sn^{2+} can be present only in acid and reducing environments (*Kabata-Pendias and Pendias, 1992*). The following range of Sn-levels in soils is reported in *Kabata-Pendias and Pendias (1992)*: 1-4.6 ppm; 1-11 ppm; 50-300 ppm (in peat soils only).

Selected physicochemical properties

Bockting et al. (1992) estimated a K_d of 1905 $l.kg^{-1}$ for tin, based on comparison with the adsorption behaviour of lead. For this reason, this K_d is supposed to be a weak value. If Sn is present in the nutrient solution, it is easily taken up by crops (Romney *et al.*, 1975). The Sn in crops grown on contaminated soils may be highly enriched. *Pesek and Kolsky (1967)* found Sn concentrations of about 1000 ppm dry weight in sugar beets that were grown in the vicinity of a chemical factory.

Sauerbeck gives a BCF range of 0.01-0.1. *Bockting and Van den Berg (1992)* report values of BCF_{root} = 0.015 and BCF_{shoot} = 0.03, which have been based on calculated values in *Baes et al. (1984)* and were adapted in *Van den Berg (1995)* to derive a HUM-TOX SCC for tin. However, *Bockting and Van den Berg (1992)* state that there seems to be no clear relation between contents in soil and in plants. *Baes et al. (1984)* also refer to a measured plant and root content of 0.13 $mg.kg^{-1}$ and 0.10-1.8 $mg.kg^{-1}$, respectively, for an average soil content of 10 $mg.kg^{-1}$. From this observed data a BCF_{root} of 0.095 and BCF_{shoot} of 0.013 can be derived. Although these values are calculated using ranges of soil and plant content, they are used in this report because they are based on measured data and are in agreement with *Romney et al. (1975)*, who state that most of the absorbed Sn remains in the root. It is noted, however, that the values of BCF_{shoot} and mainly of the BCF_{root} have to be interpreted as weakly based values.

The selected physicochemical properties of vanadium, selenium, tellurium, thallium and tin are summarised in Table 1. The underlying data are shown in Appendix I.

***Table 1** Physicochemical data for metals*

Vanadium	
CAS reg.number	(7440-62-2)
molecular weight	50.94 $g.mol^{-1}$
K_d	309 $l.kg^{-1}$
BCF_{root}	0.006** $mg.kg^{-1}$ c_{root}/c_{soil} (dry weight)
BCF_{shoot}	0.006 $mg.kg^{-1}$ c_{shoot}/c_{soil} (dry weight)
Selenium	
CAS reg.number	(7782-49-2)
molecular weight	78.96 $g.mol^{-1}$
K_d	20 $l.kg^{-1}$
BCF_{root}	0.20 $mg.kg^{-1}$ c_{root}/c_{soil} (dry weight)
BCF_{shoot}	0.37 $mg.kg^{-1}$ c_{shoot}/c_{soil} (dry weight)
Tellurium	
CAS reg.number	(13494-80-9)
molecular weight	127.6 $g.mol^{-1}$
K_d	300* $l.kg^{-1}$
BCF_{root}	0.025** $mg.kg^{-1}$ c_{root}/c_{soil} (dry weight)
BCF_{shoot}	0.025** $mg.kg^{-1}$ c_{shoot}/c_{soil} (dry weight)
Thallium	
CAS reg.number	(7440-28-0)
molecular weight	204.37 $g.mol^{-1}$
K_d	158* $l.kg^{-1}$
BCF_{root}	0.0004** $mg.kg^{-1}$ c_{root}/c_{soil} (dry weight)
BCF_{shoot}	0.0045 $mg.kg^{-1}$ c_{shoot}/c_{soil} (dry weight)

Tin

CAS reg.number	(7440-31-5)
molecular weight	118.69 $g.mol^{-1}$
K_d	1905* $l.kg^{-1}$
BCF_{root}	0.095** $mg.kg^{-1}$ c_{root}/c_{soil} (dry weight)
BCF_{shoot}	0.013** $mg.kg^{-1}$ c_{shoot}/c_{soil} (dry weight)

* No reliable value could be derived, but parameter is *no* sensitive input parameter for the calculation of the HUM-TOX SCC.

** No reliable value could be derived and parameter is a sensitive input parameter for the calculation of the HUM-TOX SCC.

3.2 Aromatic compounds

Application

The **chloroanilines** are a group of compounds consisting of mono-, di-, tri-, tetra-, and pentachloroanilines. 2-and 3-monochloroanilines (2- and 3-MCA) are used as intermediates, mainly in the production of pesticides and herbicides, pigments and pharmaceuticals (*BUA, 1991*). 4-MCA is widely used in the dye, chemical, textile, rubber and pharmaceutical industries (*NTP, 1989; IARC, 1993*). 2,4- and 2,5-dichloroaniline are used as precursors for the synthesis of dyestuffs and pigments. 3,4-dichloroaniline is used for the production of herbicides. Information on possible sources of tri-, tetra- and pentachloroanilines is lacking.
Chloroanilines may also be released into the environment due to (bio)degradation of pesticides and pigments but also as an impurity of pesticides and herbicides (*BUA, 1991*).

4-chloro-methylphenol is used as an external germicide, and preservative for glues, gums, inks, textile and leather goods (*Verschueren, 1983*). It is also applied as preservative in coatings for food products.

Selected physicochemical properties

The selected values for K_{oc} for the mono-, di- and trichloroanilines are geometric means of K_{oc}s selected from the studies *Bockting et al. (1992); Rippen et al. (1982); Van Gestel and Ma (1993) and Paya-Peres and Pelusio (1992)*. These geometric means are based on 12 to 20 data for K_{oc}, which implies a fairly reliable value for each K_{oc}. Since the K_{oc} of tetrachloroanilines is based on five observations, it is also implied to be a reasonable value. The K_{oc} of pentachloroaniline (1.0×10^4 $l.kg^{-1}$) is, on the contrary, based on one value only (*Reuther et al., 1998*), which is calculated and therefore should be considered a weakly based value.

The selected values for K_{ow} and solubilities are based on several databases and handbooks, including: *Howard, 1989; BUA, 1994; Chemiekaarten, 1991; HSDB, 1996* and *ASTER, 1994*. Many data are found for mono- to trichloroanilines. However, since the K_{ow}s and solubilities of

tetra- and pentachloroaniline are based on only two and one observation(s), respectively *(ASTER, 1994)*, they should be regarded as weakly based.
The selected K_{oc} for 4-chloro-methylphenol is the geometrical mean of two empirical K_{oc} values determined by *Susarla et al.* (1992; 1993) and Bhamidimarri et al. (1992). The K_{ow} is selected from the *Medchem (1996)* database and the solubility from *Verschueren (1983)*.

For mono- and dichloroanilines much data are found for the vapour pressure, which for the tri- and tetrachloroanilines have been based on three and two pieces of data, respectively, where the vapour pressure of pentachloroaniline has been based on only one measured piece of data. The vapour pressure of 4-chloro-3-methylphenol taken from *Verschueren (1983)* should be regarded as weakly based, being founded on one value only. For chloroanilines another permeation coefficient of 1 x 10^{-6} $m^2.day^{-1}$ is used instead of 1 x 10^{-7} $m^2.day^{-1}$.

Table 2 summarises the selected physicochemical properties of mono-, di-, tri, tetra-, and pentachloroanilines and 4-chloromethylphenol . The underlying data are given in Appendix II.

Table 2 *The selected physicochemical properties for aromatic compounds*

Monochloroanilines		
CAS registration number	(27134-26-5)	
molecular weight	127.6	($g.mol^{-1}$)
water solubility (10°C)	27.2	($mol.m^{-3}$)
log K_{ow}	1.88	
K_{oc}	347	($l.kg^{-1}$)
vapour pressure (10°C)	3.1	(Pa)
Henry's law constant (10°C)	4.80. $10^{-5\#}$	(-)
permeation coefficient	1. 10^{-6}	(m^2.day)
Dichloroanilines		
CAS registration number	(27134-27-6)	
molecular weight	162	($g.mol^{-1}$)
water solubility (10°C)	3	($mol.m^{-3}$)
log K_{ow}	2.79	
K_{oc}	708	($l.kg^{-1}$)
vapour pressure (10°C)	1.2	(Pa)
Henry's law constant (10°C)	1.7. $10^{-4\#}$	(-)
permeation coefficient	1. 10^{-6}	(m^2.day)
Trichloroanilines		
CAS registration number	(54686-91-8)	
molecular weight	196.5	($g.mol^{-1}$)
water solubility (10°C)	0.14	($mol.m^{-3}$)
log K_{ow}	3.62	
K_{oc}	1202	($l.kg^{-1}$)
vapour pressure (10°C)	0.08	(Pa)
Henry's law constant (10°C)	2.4. $10^{-4\#}$	(-)
permeation coefficient	1. 10^{-6}	(m^2.day)

Tetrachloroanilines

CAS registration number	(n.a.)	
molecular weight	230.9	($g.mol^{-1}$)
water solubility (10°C)	6,4. 10^{-3}	($mol.m^{-3}$)
log K_{ow}	4.52	
K_{oc}	6920	($l.kg^{-1}$)
vapour pressure (10°C)	0.02	(Pa)
Henry's law constant (10°C)	1.3. 10^{-3}#	(-)
permeation coefficient	1. 10^{-6}	(m^2.day)

Pentachloroanilines

CAS registration number	(527-20-8)	
molecular weight	265.3	($g.mol^{-1}$)
water solubility (10°C)	7.7. 10^{-5}*	($mol.m^{-3}$)
log K_{ow}	5.08**	
K_{oc}	10000***	($l.kg^{-1}$)
vapour pressure (10°C)	4.9. 10^{-4}*	(Pa)
Henry's law constant (10°C)	2.7. 10^{-3}#	(-)
permeation coefficient	1. 10^{-6}	(m^2.day)

4-chloromethylphenol

CAS registration number	(1570-64-5; 59-50-7)	
molecular weight	142.6	($g.mol^{-1}$)
water solubility (10°C)	2.4*	($mol.m^{-3}$)
log K_{ow}	2.87**	
K_{oc}	72.4	($l.kg^{-1}$)
vapour pressure (10°C)	5.3*	(Pa)
Henry's law constant (10°C)	9.4. 10^{-4}#	(-)
permeation coefficient	1. 10^{-7}	(m^2.day)

n.a. not available
calculated value
* No reliable value could be derived, but parameter is *no* sensitive input parameter for the calculation of the HUM-TOX SCC.
** No reliable value could be derived and parameter is a sensitive input parameter for the calculation of the HUM-TOX SCC.
*** No reliable value could be derived and parameter is a *very* sensitive input parameter for the calculation of the HUM-TOX SCC.

3.3 Chlorinated hydrocarbons

Application

1,1,2-trichloroethane is used in the organic chemical industry as a solvent for chlorinated rubber and in various organic materials as fat, oils, and resins (*Verschueren, 1983*).

1,2-dichloropropane is used as an intermediate in chemical synthesis (major use), as dry-cleaning solvent, paint remover, metal degreaser and as a component in soil fumigants. Several of these applications are no longer practised (*IARC,1986; ASTDR, 1989; IPCS, 1993*).

1,3-dichloropropane is used as an auxiliary agent in chemical syntheses and is present as a contaminant in soil fumigants containing 1,3-dichloropropene (*WHO-WQG, 1996*).

1,1-dichloroethene is among others used as solvent for fats and phenols, for retardation of fermentation, solvent for rubber, refrigerant, additive to dye and lacqer solutions; constituent of perfumes and thermoplastics. It is also used in organic synthesis and medicine (*Verschueren, 1983*).

Selected physicochemical properties

The selected K_{oc} values for the chlorinated hydrocarbons 1,1,2-trichloroethane and the dichloropropanes are geometric means of K_{oc}s selected from studies of *Ollingher and Ahlert (1988); Bockting et al. (1992); Huang et al. (1987); Huang and Ganjidoost (1990); Chiou et al. (1979); Pignatello (1990) and MacKay et al. (1992).* These K_{oc} values are based on a reasonable amount of observed data, which implies reliable values. On the contrary, the K_{oc} of 1,1-dichloroethene, which is only based on one measured and one calculated K_{oc} from K_{ow}, is a rather weak value.

The values for K_{ow} for 1,1,2-trichloroethane and 1,1-dichloroethene are taken from the *Medchem (1996)* database. The K_{ow} for the dichloropropanes is based on two references.
The vapour pressures are based on three observations for 1,1,2-trichloroethane and the dichloropropanes and on two observations for 1,1-dichloroethene. Solubilities are based on three observations for 1,1,2-trichloroethane and on two observations for 1,1-dichloroethene and the dichloropropanes.

For the selected chlorinated hydrocarbons 1,1,2-trichloroethane, 1,2-dichloropropane and 1,1-dichloroethene other permeation coefficients were used than 1. 10^{-7} $m^2.day^{-1}$. The coefficients of 1,2-dichloropropane and 1,1-dichloroethene were calculated using the diffusion coefficient (D_w = 4.9. 10^{-8} [$m^2.day^{-1}$]) of 1,2-dichloroethane. The permeation coefficient for 1,1,2-trichloroethane is assumed to be similar to the permeation coefficient of 1,1,1-trichloroethane in *Kreule et al. (1995).*

In Table 3 the selected physicochemical properties are given for the chlorinated hydrocarbons. The underlying data are shown in Appendix III.

Table 3 *The selected physicochemical properties for 1,1,2-trichloroethane, 1,2- and 1,3-dichloropropane and 1,1-dichloroethene*

1,1,2-trichloroethane		
CAS registration number	(79-00-5)	
molecular weight	133.4	($g.mol^{-1}$)
water solubility (10°C)	22.9	($mol.m^{-3}$)
log K_{ow}	1.89	
K_{oc}	93	($l.kg^{-1}$)
vapour pressure (10°C)	1590	(Pa)
Henry's law constant (10°C)	$3.0.\ 10^{-2\#}$	(-)
permeation coefficient	$2.0.\ 10^{-6}$	(m^2.day)
1,2-dichloropropane		
CAS registration number	(78-87-5)	
molecular weight	113.0	($g.mol^{-1}$)
water solubility (10°C)	13	($mol.m^{-3}$)
log K_{ow}	1.99	
K_{oc}	38	($l.kg^{-1}$)
vapour pressure (10°C)	2475	(Pa)
Henry's law constant (10°C)	$8.1.\ 10^{-2\#}$	(-)
permeation coefficient	$1.0.\ 10^{-6}$	(m^2.day)
1,3-dichloropropane		
CAS registration number	(142-28-9)	
molecular weight	113.0	($g.mol^{-1}$)
water solubility (10°C)	13	($mol.m^{-3}$)
log K_{ow}	1.99	
K_{oc}	38	($l.kg^{-1}$)
vapour pressure (10°C)	2475	(Pa)
Henry's law constant (10°C)	$8.1.\ 10^{-2\#}$	(-)
permeation coefficient	$1.0.\ 10^{-6}$	(m^2.day)
1,1-dichloroethene		
CAS registration number	(75-35-4)	
molecular weight	97.0	($g.mol^{-1}$)
water solubility (10°C)	18.8	($mol.m^{-3}$)
log K_{ow}	2.13	
K_{oc}	60.3***	($l.kg^{-1}$)
vapour pressure (10°C)	37947	(Pa)
Henry's law constant (10°)	$8.6.\ 10^{-1\#}$	(-)
permeation coefficient	$1.0.\ 10^{-5}$	(m^2.day)

\# calculated value

*** No reliable value could be derived and parameter is a *very* sensitive input parameter for the calculation of the HUM-TOX SCC.

3.4 MCPA

Application

MCPA (2-methyl-4-chlorophenoxyacetic acid) is used as a selective, systemic, hormone-type herbicide used in post-emergence control of annual and preannual brood-leaved weeds, in cereals etc. It is often used in combination with other herbicides (*Tomlin, 1994*).

Selected physicochemical properties

The K_{oc} for MCPA is selected from *Bockting et al. (1992)* and *Gonzales-Pradas et al. (1994)*. The geometric mean is based on 7 data for K_{oc}. *Bockting et al. (1992)* determined a log K_{ow} = 2.68.
As mentioned in section 2.9, acid dissociation may occur for MCPA. MCPA has a pKa of 3.07 (*Tomlin, 1994*), which means that at a pH higher than 3.07, the dissociated acid concentration increases, which at a soil pH of 6 leads to increased solubility in water. The dissolved compound can also form aqueous complexes with free cations in solution (*Shiu et al., 1994*). For MCPA, Tomlin selected a solubility of 3.7 $mol.m^{-3}$ at 20°C, which is 3.1 $mol.m^{-3}$ at 10°C, and a vapour pressure of 3.5 x 10^{-5} Pa at 20°C, which is a vapour pressure of 2.3 x 10^{-5} Pa at 10°C. Because of limited data, the K_{ow}, vapour pressure and solubility are assumed to be weakly based values. A permeation coefficient of 1.0 x 10^{-9} $m^2.day^{-1}$ was used for MCPA (4-chloromethylfenoxyacetic acid).

Table 4 shows the selected physicochemical properties for MCPA, with underlying data given in Appendix IV.

Table 4 *The selected physicochemical properties for MCPA*

MCPA		
CAS registration number	(94-74-6)	
molecular weight	200.6	($g.mol^{-1}$)
water solubility (10°C)	3.1*	($mol.m^{-3}$)
log K_{ow}	2.68**	
K_{oc}	60.3	($l.kg^{-1}$)
vapour pressure (10° C)	2.3. 10^{-5}*	(Pa)
Henry's law constant (10°C)	3.2. 10^{-9}#	(-)
permeation coefficient	1. 10^{-9}	(m^2.day)

\# calculated value

* No reliable value could be derived, but parameter is *no* sensitive input parameter for the calculation of the HUM-TOX SCC.

** No reliable value could be derived and parameter is a sensitive input parameter for the calculation of the HUM-TOX SCC.

3.5 Miscellaneous compounds

The compounds tribromomethane and the organic solvents isopropanol, ethylacetate, 1- and 2-butylacetate, are considered miscellaneous compounds.

Application

Tribromomethane is used as an industrial solvent, for instance, as an ingredient in fire-resistant chemicals or as a solvent for waxes, greases and oils (*Verschueren, 1983*).

Isopropanol (2-propanol) is used as a non-agricultural pesticide, in the manufacture of acetone, glycerol and isopropylacetate. It is also used as an industrial solvent and a dyeing agent for liquid fuels (*Verschueren, 1983*); in pharmaceuticals and consumer products like sprays, cosmetics and as an aromatic in foodproducts (*IPCS, 1990*).

Ethylacetate is used as fruit essence because of its characteristic fruity odour and pleasant taste when diluted (*Opdyke, 1974*).

Butylacetate is used as a solvent in production of lacquers, perfumes, natural gums and synthetic resins (*Verschueren, 1983*).

Selected physicochemical properties

The selected K_{oc} for tribromomethane is based on a measured and a calculated value (*Sabljic et al., 1995*) and is not very reliable. The selected K_{oc} for isopropanol is also based on one observation (*Sabljic et al., 1995*). For this compound, no K_{oc} could be calculated from the low K_{ow} value of 0.05 (*Medchem, 1996*) because the equation has not been matched for very low K_{ow} values. As a consequence, the selected K_{oc} for isopropanol is an unreliable value. The K_{oc} of ethylacetate, calculated from the K_{ow}, is also assumed to be a weakly based value. The K_{oc} of butylacetate was adopted from *Kreule et al. (1995)*, where the authors state that this also concerns a weakly based value. The values for K_{ow} are taken from the Medchem database (*Medchem, 1996*).

The solubility and vapour pressure for tribromomethane and isopropanol are based on one value (weakly based) and the solubility and vapour pressure for ethylacetate on two values. The solubility and vapour pressure for butylacetate, also taken from *Kreule et al. (1995)*, are based on four and two observations, respectively.

The selected physicochemical properties for the chlorinated hydrocarbons are summarised in Table 5. Note that a separate proposal for an Intervention Value for butylacetate was also made in *Kreule et al. (1995)*. The underlying data for can be found in Appendix V.

Table 5 *Selected physicochemical data for miscellaneous compounds*

Tribromomethane		
CAS registration number	(75-25-2)	
molecular weight	252.8	(g.mol^{-1})
water solubility (10°C)	6.8**	(mol.m^{-3})
log K_{ow}	2.67	
K_{oc}	148***	(l.kg^{-1})
vapour pressure	279**	(Pa)
Henry's law constant (10°C)	$1.7.\ 10^{-2}$ #	(-)
permeation coefficient	$1.\ 10^{-7}$	(m^2.day)
Isopropanol		
CAS registration number	(67-63-0)	
molecular weight	60.1	(g.mol^{-1})
water solubility (10°C)	17000*	(mol.m^{-3})
log K_{ow}	0.05	
K_{oc}	3.3**	(l.kg^{-1})
vapour pressure (10°C)	2210*	(Pa)
Henry's law constant (10°C)	$5.5.\ 10^{-5}$#	(-)
permeation coefficient	$1.\ 10^{-7}$	(m^2.day)
Ethylacetate		
CAS registration number	(141-78-6)	
molecular weight	88.1	(g.mol^{-1})
water solubility (10°C)	705	(mol.m^{-3})
log K_{ow}	0.73	
K_{oc}	5.4**	(l.kg^{-1})
vapour pressure (10°C)	5790	(Pa)
Henry's law constant (10°C)	$3.5.\ 10^{-3}$#	(-)
permeation coefficient	$1.\ 10^{-7}$	(m^2.day)
1-and 2-butylacetate		
CAS registration number	(n: 123-86-4); (sec: 105-46-4)	
molecular weight	116.2	(g.mol^{-1})
water solubility (10°C)	91	(mol.m^{-3})
log K_{ow}	1.78	
K_{oc}	38***	(l.kg^{-1})
vapour pressure (10°C)	796	(Pa)
Henry's law constant (10°C)	3.72. 10#	(-)
permeation coefficient	$1.\ 10^{-7}$	(m^2.day)

calculated value

* No reliable value could be derived, but parameter is *no* sensitive input parameter for the calculation of the HUM-TOX SCC.

** No reliable value could be derived and parameter is a sensitive input parameter for the calculation of the HUM-TOX SCC.

*** No reliable value could be derived and parameter is a *very* sensitive input parameter for the calculation of the HUM-TOX SCC.

4 MAXIMUM PERMISSIBLE RISK LEVELS FOR INTAKE

In accordance with 'Premises for Risk Management' (*Ministry of VROM, 1988*), exposure equal to the Maximal Permissible Risk for human intake (MPR_{human}) is chosen as the human-toxicological basis for the derivation of the HUM-TOX SCC. For non-genotoxic carcinogens and non-carcinogenic compounds, the MPR_{human} has been defined (as in 'Premises for Risk Management') as the Tolerable Daily Intake (TDI). The TDI is the estimated quantity of a compound to which humans can be orally exposed daily during their entire lifetime without experiencing adverse effects on health. For genotoxic carcinogens the MPR_{human} has been defined as the quantity of a compound with a risk of one additional case of a lethal tumour in 10,000 lifelong-exposed individuals (*Ministry of VROM, 1988*).

Not formally laid down in 'Premises for Risk Management' is the definition of the MPR_{human} for the inhalation exposure route. When the chemical properties of the chemical under scrutiny warrant the derivation of a limit value for this route a Tolerable Concentration in Air (TCA) is derived for the compound in question. (As a general rule this applies to volatile compounds: significant inhalation exposure is expected for volatile compounds when they are present as soil contaminants.) The TCA is the long-term limit value for inhalation. For the inhalation route the TCA is the equivalent of the TDI. For genotoxic compounds the inhalation 10^{-4} excess lifetime cancer risk is used instead of the TCA. As an extension of the definition as presented in 'Premises for Risk Management', the concept of the MPR_{human} is taken to cover these inhalation limit values as well. For the fourth series of compounds, the text falling under the term "inhalation MPR" is sometimes used. Thus, the MPR_{human} is the umbrella term covering both oral and inhalation limit values.

The results of the human-toxicological (human health-based) toxicity evaluations are reported as *toxicity profiles*. The method used to prepare the toxicity profiles agrees with the approach described earlier by *Vermeire et al. (1991)*. The description of the concepts and procedures used for the toxicological evaluation of compounds has been updated in a guidance document (*Janssen and Speijers, 1997*), in which a detailed discussion of concepts and procedures is presented. Since this was done for the soil contaminants evaluated in previous years (the first three series of chemicals), a toxicity profile was prepared for each of the compounds in the present series (the fourth series). These profiles are presented in *Janssen et al. (1998)*, except for the toxicity profile of inorganic tin, described in the report of *Vermeire et al. (1991)* and the toxicity profile of butyl acetate presented in *Janssen et al. (1995)*. The toxicity profiles provide a brief outline of the available toxicity data; the data presented in the profile are limited to those directly relevant to derivation of the TDI or cancer risks. In the profiles, additional information is included about absorption factors (oral, dermal, for volatile compounds and inhalatory) and about existing guideline values in the Netherlands (e.g. regulatory guideline values for food items, occupational exposure standards).

As explained in *Janssen et al. (1998)*, finalised and officially published review documents are used in the toxicological evaluation of the individual compounds wherever possible. For almost all compounds in the present series, adequate review documents (RIVM Criteria Documents[1], evaluations by IPCS, WHO, ATSDR, DECOS or US-EPA) were available that could serve as an initial basis for the profile. In addition, for almost all of the compounds, literature searches were performed to supplement the database. Wherever necessary, the original publications of studies given in the reviews used were consulted and re-evaluated.

The available databases for several of the compounds were incomplete because of lack of information on one or more important toxicological issues. For compounds with a limited date base or a considerable uncertainty because of extrapolation from one route to another, the TDIs and/or TCAs derived are provisional (PTDI, PTCA).

Table 6 gives the MPR_{human} values for both the oral, and where relevant, inhalation routes; background exposure of the compounds is also given. The data in the table are taken from the RIVM report of *Janssen et al. (1998).*

[1] In Dutch: RIVM-Basisdocumenten.

***Table 6** MPR$_{human}$ values (oral, inhalation) for the fourth series of compounds, uncertainty factors and estimated background exposure (from* Janssen et al., 1998*)*

Compound	Oral MPR TDI[a] or 10^{-4} excess cancer risk in $\mu g.kg_{bw}^{-1}.d^{-1}$	Uncertainty factor	Inhalation MPR TCA[b] or 10^{-4} excess cancer risk in $\mu g.m^{-3}$	Uncertainty factor	Estimated background exposure in $\mu g.kg_{bw}^{-1}.d^{-1}$
I. Metals					
vanadium	2 (P)	1000	1	20	0. 3
selenium	5	3	not needed [c]	-	1
tellurium	2 (P)	1000	not needed [c]	-	1.4
thallium	0.2 (P)	1000	not needed [c]	-	0.03
tin	2000	1000	not needed [c]	-	unknown
III. Aromatic compounds					
monochloroanilines	0.9[d]	-	4 (P)[e]	-	unknown
dichloroanilines	not derivable	-	not derivable	-	unknown
trichloroanilines	not derivable	-	not derivable	-	unknown
tetrachloroanilines	not derivable	-	not derivable	-	unknown
pentachloroanilines	not derivable	-	not derivable	-	unknown
4-chloro-2-methylphenol	20 (P)	10000	90 (P)[e]	-	unknown
4-chloro-3 methylphenol	300 (P)	100	1300 (P)[e]	-	unknown
V. Chlorinated hydrocarbons					
1,1,2-trichloroethane	4 (P)	1000	17 (P)	1000	0.007
1,2-dichloropropane	70	1000	12	1000	<1
1,3-dichloropropane	50	1000	12 (P)[f]	-	unknown
1,1-dichloroethene	3(P)[e]	-	14[d]	-	0.014
VI. Pesticides					
MCPA	1.5(P)	100	7(P)[e]	-	unknown
VII. Miscellaneous compounds					
tribromomethane	20	1000	100 (P)[g]	-	<1
isopropanol (2-propanol)	1000	100	2200	100	unknown
ethylacetate	900	1000	4200(P)[e]	-	unknown
butylacetate	200(P)[e]	-	1000	100	1

a) TDI: Tolerable Daily Intake; where only a provisional value is available this is indicated by adding (P).

b) TCA: Tolerable Concentration in Air; where only a provisional value is available this is indicated by adding (P).

c) inhalation route not considered relevant in present context.

d) excess lifetime cancer risk of 10^{-4}

e) tentative value derived via route-to-route extrapolation

f) value as derived for 1,2-dichloropropane is adopted as provisional value for 1,3-dichloropropane

g) tentative value derived via route-to-route extrapolation; this value for tribromomethane is protective of systemic effects but does *not* take into account portal-of-entry effects (local effects in the lung).

5 DERIVATION OF THE HUMAN-TOXICOLOGICAL SERIOUS SOIL CONTAMINATION CONCENTRATION

5.1 Potential human exposure

The CSOIL human exposure model (version 8.0) has been used to assess potential exposure (Figure 2).

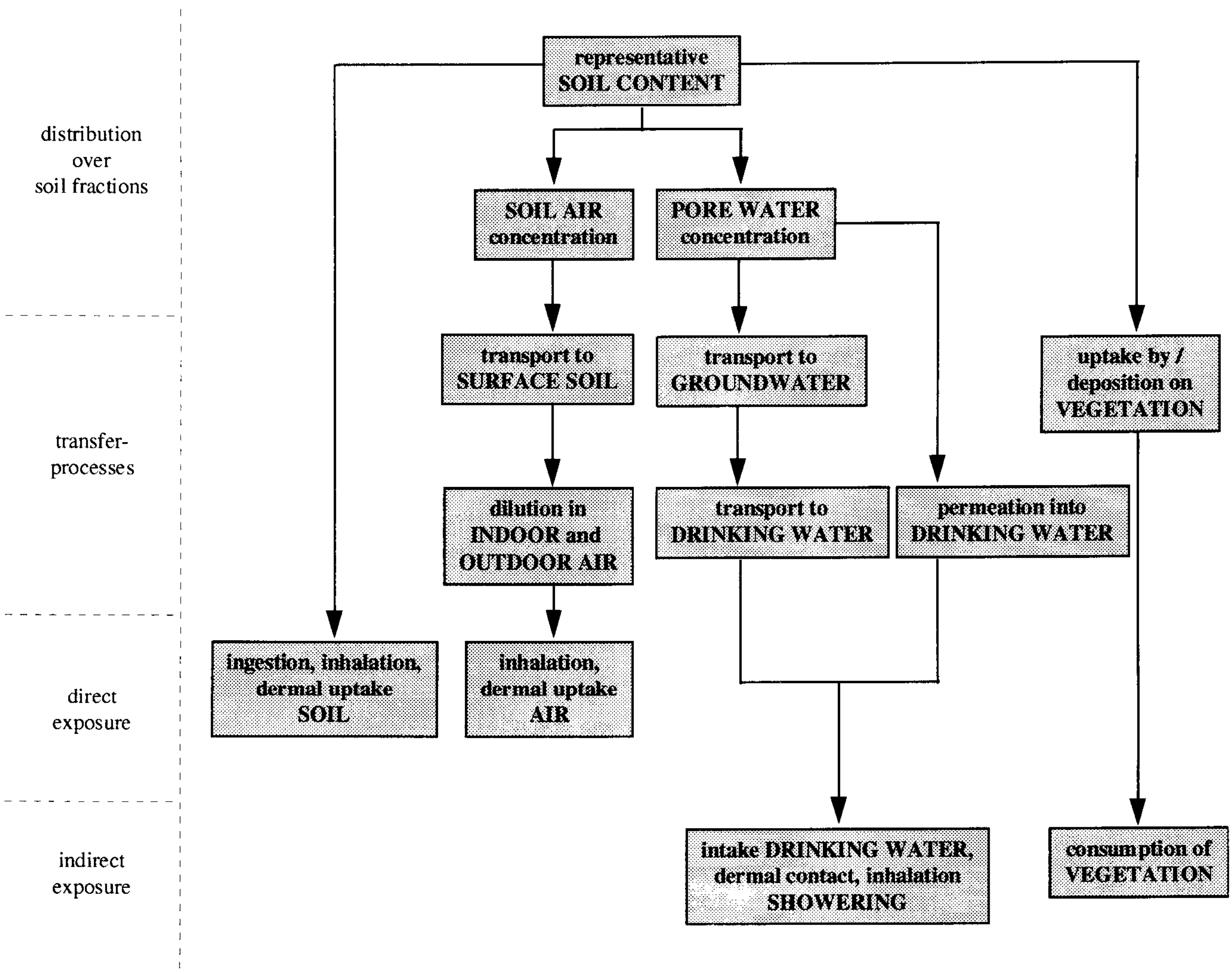

Figure 2. *CSOIL model to quantify potential exposure to contaminated soils.*

In this model three elemenst are recognised:

- contaminant distribution over the mobile phases of the soil,
- contaminant transfer from (the different mobile phases of) the soil into contact media;
- direct and indirect exposure.

The full adjusted set of CSOIL equations is given in *Van den Berg (1995).*

The potential human exposure, which is expressed as the daily averaged lifetime exposure (based on the exposure for a child and an adult calculated with CSOIL), is defined as the human exposure that could take place under standardised conditions. This standard scenario is defined as an exposure scenario on a residential site (house with garden), including a standard exposure data set, in which all CSOIL exposure pathways are assumed to be operational (*Van den Berg, 1995*). Besides the standard exposure data set the compound specific physicochemical data, described in Chapter 2 and selected in Chapter 3, are needed

5.2 Human toxicological serious soil contamination concentration

In a final step, the HUM-TOX SCC is derived from potential exposure and the MPR_{human} values given in Chapter 5. The HUM-TOX SCC is defined as the soil content of a contaminant which gives an exposure equal to the MPR_{human} for the standard scenario (potential exposure). In Figure 3 the relationship is shown between the soil content and the average lifetime exposure to a compound (here cadmium). The MPR_{human} value is also shown. Background exposure is not taken into account.

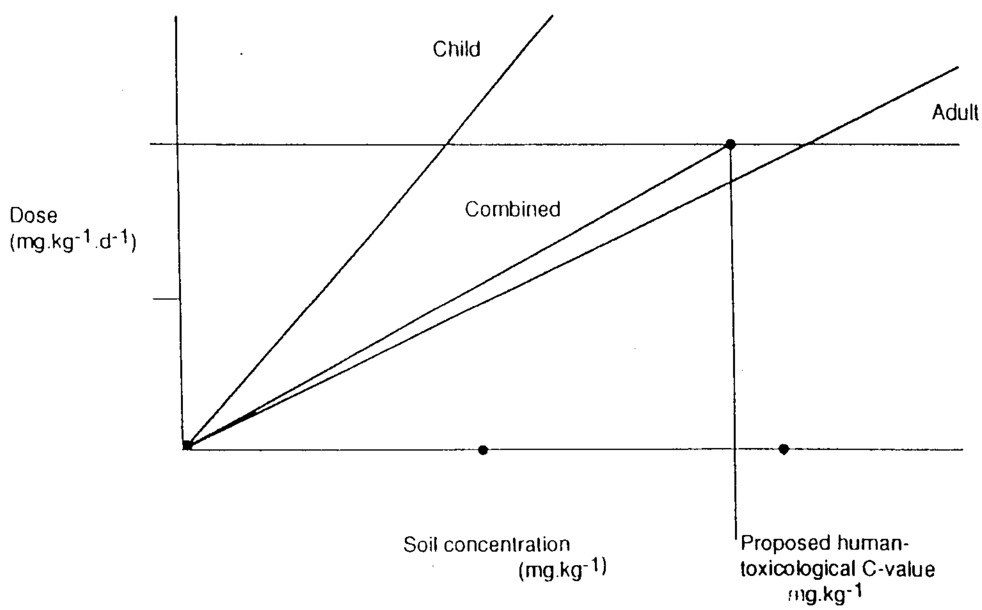

Figure 3. *The relationship between total cadmium content in soil and the potential average lifetime exposure, resulting in the HUM-TOX SCC (where the potential exposure equals the MPR_{human}).*

For the calculations of the distribution of a compound over the mobile soil phases (porewater and soil air), the selected vapour pressures, solubilities and log K_{oc}s, given in Tables 1 to 5 have been used. The MPR_{human} values are taken from Table 6. The complete input data set and (intermediate) results of the CSOIL calculations (version 8.0) for all compounds mentioned are shown in Appendix VI (in Dutch).

For a number of compounds, the Tolerable Concentrations in Air (TCAs) have been determined (*Janssen et al., 1998*; see also Table 6 of this report). If the indoor air concentration calculated with CSOIL exceeds the TCA, the HUM-TOX SCC value has to be adjusted. This is the case for the dichloropropanes. The corrected HUM-TOX SCCs are shown in Table 7.

Table 7 *TCA (Tolerable Concentration in Air) compared with indoor air concentration (Cia), calculated with CSOIL, and the original and corrected human-toxicological serious soil contamination concentration (HUM-TOX SCC) for the dichloropropanes*

Compound	TCA [µg.m^{-3}]	With CSOIL calculated HUM-TOX SCC [mg.kg$_{dw}^{-1}$]	Cia [µg.m^{-3}]	Corrected HUM-TOX SCC [mg.kg$_{dw}^{-1}$]
1,2-dichloropropane	12	30.6	203	1.81
1,3-dichloropropane	12	21.9	145	1.81

In Table 8 the final HUM-TOX SCCs are summarised for the compounds of the fourth series (to three digits significant). Besides, uncertainty scores have been determined as the product of separate sub-scores for the MPR_{human} and the exposure assessment according to *Van den Berg and Roels (1991)*. A few adjustments have been made:

- the MPR_{human} receives a sub-score of 1 (low reliability) if it concerns a provisional value;
- the calculated potential blootstelling gets a sub-score of 3 (high reliability) when all input parameters are reliable, a sub-score of 2 (moderate reliability) when the HUM-TOX SCC is sensitive to one unreliable input parameter and a sub-score of 1 (low reliability) when the HUM-TOX SCC is sensitive to two or more unreliable input parameters or *very* sensitive to at least one input parameter.

***Table 8:** MPR_{human} values and human-toxicological serious soil contamination concentration (HUM-TOX SCC) for a standard soil (10% organic matter, 25% lutum) with uncertainty scores*

Compound	Toxicological MPR_{human} value [$\mu g.kg_{bw}^{-1}.d^{-1}$]	HUM-TOX SCC [$mg.kg_{dw}^{-1}$]	US[1)]
I. Metals			
vanadium	2[2)]	1000	2
selenium	5	235	9
tellurium	2[2)]	588	1
thallium	0.2[2)]	118	1
tin	2000	324000	2
III. Aromatic compounds			
monochloroanilines	0.9	17.8	3
dichloroanilines	-	-	-
trichloroanilines	-	-	-
tetrachloroanilines	-	-	-
pentachloroanilines	-	-	-
4-chloro-2-methylphenol	20[2)]	39.3	2
4-chloro-3-methylphenol	300[2)]	589	2
V. Chlorinated hydrocarbons			
1,1,2-trichloroethane	4[2)]	8.38	3
1,2-dichloropropane	70	1.81 (30.6)[3)]	6
1,3-dichloropropane	50	1.81 (21.8)[3)]	6
1,1-dichloroethene	3[2)]	0.216	1
VI. Pesticides			
MCPA	1.5[2)]	3.59	2
VII. Miscellaneous compounds			
tribromomethane	20	74.7	2
isopropanol	1000	714	6
ethylacetate	900	546	4
butylacetate	200[2)]	469	1

\- not available.

1) Uncertainty scores (US) have been determined as the product of separate sub-scores for the MPR_{human} and the calculated potential exposure (higher score implies less uncertainty).

2) provisional value (see *Janssen et al., 1998*)

3) corrected for indoor air > TCA (in parentheses: soil content that gives an exposure equal to the MPR_{human})

5.3 Contribution of the separate exposure routes to total exposure

In Appendix VI the relative contribution of the separate exposure routes to total exposure for children, adults and lifetime exposure is also presented. From the table the following can be concluded.

5.3.1 Metals

At least 99% of total lifetime exposure can be contributed to exposure due to soil ingestion and crop intake. For vanadium and thallium, soil ingestion is dominant (76% and 89%, respectively). For selenium and tin, crop intake is the major exposure route (93% and 75%, respectively). For tellurium, exposures due to soil ingestion and crop intake are of equal importance.

5.3.2 Aromatic compounds

Total lifetime exposure to monochloroanilines and 4-chloro-methylphenol is dominated by exposure due to crop intake (62% and 88%, respectively). Besides, exposure due to inhalation of contaminated air plays an important role (19% and 11%, respectively).

5.3.3 Chlorinated hydrocarbons

The chlorinated hydrocarbons are characterised by a major contribution of exposure due to inhalation of indoor air to the total lifetime exposure: this is 62%, 83%, and 94% for 1,1,2-trichloroethane, the dichloropropanes and 1,1-dichloroethene, respectively. Besides exposure due to crop intake (for 1,1,2-trichloroethane and the dichloropropanes 24%, and 13%, respectively) and for 1,1,2-trichloroethane, exposure due to permeation into drinking water (11%) also contributes to total lifetime exposure.

5.3.4 MCPA

For MCPA, total lifetime exposure is 100% accountable to crop intake.

5.3.5 Miscellaneous compounds

For potential exposure to tribromomethane and to isopropanol exposure due to crop intake (contribution to total lifetime exposure of 64% and 52%, respectively) and due to inhalation of indoor air (35% and 45%, respectively) are important. The same exposure routes dominate exposure to ethylacetate and butylacetate (crop intake: 43% and 59%, respectively, and indoor air inhalation: 55% and 39%, respectively).

6 ECOTOXICOLOGICAL SERIOUS SOIL CONTAMINATION CONCENTRATION

The methodology to derive the ECOTOX SCC, as described by *Denneman and Van Gestel (1990, 1991)* and *Denneman (1993)*, has been updated by *Crommentuijn et al. (1994)*. The recommendations given by the Technical Soil Protection Committee (*TCB, 1992*) and the scientific knowledge and methods which have become available in recent years were taken into account. The ecotoxicological criterion for serious soil contamination is represented by the threat to 50% of the species and 50% of the microbial processes. It is assumed that species and processes are threatened if the NOEC (No-Observed-Effect-Concentration) for effects on vital life functions of species (like survival, growth and reproduction) and/or microbial and enzymatic processes are exceeded. If a substance has a potential for secondary poisoning, the possible adverse effects due to secondary poisoning are incorporated in the criterion.

The methodology used to derive the ecotoxicological criterion for serious soil contamination is described in a stepwise protocol *(Crommentuijn et al., 1994)*. The first step of the protocol describes which data are needed. The second step gives the formulas for normalisation and standardisation of the data on terrestrial species and microbial processes, after which a selection of the data is made in step 3. Step 4 describes the method used to calculate the HC50 for terrestrial species and HC50 for microbial processes. The method used to derive the HC50 for birds and mammals, to check if there is a risk for secondary poisoning, is described in step 5.

If only little terrestrial toxicity data are available a partition-HC50 is also calculated on the basis of aquatic data, applying equilibrium partitioning (using the partition coefficients K_d, K_{ow} or K_{oc} from Tables 1 to 5). If no data on terrestrial species and microbial processes are available, only a partition-HC50 can be derived. The methods used to derive partition-HC50s are described in steps 6, 7, 8 and 9 of the protocol. In step 10 the derivation of the ECOTOX SCC from the HC50 values is described. The stepwise approach makes it possible to identify the methods used and the uncertainties introduced. The advantage is that new knowledge, available in the future, can be incorporated.

The proposals for the ECOTOX SCC for the fourth series of compounds are derived in *Posthumus et al. (1998)* and summarised in Table 9 of this report of the fourth series of Intervention Values. For all compounds, except for mono- and dichloroanilines, terrestrial or microbial data were lacking. Therefore, a partition-HC50 was used for all these compounds, which resulted in low reliability.

Table 9 *Aquatic equilibrium partition-based HC50 values (Aquatic-Eq.part HC50 value) and proposals for the ecotoxicological serious soil contamination concentration (ECOTOX SCC) for a standard soil (10% organic matter, 25% lutum) with reliability (Posthumus et al., 1997)*

Compound	Aquatic-Eq.part HC50 value [$mg.kg^{-1}$]	Recommended ECOTOX SCC [$mg.kg^{-1}$]	Reliability[a] ECOTOX SCC
I. Metals			
vanadium	250	250	low
selenium	5.0	5.0	low
tellurium	3780	n.a.	-
thallium	14	14	low
tin	910	910	low
III. Aromatic compounds			
monochloroanilines	n.p.	46	high
dichloroanilines	n.p.	43	high
trichloroanilines	7.8	7.8	low
tetrachloroanilines	100	27	low
pentachloroanilines	5.9	5.9	low
4-chloro-2-methylphenol	15	15	low
4-chloro-3-methylphenol	15	15	low
V. Chlorinated hydrocarbons			
1,1,2-trichloroethane	460	460	low
dichloropropanes	125	125	low
1,1-dichloroethene	130	130	low
VI. Pesticides			
MCPA	95	95	low
VII. Miscellaneous compounds			
tribromomethane	300	300	low
isopropanol	220	220	low
ethylacetate	68	68	low
butylacetate	196	196	low

a) reliability (options: low-moderate-high)
n.p. no proposal derived.
n.a. insufficient data available

7 PROPOSAL FOR INTERVENTION VALUES FOR SOIL AND GROUNDWATER

7.1 Intervention Value for soil

The ECOTOX and the HUM-TOX SCC values are integrated into proposals for Intervention Values. The same weight is given to the HUM-TOX as to the ECOTOX SCC. For cases in which the reliability of the most stringent value is much lower, the less stringent value is chosen. This is the case when an uncertainty score is low in contrast with a high score. For comparison of the ECOTOX SCC and the HUM-TOX SCC it is necessary to give a qualification to the quantitative values of the HUM-TOX uncertainty scores. Although this is not compatible with the procedure that has been followed for the first and second series of Intervention Values (*TCB, 1997*), uncertainty scores (as in Table 8) of 1 to 3 are qualified as 'low', 4-6 are considered 'moderate' and 7-9 'high'. The procedure for the determination of the uncertainty scores and weighting the uncertainty scores of the HUM-TOX SCC and the ECOTOX SCC will be the subject of the current project "Evaluation of Intervention Values".

For all compounds described in this report, the most stringent of the HUM-TOX SCC and the ECOTOX SCC values are chosen, except for selenium and monochloroanilines. Based on the high uncertainty score in contrast to the low uncertainty score, the HUM-TOX SCC is taken as the final proposal for the Intervention Value for selenium and the ECOTOX SCC is taken as the final proposal for the Intervention Value for monochloroanilines, although this values are higher. Table 10 summarises the HUM-TOX SCC and ECOTOX SCC values, including uncertainty scores, and proposed Intervention Values for soil (the latter in bold; to two digits significant).

Table 10

Ecotoxicological Serious Soil Concentration (ECOTOX SCC), Human Toxicological Serious Soil Concentration (HUM-TOX SCC), with uncertainty scores; proposals for the Intervention Values for a standard soil (10% organic matter, 25% lutum), in bold

Compound	ECOTOX SCC [$mg.kg^{-1}_{dry\ weight}$]	US[a)]	HUM-TOX SCC. [$mg.kg^{-1}_{dry\ weight}$]	US[a)]	**Proposed Int.Value soil [$mg.kg^{-1}_{dry\ weight}$]**
I. Metals					
vanadium	250	low	1000	low	**250**
selenium	5	low	235	high	**240**
tellurium	n.a.	-	588	low	n.a. (590)[b)]
thallium	14	low	118	low	**14**
tin	910	low	324000	low	**910**
III. Aromatic compounds					
monochloroanilines	46	high	17.8	low	**46**
dichloroanilines	43	high	n.a.	-	n.a. (43)[c)]
trichloroanilines	7.8	low	n.a.		n.a. (7.8)[c)]
tetrachloroanilines	27	low	n.a.	-	n.a. (27)[c)]
pentachloroanilines	5.9	low	n.a.	-	n.a. (5.9)[c)]
4-chloro-2-methylphenol	15	low	39.3	low	**15**
4-chloro-3 methylphenol	15	low	589	low	**15**
V. Chlorinated hydrocarbons					
1,1,2-trichloroethane	460	low	8.38	low	**8.4**
dichloropropanes	125	low	1.81[d)]	moderate	**1.8**
1,1-dichloroethene	130	low	0.216	low	**0.22**
VI. Pesticides					
MCPA	95	low	3.59	low	**3.6**
VII. Miscellaneous compounds					
tribromomethane	300	low	74.7	low	**75**
isopropanol	220	low	714	moderate	**220**
ethylacetate	68	low	546	moderate	**68**
1,2-butylacetate	196	low	469	low	**200**

n.a: not available
a) uncertainty score (higher score, less uncertainty)
b) No proposal for an Intervention Value could be derived because ECOTOX SCC is not available (in parentheses: value based on HUM-TOX SCC only).
c) No proposal for an Intervention Value could be derived because HUM-TOX SCC is not available (in parentheses: value based on ECOTOX SCC only).
d) corrected for exceedance of tolerable concentration in indoor air (dichloropropanes)

7.2 Proposals for Intervention Values for groundwater

No direct risk analysis has been performed to derive proposals for the Intervention Values for groundwater. The proposed Intervention Values for groundwater have been derived from the proposed Intervention Values for soil, using the equilibrium theory for soil-porewater partitioning. Because of uncertainties in soil-porewater partition coefficients (for which wide varieties in values are possible), dilution of groundwater, soil heterogeneity and the lack of equilibrium, Intervention Values for groundwater are set at a lower level than calculated using the calculated porewater concentration based on the equilibrium theory. Intervention Values for groundwater (in accordance with the procedure of *Van den Berg and Roels (1991)* were derived by decreasing the calculated porewater equilibrium concentration by a factor of 10.

Exposure through direct consumption of groundwater was excluded in the calculation of the potential exposure. For this reason, it was investigated if direct consumption of polluted drinking water up to the Intervention Value for groundwater would result in exceedance of the MPR_{human} value, where this was the only exposure route. For more than half of the compounds this occurs. As a consequence, the Intervention Values for groundwater were lowered to a level at which drinking-water consumption would lead to an exposure equal to the MPR_{human}. However, because of the uncertainties in soil-porewater partition coefficients and the approach used for determination of Intervention Values for groundwater (division by a factor of 10), the Intervention Values for soil have not been adjusted for these compounds.

In case a calculated Intervention Value for groundwater exceeds the solubility of a compound the Intervention Value is taken equal to this solubility. This is not the case for any of he substances of the fourth series of Intervention Values.

Table 11 gives the calculated equilibrium concentration in groundwater (concentration in equilibrium with the Intervention Value for soil, divided by factor of 10) and the corrected proposal for the Intervention Value (in bold; to two digits significant).

Table 11 Calculated equilibrium concentration in groundwater and the corrected proposal for Intervention Value for groundwater (the latter in bold)

Compound	Equilibrium concentration groundwater [µg.l⁻¹]	**Proposed Int.Value groundwater** [µg.l⁻¹]
I. Metals		
vanadium	81.1	**63**[d)]
selenium	1166	**160**[d)]
tellurium	n.a. (196)	n.a. (63)[b, d)]
thallium	8.82	**6.3**[d)]
tin	47.8	**48**
III. Aromatic compounds		
monochloroanilines	227	**28**[d)]
dichloroanilines	n.a. (104)	n.a. (104)[c,d)]
trichloroanilines	n.a. (11.2)	n.a. (11)[c)]
tetrachloroanilines	n.a. (6.73)	n.a. (6.7)[c)]
pentachloroanilines	n.a. (1.02)	n.a. 1.0)[c)]
4-chloro-2-methylphenol	346	**350**
4-chloro-3 methylphenol	346	**350**
V. Chlorinated hydrocarbons		
1,1,2-trichloroethane	151	**130**[d)]
dichloropropanes	77.0	**77**
1,1-dichloroethene	5.76	**5.8**
VI. Pesticides		
MCPA	98.9	**47**[d)]
VII. Miscellaneous compounds		
tribromomethane	857	**630**[d)]
isopropanol	67800	**31000**[d)]
ethylacetate	15200	**15000**
1,2-butylacetate	8380	**6300**[d)]

n.a: not available

b) No proposal for an Intervention Value could be derived because ECOTOX SCC is not available (in parentheses: value based on HUM-TOX SCC only).

c) No proposal for an Intervention Value could be derived because HUM-TOX SCC is not available (in parentheses: value based on ECOTOX SCC only).

d) corrected for direct uptake of groundwater as drinking water

7.3 Comparison to quality objectives

Existing quality objectives for soil and groundwater are taken into consideration in relation to the proposed Intervention Values. The Intervention Value should not be lower than the Target Value or Limit Value (for newly formed sediment). For as far as Target and Limit Values exist for the compounds considered, this is not the case for any of the compounds considered. Besides, the calculated groundwater Intervention Values for metals should be compared with data generally found in groundwater of the Netherlands. However, the metals considered in the fourth series of proposals for Intervention Values have not been incorporated in the RIVM monitoring networks. In another monitoring program (*Meinardi, 1998*) the water quality of man-made springs has been investigated. The results could be considered as a rough indication of the quality of the groundwater generally found in the Netherlands. Average selenium concentrations (0.3 $\mu g.l^{-1}$) and average tin concentrations (0.005 $\mu g.l^{-1}$) are several orders of magnitude below the level of the proposed Intervention Values for groundwater (160 $\mu g.l^{-1}$, 48 $\mu g.l^{-1}$, respectively).

A pre-requisite for use of the values is that they can be determined in chemical analysis at the required levels. Therefore, the proposed values have been compared with detection limits (Appendix VII). For none of the compounds the detection limits exceeds the Intervention Values.

7.4 Reliability of proposed Intervention Values

Uncertainties of the proposed Intervention Values may be caused by an uncertain ECOTOX SCC, MPR_{human} and/or unreliable physicochemical input data to which the HUM-TOX SCC is sensitive.

Most of the compounds for which Intervention Values have been derived in this fourth series have been poorly investigated. This implies a higher uncertainty in the physicochemical input parameters and effect data on humans and ecosystems, which also implies a limited accuracy of the HUM-TOX SCC and/or the ECOTOX SCC. For several compounds no HUM-TOX SCC (di- to pentachloroanilines) or ECOTOX SCC (tellurium) could be derived at all (Table 10). Furthermore, most of the derived proposals for Intervention Values for soil are characterised by limited accuracy. The reliability of the proposal for the Intervention Value for soil of selenium, which is based on the HUM-TOX SCC, is high. However, it is plausible that an ecotoxicological risk assessment would result in more stringent values.

Half of the proposals for Intervention Values for groundwater are based on unreliable proposals for Intervention Values for soil and on unreliable values for the partition coefficients. Thus Intervention Values for groundwater, for the metals tellurium, thallium and tin, for 1,1-dichloroethene and for all four miscellaneous compounds should be regarded as weakly based.

REFERENCES

AIDA, 1991. Assessment tools for the evaluation of risk (developed at US-EPA, ERL-Duluth, USA *<OK?>*.

ASTDR, 1989. Toxicological Profile for 1,2-dichloropropane. U.S. Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. TP:89/12 *(Janssen et al., 1998).*

ASTER, 1994. Grunddatasatz; 2,5-dichloroaniline (database).

Baes, C.F. Sharp, R.D., Sjoreen, A.L., and Shor, R.W., 1984. A review and analysis of parameters for assessing transport of environmentally released radionuclides.Compound data for organic solvents. Values used for further calculations through agriculture. Oak Ridge National Laboratory, USA. ORNL Report No. 5786. Available from National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

Berrow, M.L., Wilson, M.J. and Reaves, G.A., 1978. Origin and extractable titanium and vanadium in the A horizons of Scottish podzols. Geoderma 21: 89.

Bhamidimarri, S.M.Rao and Petrie, R.A., 1992. Adsorption and biodegradation of herbicide chemicals in silt loam soil. Proc. Industrial Waste Conference, Vol. 46, pp. 591-595.

Bloomfield, C., 1981. The translocation of metals in soils, in: D.J. Greenland and M.H.B. Hayes (Eds.) The Chemistry of Soil Processes, John Wiley and Sons, New York.

Bockting, G.J.M. and Van den Berg, R., 1992. The accumulation of trace metals in crops grown on contaminated soils. A literature study. RIVM, Bilthoven (in Dutch). RIVM report 725201009

Bockting, G.J.M., Van de Plassche, E.J., Struijs, J. and Canton, J.H., 1992. Soil-water partition coefficients for trace elements. RIVM, Bilthoven. RIVM report 679101003.

Bockting, G.J.M., Van de Plassche, E.J., Struijs, J. and Canton, J.H., 1993. Soil-water partition coefficients for organic compounds. RIVM, Bilthoven. RIVM report 679101013.

Bowen, H.J.M., 1979. Environmental Chemistry of the Elements, Academic Press, NY, p. 333.

Briggs, G.G., R.H. Bromilow, and A.A. Evans, 1982. Relationship between lipophilicity and root uptake and translocation of non-ionised chemicals by barely. Pestic.Science, 13: 495-504.

Briggs, G.G., R.H. Bromilow, A.A. Evans, and M. Williams, 1983. Relationship between lipophilicity and distribution of non-ionised chemicals in barely shoots following uptake in roots. Pestic.Science, 14: 492-500.

BUA, 1991. o-chloroaniline, m-chloroaniline, p-chloroaniline.. German Chemical Society, Stuttgart. GDCh-Advisory committee on existing chemicals of environmental relevance (BUA). BUA report 57 *(Janssen et al., 1997).*

BUA, 1994. Beratergremium für Umweltrelevante Altstoffe. German Chemical Society, Wissenschaftliche Verlagsgesellschaft, Stuttgart.

Cappon, C.J., 1987. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. Water Air Soil Pollut. 34: 353-361.

Chang, R., 1990. Physical chemistry with applications to biological systems. Macmillan Publishing Co., NY.

Cheminfo, 1994 (database).

Chemiekaarten (7th ed.), 1991. Nederlands Instituut voor Arbeidsomstandigheden, Vereniging van de Nederlandse Chemische Industrie and Samson H.D. Tjeenk Willink, Alphen a/d Rijn, The Netherlands.

Chiou, C.T., Peters, L.J. and Freed, V.H., 1979. A physical concept of soil-water equilibria for nonionic organic compounds. Science 206: 831-832.

Crommentuijn, G.H., Van de Plassche, E.J. and Canton, J.H., 1994. Guidance document on the derivation of the ecotoxicological criteria for serious soil contamination concentration in view of the Intervention Value for soil clean-up. RIVM, Bilthoven. RIVM report 950011003

Crommentuijn, G. H., Posthumus, R. and Kalf, D.H., 1995. Derivation of the ecotoxicological serious soil contamination concentration. substances evaluated in 1993 and 1994. RIVM, Bilthoven. RIVM report 715810008.

Denneman, C.A.J. and Gestel van, C.A.M., 1990. Soil contamination and soil ecosystems: proposals for ecotoxicological C values. RIVM, Bilthoven (in Dutch). RIVM report 725201001.

Denneman, C.A.J. and Gestel van, C.A.M., 1991. Soil contamination and soil ecosystems: proposals for ecotoxicological C values. RIVM, Bilthoven (in Dutch). RIVM report 725201008

Denneman, C.A.J., 1993. Methode voor de bepaling van ecotoxicologische C-waarden (2e concept).VROM/DGM/BODEM notitie.

Dragun, J., 1988. The soil chemistry of hazardous materials. The Hazardous Materials Control Research Institute. Silver Spring, Columbia.

EEG.18, 1996. International Chemical Safety Cards (Second series).

Eureco, Technical Data Sheets on Substances, 1996. Candidates for List 1, Directive 76/464/EEC.

Fetter, C.W. , 1993. Contaminant Hydrogeology. Department of Geology, University of Wisconsin, USA.

Gonzales-Pradas, E, Villafranca-Sanchez, M., Fernandez-Perez, M. and Socias Viciana, M., 1994. Sorption of diuron, atrazine and MCPA on an organic matter amended calcereous soil from Spain (1994). Fraenius Environ. Bull. 3: 250-255.

Goodman, B.A. and Cheshire, M.V., 1975. The bonding of vanadium in complexes with humic acid, an electron paramagnetic resonance study. Geochim. Cosmochim. Acta 39: 1711.

Gosset, J.M., 1987. Measurements of Henry's law constants for C_1 and C_2 chlorinated hydrocarbons. Environ. Sci. Technol.

Howard, P.H., 1989. Handbook of environmental fate and exposure data for organic chemicals. Lewis Publ., Chelsea, USA.

HSDB, 1996. Hazardous Substances Data Bank. National Library of Medicine.

Huang, J-C., Dempsey, B.A., Chang, S-Y. and Ganjidoost, H., 1987. Uptake and release of hazardous chemicals by soil materials. Proc. Industrial Waste Conference, Vol. 41, pp. 390-400.

Huang, J-C. and Ganjidoost, H., 1990. Predictive models for VOC partitions in soils. Proc. Industrial Waste Conference, Vol. 44, pp. 23-32.

IARC, 1986. : Some halogenated hydrocarbons and pesticide exposures. Monographs on the evaluation of carcinogenic risk of chemicals to humans, Vol. 41. WHO International Agency for Research Cancer, Lyon, France *(Janssen et al., 1998).*

IARC, 1993. Occupational exposures of hairdressers and barbers and personal use of hair colorants; some hair dyes, cosmetic colorants, industrial dyestuffs and aromatic amines. Monographs on the evaluation of carcinogenic risk of chemicals to humans, Vol.57. WHO International Agency for Research Cancer, Lyon, France *(Janssen et al., 1998).*

IPCS, 1990. Environmental Health Criteria 103. Isopropanol. WHO International Programme of chemical safety, WHO, Geneva *(Janssen et al., 1998).*

IPCS, 1993. Environmental Health Criteria 146. 1,3-dichloropropene, 1,2-dichloropropane and mixtures. WHO International Programme of chemical safety, WHO, Geneva *(Janssen et al., 1998).*

Janssen, P.J.C.M., Van Apeldoorn, M.E., Van Koten-Vermeulen,*<voorletters?>* and Mennes, W.C., 1995. Human-toxicological criteria for serious soil contamination: Compounds evaluated in 1993 & 1994. RIVM, Bilthoven. RIVM report 715810009.

Janssen, P.J.C.M and Speijers, G.J.A., 1997. Guidance on the derivation of levels for human intake of soil. RIVM, Bilthoven. RIVM report 711701606.

Janssen, P.J.C.M., Van Apeldoorn, J.G.M., Van Engelen, M.E., Schielen, P.C.J.I. and Wouters, M.F.A., 1998. Maximum Permissable Risk Levels for Human Intake of Soil Contaminants: Fourth series of compounds. RIVM, Bilthoven. RIVM report 711701004.

Kabata-Pendias, A. and Pendias, H., 1992. Trace elements in soils and plants, 2nd ed. CRC Press, London.

Kaplan, D.I., Sajwan, K.S., Adriano, D.C. and Gettier, S., 1990a. Phytoavailability and toxicity of beryllium and vanadium. Water Air Soil Pollut. 53: 203-212.

Kaplan, D.I., Adriano, D.C. and Sajwan, K.S., 1990b. Thallium toxicity in bean. J.Environ.Qual.19: 359-365.

Karickhoff, S.W., 1981. Semi-empirical estimation of sorption of hydrophobic pollutants on natural sediments and soils. Chemosphere 10(8): 833-846.

Karickhoff, S.W., Brown, D.S. and Scott, T.A., 1979. Sorption of hydrophobic pollutants on natural sediments. Water Res. 13: 241-248.

Kreule, P., Van den Berg, R., Waitz, M.F.W., and Swartjes, F.A., 1995. Calculation of human-toxicological serious soil contamination concentrations and proposals for intervention values for clean-up of soil and groundwater: Third series of compounds. RIVM, Bilthoven. RIVM report 715810010.

Leo, A., Hansch, C. and Elkins, D., 1971. Partition coefficients and their uses. Chem. Rev. 71(6): 525-616.

Lide, D.R. *et al.*, 1993. CRC Handbook of Chemistry and Physics, 74th ed.

Logan, T.J., Chang, A.C., Page, A.L. and Ganje, T.J., 1987. Accumulation of Selenium in Crops Grown on Sludge-treated Soil. J.Environ.Qual.16: 349-352.

MacKay, D. and Shiu, W.Y., 1981. A critical review of Henry's law constants for chemicals of environmental interest. J. Phys. Chem. Ref. Data 10(4): 1175-1199.

Mackay, D., Shiu, W.H. and Ma, K.C., 1992. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Vol. I. Boca Raton, Lewis Publ.

Medchem, 1996. Database and calculation method for K_{ow} values (developed at Pomona College, Claremont, California, and described by *Leo et al., 1971*).

Meinardi, C.R. (1998). Flow characteristics and composition of manmade springs and groundwater of the Veluwe. Hydrochemistry; eutrofication; micro-components. RIVM, Bilthoven. RIVM report 714851004 (in Dutch).

Merian, E. 1991. Metals and their compounds in the environment. Occurrence, Analysis and Biological Relevance. VCH, Weinheim, Germany *(?)*.

Ministry of VROM, 1988. Premises for risk management (annex to the Dutch Environmental Policy Plan). Lower House, Session 1988-1989, 21 137, no.5. (in Dutch).

Ministry of VROM, 1994. Ministerial Circular on second phase remediation paragraph, Soil Protection. Act. Reference DBO/16d94001.

Ministry of VROM, 1997. Ministrial Circular on Intervention Values of second and third series. Reference DBO/97113605.

Norrish, K., 1975. The geochemistry and mineralogy of trace elements, in trace elements in soil-plant-animal systems . Academic Press, NY, p. 55.

NTP (National Toxicology Program), 1989. Toxicology and carcinogenesis studies of *para*-chloroaniline hydrochloride in F344/N rats and $B6C3F_1$ mice (gavage studies). U.S. DHHS, Public Health Service, National Institute of Health, Research Triangle Park, NC. Technical report series no. 351, NIH Pub. no. 89-2806 (*Janssen et al., 1998).*

Ollingher, W.M. and Ahlert, R.C., 1988. Sorption of 2,4-dichlorophenol and 1,1,1 trichloroethene onto three soils. Proc. Industrial Waste Conference, Vol. 42, pp. 781-785.

Opdyke, D.L.J., 1974. Fragrance raw materials monographs Ethyl Acetate. Food. Cosmetic Toxicol. 12: 282-285 *(Janssen et al., 1998).*

Paya-Peres, A.B. and Pelusio, F., 1992. Sorption of 3,4,5- trichloroaniline in a soil profile. Sci. Total Environ. 123/124: 519-529.

Pesek, F. and Kolskoy, V., 1967. Studies on trace contaminants of edible parts of crops, Rostl. Vyroba 13: 445.

Pignatello, J.J., 1990. Slowly reversible sorption of aliphatic halocarbons in soils. II. Mechanistic aspects. Environ. Toxicol. Chem. 9: 1117-1126.

Posthumus, R., Crommentuijn, G.H. and Van de Plassche, E., 1997. Ecotoxicological Serious Soil Contamination Concentrations, fourth series of substances. RIVM, Bilthoven. RIVM report 711701003.

Reuther, C., Crommentuijn, T., and Van de Plassche, E.J., 1998. Maximum permissable and negligible concentrations for anilines. RIVM, Bilthoven. RIVM report 601501003.

Rippen, G., M. Ilgenstein and Klöpffer, W., 1982. Screening of the adsorption behaviour of new chemicals: Natural soils and model adsorbents. Ecotoxicol. Environ. Saf. 6: 236-245.

Romney, E.M., Wallace, A. and Alexander, G.V., 1975. Responses of bush bean and barley to tin applied to soil and to solution culture, Plant Soil 42: 585.

Sawyer, C.N. and McCarty, P.L., 1989. Chemistry for environmental engineering. McGraw-Hill, Tokyo.

Schroeder, H.A., Buckman, J. and Balassa., J.J., 1967. Abnormal trace elements in man: tellurium. J. Chron. Dis. 20: 147.

Shiu, W-Y., Ma, K-C, Varhanickova, D. and Mackay, D., 1994. Chlorophenols and alkylphenols: A review and correlation of environmentally relevant properties and fate in an evaluative environment.Chemosphere 29 (6): 1155-1224.

Sabljic, A., Güsten, H., Verhaar, H. and Hermens, J., 1995. Qsar modelling of soil sorption. Improvement and systematics of log Koc vs. log Kow correlations. Chemosphere 31: 11-12; 4489-4514.

Susarla, S., G.V. Bhaskar and Bhamidimarri S.M.R., 1992. Competitive adsorption of phenoxy herbicides chemicals in soil. Water Sci. Technol. 26: 9-11, 2121-2124.

Susarla, S., Bhamidimarri, S.M.R. and Bhaskar, G.V., 1992. Competitive adsorption and desorption of a phenoxy herbicide and a chlorophenol in a volcanic soil. 47 Purdue, Proc. Industrial Waste Conference *<vol.?>*

Susarla, S., G.V. Bhaskar and Bhamidimarri S.M.R., 1993. Adsorption-desorption characteristics of some phenoxyacetic acids and chlorophenols in a volcanic soil. I. Equilibrium and kinetics. Environ. Toxicol. 14: 159-166.

Swartjes, F.A., 1997. Stofselectie voor afleiden van "voorstellen voor interventiewaarden". RIVM, Bilthoven., RIVM report no.715810016 (in Dutch).

TCB, 1992. Advice on the revision of the Soil Protection Guideline I. C values and priority assessment. TCB A01/1992. TCB, Leidschendam (in Dutch).

TCB, 1997. Advice on the second and third series of Intervention Values. TCB A21/1997. TCB, The Hague (in Dutch).

Tomlin, C. (Ed.), 1994. Pesticide Manual, The. Incorporating the agrochemicals handbook, 10th ed.. British Crop Protection Council.

Tremel, A., Masson, P., Garraud, H., Donard, O.F.X., Baize, D. and Mench, M., 1997. Thallium in French Agrosystems-II. Concentration of Thallium in Field-grown Rape and some other Plant Species. Environ. Pollut. 1-2: 161-168.

US EPA, 1986. Public Health Evaluation Manual

US EPA, 1996. Soil Screening Guidance: Technical Background Document, May 1996. 9355.4-17A, EPA/540/R-95/128, PB-963502.

Van den Berg, R., 1995. Exposure of man to soil contamination. A qualitative and quantitative analysis, resulting in proposals for human-toxicological C values. RIVM, Bilthoven, Revised version of RIVM report 725201011.

Van den Berg, R. and Roels, J.M., 1991. Assessment of risks to man and the environment in case of exposure to soil contamination. Integration of the results of the preceding studies. RIVM, Bilthoven. RIVM report 725201013.

Van den Berg, R, Bockting, G.J.M., Crommentuijn, G.H. and Janssen, P.J.C.M., 1994. Proposals for intervention values for soil clean-up: Second series of chemicals. RIVM, Bilthoven. RIVM report 715810004.

Van der Heijden, B.G. and Hofman, M.G., 1987. Sampling of groundwater at sites of soil contamination. SBD-36104. Gemeentelijke Drinkwaterleiding, Rotterdam (in Dutch).

Van Gestel, C.A.M. and Ma, W-C., 1993. Development of QSARs in soil ecotoxicology: Water Air Soil Pollut. 69: 65-276.

Veenendaal, G., Verheijen, L.A.H.M. and Vonk. M.W., 1985. De invloed van bodemverontreinigingen en leidingmateriaal op de drinkwaterkwaliteit. Een samenvatting. Mededelingen no. 87, KIWA, Nieuwegein, The Netherlands.

Vermeire, T.G., Apeldoorn, M.E., De Fouw, J.C. and Janssen, P.J.C.M., 1991. Proposal for the human-toxicological MPR-levels for derivation of C values. RIVM, Bilthoven. RIVM report 725201005(in Dutch).

Verschueren, K., 1983. Handbook of environmental data on organic chemicals, 2nd ed. Van Nostrand Reinhold, New York.

Vonk, M.W., 1985. Permeation of organic chemicals through piping materials. Mededelingen no. 85, KIWA, Nieuwegein, The Netherlands (in Dutch), also in: H_2O, 18: 529-538 (in Dutch).

Wan, H.F., Mikkelsen, R.L. and A.L. Page, 1988. Selenium uptake by Some Agricultural Crops from Central California Soils. J.Environ.Qual. 17: 269-272.

WHO-WQG, 1996. WHO Guidelines for drinking water quality, 2nd ed., vol. 2: Health criteria and other supporting information, Chapter 2: Health criteria and other supporting information. WHO, Geneva *(Janssen et al., 1998)*.

Wolff, C.J.M. and Van der Heide, H.B., 1982. A model to assess the rate of evaporation of chemical compounds from surface waters. Chemosphere 11 (2): 103-117.

Appendix I: Physicochemical data for metals

Values used for calculation of the fourth series of intervention values are printed in **bold.**

Element	K_d l.kg^{-1}		BioConcentrationFactors BCFs) (mg.kg^{-1}crop/mg.kg^{-1}soil) dry weight	
vanadium	**309**	Bockting *et al.* (1992) (n=11)	0.0055	(Baes et al., 1984)
			0.1860	(Kaplan et al., *1990)*
			0.1610	(Kaplan et al., 1990)
			0.1198	(Kaplan et al., 1990)
			0.1290	(Kaplan et al., 1990)
			0.1180	(Kaplan et al., 1990)
			0.0915	(Kaplan et al., 1990)
			0.1015	(Kaplan et al., 1990)
			0.1052	(Kaplan et al., 1990)
			0.0888	(Kaplan et al., 1990)
			0.0734	(Kaplan et al., 1990)
			0.006	shoots n=11
			0.006	roots (derived from BCF shoot)
selenium	**20**	Bockting *et al.* (1992) (n=16)	0.0220	(US EPA, 1996)
			0.1590	(US EPA, 1996)
			0.5769	(Wan et al., 1988)
			0.1639	(Wan et al., 1988)
			0.2151	(Wan et al., 1988)
			0.7692	(Wan et al., 1988)
			0.195	roots n =6
			0.0160	(US EPA, 1996)
			0.1770	(Cappon, 1987)
			0.6000	(Logan et al., 1987)
			0.1600	(Logan et al., 1987)
			0.0667	(Logan et al., 1987)
			2.0000	(Logan et al., 1987)
			0.4200	(Logan et al., 1987)
			0.1833	(Logan et al., 1987)
			0.5000	(Logan et al., 1987)
			0.1333	(Logan et al., 1987)
			0.5000	(Logan et al., 1987)
			0.0833	(Logan et al., 1987)
			0.6000	(Logan et al., 1987)
			0.1667	(Logan et al., 1987)
			0.5000	(Logan et al., 1987)
			0.1667	(Logan et al., 1987)
			0.0775	(Wan et al., 1988)
			1.6346	(Wan et al., 1988)
			0.8197	(Wan et al., 1988)
			0.7527	(Wan et al., 1988)
			1.3846	(Wan et al., 1988)
			0.1550	(Wan et al., 1988)
			1.2500	(Wan et al., 1988)
			0.7104	(Wan et al., 1988)
			1.0753	(Wan et al., 1988)
			1.6923	(Wan et al., 1988)
			0.6202	(Wan et al., 1988)
			0.7692	(Wan et al., 1988)
			0.3279	(Wan et al., 1988)
			0.2151	(Wan et al., 1988)
			0.6154	(Wan et al., 1988)
			0.369	shoots n=31
tellurium	**300**	Baes *et al.* (1984) (calculated)	**0.025**	roots (Baes *et al.*, 1984) calculated
			0.025	shoots (Baes *et al.*, 1984) calculated

Appendix I continued:

Element	K_d $l.kg^{-1}$		BioConcentrationFactors BCFs) (mg.kg^{-1}crop/mg.kg^{-1}soil) dry weight	
thallium	**158**	Bockting *et al.* (1992) (estimation)	**0.0004**	roots (Baes *et al.*, 1984) calculated
			0.0040	(Baes et al., 1984) calculated
			0.0002	(Tremel et al., 1997)
			1.1111	(Tremel et al., 1997)
			0.0191	(Tremel et al., 1997)
			0.0013	(Tremel et al., 1997)
			0.0019	(Tremel et al., 1997)
			0.0200	(Kaplan et al., 1990)
			0.0500	(Kaplan et al., 1990)
			0.0045	shoots n=6
tin	**1905**	Bockting *et al.* (1992) (estimation)	**0.095**	roots (Baes et al., 1984) estimated
			0.013	shoots (Baes *et al.*, 1984) estimated

Appendix II: Physicochemical data for aromatic compounds

Values used for calculation of the fourth series of intervention values are printed in **bold.**

Compound	Solubility mol.m^{-3}		log K_{ow}		K_{oc}	
monochloroaniline						
orthochloroaniline	29.8 at 20°C	(Howard, 1989)	1.9	(Verschueren, 1983 Chemiekaarten, 1991)	355	(Bockting *et al*, 1993 n=16)
	40 at 20°C	(BUA, 1994)	1.90	(Howard, 1989)		
			1.88	(BUA, 1994)		
parachloroaniline	not soluble	(Chemiekaarten, 1991)	1.8	(Verschueren, 1983)	355	(Bockting *et al*, 1993 n=16)
	30.6 at 20°C	(Howard, 1989)	1.83	(Howard, 1989)	112	(Rippen *et al*, 1982)
	14 at 20°C	(BUA, 1994)	1.88	(Medchem, 1996)	95.5	(Rippen *et al*, 1982)
metachloroaniline	42 at 20°C	(HSDB, 1996)	1.9	(Verschueren, 1983)	355	(Bockting *et al*, 1993 n=16)
	48.6 at 20°C	(BUA, 1994)	1.90	(HSDB, 1996)	692	(Van Gestel& Ma, 1993)
			1.88	(BUA, 1994)	1072	(Van Gestel& Ma, 1993)
	31.8 geometric mean at 20°C		1.88	(Medchem, 1996)		
	27.2 geometric mean at 10°C (n=6)					
			1.88	arithmetical mean (n=10)	**347**	geometric mean (n =20)
dichloroaniline						
2,4-dichloroaniline	slightly	(HSDB, 1996)	2.78	(EEG 18, 1996)		
	1.3 at 20°C	(ASTER, 1994)	2.79	(ASTER, 1994)		
			2.91	(Medchem,1996)		
2,5-dichloroaniline	badly soluble	(Chemiekaarten, 1991)	2.75	(HSDB, 1996)		
	15.4 at 20°C	(AIDA, 1991)	2.80	(AIDA, 1991		
	4.3 at 20°C	(Eureco, 1996)	2.79	(ASTER, 1994)		
	1.7 at 20°C	(ASTER, 1994)	2.92	(Medchem,1996)		
2,6-dichloroaniline	slightly	(HSDB, 1996)	2.75	(HSDB, 1996)		
	2 at 20°C	(ASTER, 1994)	2.79	(ASTER, 1994)		
	9.9 at 20°C	(EEG.18, 1996)	2.82	(Medchem,1996)		
3,4-dichloroaniline	badly soluble	(Chemiekaarten, 1991)	2.7	(Chemiekaarten, 1991)		
	insoluble	(HSDB, 1996)	2.69	(HSDB, 1996)		
	4.5 at 20°C	(Eureco, 1996)				
	0.9 at 20°C	(ASTER, 1994)				
3,5-dichloroaniline	insoluble	(HSDB, 1996)	2.90	(HSDB, 1996)		
	1.7 at 20°C	(ASTER, 1994)	2.79	(ASTER, 1994)		
	3.3 geometric mean at 20°C		**2.79**	arithmetical mean (n=14)	**708**	(Bockting *et al*, 1993 n=12)
	3.0 geometric mean at 10°C (n=9)					
trichloroaniline						
2,3,4-trichloroanilines	0.15 at 20°C	(ASTER, 1994)	3.69	(Medchem,1996)		
2,4,5-trichloroanilines	0.09 at 20°C	(ASTER, 1994)	3.69	(Medchem,1996)	1999	(Van Gestel & Ma, 1993)
					1698	(Van Gestel & Ma, 1993)
					933	(Bockting *et al*, 1993n=12)
2,4,6-trichloroanilines	0.13 at 20°C	(ASTER, 1994)	3.69	(Medchem,1996)		
3,4,5-trichloroanilines	0.5 at 20°C	(Paya-Perez andP,1992)	3.43	(Paya-Peres&P,1992)	3388	(Paya-Peres&Pelusio,1992)
					4169	(Paya-Peres&Pelusio,1992)
	0.17 geometric mean at 20°C		**3.62**	arithmetical mean (n=4)	933	(Bockting *et al*, 1993n=12)
	0.14 geometric mean at 10°C (n=4)					
					1202	geometric mean (n=16)

Appendix II continued:

Values used for calculation of the fourth series of intervention values are printed in **bold**.

Compound	Solubility mol.m^{-3}		log K_{ow}		Koc	
tetrachloroaniline						
2,3,4,5-tetrachloroaniline	6..5. 10^{-3} at 20°C	(ASTER, 1994)	4.57	(Medchem,1996)	4677	(Bockting *et al*, 1993 n=3)
2,3,5,6-tetrachloroaniline	9. 10^{-3} at 20°C	(ASTER, 1994)	4.46	(Medchem,1996)	11220 13490	(v Gestel & Ma, 1993) (vGestel & Ma, 1993)
	7.6. 10^{-3} geometric mean at 20°C **6.4. 10^{-3}**geometric mean at 10°C (n=2)		**4.52**	arithmetical mean (n=2)	**6918**	geometric mean (n=5)
pentachloroaniline	9. 10^{-5} at 20°C **7.7. 10^{-5}** at 10°C	(ASTER, 1994)	**5.08**	(ASTER, 1994)	**10000**	(Reuther et al., 1998)
4-chloromethylphenol	2.8 at 20°C **2.4** at 10°C	(Verschueren, 1983)	2.63 3.10	(Medchem, 1996, 2 methyl) (Medchem, 1996, 3 methyl)	53.7 97.7	(Suslara *et al*, 1992/93) (Bhamidimarri, 1992)
			2.87	arithmetical mean	**72.4**	geometric mean

Appendix II continued:
Vapour pressures and Henry's law constants for aromatic compounds

Values used for calculation of the fourth series of intervention values are printed **in bold**.

Compound	Vapour pressure [Pa]		Henry's law constant
monochloroaniline			**4.8. 10^{-5}** at 10°C
ortho	10 at 20°C	(Chemiekaarten, 1991)	
	22.7 at 20°C	(Howard, 1989)	
para	2 at 20°C	(Chemiekaarten, 1991)	
	3.3 at 20°C	(Howard,	
	1.4 at 20°C	(Eureco, 1996)	
meta	7.2 at 20°C	(HSDB, 1996)	
	3 at 20°C	(Eureco, 1996)	
	4.6 geometric mean at 20°C		
	3.1 geometric mean at 10° C (n=7)		
dichloroaniline			**1.7. 10^{-4}** at 10°C
2,3 dichloroaniline	3.7 at 20°C	(HSDB, 1996)	
	8.6 at 20°C	(ASTER, 1994)	
3,4 dichloroaniline	10 at 20°C	(Chemiekaarten, 1991)	
	1.3 at 20°C	(HSDB, 1996)	
	2.24 at 20°C	(Eureco, 1996)	
	2.12 at 20°C	(ASTER, 1994)	
3.5-dichloroaniline	0.13 at 20°C	(HSDB, 1996)	
	0.34 at 20°C	(ASTER, 1994)	
	1.7 geometric mean at 20°C		
	1.2 geometric mean at 10° C (n=8)		
trichloroaniline			**2.4. 10^{-4}** at 10°C
2,3,4-trichloroaniline	0.04 at 20°C (ASTER, 1994)		
2,4,5-trichloroaniline	0.17 at 20°C (ASTER, 1994)		
2,4,6-trichloroaniline	0.29 at 20°C (ASTER, 1994)		
	0.12 geometric mean at 20°C		
	0.08 geometric mean at 10° C (n=3)		
tetrachloroaniline			**1.3. 10^{-3}** at 10°C
2,3,4,5-tetrachloroaniline	0.03 at 20°C (ASTER, 1994)		
2,3,5,6-tetrachloroaniline	0.03 at 20°C (ASTER, 1994)		
	0.02 geometric mean at 10° C (n=2)		
pentachloroaniline	7.3. 10^{-4} at 20°C (ASTER, 1994)		**2.7. 10^{-3}** at 10°C
	4.9. 10^{-4} at 10° C		
4-chloromethylphenol	8 at 20°C	(Verschueren, 1983)	**9.4. 10^{-4}** at 10°C
	5.3 at 10°C		

Appendix III Physicochemical data for chlorinated hydrocarbons

Values used for calculation of the fourth series of intervention values are printed **in bold**.

Compound	Solubility mol.m^{-3}	log K_{ow}	K_{oc} l.kg^{-1}
1,1,2-trichloroethane	33.7 (20°C) (Verschueren, 1983)		Ollingher & Ahlert, 1988
	33.4 (25°C) (Mackay and Shiu,1981)		Huang *et al.*, 1987
	29.9 (20°C) (Chemiekaarten, 1991)		Huang & Ganjidoost,1990
			Chiou *et al.*, 1979
	32.3 geometric mean		Bockting *et al.*, 1993
	22.9 geometric mean at 10°C (n=3)	**1.89** (Medchem 1996)	**93** (n=15)
1,2 dichloropropane	23.8(20°C) (Verschueren, 1983)	1.99(Van der Plassche & Bockting, 1993)	
	25.1 (Medchem, 1996)	1.99 (Howard, 1989)	21.9 (Pignatello, 1990)
			26.3 (Pignatello, 1990)
			46.8 (Chiou, 1979)
	24.4 geometric mean	**1.99** arithmetical mean (n=2)	45.7 (Bockting *et al.*, 1993)
	13 geometric mean at 10°C (n=3)		51.3 (Bockting *et al.*, 1993)
			37.2 (MacKay *et al.*,1992)
			50.1 calculated from Kow
			38 geometric mean (n=7)
1,3 dichloropropane	**13** (analogue to 1,2-dichloropropane)	**1.99** (idem)	**38**(idem)
1,1-dichloroethene	26 (20°C) (Envi. Health crit. 100)	**2.13** (Medchem, 1996)	64.6(US EPA, 1986)
	26(25°C) (Chemiekaarten, 1991)		55 calculated from Kow
	26 geometric mean		
	18.8 geometric mean at 10°C (n=2)		**60.3** geometric mean (n=2)

Appendix III continued:
Vapour pressures and Henry's law constants for chlorinated hydrocarbons

Values used for calculation of the fourth series of intervention values are printed **in bold.**

Compound	Vapour pressure [Pa]	Henry's law constant [-]
1,1,2-trichloroethane	3651 (20°C) (Mackay and Shiu,1981) 2533 (20°C)(Verschueren, 1983) 2500 (20°C)(Chemiekaarten, 1991) 2849 geometric mean **1590** geometric mean at 10° (n=3)	**3.0. 10^{-2}** at 10°C
1,2/1,3 dichloropropane	5599 (20°C)(Verschueren, 1983) 5600 (20°C)(Chemiekaarten, 1991) 6610 (Medchem, 1996) 5918 geometric mean **2475** geometric mean at 10° (n=3)	**8.1. 10^{-2}** at 10°C
1,1-dichloroethene	66500 (20°C)(Chemiekaarten, 1991) 66650 (20°C)(Verschueren, 1983) 66575 geometric mean **37947** geometric mean at 10° (n=2)	**8.6. 10^{-1}** at 10°C

Appendix IV Physicochemical data for MCPA

Values used for calculation of the fourth series of intervention values are printed **in bold**.

Compound	Solubility mol.m^{-3}		log Kow	Koc	
MCPA	3.7 at 20°C	(Tomlin, 1994)	**2.68** (Bockting *et al* 1993)	53.7	Bockting *et al*, 1993, n=5)
				58.9 (Gonzales-Pradas et al, 1994)	
	3.1 at 10°C			107.2(Gonzales-Pradas et al, 1994)	
				60.3	geometric mean (n=7)

Compound	Vapour pressure [Pa]		Henry's law constant
MCPA	3..5 . 10^{-5}	at 20°C (Tomlin, 1994)	**3.2. 10^{-9}** at 10°C
	2..3 . 10^{-5}	at 10°C	

Appendix V: Physicochemical data for miscellaneous compounds

Values used for calculation of the fourth series of intervention values are printed in bold.

Compound	Solubility mol.m^{-3}		log K_{ow}	K_{oc} l.kg^{-1}
tribromomethane	12.6 at 30°C (Verschueren, 1983) **6.8** at 10°C		**2.67** (Medchem, 1996)	115 (Sabljic *et al*, 1995) 191 calculated from Kow **148** geometric mean
isopropanol	**1.7. 10^4**	Cheminfo (soluble in all proportions)	**0.05** (Medchem, 1996)	**3.3** (Sabljic et al., 1995)
ethylacetate	964 (20°C) 897 (20°C) 930 geometric mean 20°C **705** geometric mean 10°C (n=2)	(Chemiekaarten, 1991) (Verschueren, 1983)	**0.73** (Medchem, 1996)	**5.4** calculated from Kow
butylacetate	**91** *(Kreule et al, 1995)* (n=4)		**1.78** *(Kreule et al, 1995)*	**38** *(Kreule et al, 1995)* (calculated)

Compound	Vapour pressure [Pa]		Henry's law constant [-]
tribromomethane	746.6 at 25°C **279** at 10°C	(Verschueren, 1983)	**1.7. 10^{-2}** at 10°C
isopropanol	4265.6 (20°C) **2208** (10°C)	(Cheminfo)	**5.5. 10^{-5}** at 10°C
ethylacetate	9700 (20°C) 9706 (20°C) 9702 geometric mean 20°C **5789** geometric mean 10°C (n=2)	(Chemiekaarten, 1991) (Verschueren, 1983)	**3.5. 10^{-3}** at 10°C
butylacetate	**796** (*Kreule et al, 1995*) (n=2)		**3.72** *(Kreule et al, 1995)*

Appendix VI: CSOIL calculations (version 8.0) of the human-toxicological serious soil contamination concentration

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	-	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	-	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	-	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	3.09E+02	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	-	[-]	berekende lucht-water verdelingscoeff.
Klw	--	[-]	invoer lucht-water verdelingscoeff.
Copl	-	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	--	[-]	massafractie a. (bodemlucht)
Pw	4.31E-04	[-]	massafractie w. (bodemvocht)
Ps	1.00E+00	[-]	massafractie s. (vaste fase vd bodem)
Dsa	-	[m2/h]	diff. coeff. bodemlucht
Dsw	-	[m2/h]	diff. coeff. bodemvocht
Du	-	[m2/h]	diff. coeff. bodem
kL	-	[m/s]	water massa transport coeff.
kG	-	[m/s]	damp massa transport coeff.
Klw_sh	-	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	-	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
3.24E+02	--	3.24E+00

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
--	--	--	--	--	--

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
--	--	--	--

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
6.02E+00	7.11E+00			1.28E-01

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
--	--

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **vanadium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
1.00E-02	--	--	1.57E-05	--	--	1.03E-03	--	--	--	**1.11E-02**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
7.16E-04	--	--	8.95E-06	--	--	4.25E-04	--	--	--	**1.15E-03**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
1.51E-03	--	--	9.53E-06	--	--	4.76E-04	--	--	--	**2.00E-03**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **vanadium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
91%	--	--	0%	--	--	9%	--	--	--	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
62%	--	--	1%	--	--	37%	--	--	--	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
76%	--	--	0%	--	--	24%	--	--	--	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	--	--	9.51E-06	--	--	4.75E-04	--	--	--	1.99E-03

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
1002.5424	**1002.5424**	62.820513	324.30743	**62.820513**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.000	0.001	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	-	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	-	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	-	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	2.00E+01	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	-	[-]	berekende lucht-water verdelingscoeff.
Klw	--	[-]	invoer lucht-water verdelingscoeff.
Copl	-	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	--	[-]	massafractie a. (bodemlucht)
Pw	6.62E-03	[-]	massafractie w. (bodemvocht)
Ps	9.93E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	-	[m2/h]	diff. coeff. bodemlucht
Dsw	-	[m2/h]	diff. coeff. bodemvocht
Du	-	[m2/h]	diff. coeff. bodem
kL	-	[m/s]	water massa transport coeff.
kG	-	[m/s]	damp massa transport coeff.
Klw_sh	-	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	-	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
1.17E+03	--	1.17E+01

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
--	--	--	--	--	--

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
--	--	--	--

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
4.70E+01	8.71E+01			2.99E-02

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
--	--

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **selenium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
2.35E-03	--	--	3.68E-06	--	--	9.90E-03	--	--	--	**1.23E-02**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
1.68E-04	--	--	2.10E-06	--	--	4.15E-03	--	--	--	**4.32E-03**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
3.55E-04	--	--	2.23E-06	--	--	4.64E-03	--	--	--	**5.00E-03**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **selenium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
19%	--	--	0%	--	--	81%	--	--	--	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
4%	--	--	0%	--	--	96%	--	--	--	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
7%	--	--	0%	--	--	93%	--	--	--	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	--	--	9.51E-06	--	--	1.98E-02	--	--	--	2.13E-02

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER
HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
234.78092	**234.78092**	157.05128	1166.1304	**157.05128**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.000	-	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	-	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	-	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	-	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	3.00E+02	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	-	[-]	berekende lucht-water verdelingscoeff.
Klw	--	[-]	invoer lucht-water verdelingscoeff.
Copl	-	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	--	[-]	massafractie a. (bodemlucht)
Pw	4.44E-04	[-]	massafractie w. (bodemvocht)
Ps	1.00E+00	[-]	massafractie s. (vaste fase vd bodem)
Dsa	-	[m2/h]	diff. coeff. bodemlucht
Dsw	-	[m2/h]	diff. coeff. bodemvocht
Du	-	[m2/h]	diff. coeff. bodem
kL	-	[m/s]	water massa transport coeff.
kG	-	[m/s]	damp massa transport coeff.
Klw_sh	-	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	-	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
1.96E+02	--	1.96E+00

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
--	--	--	--	--	--

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
--	--	--	--

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
1.47E+01	1.54E+01			7.50E-02

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
--	--

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **tellurium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
5.88E-03	--	--	9.22E-06	--	--	2.39E-03	--	--	--	**8.29E-03**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
4.20E-04	--	--	5.25E-06	--	--	9.85E-04	--	--	--	**1.41E-03**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
8.89E-04	--	--	5.59E-06	--	--	1.11E-03	--	--	--	**2.00E-03**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **tellurium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
71%	--	--	0%	--	--	29%	--	--	--	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
30%	--	--	0%	--	--	70%	--	--	--	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
44%	--	--	0%	--	--	55%	--	--	--	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	--	--	9.51E-06	--	--	1.88E-03	--	--	--	3.40E-03

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER
HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
588.39433	**588.39433**	62.820513	196.04431	**62.820513**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.000	-	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	-	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	-	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	-	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	1.58E+02	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	-	[-]	berekende lucht-water verdelingscoeff.
Klw	--	[-]	invoer lucht-water verdelingscoeff.
Copl	-	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	--	[-]	massafractie a. (bodemlucht)
Pw	8.43E-04	[-]	massafractie w. (bodemvocht)
Ps	9.99E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	-	[m2/h]	diff. coeff. bodemlucht
Dsw	-	[m2/h]	diff. coeff. bodemvocht
Du	-	[m2/h]	diff. coeff. bodem
kL	-	[m/s]	water massa transport coeff.
kG	-	[m/s]	damp massa transport coeff.
Klw_sh	-	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	-	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
7.44E+01	--	7.44E-01

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
--	--	--	--	--	--

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
--	--	--	--

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
4.70E-02	6.57E-01			1.50E-02

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
--	--

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **thallium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
1.18E-03	--	--	1.84E-06	--	--	4.37E-05	--	--	--	**1.22E-03**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
8.40E-05	--	--	1.05E-06	--	--	1.92E-05	--	--	--	**1.04E-04**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
1.78E-04	--	--	1.12E-06	--	--	2.13E-05	--	--	--	**2.00E-04**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **thallium**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
96%	--	--	0%	--	--	4%	--	--	--	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
81%	--	--	1%	--	--	18%	--	--	--	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
89%	--	--	1%	--	--	11%	--	--	--	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	--	--	9.51E-06	--	--	1.81E-04	--	--	--	1.70E-03

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
117.5916	**117.5916**	6.2820513	74.36231	**6.2820513**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.000	-	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	-	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	-	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	-	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	1.91E+03	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	-	[-]	berekende lucht-water verdelingscoeff.
Klw	--	[-]	invoer lucht-water verdelingscoeff.
Copl	-	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	--	[-]	massafractie a. (bodemlucht)
Pw	7.00E-05	[-]	massafractie w. (bodemvocht)
Ps	1.00E+00	[-]	massafractie s. (vaste fase vd bodem)
Dsa	-	[m2/h]	diff. coeff. bodemlucht
Dsw	-	[m2/h]	diff. coeff. bodemvocht
Du	-	[m2/h]	diff. coeff. bodem
kL	-	[m/s]	water massa transport coeff.
kG	-	[m/s]	damp massa transport coeff.
Klw_sh	-	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	-	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
1.70E+04	--	1.70E+02

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
--	--	--	--	--	--

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
--	--	--	--

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
3.08E+04	4.56E+03			4.12E+01

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
--	--

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **tin**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
3.24E+00	--	--	5.07E-03	--	--	3.37E+00	--	--	--	**6.61E+00**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
2.31E-01	--	--	2.89E-03	--	--	1.33E+00	--	--	--	**1.57E+00**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
4.89E-01	--	--	3.08E-03	--	--	1.51E+00	--	--	--	**2.00E+00**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **tin**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
49%	--	--	0%	--	--	51%	--	--	--	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
15%	--	--	0%	--	--	85%	--	--	--	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
24%	--	--	0%	--	--	75%	--	--	--	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	--	--	9.51E-06	--	--	4.66E-03	--	--	--	6.18E-03

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
323745.51	**323745.51**	62820.513	16993.326	**16993.326**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia	TCL	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
Binnenluchtconc.	Toelaatbare Conc. Lucht			
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.000	0.000	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	8.77E+00	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	4.41E+02	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	2.01E+01	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	4.84E-05	[-]	berekende lucht-water verdelingscoeff.
Klw	4.80E-05	[-]	invoer lucht-water verdelingscoeff.
Copl	7.03E+04	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	3.19E-07	[-]	massafractie a. (bodemlucht)
Pw	6.58E-03	[-]	massafractie w. (bodemvocht)
Ps	9.93E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	8.12E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	8.12E-08	[m2/h]	diff. coeff. bodemvocht
Du	3.97E-09	[m2/h]	diff. coeff. bodem
kL	3.26E-05	[m/s]	water massa transport coeff.
kG	3.12E-03	[m/s]	damp massa transport coeff.
Klw_sh	8.92E-05	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	1.65E-03	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
8.77E+01	4.25E-05	8.77E-01

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
2.36E-04	3.65E-06	8.46E-08	1.41E-07	3.74E-06	3.80E-06

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
1.15E-08	2.32E-08	6.07E-06	6.07E-07

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		1.46E+00	9.37E-01	2.26E-03

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
4.00E-03	3.31E-08

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **monochlooraniline**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
1.78E-04	3.64E-07	7.26E-06	2.78E-07	2.71E-04	1.40E-06	1.20E-03	2.67E-04	3.49E-07	2.54E-05	**1.95E-03**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
1.27E-05	1.14E-07	1.38E-06	1.59E-07	1.65E-04	1.56E-07	4.97E-04	1.14E-04	1.97E-07	1.03E-05	**8.01E-04**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
2.68E-05	1.35E-07	1.89E-06	1.69E-07	1.74E-04	2.63E-07	5.57E-04	1.27E-04	2.10E-07	1.16E-05	**9.00E-04**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **monochlooraniline**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
9%	0%	0%	0%	14%	0%	62%	14%	0%	1%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
2%	0%	0%	0%	21%	0%	62%	14%	0%	1%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
3%	0%	0%	0%	19%	0%	62%	14%	0%	1%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	9.81E-03	1.48E-05	3.14E-02	7.17E-03	1.18E-05	6.54E-04	5.07E-02

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
17.76882	**17.76882**	28.269231	87.706805	**28.269231**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia Binnenluchtconc.	TCL Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.001	0.004	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	4.53E-01	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	4.75E+00	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	4.20E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	9.39E-04	[-]	berekende lucht-water verdelingscoeff.
Klw	9.40E-04	[-]	invoer lucht-water verdelingscoeff.
Copl	1.48E+03	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	2.89E-05	[-]	massafractie a. (bodemlucht)
Pw	3.08E-02	[-]	massafractie w. (bodemvocht)
Ps	9.69E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	7.68E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	7.68E-08	[m2/h]	diff. coeff. bodemvocht
Du	1.23E-07	[m2/h]	diff. coeff. bodem
kL	3.09E-05	[m/s]	water massa transport coeff.
kG	2.95E-03	[m/s]	damp massa transport coeff.
Klw_sh	1.75E-03	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	2.65E-02	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
9.06E+02	8.50E-03	9.06E+00

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
4.47E-02	3.78E-05	5.79E-06	9.64E-06	4.35E-05	4.74E-05

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
1.34E-07	2.70E-07	7.58E-05	7.58E-06

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		5.18E+01	2.43E+01	5.00E-03

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
4.13E-03	5.47E-07

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **4-chloor-2-methylfenol**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
3.93E-04	8.04E-07	1.60E-05	6.15E-07	3.38E-03	1.63E-05	3.82E-02	2.75E-04	5.77E-06	1.92E-04	**4.25E-02**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
2.80E-05	2.52E-07	3.06E-06	3.51E-07	2.06E-03	1.82E-06	1.56E-02	1.18E-04	3.26E-06	7.81E-05	**1.79E-02**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
5.93E-05	2.99E-07	4.17E-06	3.73E-07	2.18E-03	3.06E-06	1.75E-02	1.32E-04	3.47E-06	8.79E-05	**2.00E-02**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **4-chloor-2-methylfenol**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
1%	0%	0%	0%	8%	0%	90%	1%	0%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	12%	0%	87%	1%	0%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	11%	0%	88%	1%	0%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	5.55E-02	7.80E-05	4.47E-01	3.35E-03	8.84E-05	2.24E-03	5.09E-01

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
39.25936	**39.25936**	628.20513	906.12634	**628.20513**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.008	0.090	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	4.53E-01	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	4.75E+00	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	4.20E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	9.39E-04	[-]	berekende lucht-water verdelingscoeff.
Klw	9.40E-04	[-]	invoer lucht-water verdelingscoeff.
Copl	1.48E+03	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	2.89E-05	[-]	massafractie a. (bodemlucht)
Pw	3.08E-02	[-]	massafractie w. (bodemvocht)
Ps	9.69E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	7.68E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	7.68E-08	[m2/h]	diff. coeff. bodemvocht
Du	1.23E-07	[m2/h]	diff. coeff. bodem
kL	3.09E-05	[m/s]	water massa transport coeff.
kG	2.95E-03	[m/s]	damp massa transport coeff.
Klw_sh	1.75E-03	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	2.65E-02	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
1.36E+04	1.28E-01	1.36E+02

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
6.71E-01	5.66E-04	8.68E-05	1.45E-04	6.53E-04	7.11E-04

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
2.01E-06	4.05E-06	1.14E-03	1.14E-04

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		7.77E+02	3.65E+02	7.50E-02

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
6.20E-02	8.20E-06

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **4-chloor-3-methylfenol**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
5.89E-03	1.21E-05	2.41E-04	9.23E-06	5.08E-02	2.44E-04	5.73E-01	4.13E-03	8.66E-05	2.89E-03	**6.37E-01**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
4.21E-04	3.78E-06	4.59E-05	5.26E-06	3.10E-02	2.73E-05	2.34E-01	1.77E-03	4.88E-05	1.17E-03	**2.68E-01**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
8.89E-04	4.49E-06	6.25E-05	5.60E-06	3.27E-02	4.59E-05	2.63E-01	1.97E-03	5.21E-05	1.32E-03	**3.00E-01**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **4-chloor-3-methylfenol**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
1%	0%	0%	0%	8%	0%	90%	1%	0%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	12%	0%	87%	1%	0%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	11%	0%	88%	1%	0%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	5.55E-02	7.80E-05	4.47E-01	3.35E-03	8.84E-05	2.24E-03	5.09E-01

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
588.89039	**588.89039**	9423.0769	13591.895	**9423.0769**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia Binnenluchtconc.	TCL Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.114	1.300	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	1.44E-02	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	1.94E-01	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	5.39E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	2.95E-02	[-]	berekende lucht-water verdelingscoeff.
Klw	3.00E-02	[-]	invoer lucht-water verdelingscoeff.
Copl	1.69E+04	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	7.11E-04	[-]	massafractie a. (bodemlucht)
Pw	2.41E-02	[-]	massafractie w. (bodemvocht)
Ps	9.75E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	7.95E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	7.95E-08	[m2/h]	diff. coeff. bodemvocht
Du	2.84E-06	[m2/h]	diff. coeff. bodem
kL	3.19E-05	[m/s]	water massa transport coeff.
kG	3.05E-03	[m/s]	damp massa transport coeff.
Klw_sh	5.57E-02	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	1.61E-01	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
1.51E+02	4.47E-02	1.51E+00

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
2.43E-01	6.31E-06	2.85E-05	4.75E-05	3.48E-05	5.38E-05

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
1.07E-07	2.16E-07	8.61E-05	8.61E-06

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		2.55E+00	1.63E+00	1.07E-03

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
1.38E-02	1.11E-05

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **112-trichloorethaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
8.38E-05	1.72E-07	3.42E-06	1.31E-07	3.84E-03	1.30E-05	2.10E-03	9.21E-04	1.18E-04	6.88E-05	**7.15E-03**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
5.98E-06	5.38E-08	6.52E-07	7.48E-08	2.34E-03	1.46E-06	8.64E-04	3.95E-04	6.63E-05	2.79E-05	**3.70E-03**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
1.27E-05	6.39E-08	8.90E-07	7.96E-08	2.47E-03	2.45E-06	9.70E-04	4.40E-04	7.07E-05	3.14E-05	**4.00E-03**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **112-trichloorethaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
1%	0%	0%	0%	54%	0%	29%	13%	2%	1%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	63%	0%	23%	11%	2%	1%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	62%	0%	24%	11%	2%	1%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	2.95E-01	2.92E-04	1.16E-01	5.25E-02	8.43E-03	3.75E-03	4.77E-01

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
8.3781667	**8.3781667**	125.64103	151.46919	**125.64103**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia	TCL	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
Binnenluchtconc.	Toelaatbare Conc. Lucht			
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.009	0.017	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	5.25E-03	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	2.89E-02	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	2.20E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	8.09E-02	[-]	berekende lucht-water verdelingscoeff.
Klw	8.10E-02	[-]	invoer lucht-water verdelingscoeff.
Copl	3.45E+03	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	4.59E-03	[-]	massafractie a. (bodemlucht)
Pw	5.68E-02	[-]	massafractie w. (bodemvocht)
Ps	9.39E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	8.63E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	8.63E-08	[m2/h]	diff. coeff. bodemvocht
Du	1.99E-05	[m2/h]	diff. coeff. bodem
kL	3.47E-05	[m/s]	water massa transport coeff.
kG	3.31E-03	[m/s]	damp massa transport coeff.
Klw_sh	1.50E-01	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	1.94E-01	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
1.30E+03	1.05E+00	1.30E+01

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
6.22E+00 -	5.43E-05	7.29E-04	1.21E-03	7.83E-04	1.27E-03

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
2.41E-06	4.86E-06	2.03E-03	2.03E-04

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		2.41E+01	1.52E+01	3.90E-03

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
5.94E-02	5.78E-05

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **12-dichloorpropaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
3.06E-04	6.26E-07	1.25E-05	4.79E-07	9.06E-02	2.93E-04	1.97E-02	3.96E-03	6.10E-04	4.95E-04	**1.16E-01**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
2.19E-05	1.96E-07	2.38E-06	2.73E-07	5.53E-02	3.27E-05	8.12E-03	1.70E-03	3.44E-04	2.01E-04	**6.57E-02**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
4.62E-05	2.33E-07	3.25E-06	2.91E-07	5.83E-02	5.51E-05	9.12E-03	1.89E-03	3.67E-04	2.26E-04	**7.00E-02**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **12-dichloorpropaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
0%	0%	0%	0%	78%	0%	17%	3%	1%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	84%	0%	12%	3%	1%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	83%	0%	13%	3%	1%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	1.91E+00	1.80E-03	2.98E-01	6.18E-02	1.20E-02	7.40E-03	2.29E+00

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
30.591636	**30.591636**	2198.7179	1302.8131	**1302.8131**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia	TCL	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
Binnenluchtconc.	Toelaatbare Conc. Lucht			
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.203	0.012	**1.808**	76.990	**76.990**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	5.25E-03	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	2.89E-02	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	2.20E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	8.09E-02	[-]	berekende lucht-water verdelingscoeff.
Klw	8.10E-02	[-]	invoer lucht-water verdelingscoeff.
Copl	3.45E+03	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	4.59E-03	[-]	massafractie a. (bodemlucht)
Pw	5.68E-02	[-]	massafractie w. (bodemvocht)
Ps	9.39E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	8.63E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	8.63E-08	[m2/h]	diff. coeff. bodemvocht
Du	1.99E-05	[m2/h]	diff. coeff. bodem
kL	3.47E-05	[m/s]	water massa transport coeff.
kG	3.31E-03	[m/s]	damp massa transport coeff.
Klw_sh	1.50E-01	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	1.94E-01	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
9.31E+02	7.53E-01	9.31E+00

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
4.45E+00	3.88E-05	5.21E-04	8.68E-04	5.59E-04	9.07E-04

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
1.72E-06	3.47E-06	1.45E-03	1.45E-04

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		1.72E+01	1.08E+01	2.78E-03

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
4.24E-02	4.13E-05

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **13-dichloorpropaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
2.19E-04	4.47E-07	8.92E-06	3.42E-07	6.47E-02	2.09E-04	1.41E-02	2.83E-03	4.36E-04	3.54E-04	**8.29E-02**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
1.56E-05	1.40E-07	1.70E-06	1.95E-07	3.95E-02	2.34E-05	5.80E-03	1.21E-03	2.46E-04	1.44E-04	**4.69E-02**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
3.30E-05	1.67E-07	2.32E-06	2.08E-07	4.16E-02	3.93E-05	6.51E-03	1.35E-03	2.62E-04	1.62E-04	**5.00E-02**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **13-dichloorpropaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
0%	0%	0%	0%	78%	0%	17%	3%	1%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	84%	0%	12%	3%	1%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	83%	0%	13%	3%	1%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	1.91E+00	1.80E-03	2.98E-01	6.18E-02	1.20E-02	7.40E-03	2.29E+00

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	HUM-TOX EBVC	Cmax	Cgw	HUM-TOX EBVC GRONDWATER
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
21.851169	**21.851169**	1570.5128	930.58079	**930.58079**

Cia	TCL	Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.145	0.012	**1.808**	76.990	**76.990**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	4.95E-04	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	4.33E-03	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	3.50E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	8.58E-01	[-]	berekende lucht-water verdelingscoeff.
Klw	8.60E-01	[-]	invoer lucht-water verdelingscoeff.
Copl	6.83E+03	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	3.05E-02	[-]	massafractie a. (bodemlucht)
Pw	3.56E-02	[-]	massafractie w. (bodemvocht)
Ps	9.34E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	9.32E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	9.32E-08	[m2/h]	diff. coeff. bodemvocht
Du	1.42E-04	[m2/h]	diff. coeff. bodem
kL	3.74E-05	[m/s]	water massa transport coeff.
kG	3.58E-03	[m/s]	damp massa transport coeff.
Klw_sh	1.60E+00	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	2.23E-01	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw. [ug/dm3]	bodeml. [g/m3]	bodemvo. [g/m3]
Cgw	Csa	Cpw
5.76E+00	4.94E-02	5.76E-02

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
3.15E-01	2.40E-07	3.68E-05	6.14E-05	3.71E-05	6.16E-05

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
1.14E-07	2.30E-07	9.86E-05	9.86E-06

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		1.23E-01	7.57E-02	2.75E-05

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater [mg/dm3]	concentratie badkamerlucht [g/m3]
Cdw	Cbk
2.63E-03	2.93E-06

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **11-dichlooretheen**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
2.16E-06	4.42E-09	8.81E-08	3.38E-09	4.40E-03	1.39E-05	9.98E-05	1.75E-04	3.09E-05	3.76E-05	**4.76E-03**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
1.54E-07	1.39E-09	1.68E-08	1.93E-09	2.68E-03	1.55E-06	4.11E-05	7.51E-05	1.74E-05	1.53E-05	**2.83E-03**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
3.26E-07	1.65E-09	2.29E-08	2.05E-09	2.83E-03	2.61E-06	4.62E-05	8.36E-05	1.86E-05	1.72E-05	**3.00E-03**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **11-dichlooretheen**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
0%	0%	0%	0%	92%	0%	2%	4%	1%	1%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	95%	0%	1%	3%	1%	1%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	94%	0%	2%	3%	1%	1%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	1.31E+01	1.21E-02	2.14E-01	3.88E-01	8.62E-02	7.96E-02	1.39E+01

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS [mg/kg]	**HUM-TOX EBVC [mg/kg]**	Cmax [ug/dm3]	Cgw [ug/dm3]	**HUM-TOX EBVC GRONDWATER [ug/dm3]**
0.2157651	**0.2157651**	94.230769	5.7612466	**5.7612466**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia Binnenluchtconc. [mg/m3]	TCL Toelaatbare Conc. Lucht [mg/m3]	**HUM-TOX EBVC [mg/kg]**	GRONDW. [ug/dm3]	**HUM-TOX EBVC GRONDWATER [ug/dm3]**
0.010	0.014	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	1.35E+05	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	1.18E+06	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	3.50E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	3.15E-09	[-]	berekende lucht-water verdelingscoeff.
Klw	3.20E-09	[-]	invoer lucht-water verdelingscoeff.
Copl	2.26E+03	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	1.16E-10	[-]	massafractie a. (bodemlucht)
Pw	3.67E-02	[-]	massafractie w. (bodemvocht)
Ps	9.63E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	6.48E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	6.48E-08	[m2/h]	diff. coeff. bodemvocht
Du	1.19E-08	[m2/h]	diff. coeff. bodem
kL	2.60E-05	[m/s]	water massa transport coeff.
kG	2.49E-03	[m/s]	damp massa transport coeff.
Klw_sh	5.94E-09	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	8.87E-08	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
9.89E+01	3.12E-09	9.89E-01

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
1.38E-08	4.12E-06	5.12E-08	8.54E-08	1.38E-08	1.38E-08

LUCHTCONCENTRATIES [g/m3]

buitenl.		kruipr.	binnenl.
volw.	kind		
Coaa	Coac	Cba	Cia
4.26E-11	8.57E-11	2.21E-08	2.21E-09

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		4.27E+00	2.20E+00	4.57E-04

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
4.51E-06	2.00E-15

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **MCPA**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
3.59E-05	7.35E-08	1.47E-06	5.62E-08	9.87E-07	5.17E-09	3.24E-03	3.01E-07	2.11E-14	5.55E-08	**3.28E-03**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
2.56E-06	2.30E-08	2.80E-07	3.21E-08	6.02E-07	5.78E-10	1.33E-03	1.29E-07	1.19E-14	2.25E-08	**1.33E-03**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
5.42E-06	2.74E-08	3.81E-07	3.41E-08	6.35E-07	9.71E-10	1.49E-03	1.44E-07	1.27E-14	2.54E-08	**1.50E-03**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **MCPA**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
1%	0%	0%	0%	0%	0%	99%	0%	0%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	1.77E-04	2.71E-07	4.16E-01	4.00E-05	3.53E-12	7.06E-06	4.18E-01

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
3.5896346	**3.5896346**	47.115385	98.868031	**47.115385**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.000	0.007	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	2.44E-02	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	5.23E-01	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	8.58E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	1.74E-02	[-]	berekende lucht-water verdelingscoeff.
Klw	1.74E-02	[-]	invoer lucht-water verdelingscoeff.
Copl	1.50E+04	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	2.67E-04	[-]	massafractie a. (bodemlucht)
Pw	1.53E-02	[-]	massafractie w. (bodemvocht)
Ps	9.84E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	5.77E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	5.77E-08	[m2/h]	diff. coeff. bodemvocht
Du	7.74E-07	[m2/h]	diff. coeff. bodem
kL	2.32E-05	[m/s]	water massa transport coeff.
kG	2.21E-03	[m/s]	damp massa transport coeff.
Klw_sh	3.24E-02	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	1.05E-01	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
8.57E+02	1.49E-01	8.57E+00

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
5.90E-01	3.57E-05	6.94E-05	1.16E-04	1.05E-04	1.51E-04

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
3.24E-07	6.51E-07	2.42E-04	2.42E-05

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		3.64E+01	1.89E+01	9.52E-03

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
3.91E-03	2.05E-06

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **tribroommethaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
7.47E-04	1.53E-06	3.05E-05	1.17E-06	1.08E-02	3.93E-05	2.77E-02	2.60E-04	2.17E-05	1.82E-05	**3.97E-02**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
5.34E-05	4.79E-07	5.82E-06	6.67E-07	6.59E-03	4.39E-06	1.14E-02	1.12E-04	1.22E-05	7.41E-06	**1.82E-02**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
1.13E-04	5.69E-07	7.93E-06	7.10E-07	6.95E-03	7.39E-06	1.28E-02	1.24E-04	1.30E-05	8.34E-06	**2.00E-02**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **tribroommethaan**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
2%	0%	0%	0%	27%	0%	70%	1%	0%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	36%	0%	63%	1%	0%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
1%	0%	0%	0%	35%	0%	64%	1%	0%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	9.30E-02	9.89E-05	1.71E-01	1.66E-03	1.74E-04	1.12E-04	2.68E-01

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
74.690815	**74.690815**	628.20513	856.57961	**628.20513**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia	TCL	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
Binnenluchtconc.	Toelaatbare Conc. Lucht			
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.024	0.100	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	7.69E+00	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	3.68E+00	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	1.91E-01	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	5.52E-05	[-]	berekende lucht-water verdelingscoeff.
Klw	5.52E-05	[-]	invoer lucht-water verdelingscoeff.
Copl	3.32E+05	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	2.27E-05	[-]	massafractie a. (bodemlucht)
Pw	4.11E-01	[-]	massafractie w. (bodemvocht)
Ps	5.89E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	1.18E-03	[m2/h]	diff. coeff. bodemlucht
Dsw	1.18E-07	[m2/h]	diff. coeff. bodemvocht
Du	3.77E-07	[m2/h]	diff. coeff. bodem
kL	4.75E-05	[m/s]	water massa transport coeff.
kG	4.54E-03	[m/s]	damp massa transport coeff.
Klw_sh	1.03E-04	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	2.77E-03	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
2.20E+05	1.22E-01	2.20E+03

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
9.84E-01	9.17E-03	3.23E-04	5.39E-04	9.49E-03	9.71E-03

LUCHTCONCENTRATIES [g/m3]

buitenl.		kruipr.	binnenl.
volw.	kind		
Coaa	Coac	Cba	Cia
2.92E-05	5.88E-05	1.55E-02	1.55E-03

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		1.88E+03	4.20E+02	9.10E-02

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
1.00E+00	1.39E-05

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **isopropanol**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
7.14E-03	1.46E-05	2.92E-04	1.12E-05	6.93E-01	3.55E-03	1.15E+00	6.69E-02	1.47E-04	3.39E-04	**1.92E+00**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
5.10E-04	4.59E-06	5.56E-05	6.38E-06	4.23E-01	3.97E-04	4.61E-01	2.87E-02	8.27E-05	1.37E-04	**9.14E-01**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
1.08E-03	5.45E-06	7.59E-05	6.79E-06	4.46E-01	6.67E-04	5.20E-01	3.19E-02	8.82E-05	1.55E-04	**1.00E+00**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **isopropanol**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
0%	0%	0%	0%	36%	0%	60%	3%	0%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	46%	0%	50%	3%	0%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	45%	0%	52%	3%	0%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	6.24E-01	9.34E-04	7.28E-01	4.47E-02	1.23E-04	2.17E-04	1.40E+00

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
714.44293	**714.44293**	31410.256	220004.12	**31410.256**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
1.553	2.200	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	1.22E-01	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	9.53E-02	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	3.13E-01	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	3.49E-03	[-]	berekende lucht-water verdelingscoeff.
Klw	3.49E-03	[-]	invoer lucht-water verdelingscoeff.
Copl	2.78E+04	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	1.04E-03	[-]	massafractie a. (bodemlucht)
Pw	2.98E-01	[-]	massafractie w. (bodemvocht)
Ps	7.01E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	9.78E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	9.78E-08	[m2/h]	diff. coeff. bodemvocht
Du	5.24E-06	[m2/h]	diff. coeff. bodem
kL	3.93E-05	[m/s]	water massa transport coeff.
kG	3.75E-03	[m/s]	damp massa transport coeff.
Klw_sh	6.48E-03	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	9.01E-02	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
1.22E+05	4.26E+00	1.22E+03

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
2.85E+01	5.09E-03	3.43E-03	5.72E-03	8.52E-03	1.08E-02

LUCHTCONCENTRATIES [g/m3]

buitenl.		kruipr.	binnenl.
volw.	kind		
Coaa	Coac	Cba	Cia
2.62E-05	5.28E-05	1.73E-02	1.73E-03

GEHALTEN IN PLANTEN

spore-metalen		org. stoffen/anorg. verb.		
knolgew.	bladgew.	wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		1.14E+03	5.27E+02	6.95E-02

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
5.57E-01	2.51E-04

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **ethylacetaat**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
5.46E-03	1.12E-05	2.23E-04	8.55E-06	7.71E-01	3.19E-03	8.34E-01	3.71E-02	2.65E-03	4.49E-04	**1.65E+00**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
3.90E-04	3.50E-06	4.25E-05	4.87E-06	4.70E-01	3.56E-04	3.41E-01	1.59E-02	1.49E-03	1.82E-04	**8.29E-01**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
8.24E-04	4.16E-06	5.80E-05	5.19E-06	4.96E-01	5.99E-04	3.83E-01	1.77E-02	1.59E-03	2.05E-04	**9.00E-01**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **ethylacetaat**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
0%	0%	0%	0%	47%	0%	50%	2%	0%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	57%	0%	41%	2%	0%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	55%	0%	43%	2%	0%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	9.09E-01	1.10E-03	7.01E-01	3.25E-02	2.92E-03	3.76E-04	1.65E+00

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
545.81918	**545.81918**	28269.231	122107.55	**28269.231**

Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC

Cia	TCL			
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
1.728	4.200	**n.v.t.**	n.v.t.	**n.v.t.**

TUSSENBEREKENINGEN

VERDELING OVER DE BODEMFASEN

symbool	waarde	eenheid	beschrijving
Za	4.25E-04	[mol/m3.Pa]	fugaciteitscap. cst. a.
Zw	1.14E-01	[mol/m3.Pa]	fugaciteitscap. cst. w.
Zs	6.30E-01	[mol/m3.Pa]	fugaciteitscap. cst. s.
Kd	2.20E+00	[kg/dm3]	verdelingscoeff. grond-water
Klw BEREKEND	3.72E-03	[-]	berekende lucht-water verdelingscoeff.
Klw	3.72E+00	[-]	invoer lucht-water verdelingscoeff.
Copl	2.47E+04	[mg/kg]	gehalte in bodem waarbij Cpw >= S
Pa	2.12E-04	[-]	massafractie a. (bodemlucht)
Pw	5.70E-02	[-]	massafractie w. (bodemvocht)
Ps	9.43E-01	[-]	massafractie s. (vaste fase vd bodem)
Dsa	8.51E-04	[m2/h]	diff. coeff. bodemlucht
Dsw	8.51E-08	[m2/h]	diff. coeff. bodemvocht
Du	9.27E-07	[m2/h]	diff. coeff. bodem
kL	3.42E-05	[m/s]	water massa transport coeff.
kG	3.27E-03	[m/s]	damp massa transport coeff.
Klw_sh	6.91E+00	[-]	lucht-water verdelingscoeff. bij badwater temperatuur
Kwa	2.05E-01	[-]	mate van verdamping v.d. stof

CONCENTRATIES IN BODEMFASEN

grondw.	bodeml.	bodemvo.
[ug/dm3]	[g/m3]	[g/m3]
Cgw	Csa	Cpw
2.00E+04	7.45E-01	2.00E+02

LUCHTFLUXEN [g/m2/h]

grenslaag	evapo.	diffusie buiten	diffusie binnen	totaal buiten	totaal binnen
J2'	J3'	J4'	J5'	Jo	Ji
4.34E+00	8.35E-04	5.21E-04	8.69E-04	1.36E-03	1.70E-03

LUCHTCONCENTRATIES [g/m3]

buitenl. volw.	kind	kruipr.	binnenl.
Coaa	Coac	Cba	Cia
4.18E-06	8.41E-06	2.73E-03	2.73E-04

GEHALTEN IN PLANTEN

spore-metalen knolgew.	bladgew.	org. stoffen/anorg. verb. wortel	blad	
[mg/kg dw]	[mg/kg dw]	[mg/kg vg]	[mg/kg vg]	
Cpr1	Cps1	Cpr0	Cps0	Cpdep
		3.06E+02	1.98E+02	5.97E-02

PERMEATIE DRINKWATERLEIDING

concentratie drinkwater	concentratie badkamerlucht
[mg/dm3]	[g/m3]
Cdw	Cbk
9.14E-02	9.36E-05

RESULTATEN

BLOOTSTELLING (KIND/VOLWASSENE/LEVENSLANG GEMIDDELD)

stof: **butylacetaat**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [mg/kg l.g./d]										**KIND**
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	**TCH**
4.69E-03	9.60E-06	1.91E-04	7.34E-06	1.22E-01	5.08E-04	2.53E-01	6.09E-03	9.88E-04	4.42E-04	**3.88E-01**
BLOOTSTELLING VOLWASSENE [mg/kg l.g./d]										**VOLWASSENE**
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	**TAD**
3.35E-04	3.01E-06	3.65E-05	4.18E-06	7.42E-02	5.67E-05	1.04E-01	2.61E-03	5.57E-04	1.79E-04	**1.82E-01**
BLOOTSTELLING LEVENSLANG-GEMIDDELD [mg/kg l.g./d]										**LEVENSLANG GEMIDDELD**
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	**DOSIS**
7.08E-04	3.57E-06	4.98E-05	4.46E-06	7.83E-02	9.54E-05	1.17E-01	2.91E-03	5.94E-04	2.02E-04	**2.00E-01**

PROCENTUELE BIJDRAGE ROUTES KIND, VOLW., LEVENSLANG-GEMIDDELD

stof: **butylacetaat**

ING. GROND	DERM. GROND	DERM. GROND	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW.	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl.
BLOOTSTELLING KIND [%]										
dic	daci	daco	ipc	ivci	ivco	vic	diwc	ivwc	dawc	Kind
1%	0%	0%	0%	31%	0%	65%	2%	0%	0%	100%
BLOOTSTELLING VOLWASSENE [%]										
dia	daai	daao	ipa	ivai	ivao	via	diwa	ivwa	dawa	Volwasse
0%	0%	0%	0%	41%	0%	57%	1%	0%	0%	100%
BLOOTSTELLING LEVENSLANG GEMIDDELD [%]										
dil	dali	dalo	ipl	ivli	ivlo	vil	diwl	ivwl	dawl	Levenslang
0%	0%	0%	0%	39%	0%	59%	1%	0%	0%	100%

BLOOTSTELLINGSCOEFFICIENTEN LEVENSLANG-GEMIDDELD [1000/d]

ING. GROND	DERM. GROND BINNEN	DERM. GROND BUITEN	INH. GROND	INH. BINNENL.	INH. BUITENL.	ING. GEWAS	PERM. DRINKW	DAMPEN DOUCHEN	DERM. DOUCHEN	TOTAAL (excl. dierl. produkten)
1.51E-03	7.62E-06	1.06E-04	9.51E-06	1.67E-01	2.04E-04	2.50E-01	6.21E-03	1.27E-03	4.31E-04	4.27E-01

HUMAAN TOXICOLOGISCHE ERNSTIGE BODEMVERONTREINIGINGSCONCENTRATIE, BODEM/BODEMWATER HUMAAN-TOX. MAXIMUM CONCENTRATIE GRONDWATER

CS	**HUM-TOX EBVC**	Cmax	Cgw	**HUM-TOX EBVC GRONDWATER**
[mg/kg]	**[mg/kg]**	[ug/dm3]	[ug/dm3]	**[ug/dm3]**
468.65651	**468.65651**	6282.0513	20046.655	**6282.0513**

Cia	TCL	**Als Cia>TCL dan gecorrigeerde HUM-TOX EBVC**		
Binnenluchtconc.	Toelaatbare Conc. Lucht	**HUM-TOX EBVC**	GRONDW.	**HUM-TOX EBVC GRONDWATER**
[mg/m3]	[mg/m3]	**[mg/kg]**	[ug/dm3]	**[ug/dm3]**
0.273	1.000	**n.v.t.**	n.v.t.	**n.v.t.**

Appendix VII Detection limits for fourth series of compounds.

The height of detection limits for compounds depends on the analytical methods used, the matrix (e.g soil, water) and on the sample volume. Therefore detection limits are chosen which are general for the environmental laboratories in the Netherlands [illegible] was made and can be seen in the following tables:

Detection limits soil

compound	detection limit soil mg.kg^{-1}ds + analytical method[1]	detection limit soil mg.kg^{-1}ds + analytical method[2]
vanadium	-	10 (ICP)
selenium	-	10 (ICP)
tellurium	-	-
thallium	-	-
tin	-	-
monochloroanilines	0.005	0.02 (sum)
dichloroaniline	0.005	0.01 (sum)
trichloroaniline	0.005	0.01 (sum)
tetrachloroaniline	-	0.01 (sum)
pentachloroaniline	-	0.01 (sum)monochloroanilines
chlorophenols.	0.001-0.005	0.0005
1,1,2-trichloroethane	0.1	0.05[3] 0.05[4] (GC/ECD)
1,2-dichloropropane	0.1	0.3
1,3-dichloropropane	0.1	0.5
1,1-dichloroethene	0.1	0.2
MCPA	0.01	-
isopropanol	1	-
ethylacetate	0.5	[illegible] (GC)[4]
butylacetate	0.5	[illegible] (GC)[4]
tribromomethane	-	0.5

[1] TAUW Milieu, 1998
[2] BCO, 1996
[3] Milieulab, 1996
[4] IWACO Prijslijst, februari, 1995

* no information on choroalkylphenols
-= no standard method for determination of the compound
Note:

AAS	=Atomic Absorption Spectrometer
GC	=Gas Chromatography
ECD	=Electron Capture Detection
FID	=Flame Ionisation Detection

GC (Gas Chromatography) analysis can be amplified with MS (Massa Spectometry)

Detection limits groundwater

compound	detection limit gr.water* $\mu g.l^{-1}$ + analytical method[1]	detection limit gr.water $\mu g.l^{-1}$ + analytical method[2]
vanadium		5[3]
selenium		5[3]
tellurium	-	-
thallium	-	-
tin	-	5[3]
monochloroanilines	0.05	0.2 (sum)
dichloroaniline	0.05	0.1 (sum)
trichloroaniline	0.05	0.1 (sum)
tetrachloroaniline	-	0.1 (sum)
pentachloroaniline	-	0.1 (sum)
chlorophenols*	0.003-0.1	0.005
1,1,2-trichloroethane	0.1	0.5
1,2-dichloropropane	0.5	0.2
1,3-dichloropropane	0.5	0.5
1,1-dichloroethene	0.5	0.1
MCPA	0.1	-
isopropanol	1000	-
ethylacetate	500	1000 (Iwaco)
butylacetate	500	1000 (Iwaco)
tribromomethane	-	0.5

*=groundwater
[1] TAUW Milieu, 1998
[2] BCO, 1996
[3] Milieulab, 1996
[4] IWACO Prijslijst, februari, 1995

Most laboratory do not have a standard analytical method for the determination of acrylonitrile and formaldehyde. The Laboratory for Organic Analytical Chemistry (RIVM) have developed methods for the determination of these compounds, but the required amount of sample may be different than the standard sample volume as proposed in NVN 5740[*] and NEN (Dutch Final Norms).

[*] NVN 5740= Dutch Prenorm: Soil, Investigation strategy for exploratory survey

Appendix VIII: RIVM reports related to potential (Intervention Values) and actual risks due to soil contamination (December 1997)

CONTENTS

GENERAL

Van de Meent, D, T. Aldenberg, J.H. Canton, C.A.M. van Gestel, and W. Sloof (1990).
Desire for levels. Background study for the policy document "Setting environmental quality standards for water and soil". In English: RIVM-report 6701010012.
Description of the methodology used to derive risk concentrations for metals, PAHs, chlorophenols and pesticides.

Peijnenburg, W.J.G.M., M.A.G.T. van der Hoop, D. van der Meent, and J. Struijs (1996?). Een conceptuele basis voor het omgaan met risicogrenzen en achtergrondgehalten bij het afleiden van milieukwaliteitsdoelstellingen. In Dutch/English: RIVM-report no. 719101018. 20 pp.
Two methods are evaluated to derive environmental quality objectives, incorporating background concentrations and availability: the so-called methods of effect-addition and effect limitation.

(DERIVATION OF) INTERVENTION VALUES

Berg, R. van den & Roels, J.M. (1991).
Beoordeling van risico's voor mens en milieu bij blootstelling aan bodemverontreiniging. Integratie van deelaspecten. In Dutch: RIVM-report no. 725201007; In English RIVM-report no. 725201013; in German: RIVM-report no. 725201012. Circa 100 pp.
For the 1st series of compounds: integration of ecotoxicological criteria with the results of CSOIL calculations based on the human-toxicological criteria, yielding proposals for soil intervention values; note that several of the then proposed values have been modified at a later stage.

Berg, R. van den, Bockting, G.J.M., Crommentuyn, G.H. & Janssen, P.J.C.M. (1994)
Proposals for intervention values for soil clean-up: Second series of compounds. In English: RIVM-report no. 715810004. 163 pp.
Physicochemical properties, results of CSOIL calculations, derivation of the serious-soil-contamination-concentrations (scc) using the ecotoxicological and human-toxicological criteria; integration of values yielding proposals for intervention values; this 2nd series consists of 12 compounds.

Kreule, P., Van den Berg, R., Waitz, M.F.W., and Swartjes, F.A. (1995)
Calculation of human-toxicological serious soil contamination concentrations and proposals for intervention values for clean-up of soil and groundwater: Third series of compounds. In English: RIVM-report no. 715810010. Circa 85 pp.
Physicochemical properties, results of CSOIL calculations, derivation of the serious-soil-contamination-concentrations (scc) using the ecotoxicological and human-toxicological criteria; integration of values yielding proposal for intervention values; this 3rd series consists of 15 compounds.

Berg, R. van den (1997).
Verantwoording van gegevens en procedures voor de 1e tranche interventiewaarden: van RIVM-rapporten nab de Notitie Interventiewaarden bodemsanering. In Dutch: RIVM-report 715810012. 117 pp.
The report describes the adjustments and changes that were made in models, parameters and data, during the period from release of the first series of proposals for intervention values (1991) up to implementation into the Dutch Act on Soil Protection (1994).

Swartjes, F.A. (1997).
Stofselectie voor afleiden " voorstellen voor interventiewaarden". In Dutch: RIVM-report 71581016. circa 97 pp.
Criteria for selecting compounds for deriving intervention values; Inventarisation and selection of compounds for (eventual) deriving intervention values.

Kreule, P., Swartjes, F.A. (in progress, planned in 1998).
Calculation of human-toxicological serious soil contamination concentrations and proposals for intervention values for clean-up of soil and groundwater: Fourth series of compounds. In English: RIVM-report no. 711701005.
Physicochemical properties, results of CSOIL calculations, derivation of the serious-soil-contamination-concentrations (scc) using the ecotoxicological and human-toxicological criteria; integration of values yielding proposal for intervention values; this 4th series consists of 15 compounds.

HUMAN EXPOSURE

Linders, J.B.H.J. (1990)
Risicobeoordeling bij de mens bij blootstelling aan stoffen. Uitgangspunten en veronderstellingen. In Dutch: RIVM-report no. 725201003.
Description of calculation formulae to be used for estimation of human exposure via several routes in case of soil contamination; the formulas in this report were used in the compilation of the CSOIL-model as reported in the RIVM-report by van den Berg (1995).

De Nijs, A.C.M., T.G. Vermeire (1990).
Soil-plant mammal transfer factors. in English: RIVM-report no. 670203001. 31 pp.
The factors controlling accumulation in fruits, vegetables, grains, meat, and dairy products are derived.

Van den Berg, R. van den (1991/1994/1995)
Blootstelling van de mens aan bodemverontreiniging. Een kwalitatieve en kwantitatieve analyse leidend tot voorstellen voor humaantoxicologische C-toetsingswaarden (beperkt herziene versie). **Modified version of the original report Van den Berg, 1991/ Van den Berg 1994.** In Dutch: RIVM-report no. 725201006; in English: RIVM-report no. 725201011. Circa 100 pp.
Description of the formulas that constitutes the CSOIL model, the model used to estimate human exposure in case of soil contamination; based on the human-toxicological criteria (MPR-values) for the 1st series of compounds, CSOIL is used to derive human-toxicological intervention values; table 2 to this report gives 'new' modified human-toxicological intervention values.

Bockting, G. en R. van den Berg (1992).
De accumulatie van sporenelementen in groenten geteeld op verontreinigde bodems. Een literatuurstudie. In Dutch: RIVM-report 725201009. 87 pp.
Literature-research on the accumulation of metals in plants, grown on contaminated sites; the basis for human exposure due to plant uptake.

Heijna-Merkus, E. and M. Hof (1994).
Harmonisation of model parameters. In English RIVM-report no. 679102022. 20 pp.
The report describes the differences in input parameters used in different exposure models used in the Netherlands for compound independent characteristics.

Bockting, G.J.M., Swartjes, F.A., Koolenbrander, L.G.M. & Berg, R. van den (1994)
Beoordelingssystematiek bodemkwaliteit ten behoeve van bouwvergunnings-aanvragen. Deel I. Bodemgebruiksspecifieke beoordelingsmethodiek voor de humane blootstelling. In Dutch: RIVM-report no. 715810001. 123 pp.
Methodology for estimating actual (i.e. location specific) human exposure using formulas from the CSOIL model and measurements in contact media; several standard soil use categories are defined using standard assumptions as to human exposure; this method is part of a system for the evaluation of soil quality in dealing with requests for official building permits to be granted by local authorities.

Polder, M.D., E.M. Hulzebos, and D.T. Jager (1994).
Validation of models on uptake of organic chemicals by plant roots. In English: RIVM-report 679102024. 45 pp.
In this report the application of soil-plant transfer factors was investigated. It is concluded that the root concentration factor is an appropriate instrument for the estimation of residues in roots, whereas the application of the stem factor is insufficient.

Hulzebos, E.M. (1994).
The uptake of air-borne substances in plants. In English: RIVM-report 679102023. 24 pp.
In this report several models, time-dependant and time-independent models, are discussed which describe the deposition of aerosols and gases and the subsequent uptake into plants.

Rikken, M.J.G. (1995).
De accumulatie van zeldzame aardmetalen in planten. Een literatuurstudie. In Dutch: RIVM-report 601014013. 51 pp.
The report summarizes literature data on the transfer of rare earth metals in plants.

Jager, D.T. (1995).
Feasibility of validating the Uniform System for the Evaluation of Substances (USES). In English: RIVM-report 679102026. 56 pp.
The report describes a procedure that can be followed to show the user of the USES (Uniform System for Evaluation of Substances)-model the degree of accuracy of model calculations. For this purpose separate (sub)modules of USES should be validated.

Jager, D.T. (1995).
Uncertainty analysis of the Uniform System for the Evaluation of Substances (USES). Example calculations. In English: RIVM-report 679102032. 47 pp.
Example calculations are presented, based on Monte Carlo simulations, showing the contribution of some major parameters to the calculation results of some USES (Uniform System for Evaluation of Substances)-(sub)modules.

Jager, D.T. and W. Slob (1995).
Uncertainty analysis of the Uniform System for the Evaluation of Substances (USES). In English: RIVM-report 679102027. 65 pp.
A uncertainty analysis on the USES (Uniform System for Evaluation of Substances)-(sub)modules has been performed using the multiplicative models (analytical method) and the non-multiplicative (sub)modules (Monte Carlo techniques) .

Hooft, W.F. van (1995).
Risico's voor de Volksgezondheid als gevolg van blootstelling van runderen aan sporenelementen bij beweiding. In Dutch: RIVM-report 693810001. 123 pp.
A model was developed to calculate concentrations of trace elements in tissues and milk for human consumption, to be able to quantify the risks to public health of exposition of grazing cattle to trace elements.

Janus, J.A., M.G.J. Rikken, M. Rutgers, H. Booij, E.M. Paardekoper (1995).
Overdracht van zeldzame aardmetalen in de keten kunstmest, bodem, plant, vee en mens. In Dutch: RIVM-report 601014014. 31 pp.
The report summarizes literature data on the transfer of rare earth metals in the chain artificial fertilizers, soil, crops, livestock and man.

Waitz, M.F.W., J.I. Freijer, P. Kreule, F.A. Swartjes (1996).
The VOLASOIL risk assessment model based on CSOIL for soils contaminated with volatile compounds. In English: RIVM-report 715810014. 189 pp.
Description and evaluation of VOLASOIL, an model to calculate the site-specific indoor air quality, where variable groundwater table depth, convective flow of contaminated air originating from the soil and variability of building construction features have been incorporated.

Sips, A.J.A.M., and J.C.H. van Eijkeren (1996).
Oral bioavailability of heavy metals and organic compounds from soil; too complicated to adsorb? An inventarisation of factors affecting bioavailability of environmental contaminants from soil. In English RIVM-report no. 711701002.
The report gives an overview of the data available on bioavailability of the heavy metals Pb, As, Cd, and organic toxicants as PCDD's/PCDF's and PCB's from soil. It is concluded that the soil matrix can reduce the bioavailability of environmental contaminants up to 10.

Polder, M.D., E.M. Hulzebos, and D.T. Jager (1996).
Bioconcentration of gaseous organic chemicals in plant leaves: comparison of experimental data with model predictions. In English: RIVM-report 679102034. 33 pp.
Evaluation of the models of Riederer (1990) and Trapp and Matthies (1995).

Bockting, G.J.M., J.G.M. Koolenbrander, F.A. Swartjes (1996).
Model ter berekening van de humane blootstelling ten gevolge van verontreinigde waterbodems. In Dutch: RIVM-report 715810011. 50 pp.
Description of the SEDISOIL model, which model enables quantification of human exposure due to contaminated sediments.

Sinke, J., H.J.G.M. Derks, K. Groen, and A.J.A.M. Sips (1996).
Bioavailability in the dog of benzo(a)pyrene from contaminated soil. In English: RIVM-report 711701001. 21 pp.
To come to a realistic risk assessment for benzo(a)pyrene the absolute oral bioavalilability of the contaminant, based on influence of the soil matrix, is assessed. To this purpose dogs received B(a)p orally or intravenously in a four-way cross-over study design.

Vissenberg, H.A., F.A. Swartjes (1996).
Evaluatie van de met CSOIL berekende blootstelling, middels een op Monte Carlo technieken gebaseerde gevoeligheids- en onzekerheidsanalyse. Hoofdrapport en bijlagen. In Dutch: RIVM-report 715810018. 130 + 90 pp.
The spread in the potential human exposure was quantified for five major contaminants. Furthermore, the contribution of the input-parameters for the spread in actual and potential human exposure was investigated.

Vermeire, T.G., M.P. van Veen, M.P.M. Janssen, R.C.G.M. Smetsers (1997).
De schatting van de blootstelling van de mens aan stoffen en straling. In Dutch: RIVM-rapport 601132002. 102 pp.
This report gives a review of models related to the assessment of human exposure to contaminants and radiation, developed at the RIVM. In the report purpose, concepts and default parameters of the models has been described.

Versluijs, K, R, Koops, P. Kreule, and M. Waitz (in progress; planned in 1998).
Evaluation of the CSOIL module for accumulation in plants; phase I: definition study. In English: RIVM-report 711701008.

EFFECT ASSESSMENT, HUMAN TOX

Vermeire, T.G., Apeldoorn, M.E. van, Fouw, J.C. de & Janssen, P.J.C.M. (1991)
Voorstel voor de humaantoxicologische onderbouwing van C-(toetsings)waarden. In Dutch: RIVM-report no. 725201005. 170 pp.
Human-toxicological criteria (MPR-values) for 1st series of compounds, this 1st series consists of 55 compounds or groups of compounds; includes description of the method used to derive the MPR-values.

Vermeire, T.G. (1993)
Voorstel voor de humaantoxicologische onderbouwing van C-(toetsings)waarden. Betreft addendum op rapport 725201005. In Dutch: RIVM-report no. 715801001.
Re-evaluation of the Maximum Permissible Intake values for 9 (groups of) compounds from the set dealt with in the Vermeire et al.-report from 1991.

Janssen, P.J.C.M., Apeldoorn van M.E., van Koten-Vermeulen and Mennes, W.C. (1995).
Human-toxicological criteria for serious soil contamination: Compounds evaluated in 1993 & 1994. In English: RIVM-report 715810009. 96 pp.
This report gives the derivation of the Maximal Permissable Risk levels for human intake for 26 compounds, which were used in the second and third series of the intervention values.

Janssen, P.J.C.M. and Speijers, G.J.A. (1997)
Guidance document on the Derivation of Maximum Permissible Risk levels for human intake of soil contaminants. In English: RIVM-report 711701006. 49 pp.
Step by step procedure to derive the Maximum Permissible Risk levels

M.N. Pieters, W.H. Könemann (1997)
Mengseltoxiciteit: een algemeen overzicht en evaluatie van de veiligheidsfactor van 100 toegepast in het stoffenbeleid. In Dutch: RIVM-report 620110004. 57 pp.
The report gives i) an overview of the Dutch standard setting procedures in general; ii) an overview of common concepts in toxicology of mixures and strategies which can be followed in their risk evaluation; iii) the plausibility of combined effects of compounds at low doses; iv) an evaluation of the safety factor of 100 used for the combined action of chemicals (difference between maximum tolerable risk and negligible risk).

W. Slob, M.N. Pieters (1997).
A probabilistic approach for deriving acceptable human intake limits and human health risks from toxicological studies: general framework. In English: RIVM-report 620110005. 34 pp.
In this report a general framework is discussed that quantifies both the uncertainties in the estimated no-effect level in the animal and the uncertainties in the several extrapolation steps.

Janssen, P.J.C.M., Apeldoorn van M.E., van Koten-Vermeulen and Mennes, W.C. (in progress; planned in 1998).
Human-toxicological criteria for serious soil contamination: 4th series of compounds: In English: RIVM-report 715810004.

CONTAMINANT BEHAVIOUR IN RELATION TO RISKS

Lagas, P., H. Snelting, R. van den Berg (1990).
Verspreiding van stoffen bij bodemverontreiniging. In Dutch: RIVM-report no. 725201002. 27 pp.
Four instruments for predicting the risks due to contaminant migration are presented: i) mobility (retardation); ii) velocity and direction of groundwater flow; iii) contaminant concentration; and iv) potential volume of polluted soil or groundwater.

Bockting, G.J.M., E.J. van der Plassche, J. Struijs, J.H. Canton (1993).
Soil-water partition coefficients for some trace metals. In English: RIVM-report no. 679101003. 51 pp.
Partition coefficients in soils and sediments have been derived for Ba, Be, Co, Mo, Se, Ti, Sb, Sn, and V, based on literature search.

Bockting, G.J.M., E.J. van der Plassche, J. Struijs, J.H. Canton (1993).
Soil-water partition coefficients for organic compounds. In Dutch: RIVM-report no. 679101013. 143 pp.
Organic carbon normalised partition coefficients in soils and sediments have been derived for, among others, halogenated biphenyl's and benzyltoluenes, chlorinated anilines and nitrobenzenes, various pesticides, phthalate esters and organotin compounds, based on literature search.

Swartjes, F.A., Koolenbrander, L.G.M. & Bockting, G.J.M. (1994)
Beoordelingssystematiek bodemkwaliteit ten behoeve van bouwvergunnings-aanvragen. Deel II. Methodiek ter bepaling van het verspreidingsrisico. In Dutch: RIVM-report no. 715810002. 68 pp.
Method for classification of calculated fluxes into 3 classes of increasing risk of contaminant dispersal; this classification provides a pragmatic assessment of the risk of dispersal; this method is part of a system for the evaluation of soil quality in dealing with requests for official building permits to be granted by local authorities.

Elzinga, E.J., B. van den Berg, J.J.M. van Grinsven, and F.A. Swartjes (1997).
Freundlich Isothermen voor Cadmium, Koper en Zink als functie van de bodemeigenschappen, op basis van een literatuuronderzoek. In Dutch: RIVM-report no. 711501001. circa 150 + 50 pp.
For cadmium, cupper and zinc a soil specific Freundlich adsorption isotherm has been derived, based on literature research. To improve the possibilities for application several combinations of soil characteristics has been implemented in the regression equations. Besides, the influence of correction for metal free ion activity and precipitation on the Freundlich equations has been investigated.

RISK ASSESSMENT ECOTOX

Denneman, C.A.J. & Gestel, C.A.M. van (1990)
Bodemverontreiniging en bodemecosystemen: voorstel voor C-(toetsings)waarden op basis van ecotoxicologische risico's. In Dutch: RIVM-report no. 725201001. 64 pp. + 133 pp. annex.
Ecotoxicological criteria for 1st series of compounds; only data for soil organisms taken into consideration; the separate data for the individual compounds are presented in the appendix to this report.

Denneman, C.A.J. & Gestel, C.A.M. van (1991)
Afleiding van C-waarden voor bodemecosystemen op basis van aquatisch ecotoxicologische gegevens. In Dutch: RIVM-report no. 725201008. 29 pp.
For the 1st series of compounds aquatic ecotoxicological data and QSARs were now also taken into consideration for derivation of C-values for water; from the latter values soil C-values were calculated and compared to the soil C-values previously derived leading to changes for several compounds.

E.J. van der Plassche and J.H.M. de Bruijn (1992).
Towards integrated environmental quality objectives for surface water, groundwater, sediment and soil for nine trace metals. In English: RIVM-report no. 679101005. 33 pp.
The ecotoxicological Maximum Permissable Concentrations (MPCs) and Negligible Concentrations (Ncs) are derived for surface water, groundwater, sediment and soil for nine exotic trace metals. The derivation includes secondary poisoning, derivation of partition coefficients, and selection of background levels in the different compartments.

Van der Plassche, E.J. and G.J.M. Bockting (1993).
Towards integrated environmental quality objectives for several volatile compounds. In English: RIVM-report no. 679101011. 78 pp.
The ecotoxicological Maximum Permissable Concentrations (MPCs) and Negligible Concentrations (Ncs) are derived for water, sediment and soil. In a second step the limit and target values are harmonised, because a limit value in a specific compartment may not lead to exceeding of a limit value in other compartments.

Crommentuyn, G.H., Plassche, E.J. van de & Canton, J.H. (1994).
Guidance document on the derivation of ecotoxicological criteria for serious soil contamination in view of the intervention value for soil clean-up. In English: RIVM-report no. 950011003.
Description of the methodology used to derive ecotoxicological criteria in a stepwise protocol: data needs, formulas for normalisation & standardisation, data selection & method for calculation of the several HC50-values.

Jongbloed, R.H., J. Pijnenburg, B.J.W.G. Mensink, Th.P. Traas, and R. Luttik (1994).
A model for environmental risk assessment and standard setting based on biomagnification. Top predators in terrestrial ecosystems. In English: RIVM-report no. 719101012. 99 pp.
In this study Maximal Permissable Concentrations have been derived for soil contaminants based on the risk of secondary poisoning for top predators. Secondary poisoning is based on the risks for birds and mammals through consumption of worms that are exposed to contaminated soil.

Jongbloed, R.H., J. Pijnenburg, B.J.W.G. Mensink, Th.P. Traas, and R. Luttik (1994).
A model for environmental risk assessment and standard setting based on biomagnification. Top predators in terrestrial ecosystems. In English: Annex to RIVM-report no. 719101012. 188 pp.
Annex to RIVM-report no. 719101012

Van der Plassche, E.J. (1994).
Towards integrated environmental quality objectives for several compounds with a potential for secondary poisonings. In English: RIVM-report no. 679101012. 120 pp.
The ecotoxicological Maximum Permissable Concentration (MPCs) is derived for 25 compounds with a potential for secondary poisoning. Two foodchains are taken into account: an aquatic route and a terrestrial route.

E.J. van der Plassche, J.H. Canton, Y.A. Eijs, J.W. Evers, P.J.C.M. Janssen, J.E.M. van Koten-Vermeulen, M.D. Polder, R. Posthumus, and J.M. de Stoppelaar (1994).
Towards integrated environmental quality objectives for several compounds with a potential for secondary poisonings. In English: Annex to RIVM-report no. 679101012. 130 pp.
Annex to RIVM-report no. 679101012.

De Zwart, D (1994).
Verslag Discussiebijeenkomst "Kwantificering van actuele risico's voor ecosystemen bij bodemverontreiniging" (De Bilt, 27/10/1993). In Dutch: RIVM-report 719102026. 42 pp.
Philosophical discussion on the possibilities how to deal with site specific risk assessment of ecosystems.

Crommentuijn, G.H., Posthumus, R. and D.F. Kalf (1995).
Ecotoxicological criteria for serious soil contamination in view of the intervention value for soil clean-up, second and third series of substances. In English: RIVM-report no. 715810008. 141 pp.

Posthuma. L. (1995).
An inventory on delayed effects of toxicants in biological systems. In English: RIVM-report 711311002. 28 pp.
An uncertainty in ecological risk-assessment is the occurrence of delayed effects caused by exhaustion of biological homoeostatic mechanisms, due to a mobilization of chemicals stored in soils and sediments in response to slow alterations in the environment.

Notenboom, J., Eijsackers, H.J.P. & Swartjes, F.A. (1995).
Beoordelingssystematiek ten behoeve van bouwvergunningsaanvragen. Deel III. Methodiek ter bepaling van het actuele risico voor het ecosysteem. In Dutch: RIVM-report no. 715810003. 33 pp.
Method, which provide a pragmatic assessment for determination of risks for ecosystems used during the evaluation of soil quality in dealing with requests for official building permits to be granted by local authorities.

Weltje L., L. Posthuma, F.C. Mogo, E.M. Dirven-van Breemen, R.P.M. van Veen (1995).
Toxische effecten van combinaties van cadmium, zink en koper op terrestrische oligochaeten in relatie tot bodem-chemische interacties. In Dutch: RIVM-report 719102043. 92 pp.
The joint toxicity of heavy metal combinations to soil organisms was studied. Effects of mixtures were evaluated by applying the toxic unit concept and the isobolograhpic method. Thew influence of soil chemical behaviour of the metals was also studied.

Posthuma, L, L. Weltje, F.A. Antón-Sánchez (1996).
Joint toxic effect of cadmium and pyrene on reproduction and growth of the earthworm *Eisenia andrei*. In English: RIVM-report 607506001. 38 pp.
Emperical data concerning toxic effects of PAH, cadmium and mixures.

Janssen, R.P.T., L. Postuma, R. Baerselman, H.A. den Hollander, R.P.M. van Veen, W.J.G.M. Peijnenburg (1996).

Equilibrium partitioning of heavy metals in Dutch soils: Prediction of metal accumulation in earthworms. In English: RIVM-report no. 719101028. 38 pp.

To evaluate the adequacy of the equilibrium partitioning concept in predicting metal bio-accumulation, earth worms (Eisenia andrei) was exposed in twenty Dutch field soils with moderate metal concentration. Multivariate statistical analyses suggested that the BCFs for As, Cd, Cu, and Zn are governed by the same soil characteristics that determine the equilibrium partition coefficients.

Alkemade, J.R.M., A.J. Schouten, P. Kersten, M.L.P. van Esbroek (1996).

Vergelijking van effectniveaus voor bodemorganismen met het Maximaal toelaatbaar risico. Een veldstudie naar de invloed van zware metalen in een gradiënt te Budel. In Dutch: RIVM-report 607505001. 35 pp.

The main objective is to verify ecotoxicological standards for soil by evaluation the representativeness of laboratory experiments for the toxic effects in the field situation, field-(mesocosm)experiments and research in a contaminated area.

Posthuma, L., J. Notenboom (1996).

Toxic effects of heavy metals in three worms species exposed in artificially contaminated soil substrates and contaminated soils. In English: RIVM-report 719102048. 79 pp.

Ecotoxicological effects in natural and artificial soils due to zinc and mixtures of metals were compared for three worm species. The predictability of effects in field soil from laboratory toxicity data improved when differences in metal extractability and joined effects of metals were taken into account.

Ter Meulen-Schmidt, G.R.B., W. de Vries, J. Bril, W. Ma (1996).

Programmeringsstudie Veranderend landgebruik Gedrag van geaccumuleerde stoffen in verband met veranderingen in landgebruik en herstelbaarheid van ecosystemen. In Dutch: RIVM-rapport 711401001. 122 pp.

The aim of this programming study is to determine the available knowledge and the short-, medium-, and long-term research, needed to develop a risk assessment system for the effects of mobilisation of nutrients and contaminants due to changes in land-use from agriculture to natural areas.

Jager, D.T. and T, Hamers (1997).

Estimation methods for bioaccumulation in risk assessment of organic chemicals. In English: RIVM-report 679102013. 83 pp.

In this study the methodology for estimating bioaccumulation of organic chemicals in three types of organisms (fish, earthworms and plants) is evaluated. A simple mechanistic model for estimating BCF is proposed, which performs well against measured data.

Lijzen, J.P.A., G.R.B. ter Meulen and W. de Vries (1997).

Opzet voor een Leidraad Bodembeoordeling bij natuurontwikkeling. In Dutch: RIVM-rapport 711501003. 123 pp.

The report describes a framework of a Guideline for the evaluation of soil contamination, which can be used for limiting, constructing, managing or purchasing agricultural land on behalf of nature reserves (in the framework of the Netherlands' National Ecological Network).

Posthumus, R. and G.H. Crommentuijn (in progress, planned in 1998).

Ecotoxicological criteria for serious soil contamination in view of the intervention value for soil clean-up, fourth series of substances. In English: RIVM-report no. 717701003.