



Cleaner Air Oregon: Modeling Protocol and Level 4 Risk Assessment Work Plan Toxicology Related Proposals

Nov. 5, 2021

Soil Relative Bioavailability – Change Required

- Owens-Brockway proposed to change the relative bioavailability (RBA) value for arsenic in soil from 100% to 44%. DEQ will accept an RBA of 60% for arsenic in soil.

Description

DEQ does not accept Owens-Brockway’s proposal to change the relative bioavailability (RBA) value for arsenic in soil from 100% to 44% because site specific soil RBA data is not available where emissions from Owens-Brockway are expected to deposit to soil. The EPA states that there are important factors that can affect the bioavailability of arsenic in soil that are expected to vary from site to site, or within a given site (EPA 2012c). These factors include the physical and chemical characteristics of arsenic-bearing soil particles and the chemical forms of arsenic in the soil (EPA 2012c). A 2012 EPA analysis found that soil RBAs from different sites exhibited substantial variability (EPA 2012a,c).

As Owens-Brockway noted in their proposal, a site-specific RBA of arsenic in soil has been previously calculated in Portland, Oregon. Specifically, a soil RBA of 22% for arsenic was used in OHA’s Public Health Assessment for Bullseye Glass Co. because EPA Region 10 completed RBA evaluations with soil samples collected within one to two city blocks of the facility (OHA Public Health Division 2021). However, DEQ does not have data to indicate how similar or different the arsenic soil RBA near Bullseye Glass Co. (southeast Portland) is from the arsenic soil RBA near Owens-Brockway (northeast Portland).

Following EPA guidance for when a site-specific soil RBA estimate is not available, DEQ will accept an RBA of 60% for arsenic in soil. There have been significant efforts to summarize and evaluate the RBA of arsenic in soil (US EPA 2012a,b,c). EPA states that the default assumption of an RBA of 100% for arsenic in soil will result in an overestimation of risk (EPA 2012c). Based on an evaluation of available literature, the U.S. EPA recommends a default RBA of 60% for arsenic in soil, which is the upper 95th percentile 13.9:

“BASED UPON THE ANALYSIS AND EXTERNAL INDEPENDENT PEER REVIEW, THE FOLLOWING CONCLUSIONS HAVE BEEN DETERMINED: 1) CURRENTLY AVAILABLE RESEARCH INFORMATION SUGGESTS THAT AN RBA OF ARSENIC IN SOILS CAN BE EXPECTED TO BE LESS THAN 100%; 2) BASED UPON EVALUATION OF CURRENT DATA SETS OF ARSENIC RBAS IN THE US, THE UPPER PERCENTILE OF THE DATA SET RESULTS IN A RBA VALUE OF 60%; 3) THE DEFAULT RBA FOR ARSENIC IN SOILS SHOULD ONLY BE USED IF SITE-SPECIFIC ASSESSMENTS FOR ARSENIC RBA ARE NOT FEASIBLE.” (US EPA 2012B)

The default RBA of 60% for arsenic in soil is not only used by the U.S. EPA, but also used by the U.S. Agency for Toxic Substances and Disease Registry and Oregon Health Authority when conducting human health risk assessments. Because an RBA of 60% for arsenic in soil is widely used by agencies in the absence of site specific data and is health protective, DEQ will accept a soil RBA of 60% for arsenic.

In addition to changing the arsenic soil RBA to 60% from 44%, DEQ requests that Owens-Brockway make it clear in the text of the risk assessment report that this change to the arsenic RBA only applies to ingested soil. DEQ wants it to be clear in the report that this change to the RBA does not apply to produce.

References

- OHA Public Health Division. 2021. “Public Health Assessment Initial and Public Comment Release: Bullseye Glass Company (Manufacturing Site), 3722 SE 21st Ave, Portland, OR, 97202.” Portland, OR: OHA. <https://sharedsystems.dhsoha.state.or.us/DHSForms/Served/le8163A.pdf>
- US EPA. 2012a. “Compilation and Review of Data on Relative Bioavailability of Arsenic in Soil.” OSWER 9200. 1-113. Washington, D.C.: USEPA. <https://www.epa.gov/superfund/soil-bioavailability-superfund-sites-guidance#arsenic> | <https://semspub.epa.gov/work/HQ/175339.pdf>.
- US EPA. 2012b. “Memorandum Compilation and Review of Data on Relative Bioavailability of Arsenic in Soil and Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil Documents.” OSWER Directive 9200. 1-113. Washington, D.C.: USEPA. <https://www.epa.gov/superfund/soil-bioavailability-superfund-sites-guidance#arsenic> | <https://semspub.epa.gov/work/HQ/174539.pdf>.
- US EPA. 2012c. “Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil.” OSWER 9200. 1-113. Washington, D.C.: USEPA. <https://www.epa.gov/superfund/soil-bioavailability-superfund-sites-guidance#arsenic> | <https://semspub.epa.gov/work/HQ/175338.pdf>.

Produce Ingestion Rates – Change Required

- **Owens-Brockway proposed to change the produce ingestion rates from OEHHA’s 95th percentile to the mean by age group. DEQ will accept OEHHA’s 75th percentile by age group.**

Description

DEQ agrees that the higher percentiles for produce ingestion rates include significant uncertainty. Currently, the MPAF uses OEHHA’s 95th percentile for produce ingestion rates by age group. These produce ingestion rates originate from 1999 to 2004 national survey data collected by the Centers for Disease Control and Prevention program called the National Health and Nutrition Examination Survey. The U.S. EPA also uses NHANES survey data to generate produce ingestion rates and states that the upper percentiles of the data may tend to overestimate true long-term ingestion rates (EPA 2018).

This will protect the health of people that eat more produce than average. Certain people eat more produce than others. For example, people that garden may eat more home-grown produce than those who do not garden. The 2011 EPA Exposure Factors Handbook states: “Home-produced intake was generally higher among individuals who indicated that they operate a farm, **grow their own vegetables**, raise animals, and catch their own fish” (EPA 2011, emphasis added). Therefore, DEQ will not accept Owens-Brockway’s proposal to move from OEHHA’s 95th to the mean for the produce ingestion rates by age group.

DEQ will accept OEHHA's 75th percentile for produce ingestion rates by age group. This determination avoids the higher uncertainty of the upper percentiles that is inherent in underlying NHANES survey data and still protects the health of people that eat more produce than average.

Regulatory agencies sometimes use the 75th percentile when selecting exposure factors for calculating risk. In DEQ's 2007 *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*, biota-sediment bioaccumulation factors were selected as the 75th percentile based on a report by the Washington Department of Health (DEQ 2007, Washington Department of Health 1995).

In DEQ's recent September 2020 guidance on *Conducting Ecological Risk Assessments*, the soil screening levels for total petroleum hydrocarbons are taken as the 25th quantile of toxicity data, meaning that the values would be protective in 75 percent of the toxicity tests (DEQ 2020). This approach is based on studies by the Washington Department of Ecology (Washington State Department of Ecology 2016).

Calculation Errors

DEQ noticed what appears to be an incorrect value used for the high end consumption of root vegetation for the 0 to 2 year age group. Owens-Brockway used 17.3 g/kg/day instead of the 15.3 g/kg/day listed in OEHHA's guidance (Table 5.15). This does not result in a substantial change to final produce dose or risk values.

References

- DEQ. 2007. "Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment." 07-LQ-023A. Portland, OR. <https://sempub.epa.gov/work/10/500011406.pdf>.
- DEQ. 2020. "Conducting Ecological Risk Assessments." Portland, OR. <https://www.oregon.gov/deq/FilterDocs/EcoRiskIMD.pdf>.
- US EPA. 2011. "Chapter 13. Intake of Home-Produce Foods. Exposure Factors Handbook: 2011 Edition." EPA/600/R-09/052F. Washington, D.C.: USEPA. <https://www.epa.gov/sites/default/files/2015-09/documents/efh-chapter13.pdf>.
- US EPA. 2018. "Update for Chapter 9 of the Exposure Factors Handbook: Intake of Fruits and Vegetables." EPA/600/R-18/098F. Washington, D.C.: USEPA. <https://www.epa.gov/sites/default/files/2018-08/documents/efh - chapter 9 update.pdf>.
- Washington State Department of Ecology. 2016. "Toxicity Testing of Soils Contaminated with Gasoline, Diesel, and Heavy Oil: Toxicity Testing of Washington Soils." 16-03-038. Olympia, WA. <https://apps.ecology.wa.gov/publications/documents/1603038.pdf>.
- Washington State Department of Health. 1995. "Development of Sediment Quality Criteria for the Protection of Human Health: Tier 1 Report."

Homegrown Produce Ingestion Rates – Change Required

- **Owens-Brockway proposed to change the fraction of food intake that is home-produced from 0.137 (13.7%) to 0.0595 (5.95%). DEQ will accept the original fraction 0.137 (13.7%).**

Description

In the current MPAF, the fraction of food intake that is home-produced is 0.137. This is calculated from the average total fruits and vegetables consumed by households that garden captured by one-week

survey data (EPA 2011). DEQ took a close look at the West region 0.0595 fraction that Owens-Brockway is proposing to use instead. DEQ will not accept the West region homegrown produce fraction of 0.0595 and will accept 0.137 for the following two reasons:

1. The West group includes answers from people that do not garden, which may dilute the results and lead to lower intake fractions. Therefore this value may not be sufficiently health-protective of those that garden. In the 2011 Exposure Factors Handbook, EPA stated that “Home-produced intake was generally higher among individuals who indicated that they operate a farm, **grow their own vegetables**, raise animals, and catch their own fish” (EPA 2011, emphasis added). Therefore, DEQ will accept the 0.137 fraction because it is based only on data from households that garden, which is the population DEQ aims to protect.
2. The West group also does not add sufficient geographic specificity to the analysis. In the EPA Exposure Factors Handbook, West is defined as Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming (EPA 2011). This is a large area that encompasses many different types of gardens and growing seasons.

Calculation Errors

In the proposal, Owens-Brockway stated an intention to reduce the home-grown consumption percentage from 13.7% to 5.95%. In the submitted calculation spreadsheet, Owens-Brockway appears to use 59.5% rather than 5.95%. DEQ assumes this was a simple spreadsheet entry error and wanted Owens-Brockway to be aware of it while updating calculations back to the default 13.7% home-grown consumption percentage.

References

- US EPA. 2011. “Chapter 13. Intake of Home-Produced Foods. Exposure Factors Handbook: 2011 Edition.” EPA/600/R-09/052F. Washington, D.C.: USEPA.
<https://www.epa.gov/sites/default/files/2015-09/documents/efh-chapter13.pdf>.

Soil Ingestion Rates – Proposal Accepted with Minor Requests

- **Owens-Brockway proposed to change the soil ingestion rates from OEHHA’s weight adjusted soil ingestion rates to the soil ingestion rates and body weights used in OHA’s Public Health Assessment for Bullseye Glass Co. and mean weight adjusted soil ingestion rate from OEHHA for the third trimester. DEQ accepts Owens-Brockway’s proposal for the 0 to 70 age groups, but needs to see all the background calculations behind the conversion of OHA’s ingestion rates and body weights for different age groups to weight adjusted soil ingestion rates for age groups compatible with California’s Hot Spots Analysis and Reporting Program. DEQ does not accept the inclusion of a soil ingestion rate for the third trimester age group in order to stay consistent with the original MPAF calculations for noncancer health effects.**

Description

DEQ agrees with Owens-Brockway’s proposal to use the weight adjusted soil ingestion rates by age group from OHA’s Public Health Assessment for Bullseye Glass Co. for the 0 to 70 age groups. The soil ingestion rates and body weights by age group used in OHA’s Public Health Assessments, including the

one for Bullseye Glass Co., are consistent with ATSDR and EPA guidance (OHA Public Health Division 2020, EPA 2011, EPA 2017).

DEQ does not accept the proposal to include the third trimester age group in the weight adjusted soil ingestion rates. Even though the OEHHA guidance said that third trimester would be included in the exposure calculations, this was for cancer effects only. It was not included for noncancer health effects, which is consistent with the approach used in the development of South Coast Air Quality Management District MPAFs that were directly adopted into the CAO program.

Calculation Errors

DEQ was unable to replicate the proposed weight adjusted soil ingestion rates that Owens-Brockway provided. For example, in converting soil ingestion rates and body weights from OHA's Public Health Assessment for ages 2-6, 6-11, and 11-16 to age- and weight-adjusted soil ingestion rates for ages 2-16, Owens-Brockway got 5.4 mg/kg-day and DEQ got 6.8 mg/kg-day. DEQ requests that Owens-Brockway show their work for the age- and weight-adjusted soil ingestion rate conversions for each age group so they can be verified.

Other Comments

For organization purposes in the Level 4 Risk Assessment Report, DEQ requests that all the soil-related modifications be grouped together (i.e., soil ingestion rates and soil RBA) and all the produce-related modifications be grouped together (i.e., produce ingestion rates and homegrown produce ingestion rates).

DEQ also requests that Owens-Brockway specifies in writing that this ingestion rate is only applicable to soil (e.g., "Weight-adjusted soil ingestion rates by age group from PHA for ages 0 to 70, and mean soil ingestion rate from OEHHA for the 3rd trimester").

References

- OHA Public Health Division. 2021. "Public Health Assessment Initial and Public Comment Release: Bullseye Glass Company (Manufacturing Site), 3722 SE 21st Ave, Portland, OR, 97202." Portland, OR: OHA. <https://sharesystems.dhsoha.state.or.us/DHSForms/Served/1e8163A.pdf>
- US EPA. 2011. "Chapter 8. Body Weight Studies." EPA/600/R-09/052F. Washington, D.C.: USEPA. <https://www.epa.gov/sites/default/files/2015-09/documents/efh-chapter08.pdf>.
- US EPA. 2017. "Update for Chapter 5 of the Exposure Factors Handbook: Soil and Dust Ingestion." EPA/600/R-17/384F. Washington, D.C.: USEPA. https://www.epa.gov/sites/default/files/2018-01/documents/efh-chapter05_2017.pdf

Summary Tables

Table 1. Proposed Facility-Specific Multi-Pathway Adjustment Factors (MPAFs)

	Cancer		Non-Cancer	
	Resident MPAF	Worker MPAF	Resident MPAF	Worker MPAF
Arsenic				
CAO Default	9.7	4.5	88	28
Level 4 HRA	2.6	1.6	14.3	3.8
Corrected Level 4 HRA	NA	NA	4.3	NA
DEQ Requirement	2.6	1.6	6.7	3.8
Cadmium				
CAO Default	1	1	2	1.2
Level 4 HRA	1	1	1.2	1
DEQ Requirement	1	1	1.2	1
Chromium VI				
CAO Default	1.6	1	2.4	1
Level 4 HRA	1.1	1	1.3	1
DEQ Requirement	1.1	1	1.3	1

Notes:

1. “Corrected Level 4 HRA” includes DEQ-corrected values determined during review of the September 20, 2021 submittals.
2. Corrections made to non-cancer arsenic incidental soil ingestion rate and fraction home-grown produce. See Table 2.

NA = not applicable, no corrections made to these calculations.

Table 2. Summary of Facility-Specific Exposure Factor Revisions

Parameter	Value	Reduction Ratio
Soil ingestion rate	(mg/kg/day)	
Default	5.46	--
Level 4 HRA	2.59	2.11
Corrected Level 4 HRA	2.87	1.90
DEQ Requirement	2.87	1.90
Relative bioavailability in soil	(fraction)	
Default	1	--
Level 4 HRA	0.44	2.27
DEQ Requirement	0.60	1.67
Produce ingestion rate	(g/kg/day)	
Default (high)	Varies by type of produce	--
Level 4 HRA (mean)	Varies by type of produce	Approx. 3
DEQ Requirement (high)	Varies by type of produce	--
Fraction homegrown produce	(fraction)	
Default	0.137	--
Level 4 HRA	0.595	0.230
Corrected Level 4 HRA	0.0595	2.30
DEQ Requirement	0.137	--

Note:

Reduction ratio = Default value / Facility-specific value