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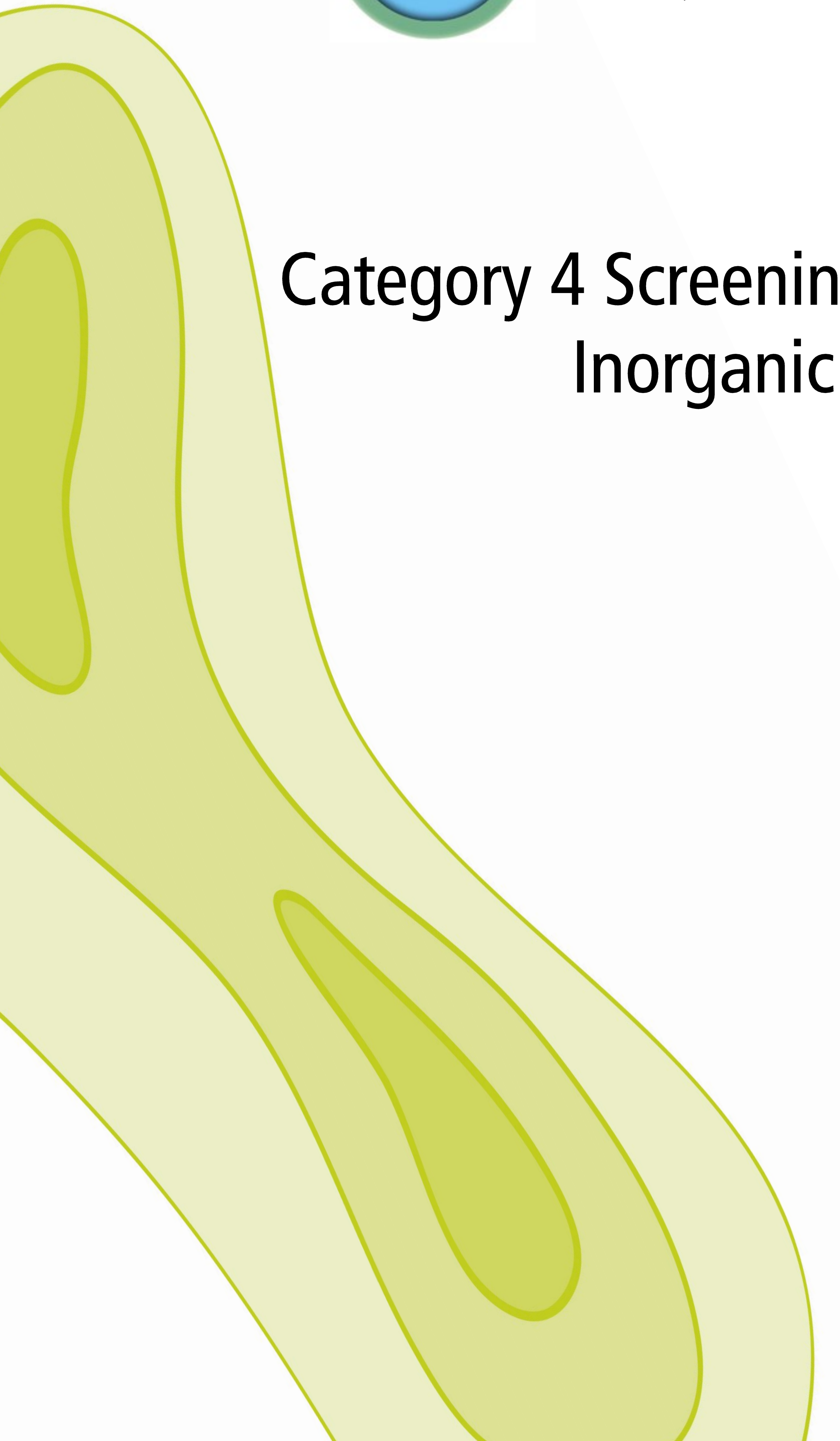
Category 4 Screening Levels: Inorganic Mercury



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Foreword by Frank Evans, Chair of SAGTA

Looking back, the original Defra work from 2014 that developed the Category 4 Screening Levels (C4SL) was important in establishing the level at which risk from land contamination was considered to be acceptably low. It also provided a useful scientific framework for making this assessment of risk. I was also impressed by the delivery model used to create the Soil Generic Assessment Criteria in 2010 and in particular the strength that comes from the collective efforts of a group of experts and peers.

This report presents an output from a phase 2 project to develop a further set of C4SL. It is the result of a cross-industry collaboration brought together by seed funding from SAGTA, project management from CL:AIRE and a project team made up of a number of toxicologists and exposure modellers who have given considerable time and expertise. This guidance document would not have been possible without everyone's collaborative working, determination, and enthusiasm. My deepest thanks go to them, and to the members of the Steering Group who have overseen the development of this guidance document.

I would also acknowledge the effort and commitment of Doug Laidler who was the long-standing secretary of SAGTA and who played an important role in initiating and coordinating the project. Sadly, Doug died in the autumn of 2019 and as with so many other matters in his life, was unable to see this work brought to conclusion. May he rest in peace.

FW Evans

Frank Evans
Chair of SAGTA

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CONTENTS

APPENDICES

ABBREVIATIONS

ADE	Average Daily Exposure
AIC	Akaike Information Criteria
ATSDR	Agency for Toxic Substances and Disease Registry
BMD	Benchmark Dose
BMDL	Lower Confidence Limit of BMD
BMDS	Benchmark Dose Software
BMR	Benchmark Response
C4SL	Category Four Screening Level
CAS	Chemical Abstracts Service
CDM	Camp Dresser and McKee
CL:AIRE	Contaminated Land: Applications in Real Environments
CLEA	Contaminated Land Exposure Assessment
CSAF	Chemical Specific Assessment Factor
COT	Committee on Toxicology of Chemicals in Food, Consumer Products and the Environment
Defra	Department for Environment, Food and Rural Affairs
DWI	Drinking Water Inspectorate
EFSA	European Food Safety Authority
ELCR	Excess Lifetime Cancer Risk
HBGV	Health Based Guidance Value
HCV	Health Criteria Value
Hg	Mercury
JECFA	Joint FAO/WHO Expert Committee on Food Additives
LLTC	Low Levels of Toxicological Concern
LLTC$_{inhal}$	Low Levels of Toxicological Concern - Inhalation
LLTC$_{oral}$	Low Levels of Toxicological Concern - Oral
LOAEL	Lowest Observed Adverse Effect Level
MDI	Mean Daily Intake
NBC	Normal Background Concentration
NOAEL	No Observed Adverse Effect Level
NTP	National Toxicology Program
PHE	Public Health England
POD	Point of Departure
POS	Public Open Space
POS$_{park}$	Public Open Space - Park
POS$_{resi}$	Public Open Space – Residential
RIVM	National Institute of Public Health and the Environment
SAGTA	Soil and Groundwater Technology Association
SGV	Soil Guideline Value
SoBRA	Society of Brownfield Risk Assessment
SR	Science Report
TDI	Tolerable Daily Intake
UBM	Unified BARGE Method
UF	Uncertainty Factor
UK	United Kingdom
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

1. INTRODUCTION

This report presents Category 4 Screening Levels (C4SLs) for inorganic forms of mercury (excluding elemental mercury) based on the methodology described in Section 5 of CL:AIRE (2014) “SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination”. Section 1.1 provides brief background information on inorganic mercury, while Section 2 summarises the toxicological review from which Low Levels of Toxicological Concern (LLTCs) are identified. Section 3 presents the exposure modelling aspects for the generic land-uses under consideration, while Section 4 presents the C4SLs.

1.1 BRIEF OVERVIEW OF INORGANIC MERCURY

Mercury is most commonly encountered in soil as inorganic mercuric compounds, but can occasionally also be found in its elemental form or as monomethylated mercury compounds with the general formula, CH_3HgX (where X represents common anions including chloride, nitrate, sulfate and sulfide). **The C4SLs presented herein are for inorganic mercury only and should not be used for assessing risks from elemental mercury or methyl mercury**. If the presence of elemental mercury or methyl mercury in soil is known or suspected then further consideration of the risks from these substances will be required (see Section 4.2 for further discussion on this).

Mercury forms inorganic compounds in mercurous (Hg(I)) and mercuric (Hg(II)) valent states (O’Connor *et al.*, 2019). The principal source of mercury is the naturally occurring mineral cinnabar (mercury[II]sulfide - HgS), an insoluble stable compound (ATSDR, 1999).

Mercuric chloride (CAS No. 7487-94-7) has the chemical formula $HgCl_2$ and is commonly used for experimental studies on the toxicology and environmental behaviour of inorganic mercury. Monomethylated mercury compounds are most likely to be found in soil as a result of natural microbial transformation of inorganic mercury.

Mercury has been used by humans since ancient times and was known to the Egyptians, Chinese and Indians (Steinnes, 1995; Kabata-Pendias and Mukherjee, 2007). More recently, it was used in agriculture, alkaline batteries, chloralkali plants, dental fillings, paints, pharmaceuticals, thermometers, and in electrical apparatus. Many of these applications have now been phased out in western countries (Steinnes, 1995; ATSDR, 1999; Kabata-Pendias and Mukherjee, 2007). Global production fell markedly during the 20th Century, with new mercury production in the European Union between 550–680 tonnes in 1999 (Kabata-Pendias and Mukherjee, 2007). During the latter years of the 20th Century, mercury was used primarily in the recovery of gold and silver from ores, and in the manufacture of fulminate (explosive salt) and vermillion (red pigment) (Steinnes, 1995).

The United Nations’ Minamata Convention on Mercury is an international treaty designed to protect global human health and the environment from the adverse effects of exposure to mercury. The convention came into force in the UK in 2018 (Treaty Series No.9, 2018). Article 12 relating to contaminated sites gives generalised statements on risk assessment/management but nothing specific that would impact the derivation or use of the C4SLs for mercury.

2. DERIVATION OF LOW LEVEL OF TOXICOLOGICAL CONCERN FOR INORGANIC MERCURY

A framework for evaluating chemical-specific toxicology data for the purposes of LLTC derivation is presented in the form of a flowchart in Figure 2.2 of SP1010 (CL:AIRE, 2014) and reproduced below as Figure 2.1. The remainder of this section demonstrates the application of this framework to inorganic forms of mercury. Organic forms of mercury (including methyl mercury) and mercury in its elemental form are not considered within this report. A proforma summarising the pertinent information referred to in this section is included as Appendix A.

As indicated in Figure 2.1, the first task is to perform a review of existing health based guidance values (HBGV) for all routes of exposure, collating information from authoritative bodies, as per the process in SR2 (Environment Agency, 2009a).

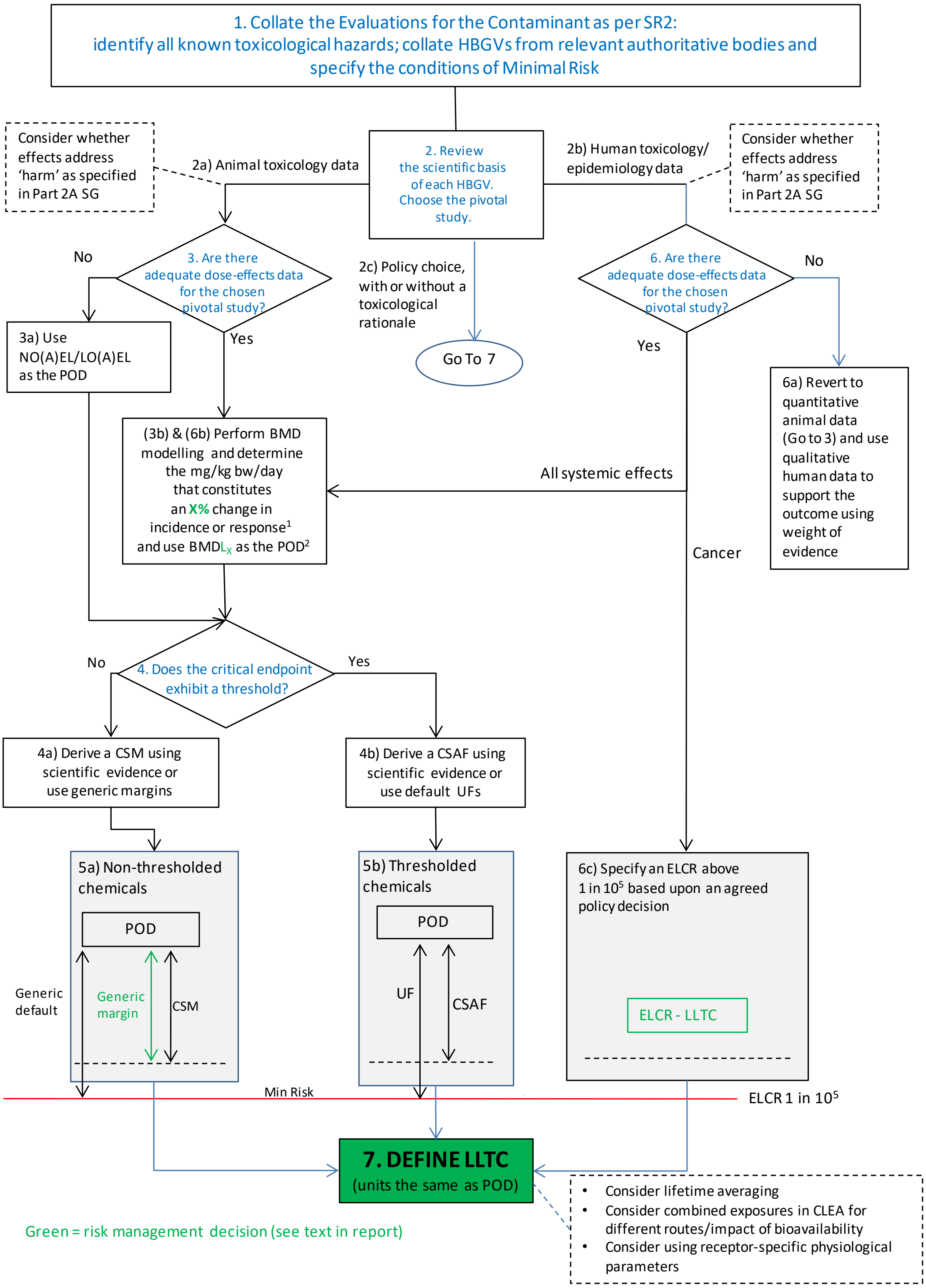

Figure 2.1: A framework for evaluating chemical-specific toxicology data for the purposes of LLTC derivation (reproduced from Figure 2.2 of SP1010 (CL:AIRE, 2014)).

2.1 ORAL ROUTE

2.1.1 FLOWCHART ELEMENT 1: Collate the evaluations for the contaminant as per SR2: identify all known toxicological hazards; collate HBGVs from relevant authoritative bodies and specify the conditions of minimal risk

A review of toxicological hazards and available HBGVs presented by authoritative bodies for the oral route of exposure has been undertaken and is provided in Appendix A. This review indicates that nephrotoxicity (kidney effects), including increased relative and absolute kidney weights (ATSDR, 1999), mild nephropathy (NTP, 1993), renal tubule necrosis (NTP, 1993) and autoimmune glomerulonephritis (US EPA, 1995), are the most sensitive[1] toxicological effects by the oral route.

2.1.2 FLOWCHART ELEMENT 2: Review the scientific basis of each HBGV. Choose the pivotal study

Three possible options are provided for the type of pivotal study that could be chosen at this point, *i.e.* in the form of: 1) animal toxicology data; 2) human toxicology/epidemiology data; and 3) a policy choice (*i.e.* based on an existing guideline from another regime, with or without a toxicological rationale).

2a) Animal Toxicology Data

As shown in Appendix A the pivotal studies selected by authoritative bodies for derivation of an oral HBGV all involve exposure of animals to mercuric chloride.

The most sensitive toxic endpoint selected from the toxicity studies available is mild nephropathy. Based on all the data available, the National Toxicology Program (NTP) study has been selected as the pivotal study (NTP, 1993).

In a 6-month oral gavage study, Fischer 344 rats (10/sex/group) were administered 0, 0.312, 0.625, 1.25, 2.5 or 5 mg kg^{-1} bw day^{-1} as mercuric chloride (adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg kg^{-1} bw day^{-1} as mercury), 5 days per week for 26 weeks.

Increased relative and absolute kidney weights were observed at 0.46 mg Hg kg^{-1} bw day^{-1} in both males and females and renal tubule necrosis at higher doses. Mild nephropathy, characterised by foci of tubular regeneration, thickened tubular basement membrane and scattered dilated tubules containing hyaline casts, was observed in the two low-dose groups.

Increased kidney weight without accompanying clinical chemistry or histopathological signs is not considered to represent an adverse effect and therefore is not the preferred approach to use as the basis for the oral LLTC. Mild nephropathy has therefore been used as the critical endpoint for derivation of the LLTC.

The NTP (1993) study was selected as the pivotal study by the US Agency for Toxic Substances and Disease Registry (ATSDR) (1999), the Netherlands National Institute of Public Health and the Environment (RIVM) (2001), the World Health Organization (WHO) (2003), the Joint FAO/WHO Expert Committee on Food Additives (JECFA) (2011) and the European Food Safety Authority (EFSA) for derivation of their threshold oral HBGV.

GO TO FLOWCHART ELEMENT 3

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[1] In defining minimal/tolerable risk, it is only necessary to focus on the most sensitive of all effects in defining the HBGV. In order to choose a point on the dose-response curve that is higher than minimal/tolerable risk, it is important to note that the dose-responses for the most sensitive effects may overlap with other effects. Therefore, in setting the LLTC, ALL endpoints must be borne in mind. This is an important principle in any of the toxicological evaluations where there are overlapping toxicological effects data, and is an important departure from the principles of how SR2 and minimal risk evaluations are implemented more simply.

2b) Human Toxicology/Epidemiology Data

Not applicable to the derivation of an oral LLTC for inorganic mercury.

GO TO FLOWCHART ELEMENT 6

2c) Policy choice, with or without a toxicological rationale

The UK drinking water standard for mercury is 1.0 µg L^{-1} which is equivalent to an intake of 0.03 µg kg^{-1} bw day^{-1} for a 70 kg adult drinking 2 L of water per day. This is lower than the $LLTC_{oral}$ derived from toxicological data (see Section 2.1.10) and does not affect the final choice of $LLTC_{oral}$. This is consistent with the position that the C4SL should not disproportionately target exposure to soil compared to other media such as water or air (CL:AIRE, 2014).

GO TO FLOWCHART ELEMENT 7

2.1.3 FLOWCHART ELEMENT 3/6: Are there adequate dose-effects data for the chosen pivotal study to perform BMD modelling – animal data?

Yes	No	Not applicable
X		

The data from the NTP (1993) study on nephrotoxicity effects will be considered as the pivotal study from which to derive an $LLTC_{oral}$. These data were used by ATSDR (1999), RIVM (2001), WHO (2003) and JECFA (2011) as the pivotal study for derivation of their threshold oral HBGV.

GO TO FLOWCHART ELEMENT 3a/b or 6a/b/c

2.1.4 FLOWCHART ELEMENT 3a: Use NOAEL/LOAEL as POD

Not applicable. There are adequate quantitative data available to enable benchmark dose (BMD) modelling for the $LLTC_{oral}$.

2.1.5 FLOWCHART ELEMENT 3b/6b: Perform BMD modelling

There are good quantitative data available from the NTP (1993) study that EFSA used to carry out BMD modelling to determine a threshold oral HBGV. However, EFSA used increased relative kidney weight in male rats as the critical endpoint (EFSA, 2018) whereas, as discussed in Section 2.1.2, mild nephropathy has been selected as the critical endpoint for the derivation of the $LLTC_{oral}$.

BMD modelling was carried out to derive the $LLTC_{oral}$ for inorganic mercury using US Environmental Protection Agency (US EPA) Benchmark Dose Software (BMDS) (version 2.7) based on mild nephropathy in male Fischer rats exposed to mercuric chloride by gavage for six months (NTP, 1993).

The dose-response models used to fit the data included:

- Gamma model
- Logistic model
- LogLogistic model
- LogProbit model
- Multistage model
- Probit model
- Weibull model
- Quantal-Linear model

From the NTP (1993) data, the BMD_{10} and the corresponding 95th lower confidence limit ($BMDL_{10}$) were calculated associated with a benchmark response (BMR) of 10% additional risk of mild nephropathy[2]. For the derivation of the $LLTC_{oral}$, the BMD_{10} value has been selected as the point of departure (POD).

Doses based on mercury content were used for modelling. The BMD was adjusted after modelling from a five days/week dosing schedule to an average daily dose (by multiplying by 5/7). The BMD model results are shown in Appendix A.

To assess the acceptability of the different models, various criteria were evaluated in accordance with good practice (US EPA, 2012). In general, model fit was assessed by a chi-square goodness of fit test (*i.e.* models with $p<0.1$ failed the goodness of fit criterion) and the Akaike Information Criteria (AIC) value. Smaller AIC values indicate a better fit of data. Of the models exhibiting adequate fit, the models with the lowest AIC values were the gamma model (AIC = 52.23) and the multi stage model (AIC = 52.88). The multi stage model calculated the lowest BMD of all the models and has been selected for the derivation of the LLTC. The BMD model results from the multi-stage model are presented in Table 2.1 and the modelling output from BMDS is shown in Figure 2.2.

Table 2.1: BMD_{10} and $BMDL_{10}$ (adjusted for continuous exposure) calculations from the best fitting models for mild nephropathy.

Endpoint	Species/ sex	Model	AIC	BMD_{10} (mg kg^{-1} bw day^{-1})	$BMDL_{10}$ (mg kg^{-1} bw day^{-1})
Mild nephropathy	*Fischer 344 rats, male*	*Multistage model*	*52.88*	*0.235*	*0.124*

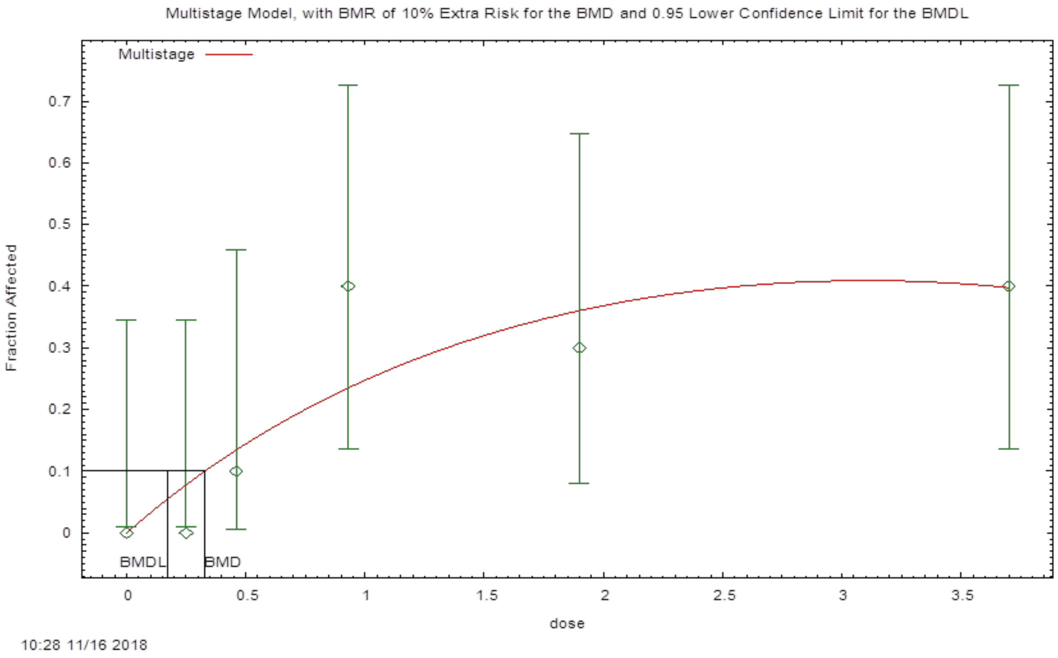

Figure 2.2: Multistage model of mild nephropathy in male F344 rats (results shown are not adjusted for continuous exposure).

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[2] A BMR of 10% is considered a reasonable response level to set for the BMD modelling for several reasons: Firstly, according to Haber *et al*. (2018) both EFSA (2017) and US EPA (2012) focus on the 10% response range in determining the BMR for dichotomous data. Secondly, given that the NTP (1993) study involved testing groups of ten rats, a BMR of 10% represents the lower end of the observation range.

For the purposes of deriving an oral LLTC, a BMD_{10} of 0.235 mg kg^{-1} bw day^{-1} is proposed, based on mild nephropathy in male Fischer rats.

GO TO FLOWCHART ELEMENT 4a/b

2.1.6 FLOWCHART ELEMENT 4: Does the critical endpoint exhibit a threshold?

Yes	No	Not applicable
x		

2.1.7 FLOWCHART ELEMENT 4a: Define a suitable chemical-specific margin

Not applicable.

GO TO FLOWCHART ELEMENT 5a

2.1.8 FLOWCHART ELEMENT 4b: Derive a chemical-specific assessment factor using scientific evidence

Several authoritative bodies used an uncertainty factor (UF) of 100 in the derivation of the tolerable risk oral HBGVs for inorganic mercury, based on the NTP (1993) study and using the same critical endpoint of mild nephropathy. This accounted for extrapolation from animals to humans and human variability (ATSDR 1999, RIVM 2001, WHO 2003 and JECFA 2011).

For the derivation of a LLTC, the default UF is proposed as per the following:

- Intraspecies variability: 10 (to account for toxicokinetic and toxicodynamic variability within the human population); and
- Interspecies variability: 10 (to account for toxicokinetic and toxicodynamic variability between humans and rats).

Therefore an UF of 100 is proposed.

GO TO FLOWCHART ELEMENT 5b

2.1.9 FLOWCHART ELEMENT 5a/b: Calculate the LLTC for non-thresholded / thresholded chemicals

For thresholded chemicals, the POD is divided by the relevant margin (either a generic margin or a chemical specific assessment factor (CSAF):

POD/default UF or CSAF = LLTC (units as per POD)

Therefore, for this evaluation:

POD = 0.235 mg kg^{-1} bw day^{-1} = 235 µg kg^{-1} bw day^{-1}

LLTC = POD/UF = 235 / 100 = 2.35 µg kg^{-1} bw day^{-1}

GO TO FLOWCHART ELEMENT 7

2.1.10 FLOWCHART ELEMENT 7: Assess $LLTC_{oral}$ for inorganic mercury

Based upon a scientific evaluation of a gavage study in Fischer rats, an oral LLTC of **2.35 µg kg^{-1} bw day^{-1}** is proposed, based on a BMD_{10} (adjusted for continuous exposure) of 0.235 mg kg^{-1} bw day^{-1} as the POD and a default UF of 100.

This LLTC is slightly greater than the now withdrawn Environment Agency oral health criteria value (HCV) of 2.0 μg kg^{-1} bw day^{-1} (Environment Agency, 2009b) which had been derived using the same critical study (NTP, 1993) and the same default UF of 100 as the LLTC. However, whereas the HCV had been based on a no observed adverse effect level (NOAEL) (unadjusted for continuous exposure) of 0.23 mg kg^{-1} bw day^{-1} as the POD, the LLTC is based on a BMD_{10} adjusted for continuous exposure of 0.235 mg kg^{-1} bw day^{-1}. The HCV was then rounded to one significant figure (2 μg kg^{-1} bw day^{-1}) whereas, in accordance with the C4SL convention, the LLTC is reported to three significant figures.

The Environment Agency (2009b) HCV was withdrawn following the EFSA (2018) review which had derived an oral tolerable daily intake (TDI) of 0.6 μg kg^{-1} bw day^{-1}. This was lower than the HCV and indicated that the HCV may no longer be representative of tolerable risk. The EFSA TDI was based on a $BMDL_{10}$ for increased kidney weights from the NTP (1993) study. However, as discussed in Section 2.1.2 the increase in kidney weight was without accompanying clinical chemistry or histopathological signs and is not considered to represent an adverse effect, so has not been used to derive the LLTC. The $LLTC_{oral}$ for inorganic mercury is considered to be a pragmatic level for setting a C4SL, in that it represents low risk and is above what is likely to be minimal/tolerable risk, but is suitably protective of all health effects in the general population.

2.2 INHALATION ROUTE

2.2.1 FLOWCHART ELEMENT 1: Collate the evaluations for the contaminant as per SR2: identify all known toxicological hazards; collate HBGVs from relevant authoritative bodies and specify the conditions of minimal risk

A review of toxicological hazards and available HBGVs presented by authoritative bodies for the inhalation route of exposure has been undertaken and is provided in Appendix A. This did not identify any inhalation studies for inorganic mercury (the only inhalation studies identified were for elemental mercury vapour).

In accordance with SR2 (Environment Agency, 2009a), on the basis that there are no suitable toxicological data to derive an inhalation HBGV, inhalation exposure will be compared against the oral LLTC for the purposes of the derivation of the C4SL for inorganic mercury.

2.3 DERMAL ROUTE

No data were found on the acute, chronic or cancer effects via the dermal route.

In the absence of suitable dermal toxicity data and in accordance with SR2 (Environment Agency, 2009a), dermal exposure will be compared against the oral LLTC for the purposes of the derivation of the C4SL for inorganic mercury.

2.4 MEAN DAILY INTAKE

The oral LLTC recommended for inorganic mercury is based on threshold effects and, due to a lack of studies on the toxicological effects via inhalation, it is recommended that inhalation exposure is compared to the threshold oral LLTC. As such, in accordance with the C4SL SP1010 framework (CL:AIRE, 2014) and SR2 (Environment Agency, 2009a), the Mean Daily Intake (MDI) from non-soil sources is to be included in the exposure modelling for comparison with the oral LLTC.

Available oral and inhalation MDI data have been collated and reviewed, and used to derive estimated adult MDIs for the oral and inhalation pathways (Appendix B). The adult MDIs used to derive the C4SLs for inorganic mercury are shown in Table 2.2 below.

The oral MDI is based upon mean dietary exposure reported by the Food Standards Agency (FSA) in the most recently available UK Total Diet Study (TDS) (FSA, 2014) and the mean of the 99th percentile concentrations of mercury measured in tap water reported by the Drinking Water Inspectorate (DWI) for water companies in England and Wales for the year 2022 (DWI, 2023). FSA (2014) reports a MDI of total mercury from food for adults to be between 0.022 to 0.041 µg kg^{-1} bw day^{-1}, which is equivalent to 1.54 to 2.87 µg day^{-1} assuming an adult body weight of 70 kg.

DWI (2023) reports that the majority of 99th percentile concentrations[3] of total mercury in tap water reported by the water companies are below the (varying) limits of detection. Using the limits of detection as a worst case, the mean 99th percentile concentration of total mercury was 0.09 µg L^{-1}. This is converted to a worst case daily background exposure from consumption of water of 0.18 µg day^{-1} by multiplying by an assumed adult water consumption rate of 2 L day^{-1}. This has been added to the mid-point of the MDI range for dietary exposure (2.21 µg day^{-1}) to give a total adult MDI of 2.39 µg day^{-1}. This is higher than the MDI of 1 µg day^{-1} previously used by the Environment Agency (2009b) for derivation of the (now withdrawn) SGV.

The majority of mercury in air is present as elemental mercury. ATSDR (1999) estimates elemental mercury vapour to comprise >95% of total mercury in air and PHE (2016) estimates atmospheric mercury to be 90-99% in the elemental form. PHE (2016) also reports a range of atmospheric concentrations of mercury between 0.1 and 5 ng m^{-3} in urban areas within the EU. On this basis, background exposure to inorganic mercury in ambient air is assumed to be negligible.

Table 2.2: Adult mean daily intake values for inorganic mercury for input to CLEA.

Adult Mean Daily Intake	Value (µg day^{-1})
Oral MDI	2.39
Inhalation MDI	0

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[3] Note that mean concentrations are not provided in DWI (2023). The mean of the reported 99th percentile concentrations is likely to be a highly conservative estimate of MDI.

3. EXPOSURE MODELLING FOR INORGANIC MERCURY

As described in the C4SL SP1010 report (CL:AIRE, 2014), the CLEA model has been used deterministically with the above LLTCs to derive C4SLs for the following six land-uses for a sandy loam soil type:

- Residential with consumption of homegrown produce;
- Residential without consumption of homegrown produce;
- Allotments;
- Commercial;
- Public open space (POS):
  - The scenario of open space close to housing that includes tracking back of soil (POS_{resi}); and
  - A park-type scenario where the park is considered to be at a sufficient distance from the home that there is negligible tracking back of soil (POS_{park}).

3.1 CLEA PARAMETER INPUTS

CLEA derives an estimate of average daily exposure (ADE) for each exposure pathway. ADEs are then summed for some or all exposure pathways for comparison with the LLTC. The pathways considered in the summation are dependent on the critical toxicological effects that the LLTC is based on. CLEA uses iteration to find the soil concentrations at which the summed ADEs equal the respective LLTC values and these are termed 'assessment criteria'. As described in the CLEA SR2 and SR3 documents (Environment Agency, 2009a,c), the assessment criteria are normally integrated by CLEA to determine an overall value where the critical toxicological effects via both routes of exposure are systemic. Where the critical toxicological effect is localised for either the oral or inhalation routes of exposure, the assessment criteria are not integrated and the lowest of the two criteria is chosen as the overall assessment criterion.

In the case of inorganic mercury, the $LLTC_{oral}$ is based on the systemic effect of mild nephropathy (kidney disease). Insufficient toxicological data were identified in order to derive an $LLTC_{inhal}$, therefore the C4SLs have been calculated by adding systemic inhalation exposure to exposure from all other routes. Total systemic exposure was then evaluated against the $LLTC_{oral}$ (i.e. simple route-to-route extrapolation).

CLEA requires a number of contaminant and non-contaminant specific parameter values for modelling exposure. The description of these parameters is provided within the C4SL SP1010 report (CL:AIRE, 2014) and the SR3 report (Environment Agency, 2009c). Contaminant-specific parameter values used for inorganic mercury are shown in Table 3.1.

Table 3.1: Contaminant-specific parameter values used for derivation of C4SLs for inorganic mercury.

Parameter	Units	Value	Source/Justification
Water solubility	mg L^{-1}	-	Not required for C4SL derivation as empirical soil-to-plant concentration factors used.
Kd	$cm^3 g^{-1}$	-	Not required for C4SL derivation as empirical soil-to-plant concentration factors used.
Dermal absorption fraction	dimensionless	0	Environment Agency, 2009c
Soil-to-plant concentration factor (green vegetables)	mg g^{-1} FW plant over mg g^{-1} DW soil	0.00478	A review of empirically-derived soil-to-plant concentration factors in literature was undertaken including, but not limited to, data in Environment Agency, 2009e – see Appendix C. Geomean of data is presented. No data available for tree fruit, value extrapolated from other produce categories. See discussion below.
Soil-to-plant concentration factor (root vegetables)		0.0108	
Soil-to-plant concentration factor (tuber vegetables)		0.00125	
Soil-to-plant concentration factor (herbaceous fruit)		0.00129	
Soil-to-plant concentration factor (shrub fruit)		0.00143	
Soil-to-plant concentration factor (tree fruit)		0.001	
Soil-to-dust transport factor	g g^{-1} DW	0.5	Default value from CLEA SR3, Environment Agency, 2009c
Sub-surface soil to indoor air correction factor	dimensionless	1	Default value from CLEA SR3, Environment Agency, 2009c
Relative bioavailability soil	-	1	Conservative assumption made that bioavailability of inorganic mercury in soil and dust is the same as bioavailability of inorganic mercury in critical toxicological study used to derive the LLTC.
Relative bioavailability dust	-	1	

The key contaminant-specific parameter values used for derivation of the C4SLs for inorganic mercury are discussed briefly below.

Soil-to-dust transport factor

The soil-to-dust transport factor should be contaminant specific but where contaminant-specific data are not available the SR3 report (Environment Agency, 2009c) recommends a default value of 0.5, meaning that the concentration of contaminant in respirable dust is assumed to be 50% of the concentration of contaminant in outdoor soil. This default value has been used to calculate the C4SL.

Soil-to-plant concentration factors

Soil-to-plant concentration factors have been estimated from empirically-derived literature values for green vegetables, root vegetables, tuber vegetables, herb fruit and shrub fruit. Full details of empirically-derived values and references are provided in Appendix C. In the absence of data to the contrary, a default soil-to-plant concentration factor of 0.001 mg kg^{-1} FW plant per mg kg^{-1} DW soil (consistent with the other fruit categories) has been adopted for tree fruit.

Based on empirically-derived soil-to-plant concentrations factors and CLEA model input parameters (Environment Agency, 2009c), CLEA predicts the greatest exposure to inorganic mercury from ingestion of root vegetables and green vegetables for both the residential and allotments scenarios (via the consumption of homegrown produce pathways). Therefore, in accordance with the "top two" approach, 90th percentile consumption rates have been used for these two produce types and mean consumption rates have been used for the remaining produce types.

Relative bioavailability

The relative bioavailability is the ratio of the bioavailability of the contaminant in soil to the bioavailability of the contaminant in the critical study used to derive the HBGV (i.e. the LLTCs in this context). For the derivation of the C4SLs for inorganic mercury, this is conservatively assumed to be 100% for both the oral and inhalation routes of exposure.

The proposed $LLTC_{oral}$ is based on a study on rats which were fed mercuric chloride in deionised water by gavage (NTP, 1993). The absorption (bioavailability) of the mercuric chloride in this study was not reported but Barnett and Turner (2001) note that mercuric chloride is a very soluble form of mercury and as such is likely to have a bioavailability that is significantly greater than that of other forms of inorganic mercury found in soil.

In-vitro bioaccessibility testing can be used to estimate the oral bioaccessibility as a surrogate for bioavailability of a substance in soil. Such testing has shown that mercury speciation has a strong control on its bioaccessibility. Barnett and Turner (2001) found that the bioaccessibility of mercuric chloride[4] was 100% whereas that of mercuric sulfide was less than 1%. They used the same method on twenty soil samples taken from a mercury contaminated site in Oak Ridge, Tennessee. Bioaccessibility ranged from 0.3% to 14% in nineteen samples and 46% in the remaining sample. Barnett and Turner concluded that the generally low bioaccessibility of mercury in the soils at Oak Ridge was due to the predominance of mercuric sulfide in soil. Similar results (using the same method) were reported by Zagury *et al.* (2009).

Whilst bioaccessibility testing may provide a useful line of evidence for human health risk assessments of inorganic mercury in soil, in the absence of speciation data it is appropriate to assume a relative bioavailability of 100% for the purposes of deriving the C4SL.

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[4] Using a method based on the Camp Dresser and McKee Inc. (CDM) in-vitro extraction protocol.

4. C4SLs FOR INORGANIC MERCURY

4.1 C4SLS

The C4SLs for inorganic mercury are presented in Table 4.1. Note that the C4SLs for inorganic mercury are not dependent on soil organic matter content and so, unlike organic substances which have C4SLs presented for 1%, 2.5% and 6% soil organic matter, only one C4SL is presented for each land-use.

Table 4.1: C4SLs for inorganic mercury.

Land-use	C4SLs (mg kg^{-1})
Residential with consumption of homegrown produce	200
Residential without consumption of homegrown produce	300
Allotments	86
Commercial	5,100
Public Open Space (residential)	610
Public Open Space (park)	1,300

N.B. These C4SLs are for inorganic mercury only and should not be used for assessing risks from elemental mercury or methyl mercury. If the presence of elemental mercury or methyl mercury in soil is known or suspected then further consideration of the risks from these substances will be required (see Section 4.2).
These C4SLs are based on chronic risk only. For further discussion of acute risks and other factors that should be considered when using these C4SL see Section 4.2 below.

The relative contribution of each exposure pathway contributing to the C4SL is shown for each land-use in Table 4.2.

Table 4.2: Relative contributions of exposure pathways to overall exposure.

Exposure pathway	Relative contribution to total exposure (%)					
	Residential		Allotments	Commercial	POS$_{resi}$	POS$_{park}$
	With home grown produce	Without home grown produce				
Direct soil & dust ingestion	63.40	94.07	7.27	97.88	95.96	94.25
Sum of consumption of homegrown produce and attached soil	30.73	0.00	87.00	0.00	0.00	0.00
Dermal contact (indoor)	0.00	0.00	0.00	0.00	0.00	0.00
Dermal contact (outdoor)	0.00	0.00	0.00	0.00	0.00	0.00
Inhalation of dust (indoor)	0.14	0.21	0.00	0.66	0.33	0.00
Inhalation of dust (outdoor)	0.00	0.00	0.00	0.00	0.00	0.02
Inhalation of vapour (indoor)	0.00	0.00	0.00	0.00	0.00	0.00
Inhalation of vapour (outdoor)	0.00	0.00	0.00	0.00	0.00	0.00
Oral background	5.72	5.72	5.72	1.45	3.71	5.72
Inhalation background	0.00	0.00	0.00	0.00	0.00	0.00

Based on the information in Table 4.2 the principal risk driving pathways for inorganic mercury are expected to be:

- Consumption of homegrown produce for allotments; and
- Ingestion of soil and soil-derived dust for residential with homegrown produce, residential without homegrown produce, commercial, POS_{resi} and POS_{park} land-uses.

4.2 OTHER CONSIDERATIONS

Other considerations that were relevant when setting the C4SLs for inorganic mercury include the following:

- These C4SLs have been derived for inorganic mercury and are not suitable for use when assessing other forms of mercury (including but not limited to elemental mercury and methyl mercury). For each site, a site-specific conceptual site model should be developed to identify the forms of mercury likely to be present.
- In most cases, to simplify the assessment the C4SLs for inorganic mercury can be compared with chemical analysis for total mercury content in soil because the equilibrium concentrations of elemental mercury and methyl mercury compounds in soil will normally be very low (Environment Agency, 2009d). However, where the presence of either elemental mercury or methyl mercury compounds are suspected[5] then consideration should be given to conducting speciated mercury analyses and/or comparison of measured concentrations with appropriate generic screening values (published or derived) for elemental mercury and methyl mercury (noting that the SGVs for these substances have been withdrawn).
- The British Geological Survey under instruction from Defra has derived normal background concentrations (NBCs) for total mercury in soils in England (Defra, 2012a,b) and has separately derived NBCs for total mercury in soils in Wales (Defra, 2013). NBCs are defined by the British Geological Survey as the 95th percentile upper confidence limit of the mean of recorded soil concentrations. For England the NBC was calculated to be 1.9 mg kg^{-1} for the Urban Domain and 0.5 mg kg^{-1} for the Principal (non-urban) domain. For Wales the NBC was calculated to be 0.25 mg kg^{-1} for the Principal domain, with insufficient data to calculate a NBC for the urban domain. The generated C4SL are all greater than calculated NBCs. Therefore, if soil inorganic mercury concentrations exceed C4SL they can also be taken to exceed NBCs.
- Background intake of inorganic mercury from non-soil sources (food, water and air) compares to the oral LLTC as follows:
  - Dividing the adult oral MDI of 2.39 µg day^{-1} by an adult body weight of 70 kg results in an estimated background exposure of 0.0341 µg kg^{-1} bw day^{-1}, which is approximately 1.5% of the $LLTC_{oral}$.
- Background exposure to inorganic mercury via inhalation was considered to be negligible and therefore an inhalation MDI of 0 µg day^{-1} was assumed. For the residential with homegrown produce and allotment scenarios, consumption of homegrown produce and attached soil is the main pathway contribution. The C4SLs have used the “top two” approach, with 90th percentile consumption rates used for green and root vegetables and mean consumption rates used for other produce. Site-specific knowledge should be used where available to determine whether the assumptions on produce consumption are appropriate.

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[5] For example, elemental mercury may be present as a result of the historical use of the land by processes that used amalgams such as for millinery or chloralkali production (Environment Agency, 2000d). Inorganic forms of mercury may be biogeochemically transformed into organo-mercury compounds (of which methyl mercury is the most prevalent) in soils with low redox (reducing) conditions such as occur in many permanently or periodically flooded soils (e.g. paddy fields) (O’Connor *et al.*, 2019).

- Ingestion of soil is the main pathway contribution for residential without homegrown produce, commercial, POS_{resi} and POS_{park} land-uses. When assessing site-specific risks from inorganic mercury soil contamination the potential for direct contact pathways to be present should be considered in the site-specific conceptual site model.

- C4SLs have been derived on the basis of chronic exposure and risks to human health, and do not explicitly account for acute risks (e.g. due to one-off ingestion of a significant amount of soil by a young child). PHE (2016) identifies that the gastrointestinal tract can be highly irritated by inorganic mercury compounds. Potential symptoms of acute ingestion include metallic taste, abdominal pain, vomiting, diarrhoea, tachycardia, hypertension and ulceration. In severe cases it can lead to necrosis of the intestinal inner lining, "possible leading to circulatory collapse and death". After 24 hours acute renal failure may occur. Therefore, further consideration of the possibility of acute risk due to ingestion of soil at the inorganic mercury concentrations indicated by the C4SLs may be necessary. The reader is referred to the Society of Brownfield Risk Assessment (SoBRA) "Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil" (SoBRA, 2020) for further guidance on this.

- These C4SLs have been derived assuming a relative bioavailability of 100%. This may be highly conservative depending on the speciation of the inorganic mercury in soil (Zagury *et al*. 2009, Barnett and Turner, 2001). For site-specific risk assessment consideration could be given to the use of oral bioaccessibility testing (such as the Unified BARGE method [UBM]) to help assess the relative oral bioavailability of inorganic mercury in soil. However, such an assessment would need to take account of the uncertainties involved including the bioavailability of mercuric chloride in the toxicological study used as the basis of the $LLTC_{oral}$ and the accuracy of the test method as an indicator of bioavailability in the human gut.

5. REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR), 1999. Toxicological Profile for Mercury.

Barnett, M.O. and Turner, R.R., 2001. Bioaccessibility of Mercury in Soils. Soil and Sediment Contamination, 10(3), 301-316.Contaminated Land: Applications in Real Environments (CL:AIRE), 2014. SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report (revision 2). FINAL.

CL:AIRE, 2014. SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report (Revision 2). 24th September 2014. Contaminated Land: Applications in Real Environments.

Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT), 2006. UK Total Diet Study of Metals and other Elements. TOX/2008/29.

Department for Environment, Food and Rural Affairs (Defra), 2012a. Technical Guidance Sheet on normal levels of contaminants in English soils: Mercury. Technical Guidance Sheet No. TGS07, July 2012. Soils R&D Project SP1008. Available on-line from Defra project SP1008.

Defra, 2012b. Technical Guidance Sheet on normal levels of contaminants in English soils: Mercury. Technical Guidance Sheet Supplementary Information No. TGS07s, July 2012. Soils R&D Project SP1008. Available on-line from Defra project SP1008.

Defra, 2013. Technical Guidance on normal levels of contaminants in Welsh soil: Mercury: British Geological Survey (Keyworth, Nottingham) and Defra (London). R&D Project SP1008, January 2013. Available on-line from Defra project SP1008.

Drinking Water Inspectorate (DWI), 2023. Drinking Water 2022 – Water Company Data – Sample Results. Accessed from https://www.dwi.gov.uk/what-we-do/annual-report/drinking-water-2022/.

Environment Agency, 2009a. Human health toxicological assessment of contaminants in soil. Science Report – SC050021/SR2.

Environment Agency, 2009b. Contaminants in soil: updated collation of toxicological data and intake values for humans. Mercury. SC050021. (WITHDRAWN)

Environment Agency, 2009c. Updated technical background to the CLEA model. Science Report – SC050021/SR3.

Environment Agency, 2009d. Soil Guideline Values for mercury in soil. Science Report SC050021/Mercury SGV. (WITHDRAWN)

Environment Agency, 2009e. Supplementary Information for the Derivation of SGV for mercury: SC050021. Environment Agency, Bristol, 2009. (WITHDRAWN)

European Food Safety Authority (EFSA), 2017. Update: guidance on the use of the benchmark dose approach in risk assessment. EFSA Journal 15:4658.

EFSA, 2018. Scientific Opinion on the risk for public health related to the presence of mercury and methylmercury in food.

Food Standards Agency (FSA), 2014. Total diet study: metals and other elements. FSA project code: FS102081. Accessed from https://www.food.gov.uk/research/chemical-hazards-in-food-and-feed/total-diet-study-metals-and-other-elements

Haber, L.T., Dourson, M.L., Allen, B.C., Hertzberg, R.C., Parker, A., Vincent, M.J., Maier, A. and Boobis A.R., 2018. Benchmark dose (BMD) modeling: current practice, issues, and challenges. Critical Reviews in Toxicology, Vol. 48, No. 5, pp 387-415.

Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2011. Safety evaluation of certain contaminants in food. Mercury (Addendum) WHO food Additives series: 63. FAO JECFA Monographs 8. Pages 605-684.

Kabata-Pendias, A. and Mukherjee, A.B., 2007. Trace Elements from Soil to Human. Berlin: Springer-Verlag.

National Institute of Public Health and the Environment (RIVM), 2001. Re-evaluation of human-toxicological maximum permissible risk levels. RIVM report 711701 025.

National Toxicology Program (NTP), 1993. Technical Report on the Toxicology and Carcinogenesis Studies of Mercuric Chloride in F344 Rats and B6C3F Mice (Gavage Studies). NTP TR 408.

O'Connor, D., Hou, D., Ok, Y.S., Mulder, J., Duan, L., Wu, Q., Wang, S., Tack, F.M. and Rinklebe, J., 2019. Mercury speciation, transformation, and transportation in soils, atmospheric flux, and implications for risk management: A critical review. Environment International, 126, 747-761.

Public Health England (PHE), 2016. Inorganic Mercury / Elemental Mercury Toxicological Overview. PHE publications gateway number: 2014790.

Society of Brownfield Risk Assessment (SoBRA), 2020. Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil. V2.0. July 2020.

Steinnes, E., 1995. Mercury. In Heavy Metals in Soils (2nd edn.) (ed. B.J. Alloway). London: Blackie Academic & Professional.

United States Environmental Protection Agency (US EPA), 1995. National Center for Environmental Assessment. Integrated Risk Information System (IRIS) Chemical Assessment Summary for Mercury, elemental (CASRN 7439-97-6).

US EPA, 2012. Benchmark Dose Technical Guidance. U.S. Environmental Protection Agency, Washington, DC 20460. EPA/100/R-12/001. June 2012.

World Health Organization (WHO) Regional Office for Europe, 2000. Air quality guidelines for Europe. Second edition.

WHO, 2003. Concise International Chemical Assessment Document (CICAD) 50. Elemental Mercury and Inorganic Mercury Compounds: Human Health Aspects.

Zagury, G.J., Bedeaux, C. and Welfringer, B.M., 2009. Influence of Mercury Speciation and Fractionation on Bioaccessibility in Soils. Arch Environ Contam Toxicol 56:371-379.

APPENDIX A

HUMAN TOXICOLOGICAL DATA SHEET FOR INORGANIC MERCURY

Human Toxicological Data Sheet for C4SL derivation: Reference checklist for sources of authoritative information

Chemical: **Inorganic Mercury**

Human Health Hazard Profile - References

Authoritative bodies	Website	Checked (Y/N)	References
Environment Agency	hhttps://www.gov.uk/government/organisations/environment-agency	Y	EA, 2009. Contaminants in soil: updated collation of toxicological data and intake values for humans. Mercury. SC050021
Foods Standards Agency	http://www.food.gov.uk/	Y	N/A
Public Health England	https://www.gov.uk/government/organisations/public-health-england	Y	PHE, 2016. Inorganic Mercury / Elementary Mercury: Toxicological Overview. 2014790
Committee on Carcinogenicity	products-and-the-environment-coc	Y	
Committee on Mutagenicity	chemicals-in-food-consumer-products-and-the-environment	Y	
Committee on Toxicity	http://cot.food.gov.uk/	Y	COT statement on the 2006 UK Total Diet Study of metals and other elements
ECHA REACH - is there a dossier?	http://echa.europa.eu/information-on-chemicals	Y	https://echa.europa.eu/registration-dossier/-/registered-dossier/5169
EFSA - is there an opinion?	http://www.efsa.europa.eu/	Y	EFSA, 2018. Scientific Opinion on the risk for public health related to the presence of mercury and methylmercury in food
JECFA	http://www.fao.org/food/food-safety-quality/scientific-advice/jecfa/en/?	Y	WHO, 2011. Mercury (addendum). WHO Food Additives Series: 63 FAO JECFA Monographs 8
WHO	http://www.who.int/en/	Y	WHO, 2003. Elemental Mercury and Inorganic Mercury Compounds: Human Health Aspects. CICAD 50
WHO IPCS	http://www.who.int/ipcs/en/	Y	http://www.who.int/ipcs/assessment/public_health/mercury/en/
WHO EHC	http://www.who.int/ipcs/publications/ehc/en/	Y	WHO, 1991. EHC118. Inorganic Mercury
RIVM	https://www.rivm.nl/en	Y	RIVM, 2001. Re-evaluation of human-toxicological maximum permissible risk levels. RIVM report 711701 025
US ATDSR	http://www.atsdr.cdc.gov/	Y	ATSDR, 1999. Toxicological Profile for Mercury. March 1999
US EPA	http://www.epa.gov/	Y	IRIS website
US National Toxicology Program	https://ntp.niehs.nih.gov/	Y	NTP Technical Report on the Toxicology and Carcinogenesis Studies of Mercuric Chloride in F344 Rats and B6C3F Mice (Gavage Studies). National Toxicology Program. February 1993. NTP TR 408
Health Canada	http://www.hc-sc.gc.ca/index-eng.php	Y	Mercury: Your Health and the Environment. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/environmental-contaminants/mercury-your-health-environment-resource-tool.html
Australia NICNAS	http://www.nicnas.gov.au/	Y	**Human Health Tier II Assessment for Mercury. NICNAS**
Risk Assessment Information System	http://rais.ornl.gov	Y	
Other scientific reviews		Y	Mercury and inorganic mercury compounds. The MAK Collection for Occupational Health & Safety 2016, Vol. 1 No. 1
		Y	Human Exposure and Health Effects of Inorganic and Elemental Mercury. J Prev Med Public Health. 2012 Nov; 45(6): 344-352
		Y	ORNL, 1997. Mercury Compounds
	Check for key reviews on pubmed	Y	NIOSH, 1973. Criteria for a recommended standard Occupational Exposure to Inorganic Mercury

NB. These weblinks were checked on 6 Mar 2018, and may be subject to change at source.

Human Toxicological Data Sheet for C4SL derivation: Toxicological Evidence, HBGVs, MDIs and LLTC derivation

Chemical: **Inorganic Mercury**

I) Human Health Hazard Profile - Toxicological Evidence

Most sensitive health effects:

Sensitive endpoints	Other information	Source of evidence
Nephrotoxicity	Increased relative and absolute kidney weights (ATSDR, 1999),	ATSDR, 1999
Nephrotoxicity	Mild nephropathy and renal tubule necrosis	NTP, 1993
Nephrotoxicity	Autoimmune glomerulonephritis	USEPA, 1995

II) Health Based Guidance Values (HBGVs) from Authoritative Bodies (in descending order of magnitude)

A) Oral route

Authoritative body (date) and HBGV type	HBGV value	Unit	UF used	PoD	POD value	Unit (as Hg)	Endpoint	Pivotal data used & Comments	Full Reference
ATSDR (1999) Oral Intermediate MRL	2	µg/kg bw/day	100	NOAEL	0.16	mg/kg bw/day	Absolute and relative kidney weight	ATSDR calculated an intermediate-duration oral MRL of 2 µg/kg bw/day based on data from the NTP study (NTP, 1993), in which Fischer 344 rats (10/sex/group) were administered 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg Hg/kg bw/day as mercuric chloride by oral gavage, 5 days per week for 26 weeks. ATSDR derived a NOAEL of 0.16 mg Hg/kg bw/day (adjusted from 0.23 mg Hg/kg bw/day to account for 5 days dosing) based on minimal nephropathy (10 % increase in relative and absolute kidney weights without accompanying pathological or clinical chemistry changes) seen at 0.46 mg Hg/kg bw/day. Renal tubule necrosis was seen at higher doses. An uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability) was applied to the NOAEL to derive the MRL. It should be noted that the actual doses used in the NTP study were 0, 0.312, 0.625, 1.25, 2.5 or 5 mg mercuric chloride/kg bw/day, which were adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg Hg/kg bw/day and then futher adjusted for continuous dosing.	ATSDR, 1999. Toxicological Profile for Mercury. March 1999
USEPA (1995) RfD	0.3	µg/kg bw/day	1000	LOAEL	0.226 - 0.633	mg/kg bw/day	Auto-immune glomerulonephritis	US EPA calculated a RfD of 0.3 µg/kg bw/day which is based on back calculations from a Drinking Water Equivalent Level (DWEL) of 0.010 mg/l assuming a 70 kg adult drinking 2 l of water per day. Dose conversions in the three studies used a 0.739 factor for HgCl2 to Hg2+; a 100% factor for subcutaneous (s.c.) to oral route of exposure; and a time-weighted average for days/week of dosing. The DWEL was based on LOAELs (0.266, 0.317 and 0.633 mg/kg bw/day) from three studies, namely Druet et al. (1978; i.p. study), Bernaudin et al. (1981; gavage study) and Andres (1984; gavage) in which Brown Norway rats were administered mercuric chloride via i.p. or oral gavage for 60 days. An uncertainty factor of 1000 (10 for LOAEL to NOAEL conversion, 10 for use of subchronic studies and 10 for animal to human and sensitive human populations) was applied to the LOAELs to derive the RfD.	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=692
WHO (1991) Equivalent human oral dose (LOAEL)				LOAEL	0.0158	mg/kg bw/day	Auto-immune glomerulonephritis	WHO (EHC) considered five studies on the auto-immune effects of mercuric mercury on the glomerular basement membrane (Bernaudin et al, 1981, Andres, 1984, Druet et al 1977, Druet et al 1978 and Roman-Franco et al 1978). A LOAEL of 0.05 mg/kg bw was selected from the study by Druet et al (1978) in which Brown Norway rats (number/sex not given) were administered mercuric chloride (0.05 mg/kg) three times a week via i.p. for 12 weeks. The average daily subcutaneous daily dose (adjusted LOAEL) of 0.0158 mg/kg bw/day was calculated using a 0.739 factor for HgCl2 to Hg2+ (adjusted to account for 3 day per week dosing regime). A human oral exposure equivalent of 15.8 mg/day was determined based on a 70 kg adult; 0.0158 mg/kg bw/day being the average subcutaneous dose; 100 % absorption from the subcutaneous route of exposure; and 7 % absorption from the oral route of exposure.	WHO, 1991. EHC118. Inorganic Mercury
WHO CICAD (2003) Tolerable intake	2	µg/kg bw/day	100	NOAEL	0.23	mg/kg bw/day	Absolute and relative kidney weight	The WHO CICAD calculated a tolerable intake of 2 µg/kg bw/day based on data from the NTP study (NTP, 1993), in which Fischer 344 rats (10/sex/group) were administered 0, 0.312, 0.625, 1.25, 2.5 or 5 mg/kg bw/day mercuric chloride (adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg/kg bw/day to account for Hg content) by oral gavage, 5 days per week for 26 weeks. A NOAEL of 0.23 mg Hg/kg bw/day (adjusted from 0.312mg Hg chloride /kg bw/day) was based on minimal nephropathy (10 % increase in relative and absolute kidney weights without accompanying pathological or clinical chemistry changes) seen at 0.46 mg Hg/kg bw/day. Renal tubule necrosis was seen at higher doses. An uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability) was applied to the NOAEL to derive the tolerable intake. A LOAEL of 1.9 mg/kg bw/day was also cited from the 2 year NTP study, based on microscopic changes in the kidney. Using the LOAEL or NOAEL as the point of departure and a total uncertainty factor of 1000 results in the same tolerable intake.	WHO, 2003. Elemental Mercury and Inorganic Mercury Compounds: Human Health Aspects. CICAD 50

JECFA (2011) PTDI	0.6	µg/kg bw/day	100	BMDL10	0.06	mg/kg bw/day	Absolute and relative kidney weight	JECFA calculated PTWI of 4 µg/kg bw/day based on data from the NTP study (NTP, 1993), in which Fischer 344 rats (10/sex/group) were administered 0, 0.312, 0.625, 1.25, 2.5 or 5 mg/kg bw/day mercuric chloride (adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg Hg /kg bw/day) by oral gavage, 5 days per week for 26 weeks. A BMD10 and BMDL10 of 0.220 and 0.112 mg/kg bw/day, respectively, was calculated for increased relative kidney weight in male rats, using the USEPA BMD software (BMDS v 2.1.1), with all available continuous models (i.e. exponential, Hill, linear, polynomial, power). The BMDL10 was adjusted to account for a 5 day dosing regime and for the per cent contribution of inorganic mercury to mercury (II) chloride used in the study, to give a BMD10 of 0.12 mg/kg bw/day and a BMDL10 of 0.06 mg/kg bw/day. An uncertainty factor of 100 (details not given) was applied to the BMDL10 to derive the PTDI (PTWI of 4 µg/kg bw/day calculated in the document by multiplying by 7).	WHO, 2011. Mercury (addendum). WHO Food Additives Series: 63 FAO JECFA Monographs 8
RIVM (2001) TDI	2	µg/kg bw/day	100	NOAEL	0.23	mg/kg bw/day	Absolute and relative kidney weight	RIVM calculated TDI of 2 µg/kg bw/day based on data from the NTP study (NTP, 1993), in which Fischer 344 rats (10/sex/group) were administered 0, 0.312, 0.625, 1.25, 2.5 or 5 mg/kg bw/day mercuric chloride (adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg Hg /kg bw/day) by oral gavage, 5 days per week for 26 weeks. A NOAEL of 0.23 mg Hg/kg bw/day was based on minimal nephropathy (10 % increase in relative and absolute kidney weights without accompanying pathological or clinical chemistry changes) seen at 0.46 mg/kg bw/day. Renal tubule necrosis was seen at higher doses. An uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability) was applied to the NOAEL to derive the tolerable intake. A LOAEL of 1.9 mg/kg bw/day was also cited from the 2 year NTP study, based on microscopic changes in the kidney. Using the LOAEL or NOAEL as the point of departure results in the same TDI.	RIVM, 2001. Re-evaluation of human-toxicological maximum permissible risk levels. RIVM report 711701 025
EFSA (2018) TDI	0.6	µg/kg bw/day	100	BMDL10	0.06	mg/kg bw/day	Absolute and relative kidney weight	EFSA CONTAM panel considered the JECFA evaluation of data from the NTP study (NTP, 1993), in which Fischer 344 rats (10/sex/group) were administered 0, 0.312, 0.625, 1.25, 2.5 or 5 mg/kg bw/day mercuric chloride (equivalent to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg/kg bw/day expressed as mercury) by oral gavage, 5 days per week for 26 weeks, and established a TWI of 4 µg/kg bw/day for inorganic mercury. The CONTAM Panel concluded that, in this study, a 10 % increase in relative kidney weight was not accompanied by nephropathological changes and therefore represented an appropriate BMR. A BMD10 and BMDL10 of 0.220 and 0.112 mg/kg bw/day, respectively, was calculated for increased relative kidney weight in male rats, using the USEPA BMD software (BMDS v 2.1.1), with all available continuous models (i.e. exponential, Hill, linear, polynomial, power). The BMDL10 was adjusted to account for a 5 day dosing regime and for the per cent contribution of inorganic mercury to mercury (II) chloride used in the study, to give a BMDL of 0.12 mg/kg bw/day and a BMDL10 of 0.06 mg/kg bw/day. An uncertainty factor of 100 (details not given) was applied to the BMDL10 to derive the PTDI (PTWI of 4 µg/kg bw/day calculated in the document by multiplying by 7).	EFSA, 2018. Scientific Opinion on the risk for public health related to the presence of mercury and methlymercury in food.

COT/COC Opinion	(COT, 2006) COT concluded that current dietary exposures to bismuth, chromium, germanium, mercury, nickel, strontium, thallium, tin and zinc are unlikely to be of toxicological concern

Current UK oral HCV

Authoritative body (date) and HBGV type	HBGV value	Unit	UF used	PoD	POD value	Unit	Endpoint	Pivotal data used & Comments	Full Reference
EA (2009) Oral TDI (subsequently withdrawn)	2	µg/kg bw/day	100	NOAEL	0.23	mg/kg bw/day	Renal effects	26-week gavage study of mercuric chloride in rats (NTP, 1993)	EA, 2009. Contaminants in soil: updated collation of toxicological data and intake values for humans. Mercury. SC050021

B) Inhalation Route

Authoritative body (date) and HBGV type	Converted HBGVinh	Unit	HBGVinh	Unit	UF used	POD	POD value	Unit	Endpoint	Pivotal Study used & Comments	Full Reference
WHO Air Quality Guideline (2000) (elemental mercury vapour)	0.29	µg/kg bw/day	0.001	mg/m3	20	LOAEL	0.020	mg/m3	Renal tubule effects (changes in plasma enzymes), increased frequency of tremors	WHO presented a tabulated summary of occupational studies with mercury vapour with effects being observed at 0.030 mg/m3 (objective tremors) and renal tubular effects at 0.015 mg/m3 in an occupational study by Cardenas (1993). These were considered to be LOAEL values. To convert the workplace air concentrations to equivalent ambient air concentrations, values were first multiplied by 3 to convert to actual concentrations in the workplace, and then divided by 3 to correct for the greater amount of ambient air inhaled per week by the average adult (the total amount of air inhaled at the workplace per week is assumed to be 50 m3 (10 m3/day × 5 days) whereas the amount of ambient air inhaled per week would be 140 m3 (20 m3/day × 7 days)). The PoD was chosen as 0.015 -0.030 mg/m3 (0.020 mg/m3). A total UF of 20 was applied (10 for interspecies variation due to the data being based on occupational studies and 2 at it seemed unlikely that effects would be seen if air concentrations as were low as a half of the values seen) giving a HBGV of 1 µg/m3.	WHO,2000. Air Quality Guidelines for Europe 2nd edition p 157 -161
ATSDR (1999) Chronic Inhalation MRL (elemental mercury vapour)	0.06	µg/kg bw/day	0.0002	mg/m3	30	LOAEL	0.006	mg/m3	Increased frequency of tremors	ATSDR calculated an chronic-duration inhalation MRL of 0.2 µg/m3 for metallic mercury vapour (0.057 µg/kg bw/day) based on an occupation study (Fawer, 1983), in which a group of 26 mercury- exposed workers (from three industries) were exposed to low levels of mercury for an average of 15.3 years. A LOAEL of 0.026 mg/m3 (adjusted to 0.0062 mg/m3 to account for 8 hour/day exposure 5 days per week) was based on increase in the average velocity of naturally occurring tremor compared to controls. An uncertainty factor of 30 (10 for human variability and 3 for the use of a LOAEL rather than a NOAEL) was applied to the LOAEL to derive the MRL. No MRL has been determined for inorganic mercury. The HBGV is calculated assuming a 70 kg adult inhales 20 m3/day.	ATSDR, 1999. Toxicological Profile for Mercury. March 1999
USEPA (1995) RfC (elemental mercury vapour)	0.09	µg/kg bw/day	0.0003	mg/m3	30	LOAEL	0.009	mg/m3	Neurobehavioural effects	US EPA calculated a RfC of 0.3 µg/m3 for metallic mercury vapour (0.086 µg/kg bw/day) based on a number of occupation studies (Fawer et al 1983, Piikivi and Tolomen 1989, Piikivi and Hanninen 1989, Piikivi 1989, Ngim et al 1992 and Liang et al 1993). A LOAEL of 0.025 mg/m3 (adjusted to 0.009 mg/m3 to account for 8 hour/day exposure 5 days per week) was based on hand tremor, increases in memory disturbance; slight subjective and objective evidence of autonomic dysfunction. Air concentrations were extrapolated from blood levels. An uncertainty factor of 30 (10 for human variability and 3 for lack of data particularly reproductive and developmental studies) was applied to the LOAEL to derive the RfC. No MRL has been determined for inorganic mercury. The HBGV is calculated assuming a 70 kg adult inhales 20 m3/day.	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=370
WHO (1991) Equivalent human inhalation dose (LOAEL) (inorganic mercury but not from inhalation study)						LOAEL	0.069	mg/m3	Auto-immune glomerulonephritis	A LOAEL of 0.05 mg/kg bw was selected from the study by Druet et al (1978) in which Brown Norway rats (number/sex not given) were injected mercuric chloride subcutaneously (0.05 mg/kg) three times a week for 12 weeks. The average daily subcutaneous daily dose (adjusted LOAEL) of 0.0158 mg/kg bw/day was calculated using a 0.739 factor for $HgCl_2$ to Hg^{2+}, and adjusted to account for 3 day per week dosing regime. A human inhalation exposure equivalent of 0.069 mg/m3 was determined based on a 70 kg adult; 0.0158 mg/kg bw/day being the average subcutaneous dose; 20 mg/m3 volume of air inhaled per day, 100 % absorption from the subcutaneous route of exposure; and 80 % absorption from the lung.	WHO, 1991. EHC118. Inorganic Mercury

WHO CICAD (2003) Tolerable concentrations (elemental mercury vapour)	0.05	µg/kg bw/day	0.00016	mg/m3	30	LOAEL	0.005	mg/m3	CNS effects	The WHO CICAD calculated a tolerable intake of 0.2 µg/m3 for metallic mercury vapour based on a number of occupational studies (Fawer et al 1983, Piikivi and Tolomen 1989, Piikivi and Hanninen 1989, Piikivi 1989, Ngim et al 1992 and Roels et al 1982, 1985), in which mild sub-clinical signs of central nervous system toxicity was observed amongst workers occupationally exposed to 20 µg/m3 or more of elemental mercury for several years. Therefore this concentration was considered to be the LOAEL. Extrapolating this to a continuous exposure (multiplying by 8/24 and 5/7) and using an uncertainty factor of 30 (10 for inter-individual variation and 3 for the use of a LOAEL instead of a NOAEL), the tolerable concentration was derived. The HBGV is calculated assuming a 70 kg adult inhales 20 m3/day.	WHO, 2003. Elemental Mercury and Inorganic Mercury Compounds: Human Health Aspects. CICAD 50
RIVM (2001) TCA (elemental mercury vapour)	0.06	µg/kg bw/day	0.00021	mg/m3	30	LOAEL	0.006	mg/m3	Mild tremors	RIVM calculated a TCA of 0.2 µg/m3 based on occupational studies. A LOAEL of 0.026 mg/m3 (adjusted to 0.006 mg/m3 to account for continuous exposure) was determined for metallic mercury vapour based on increased frequency of mild tremors and cognitive skills that were associated with increased creatinine and mercury blood levels. An uncertainty factor of 30 (10 for intraspecies variation and 3 for the use of a LOAEL instead of a NOAEL) was applied to the LOAEL to derive the TCA. The HBGV is calculated assuming a 70 kg adult inhales 20 m3/day.	RIVM, 2001. Re-evaluation of human-toxicological maximum permissible risk levels. RIVM report 711701 025

COT/COC Opinion	N/A

Current UK inhalation HCV

Authoratative body (date) and HBGV type	HBGV value	Unit	UF used	PoD	POD value	Unit	Endpoint	Pivotal data used & Comments	Full Reference
EA (2009) Inhalation TDI (subsequently withdrawn)	**0.06**	µg/kg bw/day	30	LOAEL	0.006	mg/m3	Increased frequency of tremors	Epidemiological study. Fawer et al (1983). HBGV based upon TDI (inh) for elementary mercury.	EA, 2009. Contaminants in soil: updated collation of toxicological data and intake values for humans. Mercury. SC050021

C) Dermal Route

Authoratative body (date) and HBGV type	HBGV value	Unit	UF used	POD	POD value	Unit	Endpoint	Pivotal Study used & Comments	Full Reference

III) Current UK (WHO) regulatory values

	Value	Units	Refs
UK drinking water standard	1	µg/l	The Water Supply (Water Quality) Regulations 2016
WHO drinking water standard	6	µg/l	WHO, 2017. Guidelines for Drinking-water quality (based on 60kg adult and oral TDI of 2 µg/kg bw/d)
UK air quality standard	N/A		There is no target value in the UK for mercury in air
WHO air quality standard	1	µg/m3	WHO Air Quality Guidelines for Europe. Second Edition. 2000 (guideline for inorganic mercury vapour as an annual average - protects against mild renal effects)

IV) Mean Daily Intakes from Other Sources (e.g. Diet)

	Pathways	Units	Adults	Children	Refs
Food (average)	Oral				
Food (average)	Oral				
Water	Oral				
Air	Inhalation				
Smoking	Inhalation				

V) LLTC derivation

A) ORAL

Choice of Pivotal Data	Dosing vehicle	Doses	Units	Species	Study Type	Comments
NTP 2008	*Drinking water*	*0.38, 0.91, 2.4 or 5.9 (m/m); 0.38, 1.4, 3.1 or 8.7 (f/m)*	*mg/kg bw/day*	*Mouse*	*2 year drinking water study*	*Endpoints based on non-neoplasic epithelial hyperplasia in female mice via a threshold MOA (BMDL 0.09) or oral carcinoma in male mice mg kg (BMDL 1.2) (IPCS 2011) .*
NTP 1993 as assessed by all authoritative bodies	**Deionised water**	**0, 0.312, 0.625, 1.25, 2.5 or 5 (adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg Hg/kg bw/day)**	mg/kg bw/day	**Rat**	**6 month gavage study**	NTP carried out a 6 month oral gavage study in which Fischer 344 rats (10/sex/group) were administered 0, 0.312, 0.625, 1.25, 2.5 or 5 mg/kg bw/day as mercuric chloride (adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg Hg /kg bw/day) by oral gavage, 5 days per week for 26 weeks. The critical effect observed was kidney effects, with increased relative and absolute kidney weights observed at 0.625 mg/kg bw/day and renal tubule necrosis at higher doses. Mild nephropathy was also observed and was used as the critical endpoint for BMD modelling to represent low risk. A NOAEL of 0.23 mg Hg/kg bw/day and a BMD10 or BMDL10 of 0.12 and 0.06 mg Hg/kg bw/day, respectively were determined based on increased kidney weight in males.

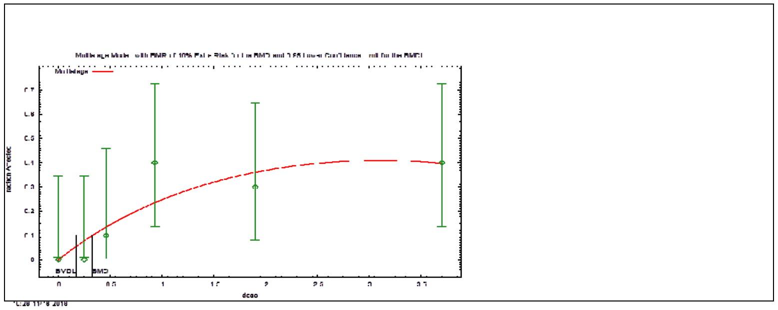
Selection of POD

Published POD for ORAL LLTC:		
Are dose response data of adequate quality to derive a	Yes	
Type of PoD	BMD	
Value selected	0.235	mg/kg bw/day

Derived POD for ORAL LLTC:		
Type of PoD		
Value derived		

BMD Modelling (if answered 'Yes' to question above - see worksheet BMD modelling pivotal study)

Software used	**US EPA BMDS Version [to be specified]**			
	BMD1	BMD5	BMD10	BMD15
BMD modelling (value) (mg/kg bw/day)			0.235	
	BMDL1	BMDL5	BMDL10	BMDL15
BMD modelling (value) (mg/kg bw/day)			0.124	



Comments:	BMD modelling was carried out using US EPA BMDS (version 2.7) based on mild nephropathy in male rats exposed to mercury chloride by gavage for 6 months (NTP, 1993). The lowest BMD10 and BMDL10 was 0.329 and 0.173 mg Hg/kg bw/day based on effects in males, calculated using the multistage model. The AIC value was 52.88. Note. Doses based on Hg content were used for modelling. Data were not adjusted for the dosing schedule prior to modelling. The BMD was adjusted for a 5 days/week dosing schedule to an average daily dose giving a BMD10 and BMDL10 of 0.235 and 0.124 mg Hg/kg bw/day, respectively

Addressing uncertainty

Thresholded effects?	Yes
If yes - use generic UF of 100 or (if data allow) calculate CSAF	100
If no : see below for non-thresholded effects	
If animal data are used as POD (NO(A)EL or BDM) use generic margin of 5000 or (if data allows) calculate CSM	5000
If human data are used to derive a BMD use the margin that relates to a notional risk of 1 in 50000 based on the BMR (using the table opposite). The same margin	
ELCR =	1 in 50000

BMR	**Margin**	**Corresponding ELCR estimate**
0.50%	250	1 in 50000
1%	500	1 in 50000
5%	2500	1 in 50000
10%	5000	1 in 50000

Chemical Specific Adjustment Factor/Chemical Specific Margin to account for uncertainties in the data		
	Range	**Selected value**
Intraspecies	1 - 10	10
Interspecies	1 - 10	10
Sub-chronic to chronic	1-10	1
Database deficiencies	1-3	1
Quality of study	1 - 10	1
Use of LOAEL as POD	1-10	1
Other	1 - 10	1
Total CSAF/CSM		100

Is the LLTC based on systemic or localised toxicological effects?	Systemic
Lifetime averaging to be applied in CLEA (Yes/No)	

Oral LLTC calculation:

	Value	**Units**	**Justification**
LLTC (Thresholded chemical) using NOAEL		µg/kg bw/day	
LLTC (Thresholded chemical) using BMD	2.35	µg/kg bw/day	This represents low risk based on mild nephropathy. It is the same BMD as EFSA calculated for min risk based on kidney weight.

LLTC (Non Thresholded chemical) using NOAEL/LOAEL		µg/kg bw/day	
LLTC (Non Thresholded chemical) using BMD		µg/kg bw/day	

Delete as appropriate

Sensitive Receptor		

b) INHALATION

Choice of Pivotal Data	Dosing vehicle	Doses	Units	Species	Study Type	Comments
Epidemiology study of lung cancer in workers in a chromate	*N/A*	*N/A*	*N/A*	*Human*	*Epidemiology study in chromate production workers*	*The ELCR for for lung cancer for 1, 0.1, 0.01 or 0.001 µg m-3 is equivalent to environmental exposure of 4 in 100, 4 in 1000, 4 in 10,000, or 4 in 100,000. Hence 1 in 100,000 would equate to 0.00025 mg m-3 (0.25 ng m-3).*
Not derived	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	Due to the lack of data on inorganic mercury, the lack of localised toxic effects, the differences in toxicity between inorganic and elemental mercury following inhalation, an inhalation LLTC should not be derived. All routes of exposure can be compated to the oral LLTC.

Selection of POD

Published POD for INHALATION LLTC:		
Are dose response data of adequate quality to derive a	No	
Type of PoD	LOAEL	
Value selected		mg/kg bw/day

Derived POD for INHALATION LLTC: (from data below)		
Type of PoD	BMDL	
Value derived		mg/kg bw/day
AIC value		
P value		

BMD Modelling (if answered 'Yes' to question above - see worksheet BMD modelleing pivotal study)

Software used

	BMD1	BMD5	BMD10	BMD15
BMD modelling (value) (mg/kg bw/day)				
	BMDL1	BMDL5	BMDL10	BMDL15
BMD modelling (value)				

Present benchmark dose graph here

Comments:

Example: Multistage model used for cancer effects.
Gamma etc used for non-cancer effects (diffuse epithelial hyperplasia)

Thresholded effects?	Yes
If yes - use generic UF of 100 or (if data allow) calculate CSAF	100
If no : see below for non-thresholded effects	
If animal data are used as POD (NO(A)EL or BDM) use generic margin of 5000 or (if data allows) calculate CSM	5000
If human data are used to derive a BMD use the margin that relates to a notional risk of 1 in 50000 based on the BMR (using the table opposite). The same margin	
ELCR =	1 in 50000

BMR	Margin	Corresopnding ELCR estimate
0.50%	250	1 in 50000
1%	500	1 in 50000
5%	2500	1 in 50000
10%	5000	1 in 50000

Chemical Specific Adjustment Factor/Chemical Specific Margin to account for uncertainties in the data	Range	Selected value
Intraspecies	1 - 10	10
Interspecies	1 - 10	1
Sub-chronic to chronic	1-10	1
Database deficiencies	1-3	1
Quality of study	1 - 10	1
Use of LOAEL as POD	1-10	1
Other	1 - 10	1
Total CSAF/CSM		10

Inhalation LLTC calculation:

	Value	Units	Justification
LLTC (Thresholded chemical) using LOAEL		µg/kg bw/day	
LLTC (Thresholded chemical) using BMD		µg/kg bw/day	

LLTC (Non Thresholded chemical) using ELCR ADULT RECEPTOR		µg/kg bw/day	
LLTC (Non Thresholded chemical) using ELCR CHILD RECEPTOR AGED 1-6		µg/kg bw/day	
LLTC (Non Thresholded chemical) using ELCR CHILD RECEPTOR AGED 4-9		µg/kg bw/day	

Is the LLTC based on systemic or localised toxicological effects?	Systemic
Lifetime averaging to be applied in CLEA (Yes/No)	

Sensitive Receptor		

Any Additional Comments:

Inorganic mercury causes effects on the kidney following oral exposure and central nervous system effects following inhalation.

The LLTC$_{oral}$ is based on a NTP 6 month oral gavage study in which Fischer 344 rats (10/sex/group) were administered mercuric chloride (0, 0.312, 0.625, 1.25, 2.5 or 5 mg/kg bw/day; adjusted to 0, 0.23, 0.46, 0.93, 1.9 or 3.7 mg Hg/kg bw/day) (NTP, 1993). Critical effects included increased kidney weight at low doses and mild nephropathy at higher doses. The latter was used as the critical endpoint for BMD modelling to represent low risk. Increased kidney weight was not selected as the critical endpoint as there were no changes in clinical chemistry or histopathology hence the mild nephropathy, characterised by tubule regeneration, basement membrane thickenin+A68g and scattered dilated tubules containing hyaline cysts, was considered to be more most appropriate endpoint to represent low risk.
BMD modelling was carried out using US EPA BMDS (version 2.7). The lowest BMD10 and BMDL10 were 0.235 and 0.124 mg Hg/kg bw/day respectively, calculated using the multistage model. An UF of 100 was used to derive a LLTCoral of 2.35 µg/kg bw/day.
Note. Doses based on Hg content were used for modelling. Data were not adjusted for the dosing schedule prior to modelling. The BMD was adjusted for a 5 days/week dosing schedule to an average daily dose giving a BMD10 and BMDL10 of 0.235 and 0.124 mg Hg/kg bw/day, respectively.

For inhalation, due to the lack of data on inorganic mercury, the lack of localised toxic effects, the differences in toxicity between inorganic and elemental mercury following inhalation, and the methodology used for other contaminants with no robust inhalation data, an inhalation LLTC should not be derived and all routes of exposure be compated to the oral LLTC.

BMD modelling

ARE DATA OF SUFFICIENT QUALITY

Toxicological data	NTP
Endpoint	Mild nephropathy
Level of modelled response	10%
Chemical used in study	Mercuric chloride

Dose (mg/kg bw/day)(mercuric chloride)	Dose (mg/kg bw/day)(as Hg)	Species	Sex	n	Incidence of endpoint
0	0	Rat	M	10	0
0.312	0.23	Rat	M	10	0
0.625	0.46	Rat	M	10	1
1.25	0.93	Rat	M	10	4
2.5	1.9	Rat	M	10	3
5	3.7	Rat	M	10	4

Model Name	Maximum number of iterations	AIC	Chi squared value	p value	Accept	BMD	BMDL
Gamma	250	52.23		0.43		0.517	0.331
Logistic	250	57.94		0.11		1.316	0.890
LogLogistic	250	53.42		0.50		0.356	0.015
LogProbit	250	53.16		0.52		0.391	0.028
Multistage	250	52.88		0.62		0.329	0.173
Probit	250	57.65		0.12		1.218	0.833
Weibull	250	52.23		0.43		0.517	0.331
Quantal-Linear	250	52.23		0.43		0.517	0.331

Adjusted for 5 day a week dosing

Model Name	Maximum number of iterations	AIC	Chi squared value	p value	Accept	BMD	BMDL
Gamma	250	52.23		0.43		0.369	0.237
Logistic	250	57.94		0.11		0.940	0.636
LogLogistic	250	53.42		0.50		0.254	0.011
LogProbit	250	53.16		0.52		0.279	0.020
Multistage	250	52.88		0.62		0.235	0.124
Probit	250	57.65		0.12		0.870	0.595
Weibull	250	52.23		0.43		0.369	0.237

APPENDIX B

MEAN DAILY INTAKE DATA SHEET FOR INORGANIC MERCURY

Substance: **Inorganic Mercury**

MDI Oral			**Recommended adult oral MDI**	**Units**	**Justification:** Midpoint of range of adult MDI from dietary exposure from FSA (2015) (2.21 ug/day) plus adult MDI from drinking water based on average reported 99th concentrations in drinking water (0.18 ug/day)		
			2.39	µg day-1			
Organisation/Source	**Date**	**Media**	**Value**	**Units**	**Description**	**Reference**	**Web link**
Food Standards Agency	2014	Food	1.54 - 2.87		Estimated total dietary exposure = 0.047 to 0.097 ug/kg bw/day for 1.5 to 3 yr old, 0.032 to 0.067 ug/kg bw/day for 4 to 10 yr old, 0.015 to 0.032 ug/kg bw/day for 11 to 18 yr old, 0.022 to 0.041 ug/kg bw/day for 19 yr old to adult. Exposures for adult equivalent to adult MDI of 1.54 to 2.87 ug/day	FSA (2014). Total diet study: metals and other elements.FSA project code: FS102081. Metals exposure data spreadsheet.	https://www.food.gov.uk/research/chemical-hazards-in-food-and-feed/total-diet-study-metals-and-other-elements
Committee on Toxicity of Chemicals in Food, Consumer Products and The Environment	2006	Food	1 - 3	µg day-1	Estimate of population exposure 1 - 3 ug day-1.	COT (2006). UK Total Diet Study of Metals and other Elements. Ref. TOX/2008/29	https://cot.food.gov.uk/sites/default/files/cot/tox200829.pdf
Committee on Toxicity of Chemicals in Food, Consumer Products and The Environment	2003	Food	0.17 - 0.26	µg kg(bw)-1 day-1	Max daily intake is for Pre-school Children (1.5 to 4.5 yrs) 0.17 - 0.26 ug/kg bw/day.	COT (2003). COT Statement on a Survey of Metals in Infant Food	https://cot.food.gov.uk/sites/default/files/cot/statement.pdf
DEFRA & Environment Agency Report	2009	Food	1.0	µg day-1	Total MDI of 1.5 ug/day for food and water, 66% of which is inorganic and 33% is organic. MDI for inorganic mercury 1 ug/day	Defra and Environment Agency (2009). Contaminants in Soil. Collation of Toxicological Data Intake Values for Human Exposure. Mercury	https://webarchive.nationalarchives.gov.uk/20140328172842/http://cdn.environment-agency.gov.uk/scho0309bpqn-e-e.pdf
WHO IPCS	1991	Food	4.2	µg day-1	MDI of 3.6 ug day-1 (non-fish) and 0.6 ug day-1 (fish) for inorganic mercury compounds.	WHO IPCS (1991). Environmental Health Criteria 101 - Methylmercury	https://apps.who.int/iris/bitstream/handle/10665/38082/9241571012_eng.pdf;jsessionid=97B9401311A1ED017FC7BD11BAC180AF?sequence=1
ATSDR	1999	Food	8.6	µg day-1	Cites a MacIntosh et al (1996) study which estimates male mercury dietary intake at 8.6 ug day-1.	ATSDR (1999). Toxicological Profile for Mercury.	https://www.atsdr.cdc.gov/toxprofiles/tp46-c5.pdf
DWI	2022	Tap water	0.09	µg L-1	99th percentile concentrations of mercury measured in 2022 averaged across all 30 water companies in England & Wales = 0.09 ug/L. Assuming an adult drinks 2L of water per day this is equivalent to an MDI of 0.18 ug/day	Data summary tables from Drinking Water Inspectorate annual report Drinking water 2022	https://www.dwi.gov.uk/what-we-do/annual-report/drinking-water-2022/

MDI Inhalation			**Recommended adult inhalation MDI**	**Units**	**Justification:** There is clear evidence that the majority of mercury which is present in ambient air is in the elemental form as vapours. Therefore, as with the now withdrawn mercury SGV, the inhalation MDI for inorganic mercury is assumed to be zero.		
			0	ug day-1			
Organisation/Source	**Date**	**Media**	**Value**	**Units**	**Description**	**Reference**	**Web link**
DEFRA & Environment Agency Report	2009	Ambient air	0	µg m-3	Most of the mercury in air is present as elemental mercury vapour. Percentages vary as follows: 90-99% (EC (2001)), >95% (ATSDR (1999)), 75% (IPCS (1990)). As such, the inhalation MDI for the inorganic form of mercury was determined to be negligible.	Defra and Environment Agency (2009). Contaminants in Soil. Collation fo Toxicological Data Intake Values for Human Exposure. Mercury	https://webarchive.nationalarchives.gov.uk/20140328172842/http://cdn.environment-agency.gov.uk/scho0309bpqn-e-e.pdf
Uk Health Security Agency (UKHSA)	2022	Ambient air	-		In the atmosphere, mercury mainly exists as elemental mercury vapour (90 to 99%), particle bound mercury (<5%) and gaseous divalent mercury (<5%). In the EU, reported levels of mercury in air range from 0.001 to 6 ng/m3 in remote areas, 0.1 to 5 ng/m3 in urban areas and 0.5 to 20 ng/m3 in industrial areas.	Guidance: Elemental mercury and inorganic mercury: toxicological overview. Updated 8 June 2022	https://www.gov.uk/government/publications/mercury-properties-incident-management-and-toxicology/elemental-mercury-and-inorganic-mercury-toxicological-overview
WHO	2000	Ambient air	-		WHO states that in areas remote from industry, atmospheric levels of mercury are about 2–4 ng/m3 , and in urban areas about 10 ng/m3. (But as stated above 90-99% of this likely present as elemental mercury)	Air quality guidelines for Europe, 2nd ed. World Health Organization, 2000	https://iris.who.int/handle/10665/107335
ATSDR	1999	Ambient air	-		Over 95% of the mercury found in the atmosphere is gaseous elemental mercury.	ATSDR (1999). Toxicological Profile for Mercury.	https://www.atsdr.cdc.gov/toxprofiles/tp46-c5.pdf

APPENDIX C

SOIL-TO-PLANT EMPIRICAL DATA SHEETS FOR INORGANIC MERCURY

Year	Reference	Type of study	Location	Soil Type	Soil pH	Soil Organic Matter (%)	Plant type(s)	CLEA produce type	Contaminant	Number of CF estimates	Range in soil concentrations (mg/kg(DW)soil)	Soil to plant concentration factor	Units	Type	Additional notes
2006	Millán, R., *et al.,* 2006. Mercury content in vegetation and soils of the Almadén mining area (Spain). *Science of the Total Environment,* 368, 79–87.	Soil outdoor	Spain (Plot 2)	Inceptisols, Entisols, Alfisols, with xeric moisture regime	NA	NA	Asparagus	Green vegetable	Mercury	10	4.60 - 5.46	1.05E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	DW conversion factor of 0.079 for asparagus adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
2006	Millán, R., *et al.,* 2006. Mercury content in vegetation and soils of the Almadén mining area (Spain). *Science of the Total Environment,* 368, 79–87.	Soil outdoor	Spain (Plot 10)	Inceptisols, Entisols, Alfisols, with xeric moisture regime	NA	NA	Asparagus	Green vegetable	Mercury	10	106 - 130	1.34E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	DW conversion factor of 0.079 for asparagus adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
2017	Antoniadis, V., *et al.,* 2017. Bioavailability and risk assessment of potentially toxic elements in garden edible vegetables and soils around a highly contaminated former mining area in Germany. *Journal of Environmental Management,* 186, 192-200.	Soil outdoor	Germany (Gardens 1,3 &4)	Loamy Cambisols	6.2 - 6.7	3.15%	Lettuce	Green vegetable	Total Mercury	3	0.69 - 1.36	3.85E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Soil to plant concentration factor presented for lettuce leaves. DW conversion factor of 0.05 adopted based on 95% moisture content for lettuce quoted in Antoniadis, et al. 2017.
2017	Antoniadis, V., *et al.,* 2017. Bioavailability and risk assessment of potentially toxic elements in garden edible vegetables and soils around a highly contaminated former mining area in Germany. *Journal of Environmental Management,* 186, 192-200.	Soil outdoor	Germany (Gardens 1,2,3 and 4)	Loamy Cambisols	6.0 - 6.7	4.17%	Bean	Green vegetable	Total mercury	4	0.69 - 36.79	1.06E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Soil to plant concentration factor presented for bean seeds. DW conversion factor of 0.08 adopted based on 92% moisture content for beans quoted in Antoniadis, et al. 2017.
2016	Cozzolino, V., *et al.,* 2016. Plant tolerance to mercury in a contaminated soil is enhanced by the combined effects of humic matter addition and inoculation with arbuscular mycorrhizal fungi. *Environ Sci Pollut Res,* 23, 11312 – 11322.	Pot	Italy	98 % sand (80 % coarse sand and 18 % fine sand), 1% silt and 1 % clay	8.1	0.05%	Lettuce	Green vegetable	Total Mercury	5	10	9.04E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	For soil not spiked with arbuscular mycorrhizal fungi and no humic acid added, the mean concentration of total mercury measured in the lettuce leaves was 0.9035mg/kg. Unclear if values presented in the paper are DW or FW. Assumed FW as more conservative.
2016	Cozzolino, V., *et al.,* 2016. Plant tolerance to mercury in a contaminated soil is enhanced by the combined effects of humic matter addition and inoculation with arbuscular mycorrhizal fungi. *Environ Sci Pollut Res,* 23, 11312 – 11322.	Pot	Italy	98 % sand (80 % coarse sand and 18 % fine sand), 1% silt and 1 % clay	8.1	0.05%	Lettuce	Green vegetable	Total Mercury	5	10	3.97E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	For soil not spiked with arbuscular mycorrhizal fungi and 1g/kg of humic acid added, the mean concentration of total mercury measured in the lettuce leaves was 0.3965mg/kg. Unclear if values presented in the paper are DW or FW. Assumed FW as more conservative.
2016	Cozzolino, V., *et al.,* 2016. Plant tolerance to mercury in a contaminated soil is enhanced by the combined effects of humic matter addition and inoculation with arbuscular mycorrhizal fungi. *Environ Sci Pollut Res,* 23, 11312 – 11322.	Pot	Italy	98 % sand (80 % coarse sand and 18 % fine sand), 1% silt and 1 % clay	8.1	0.05%	Lettuce	Green vegetable	Total Mercury	5	10	3.70E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	For soil not spiked with arbuscular mycorrhizal fungi and 2g/kg of humic acid added, the mean concentration of total mercury measured in the lettuce leaves was 0.3704mg/kg. Unclear if values presented in the paper are DW or FW. Assumed FW as more conservative.
2016	Cozzolino, V., *et al.,* 2016. Plant tolerance to mercury in a contaminated soil is enhanced by the combined effects of humic matter addition and inoculation with arbuscular mycorrhizal fungi. *Environ Sci Pollut Res,* 23, 11312 – 11322.	Pot	Italy	98 % sand (80 % coarse sand and 18 % fine sand), 1% silt and 1 % clay	8.1	0.05%	Lettuce	Green vegetable	Total Mercury	5	10	3.61E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	For soil spiked with arbuscular mycorrhizal fungi and no humic acid added, the mean concentration of total mercury measured in the lettuce leaves was 0.3614mg/kg. Unclear if values presented in the paper are DW or FW. Assumed FW as more conservative.
2016	Cozzolino, V., *et al.,* 2016. Plant tolerance to mercury in a contaminated soil is enhanced by the combined effects of humic matter addition and inoculation with arbuscular mycorrhizal fungi. *Environ Sci Pollut Res,* 23, 11312 – 11322.	Pot	Italy	98 % sand (80 % coarse sand and 18 % fine sand), 1% silt and 1 % clay	8.1	0.05%	Lettuce	Green vegetable	Total mercury	5	10	1.94E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	For soil spiked with arbuscular mycorrhizal fungi and 1g/kg of humic acid added, the mean concentration of total mercury measured in the lettuce leaves was 0.1939mg/kg. Unclear if values presented in the paper are DW or FW. Assumed FW as more conservative.
2016	Cozzolino, V., *et al.,* 2016. Plant tolerance to mercury in a contaminated soil is enhanced by the combined effects of humic matter addition and inoculation with arbuscular mycorrhizal fungi. *Environ Sci Pollut Res* 23, 11312 – 11322.	Pot	Italy	98 % sand (80 % coarse sand and 18 % fine sand), 1% silt and 1 % clay	8.1	0.05%	Lettuce	Green vegetable	Total mercury	5	10	1.88E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	For soil spiked with arbuscular mycorrhizal fungi and 2g/kg of humic acid added, the mean concentration of total mercury measured in the lettuce leaves was 0.1877mg/kg. Unclear if values presented in the paper are DW or FW. Assumed FW as more conservative.
2004	Chunilall, V., Kindness, A. & Jonnalagadda, S.B., 2004. Heavy metal uptake by spinach leaves grown on contaminated soils with lead, mercury, cadmium and nickel. *Journal of Environmental Science and Health,* B39, No.3, 473-481.	Pot greenhouse	NA	NA	5.569 - 6.758	11.41% - 11.65%	Spinach	Green vegetable	Total mercury	3 (1 per pot)	10-50ppm	2.62E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Concentration factor calculated based on the mean of 3 concentrations recorded in spinach leaves after 5 weeks growth in 3 pots with soils containing 10ppm, 25ppm and 50ppm of mercury. Control values taken away from leaf values. Uncertainty in values as limited results. DW conversion factor of 0.063 adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
2004	Chunilall, V., Kindness, A. & Jonnalagadda, S.B., 2004. Heavy metal uptake by spinach leaves grown on contaminated soils with lead, mercury, cadmium and nickel. *Journal of Environmental Science and Health,* B39, No.3, 473-481.	Pot greenhouse	NA	NA	5.569 - 6.758	11.41% - 11.65%	Spinach	Green vegetable	Total mercury	3 (1 per pot)	10-50ppm	2.26E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Concentration factor calculated based on the mean of 3 concentrations recorded in spinach leaves after 10 weeks full growth in 3 pots with soils containing 10mg/kg, 25mg/kg and 50mg/kg of mercury. Control values taken away from leaf values. Uncertainty in values as limited results. DW conversion factor of 0.063 adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
2015	Li Xu *et al.* , 2015. Accumulation status, sources and phytoavailability of metals in greenhouse vegetable production systems in Beijing, China. *Ecotoxicology and Environmental Safety,* 122, 214– 220.	Pot greenhouse	Beijing, China	Surface topsoil samples collected from green houses	7.79	2.38%	"Leaf Vegetables"	Green vegetable	Mercury	75	0.01-1.13	7.72E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	14 varieties of leaf vegetables included within the study - cabbage, spinach, green onion, wild cabbage, fennel, leek, water spinach, ruccola salad, malabar spinach, celery, okra, lettuce, crown daisy and oilseed rape.
2018	Zhang. J., *et al.,* 2018. Bioavailability and soil-to-crop transfer of heavy metals in farmland soils: A case study in the Pearl River Delta, South China. *Environmental Pollution,* 235, 710-719.	Soil outdoor	Sihui, China	River alluvial deposits (sand, clay and sandy clay)	5.87	1.31%	Leaf - lettuce	Green vegetable	Total mercury	35	0.03-0.35	2.89E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Concentration factor calculated based on mean concentrations reported within lettuce leaves (assuming a DW conversion factor of 0.04 (adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol) divided by the mean measured concentration in soils sampled from Sihui.

2018	Zhang. J., *et al.,* 2018. Bioavailability and soil-to-crop transfer of heavy metals in farmland soils: A case study in the Pearl River Delta, South China. *Environmental Pollution,* 235, 710-719.	Soil outdoor	Shunde, China	River alluvial deposits (sand, clay and sandy clay)	5.7	3.91%	Chinese cabbage, lettuce, rape, leaf lettuce, flowering cabbage and Chinese kale	Green vegetable	Total mercury	50	0.17-0.75	1.33E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Concentration factor calculated based on mean concentrations reported within Chinese cabbage, lettuce, rape, leaf lettuce, flowering cabbage and Chinese kale (assuming a DW conversion factor of 0.105 (adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol), divided by the mean measured concentration in soils sampled from Shunde.
2005	Raza, R., 2005. Investigation of trace metals in vegetables grown with industrial effluents. *Journal of the Chemical Society of Pakistan* , 2005, 27(4), 341 - 345. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Karachi, Pakistan	NA	NA	NA	Spinach	Green vegetable	Total mercury	NA	2.7	4.20E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from review of Environment Agency 2009 document and the original paper by Raza.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Broccoli	Green vegetable	Total mercury	8	NA	7.05E-04	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Brussels sprouts	Green vegetable	Total mercury	9	NA	1.67E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Cabbage	Green vegetable	Total mercury	32	NA	1.28E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Cauliflower	Green vegetable	Total mercury	13	NA	7.41E-04	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Bean	Green vegetable	Total mercury	34	NA	1.09E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2004	Zarcinas, B.A., Ishak, C.F., McLaughlin, M.J., and Cozens, G., 2004. Heavy metals in soils and crops in southeast Asia. 1. Peninsular Malaysia. *Environmental Geochemistry and Health,* 26, 343-357. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Malaysia Peninsular	Varied	NA	NA	Cabbage	Green vegetable	Total mercury	8	0.105	3.50E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Zarcinas *et al.* not reviewed.
2004	Zarcinas, B.A., Ishak, C.F., McLaughlin, M.J., and Cozens, G., 2004. Heavy metals in soils and crops in southeast Asia. 1. Peninsular Malaysia. *Environmental Geochemistry and Health,* 26, 343-357. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Malaysia Peninsular	Varied	NA	NA	Spinach	Green vegetable	Total mercury	8	0.089	7.08E-07	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Zarcinas *et al.* not reviewed.
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Cabbage	Green vegetable	Inorganic mercury	3	1	1.00E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in cabbage (0.01mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 1mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Cabbage	Green vegetable	Inorganic mercury	3	1	1.00E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in cabbage (0.01mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 1mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Cabbage	Green vegetable	Inorganic mercury	3	10	4.30E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in cabbage (0.043mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 10mg/kg of mercuric chloride (MC).

1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Bean	Green vegetable	Inorganic mercury	3	10	6.00E-04	mg/kg(FW)plant per mg/kg(DW)soil		Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in mercury (0.006mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 10mg/kg of mercuric chloride (MC).
2005	Caille, N., Vauleon, C., Leyval, C. and Morel, J-L., 2005. Metal transfer to plants grown on a dredged sediment: use of radioactive isotope 203-Hg and titanium. *Science of the Total Environment,* 341, 227 - 239. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silty sediment	7.1	10.00%	Cabbage	Green vegetable	Inorganic mercury	5+	17.6	8.95E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Caille *et al.* not reviewed. Concentration factor calculated based on FW concentration reported in cabbage of 0.1575mg/kg.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Bean	Green vegetable	Total mercury	30	0.3259	1.81E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.131 for beans adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Broccoli	Green vegetable	Total mercury	8	0.3259	4.10E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.079 for broccoli adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Cabbage	Green vegetable	Total mercury	4	0.3259	4.48E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.105 for cabbage adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Cauliflower	Green vegetable	Total mercury	8	0.3259	2.54E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.076 for cauliflower adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Lettuce (leaf)	Green vegetable	Total mercury	36	0.3259	4.97E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.040 for lettuce adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Lettuce (head)	Green vegetable	Total mercury	10	0.3259	4.03E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.040 for lettuce adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Bean	Green vegetable	Total mercury	40	0.428	1.32E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Broccoli	Green vegetable	Total mercury	8	0.428	9.14E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Cabbage	Green vegetable	Total mercury	8	0.428	1.58E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Lettuce (head)	Green vegetable	Total mercury	12	0.428	1.30E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Lettuce (leaf)	Green vegetable	Total mercury	40	0.428	6.95E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.

1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Spinach	Green vegetable	Total mercury	24	0.428	1.08E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Lettuce	Green vegetable	Total mercury	11	0.1187	3.25E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Lettuce	Green vegetable	Total mercury	13	0.1963	4.81E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Lettuce	Green vegetable	Total mercury	13	0.2117	4.69E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Lettuce	Green vegetable	Total mercury	14	0.2233	5.61E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Cabbage	Green vegetable	Total mercury	4	0.1187	7.52E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Cabbage	Green vegetable	Total mercury	5	0.1963	1.21E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Cabbage	Green vegetable	Total mercury	8	0.2117	1.41E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 - 8.1	1.60% - 2.80%	Cabbage	Green vegetable	Total mercury	7	0.2233	1.70E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Lettuce	Green vegetable	Inorganic mercury	18	4	1.70E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Lettuce	Green vegetable	Inorganic mercury	18	20	9.00E-05	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Spinach	Green vegetable	Inorganic mercury	24	4	5.34E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Spinach	Green vegetable	Inorganic mercury	24	20	2.19E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Broccoli	Green vegetable	Inorganic mercury	9	4	1.54E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.

1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Broccoli	Green vegetable	Inorganic mercury	9	20	1.15E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Cauliflower	Green vegetable	Inorganic mercury	9	4	1.29E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Cauliflower	Green vegetable	Inorganic mercury	9	20	2.32E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Pea	Green vegetable	Inorganic mercury	9	4	4.90E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Pea	Green vegetable	Inorganic mercury	9	20	3.74E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.

Summary Statistics - Green Vegetables	Geomean	4.8E-03	mg/kg(FW)plant per mg/kg(DW)soil
	Minimum	7.1E-07	mg/kg(FW)plant per mg/kg(DW)soil
	Maximum	1.7E-01	mg/kg(FW)plant per mg/kg(DW)soil
	Standard Deviation	3.8E-02	mg/kg(FW)plant per mg/kg(DW)soil
	Total number of estimates	58	

Year	Reference	Type of study	Location	Soil Type	Soil pH	Soil Organic Matter (%)	Plant type(s)	CLEA produce type	Contaminant	Number of CF estimates	Range in soil concentrations (mg/kg(DW)soil)	Soil to plant concentration factor	Units	Type	Additional notes
2010	Massa, N., *et al.,* 2010. Screening for heavy metal accumulators amongst autochthonous plants in a polluted site in Italy. *Ecotoxicology and Environmental Safety,* 73, 1988–1997.	Soil outdoor	North western Italy, next to a factory	Topsoil	NA	NA	Wild Carrot	Root vegetable	Total mercury	1	1	2.99E-02	mg/kg(FW)plant per mg/kg(DW)soil	Single value	Soil to plant concentration factor for wild carrot roots presented for Area 2, 1 measurement. DW conversion factor of 0.097 carrots adopted in line Environment Agency 2008 plant uptake calculations.
2010	Massa, N., *et al.,* 2010. Screening for heavy metal accumulators amongst autochthonous plants in a polluted site in Italy. *Ecotoxicology and Environmental Safety,* 73, 1988–1997.	Soil outdoor	North western Italy, next to a factory	Topsoil	NA	NA	Wild Carrot	Root vegetable	Total mercury	3	0.5	4.35E-02	mg/kg(FW)plant per mg/kg(DW)soil	Min	Minimum soil to plant concentration factor for wild carrot roots presented for Area 3, 3 measurements. DW conversion factor of 0.097 carrots adopted in line Environment Agency 2008 plant uptake calculations.
2010	Massa, N., *et al.,* 2010. Screening for heavy metal accumulators amongst autochthonous plants in a polluted site in Italy. *Ecotoxicology and Environmental Safety,* 73, 1988–1997.	Soil outdoor	North western Italy, next to a factory	Topsoil	NA	NA	Wild Carrot	Root vegetable	Total mercury	3	0.5	1.20E+00	mg/kg(FW)plant per mg/kg(DW)soil	Max	Maximum soil to plant concentration factor for wild carrot roots presented for Area 3, 3 measurements. DW conversion factor of 0.097 carrots adopted in line Environment Agency 2008 plant uptake calculations.
2017	Antoniadis, V., *et al.,* 2017. Bioavailability and risk assessment of potentially toxic elements in garden edible vegetables and soils around a highly contaminated former mining area in Germany. *Journal of Environmental Management,* 186, 192-200.	Soil outdoor	Germany (Gardens 1,3 and 4)	Loamy Cambisols	6.2 - 6.7	3.15%	Carrot	Root vegetable	Total mercury	3	0.69 - 36.79	6.12E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Soil to plant concentration factor presented for carrot roots. DW conversion factor of 0.12 adopted based on 88% moisture content for carrots quoted in Antoniadis, *et al.* 2017.
2015	Li Xu et al., 2015. Accumulation status, sources and phytoavailability of metals in greenhouse vegetable production systems in Beijing, China. *Ecotoxicology and Environmental Safety,* 122, 214– 220.	Pot greenhouse	Beijing, China	Surface topsoil samples collected from green houses	7.79	2.38%	"Root vegetables"	Root vegetable	Mercury	10	0.01-1.13	6.44E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Radish was the only route vegetable included in the study.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Onion	Root vegetable	Total mercury	35	NA	1.15E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Carrot	Root vegetable	Inorganic mercury	9	1	1.40E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in carrot (0.014mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 1mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Carrot	Root vegetable	Inorganic mercury	9	10	1.20E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in carrot (0.012mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 10mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Carrot	Root vegetable	Inorganic mercury	9	10	7.30E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in carrot (0.073mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 10mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Onion	Root vegetable	Inorganic mercury	9	1	3.00E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in onion (0.003mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 1mg/kg of mercuric chloride (MC).

1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Onion	Root vegetable	Inorganic mercury	9	10	5.00E-04	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in onion (0.005mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 10mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Onion	Root vegetable	Inorganic mercury	9	1	1.00E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in onion (0.010mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 1mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Onion	Root vegetable	Inorganic mercury	9	10	1.09E-01	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in onion (1.087mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 10mg/kg of mercuric chloride (MC).
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Beet	Root vegetable	Total mercury	40	0.3259	3.05E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.138 for other root vegetables adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Onion	Root vegetable	Total mercury	20	0.3259	5.09E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.097 for onions adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Radish	Root vegetable	Total mercury	60	0.3259	2.31E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the original paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. Value is an average for red and white radishes. DW conversion factor 0.138 for other root vegetables adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Beet	Root vegetable	Total mercury	36	0.428	8.83E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Onion	Root vegetable	Total mercury	24	0.428	8.20E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Carrot	Root vegetable	Total mercury	48	0.428	2.99E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.

1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Radish	Root vegetable	Total mercury	36	0.428	8.06E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Turnip	Root vegetable	Total mercury	18	0.428	2.39E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Cappon 1986 not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Radish	Root vegetable	Total mercury	15	0.1187	1.07E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Radish	Root vegetable	Total mercury	11	0.1963	1.29E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Radish	Root vegetable	Total mercury	12	0.2117	1.19E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Radish	Root vegetable	Total mercury	12	0.2233	1.55E-01	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Carrot	Root vegetable	Total mercury	7	0.1187	4.49E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Carrot	Root vegetable	Total mercury	6	0.1963	3.71E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Carrot	Root vegetable	Total mercury	4	0.2117	3.57E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1982	Elsokkary, I.H., 1982. Contamination of soils and plants by mercury as influenced by the proximity to industries in Alexandria, Egypt. *Science of the Total Environment,* 23, 55 - 60. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Alexandria, Egypt	Clay loam	7.5 to 8.1	1.6 to 2.8	Carrot	Root vegetable	Total mercury	5	0.2233	4.00E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Elsokkary not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Radish	Root vegetable	Inorganic mercury	24	4	8.97E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Radish	Root vegetable	Inorganic mercury	24	20	4.57E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.
1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Carrot	Root vegetable	Inorganic mercury	30	4	1.29E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.

1972	John, M.K., 1972. Mercury uptake from soil by various plant species. *Bulletin of Environmental Contamination and Toxicology,* 8 (2), 77 - 80. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	NA	Silt loam	5.1	11.80%	Carrot	Root vegetable	Inorganic mercury	30	20	1.89E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by John not reviewed.

Summary Statistics - Root Vegetables	Geomean	1.1E-02	mg/kg(FW)plant per mg/kg(DW)soil
	Minimum	1.9E-04	mg/kg(FW)plant per mg/kg(DW)soil
	Maximum	1.2E+00	mg/kg(FW)plant per mg/kg(DW)soil
	Standard Deviation	2.1E-01	mg/kg(FW)plant per mg/kg(DW)soil
	Total number of estimates	33	

Year	Reference	Type of study	Location	Soil Type	Soil pH	Soil Organic Matter (%)	Plant type(s)	CLEA produce type	Contaminant	Number of CF estimates	Range in soil concentrations (mg/kg(DW)soil)	Soil to plant concentration factor	Units	Type	Additional notes
2011	Cotching, W.E., and Coad, J.R., 2011. Metal element uptake in vegetables and wheat after biosolids application. *Journal of Solid Waste Technology and Management,* 37, No. 2, 75-82.	Pot greenhouse		Digester sludge with or without quicklime added, mixed with soil	5.9 before amendment	3%	Potato	Tuber vegetable	Total mercury	14	34 to 62	3.23E-04	mg/kg(FW)plant per mg/kg(DW)soil	Min	Mercury not recorded above laboratory levels of detection (LoD) in potatoes. Assumed LoD as a measurable value (0.02mg/kg).
2011	Cotching, W.E., and Coad, J.R., 2011. Metal element uptake in vegetables and wheat after biosolids application. *Journal of Solid Waste Technology and Management,* 37, No. 2, 75-82.	Pot greenhouse		Digester sludge with or without quicklime added, mixed with soil	5.9 before amendment	3%	Potato	Tuber vegetable	Total mercury	14	34 to 62	5.88E-04	mg/kg(FW)plant per mg/kg(DW)soil	Max	Mercury not recorded above laboratory levels of detection (LoD) in potatoes. Assumed LoD as a measurable value (0.02mg/kg).
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Potato	Tuber vegetable	Total mercury	35	NA	1.28E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Potato	Tuber vegetable	Inorganic mercury	3	1	2.00E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in potato (0.002mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 1mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Potato	Tuber vegetable	Inorganic mercury	3	10	6.00E-04	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in potato (0.006mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 10mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Potato	Tuber vegetable	Inorganic mercury	3	10	1.30E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the original paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in potato (0.13mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 10mg/kg of mercuric chloride (MC).

Summary Statistics - Tuber Vegetables			
	Geomean	1.2E-03	mg/kg(FW)plant per mg/kg(DW)soil
	Minimum	3.2E-04	mg/kg(FW)plant per mg/kg(DW)soil
	Maximum	1.3E-02	mg/kg(FW)plant per mg/kg(DW)soil
	Standard Deviation	5.0E-03	mg/kg(FW)plant per mg/kg(DW)soil
	Total number of estimates	6	

Year	Reference	Type of study	Location	Soil Type	Soil pH	Soil Organic Matter (%)	Plant type(s)	CLEA produce type	Contaminant	Number of CF estimates	Range in soil concentrations (mg/kg(DW)soil)	Soil to plant concentration factor	Units	Type	Additional notes
2015	Li Xu *et al*., 2015. Accumulation status, sources and phytoavailability of metals in greenhouse vegetable production systems in Beijing, China. *Ecotoxicology and Environmental Safety*,122, 214– 220.	Pot greenhouse	Beijing, China	Surface topsoil samples collected from green houses	7.79	2.38%	"Fruit Vegetables"	Herbaceous fruit	Total Mercury	106	0.01-1.13	3.24E-02	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Tomato and cucumber were the only fruit vegetables included in the study.
2005	Raza, R., 2005. Investigation of trace metals in vegetables grown with industrial effluents. *Journal of the Chemical Society of Pakistan*, 2005, 27(4), 341 - 345. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Karachi, Pakistan	NA	NA	NA	Tomato	Herbaceous fruit	Total mercury	NA	2.7	9.81E-04	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from review of Environment Agency 2009 document and the origional paper by Raza.
2004	Zarcinas, B.A., Ishak, C.F., McLaughlin, M.J., and Cozens, G., 2004. Heavy metals in soils and crops in southeast Asia. 1. Peninsular Malaysia. *Environmental Geochemistry and Health,* 26, 343-357. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Malaysia Peninsular	Varied	NA	NA	Aubergine	Herbaceous fruit	Total mercury	9	0.218	7.98E-05	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the deriviation of SGV for mercury and supporting data provided from this project. Origional paper by Zarcinas *et al.* not reviewed.
2004	Zarcinas, B.A., Ishak, C.F., McLaughlin, M.J., and Cozens, G., 2004. Heavy metals in soils and crops in southeast Asia. 1. Peninsular Malaysia. *Environmental Geochemistry and Health,* 26, 343-357. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	Malaysia Peninsular	Varied	NA	NA	Cucumber	Herbaceous fruit	Total mercury	13	0.12	8.33E-05	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented from Environment Agency 2009 document: Supplementary information for the deriviation of SGV for mercury and supporting data provided from this project. Origional paper by Zarcinas *et al.* not reviewed.
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Tomato	Herbaceous fruit	Inorganic mercury	3	1	2.30E-02	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the origional paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in tomatos (0.023mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 1mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Silt loam	NA	NA	Tomato	Herbaceous fruit	Inorganic mercury	3	10	1.30E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the origional paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in tomato (0.013mg/kg) (corrected for control in the value presented in the paper), grown in silt loam soils spiked with 10mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Tomato	Herbaceous fruit	Inorganic mercury	3	1	7.00E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the origional paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in tomatos (0.007mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 1mg/kg of mercuric chloride (MC).
1973	Bache, C.A., Gutenmann, W.H., St. John, L.E., Sweet, R.D., Hatfield, H.H., and Lisk, D.J., 1973. Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds. *Journal of Agricultural Food and Chemistry,* 21 (4), 607 - 613. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Pot	US, New York	Gravelly loam	NA	NA	Tomato	Herbaceous fruit	Inorganic mercury	3	10	1.30E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review of the origional paper by Bache *et al.* (1973) and Environment Agency (2009) supplementary information for mercury guidance. Concentration factor calculated based on the concentration of total mercury recorded in tomato (0.013mg/kg) (corrected for control in the value presented in the paper), grown in gravelly loam soils spiked with 10mg/kg of mercuric chloride (MC).
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Cucumber	Herbaceous fruit	Total mercury	3	0.3259	5.65E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the origional paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.04 for cucumber adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Pumpkin	Herbaceous fruit	Total mercury	6	0.3259	4.45E-04	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the origional paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.058 for pumpkin adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1981	Cappon, C.J., 1981. Mercury and selenium content and chemical form in vegetable crops grown on sludge-amended soil. *Archives of Environmental Contamination and Toxicology,* 10, 673 - 689. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	New York, United States	Clay loam and sewage sludge	6.8	3.00%	Tomato	Herbaceous fruit	Total mercury	8	0.3259	1.22E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	Information presented based on review of the origional paper by Cappon (1981) and Environment Agency (2009) supplementary information for mercury guidance. DW conversion factor 0.058 for tomato adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Squash	Herbaceous fruit	Total mercury	3	0.428	1.18E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the deriviation of SGV for mercury and supporting data provided from this project. Origional paper by Cappon 1986 not reviewed.
1986	Cappon, C.J., 1986. Uptake and speciation of mercury and selenium in vegetable crops grown on compost-treated soil. *Water, Air, and Soil Pollution,* 34, 353 - 361. Cited in: Environment Agency, 2009. Supplementary information for the deriviation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	NA	Clay loam and compost	6.5	NA	Tomato	Herbaceous fruit	Total mercury	8	0.428	3.28E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented based on review from the Environment Agency 2009 document: Supplementary information for the deriviation of SGV for mercury and supporting data provided from this project. Origional paper by Cappon 1986 not reviewed.

Summary Statistics - Herbaceous Fruit	Geomean	1.3E-03	mg/kg(FW)plant per mg/kg(DW)soil
	Minimum	8.0E-05	mg/kg(FW)plant per mg/kg(DW)soil
	Maximum	3.2E-02	mg/kg(FW)plant per mg/kg(DW)soil
	Standard Deviation	1.1E-02	mg/kg(FW)plant per mg/kg(DW)soil
	Total number of estimates	12	

Year	Reference	Type of study	Location	Soil Type	Soil pH	Soil Organic Matter (%)	Plant type(s)	CLEA produce type	Contaminant	Number of CF estimates	Range in soil concentrations (mg/kg(DW)soil)	Soil to plant concentration factor	Units	Type	Additional notes
2003	D. Schwesig & O. Krebs. The role of ground vegetation in the uptake of mercury and methylmercury in a forest ecosystem. *Plant and Soil,* 253: 445–455, 2003.	Pot	Bavaria, Germany	Cambisols/ podzols of a loamy to sandy nature			Bilbery/European blueberry	Shrub fruit	Inorganic Mercury. 202Hg2+	10	0.2	4.15E-03	mg/kg(FW)plant per mg/kg(DW)soil	Mean	3 month experiment, with 10 plants. Soil to plant concentration factor presented for fruit and considers residual amount in soil after volatile loss. DW conversion factor of 0.166 for soft fruit adopted from Table 7.1 contained in Environment Agency, 2009. Updated technical background to the CLEA model, SR3, Environment Agency: Bristol.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Blackberries	Shrub fruit	Total mercury	2	NA	8.12E-04	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Blackcurrants	Shrub fruit	Total mercury	3	NA	1.25E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Gooseberries	Shrub fruit	Total mercury	12	NA	1.12E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.
2005	Weeks, C., and Knowles, T., 2005. Multi-element survey of allotment produce, Final Report C02043. Food Standards Agency: London. Cited in: Environment Agency, 2009. Supplementary information for the derivation of SGV for mercury. Science report - SC050021. Environment Agency: Bristol.	Soil outdoor	UK (12 sites Birmingham, Glasgow and London)	Varied	Varied	NA	Raspberries	Shrub fruit	Total mercury	7	NA	1.27E-03	mg/kg(FW)plant per mg/kg(DW)soil	NA	Information presented from Environment Agency 2009 document: Supplementary information for the derivation of SGV for mercury and supporting data provided from this project. Original paper by Weeks and Knowles not reviewed.

Summary Statistics - Shrub Fruit	Geomean	1.4E-03	mg/kg(FW)plant per mg/kg(DW)soil
	Minimum	8.1E-04	mg/kg(FW)plant per mg/kg(DW)soil
	Maximum	4.2E-03	mg/kg(FW)plant per mg/kg(DW)soil
	Standard Deviation	1.4E-03	mg/kg(FW)plant per mg/kg(DW)soil
	Total number of estimates	5	