

# **A Comparison of Default Ingestion Input Parameters for Dust Ingestion**

BPRG and BDCC compared to select other EPA, DOD, and California Approaches

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Summary Table Comparing Default Ingestion Input Parameters for Dust Ingestion		BPRG when issued (2007), update (2014), and current (2022)						World Trade Center 2003 benchmarks	EPA OPP Guidance (2012)			California HERO HHRA Guidance (2018) and (2020)						DOD CHPPM Guidance (2009)			EPA OEHHA Guidance (2009)		
Variable	Description	BPRG 2007	Units 2007	BPRG 2014	Units	BPRG 2022	Units		OPP Variable	OPP 2020	OPP Units	HERO HHRA Variable	HERO HHRA 2018	Units 2018	HERO HHRA Variable	HERO HHRA 2020	Units 2020	CHPPM Parameter	CHPPM Value or Equation No.	CHPPM Units	OEHHA Variable	OEHHA 2018	Units 2018
k	Dissipation Rate Constant	0	yr^-1	0	yr^-1	0	yr^-1																
SE	Saliva Extraction Factor	0.5	unitless	0.5	unitless	0.5	unitless	SE	0.48	unitless	fdo	0.04	unitless	fdo	0.04	unitless	FTsm	0.4	unitless	remv_mouth	0.3	unitless	
FTSSh	Fraction Transferred Surface to Skin - hard surface	0.5	unitless	0.5	unitless		unitless																
FTSSh-child	Fraction Transferred Surface to Skin - hard surface					0.64	unitless	Fai-hands	0.15	unitless	TE	0.1	unitless	TE	0.1	unitless	FTss	0.063	unitless	transfer_dermal	0.6 - 8.4	unitless	
FTSSh-adult	Fraction Transferred Surface to Skin - hard surface					0.4	unitless																
FTSSs	Fraction Transferred Surface to Skin - soft surface	0.1	unitless	0.1	unitless		unitless																
FTSSs-child	Fraction Transferred Surface to Skin - soft surface					0.14	unitless																
FTSSs-adult	Fraction Transferred Surface to Skin - soft surface					0.08	unitless																
EDres	Exposure Duration - Resident	30	yrs	26	yrs	26	yrs																
EDres-c	Exposure Duration - Resident Child	6	yrs	6	yrs	6	yrs				ED	6	yrs	ED	6	yrs							
EDres-a	Exposure Duration - Resident Adult	24	yrs	20	yrs	20	yrs				ED	25	yrs	ED	25	yrs							
EFres	Exposure Frequency - Resident	350	days/yr	350	days/yr	350	days/yr																
EFres-c	Exposure Frequency - Resident Child	350	days/yr	350	days/yr	350	days/yr				EF	230	days/yr	EF	230	days/yr							
EFres-a	Exposure Frequency - Resident Adult	350	days/yr	350	days/yr	350	days/yr				EF	230	days/yr	EF	230	days/yr							
ETres	Exposure Time - Resident	24	hr/day	24	hr/day	24	hr/day																
ETres-c	Exposure Time - Resident Child	24	hr/day	24	hr/day	24	hr/day																
ETres-a	Exposure Time - Resident Adult	24	hr/day	24	hr/day	24	hr/day																
ETres-c,h	Exposure Time - Resident Child Hard Surface	6	hr/day	6	hr/day	6	hr/day	ET	2	hr/day													
ETres-a,h	Exposure Time - Resident Adult Hard Surface	6	hr/day	6	hr/day	6	hr/day																
ETres-c,s	Exposure Time - Resident Child Soft Surface	10	hr/day	10	hr/day	10	hr/day	ET	4	hr/day													
ETres-a,s	Exposure Time - Resident Adult Soft Surface	10	hr/day	10	hr/day	10	hr/day																
FQres-c	Frequency of Hand to Mouth - child	9.5	event/hr	17	event/hr	17.7	event/hr	Freq_HtM	20	event/hr	CF	6	events/day	CF	6	events/day				hm_freq	Range 1-18	event/hr	
FQres-a	Frequency of Hand to Mouth - adult	1	event/hr	3	event/hr	3.025	event/hr				CF	6	events/day	CF	6	events/day							
FSAres-c	Fraction of dust transferred from soft surfaces to skin child					0.1	fraction																
FSAres-a	Fraction of dust transferred from soft surfaces to skin adult					0.07	fraction																
IFDres-adj	Age-Adjusted Resident Dust Ingestion Fraction	3870	cm^2-year/day	3200400	cm^2	3115591	cm^2				Intake Factor	0.014	cm^2/kg-day	Intake Factor	0.014	cm^2/kg-day							
SAres-a	Surface Area of Fingers - Resident Adult	45	cm^2	49	cm^2	398	cm^2				Intake Factor	0.044	cm^2/kg-day	Intake Factor	0.044	cm^2/kg-day							
SAres-c	Surface Area of Fingers - Resident Child	15	cm^2	16	cm^2	223	cm^2				CA	372	cm^2/event	CA	372	cm^2/event							
tres	Time - resident	30	yr	26	yr	26	yr	SAH	150	cm^2	CA	647	cm^2/event	CA	647	cm^2/event							
EDiw	Exposure Duration - Indoor Worker	25	yrs	25	yrs	25	yrs										ED	10	yr				
EFiw	Exposure Frequency - Indoor Worker	250	days/yr	250	days/yr	250	days/yr										EF	250	days/yr				
ETiw	Exposure Time - Indoor Worker	8	hr/day	8	hr/day	8	hr/day										ET	8	hr/day				
FQiw	Frequency of Hand to Mouth - Indoor Worker	1	events/hr	3	events/hr	3.025	events/hr										EVderm	4	events/day				
FSAiW	Fraction of dust transferred from soft surfaces to skin adult					0.07	fraction										EVing	27 (fingertip/nail biting)	events/day				
SAiw	Surface Area of Fingers - Indoor Worker	45	cm^2	49	cm^2	398	cm^2										SA	Forearms: 873 Hands (palmar side): 326	cm^2				
IFDiW	Indoor Worker Dust Ingestion Fraction	54	cm^2/day	176.4	cm^2/day	505659	cm^2																
								Fm	0.13	fraction/event							Ff	0.08	unitless	hm_fraction	0.78	unitless	
																	Fd	Forearm: 1 Hand (palmar side): 0.30	unitless	contacth	6	hr^-1	

Notes: Please see individual comparison tables for references.

**Table Comparing Default Ingestion Input Parameters for Dust Ingestion  
BPRG when issued (2007), update (2014), and current (2022) and World Trade Center 2009 guidance "World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks"**

Variable	Description	WTC 2003	Units 2003	BPRG 2007	Units 2007	BPRG 2014	Units	Reference/Reason for change in 2014	BPRG 2022	Units	Reference/Reason for change in 2022
EDres	Exposure Duration - Resident	30	yrs	30	yrs	26	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	26	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
EDres-c	Exposure Duration - Resident Child	6	yrs	6	yrs	6	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	6	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
EDres-a	Exposure Duration - Resident Adult	24	yrs	24	yrs	20	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	20	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
EFres	Exposure Frequency - Resident	350	days/yr	350	days/yr	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
EFres-c	Exposure Frequency - Resident Child	350	days/yr	350	days/yr	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
EFres-a	Exposure Frequency - Resident Adult	350	days/yr	350	days/yr	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
ETres	Exposure Time - Resident	24	hr/day	24	hr/day	24	hr/day	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	24	hr/day	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
ETres-c	Exposure Time - Resident Child	24	hr/day	24	hr/day	24	hr/day	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	24	hr/day	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
ETres-a	Exposure Time - Resident Adult	24	hr/day	24	hr/day	24	hr/day	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	24	hr/day	<a href="#">U.S. EPA 2014 (Attachment 1)</a>
ETres-c,h	Exposure Time - Resident Child Hard Surface	6	hr/day	6	hr/day	6	hr/day	<a href="#">WTC 2003</a>	6	hr/day	<a href="#">WTC 2003</a>
ETres-a,h	Exposure Time - Resident Adult Hard Surface	6	hr/day	6	hr/day	6	hr/day	<a href="#">WTC 2003</a>	6	hr/day	<a href="#">WTC 2003</a>
ETres-c,s	Exposure Time - Resident Child Soft Surface	10	hr/day	10	hr/day	10	hr/day	<a href="#">WTC 2003</a>	10	hr/day	<a href="#">WTC 2003</a>
ETres-a,s	Exposure Time - Resident Adult Soft Surface	10	hr/day	10	hr/day	10	hr/day	<a href="#">WTC 2003</a>	10	hr/day	<a href="#">WTC 2003</a>
FQres-c	Frequency of Hand to Mouth - child	9.5	event/hr	9.5	event/hr	17	event/hr	<a href="#">EPA 2011 Table 4.1</a>	17.7	event/hr	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>
FQres-a	Frequency of Hand to Mouth - adult	1	event/hr	1	event/hr	3	event/hr	<a href="#">EPA 2011 Table 4.1</a>	3.025	event/hr	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>
FTSSh	Fraction Transferred Surface to Skin - hard surface	0.5	unitless	0.5	unitless	0.5	unitless	<a href="#">WTC 2003</a>			
FTSSs	Fraction Transferred Surface to Skin - soft surface	0.1	unitless	0.1	unitless	0.1	unitless	<a href="#">WTC 2003</a>			
FTSSh-child	Fraction Transferred Surface to Skin - hard surface								0.64	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>
FTSSs-child	Fraction Transferred Surface to Skin - soft surface								0.14	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>
FTSSh-adult	Fraction Transferred Surface to Skin - hard surface								0.4	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>
FTSSs-adult	Fraction Transferred Surface to Skin - soft surface								0.08	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>
FSA-child	fractional surface area of hand mouthed child								0.1	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>
FSA-adult	fractional surface area of hand mouthed adult								0.07	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>
IFDres-adj	Age-Adjusted Resident Dust Ingestion Fraction			3870	cm <sup>2</sup> -year/day	3200400	cm <sup>2</sup>	Change in units because equation was rearranged to accommodate age adjustment (compare of BPRG age adjusted ingestion of dust equation to the 2007 ingestion of dust equation). Additionally, the value for FQ was updated.	3115591	cm <sup>2</sup>	A factor called FSA (fraction of hand mouthed) has been incorporated that has not previously been used. In addition, the indoor worker IFD now includes EF and ED for consistency with resident IFD.
IFDiw	Indoor Worker Dust Ingestion Fraction			54	cm <sup>2</sup> /day	54	cm <sup>2</sup> /day		505659	cm <sup>2</sup>	
k	Dissipation Rate Constant	0.38	yr <sup>-1</sup>	0	yr <sup>-1</sup>	0	yr <sup>-1</sup>	WTC justified site-specific dissipation rate.	0	yr <sup>-1</sup>	WTC justified site-specific dissipation rate.
SAres-a	Surface Area of Fingers - Resident Adult	45	cm <sup>2</sup>	45	cm <sup>2</sup>	49	cm <sup>2</sup>	<a href="#">EPA 2011 Table 7.2</a>	398	cm <sup>2</sup>	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>
SAres-c	Surface Area of Fingers - Resident Child	15	cm <sup>2</sup>	15	cm <sup>2</sup>	16	cm <sup>2</sup>	<a href="#">EPA 2011 Table 7.2</a>	223	cm <sup>2</sup>	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>
SE	Saliva Extraction Factor	0.5	unitless	0.5	unitless	0.5	unitless		0.5	unitless	<a href="#">WTC 2003</a>
tres	Time - resident	30	yr	30	yr	26	yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	26	yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>

Yellow highlighted BPRG defaults that differ from WTC defaults

WTC 2003 = World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks

U.S. EPA 2011 = 2011 Exposure Factors Handbook

U.S. EPA 2014 = 2014 Human Health Evaluation Manual: Update of Standard Exposure Factors (OSWER Directive 9200.1-120)

U.S. EPA 2017 = 2017 Exposure Factors Handbook, Chapter 5. Soil and Dust Ingestion Update

a; Average of all age groups from birth to 6 years.

b; Average of all age groups for ages 6+.

**Table Comparing Default Ingestion Input Parameters for Dust Ingestion**  
**Current BPRG (2022) and California's Human and Ecological Risk Office (HERO), Human Health Risk Assessment (HHRA) for 2018 & 2020 Note Number 8**  
**"Recommendations for Evaluating Polychlorinated Biphenyls (PCBs) at Contaminated Sites in California"**

BPRG Variable	BPRG Description	BPRG 2022	Units 2022	BPRG Ref	HERO HHRA Variable	HERO HHRA Description	HERO HHRA 2018	Units 2018	Reference 2018	HERO HHRA Variable	HERO HHRA Description	HERO HHRA 2020	Units 2020	Reference 2020
EDres-c	Exposure Duration - Resident Child	6	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	ED	Exposure Duration - student	6	yrs	conservative assumption based on years in school	ED	Exposure Duration - student	6	yrs	conservative assumption based on years in school
EDres-a	Exposure Duration - Resident Adult	20	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	ED	Exposure Duration - teacher	25	yrs	conservative assumption based on years in school	ED	Exposure Duration - teacher	25	yrs	conservative assumption based on years in school
EFres-c	Exposure Frequency - Resident Child	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	EF	Exposure Frequency - student	230	days/yr	conservative assumption based on length of school year	EF	Exposure Frequency - student	230	days/yr	conservative assumption based on length of school year
EFres-a	Exposure Frequency - Resident Adult	350	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	EF	Exposure Frequency - teacher	230	days/yr	conservative assumption based on length of school year	EF	Exposure Frequency - teacher	230	days/yr	conservative assumption based on length of school year
FQres-c	Frequency of Hand to Mouth - child	17.7	event/hr	<a href="#">EPA 2011 Table 4.1</a>	CF	Contact Frequency - student	6	events/day	conservative assumption based on classes per day	CF	Contact Frequency - student	6	events/day	conservative assumption based on classes per day
FQres-a	Frequency of Hand to Mouth - adult	3.025	event/hr	<a href="#">EPA 2011 Table 4.1</a>	CF	Contact Frequency - teacher	6	events/day	conservative assumption based on classes per day	CF	Contact Frequency - teacher	6	events/day	conservative assumption based on classes per day
SE	Saliva Extraction Factor	0.5	unitless	<a href="#">WTC 2003</a>	fdo	skin to mouth transfer efficiency	0.04	unitless	Michaud, et. al. (1994).	fdo	skin to mouth transfer efficiency	0.04	unitless	Michaud, et. al. (1994).
FTSSh FTSSs	Fraction Transferred Surface to Skin - hard or soft surface													
FTSSh-child	Fraction Transferred Surface to Skin - hard surface	0.64	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	TE	surface to skin transfer efficiency	0.1	unitless	DiBiasio, et. al. (2003)	TE	surface to skin transfer efficiency	0.1	unitless	DiBiasio, et. al. (2003)
FTSSs-child	Fraction Transferred Surface to Skin - soft surface	0.14	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>										
FTSSh-adult	Fraction Transferred Surface to Skin - hard surface	0.4	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>										
FTSSs-adult	Fraction Transferred Surface to Skin - soft surface	0.08	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>										
IFDres-adj	Age-Adjusted Resident Dust Ingestion Fraction	NA	NA	NA	Intake Factor	Intake Factor - student	0.014	cm <sup>2</sup> /kg-day	calculated from other inputs	Intake Factor	Intake Factor - student	0.014	cm <sup>2</sup> /kg-day	calculated from other inputs
		NA	NA	NA	Intake Factor	Intake Factor - teacher	0.044	cm <sup>2</sup> /kg-day	calculated from other inputs	Intake Factor	Intake Factor - teacher	0.044	cm <sup>2</sup> /kg-day	calculated from other inputs
SAres-c	Surface Area of Fingers - Resident Child	223	cm <sup>2</sup>	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	CA	Surface Area of Fingers - Resident Child	372	cm <sup>2</sup> /event	50% of the recommended surface areas for the hands and forearms on pages 7-40 and 7-41 of the Exposure Factors Handbook (USEPA 2011)	CA	Surface Area of Fingers - Resident Child	372	cm <sup>2</sup> /event	50% of the recommended surface areas for the hands and forearms on pages 7-40 and 7-41 of the Exposure Factors Handbook (USEPA 2011)
SAres-a	Surface Area of Fingers - Resident Adult	398	cm <sup>2</sup>	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>	CA	Surface Area of Fingers - Resident Adult	647	cm <sup>2</sup> /event	50% of the recommended surface areas for the hands and forearms on pages 7-40 and 7-41 of the Exposure Factors Handbook (USEPA 2011)	CA	Surface Area of Fingers - Resident Adult	647	cm <sup>2</sup> /event	50% of the recommended surface areas for the hands and forearms on pages 7-40 and 7-41 of the Exposure Factors Handbook (USEPA 2011)

WTC 2003 = World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks

U.S. EPA 2011 = 2011 Exposure Factors Handbook

U.S. EPA 2014 = 2014 Human Health Evaluation Manual: Update of Standard Exposure Factors (OSWER Directive 9200.1-120)

U.S. EPA 2017 = 2017 Exposure Factors Handbook, Chapter 5. Soil and Dust Ingestion Update

Michaud, et. al. (1994).

DiBiasio, et. al. (2003)

a; Average of all age groups from birth to 6 years.

b; Average of all age groups for ages 6+.

**Table Comparing Default Ingestion Input Parameters for Dust Ingestion**  
**Current BPRG (2022) and Department of Defense's (DOD) Center for Health Promotion and Preventative Medicine (CHPPM) 2009 Technical Guide**  
**"Health Risk Assessment Methods and Screening Levels for Evaluating Office Worker Exposures to Contaminants on Indoor Surfaces Using Surface Wipe Data"**

BPRG Variable	BPRG Description	BPRG 2022	Units 2022	BPRG Ref	CHPPM Parameter	CHPPM Definition	CHPPM Value or Equation No.	CHPPM Reference	CHPPM Important Notes	CHPPM Limitations
NA	NA	NA	NA	NA	Fd	Fraction of exposed skin surface area that actually contacts the contaminated surface (unitless)	Forearm: 1 Hand (palmar side): 0.30	Zainudin and Semple 2005 (fraction of forearm and hand surface area that actually has contact with smooth, nonporous surfaces in an office setting)	Fd values provided are limited to fine particles and should not be used for direct contact with liquids on the surface.	
FSaInd	Fractional surface area of hand mouthed adult	0.07	unitless	<a href="#">EPA 2017 Table 5-13.a</a>	Ff	Fraction of exposed skin that contacts the mouth (unitless)	0.08	Estimated using professional judgment. The following assumptions were used to estimate the fingertip fraction of 0.08 that contacts the mouth: <ul style="list-style-type: none"> <li>Total finger area is one-half the hand area (0.5).</li> <li>The joint at the distal end of the finger is one-third of each finger (0.33).</li> <li>One-half of the joint at the distal end of the finger contacts the mouth (0.5).</li> </ul>	A fraction of this area that contacts the mouth during adult mouthing behaviors such as nail biting or placing the fingertips in the mouth.	
SE	Saliva Extraction Factor	0.5	unitless	<a href="#">WTC 2003</a>	FTsm	Fraction of substance transferred from skin to mouth (unitless)	0.4	Rusin et al. (2002)	The data from Rusin et al. is more representative of office worker exposures.  USEPA uses Kissel et al. 1998 which accounts for a three different activities: thumb sucking, finger mouthing ("mouthing three fingers above the first knuckle"), and palm licking ("three swipes with the tongue"). These activities are not appropriate for office worker exposure.	
FTSSInd-h FTSSInd-s	Fraction Transferred Surface to Skin	hard surfaces = 0.4 soft surfaces = 0.08	unitless	<a href="#">EPA 2017 Table 5-13.a</a>	FTss	Fraction transferred from the surface to the skin (unitless)	0.063	Calculating the fraction transferred using the Brouwer et al. assumption—that the transfer surface area is similar to the exposed hand area—estimated FTss would be 6.3 percent and 0.5 percent at surface loadings of 6 µg/cm <sup>2</sup> and 177 µg/cm <sup>2</sup> , respectively. (Note: This value is based on results reported by Brouwer et al. for six repeated contacts at a low surface loading of 6 µg/cm <sup>2</sup> .)	For office workers, FTss values should reflect casual contact with the surface; therefore, experimental values derived from vigorous rubbing are probably not appropriate. In addition, although not explicitly stated, many studies focused on a crawling infant as the likely receptor. Studies designed to mimic exposures to a crawling infant applied forces not normally associated with casual surface contacts.	The default FTss was selected using office worker exposure assumptions and should not be applied to other exposure scenarios without considering additional factors for those scenarios. For example, children are more likely to contact surfaces with wet hands than adults, and experimental data show moisture can increase the amount transferred from the surface to the skin.
EDiw	Exposure Duration - Indoor Worker	25	yrs	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	ED	Exposure duration (year)	10	Based on the mass balance analysis, an ED of 10 years is recommended for evaluating office worker exposures.	The mass balance analysis assumes that the initial contamination is not the level at which a worker would be exposed for the duration of employment. (essentially, they are applying k (dissipation rate) to ED)	USEPA (1991) recommends using a 95th percentile ED of 25 years, which is based on 1990 BLS data.
EFiw	Exposure Frequency - Indoor Worker	250	days/yr	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	EF	Exposure frequency (days/year)	250	USEPA recommendation		
ETiw	Exposure Time - Indoor Worker	8	hr/day	<a href="#">U.S. EPA 2014 (Attachment 1)</a>	ET	Exposure time (hours/day)	8	(BLS 2007)		
FQiw	Frequency of Hand to Mouth - Indoor Worker	3.025	events/hr	<a href="#">EPA 2017 Table 5-13.a</a>	EVderm	Event frequency for estimating the dermal dose (events/day)	4	selected using professional judgment	The default value should not be used for exposure scenarios that are significantly different from these considerations. (i.e. office workers)	Examples are computer work (includes typing, working in front of the computer); talking on the phone; and working at a desk away from the computer (for example, writing, reading, attending meetings). When a break occurs, an activity is considered a new event even when the office worker resumes the same activity.
					EVing	Event frequency for estimating intake from incidental ingestion (events/day)	27 (fingertip/nail biting)	Zainudin and Semple (2005)	For the purposes of estimating office worker exposure from incidental ingestion, Zainudin's observation of 3.4 hand-to-perioral area contacts per hour was used to estimate EVing for fingertip/fingernail biting habits. Multiplying this by a typical 8-hour workday results in a total EVing of 27 events/day.	
SAiw	Surface Area of Fingers - Indoor Worker	398	cm <sup>2</sup>	<a href="#">EPA 2017 Table 5-13.a</a>	SA	Exposed skin surface area per event (cm <sup>2</sup> )	Forearms: 873 Hands (palmar side): 326	Forearm surface areas were obtained from the Exposure Factors Handbook (USEPA 1997c).  Palmar surface areas (wrist crease to fingertips) were obtained from the open literature Edwards and Liroy (1999). (Value was doubled to account for SA on both hands)	As the Exposure Factors Handbook provides only whole forearm surface area values, an adjustment factor of 66.7 percent, or two-thirds of the whole forearm surface area, was used to modify the forearm surface area. This adjustment factor accounts for the underside of the forearm as well as the "spread-out" effect of the arm when it is laid on a flat surface.  As discussed in paragraph 9.1, residents are expected to have a larger exposed skin area available for contact with surfaces than office workers.	Paragraph 9.1: Residents are more likely to come in contact with a greater variety of indoor surfaces and from different parts of the home. In addition, due to the more relaxed atmosphere of a home as compared to that of an office, residents of a home tend to dress more casually, resulting in a greater skin surface area available for contact. Residents are also more apt to engage in activities that involve direct contact with floor surfaces. Some examples include walking barefooted or sitting on the floor. This is especially true of children and infants, with the latter group spending most of their time close to the floor.

WTC 2003 = World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks

U.S. EPA 2011 = 2011 Exposure Factors Handbook

U.S. EPA 2014 = 2014 Human Health Evaluation Manual: Update of Standard Exposure Factors (OSWER Directive 9200.1-120)

U.S. EPA 2017 = 2017 Exposure Factors Handbook, Chapter 5. Soil and Dust Ingestion Update

Zainudin and Semple (2005)

Rusin et al. (2002)

(BLS 2007)

Edwards and Liroy (1999)

a; Average of all age groups from birth to 6 years.

**Table Comparing Default Ingestion Input Parameters for Dust Ingestion**  
**Current BPRG (2022) and California's Office of Environmental Health Hazard Assessment (OEHHA) Environmental Protection Agency 2009 Guidance**  
**"Assessment of Children's Exposure to Surface Methamphetamine Residues in Former Clandestine Methamphetamine Labs, and Identification of a Risk-Based Cleanup Standard for Surface Methamphetamine Contamination"**

BPRG Variable	BPRG Description	BPRG 2022	Units 2022	BPRG Ref	OEHHA Variable	OEHHA Description	OEHHA 2018	Units 2018	Reference 2018
NA	NA	NA	NA	NA	contacth	Hand-surface fractional contact rate	6	hr^-1	<a href="#">OEHHA 2009</a>
NA	NA	NA	NA	NA	contactb	Body-surface fractional contact rate	6	hr^-1	<a href="#">OEHHA 2009</a>
FQres-c	Frequency of Hand to Mouth - child	17.7	event/hr	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	hm_freq	Hand mouthing events per hour	Range 1-18	event/hr	<a href="#">OEHHA 2009</a>
FQres-a	Frequency of Hand to Mouth - adult	3.025	event/hr	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>					
SE	Saliva Extraction Factor	0.5	unitless	<a href="#">WTC 2003</a>	remv_mouth	Removal efficiency during mouthing (skin-to-mouth only)	0.3	unitless	mean of Kissel et al. (1998) min= 0.1, max=0.5
FTSSh-child	Fraction Transferred Surface to Skin - hard surface	0.64	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	transfer_dermal	Residue-skin transfer efficiency	0.6 - 8.4	unitless	references from Glen/Smith (12/15/06)
FTSSs-child	Fraction Transferred Surface to Skin - soft surface	0.14	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>					
FTSSh-adult	Fraction Transferred Surface to Skin - hard surface	0.4	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>					
FTSSs-adult	Fraction Transferred Surface to Skin - soft surface	0.08	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>					
IFDres-adj	Age-Adjusted Resident Dust Ingestion Fraction	3115591	cm^2	calculated based on WTC 2003 equation	ingestion_indoor	Dust ingestion rate (indoor, direct only)	1	mg/hr	U.S. EPA 2005 Table 10
FSA-child	fractional surface area of hand mouthed child	0.1	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	hm_fraction	Fraction of surface of one hand that enters mouth	0.78	unitless	<a href="#">OEHHA 2009</a>
FSA-adult	fractional surface area of hand mouthed adult	0.07	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>					

WTC 2003 = World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks  
U.S. EPA 2011 = 2011 Exposure Factors Handbook  
U.S. EPA 2014 = 2014 Human Health Evaluation Manual: Update of Standard Exposure Factors (OSWER Directive 9200.1-120)  
U.S. EPA 2017 = 2017 Exposure Factors Handbook, Chapter 5. Soil and Dust Ingestion Update  
OEHHA 2009 = Assessment of Children's Exposure to Surface Methamphetamine Residues in Former Clandestine Methamphetamine Labs, and Identification of a Risk-Based Cleanup Standard for Surface Methamphetamine Contamination  
Glen/Smith = A probabilistic arsenic exposure assessment for children who contact CCA-treated playsets and decks, Part 1: Model methodology, variability results, and model evaluation  
Kissel et al. 1998 = same reference used by BPRG and WTC.  
U.S. EPA 2005 = A Probabilistic Exposure Assessment for Children who Contact CCA-Treated Playsets and Decks. Using the Stochastic Human Exposure and Dose Simulation Model for the Wood Preservative Exposure Scenario (SHEDS-Wood). Final Report.  
a; Average of all age groups from birth to 6 years.  
b; Average of all age groups for ages 6+.

**Table Comparing Default Ingestion Input Parameters for Dust Ingestion  
Current BPRG (2022) and EPA Office of Pesticide Programs (OPP) 2012 guidance**

BPRG Variable	BPRG Description	BPRG 2022	BPRG Units	BPRG Reference	OPP Variable	OPP Description	OPP 2020	OPP Units	OPP Reference
ETres-c,h	Exposure Time - Resident Child Hard Surface	6	hr/day	<a href="#">WTC 2003</a>	ET	Exposure time	2	hr/day	EPA, 2011; Tables 16-15 and 16-25
ETres-c,s	Exposure Time - Resident Child Soft Surface	10	hr/day	<a href="#">WTC 2003</a>	ET	Exposure time	4	hr/day	EPA, 2011; Tables 16-15 and 16-25
FQres-c	Frequency of Hand to Mouth - child	17	event/hr	<a href="#">EPA 2011 Table 4.1</a>	Freq_HtM	Hand-to-mouth events per hour	20	event/hr	Xue et al. (2007)
FTSSh-child	Fraction Transferred Surface to Skin - hard surface	0.64	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	Fai-hands	Fraction of ai on hands	0.15	unitless	Krieger, 2000 and Selim, 2004
FTSSs-child	Fraction Transferred Surface to Skin - soft surface	0.14	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>					
FTSSh-adult	Fraction Transferred Surface to Skin - hard surface	0.4	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>					
FTSSs-adult	Fraction Transferred Surface to Skin - soft surface	0.08	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>					
SAres-c	Surface Area of Fingers - Resident Child	223	cm <sup>2</sup>	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	SAH	Surface area of one hand	150	cm <sup>2</sup>	U.S. EPA, 2011; Table 7-2
SE	Saliva Extraction Factor	0.5	unitless	<a href="#">WTC 2003</a>	SE	Saliva Extraction Factor	0.48	unitless	Camann et al. (1996)
FSA-child	fractional surface area of hand mouthed child	0.1	unitless	<a href="#">EPA 2017 Table 5-13.<sup>b</sup></a>	Fm	Fraction of hand mouthed per event	0.13	fraction/event	Zartarian et al. (2005).
FSA-adult	fractional surface area of hand mouthed adult	0.07	unitless	<a href="#">EPA 2017 Table 5-13.<sup>a</sup></a>					

Yellow highlighted BPRG defaults that differ from WTC defaults

WTC 2003 = World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks

U.S. EPA 2011 = 2011 Exposure Factors Handbook

U.S. EPA 2014 = 2014 Human Health Evaluation Manual: Update of Standard Exposure Factors (OSWER Directive 9200.1-120)

U.S. EPA 2017 = 2017 Exposure Factors Handbook, Chapter 5. Soil and Dust Ingestion Update

Xue et al. (2007) = A Meta-Analysis of Children's Hand-to-Mouth Frequency Data for Estimating Nondietary Ingestion Exposure. Risk Analysis, 27(2):411-420.

Krieger, 2000 = Biomonitoring and Whole Body Cotton Dosimetry to Estimate Potential Human Dermal Exposure to Semivolatile Chemicals. J. Exposure Analysis & Environ. Epidemiol. 10: 50-57.

Camann et al. (1996) = Comparison of Methods to Determine Dislodgeable Residue Transfer from Floors (EPA/600/R96/089) United States Environmental Protection Agency, Research Triangle Park, NC.

Zartarian et al. (2005). = A Probabilistic Exposure Assessment for Children Who Contact CCA-treated Playsets and Decks Using the Stochastic Human Exposure and Dose Simulation Model for the Wood Preservative Scenario (SHEDS-WOOD). Final Report. U.S.

Selim, 2004 = Measurement of Transfer of Deltamethrin Residues from Vinyl and Carpet flooring Treated with a Fogger Formulation Following a Single Hand Press. Unpublished study prepared by Non-Dietary Exposure Task Force. (MRID 46297602).

a; Average of all age groups from birth to 6 years.

b; Average of all age groups for ages 6+.