

## Appendix D Summary of NZ and Overseas Soil Guidelines for Dioxin

### D.1 Summary

A summary of dioxin soil criteria established for residential soil in New Zealand and overseas is provided in Table D-1. Further details for each country are provided following the summary table. References to dioxin in this summary are either to TCDD or to TEQ.

<b>Table D-1:</b> Summary of dioxin criteria		
<b>Country</b>	<b>Residential soil criteria</b>	<b>Comment [Reference]</b>
New Zealand	1,500 ng I-TEQ/kg	Present criterion - set as an interim value in the timber treatment guidelines. Currently under review. (MfE/MoH, 1997).
Germany	1,000 ng I-TEQ/kg	Set as an "action value" by the Federal Soil Protection and Contaminated Sites Ordinance (BodSchV) (BMU, 1999).
Japan	1,000 ng TEQ/kg	Environmental Quality Standard set under the Law Concerning Special Measures against Dioxin (Law No. 105 of 1999) (MoE, 2001)
Canada	4 ng TEQ/kg	Soil Quality Guideline. Derived using ambient background concentrations; i.e. is not effects based. (CCME, 2001)
United States Federal Environmental Protection Agency (USEPA)	1,000 ng TEQ/kg	Preliminary Remediation Goal. Based on criterion developed by Kimbrough <i>et al.</i> (1984).
USEPA Region 6	39 ng/kg (for TCDD) <sup>1</sup>	Screening Level for 2,3,7,8-TCDD [US EPA R6, 2001]
USEPA Region 9	39 ng/kg (for TCDD) <sup>1</sup>	Preliminary Remediation Goal for 2,3,7,8-TCDD (US EPA R9, 2000)
Michigan Department of Environmental Quality	90 ng TEQ/kg	Direct Contact Criterion. Derived based on a 1 in 100,000 cancer risk. (DEQ, 1998)
US Department of Health and Human Services – Agency for Toxic Substances and Disease Register	≤50 ng TEQ/kg >50 – <1,000 ng TEQ/kg ≥1,000 ng TEQ/kg	Screening level Evaluation level Action level. (ATSDR, 1998).
Notes:		
1. Set at 3.9 ng/kg for a one in a million cancer risk. Figure of 39 ng/kg is adjusted value for 1 in 100,000 cancer risk, consistent with other NZ guideline values.		

## D.2 Country Specific Dioxin Criteria

### D.2.1 New Zealand

The current New Zealand criterion of 1500 ng TEQ/kg dry weight is taken from the timber treatment guidelines published by the MfE and MoH (1997). This criterion was established as an interim guideline value.

The 1500 ng TEQ/kg value was derived using a risk methodology and was based on a tolerable daily intake (TDI) of 10 µg TEQ/kg bw/day. This TDI has since been superseded by an Interim Maximum Monthly Intake of 30 µg TEQ/kg bw/month (MoH, 2002), which, when expressed on a daily basis, is equivalent to one tenth the TDI used to derive the timber treatment guideline value.

The timber treatment guideline value is currently under review, which is expected to be completed by June 30 2003.

### D.2.2 Germany

The Federal Soil Protection and Contaminated Sites Ordinance (BodSchV) has set the following action values (ng I-TEQ/kg dry matter) for the protection of human health (BMU, 1999):

✦ Playgrounds	100
✦ Residential areas	1,000
✦ Parks and recreational facilities	1,000
✦ Land used for industrial and commercial purposes	10,000

The action values are for the direct intake of dioxins for the "soil-human health" pathway.

### D.2.3 Japan

The Japanese Government have set an environmental quality standard for soil of 1,000 ng TEQ/kg, with an index of research of 250 ng TEQ/kg (MoE, 2001). If the soil concentration exceeds the index of research, then investigations need to be undertaken. The environmental quality standard is set under Article 7 of the Law Concerning Special Measures against Dioxin (Law No. 105 of 1999) (EA, 1999).

The environmental quality standard was established taking account of the direct intake of dioxin from soils, and is applied to residential (as well as agricultural and industrial) land (Takabatake, pers com).

The standard was set for the protection of human health and promotion of necessary policy measures. When an area's dioxin contamination exceeds the environmental quality standard the responsible prefectural governor can specify it as a soil protection policy area based on the Law Concerning Special Measures against Dioxin. The local

government must take necessary corrective action, including removal of contaminated soil (EA, 1999; MoE, 2001b).

#### D.2.4 Canada

The basis for the Canadian policy on dioxins is their classification of dioxin as 'toxic' under the Canadian Environmental Protection Act. As such, they are slated for virtual elimination under the federal Toxic Substances Management Policy and the CCME Policy for the Management of Toxic Substances.

In 2001, as part of their Environmental Quality Guidelines, the Canadian Council of Ministers of the Environment (CCME) set a soil quality guideline for residential/parkland of 4 ng TEQ/kg (CCME, 2001). The same value also applies to agricultural, commercial and industrial land. This soil quality guideline replaces the interim soil quality criteria set in 1991.

The 4 ng TEQ/kg was set because it was considered representative of the mean background concentration of dioxins in Canadian soils. For residential/parkland use, exposure analysis showed that the estimated daily intake (EDI) for the most sensitive receptor was greater than the tolerable daily intake (TDI), and therefore according to CCME protocol, it is desirable to prevent or disallow any additional soil contamination above background levels. Consequently the soil quality guidelines were set based on mean background ambient concentrations.

The supporting documentation notes that:

*the soil quality guidelines for dioxins are considered to be management levels, rather than levels that are protective of human or environmental health, because they are not effects based. However, due to the conservative nature of the TDI and EDI values and of the guideline derivation protocol, risks associated with ambient levels are considered to be minimal.*

#### D.2.5 United States

##### Federal EPA

The EPA is the primary agency for setting regulations for air, water and soil in the United States. It can receive input from other agencies, such as the Centres for Disease Control (CDC) or the ATSDR, and has often relied on data developed by these agencies, but it is not under any mandate to accept their recommendations.

The current preliminary remediation goal (PRG) adopted by the federal EPA is 1,000 ng TEQ/kg. This dates back to Times Beach and several other early cases of soil contamination. Renate Kimbrough, then employed by CDC, worked in an official capacity in evaluating the health effects at those sites. She and her co-workers developed the

criterion of 1,000 ng/kg for 2,3,7,8-TCDD, articulated in Kimbrough et al. (1984), which was subsequently adopted by CDC, ATSDR, and the EPA. Their paper states:

*One ppb of 2,3,7,8-TCDD in soil is a reasonable level at which to begin consideration of action to limit human exposure to contaminated soil. This 1,000 ng/kg level was used as the clean-up standard for Times Beach.*

The policy directive for EPA's clean-up criteria is best articulated in a memo by Timothy Fields, Jr. Acting Administrator in the Office of Solid Waste and Emergency Response (OSWER), dated April 13 1998 (Fields, 1998). This is OSWER Directive 9200.4-26. It states:

*One ppb (TEQs, or toxicity equivalents) is to be generally used as a starting point for setting cleanup levels for CERCLA removal sites and as a PRG for remedial sites for dioxin in the surface soil involving a residential exposure scenario.*

The EPA have urged the various EPA regions to follow this guidance and do not believe it is prudent to establish new, and possibly varying, precedents for dioxin levels in soil prior to the release of the EPA dioxin reassessment report (see actions taken by various EPA regions as outlined below). This is specifically addressed in the latter portion of the Fields memo:

*In the interim, for sites that require the establishment of a final dioxin soil cleanup level prior to the release of the reassessment report and development of OSWER guidance, EPA should generally use 1 ppb (TEQs) as a starting point for residential soil cleanup levels for CERCLA non-time critical removal sites (time permitting, for emergency and time critical sites) and as a PRG for remedial sites.*

#### EPA Region 6 and Region 9

EPA Regions 6 and 9 have set their own risk-based criteria for 2,3,7,8-TCDD for residential land use. The derivations of these criteria are consistent with the USEPA Soil Screening Guidance (USEPA, 1996a, 1996b).

The Region 6 criterion, referred to as a Human Health Medium-Specific Screening Level, is 3.9 ng/kg for residential soil (USEPA R6, 2001). Similarly, the Region 9 criterion, referred to as a Preliminary Remediation Goal (PRG), is also 3.9 ng/kg for residential soil (USEPA R9, 2000).

These criteria are based on a one in 1,000,000 cancer risk, and take into consideration exposure via soil ingestion, inhalation of particles and dermal absorption. The method of their derivation allows for the criteria to be adjusted for different cancer risks. For a one in 100,000 cancer risk (the risk normally adopted for the setting of New Zealand standards and guidelines), the adjusted criteria for 2,3,7,8-TCDD become 39 ng/kg.

The Region 6 and Region 9 criteria are applied as a screening level, triggering further investigation, and are not regulatory values. Region 9 states that PRGs are considered to be protective of humans, including sensitive groups, over a lifetime. Chemical concentrations above these levels would not automatically designate a site as “dirty” or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates.

#### Michigan Department of Environmental Quality

The Department of Environmental Quality has established generic criteria for a range of contaminants in soil, including dioxin (DEQ, 1998). These direct contact criteria are risk based concentrations that are considered to be protective against adverse health effects due to long-term ingestion of and dermal contact with contaminated soil.

For residential land, and using a one in 100,000 cancer risk, the direct contact criterion for 2,3,7,8-TCDD is 90 ng/kg. This is also applied as 90 ng TEQ/kg for all PCDDs and PCDFs, which are considered as one hazardous substance. The residential land use setting includes single family dwellings, condominiums and apartment buildings.

#### Agency for Toxic Substances and Disease Registry

The ATSDR has adopted a policy guideline to assess the public health implications of dioxin and dioxin-like compounds in residential soils (ATSDR, 1998). The policy applies to human exposure for the direct ingestion of soils contaminated with dioxin.

The guideline specifies a screening level of  $\leq 50$  ng TEQ/kg, an evaluation level of  $>50$  but  $<1,000$  ng TEQ/kg and an action level of  $\geq 1,000$  ng TEQ/kg.

The screening level is based on a minimal risk level (MRL) of 1 picogram/kilogram body weight/day (1 pg/kg bw/day) for 2,3,7,8-TCDD.<sup>16</sup> When concentrations exceed 50 ng TEQ/kg, site specific evaluations are needed. Evaluation levels consider site specific factors such as bioavailability, ingestion rates, pathway analysis, soil cover, community concerns, background exposures. When exposures to dioxin concentrations in residential soils exceed 1,000 ng TEQ/kg, public health actions such as surveillance, research, health studies and exposure investigations are considered. The ATSDR action level of 1,000 ng TEQ/kg is based on the original work of Kimbrough et al. (1984).

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<sup>16</sup> An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration and route of exposure. The Ministry of Health has recently adopted an interim maximum monthly intake of 30 pg/kg bw/month (MoH, 2002), which is equivalent to the MRL of 1 pg/kg bw/day recommended by the ATSDR and used by them to develop their dioxin screening level.

ATSDR conclude that:

*the action level of 1 ng/kg (TEQ) for dioxin and dioxin-like compounds, when coupled to a site-specific context of evaluation for the range >50 ng/kg to <1,000 ng/kg TEQs in residential soil, is protective of public health and continues to represent a level at which consideration of health action to indirect exposure, including clean-up, should occur.*

#### D.2.6 Other Known Guideline Values

The following information is taken from AEA Technology (1999). This report provided a summary of European Union member-state legislation. However, the details given for soil criteria were not comprehensive, some questions remain about application of the dioxin values reported and their current standing is unknown.

#### D.2.7 Finland

The Ministry of the Environment, Department for Environmental Protection have proposed a guideline of 2 ng I-TEQ/kg and a limit value of 500 ng I-TEQ/kg for contaminated soils. The report (AEA Technology, 1999) indicates that the 500 ng I-TEQ/kg value is applicable to residential soils. When this guideline and limit value were set, and the basis for their derivation is not stated.

#### D.2.8 The Netherlands

No legislative standards have been set for dioxins in soil. In 1987 guidance levels were proposed for soil pollution that included values of 1000 ng I-TEQ/kg dry matter for residential areas and 10 ng I-TEQ/kg dry matter for dairy farming (AEA Technology, 1999; Zorge and Liem, 1994). The basis for these values is unclear; they are also somewhat old.

#### D.2.9 Sweden

There are generic guidance values for risk assessment involving dioxin concentrations in soil. They are not binding and are applicable when it is intended that the use of a contaminated area be changed to residential, agricultural and other such uses. If the current levels exceed the guidance values, decisions on site remediation must be taken on a case-by-case basis. The guidelines are:

- ✦ Land with sensitive use            10 ng I-TEQ/kg dry matter
- ✦ Land with less sensitive use    250 ng I-TEQ/kg dry matter.

AEA Technology (1999) indicates that residential soil is categorised as "land with sensitive use", whereas industrial areas are "land with less sensitive use". The basis for the derivation of these values is not stated.

### D.3 References

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