Land Quality Management Ltd

For

Department of Environment,

Republic of Cyprus

Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances

LQM Report Number: **1472-0A-3**

Issue Number: **1.0**

Status: **Final**

Date: **June 2020**

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Document Control Sheet

Issued by:	**Land Quality Management Ltd** The Sir Colin Campbell Building University of Nottingham Innovation Park Triumph Road Nottingham NG7 2TU Tel: +44 (0)115 7484080 Email: administrator@lqm.co.uk
Client:	**Department of Environment, Republic of Cyprus** **28th October 20-22** **2414 Engomi** **Nicosia** **Cyprus**
Report Title:	**Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances**
LQM Report Number:	**1472-0A-3**
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Status:	**Final**
Date:	**30 June 2020**
File Location:	**F:\Shared drives\P drive\1472 s4cl\second deliverable\final\1472-0A_ThirdDeliverable_Report_FINAL_0.04.docx**

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Document Revision Record

Issue number	Date	Revision Details
1.0	**30 June 2020**	Final

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EXECUTIVE SUMMARY

This report describes how contaminant concentrations in soil that represent no appreciable or minimal risk to human health have been calculated. These concentrations are screening levels that apply to the Larnaca-Dhekelia area and are called Suitable for Larnaca Levels (S4LLs). S4LLs have been derived for petroleum hydrocarbons and selected heavy metal pollutants. The S4LLs are based on human exposure via specified pathways to soil contaminants and / or their degradation products and / or their metabolites and reflect the mode of action of each pollutant or group of pollutants. The S4LLs assume a residential land use with consumption of home grown produce. This decision was made to ensure that soil contamination does not constrain future land use.

The S4LLs are based on the climate, environment, spatial and population conditions of Larnaca, where information is available, as well as the characteristics of the pollutants. Excel spreadsheets of the calculations are provided.

The S4LLs should be used to screen out substances from further consideration. If contaminant concentration at a site does not exceed the relevant S4LL, then that contaminant represents minimal or no appreciable risk to human health. If contaminant concentration exceeds the relevant S4LL, then Site Specific Assessment Criteria (SSAC) can be derived using site specific measurements of, for example, bioaccessibilty or soil-to-plant uptake factors.

The spreadsheets in Appendix 1, Appendix 2 and Appendix 3 can be modified to reflect this site specific information and run to derive the SSAC. Any report using such SSAC should also detail how these SSAC were derived.

Other substances for which no S4LL is available (e.g. solvents, metals, organic chemicals), may be encountered. Such substances would need to undergo a detailed site specific assessment and the outcomes, including the description for the SSAC would be needed. This could be based on this report.

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Π Ε Ρ Ι Λ Η Ψ Η

Η Έκθεση περιγράφει τη βάση για τον υπολογισμό ορίων ρύπων του εδάφους για να διευκολύνουν την εκτίμηση επικινδυνότητας της ρύπανσης. Τα όρια αναφέρονται ως Suitable for Larnaca Levels (S4LL) και έχουν υπολογιστεί για υδρογονάνθρακες πετρελαίου και επιλεγμένα βαρέα μέταλλα.

Τα S4LL είναι συγκεντρώσεις ρύπων που αντιπροσωπεύουν αμελητέο (δόσης-απόκριση με κατώφλι) ή ελάχιστο (δόσης-απόκριση χωρίς κατώφλι) κίνδυνο για τον άνθρωπο ανεξάρτητα από τη χρήση γης.

Τα S4LL βασίζονται στην έκθεση του ανθρώπου σε περιβαλλοντικούς ρύπους μέσω καθορισμένων οδών ή / και τα προϊόντα αποδόμησης ή / και τους μεταβολίτες τους και αντικατοπτρίζουν τον τοξικολογικό τρόπο δράσης κάθε ρύπου ή ομάδας ρύπων.

Οι υπολογισμοι των S4LL λαμβάνουν υπόψη τις κλιματικές, περιβαλλοντικές, χωρικές και πληθυσμιακές συνθήκες της Λάρνακας, όπου υπάρχουν πληροφορίες, καθώς και τα συγκεκριμένα μοριακά και φυσικοχημικά χαρακτηριστικά των ρύπων.

Οι υπολογισμοι των S4LL γίνονται σε υπολογιστικά φύλλα Excel - το λεγόμενο CLEA (Contaminated Land Exposure Assessment tool). Τα φύλλα παρέχονται ως προσαρτήματα.

Τα S4LL υποστηρίζουν τον αποκλεισμό ρύπων από περαιτέρω εξέταση. Εάν μια τοπική συγκέντρωση ρύπων δεν υπερβαίνει το σχετικό S4LL όριο, τότε αυτός ο ρύπος παρουσιάζει ελάχιστο ή αμελητέο κίνδυνο για τον άνθρωπο.

Εάν όμως μια τοπική συγκέντρωση ρύπων υπερβαίνει το σχετικό, αλλά γενικό, S4LL όριο, τότε χρειάζεται απορρυπανση ή περαιτέρω έρευνα. Τα CLEA φύλλα στο Προσάρτημα 1, Προσάρτημα 2 και Προσάρτημα 3 μπορούν να τροποποιηθούν και να υπολογιστούν Τοπικα όρια αξιολόγησης (SSAC) με βάση για παράδειγμα, την τοπική βιοδιαθεσιμότητα ή των παραγόντων πρόσληψης εδάφους προς φυτό. Οποιαδήποτε εκτίμηση επικινδυνότητας που χρησιμοποιεί τέτοια SSAC θα πρέπει επίσης να αναφέρει λεπτομερώς πώς προέκυψαν αυτά τα SSAC.

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1 INTRODUCTION

1.1 Terms of Reference

(1) In December 2019 the Contracting Authority, the Department of Environment (DOE), on behalf of the Government of the Republic of Cyprus commissioned Land Quality Management Ltd (LQM) to undertake work in relation to the aim and objectives listed below. Our proposed method of approach for the works to be undertaken is included in Section 2. A contract based on our response to tender DOE 19/2019 was agreed and signed on 11 December 2019. The contract refers to Limit Values, which we term Screening Levels.

1.2 The Larnace- Dhekelia Area

(2) The work relates to deriving soil screening levels that reflect available information about the conditions in the area of the former oil refinery and fuel and gas storage and distribution facilities between Larnaca and Dhekelia, Cyprus. This recognises that, where legislation allows, site specific assessment criteria (SSAC) can be developed based on the approach we have adopted but reflecting detailed site investigation information in place of generic, and of necessity conservative, assumptions made in deriving the generic Screening Levels. We have adopted the name Suitable for Larnaca Levels (S4LL) for these screening levels. LQM have derived the most comprehensive and widely used set of screening levels for the UK (Nathanail et al. 2015). These are based on a series of Excel spreadsheets – the Contaminated Land Exposure Assessment (CLEA) model – developed by the Environment Agency. This work has formed the basis for deriving the S4LLs.

(3) This project relates to the proposed redevelopment of land occupied by the former oil refinery and fuel storage facilities, Larnaca (Cyprus) once these facilities have been decommissioned.

1.3 Aim

(4) The overall aim of this work was to develop soil screening levels ('limit values') suitable for soil pollutants from petroleum and other substances for a range of exposure pathways reflecting a residential with consumption of home grown produce land use scenario based on Cypriot climate, demographic and dietary data, where available. These are referred to as Suitable for Larnaca Levels (S4LLs).

(5) This report describes how the S4LLs for the agreed list of pollutants have been derived.

1.4 Objectives

(6) The objectives needed to develop the screening levels are:

- Ensure contaminant chemical, physical and toxicological properties to reflect Cyprus conditions and policy (e.g. some parameters are temperature sensitive);

- Ensure demographic and dietary data, land use and building data are based on Cyprus information where available;
- Document those parameters for which no information specific to Cyprus has been identified and, if relevant, the potential impact on screening levels;
- Provide substance-specific appendices with all relevant input parameters;
- Provide receptor, exposure, land use and building inputs used or assumed within CLEA;
- Outline the CLEA spreadsheets used to derive S4LLs;
- Provide the S4LLs for the residential with consumption of home grown produce land use;
- Provide copies of the relevant CLEA spreadsheet outputs.

1.5 Legal Context

(7) The legal context within which the screening levels will be used covers preparations for the redevelopment of land during the decommissioning and permit surrenders for the existing facilities and gaining planning permission for new development.

2 SCREENING LEVELS – POLLUTANTS, LAND USE SCENARIOS & CRITICAL RECEPTOR

2.1 Pollutants

(8) SS4Ls have been derived for the following pollutants:

- **Metals and metalloids:** Arsenic; Cadmium; Lead; Mercury (elemental); Mercury (inorganic); Mercury (organic); and Nickel
- **Volatile organics:** Benzene; Toluene; Ethylbenzene; o-Xylene; m-Xylene; p-Xylene
- **Petroleum Hydrocarbon equivalent carbon fractions:** Aliphatic EC 5-6; Aliphatic EC >6-8; Aliphatic EC >8-10; Aliphatic EC >10-12; Aliphatic EC >12-16; Aliphatic EC >16-35; Aliphatic EC >35-44; Aromatic EC 5-7 (benzene); Aromatic EC >7-8 (toluene); Aromatic EC >8-10; Aromatic EC >10-12; Aromatic EC >12-16; Aromatic EC >16-21; Aromatic EC >21-35; Aromatic EC >35- 44; Aliphatic + Aromatic EC >44-70.
- **Polyaromatic Hydrocarbons:** Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]anthracene; Benzo[a]pyrene; Benzo[b]fluoranthene; Benzo[ghi]perylene; Benzo[k]fluoranthene; Chrysene; Dibenzo[ah]anthracene; Fluoranthene; Fluorene; Indeno[123-cd]pyrene; Naphthalene; Phenanthrene; Pyrene; and Coal Tar (Benzo(a)pyrene as a surrogate marker).

2.2 Land use - Exposure Scenario

(9) The generic Residential with home grown produce (RwHP) land use scenario has been used (as described or outlined by Nathanail et al. (2015)) to derive S4LLs.

2.3 Exposure Pathways

(10)Exposure has been estimated via each of the following ten (10) pathways: direct soil and dust ingestion (2 pathways); consumption of home grown produce (1); soil attached to home grown produce (1); dermal contact (indoor and outdoor) (2); inhalation of indoor and outdoor dusts and vapours (4).

(11)The input parameters for each pathway are provided across of the relevant age classes within a series of default or user specified worksheets provided within the CLEA spreadsheet model, which are discussed in more detail within Section 4. All relevant data can be accessed via the CLEA spreadsheets in APPENDIX **1** (Petroleum Hydrocarbon Fractions and Organics), APPENDIX **2** (Polyaromatic Hydrocarbons) and APPENDIX **3** (Metals and Metalloids).

2.4 Critical Receptor

(12) The person most at risk, the critical receptor, is based on a certain age class range from infants (0-1 years) and children through to mature adults (75 years). The critical receptor has been identified as the female 0-6 year old child.

(13) For the case of cadmium a female lifetime (0-75 years) exposure scenario is assumed as the chronic accumulation of cadmium in the kidney, over 50 years or so, is the critical toxicological effect (Nathanail et al., 2015).

3 PHYSICO-CHEMICAL INPUTS AND TOXICOLOGICAL INPUTS

(14)Contaminant physico-chemical and toxicological inputs have been modified, where relevant and possible, to reflect Cyprus conditions and policy as indicated in this section.

(15)Parameters for every substance are included within the CLEA spreadsheets. Where these differ from the parameters used in Nathanail et al. (2015) to derive the UK specific suitable for use levels (S4UL), details are provided in this section.

3.1 Modification of physico-chemical inputs (temperature correction to ambient soil)

(16)Some of the physico-chemical parameters required for assessing the vapour inhalation pathways vary according to ambient soil temperature. This is higher in Cyprus than in the UK (where it is assumed to be 283K). Therefore, the relevant physico-chemical inputs (paragraph (19)) for each volatile or semi-volatile substance have been modified, as documented within the '*User Chemicals*' worksheet contained within the CLEA v1.071 spreadsheet model.

(17)The maximum long-term average air temperature (MLLAAT) for Larnaca[1] for August (2000-2018) is 34°C (307K). This is consistent with long-term daily minimum and maximum air temperature data for Larnaca airport (2000-2019) supplied by the Cyprus Department of Environment to LQM. Analysis of that dataset indicates the MLLAAT for August is 33.6°C, with a long-term daily average of 20.4°C (Figure **2**). A reasonably cautious assumption would be to assume an ambient soil temperature 10K less than the MLLAAT (i.e. 297K).

(18)The Cyprus Department of Meteorology[2] reports seasonal mean soil temperatures of about 10°C (283K) in January and 33°C (306K) in July at 10cm depth and of 14°C (287K) to 28°C (301K) at 1m depth. The average of the January and July mean soil temperatures at 10cm of approximately 22°C (295K) has been assumed to be a reasonably cautious assumption for Cyprus conditions and used to modify the relevant physico-chemical inputs (paragraph (19)).

(19)The Environment Agency's SR7 publication (Environment Agency, 2008a) contains several temperature correction methods for the following physical chemical parameters that impact the vapour inhalation pathways:

- Vapour pressure (VP)
- Air-water partition coefficient (K_{aw})

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[1] https://www.weatheronline.co.uk/Cyprus/Larnaca.htm, accessed 11/12/19

[2] http://www.moa.gov.cy/moa/ms/ms.nsf/DMLcyclimate_en/DMLcyclimate_en?OpenDocument, accessed 11/12/19

- Diffusion coefficient in air (D_{air})
- Diffusion coefficient in water (D_{water})

Table 1: SR7 methods or literature source(s) used for each substance or groups of substances in deriving temperature corrected parameters to 295K

Substance(s)	Method	Reference
	Vapour Pressure (VP)	
Aliphatic-Aromatic HC Fractions	Grain-Watson for liquids or solids	Equations 2-27 to 2-30 (SR7)
Benzene Ethylbenzene Toluene Xylene isomers	Grain-Watson for liquids	Equations 2-27 & 2-28 (SR7)
Polyaromatic Hydrocarbons (PAHs)	Grain-Watson for solids	Equations 2-29 & 2-30 (SR7)
Volatile metals: Mercury (elemental) Mercury (methyl)	 Recommended literature value (295K) Recommended literature value (298K)	 Lide *et al.* (2008) Environment Agency (2009a)
	Air-water partition coefficient (K_{aw})	
Aliphatic-Aromatic HC Fractions	Direct Method	Equation 2-5 (SR7)
Benzene Ethylbenzene Toluene Xylene isomers	Direct Method	Equation 2-5 (SR7)
Polyaromatic Hydrocarbons (PAHs)	Direct Method	Equation 2-5 (SR7)
Volatile metals: Mercury (elemental) Mercury (methyl)	 USEPA Method (Clapeyron relationship) Recommended literature value (298K)	 Equation 2-4 (SR7) Environment Agency (2009a)
	Diffusion coefficient in air (D_{air})	
Aliphatic-Aromatic HC Fractions	Derived using the FSG Method as ratio of temperatures (295K:283K)[a]	Equation 2-12 (SR7)
Benzene Ethylbenzene Toluene Xylene isomers	Wilke and Lee Method	Equations 2-14 to 2-17 (SR7)
Polyaromatic Hydrocarbons (PAHs)	Wilke and Lee Method	Equations 2-14 to 2-17 (SR7)
Volatile metals: Mercury (elemental) Mercury (methyl)	 Heinsohn and Cimbala FSG Method	 Equation 2-1 (Environment Agency, 2009a) Equations 2-12 & 2-13 (SR7)
	Diffusion coefficient in water (D_{water})	
Aliphatic-Aromatic HC Fractions	Derived using the Hayduk & Laudie Method as ratio of water viscosities at different ambient temperatures (295K:283K)[b]	Equation 2-20 (SR7)
Benzene Ethylbenzene Toluene Xylene isomers	Hayduk & Laudie Method	Equation 2-20 (SR7)
Polyaromatic Hydrocarbons (PAHs)	Hayduk & Laudie Method	Equation 2-20 (SR7)
Volatile metals: Mercury (elemental) Mercury (methyl)	 Hayduk & Laudie Method Hayduk & Laudie Method[b]	 Equation 2-20 (SR7) Equation 2-20 (SR7)

Table Footnotes: SR7 (Environment Agency, 2008a); [a] $D_{air-295K} = D_{air-283K} (T_{amb-295K})^{1.75} / (T_{amb-283K})^{1.75}$; [b] $D_{water-295K} = D_{water-283K} (WaterViscosity_{283K})^{1.14} / (WaterViscosity_{295K})^{1.14}$

(20)More than one temperature correction method may exist for each parameter. The method selected depends on properties such as the boiling point (See SR7 for further details (Environment Agency, 2008a)). The method used for each substance or group of substances is indicated in Table 1.

(21)The values used for each substance are in the CLEA spreadsheets and can be printed directly to PDF for archive and reference purposes. More information on methodology and values used for the full range of input parameters required for each substance is provided by Nathanail *et al.* (2015).

3.2 Modification of toxicological inputs (policy decisions)

(22)The pollutants being considered demonstrate both threshold and non-threshold behaviour and toxicological effects (Environment Agency, 2008b). Health criteria values have been selected on the basis of guidance (Defra, 2014a; Environment Agency, 2009b) that reflects no appreciable (threshold) and minimal (non-threshold) risk (with the exception of lead). These are generally based on international expert opinion (e.g. EFSA, US EPA, WHO) and, in the case of lead, with Defra policy (Defra, 2014a).

(23)The toxicological parameters presented and discussed by LQM (Nathanail et al., 2015) have been used as inputs for the derivation of the S4LLs. **Error! Reference source not found.** indicates whether each pollutant or g roups of pollutants is treated as having either threshold or non-threshold behaviour for each pathway (oral, dermal and inhalation). The toxicological input (oral or inhalation) used to compare against the exposures estimated from each pathway are also indicated.

Table 2: Dose response relationship across exposure pathways assumed for the pollutants or groups of pollutants for which Suitable for Larnaca Levels (S4LLs) have been derived

Group	Pollutant	Oral	Dermal	Inhalation
Petroleum Hydrocarbon Equivalent Carbon Fractions	Aliphatic EC 5-6	Threshold [a]		Threshold
	Aliphatic EC >6-8	Threshold [a]		Threshold
	Aliphatic EC >8-10	Threshold [a]		Threshold
	Aliphatic EC >10-12	Threshold [a]		Threshold
	Aliphatic EC >12-16	Threshold [a]		Threshold
	Aliphatic EC >16-35	Threshold [a]		
	Aliphatic EC >35-44	Threshold [a]		
	Aromatic EC 5-7 (benzene)	Threshold [a]		Threshold
	Aromatic EC >7-8 (toluene)	Threshold [a]		Threshold
	Aromatic EC >8-10	Threshold [a]		Threshold
	Aromatic EC >10-12	Threshold [a]		Threshold
	Aromatic EC >12-16	Threshold [a]		Threshold
	Aromatic EC >16-21	Threshold [a]		
	Aromatic EC >21-35	Threshold [a]		
	Aromatic EC >35- 44	Threshold [a]		
	Aliphatic + Aromatic EC >44-70	Threshold [a]		
Volatiles (VOCs)	Benzene	Non-Threshold [a]		Non-Threshold
	Toluene	Threshold [a]		Threshold
	Ethylbenzene	Threshold [a]		Threshold
	o-Xylene	Threshold [a]		Threshold
	m-Xylene	Threshold [a]		Threshold
	p-Xylene	Threshold [a]		Threshold
Polyaromatic Hydrocarbons (PAHs)	Acenaphthene	Threshold [a]		Threshold
	Acenaphthylene	Threshold [a]		Threshold
	Anthracene	Threshold [a]		Threshold
	Benzo[a]anthracene	Non-Threshold [a]		Non-Threshold
	Benzo[a]pyrene	Non-Threshold [a]		Non-Threshold
	Benzo[b]fluoranthene	Non-Threshold [a]		Non-Threshold
	Benzo[ghi]perylene	Non-Threshold [a]		Non-Threshold
	Benzo[k]fluoranthene	Non-Threshold [a]		Non-Threshold
	Chrysene	Non-Threshold [a]		Non-Threshold
	Dibenzo[ah]anthracene	Non-Threshold [a]		Non-Threshold
	Fluoranthene	Threshold [a]		Threshold
	Fluorene	Threshold [a]		Threshold
	Indeno[123-cd]pyrene	Non-Threshold [a]		Non-Threshold
	Naphthalene	Threshold [a]		Threshold (local)
	Phenanthrene	Threshold [a]		Threshold
	Pyrene	Threshold [a]		Threshold
	Coal Tar (BaP as a surrogate marker)	Non-Threshold [a]		Non-Threshold
Metals / Metalloids	Arsenic (inorganic)	Non-Threshold [a]		Non-Threshold
	Lead (C4SL child)	Non-Threshold [a]		
	Lead (C4SL adult)	Non-Threshold [a]		
	Mercury (elemental) - S4LL	Threshold [b]		
	Mercury (inorganic) - S4LL	Threshold [a]		Threshold
	Mercury (methyl) - S4LL	Threshold [a]		Threshold
	Nickel - S4LL	Threshold [a]		
	Nickel - S4LL	-		Threshold
	Cadmium	Threshold [a]		Threshold

Notes: [a] Oral toxicological input (HCV) compared to exposure pathways as indicated; [b] Inhalation toxicological input (HCV) compared to exposure pathways as indicated.

4 EXPOSURE SCENARIO INPUTS

(24)This section describes the demographic and dietary (receptor and exposure), land use and building data information that reflects Cyprus conditions. Where information is not available then information on what parameters have been used is provided.

(25)All input parameters are included within the CLEA spreadsheets in APPENDIX **1** (Petroleum Hydrocarbon Fractions and Organics), APPENDIX **2** (Polyaromatic Hydrocarbons) and APPENDIX **3** (Metals/Metalloids).

4.1 Demographic and dietary data

4.1.1 Demographic data

(26)The critical receptor is assumed to be female as they are generally shorter and weigh less than their male equivalent in each age class. The following receptor characteristics are required as inputs across each of the age classes being modelled (0-75 years):

- [Female] Body weights (mean, standard deviation)
- [Female] Body heights (mean, standard deviation)
- [Female] Inhalation rates (mean, standard deviation)
- [Female] Maximum exposed skin areas (indoor exposure)
- [Female] Maximum exposed skin areas (outdoor exposure)

(27)In the absence of Cypriot specific data, the default UK database for the above parameters have been assumed. These are described within SR3 (Environment Agency, 2009c), along with modifications to some of the inputs as reported within the Defra SP1010 project (Defra, 2014a). These inputs are provided within the '*Receptor Data'* worksheet of the CLEA v1.071 spreadsheets. If in future, Cypriot values become available they could replace these inputs.

(28)The Cyprus Department of Environment supplied LQM with body weight data for each age class[3]. This information formed part of Cyprus' submission to the European Food Safety Authority (EFSA) for their National Dietary Survey dataset (Yiannopoulos, Ioannou–Kakouri, Kanari, Anastasi, Agathocleous, et al., 2018; Yiannopoulos, Ioannou–Kakouri, Kanari, Anastasi, Agathogleous, et al., 2018). The female only (excluding

[3] Email dated 3 February 2020 supplied as a word file containing age-class data (male, female, male/female including pregnant women, only pregnant women)

pregnant women) dataset was selected. These inputs were added to the '*Receptor Data*' worksheet of the CLEA v1.071 spreadsheets, within the newly defined Cyprus specific receptor types (Section 6.9).

(29)Following discussion with the Cyprus Department of Environment it was agreed that the critical receptor should be assumed to wear short-sleeved top and shorts for the whole year when estimating dermal exposure to contaminants. This required changes to the maximum exposed skin fractions during indoor and outdoor activities from the modification of the default assumptions in CLEA. These changes were made in the '*Receptor Data*' worksheet of the CLEA spreadsheets, in the Cyprus specific receptor types (Section 6.9).

4.1.2 Dietary Data

(30)Food grown in gardens adjacent to a residence can take up contaminants from the soil and have soil or dust on the edible portions. The main home grown produce groups assumed in CLEA are: green leafy, root and tuber vegetables; and herbaceous, shrub and tree fruit. Suitably cautious rates of consuming home grown produce (50^{th} and 90^{th} percentile levels) for each age class are required by CLEA.

(31)In the absence of Cypriot specific data, the default database in CLEA for the above parameters was assumed. These are described within SR3 (Environment Agency, 2009c), along with modifications to some of the inputs as reported within the Defra SP1010 project (Defra, 2014a). These inputs are provided within the '*Produce Data'* worksheet of the CLEA spreadsheet. Cypriot specific values and/or food groups could be entered should such information become available.

4.2 Land Use data

(32)For the exposure scenario being modelled (Section 2.2) the '*Land Use Data*' spreadsheet contains the input assumptions relating to the averaging time, exposure frequency (days/year), exposure duration (years), occupancy periods (hours/day), soil ingestion rates, soil-to-skin adherence rates for each exposure pathway.

(33)In the absence of Cypriot data we have retained the default dataset from CLEA. Indoor exposure frequencies, occupancy periods and other parameters are unlikely to change significantly between Cyprus and the UK, whilst the relatively high outdoor frequencies are likely to be cautious given that Cypriot summer temperatures are likely to reduce active outdoor play time.

(34)Soil-ingestion rates and soil-to-skin adherence rates for Cyprus are considered likely to be lower compared to UK conditions, since soil is less likely to stick fingers or skin under the generally drier Cypriot environment.

(35)Using the CLEA land use data is considered to provide reasonably cautious inputs for deriving the S4LLs. These inputs are summarised and described in detail within SR3 (Environment Agency, 2009c), along with the relevant modifications to some of the inputs as reported within the Defra SP1010 project (Defra, 2014a).

(36)The Cypriot modified land uses database defined for each exposure scenario are provided within the '*User Land Uses*' worksheet of the CLEA v1.071 spreadsheet model, which include changes from defaults as described within this report. The relevant land uses are included as: '*Residential with produce (C4SL)-Cyprus*', '*Residential (lifetime exposure (C4SL)-Cyprus*', '*Public Open Space (park C4SL)-Cyprus*', '*Public Open Space (park lifetime C4SL)-Cyprus*', or '*Commercial (C4SL)-Cyprus*'.

4.3 Soil inputs

(37)Cypriot soil textures can be defined within the '*User Soils*' worksheet and selected from the default UK database and user defined list from within the '*Basic Settings*' worksheet of the CLEA spreadsheet. Currently, no Cypriot specific soil textures have been defined however the high organic matter in the near surface deposits in Larnaca has been taken into consideration.

4.3.1 Soil Organic Matter

(38)The organic carbon content of soils is an important predictor of chemical partitioning between the soil, soil solution and air phases. The empirical relationships are well established between the lipophilicity of organic chemicals and organic carbon content of soils (Environment Agency, 2009c). Therefore, this parameter is important in predicting the behaviour of organic pollutants. The fraction of organic carbon is estimated from the amount of Soil Organic Matter (SOM) measured in soil using Equation 4.2 of SR3 within the CLEA v1.071 model (Environment Agency, 2009c)[4].

(39)For organic pollutants S4LLs have been presented at four SOM% contents (1%, 3%, 9% and 12%). The higher SOM values are much higher than those for which the UK S4ULs have been derived (namely 1%, 2.5% and 6%) to reflect the anticipated high organic matter content in Larnaca's littoral deposits. We have assumed that people will not be exposed to contaminants within the horizon of 'sea weed' that is present at least in parts of Larnaca at a shallow depth.

(40)This parameter is set manually within the '*Basic Settings*' worksheet of the CLEA spreadsheet.

(41)The MOA supplied LQM with Total Organic Carbon % results for 27 'surface' soil samples (sample depth was not reported) within the Larnaca area (Figure **3**). The estimated SOM within samples from the coastal area associated with the refinery and fuel/ gas storage range between 1.7% and 3.3%, whereas the range across all samples is between 0.7% and 5.3% (Figure **3**)[4].

[4] Fraction of Organic Carbon = (Soil Organic Matter% / 100%) x 0.58

4.3.2 Soil Type

(42)The default UK soil texture (sandy loam) and property database (for air and water filled porosity, residual water content, saturated hydraulic conductivity and bulk density) has been retained within CLEA.

(43)A 'sandy loam' soil texture with comparatively high air porosity and saturated hydraulic conductivity and low residual water content has been assumed (Table 4.4, Environment Agency, 2009c). This is considered to be a reasonably cautious assumption.

4.4 Building parameters

(44)Cypriot specific user defined building types can be defined within the '*User Buildings*' worksheet and selected from the default UK database and user defined list from within the '*Basic Settings*' worksheet of the CLEA spreadsheet. Where no information on Cypriot specific building types has been identified, the derivation of the S4LLs is based on default UK buildings types.

4.4.1 Dust loading

(45)The MOA supplied via the Department of Labour Inspection (email, 08/01/2020) long-term daily ambient air PM_{10} (Larnaca Traffic Station, 2005-2018) and $PM_{2.5}$ concentrations in the Larnaca area (Larnaca Traffic Station, 2005-2009; Larnaca Residential, 2009-2016). The long-term (2005-2018) daily average concentration is 48µg/m^3 (n=5011 days) for PM_{10} and 26.2µg/m^3 (n=1510 days) for $PM_{2.5}$ at the Larnaca Traffic Station ('Roadside') site and 19.3µg/m^3 (n=1510 days) for $PM_{2.5}$ at the Larnaca Residential Station ('Urban Background') (Figure **1**).

(46)The Larnaca data are higher than the latest (2018) annual mean concentrations across UK 'Roadside' and 'Urban Background' sites for PM_{10} (18.6 and 14.7µg/m^3, respectively) and $PM_{2.5}$ (10.6 and 10.0µg/m^3, respectively)[5] by factors of up to about 2.6 times. However, the PM_{10} ambient air 'Roadside' data for Larnaca (48µg/m^3) is consistent with the default dust loading (arising from resuspension of indoor dust) PM_{10} value for a residential property of 50µg/m^3 assumed in CLEA (Section 9.3, Environment Agency, 2009c).

(47)Therefore, for a residential property in Larnaca a dust loading value of 50µg/m^3 has been assumed. For a commercial property the default dust loading value would be higher as 100µg/m^3. Indoor dust concentrations are assumed to equilibrate with those found in ambient air through natural building ventilation, more reasonable for Autumn through to Spring under Cyprus conditions. This is likely to be conservative for modern wholly air-conditioned buildings which make use of a well-maintained filtration system.

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5 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/796887/Air_Quality_Statistics_in_the_UK_1987_to_2018.pdf, accessed 20/01/2020

4.4.2 Ambient dust concentrations

(48)The soil-derived dust concentrations in ambient air are estimated in CLEA using the approach described within SR3 (Environment Agency, 2009c).

(49)A key component is the calculation of the particle emission factor (PEF), which represents an estimate of the relationship between the concentration of a contaminant in soil and its concentration in air as a consequence of dust resuspension, for dust particles <10µm (i.e. PM_{10}). PEF will depend on climate, source area and receptor height. The PEF is related to the air dispersion factor (Q/C_{wind}), values of which were generated by the Environment Agency for 13 UK cities, different source areas representative of the generic exposure scenarios and at child and adult heights (Environment Agency, 2009c). The Environment Agency used the USEPA AEROMOD PRIME dispersion model, hourly meteorological data (5 years of data) and a number of assumptions (Section 9.2.1, Environment Agency, 2009c). This approach is not currently possible, based upon the available Cypriot data.

(50)Instead, LQM have relied upon a very similar approach described in Appendix D of the USEPA 2002 Soil Screening Levels Supplemental Guidance (USEPA, 2002) to derive values of the air dispersion factor (Q/C_{wind}). Exhibit D2 (USEPA, 2002) provides constants for use in calculating site-specific values of $Q/C_{wind,}$ based on dispersion model analysis across 29 meteorological stations considered to be representative of 9 climatic zones across the US, some of which are likely to be more representative of Cypriot conditions compared to the more temperate UK data.

(51)Estimates of Q/C_{wind}, for source zone areas representative of the range of land uses considered (i.e. 0.01, 0.5 and 2 for residential, public park and commercial land use, respectively) were made across all 29 meteorological stations of the US for the adult receptor. Estimates of this parameter were consistently lower compared to the UK defaults (Table 9.1, Environment Agency, 2009c), by factors of between 3 and 200 times. The lowest estimates of Q/C_{wind} (air dispersion factors) across the US climate regions were assumed to be representative of Cyprus conditions which represents a cautious assumption in terms of estimating the intake of pollutants derived from ambient air dusts (Equations 9.5 and 9.6, Environment Agency, 2009c). The conversion Q/C_{wind} between adults (receptor height=1.6m) and for children (receptor height=0.8m) is based upon the ratios of the two sets of parameters across the different source term areas presented within SR3 (Table 9.1, Environment Agency, 2009c).

(52)Taking this cautious approach will impact those S4LLs where the inhalation of dust pathways are likely to make a significant contribution to overall exposure, for example for non-volatile organics (e.g. some PAHs) or some metals (e.g. Nickel).

(53)The values of Q/C_{wind} derived for Cypriot conditions are in the '*User Land Uses*' worksheet of CLEA.

(54)The mean annual wind speed at a height of 10m has been assumed to be 3.83m/s based on a long-term monthly average for Larnaca[6] of 13.8kph for the period 2000 to 2018. This is slightly lower than the UK default value of 5m/s (Environment Agency, 2009c). This parameter is used in the estimation of inhalation of ambient dusts (Equation 9.5, Environment Agency, 2009c). It can be modified in the '*Advanced Settings 2*' worksheet of the CLEA spreadsheets.

4.4.3 Building types and design

(55)In the absence of further information on Cypriot building types and design, the default buildings database has been used.

(56)The parameters used in CLEA include: building footprint areas (housing, apartments, commercial buildings); air exchange rates (number per hour); heights; pressure differential between building and soil-gas; foundation thickness; and floor design (e.g. concrete slab with floor crack around the perimeter as the main vapour entry route).

(57)Air-conditioning (AC) is not included within CLEA, but it is possible that its presence within buildings would create a lower 'stack effect' (due to temperature differences) compared to naturally ventilated buildings by reducing the indoor air temperature relative to outside, making the cooler internal air denser and less buoyant and hence decrease ingress. The exact effect on building pressurisation is difficult to specify and will depend upon the AC systems installed (Environment Agency, 2005). AC systems set-up to pressurise a building will reduce the entry soil gases, whilst those which de-pressurise a building will have the opposite effect. A well balanced system may help to dilute any soil gases entering the building (Environment Agency, 2005). Therefore, soil gas ingress rates in buildings with well maintained and operated AC systems are likely lower than those in the default CLEA dataset.

[6] https://www.weatheronline.co.uk/weather/maps/city?FMM=1&FYY=2000&LMM=12&LYY=2018&WMO=17609&CONT=euro&REGION=0005&LAND=CY&ART=WST&R=0&NOREGION=1&LEVEL=162&LANG=en&MOD=tab

5 CURRENTLY UNAVAILABLE CYPRUS SPECIFIC DATA

(58)LQM identified information required to better reflect Cyprus conditions (LQM Inception Report (LQM Ref: 1472-0A-1, Issue 1.0, dated 12/12/19)). Where this information was made available, it has been taken on board in deriving the S4LLs. This section sets out parameters for which no Cyprus specific information has been identified for LQM to use. Parameters likely to have a significant impact upon S4LLs are indicated.

(59) Parameters for which Cyprus specific information has not been identified:

a) Inhalation rates (mean, standard deviations) for each age class[7]

b) Dietary intakes (50^{th} and 90^{th} percentile consumption rates, g fresh weight/day/kg of body weight) of home grown produce across each age class[8]

c) Proportion of consumption from homegrown produce (Homegrown Fractions)[9]

d) Building footprint areas (housing, apartments, commercial buildings) and foundation thicknesses.

e) Living space air exchange rates (number per hour) and impact of air-conditioning.

f) Living space heights (above ground and below ground if relevant).

g) Pressure differential between building and soil-gas in typical buildings under Cyprus conditions.

h) Typical floor design for the generic building types (e.g. concrete slab with floor crack around the perimeter as the main vapour entry route).

(60)The following parameters or issues, for which default values have been assumed, are suitable for use in Cyprus:

a) Averaging times, exposure frequencies, exposure durations and occupancy periods for the relevant receptors within each land use exposure scenario.

b) Impact of air-conditioning on soil gas-building pressure differentials and the inhalation of vapours pathway.

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[7] 1-year increments for 0-16 (16 years), 16-65 (49 years) and 65-75 (10 years), female receptor

[8] possible sources are the raw data supplied as aggregated National Dietary Survey data to EFSA by Yiannopoulos *at al*. (2018; 2018)

[9] Homegrown fractions for an 'average' scenario and 'high-end' scenario (such as the 90^{th} percentile)

c) Toxicological inputs (Health Criteria Values) reflect no appreciable (threshold) and minimal (non-threshold) risk (with the exception of lead).

5.1 Sensitivity of S4LLs to input parameters

(61)The sensitivity analysis of the CLEA model (Defra (2014a, 2014b)) identified key parameters/assumptions in the derivation of screening levels. These parameters relate to the five key pathways:

a) Body weight (all pathways)

b) Averaging time (all pathways)

c) Soil and dust ingestion rate (soil & dust ingestion)

d) Exposure frequency outdoors (dermal contact outdoors)

e) Skin adherence outdoors (dermal contact outdoors)

f) Maximum exposed skin fraction outdoors (dermal contact outdoors)

g) Dermal absorption fraction (dermal contact outdoors)

h) Inhalation rate (vapour and dust inhalation indoors)

i) Dust loading factor (dust inhalation indoors)

j) Soil to dust transport factor (dust inhalation indoors)

k) Soil to indoor air correction factor (vapour inhalation indoors)

l) Building footprint (vapour inhalation indoors)

m) Living space height (vapour inhalation indoors)

n) Soil to plant concentration factors (consumption of home grown produce)

o) Home grown fraction (consumption of home grown produce)

p) Soil type (vapour inhalation indoors)

q) Produce consumption rate (consumption of home grown produce)

r) Soil organic matter (vapour inhalation indoors & consumption of home grown produce)

(62) Should information for Cyprus on any of the above conditions become available then those values can be used in the CLEA spreadsheets.

6 DERIVATION OF THE SUITABLE FOR LARNACA LEVELS – A WALKTHROUGH

(63)S4LLs have been derived for the residential with consumption of home grown produce land use assuming a female child as the critical receptor and exposure via dermal, oral and inhalation pathways. Exposure via each pathway is represented by an algorithm. Each algorithm is parameterised using information that reflects, as far as available information permits, the environmental setting and policy context of Cyprus, information about the critical receptor and data describing the physico-chemical and toxicological behaviour of the contaminants. These algorithms are coded in CLEA, amended by LQM to reflect conditions in Larnaca, Cyprus. The CLEA spreadsheet contains a series of worksheets and is used to derive generic or site specific assessment criteria.

(64)For a detailed understanding of the algorithms and assumptions underpinning the CLEA v1.071 model, Science Report SR3 (Environment Agency, 2009c) should be consulted. The CLEA Software Handbook (Environment Agency, 2009d) provides detailed information on how to use CLEA to derive generic or site-specific assessment criteria and ADE/HCV ratios.

(65)For the purposes of deriving the S4LLs the following sub-sections are provided as an additional guide for future end-users on how to reproduce them, by identifying the key worksheets to interact with. It is recommended that the user has the CLEA spreadsheet available to them when reading this brief walkthrough.

(66)An additional sheet (‘*Sheet1*’) has been added by LQM to provide a more easily accessible and extractable summary of the exposure pathway contributions.

6.1 Guide

(67)The over-arching key interactive components of CLEA can be accessed via the ‘*Guide’* worksheet, which provides a process flow diagram (Figure **4**) of using the model to generate Generic Assessment Criteria (GAC) including the SS4Ls or Site-Specific Assessment Criteria with access to more advanced settings (‘*Advanced Settings*’) to modify input parameters temporarily for an individual model run (i.e. the underlying user defined or fixed databases will not be permanently modified).

(68)This worksheet also provides access to the four key user definable interactive databases (‘*User Buildings*’, ‘*User Chemicals*’, ‘*User Land Uses*’ and ‘*User Soils*’).

6.2 Basic Settings

(69)The '*Basic Settings*' worksheet provides the key input screen dictating the land use, receptor (male/female) and age classes for averaging, building type, soil type and properties (pH, SOM%) and which exposure pathways are to be included in the assessment.

(70)Once all modifications are made the user should '*Apply Settings to Model*' prior to generating any assessment criteria. If you are generating assessment criteria you will need to ensure you are not running the model in '*Ratio Mode*'. By default, the model **does not run** in this mode.

6.3 Select Chemicals

(71)The '*Select Chemicals*' worksheet allows screening levels to be generated for up to 30 pollutants selected from the pulldown lists provided to be. The list includes the default pollutants plus any additional substances added by the user (Section 6.4).

(72)Once all of the pollutants of interest have been selected then '*Apply Chemicals to Model*'.

6.4 Defining and modifying User Chemicals

(73)The '*User Chemicals*' worksheet contains the Cypriot modified substance-specific physico-chemical and toxicological parameters. Modifications to input parameters should be made within the '*User Chemicals*' worksheet.

(74)Parameters for a number of default substances are included in the '*Chemical Data*' worksheet and for user defined substances in '*User Chemicals*' worksheet.

6.5 Defining and modifying User Buildings

(75)The '*User Buildings*' worksheet contains default data on buildings.

6.6 Defining and modifying User Land Uses

(76)The Cypriot modified land uses database defined for each exposure scenario are provided within the '*User Land Uses*' worksheet of the CLEA v1.071 spreadsheet, which include changes from defaults as described within this report. The relevant land uses are included as: '*Residential with produce (C4SL)-Cyprus*', '*Residential (lifetime exposure (C4SL)-Cyprus*', '*Public Open Space (park C4SL)-Cyprus*', '*Public Open Space (park lifetime C4SL)-Cyprus*', or '*Commercial (C4SL)-Cyprus*'. SS4Ls have only been calculated for the residential with produce (C4SL)-Cyprus land use using the data presented in this report.

6.7 Defining and modifying User Soils

(77)Cypriot specific user defined soil textures can be defined within the '*User Soils*' worksheet of the CLEA spreadsheet. The default sandy loam soil texture has been used to derive the S4LLs.

6.8 Defining and modifying Produce Data

(78)The '*Produce Data*' worksheet contains the current default UK produce groups and values for consumption rates, homegrown fractions (proportion of produce consumed grown at home), soil loading and preparation factors (Defra, 2014a; Environment Agency, 2009c). There is no user specified worksheet for the end-user to specify their own country or regional specific list of produce types and associated relevant inputs.

(79)Therefore, in order to modify these to different Cypriot food groups the current defaults would either have to be overwritten or added within this worksheet. However, careful consideration of the relationship to other chemical specific parameters (e.g. soil-to-plant concentration factors) and naming conventions within other worksheets would be required to ensure internal continuity within the model.

6.9 Defining and modifying Receptor Data

(80)In the absence of Cypriot specific data the CLEA default database for the receptor specific parameters (Section 4.1.1) have been assumed.

(81) Cyprus age class specific body weight data has been provided by the Cyprus Department of Environment. The critical receptor mean body weight female only data has been entered within the '*Receptor Data'* worksheet of the CLEA spreadsheet: *Female (res C4SL)-Cyprus*; *Female (allot)-Cyprus*; and *Female (com C4SL)-Cyprus*. The input data is summarised within Figure **5**, which indicates that the mean body weight 0-6 year old Cyprus female is approximately 7% heavier compared to that assumed in the UK, whilst the working age adult is approximately 6% lighter.

(82)Following discussion with the Cyprus Department of Environment it was agreed that the critical receptor should be assumed to wear short-sleeved top and shorts for the whole year – i.e. increase the exposed skin areas. The necessary modifications made to the default assumptions relating to the maximum exposed skin fractions during indoor and outdoor activities for each of the relevant land use exposures are as indicated within Figure **6**. These modified inputs were also added to the '*Receptor Data*' worksheet of the CLEA spreadsheet, within the newly defined Cyprus specific receptor types.

(83)Any additional Cyprus specific receptor characteristics that may become available (e.g. inhalation rates and body heights) or modification to existing Cyprus assumptions can be entered into the relevant Cyprus receptors defined within the '*Receptor Data'* worksheet of the CLEA spreadsheet.

6.10 Generating Results

(84)Once all relevant inputs have been defined and/or modified the assessment criteria (GAC or SSAC) can be generated within the '*Results*' worksheet of the CLEA spreadsheet, by selecting '*Find AC*'. CLEA will then generate the results and populate the worksheet with the exposure route (Oral + Dermal and Inhalation) soil assessment criteria, along with additional useful information on the pathway contribution to the overall exposure for the combined assessment criteria.

(85)Two separate records of the modelling can be generated:

a) a record of the assessment criteria results for each substance including substances media concentrations, pathway contributions and chemical-specific inputs; and

b) the model settings detailing the modelling assumptions and input parameters.

(86)These outputs can be printed to hard-copy or to an Adobe pdf file to create a permanent record of assessment and modelling outcome.

7 SUITABLE FOR LARNACA LEVELS (S4LLS)

(87)The S4LLs are soil contaminant concentrations that pose no appreciable or minimal risks to human health for a residential with consumption of homegrown produce land use. The S4LLs are presented in Table 3 for four SOM% values. The pathway contributions for group of pollutants are presented at 9% SOM% in Table 4 to Table 6 (residential with home grown produce).

(88)Footnotes include information to clarify the S4LLs. Where the S4LL exceeds the lower soil saturation limit and vapour inhalation makes an important contribution (>10%) to exposure (i.e. a red 'traffic light' in the CLEA software (Environment Agency, 2009e)), the modelled S4LL is reported but the lower saturation limit is also presented in brackets together with an indication of whether this was the solubility or vapour saturation limit.

(89) Separate CLEA model runs have been provided for the petroleum hydrocarbon equivalent carbon fractions and organic volatile compounds (APPENDIX 1), polyaromatic hydrocarbons (APPENDIX 2) and metal/metalloids (APPENDIX 3) for each SOM% considered in this report. This approach retains a definitive record of the S4LLs derived and the parameters used to derive them. In practice, any of the sheets could be taken as the starting model, select and apply the relevant pollutants and generate new values for S4LLs at a different SOM% value for example. It should be noted that the physico-chemical inputs (as indicated in this report|) for volatile pollutants have been modified to reflect the ambient soil temperature of the Larnaca region (i.e. 295K). A default physico-chemical database at UK ambient soil temperature (i.e. 283K) conditions is also included for some of the organic compounds for comparison purposes.

(90) The S4LLs for each set of pollutants and SOM% conditions are provided within the '*Results*' worksheet of each CLEA spreadsheet model provided.

(91)Non-exceedance of a relevant S4LL (i.e. Representative Soil Concentration < S4LL) indicates that soil contaminant levels pose minimal or not appreciable risks to human health.

(92) Exceedance of a relevant S4LL (i.e. Representative Soil Concentration > S4LL) does not constitute *prima facie* need for remediation. Such exceedance could trigger a Detailed Quantitative Risk Assessment (DQRA). The application of the S4LLs for decision making processes must be carried out within a specific legal context and any relevant guidance, code of practice or standards.

Table 3: LQM Suitable for Larnaca Levels (S4LLs) for Residential <u>with</u> homegrown produce land use at 1%, 3%, 9% and 12% soil organic matter (SOM)

Residential with home grown produce land use	LQM S4LLs for Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances (mg kg^{-1} DW) [a,b,c,d,e]			
	1% SOM	3% SOM	9% SOM	12% SOM
Aliphatic EC 5-6	34	64	160	200
Aliphatic EC >6-8	67	160	460	600
Aliphatic EC >8-10	14	40	120	150
Aliphatic EC >10-12	59 (48) vap	170 (142) vap	500 (425) vap	660 (567) vap
Aliphatic EC >12-16	410 (24) vap	1100 (71) vap	2900 (213) vap	3600 (284) vap
Aliphatic EC >16-35	23000	50000	83000	91000
Aliphatic EC >35-44	23000	50000	83000	91000
Aromatic EC 5-7 (benzene)	65	150	390	510
Aromatic EC >7-8 (toluene)	120	310	880	1200
Aromatic EC >8-10	21	60	170	230
Aromatic EC >10-12	63	180	470	600
Aromatic EC >12-16	140	380	880	1100
Aromatic EC >16-21	260	610	1100	1300
Aromatic EC >21-35	1100	1600	1900	1900
Aromatic EC >35- 44	1100	1600	1900	1900
Aliphatic + Aromatic EC >44-70	1600	1900	2000	2000
Benzene	0.078	0.18	0.46	0.6
Toluene	120	310	880	1200
Ethylbenzene	31	85	240	320
o-Xylene	31	86	250	330
m-Xylene	38	110	300	400
p-Xylene	32	88	250	330
Acenaphthene	180 (57) vap	520 (169) vap	1400 (504) vap	1700 (672) vap
Acenaphthylene	160 (86) sol	470 (254) sol	1200 (757) sol	1600 (1009) vap
Anthracene	2300	6200	14000	17000
Benzo[a]anthracene	3.5	6.3	9.1	9.7
Benzo[a]pyrene (BaP)	1.4	1.9	2.2	2.3
Benzo[b]fluoranthene	1.5	2.2	2.7	2.8
Benzo[ghi]perylene	220	250	270	280
Benzo[k]fluoranthene	47	64	75	77
Chrysene	8.7	14	19	20
Dibenzo[ah]anthracene	0.16	0.21	0.23	0.24
Fluoranthene	280	620	1100	1200
Fluorene	160 (31) vap	440 (92) vap	1100	1400
Indeno[123-cd]pyrene	17	25	30	32
Naphthalene	0.72	2.1	6	8
Phenanthrene	93	250	580	690
Pyrene	610	1400	2500	2700
Coal Tar (BaP surrogate marker)[i]	0.66	0.88	1.00	1.00
Arsenic (inorganic)	39 [f]	39 [f]	39 [f]	39 [f]
Lead (C4SL child)	200	200	200	200
Mercury (elemental)	0.47	0.47	0.47	0.47
Mercury (inorganic)	43	43	43	43
Mercury (methyl)	5.5	8.1	11	11
Nickel	77 [g]	77 [g]	77 [g]	77 [g]
Cadmium (lifetime)	12	12	12	12

[a] Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009c) and 1, 3, 9 and 12% soil organic matter (SOM); [b] S4LLs for Petroleum Hydrocarbons, BTEX, PAHs and organic metal species will vary according to SOM for all land uses; [c] S4LLs are rounded to two significant figures

[d] S4LLs assume that free phase contamination is not present; [e] S4LLs based on a sub-surface soil to indoor air correction factor of 10 (Petroleum Hydrocarbons & BTEX compounds) or 1 (PAHs & organic metal species); [sol] S4LL presented exceeds the solubility saturation limit, which is presented in brackets; [vap] S4LL presented exceed the vapour saturation limit, which is presented in brackets; [f] lower of oral or inhalation derived S4LL; [g] based on comparison of exposure from inhalation pathways with TDI_{inhal}; [h] based on comparison of exposure from all pathways with TDI_{oral}

Table 4: Contribution to total exposure for the relevant pathways as calculated by the CLEA software for the residential with homegrown produce land-use at 9% SOM (Petroleum Hydrocarbons and BTEX)

	Aliphatic							Aromatic									BTEX					
	EC5-6	EC>6-8	EC8>10	EC>10-12	EC>12-16	EC>16-35	EC>35-44	EC>5-7	EC>7-8	EC8>10	EC>10-12	EC>12-16	EC>16-21	EC>21-35	EC>35-44	EC>44-70	Benzene	Toluene	Ethylbenzene	o-Xylene	m-Xylene	P-Xylene
	ADE to HCV ratios																					
Oral ADE to HCV ratio at S4LL	0.00	0.00	0.01	0.04	0.27	1.00	1.00	0.68	0.75	0.24	0.66	0.92	1.00	1.00	1.00	1.00	0.63	0.75	0.28	0.16	0.18	0.16
Inhalation ADE to HCV ratio at S4LL	1.00	1.00	0.99	0.96	0.73	NR	NR	0.32	0.25	0.76	0.34	0.08	NR	NR	NR	NR	0.37	0.25	0.72	0.84	0.82	0.84
	Contribution to total exposure[1] (%)																					
Ingestion of soil and indoor dust[2]	<0.1	0.1	0.3	1.2	7.0	28.6	28.6	0.4	1.1	1.8	5.2	12.8	26.1	42.6	42.6	45.3	0.5	1.2	2.1	2.1	2.5	2.2
Consumption of homegrown produce and attached soil	0.2	0.2	0.1	0.1	0.1	0.4	0.4	24.7	29.9	9.8	20.0	27.0	21.3	5.0	5.0	1.9	25.2	31.3	31.7	33.6	36.2	33.3
Dermal contact (indoor)	0.0	0.0	<0.1	<0.1	0.1	0.6	0.6	<0.1	<0.1	<0.1	0.1	0.3	0.5	0.8	0.8	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dermal contact (outdoor)	0.0	0.0	<0.1	<0.1	0.2	0.8	0.8	<0.1	<0.1	<0.1	0.1	0.3	0.7	1.1	1.1	1.2	<0.1	<0.1	0.1	0.1	0.1	0.1
Inhalation of dust (indoor)	0.0	0.0	0.0	<0.1	<0.1	0.2	0.2	0.0	<0.1	<0.1	<0.1	0.1	0.1	0.2	0.2	0.3	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Inhalation of dust (outdoor)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0
Inhalation of vapour (indoor)	49.6	49.4	48.8	47.0	38.9	15.0	15.0	71.7	61.7	36.6	22.2	7.4	0.5	<0.1	<0.1	0.1	73.1	64.5	62.2	54.0	51.1	54.3
Inhalation of vapour (outdoor)	0.2	0.4	0.8	1.6	3.6	4.5	4.5	1.2	1.8	1.8	2.4	2.1	0.8	0.2	0.2	0.4	1.2	1.8	2.4	2.2	2.4	2.3
Oral background	0.2	0.2	0.4	1.3	7.5	50.0	50.0	<0.1	0.1	11.7	25.4	40.4	50.0	50.0	50.0	50.0	0.0	0.1	0.3	0.7	0.7	0.7
Inhalation background	49.8	49.8	49.6	48.7	42.5	0.0	0.0	1.8	5.4	38.3	24.6	9.6	0.0	0.0	0.0	0.0	0.0	1.0	1.3	7.2	7.0	7.2

[1] Rounded to one decimal place; [2] Treated as one pathway (Environment Agency, 2009c)

ADE = Average Daily Exposure; HCV = Health Criteria Value; NA = Not applicable (This exposure pathway is not included in the generic land use)

Table 5: Contribution to total exposure for the relevant pathways as calculated by the CLEA software for the residential with homegrown produce land-use at 9% SOM (Polyaromatic Hydrocarbons)

	PAHS																
	Acenaphthene	Acenaphthylene	Anthracene	Benzo[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[ghi]perylene	Benzo[k]fluoranthene	Chrysene	Dibenzo[ah]anthracene	Fluoranthene	Fluorene	Indeno[123-cd]pyrene	Naphthalene	Phenanthrene	Pyrene	Coal Tar (BaP as a surrogate marker)
	ADE to HCV ratios																
Oral ADE to HCV ratio at S4LL	0.84	0.90	0.97	0.49	0.57	0.56	0.60	0.57	0.54	0.59	0.98	0.90	0.56	0.03	0.96	0.99	0.81
Inhalation ADE to HCV ratio at S4LL	0.16	0.10	0.03	0.51	0.43	0.44	0.40	0.43	0.46	0.41	0.02	0.10	0.44	1.00	0.04	0.01	0.19
	Contribution to total exposure[1] (%)																
Ingestion of soil and indoor dust[2]	15.9	14.3	32.6	82.3	86.5	85.1	90.8	87.3	78.8	88.5	58.9	19.4	83.7	0.0	31.6	56.7	86.5
Consumption of homegrown produce and attached soil	66.7	74.4	62.1	11.7	7.6	9.0	3.1	6.7	15.7	5.5	35.8	69.5	10.5	0.0	61.6	38.7	7.6
Dermal contact (indoor)	0.4	0.4	0.8	2.1	2.2	2.2	2.3	2.2	2.0	2.2	1.5	0.5	2.1	0.0	0.8	1.4	2.2
Dermal contact (outdoor)	0.6	0.5	1.1	2.9	3.0	3.0	3.2	3.0	2.7	3.1	2.1	0.7	2.9	0.0	1.1	2.0	3.0
Inhalation of dust (indoor)	0.1	0.1	0.2	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.3	0.1	0.5	<0.1	0.2	0.3	0.5
Inhalation of dust (outdoor)	0.0	0.0	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	<0.1	0.0	0.0	<0.1	<0.1
Inhalation of vapour (indoor)	15.3	9.6	2.5	0.2	<0.1	<0.1	0.0	<0.1	0.1	0.0	0.8	8.9	<0.1	80.5	3.1	0.3	<0.1
Inhalation of vapour (outdoor)	1.0	0.8	0.6	0.3	0.2	0.2	0.1	0.2	0.3	0.2	0.5	0.9	0.3	1.3	0.7	0.4	0.2
Oral background	0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.6	0.1	0.0
Inhalation background	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	<0.1	0.0	18.2	0.2	<0.1	0.0

[1] Rounded to one decimal place; [2] Treated as one pathway (Environment Agency, 2009c)

ADE = Average Daily Exposure; HCV = Health Criteria Value; NA = Not applicable (This exposure pathway is not included in the generic land use)

Table 6: Contribution to total exposure for the relevant pathways as calculated by the CLEA software for the residential with homegrown produce land-use at 9% SOM (Metals and metalloids)

	Metal						
	Arsenic	Lead (C4SL child)	Mercury (elemental)	Mercury (inorganic)	Mercury (methyl)	Nickel	Cadmium (lifetime)
	ADE to HCV ratios						
Oral ADE to HCV ratio at S4LL	1.00	1.00	NR	0.97	0.77	0.39	0.88
Inhalation ADE to HCV ratio at S4LL	0.77	NR	1.00	0.03	0.23	1.00	0.12
	Contribution to total exposure[1] (%)						
Ingestion of soil and indoor dust[2]	90.0	58.2	5.4	52.6	37.1	0.0	5.1
Consumption of homegrown produce and attached soil	8.8	41.4	0.1	23.1	16.3	0.0	44.9
Dermal contact (indoor)	0.5	0.0	0.0	0.0	0.7	0.0	0.0
Dermal contact (outdoor)	0.7	0.0	0.0	0.0	1.0	0.0	<0.1
Inhalation of dust (indoor)	0.0	0.3	<0.1	0.3	0.2	48.7	<0.1
Inhalation of dust (outdoor)	0.0	<0.1	0.0	<0.1	<0.1	1.3	0.0
Inhalation of vapour (indoor)	0.0	0.0	90.7	0.0	16.9	0.0	0.0
Inhalation of vapour (outdoor)	0.0	0.0	1.5	0.0	4.7	0.0	0.0
Oral background	0.0	0.0	0.0	24.0	23.1	0.0	50.0
Inhalation background	0.0	0.0	2.4	0.0	0.0	50.0	<0.1

[1] Rounded to one decimal place; [2] Treated as one pathway ((Environment Agency, 2009c)

ADE = Average Daily Exposure; HCV = Health Criteria Value; NA = Not applicable (This exposure pathway is not included in the generic land use)

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8 Comparison to Internationally Used Screening Levels

(93)Many countries have developed generic assessment criteria to inform contaminated land risk management decisions. These reflect national policy, local environmental conditions and relevant demographic and diet data. As a result, adopting another country's values may not be compatible with the local legislation, conditions or policy. Table 7compares the residential with home grown produce S4LLs (at 1% and 9% SOM) against the UK's S4ULs (at 1% SOM) and against the Dutch Intervention Values (VROM, 2013) at 10% SOM.

(94)A more direct comparison the S4LLs with other internationally applied human health screening standards for exposures from soils would require a thorough understanding of the relevant exposure pathways, modelling and toxicological assumptions. Therefore, the most useful direct comparison is between the UK parameterised S4ULs and Cyprus parameterised S4LLs which are both derived using the model and toxicological assumptions for each pollutant.

(95)The Dutch Intervention Values (DIV) are included for qualitative comparison purposes only. The derivation of the DIVs are discussed within RIVM Report No. 711701023 (RIVM, 2001).

Table 7: Comparison of S4LLs for the residential with homegrown produce land use (1% and 9% SOM) with UK S4ULs and Dutch Intervention Levels (DIV)

	LQM S4LLs for Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances ($mg\ kg^{-1}$ DW)[a,b,c,d,e] comparison			
Residential with home grown produce land use	**S4LLs 1% SOM**	**S4ULs (UK) 1% SOM**	**S4LL 9% SOM**	**DIV (NL) 10% SOM[j]**
Aliphatic EC 5-6	34	*42*	160	*n/a*
Aliphatic EC >6-8	67	*100*	460	*n/a*
Aliphatic EC >8-10	14	*27*	120	*n/a*
Aliphatic EC >10-12	59 (48)[vap]	*130* (48)[vap]	500 (425)[vap]	*n/a*
Aliphatic EC >12-16	410 (24)[vap]	*1100* (24)[sol]	2900 (213)[vap]	*n/a*
Aliphatic EC >16-35	23000	*65000* (8.5)[sol]	83000	*n/a*
Aliphatic EC >35-44	23000	*65000* (8.5)[sol]	83000	*n/a*
Aromatic EC 5-7 (benzene)	65	*70*	390	*n/a*
Aromatic EC >7-8 (toluene)	120	*130*	880	*n/a*
Aromatic EC >8-10	21	*34*	170	*n/a*
Aromatic EC >10-12	63	*74*	470	*n/a*
Aromatic EC >12-16	140	*140*	880	*n/a*
Aromatic EC >16-21	260 [i]	*260* [i]	1100	*n/a*
Aromatic EC >21-35	1100 [i]	*1100* [i]	1900	*n/a*
Aromatic EC >35- 44	1100 [i]	*1100* [i]	1900	*n/a*
Aliphatic + Aromatic EC >44-70	1600 [i]	*1600* [i]	2000	*n/a*
Benzene	0.078	*0.087*	0.46	*1.1*
Toluene	120	*130*	880	*32*
Ethylbenzene	31	*47*	240	*110*
o-Xylene	31	*60*	250	
m-Xylene	38	*59*	300	*17*
p-Xylene	32	*56*	250	
Acenaphthene	180 (57)[vap]	*210*	1400 (504)[vap]	
Acenaphthylene	160 (86)[sol]	*170*	1200 (757)[sol]	
Anthracene	2300	*2400*	14000	*
Benzo[a]anthracene	3.5	*7.2*	9.1	*
Benzo[a]pyrene (BaP)	1.4	*2.2*	2.2	*
Benzo[b]fluoranthene	1.5	*2.6*	2.7	
Benzo[ghi]perylene	220	*320*	270	*
Benzo[k]fluoranthene	47	*77*	75	*Σ of 10* =* *
Chrysene	8.7	*15*	19	*40* *
Dibenzo[ah]anthracene	0.16	*0.24*	0.23	
Fluoranthene	280	*280*	1100	*
Fluorene	160 (31)[vap]	*170*	1100	*
Indeno[123-cd]pyrene	17	*27*	30	
Naphthalene	0.72	*2.3*	6	*
Phenanthrene	93	*95*	580	*
Pyrene	610	*620*	2500	
Coal Tar (BaP surrogate marker)	0.66	*0.79*	1.00	*n/a*
Arsenic (inorganic)	39 [f]	*37* [f]	39 [f]	*76*
Lead (C4SL child)	200	*n/a*	200	*530*
Mercury (elemental)	0.47	*1.2*	0.47	*n/a*
Mercury (inorganic)	43	*40*	43	*36*
Mercury (methyl)	5.5	*11*	11	*4*
Nickel	77 [g]	*130* [h]	77 [g]	*100*
Cadmium (lifetime)	12	*11*	12	*13*

Table Footnotes: see next page

Table Footnotes:

[a] Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009c) and 1, 3, 9 and 12% soil organic matter (SOM);

[b] S4LLs for Petroleum Hydrocarbons, BTEX, PAHs and organic metal species will vary according to SOM for all land uses;

[c] S4LLs are rounded to two significant figures

[d] S4LLs assume that free phase contamination is not present;

[e] S4LLs based on a sub-surface soil to indoor air correction factor of 10 (Petroleum Hydrocarbons & BTEX compounds) or 1 (PAHs & organic metal species);

[sol] S4LL presented exceeds the solubility saturation limit, which is presented in brackets;

[vap] S4LL presented exceed the vapour saturation limit, which is presented in brackets;

[f] lower of oral or inhalation derived S4LL;

[g] based on comparison of exposure from inhalation pathways with TDI_{inhal};

[h] based on comparison of exposure from all pathways with TDI_{oral};

[i] oral, dermal and inhalation exposure compared with TDI_{oral} ; [j] These Dutch Intervention Values (DIV) are extracted from Annex 1 (Table 1) of the Netherlands Soil Remediation Circular (VROM, 2013) for 10% organic matter and 25% lutite, for a full explanation of their derivation and relevance to the residential with home grown produce exposure scenario the reader should refer to RIVM Report No. 711701023 (RIVM, 2001).

9 CONCLUSIONS

(96)The S4LLs represent contaminant concentrations in soil that, for the residential with consumption of home grown produce land use, represent no appreciable or minimal risk to human health.

(97)The S4LLs should be used to screen out substances from further consideration. If a site contaminant concentration does not exceed the relevant S4LL, then that contaminant represents minimal or no acceptable risk to human health.

(98)If a site contaminant exceeds the relevant S4LL, then Site Specific Assessment Criteria (SSAC) can be derived using site specific measurements of, for example, bioaccessibilty or soil-to-plant uptake factors. The spreadsheets that form the basis of APPENDIX **1**, APPENDIX **2** and APPENDIX **3** can be modified to reflect this site specific information and run to derive the SSAC. Any report using such SSAC should also detail how SSAC were derived.

(99)Other substances for which no S4LL is available, may be present – e.g. solvents, other metals, organic chemicals. Such substances would need to undergo a detailed site specific assessment and the outcomes, including the description for the SSAC would be needed.

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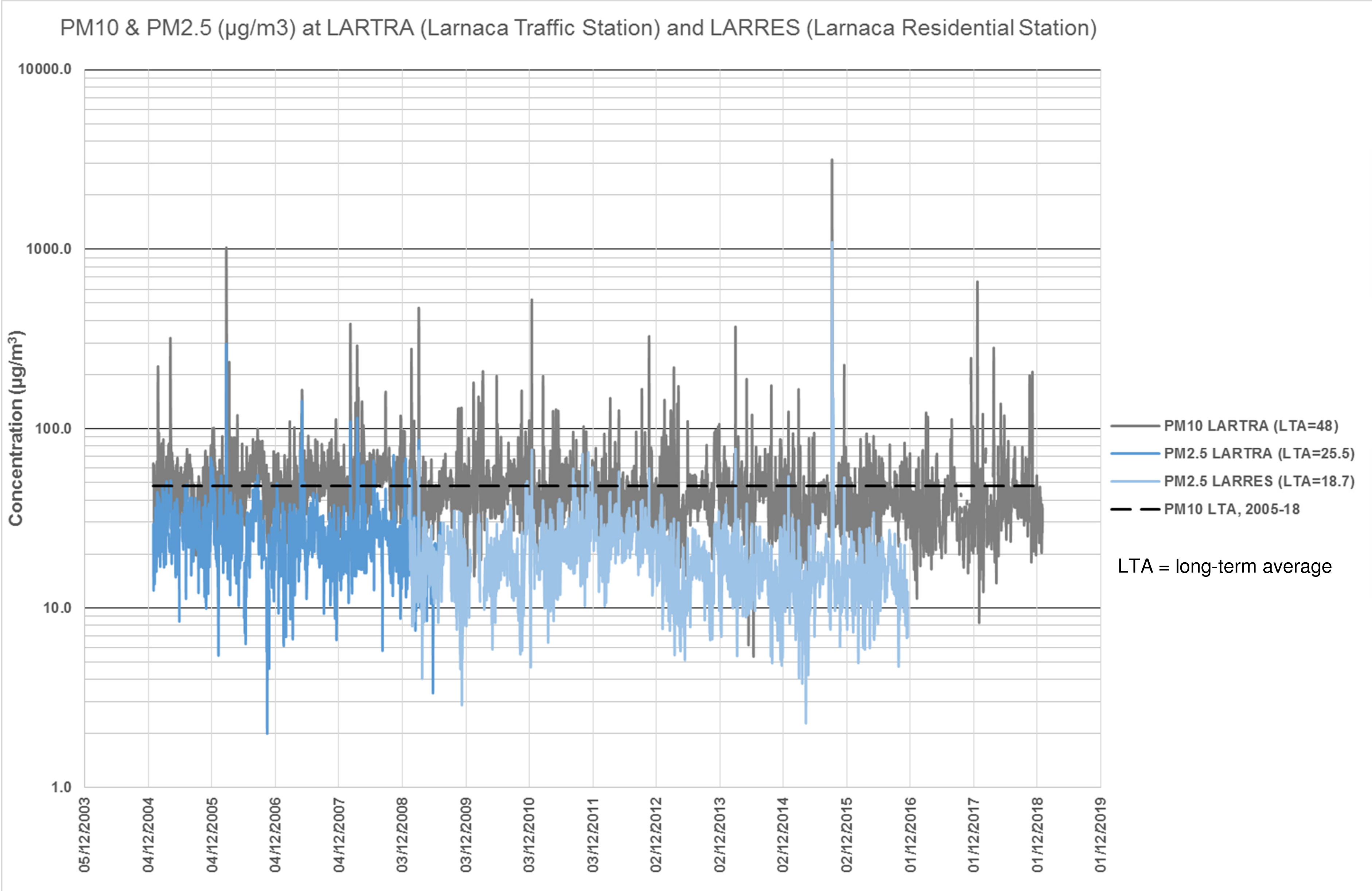
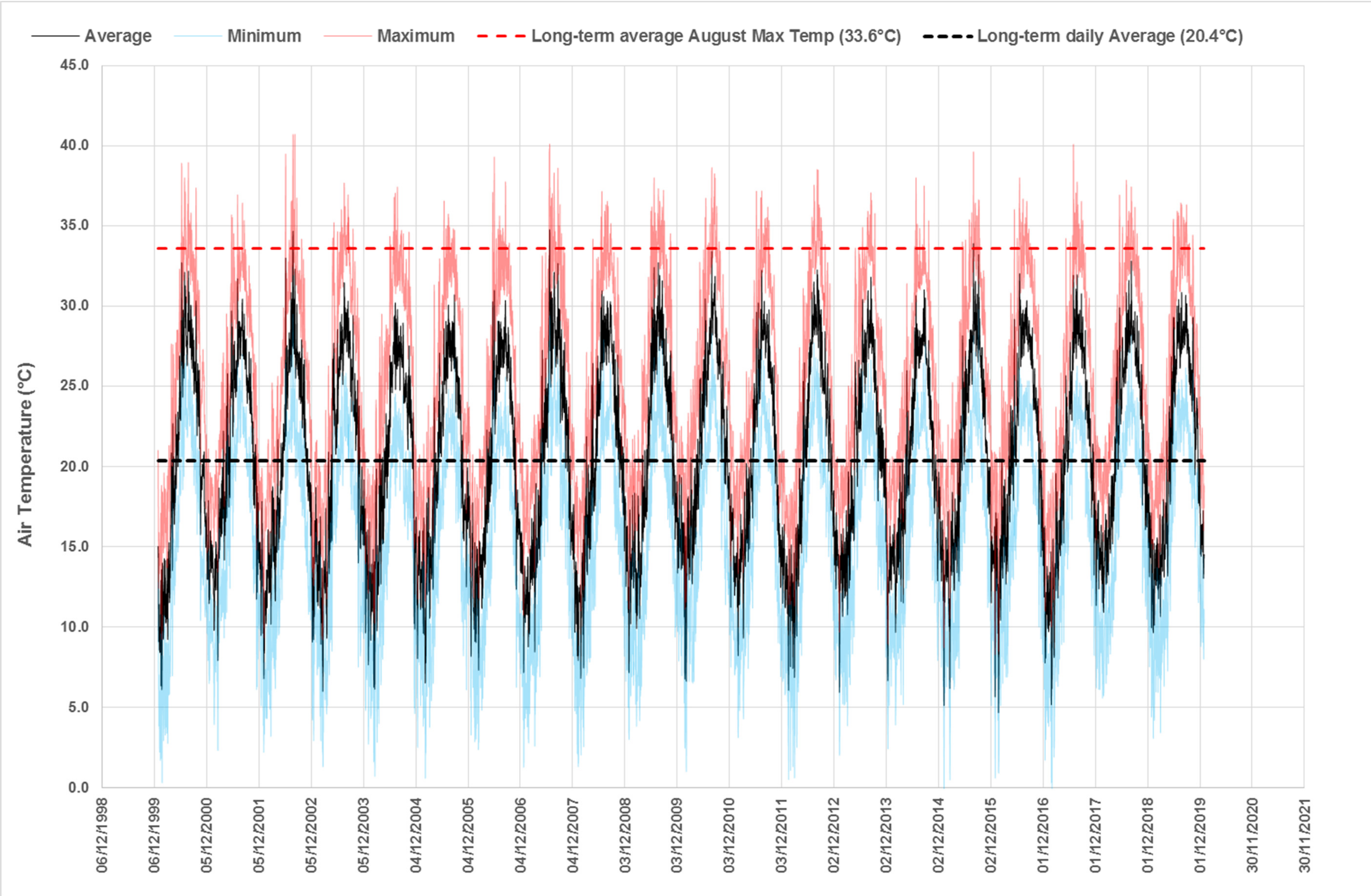
FIGURES

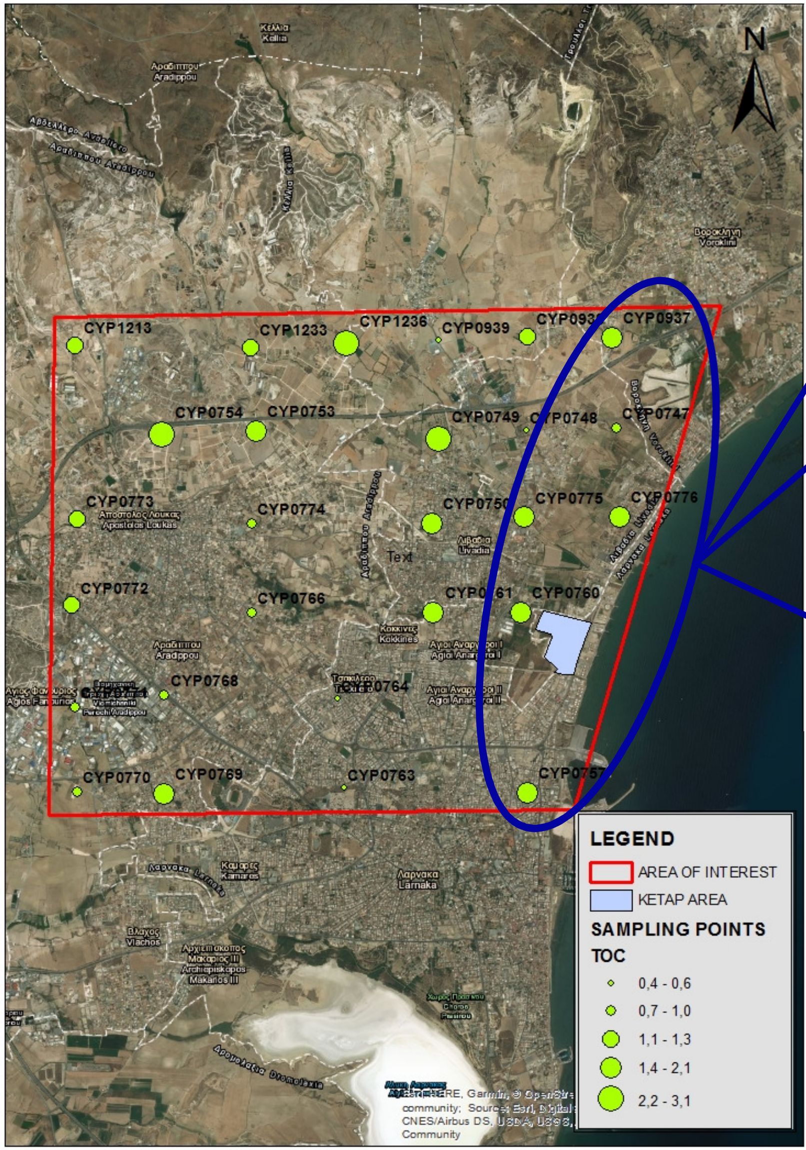


LQM Sound science: Defensible decisions	Project Name : Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances	Project Number: **1472-0A**
Client: Department of Environment Republic of Cyprus	Figure Title : PM10 and PM2.5 concentrations (µg/m3) at LARTRA (Larnaca Traffic Station) and LARRES (Larnaca Residential Station) (source: Department of Labour Inspection, Republic of Cyprus)	Figure No.: **1**



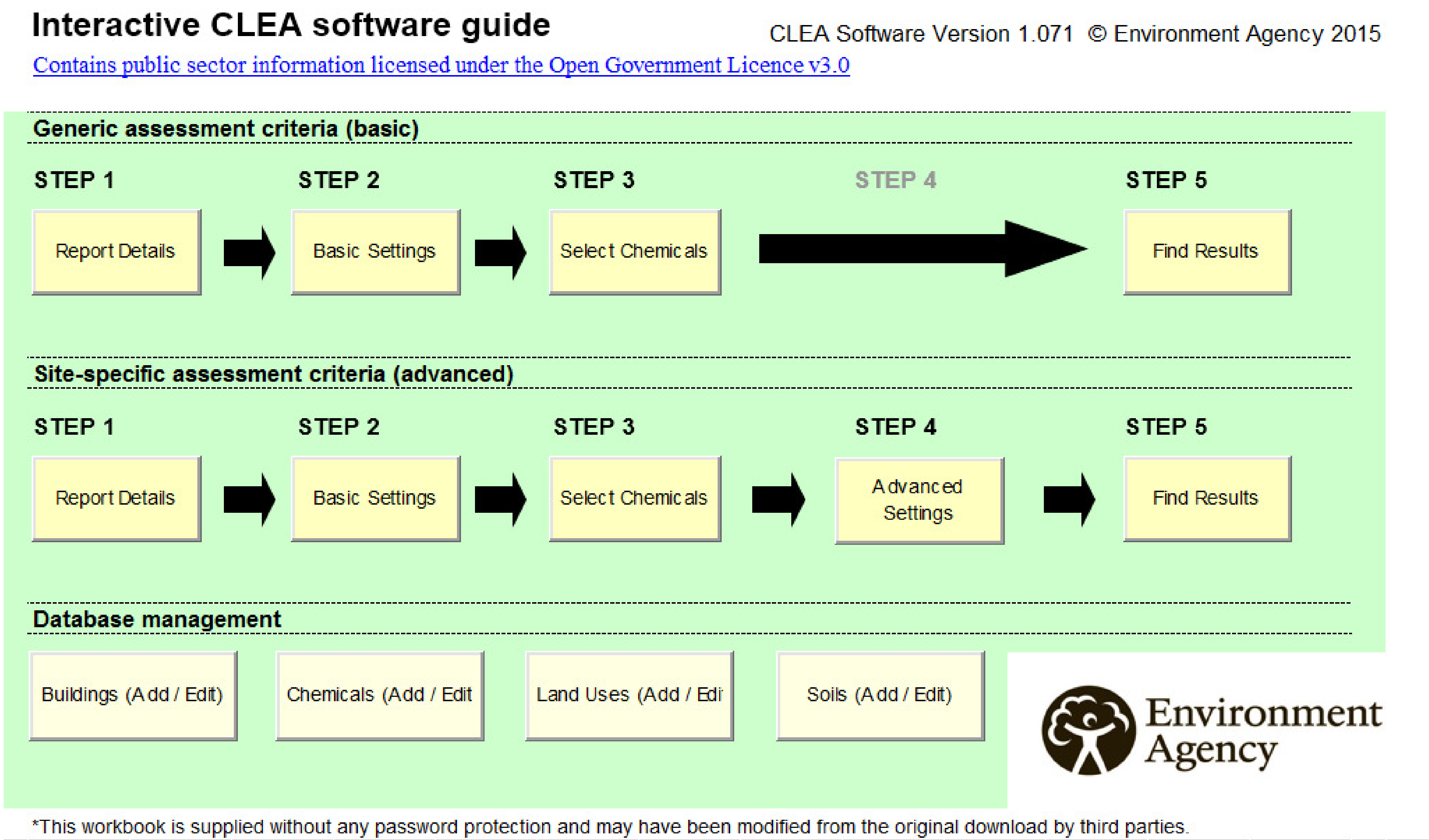
LQM Sound science: Defensible decisions	Project Name : Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances	Project Number: **1472-0A**
Client: Department of Environment Republic of Cyprus	Figure Title : Long-term air temperature data for Larnaca Airport, 2000-2019 (source: Department of Environment, Republic of Cyprus)	Figure No.: **2**

ΟΡΙΑΚΕΣ ΤΙΜΕΣ ΟΡΓΑΝΙΚΟΥ ΑΝΘΡΑΚΑ(%)
ΠΕΡΙΟΧΗ ΛΑΡΝΑΚΑΣ- ΛΕΙΒΑΔΙΑ



FID	Site	East_m_	North_m_	TOC (%)	SOM-estimate (%)
497	CYP0747	559011	3869030	1.00	1.72
498	CYP0748	558018	3869014	0.50	0.86
499	CYP0749	557045	3868918	2.70	4.66
500	CYP0750	556966	3867976	1.57	2.70
501	CYP0753	555021	3868998	2.13	3.67
502	CYP0754	553978	3868961	3.06	5.28
503	CYP0757	558025	3865000	1.93	3.33
504	CYP0760	557952	3866994	1.68	2.91
505	CYP0761	556989	3866999	1.68	2.89
506	CYP0763	556001	3865059	0.59	1.01
507	CYP0764	555920	3866051	0.39	0.67
508	CYP0766	554972	3866997	1.04	1.80
509	CYP0768	554009	3866081	0.94	1.62
510	CYP0769	554004	3864992	1.85	3.19
511	CYP0770	553042	3865013	0.84	1.44
512	CYP0771	553019	3865944	0.87	1.50
513	CYP0772	552986	3867073	1.27	2.19
514	CYP0773	553043	3868029	1.31	2.26
515	CYP0774	554974	3867975	1.00	1.73
516	CYP0775	557990	3868046	1.70	2.93
517	CYP0776	559053	3868051	1.70	2.94
579	CYP0937	558968	3870037	1.53	2.64
580	CYP0938	558032	3870047	1.15	1.98
581	CYP0939	557044	3870013	0.65	1.12
740	CYP1213	553025	3869953	1.35	2.33
756	CYP1233	554963	3869926	1.16	2.00
758	CYP1236	556020	3869972	2.38	4.11
Shaded data are closest to coastal area in proximity to Larnaca refinery				Average	2.42
				Median	2.26
	SOM% = TOC% / 0.58			Min	0.67
				Max	5.28

LQM Sound science: Defensible decisions	Project Name : Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances	Project Number: **1472-0A**
Client: Department of Environment Republic of Cyprus	Figure Title : Total Organic Carbon % within surface soils in the Larnaca area (source: Department of Environment, Republic of Cyprus)	Figure No.: **3**



LQM Sound science: Defensible decisions	Project Name : Larnaca Refinery and Oil/Gas Storage Area limit values for soil pollutants from petroleum and other substances	Project Number: **1472-0A**
Client: Department of Environment Republic of Cyprus	Figure Title : CLEA model process flow diagram indicating the key steps in deriving Generic Assessment Criteria (GAC) or Site Specific Assessment Criteria (SSCA) [Environment Agency]	Figure No.: **4**

Appendix 1: CLEA Spreadsheet Model runs for Petroleum Hydrocarbon EquivaLent Carbon Fractions and Volatile Organic Compounds Pollutants for Residential with Homegrown Produce exposure land use and Soil Organic Matter content

See separately supplied Excel Spreadsheet Models

Input parameters modified to reflect Larnaca, Cyprus conditions where information permits.

CLEA Software Version 1.071

Report generated	27-Feb-20
Report title	S4LL - Larnaca Refinery and Oil/Gas Storage Area: Third deliverable
Created by	AGG / RCO / CPN at LQM

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg-1)			Ratio of ADE to HCV			Saturation Limit (mg kg-1)	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1	Ali EC5-EC6 -S4LL	4.64E+04	2.01E+02	2.00E+02	0.00	1.00	1.00	2.24E+03 (vap)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Ali EC>6-8 -S4LL	1.19E+05	6.02E+02	6.01E+02	0.00	1.00	1.00	1.47E+03 (sol)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Ali EC>8-10 -S4LL	5.37E+03	1.54E+02	1.53E+02	0.01	0.99	1.00	9.03E+02 (vap)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Ali EC>10-12 -S4LL	6.58E+03	6.82E+02	6.63E+02	0.05	0.95	1.00	5.67E+02 (vap)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Ali EC>12-16 -S4LL	6.84E+03	4.58E+03	3.59E+03	0.36	0.64	1.00	2.84E+02 (vap)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Ali EC>16-35 -S4LL	9.10E+04	NR	NR	1.00	NR	NR	1.02E+02 (sol)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Ali EC>35-44 -S4LL	9.10E+04	NR	NR	1.00	NR	NR	1.02E+02 (sol)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Aro EC>5-7 -S4LL	7.43E+02	1.60E+03	5.07E+02	0.68	0.32	1.00	8.92E+03 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Aro EC>7-8 -S4LL	1.53E+03	4.66E+03	1.15E+03	0.75	0.25	1.00	8.57E+03 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Aro EC>8-10 -S4LL	5.54E+02	2.64E+02	2.25E+02	0.26	0.74	1.00	7.15E+03 (vap)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Aro EC>10-12 -S4LL	7.41E+02	1.22E+03	5.97E+02	0.67	0.33	1.00	4.29E+03 (sol)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Aro EC>12-16 -S4LL	1.10E+03	7.50E+03	1.06E+03	0.92	0.08	1.00	2.01E+03 (sol)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	Aro EC>16-21 -S4LL	1.28E+03	NR	NR	1.00	NR	NR	6.42E+02 (sol)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	Aro EC>21-35 -S4LL	1.90E+03	NR	NR	1.00	NR	NR	5.79E+01 (vap)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Aro EC>35-44 -S4LL	1.90E+03	NR	NR	1.00	NR	NR	5.79E+01 (vap)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	Aro EC>44-70 -S4LL	1.99E+03	NR	NR	1.00	NR	NR	3.49E+00 (vap)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	Benzene -S4LL	9.67E-01	1.61E+00	6.04E-01	0.62	0.38	1.00	8.92E+03 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
18	Toluene -S4LL	1.53E+03	4.74E+03	1.16E+03	0.76	0.24	1.00	8.57E+03 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19	Ethylbenzene -S4LL	1.15E+03	4.48E+02	3.22E+02	0.28	0.72	1.00	5.65E+03 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	Xylene, o- -S4LL	2.00E+03	3.90E+02	3.27E+02	0.16	0.84	1.00	5.19E+03 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
21	Xylene, m- -S4LL	2.19E+03	4.86E+02	3.98E+02	0.18	0.82	1.00	5.95E+03 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22	Xylene, p- -S4LL	2.06E+03	3.96E+02	3.32E+02	0.16	0.84	1.00	6.28E+03 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1	Ali EC5-EC6 -S4LL	90.7	0.4	8.8	100.0	2.00E+02	1.07E+05	1.00E+02	7.67E-06	0.00E+00	4.12E+00	4.67E-01	0.00E+00	1.40E+01	1.91E+01	5.00E+00	0.00E+00	0.00E+00	6.02E+00
2	Ali EC>6-8 -S4LL	97.0	0.1	2.9	100.0	6.01E+02	1.07E+05	3.00E+02	2.30E-05	0.00E+00	4.11E+00	8.08E-01	0.00E+00	1.40E+01	1.87E+01	6.49E+00	0.00E+00	0.00E+00	1.89E+00
3	Ali EC>8-10 -S4LL	99.3	0.0	0.7	100.0	1.53E+02	6.09E+03	7.66E+01	5.86E-06	0.00E+00	2.34E-01	9.75E-02	0.00E+00	3.65E-01	7.07E-01	7.01E-01	0.00E+00	0.00E+00	9.75E-03
4	Ali EC>10-12 -S4LL	99.9	0.0	0.1	100.0	6.63E+02	5.84E+03	3.32E+02	2.54E-05	0.00E+00	2.25E-01	1.99E-01	0.00E+00	6.23E-02	3.96E-01	8.99E-01	0.00E+00	0.00E+00	3.23E-04
5	Ali EC>12-16 -S4LL	100.0	0.0	0.0	100.0	3.59E+03	4.42E+03	1.79E+03	1.37E-04	0.00E+00	1.70E-01	4.02E-01	0.00E+00	4.17E-04	9.60E-02	2.87E-01	0.00E+00	0.00E+00	1.14E-07
6	Ali EC>16-35 -S4LL	100.0	0.0	0.0	100.0	9.10E+04	1.06E+04	4.55E+04	3.48E-03	0.00E+00	4.09E-01	3.14E+00	0.00E+00	7.68E-09	2.27E-02	6.93E-02	0.00E+00	0.00E+00	4.50E-15
7	Ali EC>35-44 -S4LL	100.0	0.0	0.0	100.0	9.10E+04	1.06E+04	4.55E+04	3.48E-03	0.00E+00	4.09E-01	3.14E+00	0.00E+00	7.68E-09	2.27E-02	6.93E-02	0.00E+00	0.00E+00	4.50E-15
8	Aro EC>5-7 -S4LL	93.9	5.4	0.7	100.0	5.07E+02	2.04E+04	2.54E+02	1.94E-05	0.00E+00	7.18E-01	3.05E-01	0.00E+00	1.34E+02	1.96E+02	1.01E+02	0.00E+00	0.00E+00	2.32E+02
9	Aro EC>7-8 -S4LL	97.9	1.9	0.2	100.0	1.15E+03	1.69E+04	5.77E+02	4.42E-05	0.00E+00	5.45E-01	3.95E-01	0.00E+00	1.86E+02	2.62E+02	8.62E+01	0.00E+00	0.00E+00	1.88E+02
10	Aro EC>8-10 -S4LL	99.7	0.2	0.1	100.0	2.25E+02	1.04E+03	1.13E+02	8.62E-06	0.00E+00	4.02E-02	4.90E-02	0.00E+00	1.05E+01	1.41E+01	3.92E+00	0.00E+00	0.00E+00	2.84E+00
11	Aro EC>10-12 -S4LL	99.8	0.2	0.0	100.0	5.97E+02	5.63E+02	2.98E+02	2.28E-05	0.00E+00	2.17E-02	5.86E-02	0.00E+00	1.97E+01	2.62E+01	7.88E+00	0.00E+00	0.00E+00	3.72E+00
12	Aro EC>12-16 -S4LL	99.9	0.1	0.0	100.0	1.06E+03	1.34E+02	5.30E+02	4.05E-05	0.00E+00	5.21E-03	3.83E-02	0.00E+00	1.93E+01	2.62E+01	1.04E+01	0.00E+00	0.00E+00	2.11E+00
13	Aro EC>16-21 -S4LL	100.0	0.0	0.0	100.0	1.28E+03	4.31E+00	6.39E+02	4.89E-05	0.00E+00	1.89E-04	8.25E-03	0.00E+00	7.84E+00	1.22E+01	7.99E+00	0.00E+00	0.00E+00	3.86E-01
14	Aro EC>21-35 -S4LL	100.0	0.0	0.0	100.0	1.90E+03	4.39E-02	9.48E+02	7.25E-05	0.00E+00	3.78E-06	1.95E-03	0.00E+00	5.49E-01	2.15E+00	4.03E+00	0.00E+00	0.00E+00	4.89E-03
15	Aro EC>35-44 -S4LL	100.0	0.0	0.0	100.0	1.90E+03	4.39E-02	9.48E+02	7.25E-05	0.00E+00	3.78E-06	1.95E-03	0.00E+00	5.49E-01	2.15E+00	4.03E+00	0.00E+00	0.00E+00	4.89E-03
16	Aro EC>44-70 -S4LL	100.0	0.0	0.0	100.0	1.99E+03	7.63E-01	9.93E+02	7.60E-05	0.00E+00	3.04E-05	4.03E-03	0.00E+00	4.91E-02	5.68E-01	1.47E+00	0.00E+00	0.00E+00	1.43E-04
17	Benzene -S4LL	93.9	5.4	0.7	100.0	6.04E-01	2.43E+01	3.02E-01	2.31E-08	0.00E+00	8.55E-04	3.63E-04	0.00E+00	1.59E-01	2.33E-01	1.21E-01	0.00E+00	0.00E+00	2.77E-01
18	Toluene -S4LL	97.9	1.9	0.2	100.0	1.16E+03	1.70E+04	5.80E+02	4.43E-05	0.00E+00	5.48E-01	3.97E-01	0.00E+00	1.87E+02	2.63E+02	8.65E+01	0.00E+00	0.00E+00	1.89E+02
19	Ethylbenzene -S4LL	99.0	0.9	0.1	100.0	3.22E+02	2.81E+03	1.61E+02	1.23E-05	0.00E+00	8.37E-02	8.08E-02	0.00E+00	3.57E+01	4.91E+01	1.44E+01	0.00E+00	0.00E+00	2.10E+01
20	Xylene, o- -S4LL	99.0	0.9	0.1	100.0	3.27E+02	2.41E+03	1.63E+02	1.25E-05	0.00E+00	7.18E-02	7.54E-02	0.00E+00	3.70E+01	5.08E+01	1.51E+01	0.00E+00	0.00E+00	2.27E+01

Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
21	Xylene, m- -S4LL	99.1	0.8	0.1	100.0	3.98E+02	2.35E+03	1.99E+02	1.52E-05	0.00E+00	6.98E-02	8.20E-02	0.00E+00	4.21E+01	5.77E+01	1.65E+01	0.00E+00	0.00E+00	2.31E+01
22	Xylene, p- -S4LL	99.0	0.9	0.1	100.0	3.32E+02	2.41E+03	1.66E+02	1.27E-05	0.00E+00	7.19E-02	7.61E-02	0.00E+00	3.69E+01	5.07E+01	1.48E+01	0.00E+00	0.00E+00	2.17E+01
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Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1	Ali EC5-EC6 -S4LL	1.38E-03	9.35E-03	6.40E-05	7.85E-06	2.50E+00	5.15E+95	5.58E+95	0.03	0.19	0.00	0.00	49.53	0.26	0.22	49.78
2	Ali EC>6-8 -S4LL	4.14E-03	8.31E-03	1.92E-04	2.35E-05	2.50E+00	5.15E+95	5.58E+95	0.08	0.17	0.00	0.00	49.31	0.44	0.25	49.75
3	Ali EC>8-10 -S4LL	1.06E-03	3.23E-04	4.90E-05	6.01E-06	1.44E-01	5.15E+95	5.58E+95	0.36	0.11	0.02	0.00	48.59	0.92	0.49	49.51
4	Ali EC>10-12 -S4LL	4.57E-03	2.57E-04	2.12E-04	2.60E-05	1.41E-01	5.15E+95	5.58E+95	1.56	0.09	0.07	0.01	46.40	1.86	1.72	48.28
5	Ali EC>12-16 -S4LL	2.47E-02	3.64E-04	1.15E-03	1.41E-04	1.13E-01	5.15E+95	5.58E+95	8.84	0.13	0.41	0.05	36.63	3.94	9.38	40.62
6	Ali EC>16-35 -S4LL	6.27E-01	7.89E-03	2.91E-02	3.57E-03	3.32E-01	5.15E+95	0.00E+00	31.36	0.39	1.45	0.18	12.31	4.30	50.00	0.00
7	Ali EC>35-44 -S4LL	6.27E-01	7.89E-03	2.91E-02	3.57E-03	3.32E-01	5.15E+95	0.00E+00	31.36	0.39	1.45	0.18	12.31	4.30	50.00	0.00
8	Aro EC>5-7 -S4LL	3.49E-03	1.48E-01	1.62E-04	1.99E-05	4.41E-01	1.55E-04	1.12E-02	0.58	24.56	0.03	0.00	71.57	1.38	0.03	1.85
9	Aro EC>7-8 -S4LL	7.95E-03	1.59E-01	3.69E-04	4.52E-05	3.40E-01	5.16E-04	2.90E-02	1.48	29.65	0.07	0.01	61.26	2.02	0.10	5.41
10	Aro EC>8-10 -S4LL	1.55E-03	6.51E-03	7.20E-05	8.83E-06	2.56E-02	5.15E+95	5.58E+95	2.30	9.65	0.11	0.01	35.94	1.99	12.06	37.94
11	Aro EC>10-12 -S4LL	4.11E-03	1.18E-02	1.91E-04	2.34E-05	1.47E-02	5.15E+95	5.58E+95	6.66	19.14	0.31	0.04	21.24	2.61	26.12	23.88
12	Aro EC>12-16 -S4LL	7.30E-03	1.16E-02	3.38E-04	4.15E-05	4.19E-03	5.15E+95	5.58E+95	15.57	24.68	0.72	0.09	6.70	2.24	40.97	9.03
13	Aro EC>16-21 -S4LL	8.81E-03	5.40E-03	4.08E-04	5.01E-05	3.40E-04	5.15E+95	0.00E+00	29.34	18.00	1.36	0.17	0.38	0.75	50.00	0.00
14	Aro EC>21-35 -S4LL	1.31E-02	1.20E-03	6.06E-04	7.43E-05	5.57E-05	5.15E+95	0.00E+00	43.56	3.99	2.02	0.25	0.01	0.18	50.00	0.00
15	Aro EC>35-44 -S4LL	1.31E-02	1.20E-03	6.06E-04	7.43E-05	5.57E-05	5.15E+95	0.00E+00	43.56	3.99	2.02	0.25	0.01	0.18	50.00	0.00
16	Aro EC>44-70 -S4LL	1.37E-02	4.71E-04	6.35E-04	7.78E-05	1.29E-04	5.15E+95	0.00E+00	45.63	1.57	2.12	0.26	0.06	0.37	50.00	0.00
17	Benzene -S4LL	4.16E-06	1.77E-04	1.93E-07	2.37E-08	5.25E-04	0.00E+00	0.00E+00	0.59	25.03	0.03	0.00	72.94	1.41	0.00	0.00
18	Toluene -S4LL	7.99E-03	1.60E-01	3.70E-04	4.54E-05	3.41E-01	5.16E-04	5.14E-03	1.55	31.03	0.07	0.01	64.12	2.11	0.10	1.00
19	Ethylbenzene -S4LL	2.22E-03	2.57E-02	1.03E-04	1.26E-05	5.27E-02	2.58E-04	1.04E-03	2.70	31.36	0.13	0.02	61.51	2.70	0.31	1.27
20	Xylene, o- -S4LL	2.25E-03	2.69E-02	1.04E-04	1.28E-05	4.53E-02	5.67E-04	5.81E-03	2.78	33.21	0.13	0.02	53.44	2.55	0.70	7.17

Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
21	Xylene, m- -S4LL	2.74E-03	2.97E-02	1.27E-04	1.56E-05	4.43E-02	5.67E-04	5.81E-03	3.29	35.69	0.15	0.02	50.50	2.70	0.68	6.97
22	Xylene, p- -S4LL	2.29E-03	2.65E-02	1.06E-04	1.30E-05	4.54E-02	5.67E-04	5.81E-03	2.83	32.87	0.13	0.02	53.67	2.58	0.70	7.19
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Environment Agency

		Oral Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})		Inhalation Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1	Ali EC5-EC6 -S4LL	TDI	5000	TDI	5000	9.99E+99	9.99E+99	3.33E+01	1.08E-05	1.43E-09	2.91	3.31	0.1	0.5	10	1	1
2	Ali EC>6-8 -S4LL	TDI	5000	TDI	5000	9.99E+99	9.99E+99	4.84E+01	1.08E-05	1.43E-09	3.58	4.13	0.1	0.5	10	1	1
3	Ali EC>8-10 -S4LL	TDI	100	TDI	290	9.99E+99	9.99E+99	8.41E+01	1.08E-05	1.43E-09	4.48	5.22	0.1	0.5	10	1	1
4	Ali EC>10-12 -S4LL	TDI	100	TDI	290	9.99E+99	9.99E+99	1.47E+02	1.08E-05	1.43E-09	5.38	6.3	0.1	0.5	10	1	1
5	Ali EC>12-16 -S4LL	TDI	100	TDI	290	9.99E+99	9.99E+99	4.60E+02	1.08E-05	1.43E-09	6.73	7.94	0.1	0.5	10	1	1
6	Ali EC>16-35 -S4LL	TDI	2000	NR	0	9.99E+99	0	4.67E+03	1.08E-05	1.43E-09	8.76	10.39	0.1	0.5	10	1	1
7	Ali EC>35-44 -S4LL	TDI	2000	NR	0	9.99E+99	0	4.67E+03	1.08E-05	1.43E-09	8.76	10.39	0.1	0.5	10	1	1
8	Aro EC>5-7 -S4LL	TDI	223	TDI	1400	3	200	2.01E-01	9.48E-06	9.50E-10	1.83	2.13	0.1	0.5	10	1	1
9	Aro EC>7-8 -S4LL	TDI	223	TDI	1400	10	520	2.13E-01	8.41E-06	8.41E-10	2.31	2.73	0.1	0.5	10	1	1
10	Aro EC>8-10 -S4LL	TDI	40	TDI	60	9.99E+99	9.99E+99	5.13E-01	1.08E-05	1.43E-09	3.2	3.69	0.1	0.5	10	1	1
11	Aro EC>10-12 -S4LL	TDI	40	TDI	60	9.99E+99	9.99E+99	1.65E-01	1.08E-05	1.43E-09	3.4	3.93	0.1	0.5	10	1	1
12	Aro EC>12-16 -S4LL	TDI	40	TDI	60	9.99E+99	9.99E+99	4.41E-02	1.08E-05	1.43E-09	3.7	4.29	0.1	0.5	10	1	1
13	Aro EC>16-21 -S4LL	TDI	30	NR	0	9.99E+99	0	3.31E-03	1.08E-05	1.43E-09	4.15	4.82	0.1	0.5	10	1	1
14	Aro EC>21-35 -S4LL	TDI	30	NR	0	9.99E+99	0	2.03E-04	1.08E-05	1.43E-09	5.1	5.95	0.1	0.5	10	1	1
15	Aro EC>35-44 -S4LL	TDI	30	NR	0	9.99E+99	0	2.03E-04	1.08E-05	1.43E-09	5.1	5.95	0.1	0.5	10	1	1
16	Aro EC>44-70 -S4LL	TDI	30	NR	0	9.99E+99	0	1.34E-02	1.08E-05	1.43E-09	5.7	6.66	0.1	0.5	10	1	1
17	Benzene -S4LL	ID	0.29	ID	1.4	NR	NR	2.01E-01	9.48E-06	9.50E-10	1.83	2.13	0.1	0.5	10	1	1
18	Toluene -S4LL	TDI	223	TDI	1400	10	92	2.13E-01	8.41E-06	8.41E-10	2.31	2.73	0.1	0.5	10	1	1
19	Ethylbenzene -S4LL	TDI	100	TDI	74.3	5	18.6	2.74E-01	7.62E-06	7.60E-10	2.65	3.15	0.1	0.5	10	1	1
20	Xylene, o- -S4LL	TDI	180	TDI	60	11	104	2.21E-01	7.61E-06	7.60E-10	2.63	3.12	0.1	0.5	10	1	1

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		Oral Health Criteria Value (µg kg^{-1} BW day^{-1})		Inhalation Health Criteria Value (µg kg^{-1} BW day^{-1})		Oral Mean Daily Intake (µg day^{-1})	Inhalation Mean Daily Intake (µg day^{-1})	Air-water partition coefficient (K_{aw}) (cm^3 cm^{-3})	Coefficient of Diffusion in Air (m^2 s^{-1})	Coefficient of Diffusion in Water (m^2 s^{-1})	log K_{oc} (cm^3 g^{-1})	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor (g g^{-1} DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
21	Xylene, m- -S4LL	TDI	180	TDI	60	11	104	2.03E-01	7.59E-06	7.60E-10	2.69	3.2	0.1	0.5	10	1	1
22	Xylene, p- -S4LL	TDI	180	TDI	60	11	104	2.28E-01	7.61E-06	7.60E-10	2.65	3.15	0.1	0.5	10	1	1
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Environment Agency

		Soil-to-water partition coefficient (cm^3 g^{-1})	Vapour pressure (Pa)	Water solubility (mg L^{-1})	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
1	Ali EC5-EC6 -S4LL	5.66E+01	3.62E+04	3.59E+01	model	model	model	model	model	model
2	Ali EC>6-8 -S4LL	2.65E+02	6.38E+03	5.37E+00	model	model	model	model	model	model
3	Ali EC>8-10 -S4LL	2.10E+03	6.76E+02	4.27E-01	model	model	model	model	model	model
4	Ali EC>10-12 -S4LL	1.67E+04	7.65E+01	3.39E-02	model	model	model	model	model	model
5	Ali EC>12-16 -S4LL	3.74E+05	4.28E+00	7.59E-04	model	model	model	model	model	model
6	Ali EC>16-35 -S4LL	4.01E+07	1.08E-01	2.54E-06	model	model	model	model	model	model
7	Ali EC>35-44 -S4LL	4.01E+07	1.08E-01	2.54E-06	model	model	model	model	model	model
8	Aro EC>5-7 -S4LL	4.71E+00	1.13E+04	1.78E+03	model	model	model	model	model	model
9	Aro EC>7-8 -S4LL	1.42E+01	3.35E+03	5.90E+02	model	model	model	model	model	model
10	Aro EC>8-10 -S4LL	1.10E+02	6.76E+02	6.46E+01	model	model	model	model	model	model
11	Aro EC>10-12 -S4LL	1.75E+02	7.65E+01	2.45E+01	model	model	model	model	model	model
12	Aro EC>12-16 -S4LL	3.49E+02	4.15E+00	5.75E+00	model	model	model	model	model	model
13	Aro EC>16-21 -S4LL	9.83E+02	2.79E-02	6.53E-01	model	model	model	model	model	model
14	Aro EC>21-35 -S4LL	8.76E+03	1.37E-05	6.61E-03	model	model	model	model	model	model
15	Aro EC>35-44 -S4LL	8.76E+03	1.37E-05	6.61E-03	model	model	model	model	model	model
16	Aro EC>44-70 -S4LL	3.49E+04	1.37E-05	1.00E-04	model	model	model	model	model	model
17	Benzene -S4LL	4.71E+00	1.13E+04	1.78E+03	model	model	model	model	model	model
18	Toluene -S4LL	1.42E+01	3.35E+03	5.90E+02	model	model	model	model	model	model
19	Ethylbenzene -S4LL	3.11E+01	1.14E+03	1.80E+02	model	model	model	model	model	model
20	Xylene, o- -S4LL	2.97E+01	1.02E+03	1.73E+02	model	model	model	model	model	model

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		Soil-to-water partition coefficient (cm^3 g^{-1})	Vapour pressure (Pa)	Water solubility (mg L^{-1})	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
21	Xylene, m- -S4LL	3.41E+01	8.11E+02	2.00E+02	model	model	model	model	model	model
22	Xylene, p- -S4LL	3.11E+01	1.05E+03	2.00E+02	model	model	model	model	model	model
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APPENDIX 2: CLEA SPREADSHEET MODEL RUNS FOR POLYAROMATIC HYDROCARBONS POLLUTANTS FOR RESIDENTIAL WITH HOMEGROWN PRODUCE EXPOSURE LAND USE AND SOIL ORGANIC MATTER CONTENT

See separately supplied Excel Spreadsheet Models

Input parameters modified to reflect Larnaca, Cyprus conditions where information permits.

Report generated	28-Feb-20
Report title	S4LL - Larnaca Refinery and Oil/Gas Storage Area: Third deliverable
Created by	AGG / RCO / CPN at LQM

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg-1)			Ratio of ADE to HCV			Saturation Limit (mg kg-1)	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1	Acenaphthene -S4LL	2.06E+03	1.11E+04	1.74E+03	0.84	0.16	1.00	6.72E+02 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Acenaphthylene -S4LL	1.75E+03	1.56E+04	1.57E+03	0.90	0.10	1.00	1.01E+03 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Anthracene -S4LL	1.75E+04	5.43E+05	1.69E+04	0.97	0.03	1.00	2.19E+01 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Benzo[a]anthracene -S4LL	1.92E+01	1.98E+01	9.75E+00	0.51	0.49	1.00	2.05E+01 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Benzo[a]pyrene -S4LL	3.99E+00	5.50E+00	2.31E+00	0.58	0.42	1.00	3.41E+01 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Benzo[b]fluoranthene -S4LL	4.92E+00	6.41E+00	2.79E+00	0.57	0.43	1.00	1.46E+01 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Benzo[ghi]perylene -S4LL	4.59E+02	7.04E+02	2.78E+02	0.61	0.39	1.00	7.54E+00 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Benzo[k]fluoranthene -S4LL	1.34E+02	1.83E+02	7.74E+01	0.58	0.42	1.00	8.24E+00 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Chrysene -S4LL	3.71E+01	4.54E+01	2.04E+01	0.55	0.45	1.00	7.65E+00 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Dibenzo[ah]anthracene -S4LL	4.05E-01	5.87E-01	2.40E-01	0.59	0.41	1.00	7.78E+00 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Fluoranthene -S4LL	1.19E+03	7.88E+04	1.18E+03	0.99	0.01	1.00	2.91E+02 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Fluorene -S4LL	1.55E+03	1.49E+04	1.40E+03	0.91	0.09	1.00	3.65E+02 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	Indeno[123-cd]pyrene -S4LL	5.56E+01	7.32E+01	3.16E+01	0.57	0.43	1.00	1.21E+00 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	Naphthalene -S4LL	2.89E+02	7.98E+00	NR	0.03	1.00	NR	8.59E+02 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Phenanthrene -S4LL	7.14E+02	1.85E+04	6.87E+02	0.96	0.04	1.00	4.29E+02 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	Pyrene -S4LL	2.76E+03	2.57E+05	2.74E+03	0.99	0.01	1.00	1.47E+02 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	Coal Tar (BaP as a surrogate mar	1.29E+00	5.50E+00	1.04E+00	0.81	0.19	1.00	3.41E+01 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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	Assessment Criterion (mg kg-1)			Ratio of ADE to HCV			Saturation Limit (mg kg-1)	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
	oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
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		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1	Acenaphthene -S4LL	99.8	0.2	0.0	100.0	1.74E+03	5.13E+01	8.70E+02	6.65E-05	0.00E+00	1.44E-02	2.45E-02	0.00E+00	6.39E+01	8.51E+01	2.61E+01	0.00E+00	0.00E+00	1.04E+01
2	Acenaphthylene -S4LL	99.8	0.2	0.0	100.0	1.57E+03	2.95E+01	7.87E+02	6.02E-05	0.00E+00	9.11E-03	1.87E-02	0.00E+00	7.13E+01	9.48E+01	2.61E+01	0.00E+00	0.00E+00	1.38E+01
3	Anthracene -S4LL	99.9	0.1	0.0	100.0	1.69E+04	2.92E+01	8.46E+03	6.47E-04	0.00E+00	1.12E-02	7.07E-02	0.00E+00	2.76E+02	3.89E+02	1.56E+02	0.00E+00	0.00E+00	2.20E+01
4	Benzo[a]anthracene -S4LL	100.0	0.0	0.0	100.0	9.75E+00	4.16E-04	4.87E+00	3.73E-07	0.00E+00	2.20E-07	8.19E-06	0.00E+00	4.80E-03	1.79E-02	1.66E-02	0.00E+00	0.00E+00	4.55E-05
5	Benzo[a]pyrene -S4LL	100.0	0.0	0.0	100.0	2.31E+00	1.30E-06	1.16E+00	8.84E-08	0.00E+00	1.66E-09	1.26E-06	0.00E+00	4.82E-04	2.56E-03	2.49E-03	0.00E+00	0.00E+00	3.01E-06
6	Benzo[b]fluoranthene -S4LL	100.0	0.0	0.0	100.0	2.79E+00	1.09E-05	1.39E+00	1.07E-07	0.00E+00	1.16E-08	1.70E-06	0.00E+00	8.20E-04	3.80E-03	3.57E-03	0.00E+00	0.00E+00	5.99E-06
7	Benzo[ghi]perylene -S4LL	100.0	0.0	0.0	100.0	2.78E+02	7.66E-06	1.39E+02	1.06E-05	0.00E+00	1.28E-08	8.25E-05	0.00E+00	6.23E-03	9.56E-02	9.89E-02	0.00E+00	0.00E+00	1.42E-05
8	Benzo[k]fluoranthene -S4LL	100.0	0.0	0.0	100.0	7.74E+01	1.50E-04	3.87E+01	2.96E-06	0.00E+00	1.69E-07	3.95E-05	0.00E+00	1.25E-02	7.48E-02	7.32E-02	0.00E+00	0.00E+00	6.91E-05
9	Chrysene -S4LL	100.0	0.0	0.0	100.0	2.04E+01	1.01E-04	1.02E+01	7.81E-07	0.00E+00	1.15E-07	1.75E-05	0.00E+00	1.74E-02	5.27E-02	4.55E-02	0.00E+00	0.00E+00	2.17E-04
10	Dibenzo[ah]anthracene -S4LL	100.0	0.0	0.0	100.0	2.40E-01	6.93E-09	1.20E-01	9.17E-09	0.00E+00	1.71E-11	1.04E-07	0.00E+00	2.56E-05	1.84E-04	1.74E-04	0.00E+00	0.00E+00	1.17E-07
11	Fluoranthene -S4LL	100.0	0.0	0.0	100.0	1.18E+03	2.60E-01	5.88E+02	4.50E-05	0.00E+00	1.33E-04	2.19E-03	0.00E+00	4.89E+00	8.95E+00	5.76E+00	0.00E+00	0.00E+00	1.51E-01
12	Fluorene -S4LL	99.9	0.1	0.0	100.0	1.40E+03	1.91E+01	7.01E+02	5.37E-05	0.00E+00	5.52E-03	1.36E-02	0.00E+00	4.41E+01	5.90E+01	1.88E+01	0.00E+00	0.00E+00	6.14E+00
13	Indeno[123-cd]pyrene -S4LL	100.0	0.0	0.0	100.0	3.16E+01	6.44E-05	1.58E+01	1.21E-06	0.00E+00	7.69E-08	2.06E-05	0.00E+00	1.29E-02	5.17E-02	4.59E-02	0.00E+00	0.00E+00	1.11E-04
14	Naphthalene -S4LL	99.4	0.6	0.0	100.0	7.98E+00	4.01E+00	3.99E+00	3.05E-07	0.00E+00	1.15E-03	4.68E-04	0.00E+00	7.20E-01	9.79E-01	2.66E-01	0.00E+00	0.00E+00	3.24E-01
15	Phenanthrene -S4LL	99.9	0.1	0.0	100.0	6.87E+02	1.67E+00	3.44E+02	2.63E-05	0.00E+00	5.79E-04	3.18E-03	0.00E+00	1.15E+01	1.62E+01	6.49E+00	0.00E+00	0.00E+00	9.15E-01
16	Pyrene -S4LL	100.0	0.0	0.0	100.0	2.74E+03	1.56E-01	1.37E+03	1.05E-04	0.00E+00	1.40E-04	4.68E-03	0.00E+00	1.31E+01	2.33E+01	1.45E+01	0.00E+00	0.00E+00	4.36E-01
17	Coal Tar (BaP as a surrogate marker) -S4L	100.0	0.0	0.0	100.0	1.04E+00	5.84E-07	5.21E-01	3.99E-08	0.00E+00	7.47E-10	5.67E-07	0.00E+00	2.17E-04	1.16E-03	1.12E-03	0.00E+00	0.00E+00	1.36E-06
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	Soil Distribution				Media Concentrations													
	Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
	%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
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		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1	Acenaphthene -S4LL	1.20E-02	3.78E-02	7.22E-04	6.82E-05	9.36E-03	5.05E-05	1.40E-06	19.97	63.02	1.20	0.11	14.49	1.12	0.08	0.00
2	Acenaphthylene -S4LL	1.08E-02	4.24E-02	6.54E-04	6.17E-05	6.00E-03	7.22E-06	6.14E-07	18.08	70.71	1.09	0.10	9.15	0.86	0.01	0.00
3	Anthracene -S4LL	1.17E-01	1.67E-01	7.03E-03	6.63E-04	8.69E-03	4.12E-06	2.29E-06	38.86	55.68	2.34	0.22	2.25	0.65	0.00	0.00
4	Benzo[a]anthracene -S4LL	6.72E-05	7.37E-06	4.05E-06	3.82E-07	3.58E-07	3.09E-06	6.14E-07	84.67	9.29	5.10	0.48	0.17	0.28	0.00	0.00
5	Benzo[a]pyrene -S4LL	1.59E-05	1.10E-06	9.60E-07	9.05E-08	3.55E-08	5.67E-06	3.35E-07	87.94	6.06	5.30	0.50	0.01	0.19	0.00	0.00
6	Benzo[b]fluoranthene -S4LL	1.92E-05	1.58E-06	1.16E-06	1.09E-07	5.37E-08	5.67E-06	7.26E-07	86.87	7.16	5.24	0.49	0.03	0.21	0.00	0.00
7	Benzo[ghi]perylene -S4LL	1.91E-03	5.52E-05	1.15E-04	1.09E-05	2.27E-06	3.09E-06	5.58E-07	91.24	2.63	5.50	0.52	0.00	0.11	0.00	0.00
8	Benzo[k]fluoranthene -S4LL	5.33E-04	3.25E-05	3.21E-05	3.03E-06	1.19E-06	4.64E-06	3.91E-07	88.56	5.40	5.34	0.50	0.02	0.18	0.00	0.00
9	Chrysene -S4LL	1.41E-04	2.14E-05	8.48E-06	8.00E-07	5.49E-07	5.67E-06	9.49E-07	81.82	12.46	4.93	0.47	0.04	0.28	0.00	0.00
10	Dibenzo[ah]anthracene -S4LL	1.65E-06	8.23E-08	9.96E-08	9.39E-09	2.86E-09	2.06E-06	1.84E-06	89.48	4.46	5.39	0.51	0.00	0.15	0.00	0.00
11	Fluoranthene -S4LL	8.10E-03	3.71E-03	4.88E-04	4.60E-05	1.40E-04	1.80E-05	4.69E-06	64.74	29.69	3.90	0.37	0.64	0.48	0.14	0.04
12	Fluorene -S4LL	9.66E-03	2.60E-02	5.83E-04	5.50E-05	3.70E-03	3.04E-05	5.36E-06	24.16	64.91	1.46	0.14	8.31	0.93	0.08	0.01
13	Indeno[123-cd]pyrene -S4LL	2.18E-04	2.11E-05	1.31E-05	1.24E-06	6.11E-07	5.16E-06	5.03E-07	85.79	8.31	5.17	0.49	0.02	0.22	0.00	0.00
14	Naphthalene -S4LL	5.50E-05	4.85E-04	3.32E-06	3.13E-07	7.03E-04	3.61E-04	1.56E-04	0.00	0.00	0.00	0.04	80.29	1.49	0.00	18.18
15	Phenanthrene -S4LL	4.73E-03	6.94E-03	2.85E-04	2.69E-05	4.36E-04	7.94E-05	2.89E-05	37.79	55.38	2.28	0.21	2.78	0.70	0.63	0.23
16	Pyrene -S4LL	1.88E-02	9.69E-03	1.14E-03	1.07E-04	2.13E-04	1.80E-05	3.63E-06	62.80	32.28	3.79	0.36	0.28	0.43	0.06	0.01
17	Coal Tar (BaP as a surrogate marker) -S4LL	7.18E-06	4.95E-07	4.33E-07	4.08E-08	1.60E-08	5.67E-06	3.35E-07	87.94	6.06	5.30	0.50	0.01	0.19	0.00	0.00
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Environment Agency

	Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
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Environment Agency

		Oral Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})		Inhalation Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1	Acenaphthene -S4LL	TDI	60	TDI	60	0.98	0.025	4.82E-03	6.34E-06	6.72E-10	3.37	4.03	0.13	0.5	1	1	1
2	Acenaphthylene -S4LL	TDI	60	TDI	60	0.14	0.011	2.38E-03	6.46E-06	6.89E-10	3.26	3.91	0.13	0.5	1	1	1
3	Anthracene -S4LL	TDI	300	TDI	300	0.08	0.041	6.76E-04	5.80E-06	6.23E-10	3.75	4.5	0.13	0.5	1	1	1
4	Benzo[a]anthracene -S4LL	ID	0.155	ID	0.0015	0.06	0.011	2.30E-04	4.99E-06	5.43E-10	4.89	5.91	0.13	0.5	1	1	1
5	Benzo[a]pyrene -S4LL	ID	0.031	ID	0.0003	0.11	0.006	5.03E-06	4.75E-06	5.25E-10	5.11	6.18	0.13	0.5	1	1	1
6	Benzo[b]fluoranthene -S4LL	ID	0.03875	ID	0.000375	0.11	0.013	2.86E-05	4.73E-06	5.18E-10	5.02	6.08	0.13	0.5	1	1	1
7	Benzo[ghi]perylene -S4LL	ID	3.4444444	ID	0.0333333	0.06	0.01	7.99E-07	4.58E-06	5.09E-10	5.62	6.81	0.13	0.5	1	1	1
8	Benzo[k]fluoranthene -S4LL	ID	1.0333333	ID	0.01	0.09	0.007	1.99E-05	4.73E-06	5.18E-10	5.17	6.26	0.13	0.5	1	1	1
9	Chrysene -S4LL	ID	0.31	ID	0.003	0.11	0.017	1.89E-05	4.95E-06	5.40E-10	4.74	5.73	0.13	0.5	1	1	1
10	Dibenzo[ah]anthracene -S4LL	ID	0.0031	ID	0.00003	0.04	0.033	3.74E-07	4.42E-06	4.86E-10	5.27	6.38	0.13	0.5	1	1	1
11	Fluoranthene -S4LL	TDI	12.5	TDI	12.5	0.35	0.084	2.80E-04	5.43E-06	5.87E-10	4.26	5.13	0.13	0.5	1	1	1
12	Fluorene -S4LL	TDI	40	TDI	40	0.59	0.096	2.68E-03	6.04E-06	6.40E-10	3.45	4.13	0.13	0.5	1	1	1
13	Indeno[123-cd]pyrene -S4LL	ID	0.4428571	ID	0.0042857	0.1	0.009	1.24E-05	4.52E-06	5.02E-10	4.94	5.97	0.13	0.5	1	1	1
14	Naphthalene -S4LL	TDI	20	TDI	0.86	7	2.8	2.27E-02	7.06E-06	7.38E-10	2.81	3.34	0.13	0.5	1	1	1
15	Phenanthrene -S4LL	TDI	12.5	TDI	12.5	1.54	0.518	9.30E-04	5.78E-06	6.18E-10	3.74	4.5	0.13	0.5	1	1	1
16	Pyrene -S4LL	TDI	30	TDI	30	0.35	0.065	6.43E-05	5.43E-06	5.93E-10	4.21	5.08	0.13	0.5	1	1	1
17	Coal Tar (BaP as a surrogate marker) -S4LL	ID	0.01	ID	0.0003	0.11	0.006	5.03E-06	4.75E-06	5.25E-10	5.11	6.18	0.13	0.5	1	1	1
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Environment Agency

		Oral Health Criteria Value (µg kg^{-1} BW day^{-1})		Inhalation Health Criteria Value (µg kg^{-1} BW day^{-1})	Oral Mean Daily Intake (µg day^{-1})	Inhalation Mean Daily Intake (µg day^{-1})	Air-water partition coefficient (K_{aw}) (cm^3 cm^{-3})	Coefficient of Diffusion in Air (m^2 s^{-1})	Coefficient of Diffusion in Water (m^2 s^{-1})	log K_{oc} (cm^3 g^{-1})	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor (g g^{-1} DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
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Environment Agency

		Soil-to-water partition coefficient ($cm^3 g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg L^{-1}$)	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
1	Acenaphthene -S4LL	1.63E+02	3.15E-01	4.11E+00	model	model	model	model	model	model
2	Acenaphthylene -S4LL	1.27E+02	3.04E-01	7.95E+00	model	model	model	model	model	model
3	Anthracene -S4LL	3.91E+02	5.21E-04	5.60E-02	model	model	model	model	model	model
4	Benzo[a]anthracene -S4LL	5.40E+03	9.41E-06	3.80E-03	model	model	model	model	model	model
5	Benzo[a]pyrene -S4LL	8.97E+03	1.86E-07	3.80E-03	model	model	model	model	model	model
6	Benzo[b]fluoranthene -S4LL	7.29E+03	5.57E-07	2.00E-03	model	model	model	model	model	model
7	Benzo[ghi]perylene -S4LL	2.90E+04	1.84E-09	2.60E-04	model	model	model	model	model	model
8	Benzo[k]fluoranthene -S4LL	1.03E+04	1.55E-07	8.00E-04	model	model	model	model	model	model
9	Chrysene -S4LL	3.82E+03	4.05E-07	2.00E-03	model	model	model	model	model	model
10	Dibenzo[ah]anthracene -S4LL	1.30E+04	1.98E-09	6.00E-04	model	model	model	model	model	model
11	Fluoranthene -S4LL	1.27E+03	7.80E-04	2.30E-01	model	model	model	model	model	model
12	Fluorene -S4LL	1.96E+02	7.36E-02	1.86E+00	model	model	model	model	model	model
13	Indeno[123-cd]pyrene -S4LL	6.06E+03	2.19E-08	2.00E-04	model	model	model	model	model	model
14	Naphthalene -S4LL	4.49E+01	8.26E+00	1.90E+01	model	model	model	model	model	model
15	Phenanthrene -S4LL	3.82E+02	1.43E-02	1.12E+00	model	model	model	model	model	model
16	Pyrene -S4LL	1.13E+03	1.01E-04	1.30E-01	model	model	model	model	model	model
17	Coal Tar (BaP as a surrogate marker) -S4LL	8.97E+03	1.86E-07	3.80E-03	model	model	model	model	model	model
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Environment Agency

	Soil-to-water partition coefficient (cm^3 g^{-1})	Vapour pressure (Pa)	Water solubility (mg L^{-1})	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
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APPENDIX 3: CLEA SPREADSHEET MODEL RUNS FOR METAL POLLUTANTS FOR RESIDENTIAL WITH HOMEGROWN PRODUCE EXPOSURE LAND USE AND SOIL ORGANIC MATTER

See separately supplied Excel Spreadsheet Models

Input parameters modified to reflect Larnaca, Cyprus conditions where information permits.

Report generated	27-Feb-20
Report title	S4LL - Larnaca Refinery and Oil/Gas Storage Area
Created by	AGG / RCO / CPN at LQM

RESULTS

Environment Agency

		Assessment Criterion (mg kg-1)			Ratio of ADE to HCV			Saturation Limit (mg kg-1)	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1	Arsenic -S4LL	3.92E+01	5.10E+01	NR	1.00	0.77	NR	NR	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Lead (C4SL child) - S4LL	1.97E+02	NR	NR	1.00	NR	NR	NR	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Mercury (elemental) - S4LL	NR	4.68E-01	NR	NR	1.00	NR	2.48E+01 (vap)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Mercury (inorganic) - S4LL	4.40E+01	1.53E+03	4.27E+01	0.97	0.03	1.00	NR	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Mercury (methyl) - S4LL	1.40E+01	5.96E+01	1.14E+01	0.81	0.19	1.00	5.80E+02 (sol)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Nickel - S4LL	1.34E+02	7.66E+01	NR	0.40	1.00	NR	NR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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Environment Agency

	Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
	oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
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Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1	Arsenic -S4LL	99.9	0.1	0.0	100.0	3.92E+01	NR	1.96E+01	1.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-02	1.57E-02	9.01E-03	1.29E-02	7.84E-03	4.31E-02
2	Lead (C4SL child) - S4LL	100.0	0.0	0.0	100.0	1.97E+02	NR	9.86E+01	7.55E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.27E-01	7.93E-01	1.44E+00	1.48E-01	4.04E-02	4.52E-02
3	Mercury (elemental) - S4LL	99.9	0.1	0.0	100.0	4.68E-01	3.14E-01	2.34E-01	1.79E-08	0.00E+00	9.02E-05	3.18E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4	Mercury (inorganic) - S4LL	99.9	0.1	0.0	100.0	4.27E+01	NR	2.14E+01	1.63E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-01	2.95E-01	1.84E-01	4.27E-02	4.70E-02	0.00E+00
5	Mercury (methyl) - S4LL	95.3	4.7	0.0	100.0	1.14E+01	3.72E-02	5.68E+00	4.34E-07	0.00E+00	4.50E-05	3.15E-04	0.00E+00	4.31E-02	7.83E-02	4.88E-02	1.14E-02	1.25E-02	0.00E+00
6	Nickel - S4LL	99.9	0.1	0.0	100.0	7.66E+01	NR	3.83E+01	2.93E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E-01	3.29E-01	1.46E-01	1.91E-01	1.91E-01	2.60E-01
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Environment Agency

	Soil Distribution				Media Concentrations													
	Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
	%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
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Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1	Arsenic -S4LL	2.70E-04	2.63E-05	3.76E-06	1.54E-06	0.00E+00	0.00E+00	0.00E+00	89.98	8.77	1.25	0.00	0.00	0.00	0.00	0.00
2	Lead (C4SL child) - S4LL	8.15E-04	5.80E-04	0.00E+00	4.95E-06	0.00E+00	0.00E+00	0.00E+00	58.24	41.41	0.00	0.35	0.00	0.00	0.00	0.00
3	Mercury (elemental) - S4LL	3.22E-06	4.05E-08	0.00E+00	1.83E-08	5.53E-05	0.00E+00	1.45E-06	5.37	0.07	0.00	0.03	90.66	1.45	0.00	2.42
4	Mercury (inorganic) - S4LL	2.94E-04	1.29E-04	0.00E+00	1.67E-06	0.00E+00	1.34E-04	0.00E+00	52.61	23.13	0.00	0.30	0.00	0.00	23.96	0.00
5	Mercury (methyl) - S4LL	7.82E-05	3.44E-05	3.63E-06	4.45E-07	3.58E-05	4.64E-05	0.00E+00	39.33	17.29	1.82	0.22	13.64	4.35	23.34	0.00
6	Nickel - S4LL	5.28E-04	2.70E-04	1.22E-06	3.00E-06	0.00E+00	6.86E-03	1.45E-05	0.00	0.00	0.00	50.00	0.00	0.00	0.00	50.00
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Environment Agency

	Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
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Environment Agency

		Oral Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Inhalation Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1	Arsenic -S4LL	ID	0.3	ID	0.002	NR	NR	NR	NR	NR	NR	NR	0.03	0.5	1	1	1
2	Lead (C4SL child) - S4LL	ID	1.4	NR	0	NR	NR	NR	NR	NR	NR	NR	0	0.5	1	0.6	0.64
3	Mercury (elemental) - S4LL	NR	0	TDI	0.06	0	0.026	3.35E-01	7.25E-06	2.86E-09	3.855	0.62	0	0.5	1	1	1
4	Mercury (inorganic) - S4LL	TDI	0.57	TDI	0.06	2.6	0	NR	NR	NR	NR	NR	0	0.5	1	1	1
5	Mercury (methyl) - S4LL	TDI	0.19	TDI	0.19	0.9	0	1.90E-05	8.61E-06	8.61E-10	1.9	1.7	0.1	0.5	1	1	1
6	Nickel - S4LL	TDI	2.8	TDI	0.006	133	0.26	NR	NR	NR	NR	NR	0.005	0.5	1	1	1
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		Oral Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})		Inhalation Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})	Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
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Environment Agency

		Soil-to-water partition coefficient ($cm^3\ g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg\ L^{-1}$)	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
1	Arsenic -S4LL	5.00E+02	NR	1.25E+06	0.00043 fw	0.0004 fw	0.00023 fw	0.00033 fw	0.0002 fw	0.0011 fw
2	Lead (C4SL child) - S4LL	1.00E+03	NR	2.96E+05	0.00419 fw	0.00402 fw	0.00731 fw	0.00074 fw	0.00020 fw	0.00022 fw
3	Mercury (elemental) - S4LL	4.99E+02	2.03E-01	5.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4	Mercury (inorganic) - S4LL	5.00E+02	NR	7.40E+04	0.0038 fw	0.0069 fw	0.0043 fw	0.001 fw	0.0011 fw	0.00E+00
5	Mercury (methyl) - S4LL	5.53E+00	1.13E+00	1.00E+02	0.0038 fw	0.0069 fw	0.0043 fw	0.001 fw	0.0011 fw	0.00E+00
6	Nickel - S4LL	5.00E+02	NR	2.50E+06	0.0038 fw	0.0043 fw	0.0019 fw	0.0025 fw	0.0025 fw	0.0034 fw
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Environment Agency

	Soil-to-water partition coefficient (cm^3 g^{-1})	Vapour pressure (Pa)	Water solubility (mg L^{-1})	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
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APPENDIX 4: DERIVATION OF THE SUITABLE FOR LARNACA LEVELS – A USER GUIDE

APPENDIX 4: DERIVATION OF THE SUITABLE FOR LARNACA LEVELS – A USER GUIDE

(1) S4LLs have been derived for the residential with consumption of home grown produce land use scenario, thereby defining the critical receptor and relevant exposure pathways. Exposure via each pathway is represented by an algorithm. The various input parameters used within these algorithms were selected, as far as possible, to reflect the environmental setting and policy context of Cyprus, information about the critical receptor and data describing the physical-chemical and toxicological behaviour of the contaminants. These algorithms are coded within the CLEA v1.071 spreadsheet model (CLEA), amended by LQM to reflect conditions in Larnaca, Cyprus.

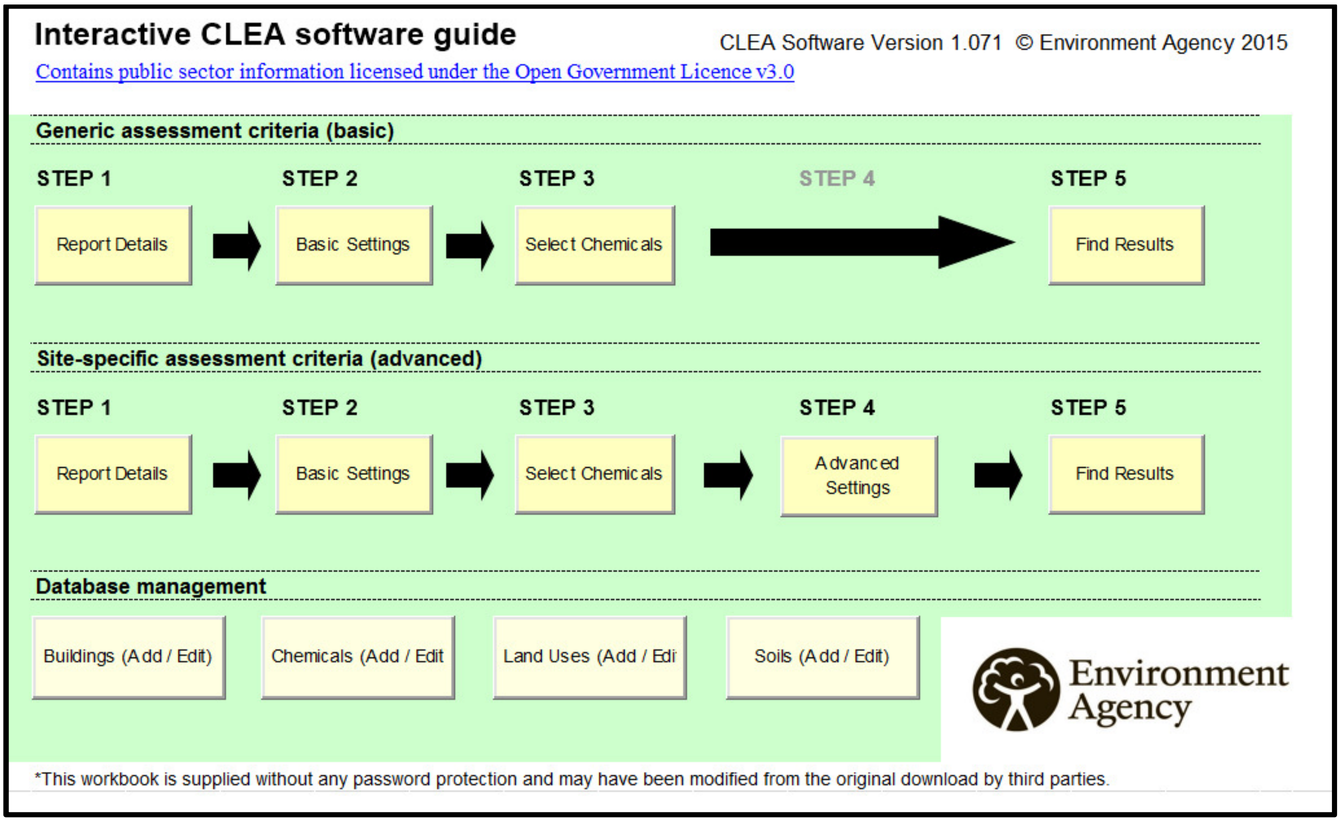
(2) For a detailed understanding of the algorithms and assumptions underpinning the CLEA model, refer to Science Report SR3 (Environment Agency, 2009a). The CLEA Software Handbook (Environment Agency, 2009b) provides detailed information on how to use the CLEA model to derive assessment criteria. This Appendix is intended to provide additional details on how to use CLEA to reproduce the S4LLs. It is recommended that the User has the spreadsheet model available when reading through this user guide.

(3) It should be noted that an additional worksheet ('*Sheet1*') has been added within the CLEA spreadsheet model by LQM to provide a more easily accessible and extractable summary of the exposure pathway contributions.

1.1 Guide

(4) The over-arching key interactive components of CLEA can be accessed via the '*Guide'* worksheet, which provides a process flow diagram (Box 1) for generating either Generic Assessment Criteria (GAC) or Site-Specific Assessment Criteria (SSAC). The '*Guide'* worksheet also provides access to the four key databases ('*User Buildings*', '*User Chemicals*', '*User Land Uses*' and '*User Soils*').

(5) To return to the Guide from other worksheets, select '*Back to Guide*' if available.



Box 1: CLEA model process flow diagram indicating the key steps in deriving Generic Assessment Criteria (GAC) or Site Specific Assessment Criteria (SSAC) [source: UK Environment Agency]

1.2 Defining and modifying the databases

1.2.1 Defining and modifying User-defined Chemicals

(6) The physical-chemical and toxicological inputs for the S4LL substances are contained in the '*Chemicals*' database (*i.e.* the '*User Chemicals*' worksheet) within the CLEA spreadsheet provided. Any future changes to these inputs should be made within the '*User Chemicals*' worksheet.

(7) The CLEA spreadsheet provided also contains inputs for the default UK substances. These are contained in the '*Chemical Data*' worksheet. These inputs are not appropriate for use in Cyprus and should not be used.

1.2.2 Defining and modifying User-defined Buildings

(8) In the absence of relevant information no Cyprus-specific buildings have been defined within the CLEA spreadsheet provided and the S4LLs have been derived using the default UK buildings database.

(9) If relevant information becomes available, Cyprus-specific building types could be defined in the future within the '*User Buildings*' worksheet.

1.2.3 Defining and modifying User-defined Land Uses

(10) The Cyprus-specific land uses have been defined for each exposure scenario within the '*User Land Uses*' worksheet of the CLEA spreadsheet provided. These land uses are: '*Residential with produce (C4SL)-Cyprus*', '*Residential (lifetime exposure (C4SL)-Cyprus*', '*Public Open Space (park C4SL)-Cyprus*', '*Public Open Space (park lifetime C4SL)-Cyprus*', or '*Commercial (C4SL)-Cyprus*'. The basis for these land uses is described elsewhere within this report. The S4LL are based on the '*Residential with produce (C4SL)-Cyprus*' land use.

1.2.4 Defining and modifying User Soils

(11) Currently, in the absence of alternative information no Cyprus-specific soils have been defined within the CLEA spreadsheet provided and the S4LLs have been derived using the default UK soils database.

(12) If relevant information becomes available, Cyprus-specific soil types could be defined within the '*User Soils*' worksheet.

1.2.5 Defining and modifying Produce Data

(13) The '*Produce Data*' worksheet contains the current default UK produce groups and values for consumption rates, homegrown fractions (proportion of produce consumed grown at home), soil loading and preparation factors (Defra, 2014; Environment Agency, 2009a).

(14) CLEA does not contain the functionality for the User to define country- or region-specific produce types (*e.g.* fruit and vegetables) and relevant inputs. Therefore, in order to modify the default UK data to represent Cypriot food groups the current data would either have to be overwritten or augmented. Although this is possible it would involve fundamental changes and careful recoding of the model. Consequently, the S4LLs have been derived using the default UK data.

1.2.6 Defining and modifying Receptor Data

(15) Where Cyprus-specific receptor data has not been provided to LQM, the default UK receptor data, as described in SR3 (Environment Agency, 2009a) and SP1010 project reports (Defra, 2014), have been used.

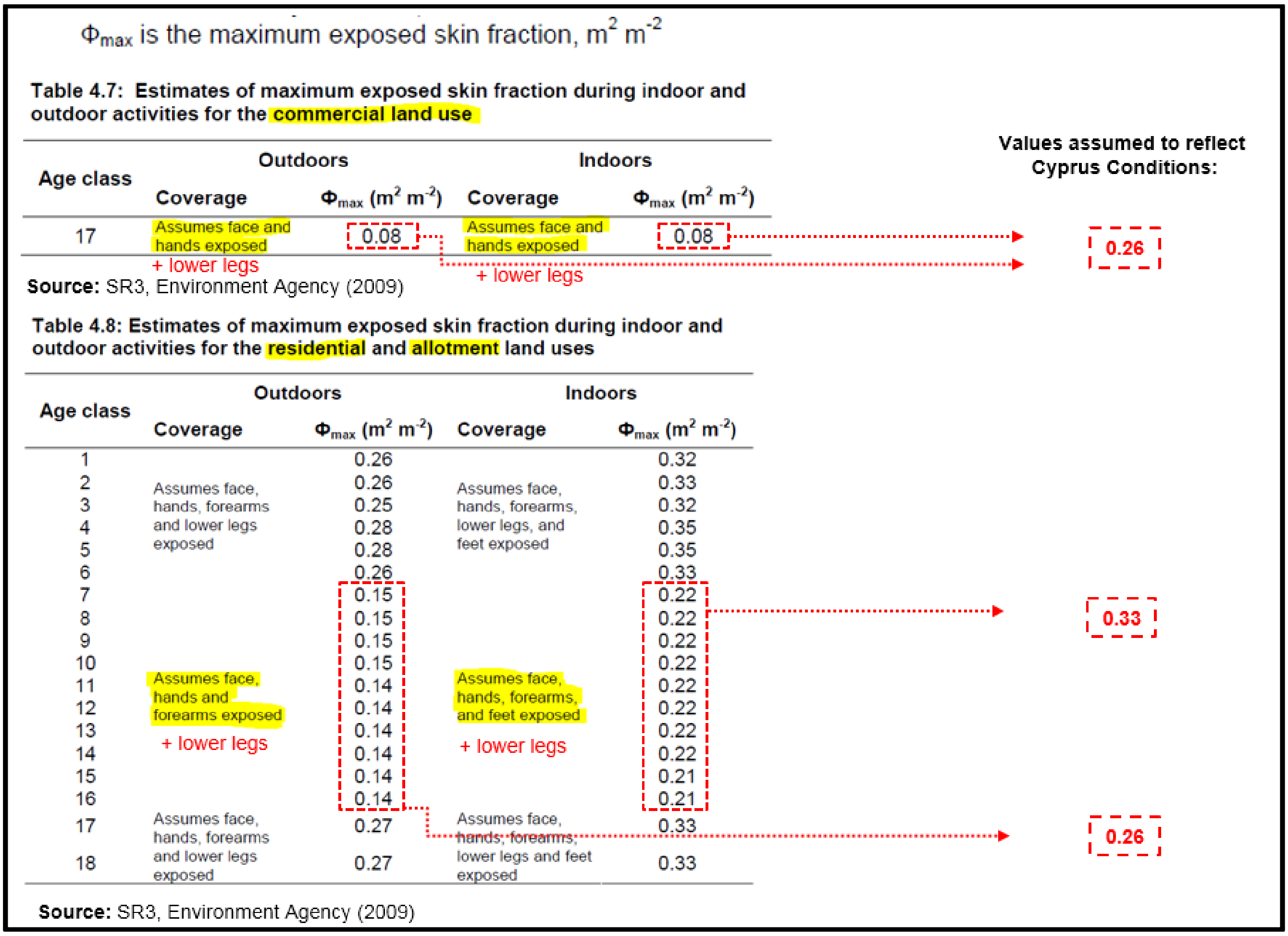
(16) Cyprus body weight data have been provided by the Cyprus Department of Environment. The critical receptor for the S4LLs is the female adult and child. So only the mean body weight data for females has been added to the '*Receptor Data*' worksheet of the CLEA spreadsheet provided. This data is contained as three additional Cyprus-specific receptors within the '*Receptor Data'* worksheet: *Female (res C4SL)-Cyprus*; *Female (allot)-Cyprus*; and *Female (com C4SL)-Cyprus*. The input data is summarised within Box 2, which indicates that the mean body weight 0-6 year old Cyprus female is

approximately 7% heavier compared to that assumed in the UK, whilst the working age adult is approximately 6% lighter.

Female Body Weight (kg) - Cyprus											
Age Class		n	Mean	St Dev	Median	Min	Max	CLEA (SR3 UK defaults)	Cyprus - UK	% Difference	
AC1	0	137	**6.8**	1.7	7	3	10.3	**5.6**	**1.2**	**18%**	**7%**
AC2	1	85	**10.8**	1.4	10.5	7.2	15	**9.8**	**1**	**9%**	
AC3	2	57	**13**	1.5	13	10	19	**12.7**	**0.3**	**2%**	
AC4	3	13	**14**	1.4	14	12	16.5	**15.1**	**-1.1**	**-8%**	
AC5	4	12	**19.4**	4.6	17.8	14.3	29	**16.9**	**2.5**	**13%**	
AC6	5	18	**20.7**	2.9	20.5	15	27	**19.7**	**1**	**5%**	
AC7	6	29	**22.9**	4.3	22.1	15.5	32	**22.1**	**0.8**	**3%**	
AC8	7	23	**27.6**	7	25.4	18.3	39.5	**25.3**	**2.3**	**8%**	
AC9	8	25	**30.8**	9.9	30	19.8	72.8	**27.5**	**3.3**	**11%**	
AC10	9	30	**37.1**	9.4	33.5	24.6	58.2	**31.4**	**5.7**	**15%**	
AC11	10	20	**43.4**	9.8	42.2	30.5	66.9	**35.7**	**7.7**	**18%**	
AC12	11	14	**43.7**	12.2	41.8	26.4	64.8	**41.3**	**2.4**	**5%**	
AC13	12	17	**47.3**	8.7	49.4	34	62	**47.2**	**0.1**	**0%**	
AC14	13	11	**54.5**	10.2	54	40.8	79.1	**51.2**	**3.3**	**6%**	
AC15	14	36	**54.2**	8.6	54	32.9	72.4	**56.7**	**-2.5**	**-5%**	
AC16	15	19	**54.6**	6.8	54.6	46.2	70.3	**59**	**-4.4**	**-8%**	
AC17	16-64	162	**65.8**	14.8	62.7	39.6	138	**70**	**-4.2**	**-6%**	
AC18	65-75	132	**72**	11.9	71.5	46.7	102	**70.9**	**1.1**	**2%**	

Box 2: Body weight data for the female critical receptor summarised by CLEA model age-classes and comparison to default UK values [source: Department of Environment, Republic of Cyprus]

(17) Following discussion with the Cyprus Department of Environment it was agreed that the critical receptor within each land use exposure scenario should be assumed to wear short-sleeved top and shorts for the whole year (*i.e.* an increased exposed skin areas compared to UK defaults). The necessary changes to the maximum exposed skin fractions during indoor and outdoor activities for each land use exposures are shown in Box 3 and are included in the additional Cyprus-specific receptor types added to the '*Receptor Data*' worksheet.



Φ_{max} is the maximum exposed skin fraction, $m^2\ m^{-2}$

Table 4.7: Estimates of maximum exposed skin fraction during indoor and outdoor activities for the commercial land use

Age class	Outdoors Coverage	Outdoors Φ_{max} ($m^2\ m^{-2}$)	Indoors Coverage	Indoors Φ_{max} ($m^2\ m^{-2}$)
17	Assumes face and hands exposed + lower legs	0.08	Assumes face and hands exposed + lower legs	0.08

Source: SR3, Environment Agency (2009)

Table 4.8: Estimates of maximum exposed skin fraction during indoor and outdoor activities for the residential and allotment land uses

Age class	Outdoors Coverage	Outdoors Φ_{max} ($m^2\ m^{-2}$)	Indoors Coverage	Indoors Φ_{max} ($m^2\ m^{-2}$)
1	Assumes face, hands, forearms and lower legs exposed	0.26	Assumes face, hands, forearms, lower legs, and feet exposed	0.32
2		0.26		0.33
3		0.25		0.32
4		0.28		0.35
5		0.28		0.35
6		0.26		0.33
7	Assumes face, hands and forearms exposed + lower legs	0.15	Assumes face, hands, forearms, and feet exposed + lower legs	0.22
8		0.15		0.22
9		0.15		0.22
10		0.15		0.22
11		0.14		0.22
12		0.14		0.22
13		0.14		0.22
14		0.14		0.22
15		0.14		0.21
16		0.14		0.21
17	Assumes face, hands, forearms and lower legs exposed	0.27	Assumes face, hands, forearms, lower legs and feet exposed	0.33
18		0.27		0.33

Source: SR3, Environment Agency (2009)

Box 3: Modifications to the default maximum exposed skin areas agreed with the Department of Environment (Republic of Cyprus) to reflect Cyprus conditions within the CLEA v1.071 model

(18) If additional or updated Cyprus-specific receptor characteristics become available (e.g. inhalation rates or body heights), the values within the relevant Cyprus-specific receptor(s) in the '*Receptor Data'* worksheet can be updated.

1.3 Report Details (Step 1)

(19) The '*Report Details*' worksheet allows the User to record basic details about the User and the assessment being undertaken. Providing these details is optional.

1.4 Basic Settings (Step 2)

(20) The '*Basic Settings*' worksheet provides the key input screen for the User to define the land use, receptor (male/female), building type and soil type by selecting relevant entries from the databases using dropdown lists, and specifying the relevant age classes (Start AC and End AC) and soil properties (pH, SOM%). The User should also select which exposure pathways are to be included in the assessment. Once all modifications are made, the User must press '*Apply Settings to Model*' before proceeding.

(21) By default, "*Ratio Mode*" will be off (*i.e.* unchecked). Ratio Mode should only be turned on if the User understands this function and when an Assessment Criteria is not required.

1.5 Select Chemicals (Step 3)

(22) Within the '*Select Chemicals*' worksheet, the User selects the substances to model from the Chemicals database using the dropdown lists provided. Up to 30 substances can be selected. The dropdown lists include the UK default substances plus the S4LL substances. The User must ensure that S4LL substances (i.e. Metals, Petroleum Hydrocarbons, BTEX and PAHs with the relevant physical-chemical parameters modified to reflect Cyprus conditions) are used. These are at the bottom of the dropdown list and include the suffix " *-S4LL*".

(23) Once all of the pollutants of interest have been selected, the User must press '*Apply Chemicals to Model*' before proceeding.

1.6 Advanced Settings (Step 4)

(24) In deriving SSAC, the User has access to the '*Advanced Settings*' feature that allows input parameters to be modified temporarily without permanently modifying the data in the underlying databases. More details are provided in the CLEA Software Handbook (Environment Agency, 2009b).

1.7 Generating Results (Step 5)

(25) Once all of the relevant inputs have been defined and/or modified, the assessment criteria (*i.e.* GAC or SSAC) can be generated within the '*Results*' worksheet by selecting '*Find AC*'. The CLEA model will then calculate the assessment criteria, along with pathway contribution data.

(26) Two separate reports can be printed:

a) '*Results*' report: a record of the assessment criteria results for each substance including substances media concentrations, pathway contributions and chemical-specific inputs; and

b) 'Settings' report: a record of the all other modelling assumptions and input parameters.

(27) These reports can be printed to hard-copy or to a Portable Document Format (PDF) file to create a permanent record of assessment and modelling outcome.

1.8 References

Defra. (**2014**). SP1010 - Development of Category 4 Screening Levels for assessment of land affected by contamination. Final Project Report (Revision 2). Accessed from http://randd.defra.gov.uk/Default.aspx?MenuMenu&ModuleMore&LocationNone&Completed0&ProjectID18341

Environment Agency. (**2009a**). Updated Technical Background to the CLEA Model. Environment Agency: Bristol, UK. Accessed from http://www.environment-agency.gov.uk/static/documents/Research/CLEA_Report_-_final.pdf

Environment Agency. (**2009b**). CLEA software (Version 1.05) Handbook. Environment Agency: Bristol, UK.

APPENDIX 5: ΠΑΡΑΡΤΗΜΑ 5: ΠΑΡΑΓΩΓΗ ΤΟΝ SUITABLE FOR LARNACA LEVELS - ΟΔΗΓΟΣ ΧΡΗΣΗΣ

ΠΑΡΑΡΤΗΜΑ 5: ΠΑΡΑΓΩΓΗ ΤΟΝ SUITABLE FOR LARNACA LEVELS - ΟΔΗΓΟΣ ΧΡΗΣΗΣ

(1) Έχουν ληφθεί S4LL για '*Residential with produce (C4SL)-Cyprus*' χρήσης γης που καθορίζει έναν κρίσιμο αποδέκτη και τα σχετικά διάνυσμα έκθεσης. Η έκθεση μέσω τις σχετικές οδούς έκθεσης αντιπροσωπεύεται από έναν αλγόριθμο. Κάθε αλγόριθμος παραμετροποιείται χρησιμοποιώντας πληροφορίες που αντανακλούν, όσον διαθέσιμες, το περιβάλλον και το πολιτικό πλαίσιο της Κύπρου, πληροφορίες σχετικά με τον κρίσιμο αποδέκτη και δεδομένα που περιγράφουν τη φυσικοχημική και τοξικολογική συμπεριφορά των ρύπων. Αυτοί οι αλγόριθμοι κωδικοποιούνται στο υπολογιστικό φύλλο CLEA v1.071, τροποποιημένο από το LQM για να αντικατοπτρίζει τις συνθήκες στη Λάρνακα, Κύπρου.

(2) Για λεπτομερή κατανόηση των αλγορίθμων και παραδοχών που υποστηρίζουν το CLEA v1.071, θα πρέπει να συμβουλεύεται το Science Report SR3 (Environment Agency, 2009a). Το εγχειρίδιο λογισμικού CLEA (Environment Agency, 2009b) παρέχει λεπτομερείς πληροφορίες σχετικά με τον τρόπο χρήσης του λογισμικού CLEA για τη λήψη γενικών κριτηρίων αξιολόγησης και ειδικών για κάθε τοποθεσία και αναλογιών ADE / HCV (Μέσος λόγος τιμής ημερήσιας έκθεσης / κριτηρίων υγιεινής).

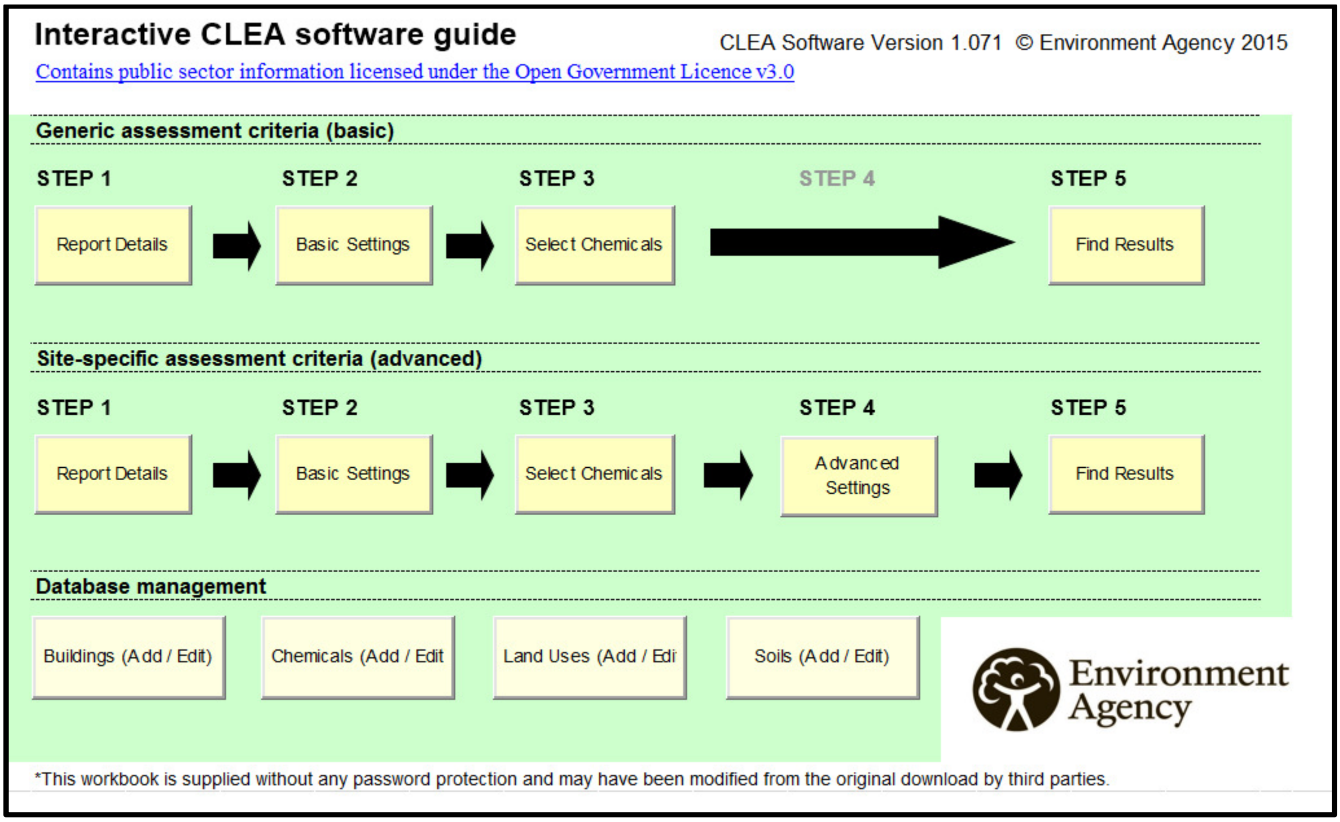
(3) Για τους σκοπούς της εξαγωγής των S4LL παρέχονται οι ακόλουθες ενότητες ως πρόσθετος οδηγός για τους μελλοντικούς τελικούς χρήστες σχετικά με τον τρόπο αναπαραγωγής τους, προσδιορίζοντας τα φύλλα εργασίας μοντέλων υπολογιστικών φύλλων με τα οποία αλληλεπιδρούν. Συνιστάται ο χρήστης να έχει στη διάθεσή του το μοντέλο υπολογιστικού φύλλου όταν διαβάζει μέσω αυτού του οδηγού χρήστη.

(4) Πρόσθετο φύλλο («Φύλλο1») προστέθηκε από το LQM για να παρέχει μια πιο εύκολα προσβάσιμη και εξαγώγιμη περίληψη των συνεισφορών της οδού έκθεσης.

1.1 Οδηγός

(5) Τα βασικά αλληλεπιδραστικά στοιχεία του CLEA μπορούν να προσεγγιστούν μέσω του φύλλου εργασίας «Guide», το οποίο παρέχει ένα διάγραμμα ροής διαδικασίας (Box 1) για τη χρήση του μοντέλου για τη δημιουργία γενικών κριτηρίων αξιολόγησης (GAC) (SSAC) με πρόσβαση σε πιο προηγμένες ρυθμίσεις ('Advanced Settings') για προσωρινή τροποποίηση των παραμέτρων εισόδου για μια μεμονωμένη εκτέλεση μοντέλου (δηλ. Οι υποκείμενες καθορισμένες ή σταθερές βάσεις δεδομένων δεν θα τροποποιηθούν μόνιμα).

(6) Το παρόν φύλλο εργασίας παρέχει επίσης πρόσβαση στις τέσσερις βασικές βάσεις δεδομένων που μπορούν να καθοριστούν από το χρήστη (*'User Buildings', 'User Chemicals', 'User Land Uses' & 'User Soils'*).



Box 1: CLEA model process flow diagram indicating the key steps in deriving Generic Assessment Criteria (GAC) or Site Specific Assessment Criteria (SSAC) [source: UK Environment Agency]

1.2 Βασικές ρυθμίσεις

(7) Το φύλλο εργασίας '*Basic Settings*' καθορίζει τη χρήση της γης, τον αποδέκτη (αρσενικό / θηλυκό), τις κατηγορίες ηλικίας, τον τύπο κτιρίου, τον τύπο και τις ιδιότητες του εδάφους (pH, SOM%) και τις οδους έκθεσης να συμπεριληφθούν στην αξιολόγηση.

(8) Μόλις ολοκληρωθούν όλες οι τροποποιήσεις, ο χρήστης πρέπει να '*Apply Settings to Model*' πριν δημιουργήσει τα κριτήρια αξιολόγησης. Εάν δημιουργείτε κριτήρια αξιολόγησης, θα πρέπει να βεβαιωθείτε ότι δεν εκτελείται το μοντέλο στο '*Ratio Mode*' ("Λειτουργία αναλογίας"). Από προεπιλογή, το μοντέλο δεν εκτελείται σε αυτήν τη λειτουργία.

1.2.1 Επιλέξτε Χημικά

(9) Ο χρήστης επιλέγει τις ουσίες για τις οποίες θα δημιουργηθούν επίπεδα διαλογής στο φύλλο εργασίας «Select Chemicals», με μέγιστο αριθμό 30 ξεχωριστών ρύπων που επιλέγονται από τις αναφερόμενες λίστες. Ο κατάλογος περιλαμβάνει τους προκαθορισμένους ρύπους (δηλ. Μέταλλα, πετρελαϊκά υδρογονάνθρακες, BTEX και PAH) συν οποιεσδήποτε πρόσθετες ουσίες που προστίθενται από τον χρήστη, με τις σχετικές φυσικοχημικές παραμέτρους τροποποιημένες ώστε να αντανακλούν τις συνθήκες της Κύπρου).

(10) Μόλις επιλεχθούν όλοι οι ρύποι που ενδιαφέρουν, τότε '*Apply Chemicals to Model*'.

1.2.2 Καθορισμός και Τροποποίηση των Χημικών Ουσιών που Έχουν Προστεθεί

(11) Οι εισροές φυσικών-χημικών και τοξικολογικών παραμέτρων για συγκεκριμένες ουσίες που έχουν τροποποιηθεί από την κυπριακή νομοθεσία περιλαμβάνονται στο φύλλο εργασίας 'User Chemicals' του CLEA. Οποιεσδήποτε μελλοντικές τροποποιήσεις στις παραμέτρους εισόδου θα πρέπει να γίνονται στο φύλλο εργασίας 'User Chemicals'.

(12) Υπάρχει ένας αριθμός προεπιλεγμένων ουσιών για την παραγωγή των σημερινών και των ιστορικών επιπέδων διαλογής στην πολιτική και στο περιβάλλον του Ηνωμένου Βασιλείου, που περιλαμβάνεται επίσης στο φύλλο εργασίας 'Chemical Data' που έχουν διατηρηθεί, καθώς και ουσίες που έχουν προστεθεί από τον χρήστη 'User Chemicals'.

1.2.3 Καθορισμός και τροποποίηση κτιρίων

(13) Κυπριακοί συγκεκριμένοι τύποι κτιρίων μπορούν να οριστούν από τον χρήστη στο φύλλο εργασίας 'User Buildings' του CLEA. Ελλείψει περαιτέρω πληροφοριών, δεν έχουν οριστεί συγκεκριμένα Κυπριακά κτίρια και η παραγωγή των S4LL βασίζεται στην προεπιλεγμένη βάση δεδομένων των κτιρίων του Ηνωμένου Βασιλείου.

1.2.4 Καθορισμός και τροποποίηση χρήσεων γης

(14) Η Κυπριακή βάση δεδομένων χρήσεων γης που ορίζεται για κάθε σενάριο έκθεσης παρέχεται μέσα στο φύλλο εργασίας "User Land Uses" του CLEA, το οποίο περιλαμβάνει αλλαγές από προεπιλογές όπως περιγράφονται στην παρούσα έκθεση. Οι σχετικές χρήσεις γης περιλαμβάνονται ως: 'Residential with produce (C4SL)-Cyprus', 'Residential (lifetime exposure (C4SL)-Cyprus', 'Public Open Space (park C4SL)-Cyprus', 'Public Open Space (park lifetime C4SL)-Cyprus', or 'Commercial (C4SL)-Cyprus'. Τα S4LL εχουν υπολογιστει για την 'Residential with produce (C4SL)-Cyprus' χρηση γης.

1.2.5 Καθορισμός και τροποποίηση των εδαφών του χρήστη

(15) Κυπριακοί τύποι εδάφους μπορούν να οριστούν στο φύλλο εργασίας «User Soils» του CLEA. Επί του παρόντος, εξαιτίας ελλείψει εναλλακτικών πληροφοριών, δεν έχουν καθοριστεί Κυπριακά εδάφη και η παραγωγή των S4LL βασίζεται στην προεπιλεγμένη βάση δεδομένων για τα εδάφη του Ηνωμένου Βασιλείου.

1.2.6 Καθορισμός και τροποποίηση δεδομένων τρόφιμα παραγωγής

(16) Δεν υπάρχει φύλλο εργασίας για τον χρήστη να καθορίζει για τη δική του χώρα ειδική λίστα των τύπων προϊόντων και των σχετικών εισροών. Το φύλλο εργασίας 'Produce Data' ("Προετοιμασία δεδομένων") περιέχει τις προεπιλεγμένες ομάδες παραγωγής του Ηνωμένου Βασιλείου και τις τιμές για τα ποσοστά κατανάλωσης, τα εγχώρια κλάσματα (ποσοστό της καταναλισκόμενης παραγωγής που καλλιεργείται στο σπίτι), τη φόρτωση από το έδαφος και τους παράγοντες προετοιμασίας (Defra, 2014; Environment Agency, 2009a).

(17) Συνεπώς, προκειμένου να προστεθούν Κυπριακές ομάδες τροφίμων, οι τρέχουσες προεπιλογές θα πρέπει είτε να αντικατασταθούν ή να προστεθούν στο φύλλο εργασίας 'Produce Data'. Ωστόσο, θα απαιτηθεί προσεκτική εξέταση της σχέσης με άλλες ειδικές χημικές παραμέτρους (π.χ. συντελεστές συγκέντρωσης εδάφους-φυτού) και συμβάσεις ονομασίας σε άλλα φύλλα εργασίας, προκειμένου να διασφαλιστεί η εσωτερική συνέχεια στο μοντέλο.

1.2.7 Καθορισμός και τροποποίηση δεδομένων υποδοχέων

(18) Σχετικά δεδομένα της Κύπρου για το συγκεκριμένο σωματικό βάρος της κατηγορίας ηλικίας έχουν παρασχεθεί από το Υπουργείο Περιβάλλοντος της Κύπρου. Για κάθε σενάριο χρήσης γης έχουν εισαχθεί τα δεδομένα για τα θηλυκά ως τρεις επιπλέον υποδοχείς στο φύλλο εργασίας 'Receptor Data' του CLEA: Female (res C4SL)-Cyprus; Female (allot)-Cyprus; και Female (com C4SL)-Cyprus. Τα δεδομένα εισαγωγής συνοψίζονται στο Πλαίσιο 2, το οποίο δείχνει ότι το μέσο βάρος σώματος ηλικίας 0-6 ετών της Κύπρου είναι κατά 7% βαρύτερο σε σύγκριση με το υποκείμενο στο Ηνωμένο Βασίλειο, ενώ η ενήλικη σε ηλικία εργασίας είναι κατά 6% ελαφρύτερη.

(19) (41) Σε περιπτώσεις όπου δεν έχουν παρασχεθεί στην LQM δεδομένα κυπριακών υποδοχέων, έχει ληφθεί υπόψη η προεπιλεγμένη βάση δεδομένων του Ηνωμένου Βασιλείου για τις συγκεκριμένες παραμέτρους του αποδέκτη, οι οποίες περιγράφονται στο SR3 (Environment Agency, 2009a), μαζί με τροποποιήσεις σε ορισμένες από τις εισαγωγες , Πρόγραμμα Defra SP1010 (Defra, 2014).

	Female Body Weight (kg) - Cyprus										
Age Class		n	Mean	St Dev	Median	Min	Max	CLEA (SR3 UK defaults)	Cyprus - UK	% Difference	
AC1	0	137	**6.8**	1.7	7	3	10.3	5.6	1.2	18%	
AC2	1	85	**10.8**	1.4	10.5	7.2	15	9.8	1	9%	
AC3	2	57	**13**	1.5	13	10	19	12.7	0.3	2%	7%
AC4	3	13	**14**	1.4	14	12	16.5	15.1	-1.1	-8%	
AC5	4	12	**19.4**	4.6	17.8	14.3	29	16.9	2.5	13%	
AC6	5	18	**20.7**	2.9	20.5	15	27	19.7	1	5%	
AC7	6	29	**22.9**	4.3	22.1	15.5	32	22.1	0.8	3%	
AC8	7	23	**27.6**	7	25.4	18.3	39.5	25.3	2.3	8%	
AC9	8	25	**30.8**	9.9	30	19.8	72.8	27.5	3.3	11%	
AC10	9	30	**37.1**	9.4	33.5	24.6	58.2	31.4	5.7	15%	
AC11	10	20	**43.4**	9.8	42.2	30.5	66.9	35.7	7.7	18%	
AC12	11	14	**43.7**	12.2	41.8	26.4	64.8	41.3	2.4	5%	
AC13	12	17	**47.3**	8.7	49.4	34	62	47.2	0.1	0%	
AC14	13	11	**54.5**	10.2	54	40.8	79.1	51.2	3.3	6%	
AC15	14	36	**54.2**	8.6	54	32.9	72.4	56.7	-2.5	-5%	
AC16	15	19	**54.6**	6.8	54.6	46.2	70.3	59	-4.4	-8%	
AC17	16-64	162	**65.8**	14.8	62.7	39.6	138	70	-4.2	-6%	
AC18	65-75	132	**72**	11.9	71.5	46.7	102	70.9	1.1	2%	

Box 2: Body weight data for the female critical receptor summarised by CLEA model age-classes and comparison to default UK values [source: Department of Environment, Republic of Cyprus]

(20) Μετά από συζήτηση με το Τμήμα Περιβάλλοντος, συμφωνήθηκε ότι ο κρίσιμος αποδέκτης σε κάθε χρήση γης θα θεωρείται ότι φορούν κοντό μανίκι και σορτς για όλο το έτος - δηλ. αυξάνουν τις εκτεθειμένες περιοχές του δέρματος. Οι απαραίτητες τροποποιήσεις στις προκαθορισμένες παραδοχές του Ηνωμένου Βασιλείου σχετικά με τα μέγιστα εκτεθειμένα κλάσματα του δέρματος κατά τη διάρκεια εσωτερικών και εξωτερικών δραστηριοτήτων για κάθε μία από τις σχετικές χρήσεις γης είναι όπως υποδεικνύεται στο πλαίσιο 3. Αυτές οι τροποποιημένες εισροές προστέθηκαν επίσης στο φύλλο εργασίας ‘Receptor Data’ στο μοντέλο υπολογιστικών φύλλων CLEA v1.071, στο πλαίσιο των καθορισμένων Κυπριακών υποδοχέων.

Φ_{max} is the maximum exposed skin fraction, $m^2\ m^{-2}$

Table 4.7: Estimates of maximum exposed skin fraction during indoor and outdoor activities for the commercial land use

Age class	Outdoors Coverage	Outdoors Φ_{max} ($m^2\ m^{-2}$)	Indoors Coverage	Indoors Φ_{max} ($m^2\ m^{-2}$)	Values assumed to reflect Cyprus Conditions:
17	Assumes face and hands exposed + lower legs	0.08	Assumes face and hands exposed + lower legs	0.08	0.26

Source: SR3, Environment Agency (2009)

Table 4.8: Estimates of maximum exposed skin fraction during indoor and outdoor activities for the residential and allotment land uses

Age class	Outdoors Coverage	Outdoors Φ_{max} ($m^2\ m^{-2}$)	Indoors Coverage	Indoors Φ_{max} ($m^2\ m^{-2}$)	Values assumed to reflect Cyprus Conditions
1	Assumes face, hands, forearms and lower legs exposed	0.26	Assumes face, hands, forearms, lower legs, and feet exposed	0.32	
2		0.26		0.33	
3		0.25		0.32	
4		0.28		0.35	
5		0.28		0.35	
6		0.26		0.33	
7	Assumes face, hands and forearms exposed + lower legs	0.15	Assumes face, hands, forearms, and feet exposed + lower legs	0.22	0.33
8		0.15		0.22	
9		0.15		0.22	
10		0.15		0.22	
11		0.14		0.22	
12		0.14		0.22	
13		0.14		0.22	
14		0.14		0.22	
15		0.14		0.21	
16		0.14		0.21	
17	Assumes face, hands, forearms and lower legs exposed	0.27	Assumes face, hands, forearms, lower legs and feet exposed	0.33	0.26
18		0.27		0.33	

Source: SR3, Environment Agency (2009)

Box 3: Modifications to the default maximum exposed skin areas agreed with the Department of Environment (Republic of Cyprus) to reflect Cyprus conditions within the CLEA v1.071 model

(21) Τα τυχόν επιπλέον χαρακτηριστικά γνωρίσματα του Κυπριακού αποδέκτη που μπορεί να είναι διαθέσιμα (π.χ. ποσοστά εισπνοής και ύψη σώματος) ή τροποποίηση υφιστάμενων υποθέσεων της Κύπρου μπορούν να καταχωρηθούν στους σχετικούς Κυπριακούς υποδοχείς που ορίζονται στο φύλλο εργασίας 'Receptor Data' του CLEA.

1.3 Δημιουργία αποτελεσμάτων

(22) Μόλις καθοριστούν και / ή τροποποιηθούν όλες οι σχετικές εισροές, μπορείτε να δημιουργήσετε τα κριτήρια αξιολόγησης (GAC ή SSAC) στο φύλλο εργασίας 'Results' του CLEA, επιλέγοντας 'Find AC'. Στη συνέχεια, το μοντέλο θα παράγει τα αποτελέσματα και θα συμπληρώσει το φύλλο εργασίας με τα κριτήρια αξιολόγησης (από το στόμα + δερματικό και από εισπνοή) καθώς και πρόσθετες χρήσιμες πληροφορίες σχετικά με τη συμβολή της οδού στη συνολική έκθεση για τα συνδυασμένα κριτήρια αξιολόγησης.

(23) Μπορούν να δημιουργηθούν δύο ξεχωριστά αρχεία της μοντελοποίησης:

α) καταγραφή των αποτελεσμάτων των κριτηρίων αξιολόγησης για κάθε ουσία, συμπεριλαμβανομένων των συγκεντρώσεων ουσιών κατα μεσον, των εισροών διαδρομής και των εισροών που είναι ειδικά για χημικά · και

β) τις ρυθμίσεις μοντέλου που περιγράφουν λεπτομερώς τις υποθέσεις μοντελοποίησης και τις παραμέτρους εισόδου.

(24) Αυτές οι εκτυπώσεις μπορούν να τυπωθούν σε έντυπη μορφή ή σε αρχείο Adobe pdf για να δημιουργήσουν μια μόνιμη καταγραφή των αποτελεσμάτων αξιολόγησης και μοντελοποίησης.

1.4 Αναφορές

Defra. (**2014**). SP1010 - Development of Category 4 Screening Levels for assessment of land affected by contamination. Final Project Report (Revision 2). Accessed from http://randd.defra.gov.uk/Default.aspx?MenuMenu&ModuleMore&LocationNone&Completed0&ProjectID18341

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