Table 1a. Tolerable Daily Intake (TDI) Values Developed by International Organizations

International			TDI (RfD)			Tissue Burde	n Used to Dere	eive TDI (RfD)		Information		Transparency/		Incorporation of Most	
Organization	Date	Value	Parameter [see note A]	Basis	Tissue Value	Basis	Uncertainty Factor (UF)	Half-time in body (t _{1/2})	Absorption Fraction (f)	Source(s)	Nature of Peer Review	Reproducibilty- Public Availability	Scientific Basis	Recent Science	Notes
World Health Organization (WHO)	1990	10 pg/kg/d	Maximum TDI	Noncancer effects in humans (based on animal studies)		no effect level of 100 pg/kg/d (equivalent dose in humans) for non-cancer effects in various laboratory animals	10			Ref [27] **More detailed information on TDI derivation may be available in Ref [28]	Based on consensus of many different national and international experts. Consultation was attended by 20 experts from 11 countries, one representative from the Netherlands government, 3 observers and 5 staff from the Regional Office and WHO headquarters.	Documents available online	Studies of liver toxicity and reproductive and immunotoxicology in the various laboratory animal species identified a no-effect level of 1000 pg/kg-day. Pharmacokinetic data indicated that this was equivalent to a dose of 100 pg/kg-day in humans. Because of the inadequate data based on reproductive effects in humans, an uncertainty factor of 10 was employed by the Consultation and therefore a TDI of 10 pg/kg-day was recommended.	Based on available toxicological literature and studies available at the time of the consultation (1990).	
World Health Organization European Centre for Environmental Health (WHO- ECEH) & International Programme on Chemical Safety (IPCS)	May 1998	1-4 pg/kg/d (reported as TEQ) 4 pg/kg/d 1 pg/kg/d	Provisional TDI for lifetime exposure Maximum TDI Target TDI	Noncancer effects in humans (based on animal studies)	28-73 ng/kg bw (maternal body burden)	range of LOAELs across multiple studies for developmental and reproductive effects in rats and monkeys	10	7.5 years	50%	Ref [18]	Based on consensus of many different national and international experts. The WHO-ECEH coordinated a comprehensive programme in collaboration with IPCS. Consultation attended by 40 experts from Australia, Belgium, Canada, Denmark, Finland, Germany, Italy, Japan, The Netherlands, New Zealand, Spain, Sweden, United Kingdom, and USA and by staff from UNEP, IARC, IPCS and WHO-ECEH.	Document available online Procedure for selection of tissue burden and calculation of TDI is transparent and reproducible	The LOAELs for the most sensitive adverse responses (noncancer effects) reported in experimental animals were associated with maternal body burdens of 28-73 ng/kg bw, from which a range of estimated long-term human daily intakes of 14-37 pg/kg/d was calculated (see Table 4). An uncertainty factor of 10 was applied to account for: a) the use of a range of LOAELs instead of a NOAEL, b) the possible susceptibility differences between humans and experimental animals, c) the potential differences in susceptibilities within the human population, and d) differences in half-lives of elimination for the compounds of a complex TEQ mixture. Based on this, a final TDI, expressed as a range of 1-4 TEQ pg/kg bw (rounded figures) was established for dioxins and dioxin-like compounds.	Based on available toxicological literature and studies available at the time of the consultation (1998).	
European Commission Scientific Committee on Food (EC- SCF)	30-May-01	14 pg/kg/d 2 pg/kg/d	TWI (TDI equiv.)	Noncancer effects in humans (based on animal studies)	40 ng/kg bw (maternal body burden)	LOAEL for reproductive effects in Wistar rats (<i>Faqi et al.,</i> 1998)	9.6	7.5 years (see notes)	50% (see notes)	Ref [19]	The SCF took cognisance of comments received from the Swedish National Food Administration (2001), the Norwegian Food Control Authority (2001) and from some members of the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) of the European Commission.	Document available online Procedure for selection of tissue burden and calculation of TDI is generally transparent and reproducible (see notes)	An estimated human daily intake (EHDI) of 20 pg/kg bw/day was calculated from the estimated steady state TCDD body burden in the rat dams at the LOEL of 40 ng/kg bw. Application of a 9.6-fold safety factor to the EHDI yielded a TDI of 2 pg/kg bw/day. Due to the long half-lives of TCDD and related compounds in the human body, this figure was converted to a TWI of 14 pg/kg bw.	The EC-SCF based their updated risk assessment on the LOEL for reproductive toxicity in male offspring of pregnant rats from the study by Faqi et al (1998), rather than the rat and monkey studies used by the WHO (1998).	t _{1/2} & f not specified explicitly in Ref [19], but confirmed based on calculation of the TDI from the specified tissue burden.
Joint FAO/WHO Expert Committee on Food Additives (JECFA)	2002	70 pg/kg/d 2.3 pg/kg/d	Provisional TMI (TDI equiv.)	Noncancer effects in humans (based on animal studies)	NOAEL: 16-22 ng/kg bw LOAEL: 28-42 ng/kg bw (range of total body burdens as estimated by two different models)	NOAEL for reproductive effects in Holzman rats (Ohsako et al., 2001) LOAEL for reproductive effects in Wistar rats (Faqi et al., 1998)	NOAEL: 3 LOAEL: 9.6	7.6 years	50%	Ref [21]	Based on consensus of many different national and international experts.	Document available online Procedure for selection of tissue burden and calculation of TDI is transparent and reproducible	JECFA derived estimated human monthly intakes (EHMIs) of 237 and 330 pg TEF/kg bw, using the linear and nonlinear models, respectively, from the study by Ohsako et al (2001). The corresponding EHMI values derived from the study by Faqi et al (1998) were 423 and 630 pg TEF/kg bw. A safety factor of 3.2 was applied to the EHMIs associated with the NOEL identified by Ohsako et al (2001). JECFA considered that use of the LOEL from by Faqi et al (1998) warranted an additional safety factor of 3, leading to an overall safety factor of (3 x 3.2) = 9.6. The four resulting provisional tolerable monthly intake (PTMI) values ranged from 44 to 103 pg/kg bw/month. JECFA took the mid-point of the range (70 pg TEF/kg bw/month) as the chosen PTMI for PCDDs, PCDFs and coplanar compounds.	JECFA chose the LOEL established in the study of Faqi et al (1998) and the NOEL provided by the study of Ohsako et al (2001). Two different models were used to estimate the equivalent maternal body burden with long-term dosing: a model that assumed a linear relationship between maternal and foetal body burden, and a nonlinear model.	

Notes:

[A] Maximum TDI - Maximum Tolerable Daily Intake; life-time exposure and occasional short-term excursions above this level would have no health consequences provided that the averaged intake over long periods is not exceeded. Target TDI - Target Tolerable Daily Intake; the ultimate goal is to reduce human intake levels below this level.

TWI - Tolerable Weekly Intake; similar to maximum TDI, but expressed on a weekly basis. TDI equivalent is calculated as TWI / 7 days. TMI - Tolerable Monthly Intake; similar to maximum TDI, but expressed on a monthly basis. TDI equivalent is calculated as TMI / 30 days.

TDI is equivalent to a non-cancer Reference Dose (RfD)

Table 1b. Tolerable Daily Intake (TDI) Values Developed by Specific Nations

Nation			TDI (RfD)			Tissue Burde	e Burden Used to Dereive TDI (RfD) Information Nature of Peer Review Reproducibility- Scientific Basis Incorporation of Most								
Agency	Date	Value	Parameter [see note A]	Basis	Tissue Value	Basis	Uncertainty Factor (UF)	Half-time in body (t _{1/2})	Absorption Fraction (f)	Source(s)	Nature of Peer Review	Reproducibilty- Public Availability	Scientific Basis	Recent Science	Notes
Japan Environment Agency of Japan	June 1999	4 pg/kg/d (reported as TEQ, includes PCBs)	Lifetime TDI	Noncancer effects in humans (based on animal studies)	86 ng/kg bw	LOAEL (lowes) body burden value just below or above that at which effects are manifested across multiple studies)		7.5 years	50%	Ref [17]	The Environment Agency and the Ministry of Health and Welfare have established expert committees (the Dioxin Risk Assessment Subcommittee, Environmental Health Committee, Central Environment Council; the Living Environment Council; and the Special Dioxin Health Effects Evaluation Committee, Food Sanitation Investigation Council) and it was decided at a joint consultation earlier this year that the TDI should be re- evaluated in Japan. On 30 March 1999, a Cabinet Meeting adopted the "Basic Guidelines of Japan for the Promotion of the Measures Against Dioxins" which reauired a review of the TDI	Document available online Procedure for selection of tissue burden and calculation of TDI is transparent and reproducible	TDI (meaning the daily dose of 2,3,7,8- TCDD which is assumed to have no adverse effects on human health if taken constantly over a lifetime), which shall be a guideline for measures against dioxins taken by the national government and local governments, shall not exceed 4 pg/kg bw. Established based upon effects due to exposure during the fetal period which is the most sensitive period. Manifestation of effects such as carcinogenicity would only occur as a result of higher exposure than the established top y extrapolating results of animal tests for humans, multiplied by a factor of 0.1 for taking account of uncertainty.	A level of approximately 86 ng/kg is the lowest body burden value just below or above that at which effects are manifested and is used as the basis for estimating TDI. This body burden corresponds to a human daily intake of 43.6 pg TEQ/kg/day, to which an an uncertainty factor of 10 was applied. The resulting TDI is 4 pg/kg/d (rounded).	Ref [17]: "This report discusses the TDI of dioxins and related compounds by analyzing and assessing the discussions of the 1998 WHO Consultation and contributing new information." "this paper utilizes newly calculated values instead of the noted [WHO] body burden values." "memorandum accepts the conclusions of the WHO Consultation"
Nordic Council	2000	5 pg/kg/d	TDI	no information located		no i	Information local	ted		[Ref 23]	Recommendation of "Nordic expert group" (details on this group not located)	Summary document vailable in public journal Available documents do not provide the underlying basis for the selected TDI the selected TDI	no information located	no information located	
United Kingdom Food Standards Agency, Committee on Toxicity of Chemicals in Food (COT)	2001	2 pg/kg/d	TDI	Noncancer effects in humans (based on animal studies)	33 ng/kg bw (maternal body burden)	LOAEL for reproductive effects in Wistar rats (Faqi et al., 1998)	9.6	7.5 years	50%	Ref [29]	No information located	Document available online Procedure for selection of tissue burden and calculation of TDI is transparent and reproducible	The calculated total steady-state maternal body burden arising from the subcutaneous dosing protocol at the LOAEL from Faqi et al. is approximately 30 ng/kg bw, which would be about 33 ng/kg bw after allowing for the TCDD intake from food. The resulting tolerable daily intake for humans is 1.7 pg/kg bw/day (rounded to 2).	Evaluation included a review of the risk assessments of dioxins carried out by the WHO, the SCF, and the USEPA. Because the correct mathematical model cannot be determined based on goodness of fit, and because the regressions are determined largely by body burdens higher than those relevant for derivation of a tolerable intake, we decided to adopt a simpler method of correction using the ratios calculated directly from the lowest doses in each of the studies by Hurst et al.	

TDI is equivalent to a non-cancer Reference Dose (RfD)

Table 2. International Data on Dioxin Levels in Soil

Note: Shaded soil values represent a "residential action level"

				Soil Level	(ppt TCDD/TE	Q)			Soil Exposure Parameters			TDI (I	RfD)				Transparency/				
Nation	Agency	Value	Land Use	Interpretation/ Application	Derivation Approach	Date	Regulatory Status	Enforcement	Pathways considered	Soil Intake Rate	e Body weight	Exposur t Freq. & D	re ur. RBA	Value	Parameter [see note A]	Basis	Date	Information Source(s)	Nature of Peer Review	Reproducibilty- Public Availability	Notes
Australia	National Health and Medical Research Council (NHMRC)			not	t specified					not	t applicable	e		2.3 pg/kg/d	Maximum TDI	Adopted the TDI recommended by JECFA (2001)	2002	As provided in Ref [22]	not appliable (no soi levels identified)	I TDI value is available online	
Austria	Federal Environment Agency Austria; Contaminated Sites Department	10 100 	not specified; assumed to be all land uses residential/ recreational (see notes) industrial (see notes)	trigger value for further investigation intervention value; no description of the proper interpretation of "intervention value" was located	Uncertain; identified by expert working group	 [per document dated 2007]	guideline	Ref [25]:soil screening values are hardly recognized due to missing legal backup	Ref [25]: "The contaminate exposure scenar an expert wor Institute (ON) referrir	soil screening ad sites have r rios or the use king group es a simplified a ng to oral upta	g values us not been c e of models stablished a nd consen ake by child	sed for risk as: alculated alon s but have bee at the Austriar vative concepi dren is assum	sessment of g specific n identified by n Standards tual approach ed."	10 pg/kg/d 1 pg/kg/d (reported as TCDD)	Maximum TDI Target TDI	Appears to have adopted the maximum TDI from WHO (1990) and target TDI from WHO (1998)	 [per document dated 1999]	Soil conc: As provided in Ref [25] TDI: As provided in Ref [1] **Cited soil conc derivation source [26]	No information located	information only available in secondary reports; primary reports not available	Soil intervention values are applicable to uses for which a direct hazard from oral intake of contaminated topsoil (0-10 cm) cannot be excluded (e.g. residential areas, sport fields, playgrounds). By purpose, no soil screening values for industrial areas have been included.
Canada	Canadian Council of Ministers of the Environment (CCME)	4	all (agricultural; residential/ parkland; commercial; and industrial)	soil quality guideline (SoQG); if exceeded, further investigation is needed to determine whether or not there is a negative impact	Soil Bkg Level	Mar-05	guideline (can be used by governments on a voluntary basis to set guidelines and clean-up targets)	No information located	not applicable Details not available Ref [25]: "The methodology for the calculation of values is not available."			2.3 pg/kg/d	Maximum TDI	Adopted the TDI recommended by JECFA (2001)	Sep-05	Soil conc: Ref [2] TDI: Ref [20]	No information located	CSoQG and derivation protocol are available online.	Developed in accord with Ref [3]. The Soil Quality Guidelines Task Group develops, approves and publishes national soil quality guidelines for the protectior of environmental and human health. The National Guidelines and Standards Office of Environment Canada acts as the technical secretariat for the task group, providing technical coordination and delivery of new and revised soil quality guidelines. This guideline was determined from the average background soil concentration in Canada because exposure to higher levels is not recommended. Health Canada is doing a comprehensive reassessment of the risks posed by dioxins (per publication dated Sept 2005).		
Czech Republic	Czech Ministry of the Interior	1 100 500 1,000 10,000	not specified; assumed to be all land uses residential recreational industrial	upper level for natural bkg (set equal to 95th percentile of bkg dataset) value btwn bkg & limit of pollution limit value; maximum acceptable values that are statistically derived, not	Soil Bkg Level Basis is not documented	1994?	guideline?	Ref [25]: "No human health screening values are directly specified in the legislation legal force is rather low"	Details not available Ref [25]: "The methodology for the calculation of values is not available."				not specified	1		As provided in Ref [25] **Soil derivation source: Ref [30]	No information located	information only available in secondary reports; primary reports not available			
Denmark	not specified		L	not	t specified	1	1	1		not	t applicable	e		5 pg/kg/d (reported as N-TEQ)	Maximum TDI	Adopted the TDI recommended by Nordic Council	 [per document dated 1999]	As provided in Ref [1] and Ref [25]	not appliable (no soi levels identified)	I information only available in secondary reports	
Finland	Ministry of the Environment, Department for Environmental Protection	10	not specified; assumed to be all land uses	threshold trigger value; if value is exceeded, a site- specific assessment of contamination and remediation needs has to be carried out	Unknown	1994?	guideline Ref [25]: "values were originally meant to be advisory	No information located		Detaik	s not availa	able		5 pg/kg/d (reported as N-TEQ)	Maximum TDI	Adopted the TDI recommended by Nordic Council	 [per document dated 1999]	Soil conc & derivation: As provided in Ref [25] (based on RIVM approach)	No information located	information only available in secondary reports; primary reports not available	The threshold value for soil has been set to a concentration level, in which risks to humans and ecosystems can be considered negligible. Additionally, certain socio-economic values were taken into account in defining the threshold values.
		100	residential	lower limit guideline; if value is exceeded, soil is considered as contaminated and risk reduction measures are required	 Uncertain; likely based on TDI approach, but this cannot be 		only and not to act straightforwardly as remediation targets."		 soil ingestion; inhalation inhalation (indoors and outdoors) of particulates; dermal 	not specified	d not specifie	child+adu ED = 70 y	ult 1 rrs					TDI: As provided in Ref [1]			The software Risc-Human version 3.1. was used to derive SSLs for the land uses considered; only the CSOIL model included in the software was applied. Specific model inputs are not specified.
		1,500	industrial	upper limit guideline; if value is exceeded, soil is considered as contaminated and risk reduction measures are required	documented				exposure (indoors and outdoors); 4. consumption of homegrown vegetables.	not specified	d not specifie	adult onl d ED = 40 y	y 1 rrs								
France	Conseil Supérieur d'Hygiène Publique of France	500	not specified	VDSS: "soil source definition value"; is <u>not</u> intended to define a pollution source in a site characterization	Uncertain; likely based on TDI approach, but this	 [per document dated 2007]	guideline? Ref [25]: "VDSS and VCI should not be used	Ref [25]: "no significance outside the ranking process of the	no (set equal to 1/2 the VCI for sensitive use) 1 e e ess		1 pg/kg/d (reported as I-TEQ)	Target TDI	Appears to have adopted the target TDI from WHO (1998)	 [per document dated 1999]	Soil conc: As provided in Ref [25] TDI: As provided in Ref [1]	No information located	information only available in secondary reports; primary reports not available				
		1,000	sensitive use (playground, garden,)	VCI: "impact statement value"; based on German regulatory values; not intended to be screening values or remediation goals	cannot be documented		outside the scoring system of the ESR ("simplified risk assessment")."	ESR."	1. soil and dust ingestion; 2. ingestion of home-grown produce (residential only);	child: 150 mg/d adult: 50 mg/d	not specifie	EDchild: 6 EDadult: 2 yrs	yrs not specified 24								

Table 2. International Data on Dioxin Levels in Soil

Note: Shaded soil values represent a "residential action level"

				Soil Level	(ppt TCDD/TE	Q)			Soil Exposure Parameters			TDI (RfD)			Information	Nature of Peer	Transparency/				
Nation	Agency	Value	Land Use	Interpretation/ Application	Derivation Approach	Date	Regulatory Status	Enforcement	Pathways considered	Soil Intake Rate	e Body weight	Exposure Freq. & Dur.	RBA	Value	Parameter [see note A]	Basis	Date	Source(s)	Review	Reproducibilty- Public Availability	Notes
		10,000	non-sensitive use (industrial and commercial use, offices,)	1					and dust.	Page 116 ir Ref [25] provides detailed parameters for all	not specified	ED: 40 yrs	not specified								
Germany	German Federal Environmental Agency (Umweltbundes amt) & Joint Working Group of the Federal and Lander Ministers of the Environment	5 40 100 1,000 10,000	agricultural playgrounds residential, parks/recreation industrial, commercial	long-term goal for use (see notes) cultivation of certain foodstuffs (see notes) risk-based action levels for protection of human exposures; if exceeded, usually leads to remedial action	Basis is not documented Includes both non-cancer TDI and cancer SF approaches	July 1999	guideline? regulation {Article 8 (1) second sentence No. 2 of the Federal Soil Protection Act}	No information located No information located	Details not available Details not available Details not available Details for the derivation of the action level are unclear (see Attachment 1) Details not available Ref [25]: "multiple exposure scenario (inhalation, ingestion, skin control to explore the ASTA DESIGN DEVIDED Level			1 pg/kg/d 0.2 pg/kg/d	TDI(total) TDI(soil)	Adopted the target TDI from WHO (1998)	Oct 2002	Soil Conc provided in Ref [1], Ref [4], and Ref [25] TDI provided in Ref [24] **Cited soil conc derivation source: Ref [5]	No information located	Soil concentrations available online; derivation basis for specified soil concentrations is only available in secondary source	More recent documents summarizing soil concentration levels (e.g., Ref [25]) only include the reported action levels. Action values pursuant to Article 8 (1) second sentence No. 2 of the Federal Soil Protection Act for the direct intake of dioxins/furanes at playgrounds, in residential areas, parks and recreational facilities, and plots of land used for industrial and commercial purposes (in ng/kg dry matter, fine soil).		
Italy	National Toxicology Commission (CCTN)	10	residential/ public use commercial/ industrial use	threshold limit values for the protection of human health; if exceeded, site is considered to be polluted and remedial action must be performed; are intended to be both intervention values and remediation targets	Uncertain; likely based on TDI approach, but this cannot be documented	 [per document dated 2007]	regulation {Article 17 of Law No. 22/97, Italian Ministerial Decree No. 471/1999}	No information located Ref [25]: "future regulations concerning soil pollution and soil clean-up are in preparation"	on Details not available Ref [25]: "multiple exposure scenario (inhalation, ingestion, skin contact)applying the ASTM PS104-98 'RBCA, Risk – Based Corrective Action' procedures" oil do n Details not available			10 pg/kg/d (reported as I-TEQ, excluding PCBs)	Maximum TDI	Appears to have adopted the maximum TDI from WHO (1990)	 [per document dated 1999]	Soil Conc: As provided in Ref [25] TDI: As provided in Ref [1] **Possible soil conc derivation source: Ref [31]	No information located	information only available in secondary reports; primary reports not available	Ref [25]: "Soil values have been criticized both scientifically and practically, because they lack flexibility and do not take sufficient account of regional and local specificities."		
Japan	Environment Agency of Japan	250	not specified; assumed to be all land uses not specified; assumed to be	"survey index"; if exceeded, testing required "quality standard" for human health: if exceeded	Basis is not documented	2009	guideline?	No information located	n Details not available Details not available Details not available				4 pg/kg/d (reported as TEQ, includes PCBs)	Lifetime TDI	Noncancer effects in humans (based on animal studies) See Table 1 for details	June 1999	Ref [6], [7], [8], [9] TDI derivation details provided in: Ref [17]	No information located	Soil concentrations and TDI value available online; derivation basis for specified soil concentrations is not provided.	Ref [17]: "This report discusses the TDI of dioxins and related compounds by analyzing and assessing the discussions of the 1998 WHO Consultation and contributing new information." "this paper utilizes newly calculated values instead of the noted [WHO] body burden values." "memorandum accepts the conclusions of the WHO	
Netherlands	National	360	all land uses	intervention value (IV) for	on TDI approach, but this cannot be documented	Feb-01	regulation?	No information	1. ingestion of	child: 100) not	EDchild: 6 yrs	1	4 pg/kg/d	Maximum TDI	Adopted the	Feb-01	Soil conc and TDI	The derived SRCs	Soil derivation	Consultation"
New Zoolood	Institute for Public Health and the Environment (RIVM)	10	ogriguttural	the protection of human exposures; if exceeded, soil is deemed "seriously contaminated" and remediation will be necessary (urgency of remediation to be determined)	Approach	lun 05	{Dutch Soil Protection Act in 2007}	located	soil/dust; 2. inhalation of indoor air; 3. ingestion of contaminated crops.	mg/d adult: 50 mg/d Table 3.11 & 3.13 in Ref [12] provide detailed parameters for all pathways	specified	EDadult: 64 yrs		1 pg/kg/d	Target TDI	recommended TDIs from WHO (1998)	lun 05	provided in Ref [12]	will be reviewed by the Technical Soil Protection Committee (TCB) and (partly) by the Health Council of the Netherlands (Gezondheidsraad).	source document available online	exposures (SRChuman) for soil, sediment and groundwater, the human-toxicological Maximal Permissible Risk (MPR) level was used in combination with the CSOIL exposure model (exposure to contaminated soil). MPR reliability score = high.
New Zealand	Ministry for the Environment (MfE) and the Ministry of Health (MoH)	10 1,500 18,000 90,000 - ∞ 21,000	agricultural residential industrial, unpaved industrial, pavec maintenance	interim soil acceptance criteria; to be used as a general indication of acceptable concentrations of dioxins in soil	TDI Approach (based on WHO 1990)	Jun-05	draft guideline (see notes)	No information located	n Details not available Details not available Details not available Details not available (lower bound: industrial, unpaved * 5 [assumed protection factor]) (upper bound: assumes ongoing paving integrity or capping) Details not available			Soil Level Derivation: 10 pg/kg/d 8 pg/kg/d (reported as TEQ) Updated: 1 pg/kg/d	Maximum Oral TDI(total) TDI(soil) IMMI	Adopted the TDI from WHO (1990) Adopted the Target TDI from WHO (1998)	Jun-05	Ref [13] **Soil conc derivation and TDI source info is unpublished: Ref [14]	No information located	Soil concentrations and TDI values available online; derivation basis for specified soil concentrations is not available.	Interim Soil Acceptance Criteria are based on site- specific values developed for dioxins and furans at the Waipa Processing Complex, as part of the "Pentachlorophenol Risk Assessment Pilot Study" (NTG, 1992). Levels were calculated using a TDI of 10 pg/kg/d (WHO 1990). Care should be exercised when applying the above values to other sites, given they were developed for specific scenarios at a particular site. Since the derivation of these values, the Organochlorines Technical Advisory Committee (OTAG) has chosen to adopt the target TDI of 1 pg/kg/d (WHO 1998). This value was adjusted to represent an "interim monthly maximum intake (IMMI)".		
Sweden	Swedish Environmental Protection Agency	10	sensitive land use (residential)	Non-binding guidance values when revising land use for a contaminated area	Uncertain; likely based on TDI approach, but this	1996	guideline	No information located	Details not available			5 pg/kg/d (reported as TEQ, including PCBs)	Maximum TDI	Adopted the TDI recommended by Nordic Council	 [per document dated 1999]	As provided in Ref [1], Ref [10], and t Ref [25] **Cited soil conc	Draft versions of the soil level derivation model spreadsheet (SEPA, 2005a) and risk assessment	information only available in secondary reports; primary reports not available	Soil values are derived assuming multi-media exposures; and adjusted to account for bkg (90th percentile of bkg).		

Table 2. International Data on Dioxin Levels in Soil

Note: Shaded soil values represent a "residential action level"

Nation				Soil Level	(ppt TCDD/TE	EQ)				Soil Expos	sure Par	rameters			TDI ((RfD)		Information	Nature of Peer	Transparency/	
Nation	Agency	Value	Land Use	Interpretation/ Application	Derivation Approach	Date	Regulatory Status	Enforcement	Pathways considered	Soil Intake Rate	Body weigh	y Expos ht Freq. &	ure Dur. RBA	Value	Parameter [see note A]	Basis	Date	Source(s)	Review	Reproducibilty- Public Availability	Notes
		250	non-sensitive land use (commercial/ industrial)		cannot be documented					Details	not avai	ailable						derivation source: Ref [15] & Ref [32] **TDI source?: Ref [23]	guidance (SEPA, 2005b) are currently under review.	,	
United Kingdom	Environmental Agency, Department for Environment, Food and Rural Affairs (Defra)			in de (se	evelopment ee notes)					not a	applicab	ble		2 pg/kg/d	TDI(total) TDI(soil)	Adopted the TDI recommended by COT (2001) TDI for soil specified in Ref [16]	March 2003	Ref [16]	not appliable (no so levels identified)	I Documents are available online	Defra reviewed evaluations by numerous Expert Committees. There was general consensus that the critical effects include immunological, developmental and reproductive effects, and that cancer effects are mediated via receptor-based non-genotoxic mechanism, so protection against non-cancer effects is also protective for cancer. Exposure is best characterized using a tissue-burden based dose metric, and a NOAEL- LOAEL approach with uncertainty factors is appropriate for estimating a Tolerable Daily Intake (TDI). Almost all estimates of TDI are about 2 pg/kg/day (total). Most of this comes from the diet. Allowing 20% of total to come from soil yields TDI(soil) = 0.4 pg/kg/day. Final step needed is to estimate PRG (soil guideline value = SGV) from TDI. Defra uses a Contaminated Land Exposure Assessment (CLEA) software program to do this. Using standard USEPA exposure methods, the PRG would be estiimated as follows: PRG = TDI / (IR/BW * RBA) Assuming IR = 0.1 g/day for a 70 kg person, the PRG for soil would be in the range of 300-3000 ppt, depending on assumed RBA for dioxin in soil.

Countries where no information was located on dioxin soil levels and/or TDI (per Ref [1], Ref [25]): Belgium, Greece, Ireland, Lithuania, Poland, Portugal, Slovakia, Spain (in development per Ref [1])

Notes:

[A] Maximum TDI - Maximum Tolerable Daily Intake; life-time exposure and occasional short-term excursions above this level would have no health consequences provided that the averaged intake over long periods is not exceeded. Target TDI - Target Tolerable Daily Intake; the ultimate goal is to reduce human intake levels below this level. TWI - Tolerable Weekly Intake; similar to maximum TDI, but expressed on a weekly basis. TDI equivalent is calculated as TWI / 7 days.

TMI - Tolerable Monthly Intake; similar to maximum TDI, but expressed on a monthly basis. TDI equivalent is calculated as TMI / 30 days.

TDI is equivalent to a non-cancer Reference Dose (RfD)

Fable 3. Summar	y of Inte	rnational	Soil L	_evels	for	Dioxin
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Nation		Screening	Action Level (ppt TCDD/TEQ)	Soil Action Level	Exposure	TDI (RfD)		Regulatory
Nation	Agency	Level (ppt TCDD/TEQ)	Residential	Commercial/ Industrial	Derivation Approach	Pathways Considered	(pg/kg-d)	Date	Status
Austria	Federal Environment Agency Austria; Contaminated Sites Department	10	100		[9]	n/a	1 - 10	[2]	guideline
Canada	Canadian Council of Ministers of the Environment (CCME)	4			[11]	n/a	n/a	Mar-05	guideline
Czech Republic	Czech Ministry of the Interior	1 - 100	500	10,000	Basis is not documented ^[12]	n/a		1994?	guideline?
Finland	Ministry of the Environment, Department for Environmental Protection	10	100	1,500	TDI Approach ^[1]	Ing. (soil and plant), Inhal., Dermal	5	1994?	guideline
France	Conseil Supérieur d'Hygiène Publique of France		[8]		TDI Approach [1]	Ing. (soil and plant), Dermal	1	[2]	guideline?
Germany	German Federal Environmental Agency (Umweltbundesamt) & Joint Working Group of the Federal and Lander Ministers of the Environment		1,000	10,000	TDI and oSF Approach	Ing. (soil only), Inhal.	1 [4]	July 1999	regulation
Italy	National Toxicology Commission (CCTN)		10	100	TDI Approach ^[1]	n/a	10	[2]	regulation ^[3]
Japan	Environment Agency of Japan	250	1,0	00 ^[7]	TDI Approach [1]	n/a	4	2009	guideline?
Netherlands	National Institute for Public Health and the Environment (RIVM)		360		TDI Approach	Ing. (soil and plant), Inhal.	1 - 4	Feb-01	regulation?
New Zealand	Ministry for the Environment (MfE) and the Ministry of Health (MoH)		1,500 ^[10]	18,000 ^[6,10]	TDI Approach	n/a	10 [5]	Jun-05	draft guideline
Sweden	Swedish Environmental Protection Agency	10 - 250			TDI Approach [1]	n/a	5	1996	guideline

See Table 2 for detailed information on soil levels and derivation approach

^[1] Uncertain; likely based on TDI approach, but this cannot be documented

^[2] Soil levels provided in a document dated 2007.

^[3] Soil values have been criticized both scientifically and practically, because they lack flexibility and do not take sufficient account of regional and local specificities. Future regulations concerning soil pollution and soil cleanup are in preparation.

^[4] Uses an adjusted TDI of 0.2 pg/kg/d (to account from fraction of TDI attributable to soil).

^[5] Uses an adjusted TDI of 8 pg/kg/d (to account from fraction of TDI attributable to contaminated soil). Since the derivation of these soil levels, New Zealand has adopted target TDI of 1 pg/kg-d.

^[6] Applicable to unpaved areas.

^[7] Reported action levels are applicable to all land uses.

^[8] Derived soil values are not intended to be screening values or remediation goals and should not be used outside of the simplified risk assessment scoring system.

^[9] Uncertain; identified by expert working group.

^[10] Site-specific values are used as interim soil acceptance criteria; use care when applying values to other sites.

^[11] No action levels specified; screening level is based on a background soil approach.

^[12] Screening levels are based on a background soil approach.

TDI = Tolerable Daily Intake; equivalent to a non-cancer Reference Dose (RfD)

Table 4.	Evaluation	of TDI	Values	and Soil	Action	Levels
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TDI Values

	Nature of peer review	Transparency/ Reproducability & Public Availability	Scientific basis	Incorporation of new science
WHO 1990	•	•	•	
WHO 1998	•	•	•	
EC-SCF 2001	•	•	•	
JECFA 2001	•	•	•	
Japan 1999	0	•	•	
Nordic Council 2000	Х	X	Х	
UK, COT 2001	X	•	•	

Soil Action Levels

	Nature of peer review	Transparency/ Reproducability & Public Availability	Scientific basis	Incorporation of new science
Austria	X	X	X	
Czech Republic	X	X	X	
Finland	X	0	О	
Germany	X	0	•	
Italy	X	X	X	
Japan	X	X	X	
Netherlands	0	•	•	
New Zealand	X	X	X	

Legend:

•	
0	
Х	

meets evaluation criteria in full

meets evaluation criteria in part

does not meet evaluation criteria or no information was located

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Figure 1. International Screening Level and Action Levels



Panel A: Screening Levels









#N/A = not available

Figure 2. International Action Levels Stratified by Adopted TDI



Panel A: Residential Action Levels





#N/A = not available

				Soil Exposure	e Paramete	rs used in Trig	ger Level C	Calculation		Estimated	Specified
Nation	Agency	Land Use	Pathways considered	Intake Rate	Body weight	Exposure Freq. & Dur.	RBA	Target risk or hazard	Daily Intake Rate (mg/kg-d)	Trigger Level (ppt)**	Action Level (ppt)
Germany	German Federal Environmental	playgrounds	 ingestion of soil; inhalation of 	ing: 500 mg/d inh: 0.625 m ³ /hr	10 kg	EF=240 d/yr ET=2 hr/d ED=8 yrs	not specified	HQ=1 Risk=1E-05	ing: 33 inhal: 0.082	~73	100
	Agency (Umweltbundes amt) & Joint Working Group	residential	soil particles.	il particles. (residential: set equal to 1/2 playground daily intake rates) inhal: (1,000
	of the Federal and Lander Ministers of the	parks/recreation		(parks/recreati	on: set equa	al to 1/5 playgro	ound daily in	take rates)	ing: 6.6 inhal: 0.016	~364	1,000
	Environment	industrial, commercial	1. inhalation of soil particles	not specified	not specified	EF=225 d/yr ET=8 hr/d	not specified	HQ=1 Risk=1E-05	inhal:		10,000

ATTACHMENT 1 DERIVATION DETAILS FOR THE COMPUTATION OF GERMANY TRIGGER LEVELS

**only incorporates soil ingestion pathway