US Environmental Protection Agency
Office of Pesticide Programs

Occupational Pesticide Handler Unit Exposure Surrogate Reference Table

March 2013

USEPA / Office of Pesticide Programs / Health Effects Division Occupational Pesticide Handler Unit Exposure Surrogate Reference Table					
Exposure Scenario (Activity, Equipment, Formulation, Site, etc.)[1]	Exposure Route	Personal Protective Equipment (PPE) Level[2]	Data Source[3]	Statistic	Unit Exposure (µg/lb ai)
Mixing / Loading Dry Flowable	Dermal	Single layer, no gloves (A)	AHETF	Mean	227
		Single layer, gloves	AHETF	Mean	51.6
		Double layer, gloves (B)	AHETF	Mean	41.2
		Engineering control (water-soluble packaging)	PHED	"Best fit"	9.8
	Inhalation	No Respirator	AHETF	Mean	8.96
		PF5 (C)	AHETF	Mean	1.79
		PF10 (D)	AHETF	Mean	0.896
		Engineering control (water-soluble packaging)	PHED	"Best fit"	0.24
Mixing / Loading Granules	Dermal	Single layer, no gloves	PHED	"Best fit"	8.4
		Single layer, gloves	PHED	"Best fit"	6.9
		Double layer, gloves	PHED	"Best fit"	3.4
		Engineering control (closed loading system)	PHED	"Best fit"	8.6
	Inhalation	No Respirator	PHED	"Best fit"	1.7
		PF5 (C)	PHED	"Best fit"	0.34
		PF10 (D)	PHED	"Best fit"	0.17
		Engineering control (closed loading system)	PHED	"Best fit"	0.083
Mixing / Loading Liquids	Dermal	Single layer, no gloves (A)	AHETF	Mean	220
		Single layer, gloves	AHETF	Mean	37.6
		Double layer, gloves (B)	AHETF	Mean	29.1
		Engineering control (closed loading system)	PHED	"Best fit"	8.6
	Inhalation	No Respirator	AHETF	Mean	0.219
		PF5 (C)	AHETF	Mean	0.044
		PF10 (D)	AHETF	Mean	0.022
		Engineering control (closed loading system)	PHED	"Best fit"	0.083
Mixing / Loading Wettable Powders	Dermal	Single layer, no gloves	PHED	"Best fit"	3700
		Single layer, gloves	PHED	"Best fit"	170
		Double layer, gloves (B)	PHED	"Best fit"	130
		Engineering control (water-soluble packaging)	PHED	"Best fit"	9.8
	Inhalation	No Respirator	PHED	"Best fit"	43.4

Exposure Scenario (Activity, Equipment, Formulation, Site, etc.)[1]			Exposure Route	Personal Protective Equipment (PPE) Level[2]	Data Source[3]	Statistic	Unit Exposure (μg/lb ai)
USEPA / Office of Pesticide Programs / Health Effects Division Occupational Pesticide Handler Unit Exposure Surrogate Reference Table							
				PF5 (C)	PHED	"Best fit"	8.68
				PF10 (D)	PHED	"Best fit"	4.34
				Engineering control (water-soluble packaging)	PHED	"Best fit"	0.24
Applicator, Aerial, Fixed-Wing		Liquids	Dermal	Engineering control (Enclosed cockpit)	AHETF	Mean	2.08
			Inhalation	Engineering control (Enclosed cockpit)	AHETF	Mean	0.0049
		Granules	Dermal	Engineering control (Enclosed cockpit)	PHED	"Best fit"	1.7
			Inhalation	Engineering control (Enclosed cockpit)	PHED	"Best fit"	1.3
Applicator, Aerosol Can		All sites (except animal treatments)	Dermal	Single layer, no gloves	PHED	"Best fit"	190000
				Single layer, gloves	PHED	"Best fit"	81000
				Double layer, gloves (B)	PHED	"Best fit"	64000
			Inhalation	No Respirator	PHED	"Best fit"	1300
				PF5 (C)	PHED	"Best fit"	260
				PF10 (D)	PHED	"Best fit"	130
		Animal treatments	Dermal	Single layer, no gloves	MRID 44433302	Mean	544000
				Single layer, gloves (E)	MRID 44433302	Mean	503000
				Double layer, gloves (B, E)	MRID 44433302	Mean	273000
			Inhalation	No Respirator	MRID 44433302	Mean	3270
				PF5 (C)	MRID 44433302	Mean	654
				PF10 (D)	MRID 44433302	Mean	327
Applicator, Open Cab Airblast			Dermal	Single layer, no gloves (A)	AHETF	Mean	1770
				Single layer, gloves	AHETF	Mean	1590
				Single layer, gloves, chemical-resistant hat	AHETF	Mean	215
				Double layer, gloves (B)	AHETF	Mean	1480
				Double layer, gloves, chemical-resistant hat (B)	AHETF	Mean	141
				Engineering control (Enclosed Cab)	AHETF	Mean	14.6
			Inhalation	No Respirator	AHETF	Mean	4.71
				PF5 (C)	AHETF	Mean	0.942
				PF10 (D)	AHETF	Mean	0.471
				Engineering control	AHETF	Mean	0.068

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Exposure Scenario (Activity, Equipment, Formulation, Site, etc.)[1]	**Exposure Route**	**Personal Protective Equipment (PPE) Level[2]**	**Data Source[3]**	**Statistic**	**Unit Exposure (µg/lb ai)**
		(Enclosed Cab)			
Applicator, Open Cab Groundboom	Dermal	Single layer, no gloves (A)	AHETF	Mean	78.6
		Single layer, gloves	AHETF	Mean	16.1
		Double layer, gloves (B)	AHETF	Mean	12.6
		Engineering control (Enclosed Cab)	PHED	"Best fit"	5.1
	Inhalation	No Respirator	AHETF	Mean	0.34
		PF5 (C)	AHETF	Mean	0.07
		PF10 (D)	AHETF	Mean	0.03
		Engineering control (Enclosed Cab)	PHED	"Best fit"	0.043
Applicator, Open Cab Solid Broadcast Spreader	Dermal	Single layer, no gloves	PHED	"Best fit"	9.9
		Single layer, gloves (E)	PHED	"Best fit"	7.2
		Double layer, gloves (B, E)	PHED	"Best fit"	4.2
		Engineering control (Enclosed Cab)	PHED	"Best fit"	2.0
	Inhalation	No Respirator	PHED	"Best fit"	1.2
		PF5 (C)	PHED	"Best fit"	0.24
		PF10 (D)	PHED	"Best fit"	0.12
		Engineering control (Enclosed Cab)	PHED	"Best fit"	0.22
Applicator, Granules by Hand	Dermal	Single layer, no gloves (A)	PHED	"Best fit"	104000
		Single layer, gloves	PHED	"Best fit"	71000
		Double layer, gloves (B)	PHED	"Best fit"	40280
	Inhalation	No Respirator	PHED	"Best fit"	470
		PF5 (C)	PHED	"Best fit"	94
		PF10 (D)	PHED	"Best fit"	47
Applicator, Paintbrush/roller	Dermal	Single layer, no gloves	PHED	"Best fit"	180000
		Single layer, gloves (E)	PHED	"Best fit"	24000
		Double layer, gloves (B, E)	PHED	"Best fit"	22000
	Inhalation	No Respirator	PHED	"Best fit"	280
		PF5 (C)	PHED	"Best fit"	56
		PF10 (D)	PHED	"Best fit"	28
Applicator, Airless Sprayer	Dermal	Single layer, no gloves	PHED / MRID 43600102	Mean	42600
		Single layer, gloves (E)	PHED / MRID 43600102	Mean	11700

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Exposure Scenario **(Activity, Equipment, Formulation, Site, etc.)[1]**		**Exposure Route**	**Personal Protective Equipment (PPE) Level[2]**	**Data Source[3]**	**Statistic**	**Unit Exposure (µg/lb ai)**
			Double layer, gloves (B, E)	PHED	Mean	10600
				MRID 43600102		
		Inhalation	No Respirator	PHED	Mean	560
				MRID 43600102		
			PF5 (C)	PHED	Mean	112
				MRID 43600102		
			PF10 (D)	PHED	Mean	56
				MRID 43600102		
Flagger	Liquids	Dermal	Single layer, no gloves	PHED	"Best fit"	11
			Single layer, gloves	PHED	"Best fit"	12
			Double layer, gloves (B)	PHED	"Best fit"	10.6
		Inhalation	No Respirator	PHED	"Best fit"	0.35
			PF5 (C)	PHED	"Best fit"	0.07
			PF10 (D)	PHED	"Best fit"	0.04
	Granules	Dermal	Single layer, no gloves (F)	PHED	"Best fit"	2.75
			Single layer, gloves (E, F)	PHED	"Best fit"	2.73
			Double layer, gloves (E, G)	PHED	"Best fit"	1.59
		Inhalation	No Respirator	PHED	"Best fit"	0.15
			PF5 (C)	PHED	"Best fit"	0.03
			PF10 (D)	PHED	"Best fit"	0.02
Loader / Applicator, Belly Grinder		Dermal	Single layer, no gloves	PHED	"Best fit"	10000
			Single layer, gloves	PHED	"Best fit"	9300
			Double layer, gloves (B)	PHED	"Best fit"	5700
		Inhalation	No Respirator	PHED	"Best fit"	62
			PF5 (C)	PHED	"Best fit"	12.4
			PF10 (D)	PHED	"Best fit"	6.2
Loader / Applicator, "Push-type" Rotary Spreader		Dermal	Single layer, no gloves	ORETF	Mean	440
			Single layer, gloves	ORETF	Mean	240
			Double layer, gloves (B)	ORETF	Mean	130
		Inhalation	No Respirator	ORETF	Mean	10
			PF5 (C)	ORETF	Mean	2.0
			PF10 (D)	ORETF	Mean	1.0
Mixer / Loader / Applicator, Manually-pressurized Handwand	Greenhouses, Wildlife management, Nurseries, Landscaping, Industrial/Commercial areas, Poultry/livestock houses,	Dermal	Single layer, no gloves	PHED	"Best fit"	100000
			Single layer, gloves	PHED	"Best fit"	430
			Double layer, gloves (B)	PHED	"Best fit"	365
		Inhalation	No Respirator	PHED	"Best fit"	30
			PF5 (C)	PHED	"Best fit"	6.0

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Exposure Scenario **(Activity, Equipment, Formulation, Site, etc.)[1]**			**Exposure Route**	**Personal Protective Equipment (PPE) Level[2]**	**Data Source[3]**	**Statistic**	**Unit Exposure (µg/lb ai)**

Exposure Scenario			Exposure Route	Personal Protective Equipment (PPE) Level[2]	Data Source[3]	Statistic	Unit Exposure (µg/lb ai)
		Animal treatments, Outdoor residential areas, Interior landscaping, Aquatic areas, Structural		PF10 (D)	PHED	"Best fit"	3.0
		Food handling establishments, Warehouses, Residential Living Spaces, Childcare centers/schools	Dermal	Single layer, no gloves (A)	PHED	"Best fit"	29000
				Single layer, gloves	PHED	"Best fit"	8600
				Double layer, gloves (B)	PHED	"Best fit"	6200
			Inhalation	No Respirator	PHED	"Best fit"	1100
				PF5 (C)	PHED	"Best fit"	220
				PF10 (D)	PHED	"Best fit"	110
Mixer / Loader / Applicator, Backpack Sprayer	General Broadcast/Foliar Applications	Poultry/Livestock houses, Industrial/Commercial areas	Dermal	Single layer, no gloves (A)	PHED	"Best fit"	2510
				Single layer, gloves	PHED	"Best fit"	2500
				Double layer, gloves (B)	PHED	"Best fit"	1600
			Inhalation	No Respirator	PHED	"Best fit"	30
				PF5 (C)	PHED	"Best fit"	6.0
				PF10 (D)	PHED	"Best fit"	3.0
		Greenhouses, Nurseries, Landscaping, Christmas Tree Farms	Dermal	Single layer, no gloves (A)	AHETF	Mean	13200
				Single layer, gloves	AHETF	Mean	11200
				Double layer, gloves (B)	AHETF	Mean	6230
			Inhalation	No Respirator	AHETF	Mean	140
				PF5 (C)	AHETF	Mean	28
				PF10 (D)	AHETF	Mean	14
		Wildlife management, Rights-of-way, Forestry, Landscaping (turf), Outdoor residential areas, Aquatic areas[4]	Dermal	Single layer, no gloves (A)	MRID 44339801	Mean	8260
				Single layer, gloves	MRID 44339801	Mean	8260
				Double layer, gloves (B)	MRID 44339801	Mean	4120
			Inhalation	No Respirator	MRID 44339801	Mean	2.58
				PF5 (C)	MRID 44339801	Mean	0.516
				PF10 (D)	MRID 44339801	Mean	0.258
	Ground/Soil-directed (e.g., drench treatments, herbicides in orchards, vineyards, and tree farms)[4]		Dermal	Single layer, no gloves (A)	MRID 44339801	Mean	8260
				Single layer, gloves	MRID 44339801	Mean	8260
				Double layer, gloves (B)	MRID 44339801	Mean	4120
			Inhalation	No Respirator	MRID 44339801	Mean	2.58
				PF5 (C)	MRID 44339801	Mean	0.516
				PF10 (D)	MRID 44339801	Mean	0.258
	Granule formulation applications		Dermal	Single layer, no gloves (A)	MRID 45167201	Mean	155
				Single layer, gloves	MRID 45167201	Mean	144
				Double layer, gloves (B)	MRID 45167201	Mean	72.6

Exposure Scenario (Activity, Equipment, Formulation, Site, etc.)[1]			Exposure Route	Personal Protective Equipment (PPE) Level[2]	Data Source[3]	Statistic	Unit Exposure (µg/lb ai)
Mixer / Loader / Applicator, Mechanically-pressurized Handgun Sprayer	Orchards, Vineyards, Specialty Agricultural Crops, Rights-of-way, Nurseries, Landscaping (non-turf), Industrial/Commercial areas, Aquatic areas		Inhalation	No Respirator	MRID 45250702	Mean	23.8
					MRID 45167201		
				PF5 (C)	MRID 45250702	Mean	4.76
					MRID 45167201		
				PF10 (D)	MRID 45250702	Mean	2.38
					MRID 45167201		
		General Broadcast/Foliar Applications	Dermal	Single layer, no gloves	PHED	"Best fit"	1300
				Single layer, gloves	PHED	"Best fit"	390
				Double layer, gloves (B)	PHED	"Best fit"	290
			Inhalation	No Respirator	PHED	"Best fit"	3.9
				PF5 (C)	PHED	"Best fit"	0.78
				PF10 (D)	PHED	"Best fit"	0.39
		Drench/Soil-directed Applications	All formulations, except wettable powders	Dermal	Single layer, no gloves	PHED	"Best fit"	1300
					Single layer, gloves	PHED	"Best fit"	390
					Double layer, gloves (B)	PHED	"Best fit"	290
				Inhalation	No Respirator	PHED	"Best fit"	3.9
					PF5 (C)	PHED	"Best fit"	0.78
					PF10 (D)	PHED	"Best fit"	0.39
			Wettable Powders	Dermal	Single layer, no gloves (A)	MRID 45773201	Mean	4310
					Single layer, gloves	MRID 45773201	Mean	4310
					Double layer, gloves (B)	MRID 45773201	Mean	2160
				Inhalation	No Respirator	MRID 45773201	Mean	3931
					PF5 (C)	MRID 45773201	Mean	786
					PF10 (D)	MRID 45773201	Mean	393
	Structural, Warehouses, Poultry/livestock houses		Dermal	Single layer, no gloves	PHED	"Best fit"	1800
				Single layer, gloves	PHED	"Best fit"	640
				Double layer, gloves (B)	PHED	"Best fit"	365
			Inhalation	No Respirator	PHED	"Best fit"	79
				PF5 (C)	PHED	"Best fit"	15.8
				PF10 (D)	PHED	"Best fit"	7.9
	Greenhouses	General Broadcast/Foliar Applications	Dermal	Single layer, no gloves (A)	PHED	"Best fit"	3500
				Single layer, gloves	PHED	"Best fit"	2500
				Double layer, gloves (B)	PHED	"Best fit"	1600
			Inhalation	No Respirator	PHED	"Best fit"	120
				PF5 (C)	PHED	"Best fit"	24
				PF10 (D)	PHED	"Best fit"	12
		Drench/Soil-	All	Dermal	See "General Broadcast/Foliar Applications"			

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	directed Applications	formulations, except wettable powders	Inhalation	See "General Broadcast/Foliar Applications"			
		Wettable Powders	Dermal	Single layer, no gloves (A)	MRID 45773201	Mean	4310
				Single layer, gloves	MRID 45773201	Mean	4310
				Double layer, gloves (B)	MRID 45773201	Mean	2160
			Inhalation	No Respirator	MRID 45773201	Mean	3931
				PF5 (C)	MRID 45773201	Mean	786
				PF10 (D)	MRID 45773201	Mean	393
Turf (lawns, fields, golf courses)		Liquids	Dermal	Single layer, no gloves (A)	ORETF	Mean	1140
				Single layer, gloves	ORETF	Mean	880
				Double layer, gloves (B)	ORETF	Mean	450
			Inhalation	No Respirator	ORETF	Mean	1.9
				PF5 (C)	ORETF	Mean	0.38
				PF10 (D)	ORETF	Mean	0.19
		Water-dispersible Granules	Dermal	Single layer, no gloves (A)	ORETF	Mean	1960
				Single layer, gloves	ORETF	Mean	1400
				Double layer, gloves (B)	ORETF	Mean	740
			Inhalation	No Respirator	ORETF	Mean	42
				PF5 (C)	ORETF	Mean	8.40
				PF10 (D)	ORETF	Mean	4.20
		Wettable Powders	Dermal	Single layer, no gloves (A)	ORETF	Mean	1650
				Single layer, gloves	ORETF	Mean	1210
				Double layer, gloves (B)	ORETF	Mean	630
			Inhalation	No Respirator	ORETF	Mean	250
				PF5 (C)	ORETF	Mean	50
				PF10 (D)	ORETF	Mean	25
		Water-soluble Packets	Dermal	Single layer, no gloves (A)	ORETF	Mean	1350
				Single layer, gloves	ORETF	Mean	855
				Double layer, gloves (B)	ORETF	Mean	458
			Inhalation	No Respirator	ORETF	Mean	18
				PF5 (C)	ORETF	Mean	0.38
				PF10 (D)	ORETF	Mean	0.19
Applicator, Termiticide Injection			Dermal	Single layer, no gloves (A)	PHED	"Best fit"	1300
				Single layer, gloves	PHED	"Best fit"	360
				Double layer, gloves (B)	PHED	"Best fit"	250

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			Inhalation	No Respirator	PHED	"Best fit"	2.2
				PF5 (C)	PHED	"Best fit"	0.44
				PF10 (D)	PHED	"Best fit"	0.22
Agricultural/Non-agricultural (pet) Treatments	Pour-on		Dermal	Single layer, no gloves (A)	AHETF	Mean	220
				Single layer, gloves	AHETF	Mean	37.6
				Double layer, gloves (B)	AHETF	Mean	29.1
			Inhalation	No Respirator	AHETF	Mean	0.219
				PF5 (C)	AHETF	Mean	0.044
				PF10 (D)	AHETF	Mean	0.022
	Back rubber		Dermal	Single layer, no gloves (A)	AHETF	Mean	220
				Single layer, gloves	AHETF	Mean	37.6
				Double layer, gloves (B)	AHETF	Mean	29.1
			Inhalation	No Respirator	AHETF	Mean	0.219
				PF5 (C)	AHETF	Mean	0.044
				PF10 (D)	AHETF	Mean	0.022
	Collar		Dermal	Single layer, no gloves (A)	MRID 44433303	Mean	112000
				Single layer, gloves	MRID 44433303	Mean	67800
				Double layer, gloves (B)	MRID 44433303	Mean	42000
			Inhalation	No Respirator	Applicator inhalation exposure expected to be negligible.		
				PF5 (C)			
				PF10 (D)			
	Dip		Dermal	Single layer, no gloves (F)	MRID 45528801	Mean	54300
				Single layer, gloves (F, E)	MRID 45528801	Mean	53400
				Double layer, gloves (G, E)	MRID 45528801	Mean	25600
			Inhalation	No Respirator	MRID 45528801	Mean	26.6
				PF5 (C)	MRID 45528801	Mean	5.33
				PF10 (D)	MRID 45528801	Mean	2.66
	Dust bag		Dermal	Single layer, no gloves (A)	AHETF	Mean	227
				Single layer, gloves	AHETF	Mean	51.6
				Double layer, gloves (B)	AHETF	Mean	41.2
			Inhalation	No Respirator	AHETF	Mean	8.96
				PF5 (C)	AHETF	Mean	1.79
				PF10 (D)	AHETF	Mean	0.90
	Ear tag		Applicator exposure expected to be negligible; chemical-resistant gloves recommended.				
	Feed-through	Liquids	Dermal	Single layer, no gloves (A)	AHETF	Mean	220
				Single layer, gloves	AHETF	Mean	37.6
				Double layer, gloves (B)	AHETF	Mean	29.1

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Exposure Scenario (Activity, Equipment, Formulation, Site, etc.)[1]			**Exposure Route**	**Personal Protective Equipment (PPE) Level[2]**	**Data Source[3]**	**Statistic**	**Unit Exposure (µg/lb ai)**
		Dust	Inhalation	No Respirator	AHETF	Mean	0.219
				PF5 (C)	AHETF	Mean	0.044
				PF10 (D)	AHETF	Mean	0.022
			Dermal	Single layer, no gloves (A)	AHETF	Mean	227
				Single layer, gloves	AHETF	Mean	51.6
				Double layer, gloves (B)	AHETF	Mean	41.2
			Inhalation	No Respirator	AHETF	Mean	8.96
				PF5 (C)	AHETF	Mean	1.79
				PF10 (D)	AHETF	Mean	0.90
		Shampoo	Dermal	Single layer, no gloves (F)	MRID 44658401	Mean	2098000
				Single layer, gloves (E, F)	MRID 44658401	Mean	2052000
				Double layer, gloves (E, B)	MRID 44658401	Mean	1029000
			Inhalation	No Respirator	MRID 44658401	Mean	292
				PF5 (C)	MRID 44658401	Mean	58.4
				PF10 (D)	MRID 44658401	Mean	29.2
		Sponge	Dermal	Single layer, no gloves (F)	MRID 45528801	Mean	844000
				Single layer, gloves (F, E)	MRID 45528801	Mean	767000
				Double layer, gloves (G, E)	MRID 45528801	Mean	386000
			Inhalation	No Respirator	MRID 45528801	Mean	208
				PF5 (C)	MRID 45528801	Mean	41.6
				PF10 (D)	MRID 45528801	Mean	20.8
		Spot-on	Dermal	Single layer, no gloves (A)	MRID 44433303	Mean	112000
				Single layer, gloves	MRID 44433303	Mean	67800
				Double layer, gloves (B)	MRID 44433303	Mean	42000
			Inhalation	No Respirator	Applicator inhalation exposure expected to be negligible.		
				PF5 (C)			
				PF10 (D)			
Loader / applicator, Bulb duster			Dermal	Single layer, no gloves	ORETF	Mean	166000
				Single layer, gloves (E)	ORETF	Mean	24700
				Double layer, gloves (E, B)	ORETF	Mean	20600
			Inhalation	No Respirator	ORETF	Mean	1690
				PF5 (C)	ORETF	Mean	338
				PF10 (D)	ORETF	Mean	169
Loader / applicator, Cup			Dermal	Single layer, no gloves	MRID 45333401	Mean	112
				Single layer, gloves (E)	MRID 45333401	Mean	11.2
				Double layer, gloves (E)	MRID 45333401	Mean	11.2
			Inhalation	No Respirator	MRID 45333401	Mean	12.5

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			PF5 (C)	MRID 45333401	Mean	2.51
			PF10 (D)	MRID 45333401	Mean	1.25
Loader / applicator, Spoon		Dermal	Single layer, no gloves (A, F)	MRID 45250702	Mean	4170
			Single layer, gloves (F)	MRID 45250702	Mean	3030
			Double layer, gloves (A, G)	MRID 45250702	Mean	1580
		Inhalation	No Respirator	MRID 45250702	Mean	121
			PF5 (C)	MRID 45250702	Mean	24.3
			PF10 (D)	MRID 45250702	Mean	12.1
Single-use Injection (gels/pastes)		Applicator exposure expected to be negligible.				
Loader / applicator, Plunger duster		Dermal	Single layer, no gloves	ORETF	Mean	166000
			Single layer, gloves (E)	ORETF	Mean	24700
			Double layer, gloves (E, B)	ORETF	Mean	20600
		Inhalation	No Respirator	ORETF	Mean	1690
			PF5 (C)	ORETF	Mean	338
			PF10 (D)	ORETF	Mean	169
Applicator, Total-release Fogger		Applicator exposure expected to be negligible.				
Applicator, Trigger-spray Bottle	All application sites, except animals	Dermal	Single layer, no gloves (A)	ORETF	Mean	3660
			Single layer, gloves	ORETF	Mean	1800
			Double layer, gloves (B)	ORETF	Mean	1110
		Inhalation	No Respirator	ORETF / MRID 41054701 / MRID 44739301	Mean	61.2
			PF5 (C)	ORETF / MRID 41054701 / MRID 44739301	Mean	12.2
			PF10 (D)	ORETF / MRID 41054701 / MRID 44739301	Mean	6.12
	Animal treatments	Dermal	Single layer, no gloves (F)	MRID 44433302	Mean	544000
			Single layer, gloves (F, E)	MRID 44433302	Mean	503000
			Double layer, gloves (G, E)	MRID 44433302	Mean	273000
		Inhalation	No Respirator	MRID 44433302	Mean	3300
			PF5 (C)	MRID 44433302	Mean	654
			PF10 (D)	MRID 44433302	Mean	327
Applicator, Shaker can	Granules	Dermal	Single layer, no gloves	MRID 45333401	Mean	112
			Single layer, gloves (E)	MRID 45333401	Mean	11.2
			Double layer, gloves (E)	MRID 45333401	Mean	11.2

USEPA / Office of Pesticide Programs / Health Effects Division						
Occupational Pesticide Handler Unit Exposure Surrogate Reference Table						
Exposure Scenario (Activity, Equipment, Formulation, Site, etc.)[1]		**Exposure Route**	**Personal Protective Equipment (PPE) Level[2]**	**Data Source[3]**	**Statistic**	**Unit Exposure (µg/lb ai)**
Dusts		Inhalation	No Respirator	MRID 45333401	Mean	12.5
			PF5 (C)	MRID 45333401	Mean	2.51
			PF10 (D)	MRID 45333401	Mean	1.25
		Dermal	Single layer, no gloves	MRID 44439901	Mean	4042000
				MRID 45519601		
			Single layer, gloves	MRID 44439901	Mean	110000
				MRID 45519601		
			Double layer, gloves (B)	MRID 44439901	Mean	72600
				MRID 45519601		
		Inhalation	No Respirator	MRID 44439901	Mean	17500
				MRID 45519601		
			PF5 (C)	MRID 44439901	Mean	3500
				MRID 45519601		
			PF10 (D)	MRID 44439901	Mean	1750
				MRID 45519601		
Trap/bait station	Re-fillable	Dermal	Single layer, no gloves (A)	PHED	"Best fit"	104000
			Single layer, gloves	PHED	"Best fit"	71000
			Double layer, gloves (B)	PHED	"Best fit"	40280
		Inhalation	No Respirator	PHED	"Best fit"	470
			PF5 (C)	PHED	"Best fit"	94
			PF10 (D)	PHED	"Best fit"	47
	Single-use	Applicator exposure expected to be negligible.				

[1] If the description of the scenario is silent on specific equipment, sites, formulations, etc., the data is applicable to all potential applications for that scenario.

[2] Single layer = long-sleeve shirt, long pants, shoes plus socks. Double layer = "coveralls" in addition to single layer.

Exposure monitoring data representing all levels of PPE for all scenarios is unavailable. In order to represent different PPE levels, exposure values are calculated using assumptions for the protection afforded by additional layers of clothing, chemical-resistant gloves, or respirators. Exposure assessors should be mindful of the uncertainties that this convention introduces into the overall calculations. In all cases, estimates based on direct measurements representing the PPE-level specified are the most reliable. If a scenario uses PPE calculation assumptions, they are identified in the table with one or more of the following notations:

(A) "No glove" hand exposure back-calculated from available "gloved hand" exposure data by multiplying by 10 (i.e., chemical-resistant gloves are assumed to reduce hand exposure by 90%).
(B) "Double layer" body exposure calculated from available "single layer" body exposure data by dividing by 2 (i.e., an additional layer of clothing is assumed to reduce body exposure by 50%).
(C) "PF5" respirator exposure calculated from available "no respirator" exposure data by dividing by 5 (i.e., a PF5 respirator is assumed to reduce inhalation exposure by 80%).
(D) "PF10" respirator exposure calculated from available "no respirator" exposure data by dividing by 10 (i.e., a PF10 respirator is assumed to reduce inhalation exposure by 90%).
(E) "Gloved" hand exposure calculated from available "no glove" hand exposure data by dividing by 10 (i.e., chemical-resistant gloves are assumed to reduce hand exposure by 90%).
(F) "Single layer" body exposure calculated from available "total deposition" body exposure data by dividing by 2 (i.e., an additional layer of clothing is assumed to reduce body exposure by 50%).
(G) "Double layer" body exposure calculated from available "total deposition" body exposure data by dividing by 4 (i.e., two layers of clothing are assumed to reduce body exposure by 75%).

If a scenario does not have one of these notations, the data underlying the recommended values is a direct match for the indicated level of PPE.

[3] PHED = Pesticide Handler Exposure Database; AHETF = Agricultural Handler Exposure Task Force; ORETF = Outdoor Residential Exposure Task Force; MRID = Master Record Identification (#).

[4] Due to the effect that the back-calculation from "gloved hands" to represent "non-gloved hands" has on distributional variability and parametric estimates, no adjustment was made to hand measurements to

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Occupational Pesticide Handler Unit Exposure Surrogate Reference Table						
Exposure Scenario **(Activity, Equipment, Formulation, Site, etc.)[1]**	**Exposure Route**	**Personal Protective Equipment (PPE) Level[2]**	**Data Source[3]**	**Statistic**	**Unit Exposure (μg/lb ai)**
represent unit exposures for "single layer, no gloves". That is, the unit exposure for "single layer, gloves" is also assigned to "single layer, no gloves".						

Attachment 1
Documentation of Revisions

Date	Documentation of Revisions (as of March 2012)

Apr2011	• Original version, modeled based on "PHED Surrogate Guide"
	• Reflects move from data from PHED to AHETF for following scenarios
	    o Open Cab Groundboom
	    o Open Mix/Load Liquids
	    o Open Mix/Load Dry Flowable
	• Published EPA webpage on occupational pesticide handler exposure, including link to reference table

May2011	• Replaced PHED values for "Closed Cab Airblast" with those from AHETF
Jun2011	• Replaced PHED values for "Open Cab Airblast" with those from AHETF • Corrected unit exposure for "Mixer / Loader / Applicator, Low-pressure Handwand, Wettable Powder, Double layer, gloves" from 620 µg/lb ai to 6200 µg/lb ai

Sep2011	• Reflects overhaul of exposure scenario assignment of available surrogate data
	    o New scenarios added (e.g., pet/animal treatments)
	    o Scenario subsets added (e.g., power handgun site subsets)
	    o Available individual proprietary studies assigned
	• Footnotes edited
	• Orientation changed to landscape to accommodate scenario additions

Mar2012	• Corrected "Dip" and "Sponge" inhalation unit exposures to reflect use of ½ LOD without correction for field fortification per standard policy • Corrected "Mixing / Loading Liquids" inhalation unit exposures to 2 significant figures • Removed PPE footnote notation "(H)" since that does not apply to any scenario • Corrected PPE notations for "Spoon" scenario to reflect exposure monitoring of "total deposition with chemical-resistant gloves" • For "Mechanically-pressurized Handgun Sprayer", added "Specialty Agricultural Crops" to a sub-set category • Added "Documentation of Revisions" as an attachment
Mar2013	• Aerial Applicator scenario: PHED replaced with data from the AHETF • Re-assigned MRID45773201 to drench/soil-directed applications of wettable powders only • Footnote (G) typographical correction: "100%" corrected to "75%" (unit exposures are unchanged)