APPENDICES

Air Toxics Hot Spots Program Risk Assessment Guidelines

The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments

SRP Draft

September 2014

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Appendix A:

Air Toxics Hot Spots Program

List of Substances*

*The List of Substances presented in Appendix A is periodically updated by the California Air Resources Board (ARB). The most recent update at the time of preparation of this document was August 27, 2007. Future updates may be obtained from the ARB web site (http://www.arb.ca.gov/ab2588/2588guid.htm).

Appendix A-I

Substances For Which

Emissions Must Be Quantified

DO NOT CITE OR QUOTE

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	**Substance Name** [Note 2]	**Add Date** [Note 3]	**Carcinogen** [Note 4]	**Applicable Degree of Accuracy (lb/yr)** [Note 5]	**Source List(s)** [Note 6]							**Other Note(s)**
75070	Acetaldehyde		c	20	1	2	3	4				
60355	Acetamide		c	2	1	2	3	4				
75058	Acetonitrile	06/91		200	1	2						
98862	Acetophenone	06/91		100	1	2						
53963	2-Acetylaminofluorene [PAH-Derivative, POM]		c	100	1	2		4	5			
107028	Acrolein			0.05	1	2						
79061	Acrylamide		c	0.01	1	2	3	4				
79107	Acrylic acid	06/91		5	1	2						
107131	Acrylonitrile		c	0.1	1	2	3	4	5			
107051	Allyl chloride		c	5	1	2		4				
7429905	Aluminum	06/91		100	1							
1344281	Aluminum oxide (fibrous forms)	06/91		100							7	
117793	2-Aminoanthraquinone [PAH-Derivative, POM]		c	5	1	2		4	5			
92671	4-Aminobiphenyl [POM]		c	100	1	2	3	4	5			
61825	Amitrole		c	0.1			3	4	5			
7664417	Ammonia			200	1	2						
6484522	Ammonium nitrate	06/91		100	1							
7783202	Ammonium sulfate	06/91		100	1							
62533	Aniline	09/90	c	5	1	2		4				
90040	o-Anisidine		c	100	1	2	3	4	5			
-	Anthracene [PAH, POM], (see PAH)											
7440360	Antimony	06/91		1							7	
*	Antimony compounds including but not limited to:	06/91		1	1	2						[7]
1309644	Antimony trioxide	09/90	c	1	1	2	3	4				[7]
7440382	Arsenic		c	0.01	1	2	3	4	5			
1016	Arsenic compounds (inorganic) including but not limited to:		c	0.01	1	2	3	4	5			[7]
7784421	Arsine			0.01	1	2					7	[7]
1017	Arsenic compounds (other than inorganic)	06/91		0.1	1							[7]
-	Asbestos (see Mineral fibers)											
7440393	Barium	06/91		1							7	
*	Barium Compounds	06/91		1	1							[7]

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-	Benz[a]anthracene [PAH, POM], (see PAH)											
71432	Benzene		c	2	1	2	3	4	5			
92875	Benzidine (and its salts) [POM]		c	0.0001	1	2	3	4	5			
1020	Benzidine-based dyes [POM] including but not limited to:		c	0.0001	1	2	3					
1937377	Direct Black 38 [PAH-Derivative, POM]		c	0.0001	1	2		4	5			
2602462	Direct Blue 6 [PAH-Derivative, POM]		c	0.0001	1	2		4	5			
16071866	Direct Brown 95 (technical grade) [POM]	09/89	c	0.0001	1	2		4				
-	Benzo[a]pyrene [PAH, POM], (see PAH)											
-	Benzo[b]fluoranthene [PAH, POM], (see PAH)											
271896	Benzofuran	06/91	c	100				4				
98077	Benzoic trichloride {Benzotrichloride}		c	10	1	2		4	5			
-	Benzo[j]fluoranthene [PAH, POM] (see PAH)											
-	Benzo[k]fluoranthene [PAH, POM] (see PAH)											
98884	Benzoyl chloride	06/91		100	1							
94360	Benzoyl peroxide	06/91		100							7	
100447	Benzyl chloride		c	1	1	2		4				
7440417	Beryllium		c	0.001	1	2	3	4	5			
*	Beryllium compounds	09/89	c	0.001	1	2	3	4	5			[7]
92524	Biphenyl [POM]	06/91		0.5	1	2						
111444	Bis(2-chloroethyl) ether {DCEE}	09/89	c	0.05	1	2		4				
542881	Bis(chloromethyl) ether		c	0.001	1	2	3	4	5			
103231	Bis(2-ethylhexyl) adipate	06/91		100	1							
7726956	Bromine			0.5		2						
*	Bromine compounds (inorganic) including but not limited to:			100	1	2						[7]
7789302	Bromine pentafluoride	11/06		100							7	
10035106	Hydrogen bromide	11/06		20							7	
7758012	Potassium bromate			0.1	1		3	4				[7]
75252	Bromoform	06/91		100	1	2		4				
106990	1,3-Butadiene		c	0.1	1	2	3	4	5			
540885	t-Butyl acetate	11/06		200							7	

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141322	Butyl acrylate	06/91		100	1							
71363	n-Butyl alcohol	06/91		100	1							
78922	sec-Butyl alcohol	06/91		100	1							
75650	tert-Butyl alcohol	06/91		100	1							
85687	Butyl benzyl phthalate	06/91		100	1							
7440439	Cadmium		c	0.01	1	2	3	4	5			
*	Cadmium compounds		c	0.01	1	2	3	4	5			[7]
156627	Calcium cyanamide	06/91		100	1	2						
105602	Caprolactam	06/91		100	1	2						
2425061	Captafol	09/89	c	100				4				
133062	Captan	09/90	c	100	1	2		4				
63252	Carbaryl [PAH-Derivative, POM]	06/91		100	1	2						
1050	Carbon black extracts		c	2	1		3	4				
75150	Carbon disulfide	09/89		200	1	2		4				
56235	Carbon tetrachloride		c	1	1	2	3	4	5			
463581	Carbonyl sulfide	06/91		100	1	2						
1055	Carrageenan (degraded)		c	100			3	4				
120809	Catechol	06/91		100	1	2						
133904	Chloramben	06/91		100	1	2						
57749	Chlordane	09/89	c	10	1	2		4				
108171262	Chlorinated paraffins (average chain length, C12; approximately 60% Chlorine by weight)	09/89	c	2			3	4	5			
7782505	Chlorine			0.5	1	2						
10049044	Chlorine dioxide	06/91		1	1							
79118	Chloroacetic acid	06/91		100	1	2						
532274	2-Chloroacetophenone	06/91		0.1	1	2						
106478	p-Chloroaniline	07/96	c	100				4			7	
1058	Chlorobenzenes including but not limited to:	06/91		100	1							
108907	Chlorobenzene			200	1	2						
25321226	Dichlorobenzenes (mixed isomers) including:	06/91		100	1						7	
95501	1,2-Dichlorobenzene	06/91		200	1						7	
541731	1,3-Dichlorobenzene	06/91		100	1						7	

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106467	p-Dichlorobenzene {1,4-Dichlorobenzene}		c	5	1	2	3		5			
120821	1,2,4-Trichlorobenzene	06/91		200	1	2						
510156	Chlorobenzilate [POM] {Ethyl-4,4'-dichlorobenzilate}	09/90	c	100	1	2		4				
67663	Chloroform		c	10	1	2	3	4	5			
107302	Chloromethyl methyl ether (technical grade)		c	100	1	2		4	5			
1060	Chlorophenols including but not limited to:		c	100	1		3					
95578	2-Chlorophenol	11/06		10	1		3					
120832	2,4-Dichlorophenol	06/91	c	100	1						7	
87865	Pentachlorophenol	09/90	c	10	1	2		4				
25167833	Tetrachlorophenols including but not limited to:	11/06		10							7	
58902	2,3,4,6-Tetrachlorophenol	07/96	c	100	1						7	
95954	2,4,5-Trichlorophenol	06/91	c	100	1	2						
88062	2,4,6-Trichlorophenol		c	2	1	2		4				
95830	4-Chloro-o-phenylenediamine		c	10			3	4	5			
76062	Chloropicrin			2							7	
126998	Chloroprene			5	1	2						
95692	p-Chloro-o-toluidine		c	0.5			3	4				
7440473	Chromium	06/91		0.001							7	
*	Chromium compounds (other than hexavalent)	06/91		0.001	1	2						[7]
18540299	Chromium, hexavalent (and compounds) including but not limited to:		c	0.0001	1	2	3	4	5			[7]
10294403	Barium chromate	06/91	c	0.001	1	2			5			[7]
13765190	Calcium chromate	06/91	c	0.001	1	2			5			[7]
1333820	Chromium trioxide	06/91	c	0.0001	1	2			5			[7]
7758976	Lead chromate	06/91	c	0.001	1	2			5			[7]
10588019	Sodium dichromate	06/91	c	0.0001	1	2			5			[7]
7789062	Strontium chromate	06/91	c	0.001	1	2			5			[7]
-	Chrysene [PAH, POM], (see PAH)											
7440484	Cobalt	06/91		0.5							7	
*	Cobalt compounds	06/91		0.5	1	2						[7]
1066	Coke oven emissions		c	0.05	1	2	3	4	5			

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7440508	Copper			0.1		2						
*	Copper compounds	09/89		0.1	1	2						[7]
1070	Creosotes		c	0.05	1		3	4				
120718	p-Cresidine		c	1			3	4	5			
1319773	Cresols (mixtures of) {Cresylic acid} including:			5	1	2						
108394	m-Cresol	06/91		5	1	2						
95487	o-Cresol	06/91		5	1	2						
106445	p-Cresol	06/91		5	1	2						
4170303	Crotonaldehyde	07/96	c	50							7	
98828	Cumene	06/91		200	1	2						
80159	Cumene hydroperoxide	06/91		100	1							
135206	Cupferron		c	0.5				4	5			
57125	Cyanide compounds (inorganic) including but not limited to:	06/91		0.05	1	2						[8]
74908	Hydrocyanic acid			10		2						
110827	Cyclohexane	06/91		200	1							
108930	Cyclohexanol	07/96		200							7	
66819	Cycloheximide			2						6		
	Decabromodiphenyl oxide [POM] (see Polybrominated diphenyl ethers)	06/91										
1075	Dialkylnitrosamines including but not limited to:			0.001	1							
924163	N-Nitrosodi-n-butylamine		c	0.0001	1		3	4	5			
1116547	N-Nitrosodiethanolamine		c	100	1		3	4	5			
55185	N-Nitrosodiethylamine		c	0.001	1		3	4	5			
62759	N-Nitrosodimethylamine		c	0.01	1	2	3	4	5			
621647	N-Nitrosodi-n-propylamine		c	0.01	1		3	4	5			
10595956	N-Nitrosomethylethylamine		c	0.001	1		3	4				
615054	2,4-Diaminoanisole		c	5			3	4				
1078	Diaminotoluenes (mixed isomers) including but not limited to:	09/90	c	100	1			4				
95807	2,4-Diaminotoluene {2,4-Toluene diamine}		c	0.05	1	2	3	4	5			
334883	Diazomethane	06/91	c	5	1	2						
226368	Dibenz[a,h]acridine [POM]		c	0.5	1	2	3	4	5			

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224420	Dibenz[a,j]acridine [POM]		c	0.5	1	2	3	4	5			
-	Dibenz[a,h]anthracene [PAH, POM], (see PAH)											
194592	7H-Dibenzo[c,g]carbazole		c	0.05	1	2	3	4	5			
-	Dibenzo[a,e]pyrene [PAH, POM], (see PAH)											
-	Dibenzo[a,h]pyrene [PAH, POM], (see PAH)											
-	Dibenzo[a,i]pyrene [PAH, POM], (see PAH)											
-	Dibenzo[a,l]pyrene [PAH, POM], (see PAH)											
132649	Dibenzofuran [POM]	06/91		100	1	2						
-	Dibenzofurans (chlorinated) (see Polychlorinated dibenzofurans) [POM]											
96128	1,2-Dibromo-3-chloropropane {DBCP}		c	0.01	1	2	3	4	5			
96139	2,3-Dibromo-1-propanol	07/96	c	50				4				
84742	Dibutyl phthalate	06/91		100	1	2						
-	p-Dichlorobenzene (1,4-Dichlorobenzene) (see Chlorobenzenes)											
91941	3,3'-Dichlorobenzidine [POM]		c	0.1	1	2	3	4	5			
72559	Dichlorodiphenyldichloroethylene {DDE} [POM]	09/89	c	100	1	2		4				
75343	1,1-Dichloroethane {Ethylidene dichloride}	09/90	c	20	1	2		4				
94757	Dichlorophenoxyacetic acid, salts and esters {2,4-D}	06/91		100	1	2						
78875	1,2-Dichloropropane {Propylene dichloride}	09/90	c	20	1	2		4				
542756	1,3-Dichloropropene		c	10	1	2	3	4	5			
62737	Dichlorovos {DDVP}	09/89	c	0.5	1	2		4				
115322	Dicofol [POM]	06/91		100	1	2						
--	Diesel engine exhaust	09/90	c		1		3	4				[9]
9901	Diesel engine exhaust, particulate matter **{**Diesel PM**}**	09/90	c	0.1	1		3	4				[9]
9902	Diesel engine exhaust, total organic gas	09/90	c	10	1		3	4				[9]
#	Diesel fuel (marine)	06/91	c									
111422	Diethanolamine	06/91		20	1	2						
117817	Di(2-ethylhexyl) phthalate {DEHP}		c	20	1	2	3	4	5			
64675	Diethyl sulfate		c	100	1	2	3	4	5			
119904	3,3'-Dimethoxybenzidine [POM]		c	100	1	2	3	4	5			
60117	4-Dimethylaminoazobenzene [POM]		c	0.01	1	2	3	4	5			

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121697	N,N-Dimethylaniline	06/91		200	1	2						
57976	7,12-Dimethylbenz[a]anthracene [PAH-Derivative, POM]	09/90	c	0.0001	1	2		4				
119937	3,3'-Dimethylbenzidine {o-Tolidine} [POM]		c	10	1	2	3	4	5			
79447	Dimethyl carbamoyl chloride		c	100	1	2	3	4	5			
68122	Dimethyl formamide	09/90	c	100	1	2	3					
57147	1,1-Dimethylhydrazine		c	0.1	1	2	3	4	5			
131113	Dimethyl phthalate	06/91		50	1	2						
77781	Dimethyl sulfate		c	0.01	1	2	3	4	5			
534521	4,6-Dinitro-o-cresol (and salts)	06/91		100	1	2						
51285	2,4-Dinitrophenol	06/91		100	1	2						
42397648	1,6-Dinitropyrene [PAH-Derivative, POM]	06/91	c	0.001	1	2	3	4				
42397659	1,8-Dinitropyrene [PAH-Derivative, POM]	06/91	c	0.05	1	2	3	4				
25321146	Dinitrotoluenes (mixed isomers) including but not limited to:	06/91		100							7	
121142	2,4-Dinitrotoluene	09/89	c	0.5	1	2		4				
606202	2,6-Dinitrotoluene	06/91		100							7	
123911	1,4-Dioxane		c	5	1	2	3	4	5			
-	Dioxins (Chlorinated dibenzodioxins) (see Polychlorinated dibenzo-p-dioxins) [POM]											
630933	Diphenylhydantoin [POM]		c	100	1	2		4				
122667	1,2-Diphenylhydrazine {Hydrazobenzene} [POM]		c	100	1	2		4	5			
1090	Environmental Tobacco Smoke		c	2	1		3	4				
106898	Epichlorohydrin		c	2	1	2	3	4	5			
106887	1,2-Epoxybutane	06/91		100	1	2						
1091	Epoxy resins	09/89		100						6		
140885	Ethyl acrylate		c	200	1	2	3	4	5			
100414	Ethyl benzene	06/91		200	1	2						
75003	Ethyl chloride {Chloroethane}			200	1	2		4				
-	Ethyl-4,4'-dichlorobenzilate (see Chlorobenzilate)											
74851	Ethylene	06/91		200							7	
106934	Ethylene dibromide {EDB, 1,2-Dibromoethane}		c	0.5	1		3	4	5	6		
107062	Ethylene dichloride {EDC, 1,2-Dichloroethane}		c	2	1	2	3	4	5			

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107211	Ethylene glycol	06/91		200	1	2						
151564	Ethyleneimine {Aziridine}	06/91		100	1	2						
75218	Ethylene oxide		c	0.5	1	2	3	4	5	6		
96457	Ethylene thiourea		c	2	1	2	3	4	5			
1101	Fluorides and compounds including but not limited to:	09/89		100		2						
7664393	Hydrogen fluoride			50	1	2					7	
1103	Fluorocarbons (brominated)			200						6		[10]
1104	Fluorocarbons (chlorinated) including but not limited to:			200	1					6		[10]
76131	Chlorinated fluorocarbon {CFC-113} {1,1,2-Trichloro-1,2,2-trifluoroethane}			200	1	2				6		
75456	Chlorodifluoromethane {Freon 22}	07/96		200	1					6	7	
75718	Dichlorodifluoromethane {Freon 12}	11/06		200							7	
75434	Dichlorofluoromethane {Freon 21}	07/96		200	1					6	7	
75694	Trichlorofluoromethane {Freon 11}	07/96		200	1					6	7	
50000	Formaldehyde		c	5	1	2	3	4	5	6		
110009	Furan	07/96	c	5				4				
--	Gasoline engine exhaust including but not limited to:	09/89	c				3					[9]
--	Gasoline engine exhaust (condensates & extracts)	06/91	c					4				[9]
9910	Gasoline engine exhaust, particulate matter	09/90	c	100			3	4				[9]
9911	Gasoline engine exhaust, total organic gas	09/90	c	100			3	4				[9]
1110	Gasoline vapors		c	200	1	2	3	4				[11]
111308	Glutaraldehyde			0.1	1					6		
1115	Glycol ethers and their acetates including but not limited to:			100	1	2				6		
111466	Diethylene glycol	09/90		100	1					6		
111966	Diethylene glycol dimethyl ether	09/90		100	1	2				6		
112345	Diethylene glycol monobutyl ether	09/90		100	1	2				6		
111900	Diethylene glycol monoethyl ether	09/90		100	1	2				6		
111773	Diethylene glycol monomethyl ether	09/90		100	1	2				6		
25265718	Dipropylene glycol	09/90		100	1					6		

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34590948	Dipropylene glycol monomethyl ether	09/90		100	1					6		
629141	Ethylene glycol diethyl ether	09/90		100	1	2				6		
110714	Ethylene glycol dimethyl ether	09/90		100	1	2				6		
111762	Ethylene glycol monobutyl ether	09/90		200	1	2				6		
110805	Ethylene glycol monoethyl ether	09/89		50	1	2				6		
111159	Ethylene glycol monoethyl ether acetate	09/90		100	1	2				6		
109864	Ethylene glycol monomethyl ether	09/89		10	1	2				6		
110496	Ethylene glycol monomethyl ether acetate	09/90		200	1	2				6		
2807309	Ethylene glycol monopropyl ether	09/90		100	1	2				6		
107982	Propylene glycol monomethyl ether	09/90		200	1					6		
108656	Propylene glycol monomethyl ether acetate	09/90		100	1					6		
112492	Triethylene glycol dimethyl ether	09/90		100	1	2				6		
76448	Heptachlor	09/89	c	100	1	2		4				
118741	Hexachlorobenzene		c	0.1	1	2	3		5			
87683	Hexachlorobutadiene	06/91		0.1	1	2						
608731	Hexachlorocyclohexanes (mixed or technical grade), including but not limited to:		c	0.05	1		3	4	5			
319846	alpha-Hexachlorocyclohexane	07/96	c	0.1	1		3	4	5		7	
319857	beta-Hexachlorocyclohexane	07/96	c	0.1	1		3	4	5		7	
58899	Lindane {gamma-Hexachlorocyclohexane}	09/90	c	0.1	1	2		4				
77474	Hexachlorocyclopentadiene			2	1	2						
67721	Hexachloroethane	09/90	c	200	1	2		4				
680319	Hexamethylphosphoramide		c	100	1	2	3	4	5			
110543	Hexane	06/91		200	1	2						
302012	Hydrazine		c	0.01	1	2	3	4	5			
7647010	Hydrochloric acid			20	1	2						
-	Hydrocyanic acid (see Cyanide compounds)											
7783064	Hydrogen sulfide			5	1	2						
123319	Hydroquinone	06/91		100	1	2						
-	Indeno[1,2,3-cd]pyrene [PAH, POM], (see PAH)											
13463406	Iron pentacarbonyl	07/96		5							7	
1125	Isocyanates including but not limited to:			0.05						6		

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Applicable Degree of Accuracy (lb/yr) [Note 5]	Source List(s) [Note 6]							Other Note(s)
822060	Hexamethylene-1,6-diisocyanate	06/91		0.05	1	2						
101688	Methylene diphenyl diisocyanate {MDI} [POM]	06/91		0.1	1	2						
624839	Methyl isocyanate			1	1	2						
-	Toluene-2,4-diisocyanate (see Toluene diisocyanates)											
-	Toluene-2,6-diisocyanate (see Toluene diisocyanates)											
78591	Isophorone	06/91		200	1	2						
78795	Isoprene, except from vegetative emission sources	07/96	c	200			3					
67630	Isopropyl alcohol	06/91		200	1							
80057	4,4'-Isopropylidenediphenol [POM]	06/91		100	1	2						
7439921	Lead		c	0.5	1			4		6		
1128	Lead compounds (inorganic) including but not limited to:		c	0.5	1		3					[7]
301042	Lead acetate		c	1	1	2		4	5			[7] [12]
-	Lead chromate (see Chromium, hexalent)											
7446277	Lead phosphate		c	2	1			4	5			[7]
1335326	Lead subacetate	09/90	c	2	1	2		4				[7] [12]
1129	Lead compounds (other than inorganic)	06/91		5	1	2						[7]
108316	Maleic anhydride			0.5	1	2						
7439965	Manganese			0.1	1	2						
*	Manganese compounds	09/89		0.1	1	2						[7]
7439976	Mercury			1	1	2		4		6		
*	Mercury compounds including but not limited to:	09/89		1	1	2		4				[7]
7487947	Mercuric chloride			1		2						[7]
593748	Methyl mercury {Dimethylmercury}			1		2						[7]
67561	Methanol			200	1	2						
72435	Methoxychlor [POM]	06/91		100	1	2						
75558	2-Methylaziridine {1,2-Propyleneimine}		c	100	1	2	3	4				
74839	Methyl bromide {Bromomethane}			20	1	2				6		
74873	Methyl chloride {Chloromethane}	06/91		20	1	2						
71556	Methyl chloroform {1,1,1-Trichloroethane}			200	1	2				6		
56495	3-Methylcholanthrene [PAH-Derivative, POM]	09/90	c	0.001	1	2		4				

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Applicable Degree of Accuracy (lb/yr) [Note 5]	Source List(s) [Note 6]							Other Note(s)
3697243	5-Methylchrysene [PAH-Derivative, POM]		c	0.05	1	2	3	4	5			
101144	4,4'-Methylene bis(2-chloroaniline) {MOCA} [POM]		c	0.1	1	2	3	4	5			
75092	Methylene chloride {Dichloromethane}		c	50	1	2	3	4	5	6		
101779	4,4'-Methylenedianiline (and its dichloride) [POM]		c	0.1	1	2	3	4	5			
78933	Methyl ethyl ketone {2-Butanone}	06/91		200	1	2						
60344	Methyl hydrazine	06/91		100	1	2						
74884	Methyl iodide {Iodomethane}		c	100	1	2		4	5			
108101	Methyl isobutyl ketone {Hexone}	06/91		20	1	2						
75865	2-Methyllactonitrile {Acetone cyanohydrin}	07/96		50							7	
80626	Methyl methacrylate			200	1	2				6		
109068	2-Methylpyridine	07/96		100							7	
1634044	Methyl tert-butyl ether	06/91		200	1	2						
90948	Michler's ketone [POM]		c	0.1	1	2		4	5			
1136	Mineral fibers (fine mineral fibers which are man-made, and are airborne particles of a respirable size greater than 5 microns in length, less than or equal to 3.5 microns in diameter, with a length to diameter ratio of 3:1) including but not limited to:	06/91	c	100	1	2					7	
1056	Ceramic fibers	09/89	c	100	1	2	3	4				
1111	Glasswool fibers	09/89	c	100	1	2	3	4				
1168	Rockwool	09/89	c	100	1	2	3					
1181	Slagwool	09/89	c	100	1	2	3					
1135	Mineral fibers (other than man-made) including but not limited to:			100		2					7	
1332214	Asbestos		c	0.0001	1	2	3	4	5			
12510428	Erionite		c	100		2	3	4				
1190	Talc containing asbestiform fibers		c	100		2	3	4				
1313275	Molybdenum trioxide	06/91		100	1							
-	Naphhthalene [PAH, POM], (see PAH)											
7440020	Nickel		c	0.1	1	2	3	4	5			
*	Nickel compounds including but not limited to:		c	1	1	2	3	4	5			[7]
373024	Nickel acetate	06/91	c	0.1	1	2			5			[7]
3333673	Nickel carbonate	06/91	c	0.1	1	2			5			[7]

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	**Substance Name** [Note 2]	**Add Date** [Note 3]	**Carcinogen** [Note 4]	**Applicable Degree of Accuracy (lb/yr)** [Note 5]	**Source List(s)** [Note 6]							**Other Note(s)**
13463393	Nickel carbonyl		c	0.1	1	2		4	5			[7]
12054487	Nickel hydroxide	06/91	c	0.1	1	2			5			[7]
1271289	Nickelocene	06/91	c	0.1	1	2			5			[7]
1313991	Nickel oxide	06/91	c	0.1	1	2			5			[7]
12035722	Nickel subsulfide		c	0.1	1	2		4	5			[7]
1146	Nickel refinery dust from the pyrometallurgical process	09/89	c	0.1				4				
7697372	Nitric acid	06/91		50	1							
139139	Nitrilotriacetic acid		c	100	1			4	5			
602879	5-Nitroacenaphthene [PAH-Derivative, POM]	11/06	c	2	1	2	3	4				
98953	Nitrobenzene			0.5	1	2						
92933	4-Nitrobiphenyl [POM]	09/89	c	100	1	2		4				
7496028	6-Nitrochrysene [PAH-Derivative, POM]	06/91	c	0.001	1	2	3	4				
607578	2-Nitrofluorene [PAH-Derivative, POM]	06/91	c	5	1	2	3	4				
302705	Nitrogen mustard N-oxide		c	0.05			3	4				
100027	4-Nitrophenol	06/91		100	1	2						
79469	2-Nitropropane		c	0.01	1	2	3	4	5			
5522430	1-Nitropyrene [PAH-Derivative, POM]	06/91	c	0.5	1	2	3	4				
57835924	4-Nitropyrene [PAH-Derivative, POM]	11/06	c	1				4				
86306	N-Nitrosodiphenylamine	11/06	c	10	1	2	3	4				
156105	p-Nitrosodiphenylamine [POM]		c	5	1	2		4	5			
684935	N-Nitroso-N-methylurea		c	100	1	2		4	5			
59892	N-Nitrosomorpholine		c	0.01	1	2	3	4	5			
100754	N-Nitrosopiperidine		c	1			3	4	5			
930552	N-Nitrosopyrrolidine		c	0.05			3	4	5			
*	Oleum (see Sulfuric acid and oleum)											
--	PAHs (Polycyclic aromatic hydrocarbons) [POM] including but not limited to:				1	2						[13]
1151	PAHs, total, w/o individ. components reported [PAH, POM]			50	1	2						
1150	PAHs, total, with individ. components also reported [PAH, POM]			50	1	2						
83329	Acenaphthene [PAH, POM]	07/96		50	1							

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	**Substance Name** [Note 2]	**Add Date** [Note 3]	**Carcinogen** [Note 4]	**Applicable Degree of Accuracy (lb/yr)** [Note 5]	**Source List(s)** [Note 6]							**Other Note(s)**
208968	Acenaphthylene [PAH, POM]	07/96		50	1							
120127	Anthracene [PAH, POM]	06/91		50	1	2					7	
56553	Benz[a]anthracene [PAH, POM]		c	0.5	1	2	3	4	5			
50328	Benzo[a]pyrene [PAH, POM]		c	0.05	1	2	3	4	5			
205992	Benzo[b]fluoranthene		c	0.5	1	2	3	4	5			
192972	Benzo[e]pyrene [PAH, POM]	07/96		0.5	1							
191242	Benzo[g,h,i]perylene [PAH, POM]	07/96		0.5	1							
205823	Benzo[j]fluoranthene [PAH, POM]		c	0.5	1	2	3	4	5			
207089	Benzo[k]fluoranthene [PAH, POM]		c	0.5	1	2	3	4	5			
218019	Chrysene [PAH, POM]	09/90	c	5	1	2		4				
53703	Dibenz[a,h]anthracene [PAH, POM]		c	0.1	1	2	3	4	5			
192654	Dibenzo[a,e]pyrene [PAH, POM]		c	0.05	1	2	3	4	5			
189640	Dibenzo[a,h]pyrene [PAH, POM]		c	0.001	1	2	3	4	5			
189559	Dibenzo[a,i]pyrene [PAH, POM]		c	0.001	1	2	3	4	5			
191300	Dibenzo[a,l]pyrene [PAH, POM]		c	0.001	1	2	3	4	5			
206440	Fluoranthene [PAH, POM]	07/96	c	0.5	1							
86737	Fluorene [PAH, POM]	07/96	c	0.5	1							
193395	Indeno[1,2,3-cd]pyrene [PAH, POM]		c	0.5	1	2	3	4	5			
91576	2-Methyl naphthalene [PAH, POM]	07/96	c	50	1							
91203	Naphthalene [PAH, POM]		c	0.1	1	2						
198550	Perylene [PAH, POM]	07/96	c	0.5	1							
85018	Phenanthrene [PAH, POM]	07/96	c	0.5	1							
129000	Pyrene [PAH, POM]	07/96	c	0.5	1							
#	PAH-Derivatives (Polycyclic aromatic hydrocarbon derivatives) [POM] (including but not limited to those substances listed in Appendix A with the bracketed designation [PAH-Derivative, POM])	06/91										[14]
56382	Parathion	06/91		100	1	2						
1336363	PCBs (Polychlorinated biphenyls), total [POM] including but not limited to:		c	0.01	1	2	3	4	5	6		
32598133	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	11/06	c	0.01		2	3	4	5			
70362504	3,4,4',5-Tetrachlorobiphenyl (PCB 81)	11/06	c	0.01		2	3	4	5			

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Applicable Degree of Accuracy (lb/yr) [Note 5]	Source List(s) [Note 6]							Other Note(s)
32598144	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	11/06	c	0.01		2	3	4	5			
74472370	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	11/06	c	0.002		2	3	4	5			
31508006	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	11/06	c	0.01		2	3	4	5			
65510443	2,3',4,4',5'-Pentachlorobiphenyl (PCB 123)	11/06	c	0.01		2	3	4	5			
57465288	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	11/06	c	0.00001		2	3	4	5			
38380084	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	11/06	c	0.002		2	3	4	5			
69782907	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	11/06	c	0.002		2	3	4	5			
52663726	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	11/06	c	0.1		2	3	4	5			
32774166	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	11/06	c	0.0001		2	3	4	5			
39635319	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	11/06	c	0.01		2	3	4	5			
82688	Pentachloronitrobenzene {Quintobenzene}	06/91		100	1	2						
79210	Peracetic acid	06/91		100	1							
127184	Perchloroethylene {Tetrachloroethene}		c	5	1	2	3	4	5	6		
2795393	Perfluorooctanoic acid {PFOA} and its salts, esters, and sulfonates	11/06		10							7	
108952	Phenol			200	1	2						
106503	p-Phenylenediamine	06/91		100	1	2						
90437	2-Phenylphenol [POM]	06/91		100	1	2						
75445	Phosgene			2	1	2						
7723140	Phosphorus			0.1	1	2						
--	Phosphorus compounds:	09/89				2						
7803512	Phosphine			0.01	1	2					7	
7664382	Phosphoric acid	09/89		50	1	2						
10025873	Phosphorus oxychloride	09/89		0.1		2						
10026138	Phosphorus pentachloride	09/89		0.1		2						
1314563	Phosphorus pentoxide	09/89		0.1		2						
7719122	Phosphorus trichloride	09/89		0.1		2						
126738	Tributyl phosphate	09/89		100		2						
78400	Triethyl phosphine	09/89		100		2						
512561	Trimethyl phosphate	09/89		100		2						
78308	Triorthocresyl phosphate [POM]	09/89		0.5	1	2						
115866	Triphenyl phosphate [POM]	09/89		100	1	2						

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Applicable Degree of Accuracy (lb/yr) [Note 5]	Source List(s) [Note 6]							Other Note(s)
101020	Triphenyl phosphite [POM]	09/89		100	1	2						
85449	Phthalic anhydride			0.01	1	2						
2222	Polybrominated diphenyl ethers {PBDEs}, including but not limited to:	11/06		1							7	
1163195	Decabromodiphenyl oxide [POM]	06/91		1	1	2						
--	Polychlorinated dibenzo-p-dioxins {PCDDs or Dioxins} [POM], including but not limited to:		c		1	2						
1086	Dioxins, total, w/o individ. isomers reported {PCDDs} [POM]		c	0.000001	1	2						
1085	Dioxins, total, with individ. isomers also reported {PCDDs} [POM]		c	0.000001	1	2						
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin {TCDD} [POM]		c	0.000001	1	2	3	4	5			
40321764	1,2,3,7,8-Pentachlorodibenzo-p-dioxin [POM]		c	0.000001	1	2						
39227286	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin [POM]		c	0.000001	1	2		4				
57653857	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin [POM]		c	0.000001	1	2						
19408743	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin [POM]		c	0.000001	1	2						
35822469	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin [POM]		c	0.000001	1	2						
3268879	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin [POM]	07/96	c	0.000001	1	2						
41903575	Total Tetrachlorodibenzo-p-dioxin [POM]	07/96	c	0.000001	1	2						
36088229	Total Pentachlorodibenzo-p-dioxin [POM]	07/96	c	0.000001	1	2						
34465468	Total Hexachlorodibenzo-p-dioxin [POM]	07/96	c	0.000001	1	2						
37871004	Total Heptachlorodibenzo-p-dioxin [POM]	07/96	c	0.000001	1	2						
--	Polychlorinated dibenzofurans {PCDFs or Dibenzofurans} [POM], including but not limited to:		c		1	2						
1080	Dibenzofurans (Polychlorinated dibenzofurans) {PCDFs} [POM]		c	0.000001	1	2						
51207319	2,3,7,8-Tetrachlorodibenzofuran [POM]		c	0.000001	1	2						
57117416	1,2,3,7,8-Pentachlorodibenzofuran [POM]		c	0.000001	1	2						
57117314	2,3,4,7,8-Pentachlorodibenzofuran [POM]		c	0.000001	1	2						
70648269	1,2,3,4,7,8-Hexachlorodibenzofuran [POM]		c	0.000001	1	2						
57117449	1,2,3,6,7,8-Hexachlorodibenzofuran [POM]		c	0.000001	1	2						

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Applicable Degree of Accuracy (lb/yr) [Note 5]	Source List(s) [Note 6]							Other Note(s)
72918219	1,2,3,7,8,9-Hexachlorodibenzofuran [POM]		c	0.000001	1	2						
60851345	2,3,4,6,7,8-Hexachlorodibenzofuran [POM]		c	0.000001	1	2						
67562394	1,2,3,4,6,7,8-Heptachlorodibenzofuran [POM]		c	0.000001	1	2						
55673897	1,2,3,4,7,8,9-Heptachlorodibenzofuran [POM]		c	0.000001	1	2						
39001020	1,2,3,4,6,7,8,9-Octachlorodibenzofuran [POM]	07/96	c	0.000001	1	2						
55722275	Total Tetrachlorodibenzofuran [POM]	07/96	c	0.000001	1	2						
30402154	Total Pentachlorodibenzofuran [POM]	07/96	c	0.000001	1	2						
55684941	Total Hexachlorodibenzofuran [POM]	07/96	c	0.000001	1	2						
38998753	Total Heptachlorodibenzofuran [POM]	07/96	c	0.000001	1	2						
#	POM (Polycyclic organic matter) (including but not limited to those substances listed in Appendix A with the bracketed designation of [POM], [PAH, POM], or [PAH-Derivative, POM])	09/89			1	2						[15]
1120714	1,3-Propane sultone		c	0.05	1	2	3	4	5			
57578	beta-Propiolactone		c	10	1	2	3	4	5			
123386	Propionaldehyde	06/91		200	1	2						
114261	Propoxur {Baygon}	06/91		100	1	2						
115071	Propylene			200	1	2						
75569	Propylene oxide		c	10	1	2	3	4	5			
-	1,2-Propyleneimine (see 2-Methylaziridine)											
110861	Pyridine	06/91		100							7	
91225	Quinoline	06/91		100	1	2						
106514	Quinone	06/91		100	1	2						
1165	Radionuclides including but not limited to:		c	100	1	2		4				[16]
24267569	Iodine-131	09/89	c	100	1	2		4				
1166	Radon and its decay products	09/89	c	100	1			4				
50555	Reserpine [POM]		c	100	1	2		4	5			
#	Residual (heavy) fuel oils	06/91	c									
7782492	Selenium			0.5		2						
*	Selenium compounds including but not limited to:			0.5	1	2						[7]
7783075	Hydrogen selenide	11/06		0.1							7	
7446346	Selenium sulfide	09/90	c	0.1		2		4	5			[7]

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Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Applicable Degree of Accuracy (lb/yr) [Note 5]	Source List(s) [Note 6]							Other Note(s)
1175	Silica, crystalline (respirable)			0.1	1		3	4				
7440224	Silver	06/91		2							7	
*	Silver compounds	06/91		2	1							[7]
1310732	Sodium hydroxide			2	1	2						
100425	Styrene		c	100	1	2	3			6		
96093	Styrene oxide		c	100	1	2	3	4				
*	Sulfuric acid and oleum											
8014957	Oleum	11/06		100							7	
7446719	Sulfur trioxide	11/06		100							7	
7664939	Sulfuric acid	06/91		2	1							
100210	Terephthalic acid	06/91		100	1							
79345	1,1,2,2-Tetrachloroethane	09/90	c	1	1	2		4				
-	Tetrachlorophenols (see Chlorophenols)											
7440280	Thallium	06/91		100							7	
*	Thallium compounds	06/91	c	100							7	[7]
62555	Thioacetamide		c	0.01			3	4	5			
62566	Thiourea		c	0.1	1		3	4	5			
7550450	Titanium tetrachloride	06/91		100	1	2						
108883	Toluene			200	1	2		4		6		
-	2,4-Toluenediamine (see 2,4-Diaminotoluene)											
26471625	Toluene diisocyanates including but not limited to:	06/91	c	0.1	1		3					
584849	Toluene-2,4-diisocyanate		c	0.1	1	2	3		5			
91087	Toluene-2,6-diisocyanate		c	0.1	1	2	3		5			
95534	o-Toluidine		c	10	1	2	3	4	5			
8001352	Toxaphene {Polychlorinated camphenes}		c	100	1	2	3	4	5			
-	1,1,1-Trchloroethane (see Methyl chloroform)											
79005	1,1,2-Trichloroethane {Vinyl trichloride}	06/91	c	1	1	2		4				
79016	Trichloroethylene		c	20	1	2		4				
-	2,4,6-Trichlorophenol (see Chlorophenols)											
96184	1,2,3-Trichloropropane	07/96	c	200			3	4			7	
121448	Triethylamine	06/91		20	1	2						
1582098	Trifluralin	06/91		100	1	2						

Substances for Which Emissions Must Be Quantified

Emittent ID [Note 1]	**Substance Name** [Note 2]	**Add Date** [Note 3]	**Carcinogen** [Note 4]	**Applicable Degree of Accuracy (lb/yr)** [Note 5]	**Source List(s)** [Note 6]							**Other Note(s)**
25551137	Trimethylbenzenes including but not limited to:	11/06		100	1							
95636	1,2,4-Trimethylbenzene	06/91		5	1							
540841	2,2,4-Trimethylpentane	06/91		100	1	2						
51796	Urethane {Ethyl carbamate}		c	0.1	1	2	3	4	5			
7440622	Vanadium (fume or dust)	06/91		10							7	[17]
1314621	Vanadium pentoxide	11/06		10		2						
108054	Vinyl acetate	06/91		200	1	2						
593602	Vinyl bromide		c	20	1	2	3	4				
75014	Vinyl chloride		c	0.5	1	2	3	4	5			
100403	4-Vinylcyclohexene	07/96	c	5			3					
75025	Vinyl fluoride	07/96	c	200			3					
75354	Vinylidene chloride			20	1	2						
1206	Wood preservatives (containing arsenic and chromate)	09/89		100						6		
1330207	Xylenes (mixed) including:			200	1	2				6		
108383	m-Xylene	06/91		200	1	2						
95476	o-Xylene	06/91		200	1	2						
106423	p-Xylene	06/91		200	1	2						
7440666	Zinc			2		2						
*	Zinc compounds including but not limited to:	09/89		2	1	2						[7]
1314132	Zinc oxide			2		2						[7]

Appendix A-II

Substances for Which Production, Use, or Other Presence Must Be Reported

Substances for Which Production, Use, or Other Presence Must be Reported											
Emittent ID [Note 1]	**Substance Name** [Note 2]	**Add Date** [Note 3]	**Carcinogen** [Note 4]	**Source List(s)** [Note 6]							**Other Note(s)**
26148685	A-alpha-C {2-Amino-9H-pyrido[2,3-b]indole}	09/89	c			3	4				[18]
34256821	Acetochlor	09/89	c				4				
62476599	Acifluorfen [POM]	09/90	c	1	2		4				
3688537	AF-2		c			3	4				
1000	Aflatoxins		c			3	4	5			
15972608	Alachlor	09/89	c				4				
309002	Aldrin	09/89	c				4				
107186	Allyl alcohol	06/91								7	
60093	p-Aminoazobenzene {4-Aminoazobenzene} [POM]		c	1	2	3	4				
97563	o-Aminoazotoluene [POM]		c	1	2	3	4	5			
6109973	3-Amino-9-ethylcarbazole hydrochloride [POM]	09/89	c	1	2		4	5			
125848	Aminoglutethimide	09/90					4				
82280	1-Amino-2-methylanthraquinone [PAH-Derivative, POM]		c	1	2		4	5			
68006837	2-Amino-3-methyl-9H-pyrido(2,3-b) indole {MeA-alpha-C}	09/89	c			3	4				
712685	2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole		c			3	4				
134292	o-Anisidine hydrochloride		c				4	5			
104949	p-Anisidine	06/91								7	
140578	Aramite		c			3	4				
492808	Auramine [POM]		c	1	2	3	4	5			
446866	Azathioprine		c	1	2	3	4	5			
103333	Azobenzene [POM]	09/90	c	1	2		4				
98873	Benzal chloride	06/91								7	
55210	Benzamide	06/91								7	
1694093	Benzyl violet 4B [POM]		c	1	2	3	4				
1025	Betel quid with tobacco		c			3	4				
494031	N-N-Bis(2-chloroethyl)-2-naphthylamine {Chlornaphazine} [PAH-Derivative, POM]		c	1	2	3	4	5			
108601	Bis(2-chloro-1-methylethyl) ether	06/91								7	
1030	Bitumens, extracts of steam-refined and air-refined bitumens		c			3	4				
1035	Bleomycins		c			3					
75274	Bromodichloromethane	09/90	c				4				

Substances for Which Production, Use, or Other Presence Must be Reported

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Source List(s) [Note 6]							Other Note(s)
1689845	Bromoxynil	06/91					4				
25013165	Butylated hydroxyanisole {BHA}		c			3	4				
123728	Butyraldehyde	06/91								7	
3068880	beta-Butyrolactone		c			3	4				
630080	Carbon monoxide	09/89					4				
143500	Chlordecone {Kepone}		c			3	4				
6164983	Chlordimeform	09/89	c				4				
115286	Chlorendic acid	09/89	c			3	4	5			
124481	Chlorodibromomethane	09/90	c				4				
563473	3-Chloro-2-methylpropene	09/89	c				4	5			
1065	Chlorophenoxy herbicides		c			3					
1897456	Chlorothalonil	09/89	c				4				
1059	p-Chloro-o-toluidine (strong acid salts)	06/91	c			3					
4680788	C. I. Acid Green 3 [POM] Note: "C.I." means "color index"	06/91		1	2					7	
569642	C. I. Basic Green 4 [POM]	06/91		1	2					7	
989388	C. I. Basic Red 1 [POM]	06/91		1	2					7	
569619	C. I. Basic Red 9 monohydrochloride [POM]	09/89	c	1	2		4	5			
2832408	C. I. Disperse Yellow 3 [POM]	06/91		1	2					7	
87296	Cinnamyl anthranilate [POM]	09/89	c	1	2		4	5			
6358538	Citrus Red No. 2 [POM]		c	1	2	3	4				
8007452	Coal tars	09/89	c			3	4	5			
21725462	Cyanazine	09/90					4				
14901087	Cycasin		c			3	4				
13121705	Cyhexatin	09/89					4	5			
3468631	D and C Orange No. 17 [PAH-Derivative, POM]	09/90	c	1	2		4				
81889	D and C Red No. 19 [POM]	09/90	c	1	2		4				
2092560	D and C Red No. 8 [PAH-Derivative, POM]	06/91	c	1	2		4				
5160021	D and C Red No. 9 [PAH-Derivative, POM]	09/90	c	1	2		4				
1596845	Daminozide	09/90	c				4				
50293	DDT {1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane} [POM]		c	1	2	3	4	5			
613354	N,N'-Diacetylbenzidine [POM]		c	1	2	3	4				
2303164	Diallate	06/91								7	
39156417	2,4-Diaminoanisole sulfate		c				4	5			

Substances for Which Production, Use, or Other Presence Must be Reported

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Source List(s) [Note 6]							Other Note(s)
101804	4,4'-Diaminodiphenyl ether [POM]		c	1	2	3	4	5			
764410	1,4-Dichloro-2-butene	09/90	c				4				
28434868	3,3'-Dichloro-4,4'-diaminodiphenyl ether [POM]	09/89	c	1	2	3	4				
72548	Dichlorodiphenyldichloroethane {DDD} [POM]	09/89	c	1	2		4				
540590	1,2-Dichloroethylene	06/91								7	
78886	2,3-Dichloropropene	06/91								7	
60571	Dieldrin	09/89	c				4				
1464535	Diepoxybutane		c			3	4	5			
1615801	1,2-Diethylhydrazine		c			3	4				
84662	Diethyl phthalate	06/91								7	
101906	Diglycidyl resorcinol ether {DGRE}		c			3	4	5			
94586	Dihydrosafrole		c			3	4				
20325400	3,3'-Dimethoxybenzidine dihydrochloride [POM]	06/91	c	1	2		4				
55738540	trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)vinyl-1,3,4-oxadiazol		c			3	4				
540738	1,2-Dimethylhydrazine		c			3	4				
105679	2,4-Dimethylphenol {2,4-Xylenol}	06/91								7	
513371	Dimethylvinylchloride {DMVC}	09/89	c				4	5			
25154545	Dinitrobenzenes (mixtures of) including:	09/90					4			7	
99650	m-Dinitrobenzene	06/91								7	
528290	o-Dinitrobenzene	06/91								7	
100254	p-Dinitrobenzene	06/91								7	
39300453	Dinocap	09/90					4				
88857	Dinoseb	09/89					4				
117840	n-Dioctyl phthalate	06/91								7	
2475458	Disperse Blue 1 [PAH-Derivative, POM]	06/91	c	1	2	3	4				
541413	Ethyl chloroformate	06/91								7	
62500	Ethyl methanesulfonate		c			3	4				
2164172	Fluometuron	06/91								7	
133073	Folpet	09/89	c				4				
3570750	2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole		c			3	4				
60568050	Furmecyclox	09/90	c				4				
67730114	Glu-P-1 {2-Amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole}		c			3	4				

Substances for Which Production, Use, or Other Presence Must be Reported

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Source List(s) [Note 6]							Other Note(s)
67730103	Glu-P-2 {2-Aminodipyrido[1,2-a:3',2'-d]imidazole}		c			3	4				
765344	Glycidaldehyde		c			3	4				
556525	Glycidol	09/90	c				4				
16568028	Gyromitrin {Acetaldehyde methylformylhydrazone}		c				4				
2784943	HC Blue 1	09/89	c				4	5			
1024573	Heptachlor epoxide	09/89	c				4				
1335871	Hexachloronaphthalene [PAH-Derivative, POM]	06/91		1	2					7	
10034932	Hydrazine sulfate		c				4	5			
76180966	IQ {2-Amino-3-methylimidazo[4,5-f]quinoline}		c			3	4				
78842	Isobutyraldehyde	06/91								7	
120581	Isosafrole	09/90	c				4				
4759482	Isotretinoin						4				
77501634	Lactofen [POM]	09/89	c	1	2		4				
1131	Lubricant base oils and derived products, specifically vacuum distillates, acid treated oils, aromatic oils, mildly solvent-refined oils, mildly hydrotreated-oils and used engine oils.	09/89	c			3	4	5			
8018017	Mancozeb	09/90	c				4				
12427382	Maneb	09/90	c				4				
59052	Methotrexate	09/89					4				
96333	Methyl acrylate	06/91								7	
590965	Methylazoxymethanol	09/90	c				4				
592621	Methylazoxymethanol acetate	09/89	c			3	4				
101611	4,4'-Methylene bis (N,N-dimethyl) benzenamine [POM]		c	1	2		4	5			
838880	4,4'-Methylene bis(2-methylaniline) [POM]	09/89	c	1	2	3	4				
74953	Methylene bromide	06/91								7	
66273	Methyl methanesulfonate		c			3	4				
129157	2-Methyl-1-nitroanthraquinone (uncertain purity) [PAH-Derivative, POM]		c	1	2	3	4				
70257	N-Methyl-N'-nitro-N-nitrosoguanidine		c			3	4				
-	N-Methyl-N-nitrosourethane (see N-Nitroso-N-methylurethane)										
924425	N-Methyloacrylamide	09/90	c				4				
9006422	Metiram	09/90					4				
1140	Mineral oils (untreated and mildly treated oils; and those used in occupations such as mulespinning, metal machining, and jute		c			3	4	5			

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Substances for Which Production, Use, or Other Presence Must be Reported

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Source List(s) [Note 6]							Other Note(s)
	processing).										
2385855	Mirex		c			3	4	5			
315220	Monocrotaline		c			3	4				
505602	Mustard gas {Sulfur mustard}		c			3	4	5			
134327	1-Naphthylamine [PAH-Derivative, POM]	09/90	c	1	2		4				
91598	2-Naphthylamine [PAH-Derivative, POM]		c	1	2	3	4	5			
54115	Nicotine	09/90					4				
1148	Nitrilotriacetic acid (salts) including but not limited to:	06/91	c			3					
18662538	Nitrilotriacetic acid, trisodium salt monohydrate	06/91	c				4				
99592	5-Nitro-o-anisidine		c				4	5			
1836755	Nitrofen (technical grade)		c			3	4	5			
51752	Nitrogen mustard {Mechlorethamine}	09/89	c			3	4	5			
55867	Nitrogen mustard hydrochloride	06/91	c				4	5			
55630	Nitroglycerin	06/91								7	
88755	2-Nitrophenol	06/91								7	
57835924	4-Nitropyrene [PAH-Derivative, POM]	09/89	c	1	2	3	4				
759739	N-Nitroso-N-ethylurea	09/89	c				4	5			
60153493	3-(N-Nitrosomethylamino)propionitrile	09/89	c			3	4				
64091914	4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone {NNK}		c			3	4				
615532	N-Nitroso-N-methylurethane		c			3	4				
4549400	N-Nitrosomethylvinylamine		c			3	4	5			
16543558	N-Nitrosonornicotine		c			3	4	5			
13256229	N-Nitrososarcosine		c			3	4	5			
303479	Ochratoxin A [POM]	09/90	c	1	2		4				
2234131	Octachloronaphthalene [PAH-Derivative, POM]	06/91		1	2					7	
2646175	Oil Orange SS [PAH-Derivative, POM]		c	1	2	3	4				
20816120	Osmium tetroxide	06/91								7	
794934	Panfuran S {Dihydroxymethylfuratrizine}		c			3	4				
122601	Phenyl glycidyl ether	09/90	c			3	4				
57410	Phenytoin [POM]		c	1	2	3	4	5			
88891	Picric acid	06/91								7	
1155	Polybrominated biphenyls {PBBs{ [POM]		c	1	2	3	4	5			

Substances for Which Production, Use, or Other Presence Must be Reported

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3]	Carcinogen [Note 4]	Source List(s) [Note 6]							Other Note(s)
53973981	Polygeenan	09/89	c				4				
3761533	Ponceau MX [PAH-Derivative, POM]		c	1	2	3	4				
3564098	Ponceau 3R [PAH-Derivative, POM]		c	1	2	3	4				
36791045	Ribavirin	09/90					4				
94597	Safrole		c			3	4	5			
1180	Shale oils		c			3	4				
132274	Sodium o-phenylphenate [POM]		c	1	2	3	4				
128449	Sodium saccharin	09/89	c				4				
1185	Soots		c			3	4				
10048132	Sterigmatocystin [POM]		c	1	2	3	4				
95067	Sulfallate		c			3	4	5			
5216251	p-alpha,alpha,alpha-Tetrachlorotoluene	09/90	c				4				
961115	Tetrachlorvinphos	06/91								7	
509148	Tetranitromethane	09/90	c				4				
139651	4,4'-Thiodianiline [POM]		c	1	2	3	4				
1314201	Thorium dioxide		c				4	5			
1200	Tobacco products, smokeless		c			3	4				
1205	alpha-chlorinated Toluenes		c			3					
636215	o-Toluidine hydrochloride		c				4	5			
106490	p-Toluidine	09/90	c				4				
52686	Trichlorfon	06/91								7	
68768	Tris(aziridinyl)-p-benzoquinone {Triaziquone}	09/90	c				4				
52244	Tris(1-aziridinyl) phosphine sulfide {Thiotepa}		c			3	4	5			
126727	Tris(2,3-dibromopropyl)phosphate	09/89	c				4				
62450060	Trp-P-1 {3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole}		c			3	4				
62450071	Trp-P-2 {3-Amino-1-methyl-5H-pyrido[4,3-b]indole}		c			3	4				
72571	Trypan blue [PAH-Derivative, POM]		c	1	2	3	4				
106876	4-Vinyl-1-cyclohexene diepoxide {Vinyl cyclohexene dioxide}	09/90	c				4				
81812	Warfarin [POM]			1	2		4				
87627	2,6-Xylidene	06/91					4				
12122677	Zineb	09/90	c				4				

Appendix A-III

Substances Which Need Not Be Reported Unless Manufactured By the Facility

Substances Which Need Not Be Reported Unless Manufactured By the Facility

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3])	Carcinogen [Note 4]	Source Lists [Note 6]					Other Note(s)
546883	Acetohydroxamic acid	09/90					4		
50760	Actinomycin D	09/90	c				4		
23214928	Adriamycin [PAH-Derivative, POM]		c	1	2	3	4	5	
28981977	Alprazolam [POM]	09/90		1	2		4		
39831555	Amikacin sulfate	09/90					4		
54626	Aminopterin						4		
1005	Analgesic mixtures containing phenacetin		c			3	4	5	
1010	Androgenic (anabolic) steroids including but not limited to:		c			3	4		
58184	Methyltestosterone	09/90					4		
434071	Oxymetholone		c				4	5	
58220	Testosterone and its esters including but not limited to:	09/89					4		
315377	Testosterone enanthate	09/90					4		
50782	Aspirin	06/91					4		
115026	Azaserine		c			3	4		
5411223	Benzphetamine hydrochloride [POM]	09/90		1	2		4		
154938	Bischloroethyl nitrosourea		c			3	4		
55981	1,4-Butanediol dimethanesulfonate {Busulfen/Myleran}		c			3	4	5	
41575944	Carboplatin	09/90					4		
474259	Chenodiol	09/90					4		
305033	Chlorambucil		c			3	4	5	
56757	Chloramphenicol		c			3	4		
1620219	Chlorcyclizine hydrochloride [POM]			1	2		4		
13010474	1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea {CCNU}		c			3	4	5	
13909096	1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea {Methyl CCNU}		c			3			
15663271	Cisplatin		c			3	4		
50419	Clomiphene citrate [POM]	09/90		1	2		4		
50180	Cyclophosphamide		c			3	4		
147944	Cytarabine	09/89					4		
4342034	Dacarbazine		c			3	4	5	
17230885	Danazol	09/90					4		
20830813	Daunomycin [PAH-Derivative, POM]		c	1	2	3	4		
23541506	Daunorubicin hydrochloride [PAH-Derivative, POM]	09/90		1	2		4		
84173	Dienestrol [POM]	09/90	c	1	2		4		

Substances Which Need Not Be Reported Unless Manufactured By the Facility

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3])	Carcinogen [Note 4]	Source Lists [Note 6]					Other Note(s)
564250	Doxycycline	09/90					4		
379793	Ergotamine tartrate [POM]	09/90		1	2		4		
1095	Estrogens, non-steroidal including but not limited to:		c			3		5	
56531	Diethylstilbestrol [POM]		c	1	2	3	4	5	
1100	Estrogens, steroidal including but not limited to:		c			3		5	
1068	Conjugated estrogens	09/90	c				4		
50282	Estradiol 17 beta		c				4	5	
53167	Estrone		c				4	5	
57636	Ethinyl estradiol		c				4	5	
72333	Mestranol		c			3	4	5	
33419420	Etoposide [POM]	09/90			2				
54350480	Etretinate						4		
51218	Fluorouracil	09/89					4		
76437	Fluoxymesterone	09/90					4		
13311847	Flutamide	09/90					4		
67458	Furazolidone	09/90	c				4		
126078	Griseofulvin		c			3	4		
23092173	Halazepam [POM]	09/90		1	2		4		
3778732	Ifosfamide	09/90					4		
9004664	Iron dextran complex		c			3	4	5	
303344	Lasiocarpine	09/89	c			3	4		
554132	Lithium carbonate	06/91					4		
919164	Lithium citrate	06/91					4		
846491	Lorazepam [POM]	09/90		1	2		4		
595335	Megestrol acetate	06/91					4		
148823	Melphalan		c			3	4	5	
9002680	Menotropins	09/90					4		
6112761	Mercaptopurine	09/90					4		
531760	Merphalan	09/89	c				4		
3963959	Methacycline hydrochloride	06/91					4		
60560	Methimazole	09/90					4		
15475566	Methotrexate sodium	09/90					4		
484208	5-Methoxypsoralen		c			3			

Substances Which Need Not Be Reported Unless Manufactured By the Facility									
Emittent ID [Note 1]	**Substance Name** [Note 2]	**Add Date** [Note 3])	**Carcinogen** [Note 4]	**Source Lists** [Note 6]					**Other Note(s)**
56042	Methylthiouracil		c			3	4		
443481	Metronidazole		c			3	4	5	
59467968	Midazolam hydrochloride [POM]	09/90		1	2		4		
62015398	Misoprostol	09/90					4		
50077	Mitomycin C		c			3	4		
70476823	Mitoxantrone hydrochloride [PAH-Derivative, POM]	09/90		1	2		4		
139913	5-(Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolidinone		c			3	4		
86220420	Nafarelin acetate [PAH-Derivative, POM]	09/90		1	2		4		
3771195	Nafenopin [POM]		c	1	2	3	4		
1405103	Neomycin sulfate	09/90					4		
56391572	Netilmicin sulfate	09/90					4		
61574	Niridazole		c			3	4		
67209	Nitrofurantoin	06/91	c				4		
59870	Nitrofurazone	09/90	c				4		
555840	1-[(5-Nitrofurfurylidene)amino]-2-imidazolidinone		c			3	4		
531828	N-[4-(5-Nitro-2-furyl)-2-thiazolyl]acetamide		c			3	4		
6533002	Norgestrel	09/90					4		
79572	Oxytetracycline	06/91					4		
115673	Paramethadione	09/90					4		
52675	Penicillamine	06/91					4		
57330	Pentobarbital sodium	09/90					4		
63989	Phenacemide	09/90					4		
62442	Phenacetin		c			3	4	5	
94780	Phenazopyridine hydrochloride		c			3	4	5	
3546109	Phenesterin	09/89	c				4	5	
50066	Phenobarbital		c			3	4		
59961	Phenoxybenzamine [POM]	09/89	c	1	2		4		
63923	Phenoxybenzimide hydrochloride [POM]	09/90	c	1	2	3	4	5	
54911	Pipobroman	09/90					4		
18378897	Plicamycin [PAH-Derivative, POM]	09/90		1	2		4		
366701	Procarbazine hydrochloride		c			3	4	5	
57830	Progesterone		c			3	4	5	
1160	Progestins including but not limited to:		c			3			

Substances Which Need Not Be Reported Unless Manufactured By the Facility

Emittent ID [Note 1]	Substance Name [Note 2]	Add Date [Note 3])	Carcinogen [Note 4]	Source Lists [Note 6]					Other Note(s)
71589	Medroxyprogesterone acetate		c			3	4		
68224	Norethisterone		c				4	5	
51525	Propylthiouracil		c			3	4	5	
302794	all-trans-Retinoic acid	09/89					4		
1167	Retinol/retinyl esters	09/89	c				4		
81072	Saccharin		c			3	4	5	
3810740	Streptomycin sulfate	06/91					4		
18883664	Streptozotocin		c			3	4	5	
54965241	Tamoxifen citrate [POM]	09/90		1	2		4		
846504	Temazepam [POM]	09/90		1	2		4		
64755	Tetracycline hydrochloride	06/91					4		
50351	Thalidomide						4		
154427	Thioguanine	09/90					4		
49842071	Tobramycin sulfate	09/90					4		
299752	Treosulfan		c			3	4		
28911015	Triazolam [POM]	09/90		1	2		4		
13647353	Trilostane	09/90					4		
127480	Trimethadione	06/91					4		
66751	Uracil mustard		c			3	4		
26995915	Urofollitropin	09/90					4		
99661	Valproate						4		
143679	Vinblastine sulfate [POM]	09/90		1	2		4		
2068782	Vincristine sulfate [POM]	09/90		1	2		4		

NOTES TO APPENDIX A:

[1] Emittent ID (the emittent identification number) is the Chemical Abstract Service (CAS) number where available, or an ARB-assigned 4-digit emittent ID code.

A dash ("-") is shown for the Emittent ID for substances which are alphabetized under a group header or synonym elsewhere on the list. Refer to the cross reference indicated in parenthesis, "( )".

A double dash ("- -") is shown for the Emittent ID to indicate that the entry is a non-reportable group header for the substances immediately following it.

An asterisk ("*") is shown for the Emittent ID to indicate that the emissions of unspecified metal compounds shall be reported as the metal atom equivalent. See Note [7].

A pound sign ("#") is shown for the Emittent ID to indicate that the individual, component listed substances must be reported for this mixture or group.

[2] Individual substances listed under a group heading must be reported individually. Other, unspecified substances in the group must be summed and reported using the emittent ID of the group heading.

The square bracket designation, "[ ]", indicates that the substance is a component of the chemical group heading(s) within the brackets.

The braces designation, "{ }", indicates a synonym for the substance listed.

[3] The date the Board approved addition of the substance to the original list. The original list was approved by the Board in July 1988.

[4] The letter "c" indicates that for purposes of this section the substance shall be treated as a human carcinogen or potential human carcinogen.

[5] Applicable degree of accuracy (in lbs/year except where noted). Radionuclides must be reported in Curie units, and the accuracy must be considered accordingly. Refer to section VII.E. and Appendix B.

[6] Substances are required to be included on the Hot Spots list based on the following lists cited in Health & Safety Code section 44321:

1 = California Air Resources Board (44321(c));

2 = Environmental Protection Agency (44321(e));

3 = International Agency for Research on Cancer;

4 = Governor's List of Carcinogens and Reproductive Toxicants; (44321(a); Labor Code section 6382(b)(1)): (44321(b); HSC section 25249.8):

5 = National Toxicology Program (44321(a));

6 = Hazard Evaluation System and Information Service (44321(d));

7 = Added pursuant to HSC section 44321 (f).

[7] Emissions of unspecified metal compounds shall be reported as the amount of the metal atom equivalent, using the metal emittent identification number for the metal itself (or the emittent identification number indicated on the table, such as for reporting inorganic versus other-than-inorganic arsenic compounds).

For unspecified metal compounds which contain two or more listed metals (e.g., zinc chromate), each component metal shall be reported as the amount of the appropriate metal atom equivalent (i.e., the zinc portion of the weight as zinc equivalent and the chromate portion as hexavalent chromium equivalent.

For specific, individually listed metal compounds (e.g., Lead chromate), emissions shall be reported for the compound (as pounds of whole compound), using the emittent identification number for that compound.

[8] Compounds of the form "X-CN", where formal dissociation can occur. Report as the amount of Cyanide equivalent in the compound using an emittent identification code of 1073.

[9] Emissions of these mixtures shall be reported as emissions of total particulate matter and total organic gas, using the following emittent identification numbers:

9901 Diesel exhaust, particulate matter 9910 Gasoline exhaust, particulate matter

9902 Diesel exhaust, total organic gas

9911 Gasoline exhaust, total organic gas

Individually listed substances from gasoline exhaust must also be reported. Emissions of diesel engine exhaust particulate matter (diesel PM), shall be reported as diesel PM using emittent ID 9901.

[10] The emittent identification number 1105 has been discontinued for all facilities reporting for the first time and for all updates. Use the listed replacement emittent identification codes 1103 and 1104.

[11] Emissions of the individual, component listed substances must be reported in addition to the total gasoline vapors emissions.

[12] These lead compounds are listed here so that the inorganic lead fraction will be quantified and reported if these individual compounds cannot be quantified.

[13] PAH: (Polycyclic Aromatic Hydrocarbon) - An organic compound consisting of a fused ring structure containing at least two (2) benzene rings, and which may also contain additional fused rings not restricted exclusively to hexagonal rings.

The structure does not include any heteroatoms or substituent groups. The structure includes only carbon and hydrogen.

PAHs are a subgroup of POM and have a boiling point of greater than or equal to 100 C.

[14] PAH-DERIVATIVE: (Polycyclic Aromatic Hydrocarbon Derivative) - An organic compound consisting of a fused ring structure containing at least two (2) benzene rings, and which may also contain additional fused rings not restricted exclusively to hexagonal rings. The fused ring structure does not contain heteroatoms. The structure does contain one or more substituent groups.

PAH-Derivatives are a subgroup of POM and have a boiling point of greater than or equal to 100 C.

[15] POM: (Polycyclic Organic Matter) - Includes organic compounds with more than one benzene ring, and which have a boiling point of greater than or equal to 100 C.

[16] Radionuclides and other radioactive substances shall be reported in units of Curies per year (for annual average emissions) and in units of milliCuries per hour (for maximum hourly emissions).

[17] Emissions of Vanadium (fume or dust) shall be reported as the amount of the vanadium atom equivalent, using the identification number 7440622.

[18] The emittent identification number 1001 has been replaced with the CAS number 26148685.

NOTE: The notation “11/06” indicates most recently added substances.

Appendix B: Regulations and Legislation

B.1. Air Toxics Hot Spots Program Overview

(Air Resources Board, 2011: see http://www.arb.ca.gov/ab2588/overview.htm)

INTRODUCTION

The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588, 1987, Connelly) was enacted in September 1987. Under this, stationary sources are required to report the types and quantities of certain substances their facilities routinely release into the air. Emissions of interest are those that result from the routine operation of a facility or that are predictable, including but not limited to continuous and intermittent releases and process upsets or leaks.

The goals of the Air Toxics "Hot Spots" Act are to collect emission data, to identify facilities having localized impacts, to ascertain health risks, and to notify nearby residents of significant risks. In September 1992, the "Hot Spots" Act was amended by Senate Bill (SB) 1731 (Calderon) to address the reduction of significant risks. The bill requires that owners of significant-risk facilities reduce their risks below the level of significance.

The Act requires that toxic air emissions from stationary sources (facilities) be quantified and compiled into an inventory according to criteria and guidelines developed by the ARB, that each facility be prioritized to determine whether a risk assessment must be conducted, that the risk assessments be conducted according to methods developed by the Office of Environmental Health Hazard Assessment (OEHHA), that the public be notified of significant risks posed by nearby facilities, and that emissions which result in a significant risk be reduced. Since the amendment of the statute in 1992 by enactment of SB 1731, facilities that pose a potentially significant health risks to the public are required to reduce their risks, thereby reducing the near-source exposure of Californians to toxic air pollutants. Owners of facilities found to pose significant risks by a district must prepare and implement risk reduction audit and plans within 6 months of the determination.

The Air Resources Board (ARB) is required to develop a program to make the emission data collected under the "Hot Spots" Program available to the public. If requested, districts must make health risk assessments available for public review. Districts must also publish annual reports which summarize the health risk assessment program, rank facilities according to the cancer risk posed, identify the facilities posing non-cancer health risks, and describe the status of the development of control measures.

The "Hot Spots" Program has complemented the ARB's existing air toxics identification and control programs. It has located sources of substances not previously under evaluation, and it has provided exposure information necessary to prioritize substances for control measures and develop regulatory action. Also, the preparation of the "Hot Spots" emission inventory made facility owners aware of their toxics problems. As a result, facilities have taken voluntary steps to reduce emissions of air toxics. Limited district and facility surveys have identified voluntary reductions of over 1.9 million pounds per year in the emission of air toxics from just 21 facilities in California. The benefits that come from this type of action are less risk to workers and to the public, reduced operation costs, demonstration of emission reduction options for other sources, and improved community relations.

The Act was further modified by AB 564, chaptered on September 19, 1996. The passage of AB 564 amended the Hot Spots statute in several ways, including adding provisions that: exempt specified low priority facilities from further compliance with the Hot Spots program; reinstate exempted facilities if specified criteria are met; specify an alternative evaluation process for facilities subject to district permit programs; and other changes to exempt specified facilities from further compliance with the Hot Spots Program.

B.2. Health and Safety Code Related to Air Toxics Hot Spots.

PART 6. AIR TOXICS "HOT SPOTS" INFORMATION AND ASSESSMENT
(Part 6 added by Stats. 1987, Ch. 1252, Sec. 1. Operative July 1, 1988, pursuant to Section 44384. Note: Sections 44380 and 44384 became operative Jan. 1, 1988.)

CHAPTER 1: LEGISLATIVE FINDINGS AND DEFINITIONS

44300. This part shall be known and may be cited as the Air Toxics "Hot Spots" Information and Assessment Act of 1987.

44301. The Legislature finds and declares all of the following:

(a) In the wake of recent publicity surrounding planned and unplanned releases of toxic chemicals into the atmosphere, the public has become increasingly concerned about toxics in the air.

(b) The Congressional Research Service of the Library of Congress has concluded that 75 percent of the United States population lives in proximity to at least one facility that manufactures chemicals. An incomplete 1985 survey of large chemical companies conducted by the Congressional Research Service documented that nearly every chemical plant studied routinely releases into the surrounding air significant levels of substances proven to be or potentially hazardous to public health.

(c) Generalized emissions inventories compiled by air pollution control districts and air quality management districts in California confirm the findings of the Congressional Research Service survey as well as reveal that many other facilities and businesses which do not actually manufacture chemicals do use hazardous substances in sufficient quantities to expose, or in a manner that exposes, surrounding populations to toxic air releases.

(d) These releases may create localized concentrations or air toxics "hot spots" where emissions from specific sources may expose individuals and population groups to elevated risks of adverse health effects, including, but not limited to, cancer and contribute to the cumulative health risks of emissions from other sources in the area. In some cases where large populations may not be significantly affected by adverse health risks, individuals may be exposed to significant risks.

(e) Little data is currently available to accurately assess the amounts, types, and health impacts of routine toxic chemical releases into the air. As a result, there exists significant uncertainty about the amounts of potentially hazardous air pollutants which are released, the location of those releases, and the concentrations to which the public is exposed.

(f) The State of California has begun to implement a long-term program to identify, assess, and control ambient levels of hazardous air pollutants, but additional legislation is needed to provide for the collection and evaluation of information concerning the amounts, exposures, and short- and long-term health effects of hazardous substances regularly released to the surrounding atmosphere from specific sources of hazardous releases.

(g) In order to more effectively implement control strategies for those materials posing an unacceptable risk to the public health, additional information on the sources of potentially hazardous air pollutants is necessary.
(h) It is in the public interest to ascertain and measure the amounts and types of hazardous releases and potentially hazardous releases from specific sources that may be exposing people to those releases, and to assess the health risks to those who are exposed.

44302. The definitions set forth in this chapter govern the construction of this part.

44303. "Air release" or "release" means any activity that may cause the issuance of air contaminants, including the actual or potential spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of a substance into the ambient air and that results from the routine operation of a facility or that is predictable, including, but not limited to, continuous and intermittent releases and predictable process upsets or leaks.

44304. "Facility" means every structure, appurtenance, installation, and improvement on land which is associated with a source of air releases or potential air releases of a hazardous material.

44306. "Health risk assessment" means a detailed comprehensive analysis prepared pursuant to Section 44361 to evaluate and predict the dispersion of hazardous substances in the environment and the potential for exposure of human populations and to assess and quantify both the individual and populationwide health risks associated with those levels of exposure.

44307. "Operator" means the person who owns or operates a facility or part of a facility.

44308. "Plan" means the emissions inventory plan which meets the conditions specified in Section 44342.

44309. "Report" means the emissions inventory report specified in Section 44341.

CHAPTER 2: FACILITIES SUBJECT TO THIS PART

44320. This part applies to the following:
(a) Any facility which manufactures, formulates, uses, or releases any of the substances listed pursuant to Section 44321 or any other substance which reacts to form a substance listed in Section 44321 and which releases or has the potential to release total organic gases, particulates, or oxides of nitrogen or sulfur in the amounts specified in Section 44322.
(b) Except as provided in Section 44323, any facility which is listed in any current toxics use or toxics air emission survey, inventory, or report released or compiled by a district. A district may, with the concurrence of the state board, waive the application of this part pursuant to this subdivision for any facility which

the district determines will not release any substance listed pursuant to Section 44321 due to a shutdown or a process change.

44321. For the purposes of Section 44320, the state board shall compile and maintain a list of substances that contains, but is not limited to, all of the following:

(a) Substances identified by reference in paragraph (1) of subdivision (b) of Section 6382 of the Labor Code and substances placed on the list prepared by the National Toxicology Program and issued by the United States Secretary of Health and Human Services pursuant to paragraph (4) of subsection (b) of Section 241 of Title 42 of the United States Code. For the purposes of this subdivision, the state board may remove from the list any substance which meets both of the following criteria:
   (1) No evidence exists that it has been detected in air.
   (2) The substance is not manufactured or used in California, or, if manufactured or used in California, because of the physical or chemical characteristics of the substance or the manner in which it is manufactured or used, there is no possibility that it will become airborne.

(b) Carcinogens and reproductive toxins referenced in or compiled pursuant to Section 25249.8, except those which meet both of the criteria identified in subdivision (a).

(c) Substances designated by the state board as toxic air contaminants pursuant to subdivision (b) of Section 39657 and substances on the candidate list of potential toxic air contaminants and the list of designated toxic air contaminants prepared by the state board pursuant to Article 3 (commencing with Section 39660) of Chapter 3.5 of Part 2, including, but not limited to, all substances currently under review and scheduled or nominated for review and substances identified and listed for which health effects information is limited.

(d) Substances for which an information or hazard alert has been issued by the repository of current data established pursuant to Section 147.2 of the Labor Code.

(e) Substances reviewed, under review, or scheduled for review as air toxics or potential air toxics by the Office of Air Quality Planning and Standards of the Environmental Protection Agency, including substances evaluated in all of the following categories or their equivalent: preliminary health and source screening, detailed assessment, intent to list, decision not to regulate, listed, standard proposed, and standard promulgated.

(f) Any additional substances recognized by the state board as presenting a chronic or acute threat to public health when present in the ambient air, including, but not limited to, any neurotoxicants or chronic respiratory toxicants not included within subdivision (a), (b), (c), (d), or (e).

44322. This part applies to facilities specified in subdivision (a) of Section 44320 in accordance with the following schedule:

(a) For those facilities that release, or have the potential to release, 25 tons per year or greater of total organic gases, particulates, or oxides of nitrogen or sulfur, this part becomes effective on July 1, 1988.

(b) For those facilities that release, or have the potential to release, more than 10 but less than 25 tons per year of total organic gases, particulates, or oxides of nitrogen or sulfur, this part becomes effective July 1, 1989.
(c) For those facilities that release, or have the potential to release, less than 10 tons per year of total organic gases, particulates, or oxides of nitrogen or sulfur, the state board shall, on or before July 1, 1990, prepare and submit a report to the Legislature identifying the classes of those facilities to be included in this part and specifying a timetable for their inclusion.

44323. A district may prepare an industrywide emissions inventory and health risk assessment for facilities specified in subdivision (b) of Section 44320 and subdivisions (a) and (b) of Section 44322, and shall prepare an industrywide emissions inventory for the facilities specified in subdivision (c) of Section 44322, in compliance with this part for any class of facilities that the district finds and determines meets all of the following conditions:
(a) All facilities in the class fall within one four-digit Standard Industrial Classification Code.
(b) Individual compliance with this part would impose severe economic hardships on the majority of the facilities within the class.
(c) The majority of the class is composed of small businesses.
(d) Releases from individual facilities in the class can easily and generically be characterized and calculated.

44324. This part does not apply to any facility where economic poisons are employed in their pesticidal use, unless that facility was subject to district permit requirements on or before August 1, 1987. As used in this section, "pesticidal use" does not include the manufacture or formulation of pesticides.

44325. Any solid waste disposal facility in compliance with Section 41805.5 is in compliance with the emissions inventory requirements of this part.

CHAPTER 3: AIR TOXICS EMISSION INVENTORIES

44340.
(a) The operator of each facility subject to this part shall prepare and submit to the district a proposed comprehensive emissions inventory plan in accordance with the criteria and guidelines adopted by the state board pursuant to Section 44342.
(b) The proposed plan shall be submitted to the district on or before August 1, 1989, except that, for any facility to which subdivision (b) of Section 44322 applies, the proposed plan shall be submitted to the district on or before August 1, 1990. The district shall approve, modify, and approve as modified, or return for revision and resubmission, the plan within 120 days of receipt.
(c) The district shall not approve a plan unless all of the following conditions are met:
(1) The plan meets the requirements established by the state board pursuant to Section 44342.

(2) The plan is designed to produce, from the list compiled and maintained pursuant to Section 44321, a comprehensive characterization of the full range of hazardous materials that are released, or that may be released, to the surrounding air from the facility. Air release data shall be collected at, or calculated for, the primary locations of actual and potential release for each hazardous material. Data shall be collected or calculated for all continuous, intermittent, and predictable air releases.
(3) The measurement technologies and estimation methods proposed provide state-of-the-art effectiveness and are sufficient to produce a true representation of the types and quantities of air releases from the facility.
(4) Source testing or other measurement techniques are employed wherever necessary to verify emission estimates, as determined by the state board and to the extent technologically feasible. All testing devices shall be appropriately located, as determined by the state board.
(5) Data are collected or calculated for the relevant exposure rate or rates of each hazardous material according to its characteristic toxicity and for the emission rate necessary to ensure a characterization of risk associated with exposure to releases of the hazardous material that meets the requirements of Section 44361. The source of all emissions shall be displayed or described.

44341. Within 180 days after approval of a plan by the district, the operator shall implement the plan and prepare and submit a report to the district in accordance with the plan. The district shall transmit all monitoring data contained in the approved report to the state board.

44342. The state board shall, on or before May 1, 1989, in consultation with the districts, develop criteria and guidelines for site-specific air toxics emissions inventory plans which shall be designed to comply with the conditions specified in Section 44340 and which shall include at least all of the following:
(a) For each class of facility, a designation of the hazardous materials for which emissions are to be quantified and an identification of the likely source types within that class of facility. The hazardous materials for quantification shall be chosen from among, and may include all or part of, the list specified in Section 44321.
(b) Requirements for a facility diagram identifying each actual or potential discrete emission point and the general locations where fugitive emissions may occur. The facility diagram shall include any nonpermitted and nonprocess sources of emissions and shall provide the necessary data to identify emission characteristics. An existing facility diagram which meets the requirements of this section may be submitted.
(c) Requirements for source testing and measurement. The guidelines may specify appropriate uses of estimation techniques including, but not limited to, emissions factors, modeling, mass balance analysis, and projections, except that source testing shall be required wherever necessary to verify emission estimates to the extent technologically feasible. The guidelines shall specify conditions and

locations where source testing, fence-line monitoring, or other measurement techniques are to be required and the frequency of that testing and measurement.

(d) Appropriate testing methods, equipment, and procedures, including quality assurance criteria.

(e) Specifications for acceptable emissions factors, including, but not limited to, those which are acceptable for substantially similar facilities or equipment, and specification of procedures for other estimation techniques and for the appropriate use of available data.

(f) Specification of the reporting period required for each hazardous material for which emissions will be inventoried.

(g) Specifications for the collection of useful data to identify toxic air contaminants pursuant to Article 2 (commencing with Section 39660) of Chapter 3.5 of Part 2.

(h) Standardized format for preparation of reports and presentation of data.

(i) A program to coordinate and eliminate any possible overlap between the requirements of this chapter and the requirements of Section 313 of the Superfund Amendment and Reauthorization Act of 1986 (Public Law 99-499). The state board shall design the guidelines and criteria to ensure that, in collecting data to be used for emissions inventories, actual measurement is utilized whenever necessary to verify the accuracy of emission estimates, to the extent technologically feasible.

44343. The district shall review the reports submitted pursuant to Section 44341 and shall, within 90 days, review each report, obtain corrections and clarifications of the data, and notify the Office of Environmental Health Hazard Assessment, the Department of Industrial Relations, and the city or county health department of its findings and determinations as a result of its review of the report.

44344. Except as provided in Section 44391, emissions inventories developed pursuant to this chapter shall be updated every four years, in accordance with the procedures established by the state board. Those updates shall take into consideration improvements in measurement techniques and advancing knowledge concerning the types and toxicity of hazardous material released or potentially released.

44344.4.

(a) Except as provided in subdivision (d) and in Section 44344.7, a facility shall be exempt from further compliance with this part if the facility's prioritization scores for cancer and noncancer health effects are both equal to or less than one, based on the results of the most recent emissions inventory or emissions inventory update. An exempt facility shall no longer be required to pay any fee or submit any report to the district or the state board pursuant to this part.

(b) Except for facilities that are exempt from this part pursuant to subdivision (a), a facility for which the prioritization scores for cancer and noncancer health effects are both equal to or less than 10, based on the results of the most recent emissions inventory or emissions inventory update, shall not be required to pay any fee or submit any report to the district or the state board pursuant to this part,

except for the quadrennial emissions inventory update required pursuant to Section 44344. A district may, by regulation, establish a fee to be paid by a facility operator in connection with the operator's submission to the district of a quadrennial emissions inventory update pursuant to this subdivision. The fee shall not be greater than one hundred twenty-five dollars ($125). A district may increase the fee above that amount upon the adoption of written findings that the costs of processing the emission inventory update exceed one hundred twenty-five dollars ($125). However, the district shall not adopt a fee greater than that supported by the written findings.

(c) For the purposes of this part, "prioritization score" means a facility's numerical score for cancer health effects or noncancer health effects, as determined by the district pursuant to Section 44360 in a manner consistent with facility prioritization guidelines prepared by the California Air Pollution Control Officers Association and approved by the state board.

(d) Notwithstanding subdivision (a) and Section 44344.7, if a district has good cause to believe that a facility may pose a potential threat to public health and that the facility therefore does not qualify for an exemption claimed by the facility pursuant to subdivision (a), the district may require the facility to document the facility's emissions and health impacts, or the changes in emissions expected to occur as a result of a particular physical change, a change in activities or operations at the facility, or a change in other factors. The district may deny the exemption if the documentation does not support the claim for the exemption.

44344.5.

(a) The operator of any new facility that previously has not been subject to this part shall prepare and submit an emissions inventory plan and report.

(b) Notwithstanding subdivision (a), a new facility shall not be required to submit an emissions inventory plan and report if all of the following conditions are met:

(1) The facility is subject to a district permit program established pursuant to Section 42300.

(2) The district conducts an assessment of the potential emissions or their associated risks, whichever the district determines to be appropriate, attributable to the new facility and finds that the emissions will not result in a significant risk. A risk assessment conducted pursuant to this paragraph shall comply with paragraph (2) of subdivision (b) of Section 44360.

(3) The district issues a permit authorizing construction or operation of the new facility.

44344.6. A district shall redetermine a facility's prioritization score, or evaluate the prioritization score as calculated and submitted by the facility, within 90 days from the date of receipt of a quadrennial emissions inventory update pursuant to Section 44344 or subdivision (b) of Section 44344.4, within 90 days from the date of receipt of an emissions inventory update submitted pursuant to Section 44344.7, or within 90 days from the date of receiving notice that a facility has completed the implementation of a plan prepared pursuant to Section 44392.

44344.7.

(a) A facility exempted from this part pursuant to subdivision (a) of Section 44344.4 shall, upon receipt of a notice from the district, again be subject to this part and the operator shall submit an emissions inventory update for those sources and substances for which a physical change in the facility or a change in activities or operations has occurred, as follows:
   (1) The facility emits a substance newly listed pursuant to Section 44321.
   (2) A sensitive receptor has been established or constructed within 500 meters of the facility after the facility became exempt.
   (3) The facility emits a substance for which the potency factor has increased.

(b) The operator of a facility exempted from this part pursuant to subdivision (a) of Section 44344.4 shall submit an emissions inventory update for those sources and substances for which a particular physical change in the facility or a change in activities or operations occurs if, as a result of the particular change, either of the following has occurred:
   (1) The facility has begun emitting a listed substance not included in the previous emissions inventory.
   (2) The facility has increased its emissions of a listed substance to a level greater than the level previously reported for that substance, and the increase in emissions exceeds 100 percent of the previously reported level.

(c) Notwithstanding subdivision (b), a physical change or change in activities or operations at a facility shall not cause the facility to again be subject to this part if all of the following conditions are met:
   (1) The physical change or change in activities or operations is subject to a district permit program established pursuant to Section 42300.
   (2) The district conducts an assessment of the potential changes in emissions or their associated risks, whichever the district determines to be appropriate, attributable to the physical change or change in activities or operations and finds that the changes in emissions will not result in a significant risk. A risk assessment conducted pursuant to this paragraph shall comply with paragraph (2) of subdivision (b) of Section 44360.
   (3) The district issues a permit for the physical change or change in activities or operations.

44345.

(a) On or before July 1, 1989, the state board shall develop a program to compile and make available to other state and local public agencies and the public all data collected pursuant to this chapter.

(b) In addition, the state board, on or before March 1, 1990, shall compile, by district, emissions inventory data for mobile sources and area sources not subject to district permit requirements, and data on natural source emissions, and shall incorporate these data into data compiled and released pursuant to this chapter.

44346.

(a) If an operator believes that any information required in the facility diagram specified pursuant to subdivision (b) of Section 44342 involves the release of a trade secret, the operator shall nevertheless make the disclosure to the district, and shall notify the district in writing of that belief in the report.

(b) Subject to this section, the district shall protect from disclosure any trade secret designated as such by the operator, if that trade secret is not a public record.

(c) Upon receipt of a request for the release of information to the public which includes information which the operator has notified the district is a trade secret and which is not a public record, the following procedure applies:

(1) The district shall notify the operator of the request in writing by certified mail, return receipt requested.

(2) The district shall release the information to the public, but not earlier than 30 days after the date of mailing the notice of the request for information, unless, prior to the expiration of the 30-day period, the operator obtains an action in an appropriate court for a declaratory judgment that the information is subject to protection under this section or for a preliminary injunction prohibiting disclosure of the information to the public and promptly notifies the district of that action.

(d) This section does not permit an operator to refuse to disclose the information required pursuant to this part to the district.

(e) Any information determined by a court to be a trade secret, and not a public record pursuant to this section, shall not be disclosed to anyone except an officer or employee of the district, the state, or the United States, in connection with the official duties of that officer or employee under any law for the protection of health, or to contractors with the district or the state and its employees if, in the opinion of the district or the state, disclosure is necessary and required for the satisfactory performance of a contract, for performance of work, or to protect the health and safety of the employees of the contractor.

(f) Any officer or employee of the district or former officer or employee who, by virtue of that employment or official position, has possession of, or has access to, any trade secret subject to this section, and who, knowing that disclosure of the information to the general public is prohibited by this section, knowingly and willfully discloses the information in any manner to any person not entitled to receive it is guilty of a misdemeanor. Any contractor of the district and any employee of the contractor, who has been furnished information as authorized by this section, shall be considered an employee of the district for purposes of this section.

(g) Information certified by appropriate officials of the United States as necessary to be kept secret for national defense purposes shall be accorded the full protections against disclosure as specified by those officials or in accordance with the laws of the United States.

(h) As used in this section, "trade secret" and "public record" have the meanings and protections given to them by Section 6254.7 of the Government Code and Section 1060 of the Evidence Code. All information collected pursuant to this chapter, except for data used to calculate emissions data required in the facility

diagram, shall be considered "air pollution emission data," for the purposes of this section.

CHAPTER 4: RISK ASSESSMENT

44360.

(a) Within 90 days of completion of the review of all emissions inventory data for facilities specified in subdivision (a) of Section 44322, but not later than December 1, 1990, the district shall, based on examination of the emissions inventory data and in consultation with the state board and the State Department of Health Services, prioritize and then categorize those facilities for the purposes of health risk assessment. The district shall designate high, intermediate, and low priority categories and shall include each facility within the appropriate category based on its individual priority. In establishing priorities pursuant to this section, the district shall consider the potency, toxicity, quantity, and volume of hazardous materials released from the facility, the proximity of the facility to potential receptors, including, but not limited to, hospitals, schools, day care centers, worksites, and residences, and any other factors that the district finds and determines may indicate that the facility may pose a significant risk to receptors. The district shall hold a public hearing prior to the final establishment of priorities and categories pursuant to this section.

(b)

(1) Within 150 days of the designation of priorities and categories pursuant to subdivision (a), the operator of every facility that has been included within the highest priority category shall prepare and submit to the district a health risk assessment pursuant to Section 44361. The district may, at its discretion, grant a 30-day extension for submittal of the health risk assessment.

(2) Health risk assessments required by this chapter shall be prepared in accordance with guidelines established by the Office of Environmental Health Hazard Assessment. The office shall prepare draft guidelines which shall be circulated to the public and the regulated community and shall adopt risk assessment guidelines after consulting with the state board and the Risk Assessment Committee of the California Air Pollution Control Officers Association and after conducting at least two public workshops, one in the northern and one in the southern part of the state. The adoption of the guidelines is not subject to Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code. The scientific review panel established pursuant to Section 39670 shall evaluate the guidelines adopted under this paragraph and shall recommend changes and additional criteria to reflect new scientific data or empirical studies.

(3) The guidelines established pursuant to paragraph (2) shall impose only those requirements on facilities subject to this subdivision that are necessary to ensure that a required risk assessment is accurate and complete and shall specify the type of site-specific factors that districts may take into account in determining when a single health risk assessment may be allowed under subdivision (d). The guidelines shall, in addition, allow the operator of a

facility, at the operator's option, and to the extent that valid and reliable data are available, to include for consideration by the district in the health risk assessment any or all of the following supplemental information:

(A) Information concerning the scientific basis for selecting risk parameter values that are different than those required by the guidelines and the likelihood distributions that result when alternative values are used.

(B) Data from dispersion models, microenvironment characteristics, and population distributions that may be used to estimate maximum actual exposure.

(C) Risk expressions that show the likelihood that any given risk estimate is the correct risk value.

(D) A description of the incremental reductions in risk that occur when exposure is reduced.

(4) To ensure consistency in the use of the supplemental information authorized by subparagraphs (A), (B), (C), and (D) of paragraph (3), the guidelines established pursuant to paragraph (2) shall include guidance for use by the districts in considering the supplemental information when it is included in the health risk assessment.

(c) Upon submission of emissions inventory data for facilities specified in subdivisions (b) and (c) of Section 44322, the district shall designate facilities for inclusion within the highest priority category, as appropriate, and any facility so designated shall be subject to subdivision (b). In addition, the district may require the operator of any facility to prepare and submit health risk assessments, in accordance with the priorities developed pursuant to subdivision (a).

(d) The district shall, except where site specific factors may affect the results, allow the use of a single health risk assessment for two or more substantially identical facilities operated by the same person.

(e) Nothing contained in this section, Section 44380.5, or Chapter 6 (commencing with Section 44390) shall be interpreted as requiring a facility operator to prepare a new or revised health risk assessment using the guidelines established pursuant to paragraph (2) of subdivision (a) of this section if the facility operator is required by the district to begin the preparation of a health risk assessment before those guidelines are established.

44361.

(a) Each health risk assessment shall be submitted to the district. The district shall make the health risk assessment available for public review, upon request. After preliminary review of the emissions impact and modeling data, the district shall submit the health risk assessment to the Office of Environmental Health Hazard Assessment for review and, within 180 days of receiving the health risk assessment, the State office shall submit to the district its comments on the data and findings relating to health effects. The district shall consult with the state board as necessary to adequately evaluate the emissions impact and modeling data contained within the risk assessment.

(b) For the purposes of complying with this section, the Office of Environmental Health Hazard Assessment may select a qualified independent contractor to review the data and findings relating to health effects. The office shall not select an independent contractor to review a specific health risk assessment who may have a conflict of interest with regard to the review of that health risk assessment. Any review by an independent contractor shall comply with the following requirements:
(1) Be performed in a manner consistent with guidelines provided by the office.
(2) Be reviewed by the office for accuracy and completeness.
(3) Be submitted by the office to the district in accordance with this section.

(c) The district shall reimburse the Office of Environmental Health Hazard Assessment or the qualified independent contractor designated by the office pursuant to subdivision (b), within 45 days of its request, for its actual costs incurred in reviewing a health risk assessment pursuant to this section.

(d) If a district requests the Office of Environmental Health Hazard Assessment to consult with the district concerning any requirement of this part, the district shall reimburse the office, within 45 days of its request, for the costs incurred in the consultation.

(e) Upon designation of the high priority facilities, as specified in subdivision (a) of Section 44360, the Office of Environmental Health Hazard Assessment shall evaluate the staffing requirements of this section and may submit recommendations to the Legislature, as appropriate, concerning the maximum number of health risk assessments to be reviewed each year pursuant to this section.

44362.

(a) Taking the comments of the Office of Environmental Health Hazard Assessment into account, the district shall approve or return for revision and resubmission and then approve, the health risk assessment within one year of receipt. If the health risk assessment has not been revised and resubmitted within 60 days of the district's request of the operator to do so, the district may modify the health risk assessment and approve it as modified.

(b) Upon approval of the health risk assessment, the operator of the facility shall provide notice to all exposed persons regarding the results of the health risk assessment prepared pursuant to Section 44361 if, in the judgment of the district, the health risk assessment indicates there is a significant health risk associated with emissions from the facility. If notice is required under this subdivision, the notice shall include only information concerning significant health risks attributable to the specific facility for which the notice is required. Any notice shall be made in accordance with procedures specified by the district.

44363.

(a) Commencing July 1, 1991, each district shall prepare and publish an annual report which does all of the following:

(1) Describes the priorities and categories designated pursuant to Section 44360 and summarizes the results and progress of the health risk assessment program undertaken pursuant to this part.

(2) Ranks and identifies facilities according to the degree of cancer risk posed both to individuals and to the exposed population.

(3) Identifies facilities which expose individuals or populations to any noncancer health risks.

(4) Describes the status of the development of control measures to reduce emissions of toxic air contaminants, if any.

(b) The district shall disseminate the annual report to county boards of supervisors, city councils, and local health officers and the district board shall hold one or more public hearings to present the report and discuss its content and significance.

44364. The state board shall utilize the reports and assessments developed pursuant to this part for the purposes of identifying, establishing priorities for, and controlling toxic air contaminants pursuant to Chapter 3.5 (commencing with Section 39650) of Part 2.

44365.

(a) If the state board finds and determines that a district's actions pursuant to this part do not meet the requirements of this part, the state board may exercise the authority of the district pursuant to this part to approve emissions inventory plans and require the preparation of health risk assessments.

(b) This part does not prevent any district from establishing more stringent criteria and requirements than are specified in this part for approval of emissions inventories and requiring the preparation and submission of health risk assessments. Nothing in this part limits the authority of a district under any other provision of law to assess and regulate releases of hazardous substances.

44366.

(a) In order to verify the accuracy of any information submitted by facilities pursuant to this part, a district or the state board may proceed in accordance with Section 41510.

CHAPTER 5: FEES AND REGULATIONS

44380.

(a) The state board shall adopt a regulation which does all of the following:

(1) Sets forth the amount of revenue which the district must collect to recover the reasonable anticipated cost which will be incurred by the state board and the Office of Environmental Health Hazard Assessment to implement and administer this part.

(2) Requires each district to adopt a fee schedule which recovers the costs of the district and which assesses a fee upon the operator of every facility subject to this part, except as specified in subdivision (b) of Section 44344.4. A district may request the state board to adopt a fee schedule for the district if the district's program costs are approved by the district board and transmitted to the state board by April 1 of the year in which the request is made.

(3) Requires any district that has an approved toxics emissions inventory compiled pursuant to this part by August 1 of the preceding year to adopt a fee schedule, as described in paragraph (2), which imposes on facility operators fees which are, to the maximum extent practicable, proportionate to the extent of the releases identified in the toxics emissions inventory and the level of priority assigned to that source by the district pursuant to Section 44360.

(b) Commencing August 1, 1992, and annually thereafter, the state board shall review and may amend the fee regulation.

(c) The district shall notify each person who is subject to the fee of the obligation to pay the fee. If a person fails to pay the fee within 60 days after receipt of this notice, the district, unless otherwise provided by district rules, shall require the person to pay an additional administrative civil penalty. The district shall fix the penalty at not more than 100 percent of the assessed fee, but in an amount sufficient in its determination, to pay the district's additional expenses incurred by the person's noncompliance. If a person fails to pay the fee within 120 days after receipt of this notice, the district may initiate permit revocation proceedings. If any permit is revoked, it shall be reinstated only upon full payment of the overdue fee plus any late penalty, and a reinstatement fee to cover administrative costs of reinstating the permit.

(d) Each district shall collect the fees assessed pursuant to subdivision (a). After deducting the costs to the district to implement and administer this part, the district shall transmit the remainder to the Controller for deposit in the Air Toxics Inventory and Assessment Account, which is hereby created in the General Fund. The money in the account is available, upon appropriation by the Legislature, to the state board and the Office of Environmental Health Hazard Assessment for the purposes of administering this part.

(e) For the 1997-98 fiscal year, air toxics program revenues for the state board and the Office of Environmental Health Hazard Assessment shall not exceed two million dollars ($2,000,000), and for each fiscal year thereafter, shall not exceed one million three hundred fifty thousand dollars ($1,350,000). Funding for the Office of Environmental Health Hazard Assessment for conducting risk assessment reviews shall be on a fee-for-service basis.

44380.1. A facility shall be granted an exemption by a district from paying a fee in accordance with Section 44380 if all of the following criteria are met:

(a) The facility primarily handles, processes, stores, or distributes bulk agricultural commodities or handles, feeds, or rears livestock.

(b) The facility was required to comply with this part only as a result of its particulate matter emissions.

(c) The fee schedule adopted by the district or the state board for these types of facilities is not solely based on toxic emissions weighted for potency or toxicity.

44380.5. In addition to the fee assessed pursuant to Section 44380, a supplemental fee may be assessed by the district, the state board, or the Office of Environmental Health Hazard Assessment upon the operator of a facility that, at the operator's option, includes supplemental information authorized by paragraph (3) of subdivision (b) of Section 44360 in a health risk assessment, if the review of that supplemental information substantially increases the costs of reviewing the health risk assessment by the district, the state board, or the office. The supplemental fee shall be set by the state board in the regulation required by subdivision (a) of Section 44380 and shall be set in an amount sufficient to cover the direct costs to review the information supplied by an operator pursuant to paragraph (3) of subdivision (b) of Section 44360.

44381.

(a) Any person who fails to submit any information, reports, or statements required by this part, or who fails to comply with this part or with any permit, rule, regulation, or requirement issued or adopted pursuant to this part, is subject to a civil penalty of not less than five hundred dollars ($500) or more than ten thousand dollars ($10,000) for each day that the information, report, or statement is not submitted, or that the violation continues.

(b) Any person who knowingly submits any false statement or representation in any application, report, statement, or other document filed, maintained, or used for the purposes of compliance with this part is subject to a civil penalty of not less than one thousand dollars ($1,000) or more than twenty-five thousand dollars ($25,000) per day for each day that the information remains uncorrected.

44382. Every district shall, by regulation, adopt the requirements of this part as a condition of every permit issued pursuant to Chapter 4 (commencing with Section 42300) of Part 4 for all new and modified facilities.

44384. Except for Section 44380 and this section, all provisions of this part shall become operative on July 1, 1988.

CHAPTER 6: FACILITY RISK REDUCTION AUDIT AND PLAN

44390. For purposes of this chapter, the following definitions apply:

(a) "Airborne toxic risk reduction measure" or "ATRRM" means those in-plant changes in production processes or feedstocks that reduce or eliminate toxic air emissions subject to this part. ATRRM's may include:

(1) Feedstock modification.
(2) Product reformulations.
(3) Production system modifications.
(4) System enclosure, emissions control, capture, or conversion.
(5) Operational standards and practices modification.

(b) Airborne toxic risk reduction measures do not include measures that will increase risk from exposure to the chemical in another media or that increase the risk to workers or consumers.
(c) "Airborne toxic risk reduction audit and plan" or "audit and plan" means the audit and plan specified in Section 44392.

44391.
(a) Whenever a health risk assessment approved pursuant to Chapter 4 (commencing with Section 44360) indicates, in the judgment of the district, that there is a significant risk associated with the emissions from a facility, the facility operator shall conduct an airborne toxic risk reduction audit and develop a plan to implement airborne toxic risk reduction measures that will result in the reduction of emissions from the facility to a level below the significant risk level within five years of the date the plan is submitted to the district. The facility operator shall implement measures set forth in the plan in accordance with this chapter.
(b) The period to implement the plan required by subdivision (a) may be shortened by the district if it finds that it is technically feasible and economically practicable to implement the plan to reduce emissions below the significant risk level more quickly or if it finds that the emissions from the facility pose an unreasonable health risk.
(c) A district may lengthen the period to implement the plan required by subdivision (a) by up to an additional five years if it finds that a period longer than five years will not result in an unreasonable risk to public health and that requiring implementation of the plan within five years places an unreasonable economic burden on the facility operator or is not technically feasible.
(d)
(1) The state board and districts shall provide assistance to smaller businesses that have inadequate technical and financial resources for obtaining information, assessing risk reduction methods, and developing and applying risk reduction techniques.
(2) Risk reduction audits and plans for any industry subject to this chapter which is comprised mainly of small businesses using substantially similar technology may be completed by a self-conducted audit and checklist developed by the state board. The state board, in coordination with the districts, shall provide a copy of the audit and checklist to small businesses within those industries to assist them to meet the requirements of this chapter.
(e) The audit and plan shall contain all the information required by Section 44392.
(f) The plan shall be submitted to the district, within six months of a district's determination of significant risk, for review of completeness. Operators of facilities that have been notified prior to January 1, 1993, that there is a significant risk associated with emissions from the facility shall submit the plan by July 1, 1993. The district's review of completeness shall include a substantive analysis of the emission reduction measures included in the plan, and the ability

of those measures to achieve emission reduction goals as quickly as feasible as provided in subdivisions (a) and (b).

(g) The district shall find the audit and plan to be satisfactory within three months if it meets the requirements of this chapter, including, but not limited to, subdivision (f). If the district determines that the audit and plan does not meet those requirements, the district shall remand the audit and plan to the facility specifying the deficiencies identified by the district. A facility operator shall submit a revised audit and plan addressing the deficiencies identified by the district within 90 days of receipt of a deficiency notice.

(h) Progress on the emission reductions achieved by the plan shall be reported to the district in emissions inventory updates. Emissions inventory updates shall be prepared as required by the audit and plan found to be satisfactory by the district pursuant to subdivision (g).

(i) If new information becomes available after the initial risk reduction audit and plan, on air toxics risks posed by a facility, or emission reduction technologies that may be used by a facility that would significantly impact risks to exposed persons, the district may require the plan to be updated and resubmitted to the district.

(j) This section does not authorize the emission of a toxic air contaminant in violation of an airborne toxic control measure adopted pursuant to Chapter 3.5 (commencing with Section 39650) or in violation of Section 41700.

44392. A facility operator subject to this chapter shall conduct an airborne toxic risk reduction audit and develop a plan which shall include at a minimum all of the following:

(a) The name and location of the facility.

(b) The SIC code for the facility.

(c) The chemical name and the generic classification of the chemical.

(d) An evaluation of the ATRRM's available to the operator.

(e) The specification of, and rationale for, the ATRRMs that will be implemented by the operator. The audit and plan shall document the rationale for rejecting ATRRMs that are identified as infeasible or too costly.

(f) A schedule for implementing the ATRRMs. The schedule shall meet the time requirements of subdivision (a) of Section 44391 or the time period for implementing the plan set by the district pursuant to subdivision (b) or (c) of Section 44391, whichever is applicable.

(g) The audit and plan shall be reviewed and certified as meeting this chapter by an engineer who is registered as a professional engineer pursuant to Section 6762 of the Business and Professions Code, by an individual who is responsible for the processes and operations of the site, or by an environmental assessor registered pursuant to Section 25570.3.

44393. The plan prepared pursuant to Section 44391 shall not be considered to be the equivalent of a pollution prevention program or a source reduction program, except insofar as the audit and plan elements are consistent with source reduction, as defined in Section 25244.14, or subsequent statutory definitions of pollution prevention.

44394. Any facility operator who does not submit a complete airborne toxic risk reduction audit and plan or fails to implement the measures set forth in the plan as set forth in this chapter is subject to the civil penalty specified in subdivision (a) of Section 44381, and any facility operator who, in connection with the audit or plan, knowingly submits any false statement or representation is subject to the civil penalty specified in subdivision (b) of Section 44381.

B.3. Toxic Air Contaminants Program Overview

(Air Resources Board, 2011: see http://www.arb.ca.gov/toxics/background.htm)

AB 1807 Program

In 1983, the California Legislature established a two-step process of risk identification and risk management to address the potential health effects from air toxic substances and protect the public health of Californians. During the first step (identification), the ARB and the Office of Environmental Health Hazard Assessment (OEHHA) determine if a substance should be formally identified as a toxic air contaminant (TAC) in California. During this process, the ARB and the OEHHA staff draft a report that serves as the basis for this determination. The ARB staff assesses the potential for human exposure to a substance and the OEHHA staff evaluates the health effects. A thorough public process assures accountability and public input. Public workshops are conducted to allow for direct exchanges of information with interested constituencies. The draft risk assessments themselves are published and widely distributed with a public notice requesting comment to further assure involvement. The final risk assessment (identification) report includes a record of the public comments and how they were addressed. After the ARB and the OEHHA staff hold several comment periods and workshops, the report is then submitted to an independent, nine member, Scientific Review Panel (SRP), who review the report for its scientific accuracy. If the SRP approves the report, they develop specific scientific findings which are officially submitted to the ARB. The ARB staff then prepares a hearing notice and draft regulation to formally identify the substance as a TAC. Based on the input from the public and the information gathered from the report, the Board will decide whether to identify a substance as a TAC. Any person may petition the Board to review a previous determination by providing new evidence.

In the second step (risk management), the ARB reviews the emission sources of an identified TAC to determine if any regulatory action is necessary to reduce the risk. The analysis includes a review of controls already in place, the available technologies and associated costs for reducing emissions, and the associated risk. Public outreach is an essential element in the development of a control plan and any control measure to ensure that the ARB efforts are cost-effective and appropriately balance public health protection and economic growth.

In 1993, the California Legislature amended the AB 1807 program for the identification and control of TACs (AB 2728). Specifically, AB 2728 required the ARB to identify the 189 federal hazardous air pollutants as TACs. For those substances that have not previously been identified under AB 1807 and identified under AB 2728, health effects values will need to be developed. This report will serve as a basis for that evaluation. For substances that were not identified as TACs and are on the TAC Identification List, this report will provide information to evaluate which substances may be entered into the air toxics identification process.

B.4. Senate Bill 352. Schoolsites: sources of pollution

CHAPTER 668
FILED WITH SECRETARY OF STATE OCTOBER 3, 2003
APPROVED BY GOVERNOR OCTOBER 2, 2003

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1.
The Legislature finds and declares all of the following:

(a) Many studies have shown significantly increased levels of pollutants, particularly diesel particulates, in close proximity to freeways and other major diesel sources. A recent study of Los Angeles area freeways measured diesel particulate levels up to 25 times higher near freeways than those levels elsewhere. Much of the pollution from freeways is associated with acute health effects, exacerbating asthma and negatively impacting the ability of children to learn.
(b) Cars and trucks release at least forty different toxic air contaminants, including, but not limited to, diesel particulate, benzene, formaldehyde, 1,3-butadiene and acetaldehyde. Levels of these pollutants are generally concentrated within 500 feet of freeways and very busy roadways.
(c) Current state law governing the siting of schools does not specify whether busy freeways should be included in environmental impact reports of nearby "facilities." Over 150 schools are already estimated to be within 500 feet of extremely high traffic roadways.
(d) A disproportionate number of economically disadvantaged pupils may be attending schools that are close to busy roads, putting them at an increased risk of developing bronchitis from elevated levels of several pollutants associated with traffic. Many studies have confirmed that increased wheezing and bronchitis occurs among children living in high traffic areas.
(e) It is therefore the intent of the Legislature to protect school children from the health risks posed by pollution from heavy freeway traffic and other nonstationary sources in the same way that they are protected from industrial pollution.

SECTION 2.

Section 17213 of the Education Code is amended to read:
17213. The governing board of a school district may not approve a project involving the acquisition of a schoolsite by a school district, unless all of the following occur:
(a) The school district, as the lead agency, as defined in Section 21067 of the Public Resources Code, determines that the property purchased or to be built upon is not any of the following:
(1) The site of a current or former hazardous waste disposal site or solid waste disposal site, unless if the site was a former solid waste disposal site, the governing board of the school district concludes that the wastes have been removed.

(2) A hazardous substance release site identified by the Department of Toxic Substances Control in a current list adopted pursuant to Section 25356 of the Health and Safety Code for removal or remedial action pursuant to Chapter 6.8 (commencing with Section 25300) of Division 20 of the Health and Safety Code.

(3) A site that contains one or more pipelines, situated underground or aboveground, that carries hazardous substances, acutely hazardous materials, or hazardous wastes, unless the pipeline is a natural gas line that is used only to supply natural gas to that school or neighborhood.

(b) The school district, as the lead agency, as defined in Section 21067 of the Public Resources Code, in preparing the environmental impact report or negative declaration has consulted with the administering agency in which the proposed schoolsite is located, pursuant to Section 2735.3 of Title 19 of the California Code of Regulations, and with any air pollution control district or air quality management district having jurisdiction in the area, to identify both permitted and nonpermitted facilities within that district's authority, including, but not limited to, freeways and other busy traffic corridors, large agricultural operations, and railyards, within one-fourth of a mile of the proposed schoolsite, that might reasonably be anticipated to emit hazardous air emissions, or to handle hazardous or acutely hazardous materials, substances, or waste. The school district, as the lead agency, shall include a list of the locations for which information is sought.

(c) The governing board of the school district makes one of the following written findings:

(1) Consultation identified none of the facilities or significant pollution sources specified in subdivision (b).

(2) The facilities or other pollution sources specified in subdivision (b) exist, but one of the following conditions applies:

(A) The health risks from the facilities or other pollution sources do not and will not constitute an actual or potential endangerment of public health to persons who would attend or be employed at the school.

(B) The governing board finds that corrective measures required under an existing order by another governmental entity that has jurisdiction over the facilities or other pollution sources will, before the school is occupied, result in the mitigation of all chronic or accidental hazardous air emissions to levels that do not constitute an actual or potential endangerment of public health to persons who would attend or be employed at the proposed school. If the governing board makes this finding, the governing board shall also make a subsequent finding, prior to the occupancy of the school, that the emissions have been mitigated to these levels.

(C) For a schoolsite with a boundary that is within 500 feet of the edge of the closest traffic lane of a freeway or other busy traffic corridor, the governing board of the school district determines, through analysis pursuant to paragraph (2) of subdivision (b) of Section 44360 of the Health and Safety Code, based on appropriate air dispersion modeling, and after considering any potential mitigation measures, that the air quality at the proposed site

is such that neither short-term nor long-term exposure poses significant health risks to pupils.

(D) The governing board finds that neither of the conditions set forth in subparagraph (B) or (C) can be met, and the school district is unable to locate an alternative site that is suitable due to a severe shortage of sites that meet the requirements in subdivision (a) of Section 17213. If the governing board makes this finding, the governing board shall adopt a statement of Overriding Considerations pursuant to Section 15093 of Title 14 of the California Code of Regulations.

(d) As used in this section:

(1) "Hazardous air emissions" means emissions into the ambient air of air contaminants that have been identified as a toxic air contaminant by the State Air Resources Board or by the air pollution control officer for the jurisdiction in which the project is located. As determined by the air pollution control officer, hazardous air emissions also means emissions into the ambient air from any substance identified in subdivisions (a) to (f), inclusive, of Section 44321 of the Health and Safety Code.

(2) "Hazardous substance" means any substance defined in Section 25316 of the Health and Safety Code.

(3) "Acutely hazardous material" means any material defined pursuant to subdivision (a) of Section 25532 of the Health and Safety Code.

(4) "Hazardous waste" means any waste defined in Section 25117 of the Health and Safety Code.

(5) "Hazardous waste disposal site" means any site defined in Section 25114 of the Health and Safety Code.

(6) "Administering agency" means any agency designated pursuant to Section 25502 of the Health and Safety Code.

(7) "Handle" means handle as defined in Article 1 (commencing with Section 25500) of Chapter 6.95 of Division 20 of the Health and Safety Code.

(8) "Facilities" means any source with a potential to use, generate, emit or discharge hazardous air pollutants, including, but not limited to, pollutants that meet the definition of a hazardous substance, and whose process or operation is identified as an emission source pursuant to the most recent list of source categories published by the California Air Resources Board.

(9) "Freeway or other busy traffic corridors" means those roadways that, on an average day, have traffic in excess of 50,000 vehicles in a rural area as defined in Section 50101 of the Health and Safety Code, and 100,000 vehicles in an urban area, as defined in Section 50104.7 of the Health and Safety Code.

SECTION 3.

Section 21151.8 of the Public Resources Code is amended to read:

21151.8.

(a) An environmental impact report or negative declaration may not be approved for any project involving the purchase of a schoolsite or the construction of a new

elementary or secondary school by a school district unless all of the following occur:

(1) The environmental impact report or negative declaration includes information that is needed to determine if the property proposed to be purchased, or to be constructed upon, is any of the following:

(A) The site of a current or former hazardous waste disposal site or solid waste disposal site and, if so, whether the wastes have been removed.

(B) A hazardous substance release site identified by the Department of Toxic Substances Control in a current list adopted pursuant to Section 25356 of the Health and Safety Code for removal or remedial action pursuant to Chapter 6.8 (commencing with Section 25300) of Division 20 of the Health and Safety Code.

(C) A site that contains one or more pipelines, situated underground or aboveground, that carries hazardous substances, acutely hazardous materials, or hazardous wastes, unless the pipeline is a natural gas line that is used only to supply natural gas to that school or neighborhood, or other nearby schools.

(D) A site that is within 500 feet of the edge of the closest traffic lane of a freeway or other busy traffic corridor.

(2) The school district, as the lead agency, in preparing the environmental impact report or negative declaration has notified in writing and consulted with the administering agency in which the proposed schoolsite is located, pursuant to Section 2735.3 of Title 19 of the California Code of Regulations, and with any air pollution control district or air quality management district having jurisdiction in the area, to identify both permitted and nonpermitted facilities within that district's authority, including, but not limited to, freeways and busy traffic corridors, large agricultural operations, and railyards, within one-fourth of a mile of the proposed schoolsite, that might reasonably be anticipated to emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste. The notification by the school district, as the lead agency, shall include a list of the locations for which information is sought.

(3) The governing board of the school district makes one of the following written findings:

(A) Consultation identified no facilities of this type or other significant pollution sources specified in paragraph (2).

(B) The facilities or other pollution sources specified in paragraph (2) exist, but one of the following conditions applies:

(i) The health risks from the facilities or other pollution sources do not and will not constitute an actual or potential endangerment of public health to persons who would attend or be employed at the proposed school.

(ii) Corrective measures required under an existing order by another agency having jurisdiction over the facilities or other pollution sources will, before the school is occupied, result in the mitigation of all chronic or accidental hazardous air emissions to levels that do not constitute an actual or potential endangerment of public health to persons who

would attend or be employed at the proposed school. If the governing board makes a finding pursuant to this clause, it shall also make a subsequent finding, prior to occupancy of the school, that the emissions have been so mitigated.

(iii) For a schoolsite with a boundary that is within 500 feet of the edge of the closest traffic lane of a freeway or other busy traffic corridor, the governing board of the school district determines, through analysis pursuant to paragraph (2) of subdivision (b) of Section 44360 of the Health and Safety Code, based on appropriate air dispersion modeling, and after considering any potential mitigation measures, that the air quality at the proposed site is such that neither short-term nor long-term exposure poses significant health risks to pupils.

(C) The facilities or other pollution sources specified in paragraph (2) exist, but conditions in clause (i), (ii) or (iii) of subparagraph (B) cannot be met, and the school district is unable to locate an alternative site that is suitable due to a severe shortage of sites that meet the requirements in subdivision (a) of Section 17213 of the Education Code. If the governing board makes this finding, the governing board shall adopt a statement of Overriding Considerations pursuant to Section 15093 of Title 14 of the California Code of Regulations.

(4) Each administering agency, air pollution control district, or air quality management district receiving written notification from a lead agency to identify facilities pursuant to paragraph (2) shall provide the requested information and provide a written response to the lead agency within 30 days of receiving the notification. The environmental impact report or negative declaration shall be conclusively presumed to comply with this section as to the area of responsibility of any agency that does not respond within 30 days.

(b) If a school district, as a lead agency, has carried out the consultation required by paragraph (2) of subdivision (a), the environmental impact report or the negative declaration shall be conclusively presumed to comply with this section, notwithstanding any failure of the consultation to identify an existing facility or other pollution source specified in paragraph (2) of subdivision (a).

(c) As used in this section and Section 21151.4, the following definitions shall apply:

(1) "Hazardous substance" means any substance defined in Section 25316 of the Health and Safety Code.

(2) "Acutely hazardous material" means any material defined pursuant to subdivision (a) of Section 25532 of the Health and Safety Code.

(3) "Hazardous waste" means any waste defined in Section 25117 of the Health and Safety Code.

(4) "Hazardous waste disposal site" means any site defined in Section 25114 of the Health and Safety Code.

(5) "Hazardous air emissions" means emissions into the ambient air of air contaminants that have been identified as a toxic air contaminant by the State Air Resources Board or by the air pollution control officer for the jurisdiction in which the project is located. As determined by the air pollution control officer, hazardous air emissions also means emissions into the ambient air from any

substances identified in subdivisions (a) to (f), inclusive, of Section 44321 of the Health and Safety Code.

(6) "Administering agency" means an agency designated pursuant to Section 25502 of the Health and Safety Code.

(7) "Handle" means handle as defined in Article 1 (commencing with Section 25500) of Chapter 6.95 of Division 20 of the Health and Safety Code.

(8) "Facilities" means any source with a potential to use, generate, emit or discharge hazardous air pollutants, including, but not limited to, pollutants that meet the definition of a hazardous substance, and whose process or operation is identified as an emission source pursuant to the most recent list of source categories published by the California Air Resources Board.

(9) "Freeway or other busy traffic corridors" means those roadways that, on an average day, have traffic in excess of 50,000 vehicles in a rural area, as defined in Section 50101 of the Health and Safety Code, and 100,000 vehicles in an urban area, as defined in Section 50104.7 of the Health and Safety Code.

B.5. Senate Bill 25, Children's Environmental Health Protection.

CHAPTER 731
FILED WITH SECRETARY OF STATE OCTOBER 10, 1999
APPROVED BY GOVERNOR OCTOBER 7, 1999

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1.
The Legislature finds and declares all of the following:

(a) Infants and children have a higher ventilation rate than adults relative to their body weight and lung surface area, resulting in a greater dose of pollution delivered to their lungs.
(b) Children have narrower airways than adults. Thus, irritation or inflammation caused by air pollution that would produce only a slight response in an adult can result in a potentially significant obstruction of the airway in a young child.
(c) Children spend significantly more time outdoors, especially in the summer, when ozone air pollution levels are typically highest. National statistics show that children spend an average of 50 percent more time outdoors than adults.
(d) Air pollution is known to exacerbate asthma and be a trigger for asthma attacks in infants and children, 500,000 of whom are afflicted with this chronic lung disease in California.
(e) Infant's and children's developing organs and tissues are more susceptible to damage from some environmental contaminants than are adult organs and tissues.
(f) It is the intent of the Legislature in enacting this act, to require that the state's air quality standards and airborne toxic control measures be reviewed to determine if they adequately protect the health of infants and children, and that these standards and measures be revised if they are determined to be inadequate.
(g) It is also the intent of the Legislature in enacting this act to require the State Air Resources Board and the Office of Environmental Health Hazard Assessment to consider the health impacts to all populations of children, including special subpopulations of infants and children that comprise a meaningful portion of the general population, such as children with asthma, cystic fibrosis, or other respiratory conditions or diseases, in setting or revising standards pursuant to this act.

SECTION 2.
Part 3 (commencing with Section 900) is added to Division 1 of the Health and Safety Code, to read:
PART 3. CHILDREN'S ENVIRONMENTAL HEALTH CENTER 900. There is hereby created the Children's Environmental Health Center within the Environmental Protection Agency. The primary purposes of the center shall include all of the following:

(a) To serve as the chief advisor to the Secretary for Environmental Protection and to the Governor on matters within the jurisdiction of the Environmental Protection

Agency relating to environmental health and environmental protection as each of those matters relates to children.

(b) To assist the boards, departments, and offices within the Environmental Protection Agency to assess the effectiveness of statutes, regulations, and programs designed to protect children from environmental hazards.

(c) To coordinate within the Environmental Protection Agency and with other state agencies, regulatory efforts, research and data collection, and other programs and services that impact the environmental health of children, and coordinate with appropriate federal agencies conducting related regulatory efforts and research and data collection.

(d) In consultation with the State Air Resources Board and the Office of Environmental Health Hazard Assessment, and notwithstanding Section 7550.5 of the Government Code, to report to the Legislature and the Governor no later than December 31, 2001, on the progress of the state board and the office toward implementing the act that added this part during the 1999-2000 Regular Session and to make recommendations for any statutory or regulatory changes that may be necessary to carry out the intent of that act to protect the public health, including infants and children, from air pollutants and toxic air contaminants.

SECTION 3.
Section 39606 of the Health and Safety Code is amended to read:
39606.

(a) The state board shall do both of the following:
  (1) Based upon similar meteorological and geographic conditions and consideration for political boundary lines whenever practicable,divide the state into air basins to fulfill the purposes of this division.
  (2) Adopt standards of ambient air quality for each air basin in consideration of the public health, safety, and welfare, including,but not limited to, health, illness, irritation to the senses, aesthetic value, interference with visibility, and effects on the economy. These standards may vary from one air basin to another. Standards relating to health effects shall be based upon the recommendations of the Office of Environmental Health Hazard Assessment.

(b) In its recommendations for submission to the state board pursuant to paragraph (2) of subdivision (a), the Office of Environmental Health Hazard Assessment, to the extent that information is available, shall assess the following:
  (1) Exposure patterns, including, but not limited to, patterns determined by relevant data supplied by the state board, among infants and children that are likely to result in disproportionately high exposure to ambient air pollutants in comparison to the general population.
  (2) Special susceptibility of infants and children to ambient air pollutants in comparison to the general population.
  (3) The effects on infants and children of exposure to ambient air pollutants and other substances that have a common mechanism of toxicity.
  (4) The interaction of multiple air pollutants on infants and children, including the interaction between criteria air pollutants and toxic air contaminants.

(c) In assessing the factors specified in subdivision (b), the office shall use current principles, practices, and methods used by public health professionals who are experienced practitioners in the field of human health effects assessment. The scientific basis or scientific portion of the method used by the office to assess the factors set forth in subdivision (b) shall be subject to peer review as described in Section 57004 or in a manner consistent with the peer review requirements of Section 57004. Any person may submit any information for consideration by the entity conducting the peer review, which may receive oral testimony.

(d)

(1) No later than December 31, 2000, the state board in consultation with the office, shall review all existing health-based ambient air quality standards to determine whether, based on public health, scientific literature, and exposure pattern data, the standards adequately protect the health of the public, including infants and children, with an adequate margin of safety. The state board shall publish a report summarizing these findings.

(2) The state board shall revise the highest priority ambient air quality standard determined to be inadequate to protect infants and children with an adequate margin of safety, based on its report, no later than December 31, 2002. Following the revision of the highest priority standard, the state board shall revise any additional standards determined to be inadequate to protect infants and children with an adequate margin of safety, at the rate of at least one per year. The standards shall be established at levels that adequately protect the health of the public, including infants and children, with an adequate margin of safety (e) Nothing in this section shall restrict the authority of the state board to consider additional information in establishing ambient air quality standards or to adopt an ambient air quality standard designed to protect vulnerable populations other than infants and children.

SECTION 4.
Section 39617.5 is added to the Health and Safety Code, to read:
39617.5.

(a) Not later than January 1, 2003, the state board shall do all of the following:

(1) Evaluate the adequacy of the current monitoring network for its ability to gather the data necessary to determine the exposure of infants and children to air pollutants including criteria air pollutants and toxic air contaminants.

(2) Identify areas where the exposure of infants and children to air pollutants is not adequately measured by the current monitoring network.

(3) Recommend changes to improve air pollution monitoring networks and data collection to more accurately reflect the exposure of infants and children to air pollutants.

(b) In carrying out this section, the state board, in cooperation with the districts, shall expand its existing monitoring program in six communities around the state in nonattainment areas, as selected by the state board, to include special monitoring of children's exposure to air pollutants and toxic contaminants. The expanded program shall include placing air pollution monitors near schools, day care centers, and outdoor recreational facilities that are in close proximity to, or

downwind from, major industrial sources of air pollutants and toxic air contaminants, including, freeways and major traffic areas. The purpose of the air pollution monitors shall be to conduct sampling of air pollution levels affecting children. Monitoring may include the use of fixed, mobile, and other monitoring devices, as appropriate.

(c) The expanded monitoring program shall include the following:
   (1) Monitoring during multiple seasons and at multiple locations within each community at schools, day care centers, recreational facilities, and other locations where children spend most of their time.
   (2) A combination of upgrading existing fixed monitoring sites, establishing new fixed monitoring sites, and conducting indoor and outdoor sampling and personal exposure measurements in each community to provide the most comprehensive data possible on the levels of children's exposure to air pollutants and toxic air contaminants.

(d) Data collected from expanded air quality monitoring activities conducted pursuant to this section may be used for any purpose authorized by law, including, but not limited to, determinations as to whether an area has attained or has not attained the state and national ambient air quality standards, if the monitoring devices from which the data was collected meet the monitoring requirements specified in Section 58.14 of Title 40 of the Code of Federal Regulations for special purpose monitors, all other monitoring requirements of Part 58 of Title 40 of the Code of Federal Regulations, and all applicable requirements specified in regulations adopted by the state board.

SECTION 5.
Section 39660 of the Health and Safety Code is amended to read:
39660.

(a) Upon the request of the state board, the office, in consultation with and with the participation of the state board, shall evaluate the health effects of and prepare recommendations regarding substances, other than pesticides in their pesticidal use, which may be or are emitted into the ambient air of California and that may be determined to be toxic air contaminants.

(b) In conducting this evaluation, the office shall consider all available scientific data, including, but not limited to, relevant data provided by the state board, the State Department of Health Services, the Occupational Safety and Health Division of the Department of Industrial Relations, the Department of Pesticide Regulation, international and federal health agencies, private industry, academic researchers, and public health and environmental organizations. The evaluation shall be performed using current principles, practices, and methods used by public health professionals who are experienced practitioners in the fields of epidemiology, human health effects assessment, risk assessment, and toxicity.

(c)
   (1) The evaluation shall assess the availability and quality of data on health effects, including potency, mode of action, and other relevant biological factors, of the substance, and shall, to the extent that information is available, assess all of the following:

(A) Exposure patterns among infants and children that are likely to result in disproportionately high exposure to ambient air pollutants in comparison to the general population.
(B) Special susceptibility of infants and children to ambient air pollutants in comparison to the general population.
(C) The effects on infants and children of exposure to toxic air contaminants and other substances that have a common mechanism of toxicity.
(D) The interaction of multiple air pollutants on infants and children, including the interaction between criteria air pollutants and toxic air contaminants.

(2) The evaluation shall also contain an estimate of the levels of exposure that may cause or contribute to adverse health effects. If it can be established that a threshold of adverse health effects exists, the estimate shall include both of the following factors:
(A) The exposure level below which no adverse health effects are anticipated.
(B) An ample margin of safety that accounts for the variable effects that heterogeneous human populations exposed to the substance under evaluation may experience, the uncertainties associated with the applicability of the data to human beings, and the completeness and quality of the information available on potential human exposure to the substance. In cases in which there is no threshold of significant adverse health effects, the office shall determine the range of risk to humans resulting from current or anticipated exposure to the substance.

(3) The scientific basis or scientific portion of the method used by the office to assess the factors set forth in this subdivision shall be reviewed in a manner consistent with this chapter by the Scientific Review Panel on Toxic Air Contaminants established pursuant to Article 5 (commencing with Section 39670). Any person may submit any information for consideration by the panel, which may receive oral testimony.

(d) The office shall submit its written evaluation and recommendations to the state board within 90 days after receiving the request of the state board pursuant to subdivision (a). The office may, however, petition the state board for an extension of the deadline, not to exceed 30 days, setting forth its statement of the reasons that prevent the office from completing its evaluation and recommendations within 90 days. Upon receipt of a request for extension of, or noncompliance with, the deadline contained in this section, the state board shall immediately transmit to the Assembly Committee on Rules and the Senate Committee on Rules, for transmittal to the appropriate standing, select, or joint committee of the Legislature, a statement of reasons for extension of the deadline, along with copies of the office's statement of reasons that prevent it from completing its evaluation and recommendations in a timely manner.

(e)

(1) The state board or a district may request, and any person shall provide, information on any substance that is or may be under evaluation and that is manufactured, distributed, emitted, or used by the person of whom the request is made, in order to carry out its responsibilities pursuant to this chapter. To the extent practical, the state board or a district may collect the

information in aggregate form or in any other manner designed to protect trade secrets.

(2) Any person providing information pursuant to this subdivision may, at the time of submission, identify a portion of the information submitted to the state board or a district as a trade secret and shall support the claim of a trade secret, upon the written request of the state board or district board. Subject to Section 1060 of the Evidence Code, information supplied that is a trade secret, as specified in Section 6254.7 of the Government Code, and that is so marked at the time of submission, shall not be released to any member of the public. This section does not prohibit the exchange of properly designated trade secrets between public agencies when those trade secrets are relevant and necessary to the exercise of their jurisdiction if the public agencies exchanging those trade secrets preserve the protections afforded that information by this paragraph.

(3) Any information not identified as a trade secret shall be available to the public unless exempted from disclosure by other provisions of law. The fact that information is claimed to be a trade secret is public information. Upon receipt of a request for the release of information that has been claimed to be a trade secret, the state board or district shall immediately notify the person who submitted the information, and shall determine whether or not the information claimed to be a trade secret is to be released to the public. The state board or district board, as the case may be, shall make its determination within 60 days after receiving the request for disclosure, but not before 30 days following the notification of the person who submitted the information. If the state board or district decides to make the information public, it shall provide the person who submitted the information 10 days' notice prior to public disclosure of the information.

(f) The office and the state board shall give priority to the evaluation and regulation of substances based on factors related to the risk of harm to public health, amount or potential amount of emissions, manner of, and exposure to, usage of the substance in California, persistence in the atmosphere, and ambient concentrations in the community. In determining the importance of these factors, the office and the state board shall consider all of the following information, to the extent that it is available:

(1) Research and monitoring data collected by the state board and the districts pursuant to Sections 39607, 39617.5, 39701, and 40715, and by the United States Environmental Protection Agency pursuant to paragraph (2) of subsection (k) of Section 112 of the federal act (42 U.S.C. Sec. 7412(k)(2)).

(2) Emissions inventory data reported for substances subject to Part 6 (commencing with Section 44300) and the risk assessments prepared for those substances.

(3) Toxic chemical release data reported to the state emergency response commission pursuant to Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (42 U.S.C. Sec. 11023) and Section 6607 of the Pollution Prevention Act of 1990 (42 U.S.C. Sec. 13106).

(4) Information on estimated actual exposures to substances based on geographic and demographic data and on data derived from analytical methods that measure the dispersion and concentrations of substances in ambient air.

SECTION 6.
Article 4.5 (commencing with Section 39669.5) is added to Chapter 3.5 of Part 2 of Division 26 of the Health and Safety Code, to read:
Article 4.5. Special Provisions For Infants And Children
39669.5. The Legislature finds and declares that certain toxic air contaminants may pose risks that cause infants and children to be especially susceptible to illness and that certain actions are necessary to ensure their safety from toxic air contaminants.

(a) By July 1, 2001, the following shall occur
  (1) The office, in consultation with the state board, shall establish a list of up to five toxic air contaminants identified or designated by the state board pursuant to Section 39657 that may cause infants and children to be especially susceptible to illness. In developing the list, the office shall take into account public exposures to toxic air contaminants, whether by themselves or interacting with other toxic air contaminants or criteria pollutants, and the factors listed in subdivision (c) of Section 39660. The office shall submit a report containing the list and its reasons for including the toxic air contaminants on the list to the Scientific Review Panel on Toxic Air Contaminants established pursuant to Article 5 (commencing with Section 39670).
  (2) The scientific review panel, in a manner consistent with this chapter, shall review the list of toxic air contaminants submitted by the office pursuant to paragraph (1). As part of the review, any person may submit any information for consideration by the panel, which may receive oral testimony.

(b)
  (1) Within two years of the establishment of the list required pursuant to subdivision (a), the state board shall review and, as appropriate, revise any control measures adopted for the toxic air contaminants identified on the list, to reduce exposure to those toxic air contaminants pursuant to Article 4 (commencing with Section 39665), to protect public health, and particularly infants and children.
  (2) Within three years of the establishment of the list required pursuant to subdivision (a), for up to five of those toxic air contaminants for which no control measures have been previously adopted, the state board shall prepare a report on the need for regulations, following the procedure specified in Section 39665. The state board shall adopt within that same three-year timeframe, as appropriate, any new control measures to reduce exposure to those toxic air contaminants pursuant to Article 4 (commencing with Section 39665), to protect public health, particularly infants and children.

(c) Beginning July 1, 2004, the office shall annually evaluate at least 15 toxic air contaminants identified or designated by the state board pursuant to Section 39657, and provide threshold exposure levels and nonthreshold health values, as

appropriate, for those toxic air contaminants. The activities required pursuant to this subdivision shall continue until all toxic air contaminants are evaluated. The levels shall be established pursuant to the procedures adopted for health and risk assessments pursuant to paragraph (2) of subdivision (b) of Section 44360, and taking into account the factors listed in subdivision (c) of Section 39660. Based on this evaluation, and after review by the scientific review panel as prescribed in paragraph (2) of subdivision (a), the office shall update the list established pursuant to subdivision (a), by July 1, 2005, and each year thereafter. Within three years of the initial or subsequent listing update, for up to five of the toxic air contaminants contained on that list for which no control measures have been previously adopted, or for at least five of the toxic air contaminants if more than five toxic air contaminants have been identified, the state board shall prepare a report on the need for regulation, following the procedure specified in Section 39665. The state board shall adopt within that three-year timeframe, as appropriate, new control measures, pursuant to Article 4 (commencing with Section 39665), to reduce exposure to those toxic air contaminants, to protect public health, and particularly infants and children.

(d) Toxic air contaminants evaluated and listed pursuant to this section shall not include substances in those uses that are not subject to regulation by the state board pursuant to this chapter.

SECTION 7.
Section 40451 of the Health and Safety Code is amended to read:
40451.

(a) The south coast district shall use the Pollutant Standards Index developed by the Environmental Protection Agency and shall report and forecast pollutant levels daily for dissemination in the print and electronic media.
(b) Using existing communication facilities available to it, the south coast district shall notify all schools and, to the extent feasible and upon request, daycare centers in the South Coast Air Basin whenever any federal primary ambient air quality standard is predicted to be exceeded.
(c) Whenever it becomes available, the south coast district shall disseminate to schools, amateur adult and youth athletic organizations, and all public agencies operating parks and recreational facilities in the south coast district the latest scientific information and evidence regarding the need to restrict exercise and other outdoor activities during periods when federal primary air quality standards are exceeded.
(d) Once every two months and annually, the south coast district shall report on the number of days and locations that federal and state ambient air quality standards were exceeded and the number of days and locations of these occurrences.

SECTION 7.5.
Section 40451 of the Health and Safety Code is amended to read:
40451.

(a) The south coast district shall use the Pollutant Standards Index developed by the United States Environmental Protection Agency and shall report and forecast

pollutant levels daily for dissemination in the print and electronic media. Commencing July 1, 2001, the south coast district shall also include in its report and forecast levels of PM2.5 in excess of the 24-hour federal ambient air standard, as adopted in July 1997, or any standard adopted by the United States Environmental Protection Agency that succeeds that standard.

(b) Using existing communication facilities available to it, the south coast district shall notify all schools and, to the extent feasible and upon request, daycare centers in the South Coast Air Basin whenever any federal primary ambient air quality standard is predicted to be exceeded. Commencing July 1, 2001, using communication facilities available to it, the south coast district shall also notify all schools in the South Coast Air Basin when the ambient level of PM2.5 is predicted to exceed the 24-hour federal ambient air standard, as adopted in July 1997, or any standard adopted by the United States Environmental Protection Agency that succeeds that standard.

(c) Whenever it becomes available, the south coast district shall disseminate to schools, amateur adult and youth athletic organizations, and all public agencies operating parks and recreational facilities in the south coast district the latest scientific information and evidence regarding the need to restrict exercise and other outdoor activities during periods when federal primary air quality standards and the 24-hour federal ambient air standard for PM2.5, as adopted in July 1997, or any standards adopted by the United States Environmental Protection Agency that succeed those standards, are exceeded.

(d) Once every two months and annually, the south coast district shall report on the number of days and locations that federal and state ambient air quality standards were exceeded. Commencing July 1, 2001, the south coast district shall also include in that report the number of days and locations on and at which the 24-hour federal ambient air standard for PM2.5, as adopted in July 1997, or any standard adopted by the United States Environmental Protection Agency that succeeds that standard, is exceeded.

SECTION 8.

Section 7.5 of this bill incorporates amendments to Section 40451 of the Health and Safety Code proposed by both this bill and SB 1195. It shall only become operative if

(1) both bills are enacted and become effective on or before January 1, 2000,
(2) each bill amends Section 40451 of the Health and Safety Code, and
(3) this bill is enacted after SB 1195, in which case Section 7 of this bill shall not become operative.

SECTION 9.

Notwithstanding Section 17610 of the Government Code, if the Commission on State Mandates determines that this act contains costs mandated by the state, reimbursement to local agencies and school districts for those costs shall be made pursuant to Part 7 (commencing with Section 17500) of Division 4 of Title 2 of the Government Code. If the statewide cost of the claim for reimbursement does not exceed one million dollars ($1,000,000), reimbursement shall be made from the State Mandates Claims Fund.

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Appendix C:

Asbestos Conversion Factors & Cancer Potency Factor

C-1. Overview

The purpose of this appendix is to provide information about the asbestos conversion factors and inhalation cancer potency factor. The table below summarizes the available conversion factors and inhalation cancer potency factor for asbestos. The subsequent sections of this appendix provide information on how the conversion factors and cancer potency factor were derived.

PCM Fibers to TEM Structure Conversion Factor	1 PCM Fiber = 320 TEM Structures
Mass to Fiber Conversion Factor	0.003 μg = 100 asbestos PCM Fibers
Asbestos Inhalation Cancer Potency Factor	$2.2 \times 10^{+2}$ $(mg/kg\text{-}day)^{-1}$

C-2. PCM Fiber to TEM Structure Conversion Factor

Two analytical methods have been used for the analysis of asbestos samples: phase contrast microscopy (PCM), the primary method used historically to analyze asbestos samples, and transmission electron microscopy (TEM), the current state-of-the-art method.

PCM analysis was developed earlier and has been preferred in the past over TEM because it could be done more quickly and was less expensive. However, one major limitation of PCM analysis, especially in outdoor environments, is that the analyst cannot distinguish asbestos from non-asbestos fibers, such as cellulose, talc, or gypsum. Also, PCM cannot detect fibers that have a diameter of about 0.3 microns or less, which could substantially underestimate the asbestos fiber concentrations. These limitations make PCM impractical for the analysis of ambient asbestos samples.

TEM is the preferred analytical method for outdoor asbestos samples because of its ability to detect small fibers (greater than or equal to 0.0002 microns in diameter) and to distinguish between asbestos fibers and non-asbestos fibers. The term “TEM structures” is often used to describe asbestos fibers detected by this method. TEM is the method recommended by the Office of Environmental Health Hazard Assessment (OEHHA). However, TEM measurements cannot be directly related to the cancer

potency factors because the studies upon which OEHHA's risk assessment was based used PCM analysis. Thus, the TEM measurements must be converted to PCM-equivalent units. The actual relationship between PCM and TEM measurements is quite variable: ARB (1990) found a range of 100 to 1000 for the ratio of TEM structures to PCM fibers for three occupational studies. For the purpose of the Air Toxics Hot Spots Program, asbestos should be converted using the geometric center of the range as defined by ARB (1990). To convert PCM fibers to TEM structures or vice versa use the following relationship:

1 PCM Fiber = 320 TEM structures

C-3. Mass to Fiber Conversion Factor

Asbestos is reported in units of pounds per year under the Air Toxics Hot Spots Program. To convert asbestos fibers to mass, the following relationship is used:

0.003 μg = 100 asbestos fibers PCM.

This conversion factor was derived from information published by the United States Environmental Protection Agency (U.S. EPA) (U.S. EPA, 1986). The number of asbestos PCM fibers associated with a given mass of asbestos can vary appreciably. In addition, U.S. EPA has stated that this conversion factor is the geometric mean of measured relationships between optical fiber counts and mass airborne chrysotile in several published studies, that the range of the conversion factor between the different studies is large (0.0005 - 0.015 µg asbestos/100 asbestos PCM fibers), and that the factor carries with it an appreciable uncertainty. Additionally, if the asbestos was analyzed using TEM, the TEM structures must be converted to PCM fibers first.

C-4. Asbestos Inhalation Cancer Potency Factor

The unit risk factor for asbestos fibers is 1.9×10^{-4} in units of $(100 \text{ PCM fibers/m}^3)^{-1}$. The unit risk factor is based on epidemiological studies in which PCM fiber measurements were used. This unit risk factor is listed in Chapter 7 and in the Asbestos Toxic Air Contaminant (TAC) identification document (CDHS, 1986) and in OEHHA, 1999b. The asbestos cancer potency factor is for mesothelioma. Since the unit risk factor is in units of concentration or dose, complications arise when the emitted asbestos quantities are reported in mass units (pounds/year and maximum pounds/hour) for the Air Toxics Hot Spots Program.

For the purpose of an Air Toxics Hot Spots Risk Assessment, the cancer potency factor $(\text{mg/kg body weight})^{-1}$ may be calculated from the fiber cancer potency factor using the relationship of 0.003 μg = 100 fibers PCM, 70 kg body weight, 20 m^3 breathed per day, and a factor of 1000 to convert μg asbestos into mg:

$$1.9\times10^{-4}\left(100\,PCM\,fibers/m^3\right)^{-1}\times\frac{70kg}{20m^3}\times\frac{1000}{0.003\mu g/100fibers}=2.2\times10^{+2}\left(mg/kg\,bodyweight\right)^{-1}$$

In order to use this cancer potency factor under the Air Toxics Hot Spots Program, the measured asbestos concentration should be expressed as microgram per cubic meter. For example, if the measured asbestos concentrations are in units of TEM structures per cubic meter, the asbestos concentration should be first converted to PCM fibers per cubic meters and then into units of microgram per cubic meters using the conversion factors as shown in the sections above.

See Chapter 8 for more information on calculating cancer risk and Appendix I for an example of how cancer risk is calculated for the inhalation pathway. Note, while the example in Appendix I uses non-asbestos substances, it is still applicable since it illustrates the steps that are used for asbestos, including use of Age Sensitivity Factors.

C-5. References

ARB, 1990. Proposed Control Measure for Asbestos-Containing Serpentine Rock in Surfacing Applications, Technical Support Document, Air Resources Board, February 1990.

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Appendix D:

Risk Assessment Procedures to Evaluate Particulate Emissions from Diesel-Fueled Engines

D-1. Introduction

The objective of this appendix is to discuss procedures for estimating the cancer and noncancer health risk from exposure to particulate matter (PM) emissions from diesel-fueled engines (diesel exhaust). It will also clarify the requirements and recommendations for acute noncancer and multipathway cancer and chronic risk assessment for diesel PM. In addition to the notification and risk reduction requirements under the Hot Spots Program, this appendix should facilitate the use of the *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles* (ARB, 2000) (Diesel Guidelines). The Diesel Guidelines were developed by the Air Resources Board (ARB) with assistance from the Office of Environmental Health Hazard Assessment (OEHHA) in October 2000. The Diesel Guidelines are intended to assist local Air Pollution Control and Air Quality Management Districts (Districts) and sources of diesel PM emissions in making consistent risk management decisions.

In advance of performing a health risk assessment (HRA), it is recommended that the District and the stationary source of diesel emissions reach a consensus on the HRA approach for estimating health impacts from diesel exhaust. See Chapter 9 for an outline of a modeling protocol.

D-2. Calculations/Risk Assessment Procedures

In August 1998, the ARB identified diesel exhaust as a toxic air contaminant (TAC) (ARB, 1998). In the identification report, OEHHA provided an inhalation noncancer chronic reference exposure level (REL) of 5 micrograms per cubic meter ($\mu g/m^3$) and a range of inhalation cancer potency factors of 1.3×10^{-4} to 2.4×10^{-3} $(\mu g/m^3)^{-1}$. The Scientific Review Panel on Toxic Air Contaminants recommended a “reasonable estimate” inhalation unit risk factor of 3.0×10^{-4} $(\mu g/m^3)^{-1}$. From the unit risk factor an inhalation cancer potency factor of 1.1 $(mg/kg\text{-}day)^{-1}$ may be calculated. These noncancer and cancer health factors were developed based on whole (gas and particulate matter) diesel exhaust. The surrogate for whole diesel exhaust is diesel PM. PM_{10} (particulate matter, ten microns or less in size) is the basis for the risk calculations.

D-2.1 Cancer

An inhalation cancer risk is required for every HRA (The methods for calculating inhalation cancer risk can be found in Chapters 5, 7, and 8.). When comparing whole diesel exhaust to speciated components of diesel exhaust (e.g., PAHs, metals), the cancer risk from inhalation exposure to whole diesel exhaust will outweigh the

multipathway cancer risk from the speciated components. For this reason, there will be few situations where an analysis of multipathway risk is necessary.

The District may elect to require a multipathway analysis if reliable data are available and the District decides that it is necessary. If the District elects to require a multipathway analysis, the components of the diesel exhaust will need to be speciated since there is no oral cancer potency factor for diesel PM. It is recommended that the District be consulted on the procedures for conducting a multipathway analysis for diesel exhaust. The District may wish to use speciation data from the ARB. If so, a resource for speciation data is available on the ARB's website at www.arb.ca.gov/emisinv/speciate/speciate.htm.

If a multipathway analysis is required, the speciated data should be compared with the substances in Table 5.1. Any substances in the speciation profile that are listed in Table 5.1 and have an oral cancer potency factor in Table 7.1 should be included in the multipathway analysis. Multipathway cancer risks are estimated following the procedures in Chapters 5 and 8 of this document. These procedures require summing the cancer risk from each carcinogen to estimate the total facility cancer risk.

D-2.2 Noncancer Chronic

To determine noncancer chronic inhalation health impacts from exposure to diesel exhaust use the methods described in Chapters 6 and 8.

The District may elect to require a multipathway analysis if reliable data is available and they feel it is necessary. If the District elects to require a multipathway analysis, the components of the diesel exhaust will need to be speciated since there is no oral reference exposure level for diesel PM. A resource for speciation data at the ARB is identified above. It is recommended that the District be consulted on the procedures for conducting a multipathway analysis. If a multipathway analysis is required, the speciated data should be compared with the substances in Table 5.1. Any substances in the speciation profile that are listed in Table 5.1 and have an oral chronic REL in Table 6.4 should be included in the multipathway analysis. Multipathway chronic risks are estimated following the procedures in Chapters 5 and 8 of this document.

Note that the effect estimate for cardiovascular mortality from exposure to ambient PM when applied to diesel PM results in many more cardiovascular deaths than lung cancer deaths.

D-2.3 Noncancer Acute

There may be certain unusual situations where an evaluation of the acute health effects may be warranted. One possible situation is when a nearby receptor is located above the emission release point (e.g. on a hillside or in a multistory apartment building). Since there is no acute REL for diesel exhaust, the components of the exhaust will need to be speciated to determine the potential acute health impacts. It is recommended that the District be consulted on the procedures for conducting an acute analysis. If an acute analysis is required, the speciated data should be compared with the substances in Table 6.1. Any substances in the speciation profile that are listed in Table 6.1 should be included in the acute analysis. A resource for speciation data at the ARB is identified above. Acute risks are estimated following the procedures in Chapters 6 and 8 of this document.

D-3. References

ARB 1998. Air Resources Board, “Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant, Appendix III, Part A, Exposure Assessment,” April 1998.

ARB 2000. Air Resources Board, “Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles,” October 2000.

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Appendix E:

Toxicity Equivalency Factors for Polychlorinated Dibenzo-p-Dioxins, Dibenzofurans and Polychlorinated Biphenyls

Polychlorinated dibenzo-p-dioxins and dibenzofurans (dioxins and furans) and polychlorinated biphenyls (PCBs) vary considerably in their potency for causing both cancer and noncancer health impacts. A Toxics Equivalents Factors (TEF) scheme, based on both cancer and noncancer toxicity studies, has been developed to relate the potency of various dioxin and furan congeners and PCB congeners to the potency of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD). A detailed explanation of the World Health Organization's 2005 Toxicity Equivalents Factor (WHO_{05}-TEF) scheme (van den Berg et al., 2006), the latest scheme adopted by OEHHA, is available in OEHHA (2011). Where the dioxin and furan and PCB mixtures are not speciated, the cancer risk and noncancer hazard index are based on the most potent congeners. A facility may choose to speciate dioxin and furan and PCB emissions in order to obtain a more accurate picture of the risks.

There are two mathematically equivalent procedures for estimating the cancer risk or the non-cancer hazard quotient using the TEF scheme. In the first method, the concentration or dose of 2,3,7,8-TCDD equivalents is calculated based on the individual congener concentration or dose multiplied by the TEF for that congener. Cancer risk is estimated by multiplying the cancer slope for 2,3,7,8-TCDD by the "TCDD equivalents" concentration or dose. The noncancer hazard quotient would be calculated by dividing the "TCDD equivalents" concentration by the REL. In the second method, TEF-adjusted potency factors or RELs are used with individual congeners.

Using the first procedure, the concentration of each congener listed in Table E-1 is multiplied by the WHO_{05}-TEF for that congener to estimate the concentration of 2,3,7,8-TCDD "toxic equivalents" of the mixture. For example, for 1,2,3,4,7,8-hexachlorodibenzodioxin, the concentration ($\mu g/m^3$) may be multiplied by 0.1 to give the concentration equivalent to 2,3,7,8-TCDD. Congeners not listed in the table are assumed to have no dioxin-like toxicity. The 2,3,7,8-TCDD equivalent concentrations for each congener in the mixture are summed and treated as 2,3,7,8-TCDD for the purposes of calculating cancer and noncancer risks. Thus, to estimate cancer risk, the "toxic equivalents" concentration is multiplied by the breathing rate to give dose (see equation 5.4.1.1), and then multiplied by the cancer potency factor for 2,3,7,8-TCDD (Table 7.1) to give the cancer risk for the entire mixture.

To estimate the chronic non-cancer inhalation hazard index, the ground level concentration of the 2,3,7,8-TCDD equivalents of the mixture is divided by the chronic reference exposure level for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin to give an inhalation hazard index for the entire mixture. Similarly, the oral chronic hazard index of the mixture is calculated by estimating the 2,3,7,8-TCDD equivalents dose and dividing by the oral chronic REL for 2,3,7,8-TCDD. The inhalation and oral hazard index is then summed to get a total chronic Hazard Index.

In order to determine the inhalation chronic hazard index by the second procedure, the ground level concentration of each dioxin and furan congener is divided by the chronic REL for each congener in Table 6.3 and the hazard quotients summed to give the inhalation chronic hazard index. The oral chronic hazard quotient is calculated by determining the oral dose of each congener and dividing by the individual chronic oral REL (Table 6.4) for each congener. The oral hazard quotients are then summed to give the oral chronic hazard index for dioxins and furans and PCBs. The oral hazard index is then added to the inhalation hazard index to give the total chronic hazard index for dioxins and furans and PCBs.

In those cases where speciation of dioxins and furans has not been performed, then 2,3,7,8-TCDD serves as the surrogate for dioxin and furan emissions. Given that 2,3,7,8-TCDD is the most potent congener in the class, the resulting risk estimate for an unspeciated mixture may be deemed significant enough to trigger health concerns. In this case, it would then be advisable to speciate the mixture and run a screening estimate using the speciated data.

As noted above, the TEF scheme includes TEFs for individual coplanar PCB congeners (see Table E-1) (OEHHA, 2011). These are the congeners that have dioxin-like biological effects. Where data are available on individual PCB congeners emitted by a facility, then the congener-specific TEFs are used. 2,3,7,8-TCDD also serves as the surrogate for the coplanar PCB congeners. To calculate the noncancer inhalation and oral RELs for individual PCB congeners shown in Tables 6.3 and 6.4, respectively, the inhalation and oral RELs for 2,3,7,8-TCDD were divided by the PCB congener TEFs in Table E-1. If only total PCB data are available, then the PCB slope factors for high, low and lowest risk provided in Table 7.1 can be used for cancer risk determination. The high risk potency factor is the default for unspeciated PCB mixtures.

As of February, 2014, there is no approved method that can be used to assess the noncancer hazard of an unspeciated PCB mixture. Persons preparing HRAs for the Hot Spots Program should consult with OEHHA and the local Air Pollution Control or Air Quality Management District if an assessment of the noncancer hazard for unspeciated PCB mixtures is needed.

TABLE E-1. WHO/05 TOXIC EQUIVALENCY FACTORS (TEFS)

Congener		TEF $_{WHO-05}$
PCDDs		
2,3,7,8-TCDD		1
1,2,3,7,8-PeCDD		1
1,2,3,4,7,8-HxCDD		0.1
1,2,3,6,7,8-HxCDD		0.1
1,2,3,7,8,9-HxCDD		0.1
1,2,3,4,6,7,8-HpCDD		0.01
1,2,3,4,6,7,8,9-OCDD		0.0003
PCDFs		
2,3,7,8-TCDF		0.1
1,2,3,7,8-PeCDF		0.03
2,3,4,7,8-PeCDF		0.3
1,2,3,4,7,8-HxCDF		0.1
1,2,3,6,7,8-HxCDF		0.1
1,2,3,7,8,9-HxCDF		0.1
2,3,4,6,7,8-HxCDF		0.1
1,2,3,4,6,7,8-HpCDF		0.01
1,2,3,4,7,8,9-HpCDF		0.01
1,2,3,4,6,7,8,9-OCDF		0.0003
PCBs (IUPAC #, Structure)		
77	3,3',4,4'-TCB	0.0001
81	3,4,4',5-TCB	0.0003
105	2,3,3',4,4'-PeCB	0.00003
114	2,3,4,4',5-PeCB	0.00003
118	2,3',4,4',5-PeCB	0.00003
123	2',3,4,4',5-PeCB	0.00003
126	3,3',4,4',5-PeCB	0.1
156	2,3,3',4,4',5-HxCB	0.00003
157	2,3,3',4,4',5'-HxCB	0.00003
167	2,3',4,4',5,5'-HxCB	0.00003
169	3,3',4,4',5,5'-HxCB	0.03
170	2,2',3,3',4,4',5-HpCB	-
180	2,2',3,4,4',5,5'-HpCB	-
189	2,3,3',4,4',5,5'-HpCB	0.00003

References

OEHHA, 2011. Technical Support Document for Cancer Potency Factors, Appendix C: Use of the Toxicity Equivalency Factor (TEFWHO 05) Scheme for Estimating Toxicity of Mixtures of Dioxin-Like Chemicals. Office of Environmental Health Hazard Assessment, Sacramento, CA. January, 2011. Available at http://www.oehha.ca.gov/air/hot_spots/pdf/AppCdioxinTEFs013111.pdf.

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Appendix F:

Overview of the Lead Risk Assessment Procedures

F.1 Introduction

The objective of this appendix is to provide a method for estimating potential cancer and noncancer health effects due to airborne lead exposure. This appendix should facilitate the use of the *Risk Management Guidelines for New, Modified, and Existing Sources of Lead* (Lead RM Guidelines) (ARB, 2001) for analysis of lead exposure. The Lead RM Guidelines were developed by the Air Resources Board (ARB) with assistance from Office of Environmental Health Hazard Assessment (OEHHA) and Department of Health Services (DHS) in March 2001 to assist local air districts and sources of lead in making consistent risk management decisions for new, modified, and existing sources of lead.

In April 1997, the ARB identified inorganic lead as a toxic air contaminant (TAC) (ARB, 1997). Lead is unique among other TACs identified by ARB in several ways. First, infants and children are particularly susceptible to the health effects of lead, and the risk assessment is based on health effects in children. Second, the chronic noncancer effects are related to blood lead levels (BLLs) as opposed to ambient air concentrations. These BLLs reflect current and past exposure from a number of sources; air emissions may only be a small part of the total exposure. Third, based on recommendations of the OEHHA and the Scientific Review Panel on Toxic Air Contaminants (SRP), the ARB did not identify a threshold level for chronic noncancer health effects due to lead exposure. Threshold levels are levels below which no adverse health effects are expected to occur. Since acute or chronic Reference Exposure Levels (RELs) are based on threshold levels, none were developed for lead. Thus, a hazard index approach is not used for lead. Instead, air concentrations are compared to defined air lead levels associated with specified percentages of children with BLL $\geq$ 10 µg/dL. Acceptable risk is based on minimizing the number of children at or above a BLL of 10 µg/dL.

F.2 Methods for Estimation of Health Risk Effects

Methods for estimating site-specific noncancer and cancer potential health impacts from exposure to lead emissions are given in the Lead RM Guidelines. The noncancer health effects pose greater public health significance than the cancer health effects. Minimizing noncancer health effects of lead will therefore also minimize cancer health effects.

Chronic noncancer health risks are estimated based on neurodevelopmental health risks to children and would also be protective of adults. These health effects can be evaluated using a tiered approach based on blood lead level distribution in the population.

Potential multipathway cancer risks are estimated following the procedures in Chapters 5 and 8 of this document. These procedures require summing individual cancer risk from each carcinogen to estimate the total facility cancer risk.

In advance of performing a health risk assessment (HRA), it is recommended that the Air Pollution Control or Air Quality Management District (District) and the stationary source of lead air emissions reach a consensus on the HRA approach for estimating chronic noncancer and cancer health risks. See Chapter 9 for an outline of a modeling protocol.

F.2.1 Tiered Approach for Estimating Noncancer Risks due to Lead Exposure

The Lead Risk Management Guidelines provide three tiers of analysis to determine baseline BLL distributions for estimating risk. Although there is a simple risk management option provided in the Lead RM Guidelines, in a risk assessment for the Air Toxics Hot Spots program one of the following tiers must be used to report estimates of the percent of children estimated to be above 10 μg/dL blood lead. The tiered approach is based on an assessment of neurodevelopmental risk, with the BLL distribution in the population as the most significant factor. The BLL distribution consists of two components: 1) the baseline BLL distribution due to all sources of exposure; and 2) the exposure due to emissions from a facility.

Tier I is a default approach that requires minimal site-specific information on concentrations of lead in environmental media other than air. Tier I uses two default BLL distributions, one for a high exposure scenario and one for an average exposure scenario. The exposure scenario is determined using the median age of the homes in the census tract and the ratio of area income to the poverty level. The default baseline BLL distribution for each of the exposure scenarios is based on a review of neighborhood and community blood lead studies. The assessor determines the 30-day average lead concentration due to the facility averaged over the 1 square kilometer area centered on the Maximum Offsite Concentration (MOC). The percentage of children with BLLs greater than or equal to 10 micrograms per deciliter (≥ 10 μg/dL) is determined using Table F-1 (also found on page 17 in the Lead RM Guidelines), the air lead concentration, and the determined exposure scenario. The 10 μg/dL threshold level has been identified by the Centers for Disease Control and Prevention (CDC) as a level where potential health effects may occur. The public health goal of management practices should be to implement procedures/practices to prevent BLLs at or above this level. The estimated percentage of children with BLLs ≥ 10 μg/dL is then used with risk management levels given in Chapter III, Section D of the Lead RM Guidelines to assist in making risk management decisions.

TABLE F-1 PERCENTAGE OF CHILDREN WITH BLOOD LEAD LEVELS ≥ 10 μG/DL FOR VARIOUS AIR LEAD CONCENTRATIONS AT TWO EXPOSURE SCENARIOS

Air Lead Concentration in the Maximum Exposure Area (30-day average) [μg/m^3]	Percent ≥ 10 μg/dL	
	High Exposure Scenario	Average Exposure Scenario
Baseline*	5.1	1.2
0.02	5.4	1.4
0.06	6.1	1.7
0.10	6.8	2.2
0.20	8.9	3.4
0.25	9.8	4.1
0.50	15.9	8.9
0.75	22.4	15.4
1.0	29.1	23.0
1.5	42.5	39.0

* The baseline represents BLLs due to lead in soil, dust, water, food, and background air lead concentrations.

Tier II requires the development of site-specific baseline BLL distributions within the impacted population using site-specific estimates of lead levels in environmental media, including soil, dust, water, and/or food, using the U.S. EPA Integrated Exposure Uptake Biokinetic (IEUBK) model. The IEUBK model calculates the probability of an individual exceeding a specific BLL based on site-specific information. The aggregate of the individual BLLs is used to estimate the neurodevelopmental risk in the maximum exposure area. A detailed discussion of this tier is beyond the scope of this overview; see Appendix D in the Lead RM Guidelines for a discussion of the IEUBK model and its use.

Tier III involves actual blood lead sampling of the population impacted by the facility to define the baseline BLLs. In Tier III, the facility is responsible for conducting BLL testing to establish a site-specific BLL distribution. The Lead RM Guidelines recommend the neurodevelopmental risk be calculated as the probability of children in an affected exposure area having a BLL ≥ 10 μg/dL using the results of the blood lead sampling. It is highly unlikely that this option would be used due to the cost incurred and the fact that the sampled population must consent to the sampling and an appropriate sampling strategy must be developed to adequately characterize the blood lead levels of the impacted population.

For further information on the tiered approach using the Tier I, Tier II, or Tier III, please see Chapter II of the *ARB Risk Management Guidelines for New, Modified, and Existing Sources of Lead* (ARB, 2001). This document can be downloaded from the ARB web site at http://www.arb.ca.gov/toxics/lead/lead.htm or can be requested by calling (916) 323-4327.

F.2.2 Methods for Estimating Potential Cancer Risks due to Lead

While lead has a unique noncancer assessment methodology, the determination of potential multipathway cancer risk is the same as other carcinogens. Chapters 5, 7, and 8, and Appendices I and L provide all the needed information for calculating potential cancer risk. The health risk assessment should report the multipathway cancer risks from lead emissions.

Chapter III in the Lead RM Guidelines provides methods for determining risk management of lead exposure, using the results from the cancer risk calculation, and the local District's defined significance levels.

F.3 References

ARB, 1997. Proposed Identification Inorganic Lead as a Toxic Air Contaminant, Parts A, B, C. California Air Resources Board. April, 1997.

ARB, 2001. ARB Risk Management Guidelines for New, Modified, and Existing Sources of Lead. California Air Resources Board. March 2001

Appendix G:

PAH Potency Factors and Selection of Potency Equivalency Factors (PEF) for PAHs based on Benzo(*a*)pyrene Potency

The Office of Environmental Health Hazard Assessment (OEHHA) has developed a Potency Equivalency Factor (PEF) procedure to assess the relative potencies of PAHs and PAH derivatives as a group. Benzo(a)pyrene (BaP) was chosen as the primary representative of the class of polycyclic aromatic hydrocarbons (PAHs) because of the large amount of toxicological data available on BaP (versus the relatively incomplete database for other PAHs), and because it serves as the referent PAH for the Potency Equivalency Factors. This procedure can address the impact of carcinogenic PAHs in ambient air since they are usually present together. This procedure was approved by the Scientific Review Panel (SRP) on Toxic Air Contaminants (TAC) as part of the Health Effects Assessment of Benzo(a)pyrene during the TAC identification process (OEHHA, 1993).

Due to the variety of data available on the carcinogenicity and mutagenicity of PAHs, an order of preference for the use of available data in assessing relative potency was developed. If a health effects evaluation and quantitative risk assessment leading to a cancer potency value had been conducted on a specific PAH, then those values were given the highest preference. Cancer potency values for PAHs developed by this process are shown in Table G-1.

TABLE G-1: POTENCIES OF PAHS AND DERIVATIVES[1]

Chemicals	Cancer potency factors $(mg/kg\text{-}day)^{-1}$	Unit risks $(\mu g/m^3)^{-1}$
Benzo[*a*]pyrene	11.5	1.1×10^{-3}
Dibenz[*a*,*h*]anthracene	4.1	1.2×10^{-4}
7,12-dimethylbenzanthracene	250	7.1×10^{-2}
3-methylcholanthrene	22	6.3×10^{-3}
Naphthalene[2]	0.12	3.4×10^{-5}
5-nitroacenaphthene	0.13	3.7×10^{-5}

[1]. Source: OEHHA (1993); Collins *et al*. (1998); OEHHA (2009). It is assumed that unit risks for inhalation have the same relative activities as cancer potencies for oral intake.

If potency values have not been developed for specific compounds, a carcinogenic activity relative to BaP, rather than a true potency, can be developed. These relative activity values are referred to as Potency Equivalency Factors or PEFs. For air contaminants, the relative potency to BaP based on data from inhalation studies would be optimal. Otherwise, intrapulmonary or intratracheal administration studies would be most relevant, since such studies are in the target organ of interest. Next in order of

preference is information on activity by the oral route and skin painting. Intraperitoneal and subcutaneous administration rank at the bottom of the *in vivo* tests considered useful for PEF development because of their lack of relevance to environmental exposures. Next, in decreasing order of preference, are genotoxicity data, which exist for a large number of compounds. In many cases genotoxicity information is restricted to mutagenicity data. Finally, there are data on structure-activity relationships among PAH compounds. Structure-activity considerations may help identify a PAH as carcinogenic, but at this time have not been established as predictors of carcinogenic potency.

Using this order of preference, PEFs were derived for 21 PAHs and are presented in Table G-2 (OEHHA, 1993: Collins *et al*., 1998).

The cancer potency comparisons show that some PAHs are more potent than BaP, while other PAHs analyzed were less or much less potent. These comparisons indicated that considering all PAHs to be equivalent in potency to BaP would likely overestimate the cancer potency of a PAH mixture, but such an assumption would be health protective and likely to be helpful in a screening estimate of PAH risks (OEHHA, 1993). If one assumes that PAHs are as carcinogenic as they are genotoxic, then their hazard relative to BaP would be dependent on their concentration in the environment. In light of the limited information available on other PAHs, BaP remains an important representative or surrogate for this group of air pollutants.

Detailed descriptions on the criteria used for developing individual PEFs can be found in OEHHA (2009). OEHHA continues to review all recent literature pertaining to the carcinogenicity and mutagenicity of PAHs. New cancer potency values for PAHs may be developed if an adequate health effects evaluation and quantitative risk assessment can be performed. Also, some current PEFs may be modified based on new data. Any changes to the potency values and PEFs for PAHs will be reflected in the HARP program when they occur. It is incumbent on the risk assessor to access the most recent version of the HARP program to ensure that the most up-to-date PAH potency values are used.

TABLE G-2. OEHHA PEF WEIGHTING SCHEME FOR PAHS AND THEIR RESULTING CANCER POTENCY VALUES.

PAH or derivative	PEF	Unit Risk $(\mu g/m^3)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$
benzo[*a*]pyrene (index compound)	**1.0**	**1.1×10^{-3}**	**3.9**	**$1.2 \times 10^{+1}$**
benz[*a*]anthracene	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
benzo[b]fluoranthene	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
benzo[*j*]fluoranthene	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
benzo[k]fluoranthene	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
dibenz[*a*,*j*]acridine	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
dibenz[*a*,*h*]acridine	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
7H-dibenzo[c,*g*]carbazole	1.0	1.1×10^{-3}	3.9	$1.2 \times 10^{+1}$
dibenzo[*a*,*e*]pyrene	1.0	1.1×10^{-3}	3.9	$1.2 \times 10^{+1}$
dibenzo[*a*,*h*]pyrene	10	1.1×10^{-2}	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
dibenzo[*a*,*i*]pyrene	10	1.1×10^{-2}	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
dibenzo[*a*,*l*]pyrene	10	1.1×10^{-2}	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
indeno[1,2,3-*cd*]pyrene	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
5-methylchrysene	1.0	1.1×10^{-3}	3.9	$1.2 \times 10^{+1}$
1-nitropyrene	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
4-nitropyrene	0.1	1.1×10^{-4}	3.9×10^{-1}	1.2
1,6-dinitropyrene	10	1.1×10^{-2}	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
1,8-dinitropyrene	1.0	1.1×10^{-3}	3.9	$1.2 \times 10^{+1}$
6-nitrochrysene	10	1.1×10^{-2}	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
2-nitrofluorene	0.01	1.1×10^{-5}	3.9×10^{-2}	1.2×10^{-1}
chrysene	0.01	1.1×10^{-5}	3.9×10^{-2}	1.2×10^{-1}

[1.] Source: OEHHA (1993)

References

Collins, J.F., Brown, J.P., Alexeeff, G.V., and Salmon, A.G. 1998. Potency equivalency factors for some polycyclic aromatic hydrocarbons and polycyclic aromatic hydrocarbon derivatives. Regul. Toxicol. Pharmacol. 28:45-54.

OEHHA, 1993. Benzo[*a*]pyrene as a Toxic Air Contaminant. Part B. Health Effects of Benzo[*a*]pyrene. Air Toxicology and Epidemiology Section, Berkeley, CA.

OEHHA, 2009. The Air Toxics Hot Spots Program Risk Assessment Guidelines; Part II. Technical Support Document for Describing Available Cancer Potency Factors, Office of Environmental Health Hazard Assessment, May 2009.

Appendix H:

Recommendations for Estimating Concentrations of Longer Averaging Periods from the Maximum One-Hour Concentration for Screening Purposes

H.1 Introduction

The U.S. Environmental Protection Agency (U.S. EPA) AERSCREEN air dispersion model can be used to estimate the maximum one-hour concentration downwind from an emissions source. The AERSCREEN model results (or AERMOD with screening meteorological data), can also be used to estimate concentrations for longer averaging periods, such as the maximum annual average concentration. In addition, it is permissible to use the AERMOD air dispersion model in a screening mode with identical meteorological conditions as used in the AERSCREEN model to superimpose results from multiple sources.

This method to assess short-term and long-term impacts may be used as a first-level screening indicator to determine if a more refined analysis is necessary. In the event that representative meteorological data are not available, the screening assessment may be the only computer modeling method available to assess source impacts.

In California, this standard procedure will generally bias concentrations towards over-prediction in most cases when the source is a continuous release. However, in the case when a source is not continuous, these screening factors may not be biased towards over prediction. In this case, we recommend an alternative procedure for estimating screening value concentrations for longer averaging periods than one-hour for intermittent releases.

H.2 Current Procedures

The current screening factors used to estimate longer term averages (i.e., 3-hour, 8-hour, 24-hour, 30-day, and annual averages) from maximum one-hour concentrations in California are shown in Table H.1. The factors are U.S. EPA recommended values with the exception of the 30-day factor. The 30-day factor is an ARB recommended value (ARB, 1994). The maximum and minimum values are recommended limits to which one may diverge from the general (Rec.) case, (U.S. EPA, 1992). Diverging from the general case should only be done on a case by case basis with prior approval from the reviewing agency.

TABLE H.1 RECOMMENDED FACTORS TO CONVERT MAXIMUM 1-HOUR AVG. CONCENTRATIONS TO OTHER AVERAGING PERIODS (U.S. EPA, 2011, 1992; ARB, 1994).

Averaging Time	Range	Typical SCREEN3 Recommended	AERSCREEN Recommended
3 hours	0.8 - 1.0	0.9	1.0
8 hours	0.5 - 0.9	0.7	0.9
24 hours	0.2 - 0.6	0.4	0.6
30 days	0.2 - 0.3	0.3	
Annual	0.06 - 0.1	0.08	0.1

AERSCREEN automatically provides the converted concentration for longer than 1-hour averaging periods. For area sources, the AERSCREEN 3, 8, and 24-hour average concentration are equal to the 1-hour concentration. No annual average concentration is calculated. SCREEN3 values are shown for comparison purposes.

H.3 Definitions

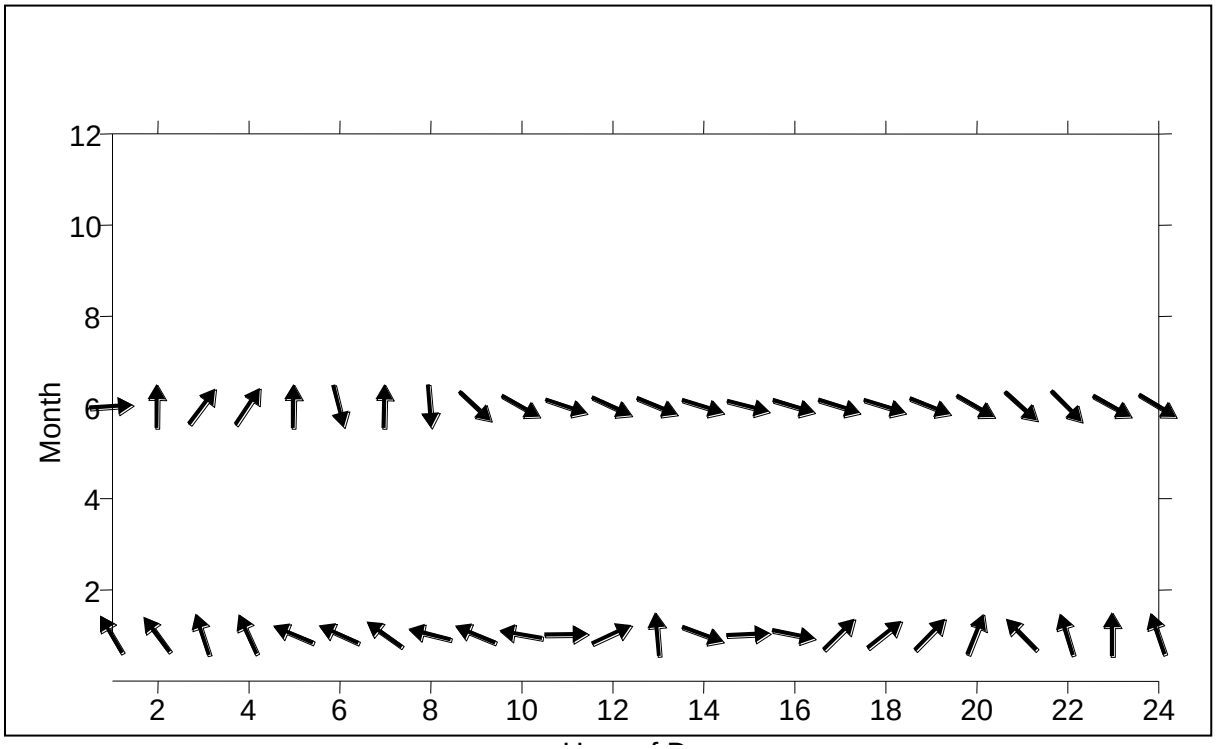
It is convenient to define the following terms relating to sources with respect to the duration of the release.

- Continuous Release – This is a release that is continuous over the duration of a year. An example of this type of release would be fugitive emissions from a 24-hour per day, 7-day per week operation or an operation that is nearly continuous.
- Intermittent Release – Many emissions fall under this category. These are emission types that are not continuous over the year. Any operation that has normal business hours (e.g., 8 am to 6 pm) would fall into this category.
- Systematic Release – These are intermittent releases that occur at a specific time of the day. As an example, these type of releases can occur when a process requires clean out at the end of the work day. Thereby releasing emissions only at the end of the workday systematically. Systematic releases are similar to intermittent releases with a shorter duration during the normal operating schedule.
- Random Release – These are intermittent releases that can occur any time during the operating schedule. An example of this type of release would be of the type that depends on batch processing. For example, a brake shop may emit pollutants only when the brakes are cleaned which happens randomly throughout the normal business hours.

H.4 Screening Factors

The U.S. EPA screening factors, as shown in Table H.1, compensate for the effects of varying conditions of wind speed, wind direction, ambient temperature, atmospheric stability, and mixing height over longer averaging periods, even though it is not explicitly indicated in the U.S. EPA Guidance (U.S. EPA, 1992). Figure H.1 shows the variability in wind direction over a 24-hour period. The data are averaged for two seven-day periods from data collected at Los Angeles International Airport (LAX). Figure H.1 was compiled for data collected in 1989 for January 1 to January 7 and June1 through June 7, 1989. The ordinate in Figure H.1 shows the months of the year. Only two months are plotted. The abscissa shows the hour of the day.

FIGURE H.1: HOURLY WIND DIRECTION - LOS ANGELES, JANUARY (BOTTOM – 1) AND JUNE (TOP - 6)



As seen in Figure H.1, the wind direction changes throughout all hours of the day. In addition, the wind direction for LAX, in the overnight and early morning hours, can vary from January to June. During the afternoon hours of 1400 – 1600, the wind direction is similar in both months of January and June.

The standard U.S. EPA screening factor to estimate the maximum 24-hour concentration from the maximum 1-hour concentration is 0.4, as seen in Table H.1. Figure H.2 shows that for 15 of 24 hours the wind blows from the west-northwest during June. A 24-hour screening factor could be 0.6 (0.6 ≈ 15hrs/24hrs) based on wind direction alone. This is consistent with the upper bound of the adjustment factors shown in Table H.1. Including the variability for wind speed, ambient temperature, and

atmospheric stability could further reduce the estimated scaling factor of 0.6 closer towards the U.S. EPA recommended value of 0.4.

H.5 Intermittent Release

Support for the U.S. EPA screening factor is demonstrated for a continuous release (i.e., 24 hours per day) in the description above. It is important to be cautious when applying the U.S. EPA screening factors to an intermittent source for the purposes of estimating an annual average concentration (e.g., a business that may only emit during normal operating hours of 8 am to 6 pm).

Intermittent emissions, such as those from burning barrels, testing a standby diesel generator, or any normal business hour operation (e.g., 8am to 6pm Monday through Friday), could have the effect of eliminating some of the annual variability of meteorological conditions. For example, emissions only during the daytime could eliminate the variability of a drainage flow pattern in mountainous terrain. Guidance for estimating long-term averages for a screening approach and intermittent emissions is not available.

For a source located in the LAX meteorological domain, an emission pattern confined to the hours of 1400 to 1600 would eliminate any variability associated with the wind direction. In this case, estimating a 24-hour average with the U.S. EPA scaling factor of 0.4 would be incorrect.

In the event the emissions are intermittent but randomly distributed throughout the day, the scaling factor of 0.4 may be appropriate because the natural diurnal variability of meteorological conditions are concurrent with emissions. An additional pro-rating of the concentration, when estimating a 24-hour concentration, would be required to discount due to the intermittent nature of the emissions.

We recommend the following steps to estimate a screening based estimate of annual average concentrations from intermittent emissions.

1. Estimate the maximum one-hour concentration ($\chi_{1\text{-hr}}$) based on the AERSCREEN model approach (or similar, e.g., AERMOD with screening meteorological data) for possible meteorological conditions consistent with the operating conditions and the actual hourly emission rate. It is acceptable to estimate downwind concentrations using all meteorological combinations available to AERSCREEN. However, it is possible to be selective for the choices of meteorological conditions and still be conservative. For example, daytime only emissions need not be evaluated for nighttime stable atmospheric conditions.

2. Estimate the concentration for the longest averaging period applicable based on the length of time of the systematic or randomly distributed emissions and the factors in Table H.1. For example, the longest averaging period concentration that may be estimated with the U.S. EPA scaling factors is an 8-hour concentration ($\chi_{8\text{-hr}}$) for emissions that are systematically released for 12 hours.

Scaling factors between 8-hours and 12-hours are not available. In the case of the 8-hour concentration, the U.S. EPA screening factor of 0.7 ± 0.2 to estimate the maximum 8-hour concentration is appropriate.

The U.S. EPA Screening Guidance allows for deviation from the suggested conversion factor on a case-by-case basis. We recommend the lower end of the range for the conversion factor (i.e., 0.5 for the 8-hour average) when estimating an annual average concentration. This is because variability associated with seasonal differences in wind speed, wind direction, and atmospheric stability would not be addressed otherwise. As seen in Figure H.1, there are seasonal differences in the wind direction.

For example, if X is the length of time of systematic or randomly distributed emissions, the following scalars can apply.

- $X \leq 2$ hrs; Scalar = 1.0 to estimate a 1-hour average
- 3 hrs $\leq X \leq$ 7 hrs; Scalar = 0.8 to estimate a 3-hour average
- 8 hrs $\leq X \leq$ 20 hrs; Scalar = 0.5 to estimate an 8-hour average (the selection of 20 hours is arbitrary)
- 21 hrs $\leq X \leq$ 24 hrs; this may be a continuous release, use standard screening procedures.

3. Estimate the annual average concentration (χ_{annual}) by assuming the longer averaging period estimated above is persistent for the entire year. In the above example the 8-hour concentration is assumed to be persistent for an entire year to estimate an annual average concentration (i.e., the annual average concentration is assumed to be equal to the 8-hour concentration).

   In addition, the annual average concentration should be pro-rated over the final averaging period based on the pro-rated emissions (i.e., the calculation should include the fact that for some hours over the year, the emission rate is zero).

   For example, if Y is the number of operating hours in the year (e.g., Y = X * 365), the following may apply.

   $(\chi_{annual}) = (\chi_{1\text{-}hr})$ (Scalar) (Y/8760hrs/yr)

4. The hourly emission rate should be calculated based on the assumed operating schedule in the steps above. An example for a facility operating Y hours per year follows.

   $(q_{hourly}) = (Q_{yearly})/(Y \text{ hrs/yr})$

5. The annual average concentration (or ground level concentration GLC) can be estimated as follows.

   $GLC = (\chi_{annual})\ (q_{hourly})$

   $= (\chi_{1\text{-}hr})(Scalar)\ (Yhrs/8760hrs)\ (Q_{yearly})/(Y\ hrs/yr)$

   $= (\chi_{1\text{-}hr})(Scalar)\ (Q_{yearly})/(8760\ hrs/yr)$

Practically speaking, the above five steps condense down to determining three values. The first value is the maximum 1-hour concentration. The second value is the Scalar (either 1.0, 0.8, or 0.5). And the third value is the hourly emission rate estimated by uniformly distributed over the entire year (8760 hours). The operating hours per year drops out of the calculations for an annual average concentration provided the emissions are based on an annual inventory (See step 5).

In the event that the acute averaging period is required and the emissions are based on an annual inventory, then the annual operating hours are required.

Below are four examples using the steps as outlined above. In each case, the annual average concentration is the desired value for use in risk assessment calculations.

<u>Example 1 - Fugitive Gasoline Station Emissions</u>

Emissions are **continuous** for 24 hours per day and 365 days per year.

1. Estimate the maximum 1-hour concentration with the AERSCREEN model (or similar screening modeling approach), $\chi_{1\text{-}hr}$.

2. Estimate the annual average concentration, $\chi_{annual,}$ with the U.S. EPA screening factor of 0.08.

3. $(\chi_{annual}) = (\chi_{1\text{-}hr})(0.08)$

4. The hourly emission rate, q_{hourly}, for the annual average concentration is based on 24 hours per day and 365 days per year (8760 hours per year).

5. $(q_{hourly}) = (Q_{yearly})/(8760\ hrs/yr)$

6. The annual average concentration (or ground level concentration GLC) can be estimated as follows.

   $GLC = (\chi_{annual})\ (q_{hourly})$

   $GLC = (\chi_{1\text{-}hr})(0.08)\ (Q_{yearly})/(8760\ hrs/yr)$

Example 2 - Dry Cleaner Emissions

Emissions are **intermittent** over the year but **systematic** for 10 hours per day, 5 days per week and 50 weeks per year.

1. Estimate the maximum 1-hour concentration with the AERSCREEN model (or similar screening modeling approach), $\chi_{1\text{-hr}}$.

2. Estimate the maximum 8-hour average concentration, $\chi_{8\text{-hr}}$, with the U.S. EPA screening factor of 0.7 ±0.2 as the longest averaging period of continuous release. The averaging period would need to be less than 10 hours. Use the lower range of the screening factor, 0.5, because the annual average is the final product and variability due to seasonal differences are not accounted for otherwise.

   $$(\chi_{8\text{-hr}}) = (\chi_{1\text{-hr}})(0.5)$$

3. Assume the worst-case 8-hour concentration is persistent throughout the year and pro-rate the concentration based on emissions over the year. For this dry cleaner, there are 2500 hours of operating condition emissions. Therefore the annual average is calculated as follows.

   $$(\chi_{annual}) = (\chi_{8\text{-hr}})\ (2500\text{hrs}/8760\text{hrs})$$

   $$= (\chi_{1\text{-hr}})(0.5)\ (2500\text{hrs}/8760\text{hrs})$$

4. The hourly emission rate, q_{hourly}, for the annual average concentration is based on 2500 hours per year.

   $$(q_{hourly}) = (Q_{yearly})/(2500\ \text{hrs/yr})$$

5. The annual average concentration (or ground level concentration GLC) can be estimated as follows.

   $$GLC = (\chi_{annual})\ (q_{hourly})$$

   $$= (\chi_{1\text{-hr}})(0.5)\ (2500\text{hrs}/8760\text{hrs})\ (Q_{yearly})/(2500\ \text{hrs/yr})$$

   $$= (\chi_{1\text{-hr}})(0.5)\ (Q_{yearly})/(8760\ \text{hrs/yr})$$

Example 3 - Burning Barrel Emissions

Emissions are **intermittent** over the year and **random** during daylight hours for two hours per burn, two burns per week, and 52 weeks per year.

1. Estimate the maximum 1-hour concentration with the AERSCREEN model (or similar screening modeling approach), $\chi_{1\text{-hr}}$. Meteorological combinations may be restricted to daytime conditions for this screening analysis.

2. Estimate the maximum 8-hour average concentration, $\chi_{8\text{-hr}}$, with the U.S. EPA screening factor of 0.7 ±0.2 as the longest averaging period where the emissions have the potential to be randomly distributed. Depending on the day of the year and latitude of the emissions, the daylight hours can vary. For this example, we assume the daylight hours can be as short as 10 hours per day to as long as 14 hours per day. Since the emissions are randomly distributed throughout the daylight hours, the longest averaging period we can scale with U.S. EPA scaling factors is a 10 hour average. In this case, the averaging period becomes the 8-hour average and the scaling factor becomes 0.7±0.2. Again since this is for an annual average, we use the lower end of the range, 0.5.

   $(\chi_{8\text{-hr}}) = (\chi_{1\text{-hr}})(0.5)$

3. Assume the worst-case 8-hour concentration is persistent throughout the year and pro-rate the concentration based on the emissions over the year. For the burning barrels there are 208 hours of operating condition emissions (208 hrs = (2hrs/burn)(2burns/wk)(52wk/yr)). Therefore the annual average concentration is calculated as follows.

   $(\chi_{annual}) = (\chi_{8\text{-hr}})\ (208\text{hrs}/8760\text{hrs})$

   $= (\chi_{1\text{-hr}})(0.5)\ (208\text{hrs}/8760\text{hrs})$

4. The hourly emission rate, q_{hourly}, for the annual average concentration is based on 208 hours per year.

   $(q_{hourly}) = (Q_{yearly})/(208\ \text{hrs/yr})$

5. The annual average concentration (or ground level concentration GLC) can be estimated as follows.

   $GLC = (\chi_{annual})\ (q_{hourly})$

   $= (\chi_{1\text{-hr}})(0.5)\ (208\text{hrs}/8760\text{hrs})\ (Q_{yearly})/(208\ \text{hrs/yr})$

   $= (\chi_{1\text{-hr}})(0.5)\ (Q_{yearly})/(8760\ \text{hrs/yr})$

The above methods were used in a recent modeling evaluation for emissions from a burning barrel (example 3 above) (ARB, 2002). Table H.2, below, shows results from the modeling evaluation. Shown in Table H.2 are the maximum annual average concentration based on the screening approach outlined above as well as a refined approach with site specific meteorological data from four locations, Alturas, Bishop, San Benito, and Escondido. As seen in Table H.2, the screening evaluation as described in the example overestimates the values calculated based on the refined analysis. This is the desired outcome of a screening approach.

TABLE H.2: MAXIMUM ANNUAL AVERAGE CONCENTRATION (χ/Q) ABOVE AMBIENT CONDITIONS - BURNING BARREL EMISSIONS

Met. City	**Alturas**	**Bishop**	**San Benito**	**Escondido**	Screening
D (m)	**($\mu g/m^3$)/(g/s)**	**($\mu g/m^3$)/(g/s)**	**($\mu g/m^3$)/(g/s)**	**($\mu g/m^3$)/(g/s)**	***($\mu g/m^3$)/(g/s)***
20	44.	61.	85.	110.	*590.*
50	12.	16.	22.	30.	*230.*
100	4.	5.	7.	9.	*85.*

Notes: (a) Annual χ/q is based on 208 hours of emissions at 1 g/s.

(b) χ/q is the concentration in $\mu g/m^3$ based on an hourly emission rate of 1 g/s.

<u>Example 4 - Standby Diesel Engine Testing</u>

Emissions are **intermittent** over the year and **systematic** for two hours per week and 50 weeks per year. The engine testing is conducted at 2 pm on Fridays.

1. Estimate the maximum 1-hour concentration with the AERSCREEN model (or similar screening modeling approach), $\chi_{1\text{-hr}}$. Meteorological combinations may be restricted to daytime conditions in this screening analysis because the engine test is conducted at 2 pm.

2. In this case, the emission schedule is systematically fixed over a two hour period. Therefore, the longest averaging period which is applicable for the U.S. EPA screening factors is one-hour because a two-hour conversion factor is not available. Therefore, we assume the maximum 1-hour concentration is persistent for the entire year. We still prorate the concentration based on the emissions. There are 100 hours of engine testing per year. Therefore the annual average concentration becomes.

   $$(\chi_{annual}) = (\chi_{1\text{-hr}})\ (100\text{hrs}/8760\text{hrs})$$

3. The hourly emission rate, q_{hourly}, for the annual average concentration is based on 100 hours per year.

   $$(q_{hourly}) = (Q_{yearly})/(100\ \text{hrs/yr})$$

4. The annual average concentration (or ground level concentration GLC) can be estimated as follows.

$$GLC = (\chi_{annual})\ (q_{hourly})$$

$$= (\chi_{1\text{-}hr})\ (100hrs/8760hrs)\ (Q_{yearly})/(100\ hrs/yr)$$

$$= (\chi_{1\text{-}hr})\ (Q_{yearly})/(8760\ hrs/yr)$$

H.6 Implementation

The approach outlined above has been implemented in the Hot Spots Analysis and Reporting Program (HARP). The HARP software has been developed in consultation with OEHHA, Air Resources Board (ARB), and District representatives. The HARP software is the recommended model for calculating and presenting HRA results for the Hot Spots Program. Information on obtaining the HARP software can be found on the ARB's web site at www.arb.ca.gov. Note, since the HARP software is a tool that uses the methods specified in this document, the software will be available after these guidelines have undergone public and peer review, been endorsed by the state's Scientific Review Panel (SRP) on Toxic Air Contaminants, and adopted by OEHHA.

H.7 References

ARB (1994). ARB memorandum dated 4/11/94 from A. Ranzieri to J. Brooks on the subject, "One-hour to Thirty-day Average Screening Factor."

ARB (2002). Staff Report: Initial Statement of Reasons for the Proposed Airborne Toxic Control Measure to Reduce Emissions of Toxic Air Contaminants from Outdoor Residential Waste Burning, January 2002. California Air Resources Board.

U.S. EPA (1992). Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, October 1992, EPA-454/R-92-019. U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. EPA (2011). AERSCREEN User's Guide. EPA-454/B-11-001. U.S. Environmental Protection Agency, Research Triangle Park, NC.

Appendix I:

Calculation Examples for Estimating Potential Health Impacts

This appendix provides four example calculations to illustrate the procedures for estimating the potential health impacts from a facility. The examples are intended to assist the risk assessor in understanding the steps associated with conducting the final step of risk assessment, risk characterization. The four examples provided in this appendix evaluate the inhalation cancer risk, the noncancer acute hazard quotient (HQ) and hazard index (HI), the noncancer 8-hour HQ and HI, and the multipathway (inhalation and oral) noncancer chronic HQ and HI. Specific requirements for health risk assessment (HRA) under the Hot Spots Program are presented in Chapter 8. The HARP software will perform the calculations that are presented here and required in the guidelines. See the ARB's website at www.arb.ca.gov for more information on HARP.

I.1 Sample Calculation for Inhalation Cancer Health Risk Assessment

The following example illustrates the steps for calculating cancer risk at the maximum exposed individual resident (MEIR) using the high-end point-estimate for the inhalation exposure pathway. For each included substance, the steps involved in this sample calculation include:

- determine the annual average concentration and look-up the inhalation cancer potency factor for each substance
- calculate the inhalation dose
- calculate the cancer risk using the OEHHA cancer potency factors for each age range and the appropriate Age Sensitivity Factors
- sum the cancer risks from each age range for the exposure duration of interest, and express the risk in chances per million

In this example, the inhalation dose and risk are calculated for the third trimester, ages 0<2, 2<9, 2<16, 16<30, and 16-70 using the high-end daily breathing rate for each age range.

This example focuses on the 30-year cancer risk calculation and does not cover the steps for completing a noninhalation or multipathway HRA. Algorithms to estimate point-estimate and stochastic multipathway exposure can be found in Chapter 5. For simplicity, it is recommended that the risk assessor use HARP to conduct a multipathway risk assessment or stochastic risk assessment.

Step one - Determine the annual average concentration at the MEIR and look-up the inhalation cancer potency factor for each emitted substance.

The risk assessor would obtain the annual average concentrations from the air dispersion modeling results. This step has been completed for this example. Table I.1

presents the annual average concentrations at a hypothetical facility. In addition, Table I.1 also presents inhalation cancer potency factors for each substance, which also can be found in Chapter 7 and Appendix L. Note that where no inhalation cancer potency has been developed for a substance, the tables in this example have been annotated with N/A since it will not be possible to conduct a quantitative risk assessment for these substances. As previously stated, this example does not take into account multipathway effects for the substances listed in Table I.1. It is recommended that the risk assessor use HARP for conducting such an analysis.

TABLE I.1 ANNUAL AVERAGE CONCENTRATIONS AT THE MEIR AND INHALATION CANCER POTENCY FACTORS

Substance	Annual Average Concentrations ($\mu g/m^3$)	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$
Ammonia	160	N/A
Arsenic	**0.0015**	**12**
Benzene	5	0.10
Chlorine	0.08	N/A
Chlorobenzene	20	N/A
2,3,7,8-TCDD (dioxin)	0.000004	130,000
Nickel	0.02	0.91

Step two - Determine the inhalation dose for each substance.

Once you have determined the annual average concentration for the emitted substance, the equation below is used to calculate the inhalation dose for each age range and each substance. This equation is listed in Section 5.4.1 of this document, and is also described in the *Air Toxics Hot Spots Risk Assessment Guidelines: Technical Support Document for Exposure Assessment and Stochastic Analysis* (OEHHA, 2012)

$$Dose-air = (Cair)\left(\frac{BR}{BW}\right)(A)(EF)(1\times 10^{-6})$$

Where:

dose-air	=	Dose through inhalation (mg/kg/d)
Cair	=	Concentration in air ($\mu g/m^3$)
BR/BW	=	Daily breathing rate normalized to body weight (L/kg BW-day). See Table I.2 for the daily breathing rate for each age range.
A	=	Inhalation absorption factor
EF	=	Exposure frequency (unitless, days/365 days)
$1x10^{-6}$	=	Milligrams to micrograms conversion (10^{-3} mg/μg), cubic meters to liters conversion (10^{-3} m^3/l)

A summary of the exposure point-estimates and data distributions for use in risk assessment can be found in Chapter 5 of this document. For more detail on point-estimates and data distributions, see OEHHA (2012). The recommended default values presented in Table I.2 can be used when site-specific information is not available. Note that in this example the mean daily breathing rates listed in the table are for information purpose only. In some cases, the mean value can be used for a tier-2 risk assessment or applied when multiple noninhalation routes of exposure dominate the risk (See Chapter 8.2.6).

TABLE I.2 RECOMMENDED DEFAULT VALUES FOR INHALATION DOSE EQUATION

Variable	Recommended Default Value		
EF	0.96 (350 days/365 days) Assumes 2-week vacation away from exposure		
Daily Breathing Rates (DBR) (L/kg BW-day) for 9, 30, and 70-year exposures in examples below	**Period**	**Mean**	**95th percentile**
	3rd trimester	225	**361**
	0<2 yrs	658	**1090**
	2<9 yrs	535	**861**
	2<16 yrs	452	**745**
	16<30 yrs	210	**335**
	16-70 yrs	185	**290**
	(For other DBRs see Chapter 5)		
A	1[a]		

[a] OEHHA's Hot Spots inhalation cancer potency factors for the Hot Spots program have already been adjusted where necessary to allow for the inhalation absorption factor, so a value of 1 is used in this equation.

The following equation shows the calculation for the inhalation dose of arsenic for the third trimester by using the annual average concentration for arsenic (Table I.1) and the recommended default values in Table I.2. Note that the high-end (95th percentile) daily breathing rates are used to estimate the third trimester inhalation dose in this example.

$$\text{Arsenic}(\text{dose}-\text{air})_{(\text{third trimester})} = \left(\frac{0.0015\mu g}{m^3}\right)\left(\frac{361 liters}{kg-day}\right)(1)(0.96)\left(\frac{1\text{x}10^{-3}\ mg}{1\mu g}\right)\left(\frac{1\text{x}10^{-3}\ m^3}{liters}\right)$$

$$\text{Arsenic}(\text{dose}-\text{air})_{(\text{third trimester})} = 5.2\times10^{-7} mg/kg-day$$

To estimate the 30-year arsenic inhalation dose, this calculation is repeated using 95th percentile breathing rates for 0<2 years, 2<16 years, and 16<30 years shown in Table I.2:

$$\text{Arsenic}(\text{dose}-\text{air})_{(0<2yrs)} = \left(\frac{0.0015\mu g}{m^3}\right)\left(\frac{1090 liters}{kg-day}\right)(1)(0.96)\left(\frac{1\text{x}10^{-3}\ mg}{1\mu g}\right)\left(\frac{1\text{x}10^{-3}\ m^3}{liters}\right)$$

Arsenic (dose-air) $_{(0<2\ \text{yrs})}$ = 1.6 × 10^{-6} mg/kg-day

$$\text{Arsenic}(\text{dose}-\text{air})_{(2<16yrs)} = \left(\frac{0.0015\mu g}{m^3}\right)\left(\frac{745 liters}{kg-day}\right)(1)(0.96)\left(\frac{1\text{x}10^{-3}\ mg}{1\mu g}\right)\left(\frac{1\text{x}10^{-3}\ m^3}{liters}\right)$$

Arsenic (dose-air) $_{(2<16\ \text{yrs})}$ = 1.1 × 10^{-6} mg/kg-day

$$\text{Arsenic}(\text{dose}-\text{air})_{(16<30yrs)} = \left(\frac{0.0015\mu g}{m^3}\right)\left(\frac{335 liters}{kg-day}\right)(1)(0.96)\left(\frac{1\text{x}10^{-3}\ mg}{1\mu g}\right)\left(\frac{1\text{x}10^{-3}\ m^3}{liters}\right)$$

Arsenic (dose-air) $_{(16<30\ \text{yrs})}$ = 4.8 × 10^{-7} mg/kg-day

To estimate 70-year exposure, the 95th percentile breathing rate for ages16-70 years in Table I.2 is used instead of the breathing rate for 16<30 years. The arsenic dose for the 16<70 year age bin is 4.2 × 10^{-7} mg/kg-day. Therefore, the age bins that are used for the 70-year scenario include the third trimester, ages 0<2 years, 2<16 years, and 16<70 years.

To estimate the 9-year arsenic inhalation dose, the 95th percentile breathing rates are used for the third trimester, ages 0<2 years and 2<9 years.

These calculations are repeated for each substance under evaluation using their respective annual average concentrations. For our hypothetical facility, we have calculated each inhalation dose for each substance by age bin. In reality, you only need to calculate the dose for the age bins that are required for the exposure duration of interest for your assessment (e.g., 30 years, etc.). However, Table I.3 shows the results from our analysis for all age bins so that potential risk for any exposure duration can be calculated.

TABLE I.3 CALCULATED INHALATION DOSES FOR SUBSTANCES

Substance		Calculated Dose (mg/kg-day)				
	3rd Tri.	0<2 yrs	2<9 yrs	2<16 yrs	16<30 yrs	16-70 yrs
Ammonia	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	5.2×10^{-7}	1.6×10^{-6}	1.2×10^{-6}	1.1×10^{-6}	4.8×10^{-7}	4.2×10^{-7}
Benzene	1.7×10^{-3}	5.2×10^{-3}	4.1×10^{-3}	3.6×10^{-3}	1.6×10^{-3}	1.4×10^{-3}
Chlorine	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
2,3,7,8-TCDD (dioxin)	1.4×10^{-9}	4.2×10^{-9}	3.3×10^{-9}	2.9×10^{-9}	1.3×10^{-9}	1.1×10^{-9}
Nickel	6.9×10^{-6}	2.1×10^{-5}	1.7×10^{-5}	1.4×10^{-5}	6.4×10^{-6}	5.6×10^{-6}

Step three – Determine inhalation cancer risk for the MEIR.

Once you have calculated the inhalation dose, then the cancer risk is calculated for each age bin and the risk estimates are summed for the exposure duration of interest. To complete this step, the dose for each age bin is multiplied by the inhalation cancer potency factor, the Age Sensitivity Factor (ASF), the exposure duration for the specified age bin over the averaging time (i.e., AT is always 70 years), and the fraction of time spent at home, to determine the cancer risk. Studies have shown that infants and children are more sensitive than adults to exposure to many carcinogens (OEHHA, 2009). Therefore, OEHHA applied ASFs to take into account the increased sensitivity to carcinogens during early-in-life exposure. OEHHA and ARB also evaluated information from activity patterns databases to estimate the percentage of the day that people are home (OEHHA, 2012). This information can be used to adjust exposure duration and risk from a specific facility's emissions, based on the assumption that exposure to the facility's emissions are not occurring while the person is away from home. The ASF and FAH variables are only used when estimating residential cancer risk (e.g., the MEIR)

The risk calculation is performed for each age bin and each substance. The total cancer risk for each substance is the sum of the cancer risks from each age bin for the exposure duration of interest.

$$\text{Cancer Risk} = \left(\text{Inhalation Dose}\,\frac{mg}{kg-day}\right)\left(\text{Cancer Potency}\,\frac{kg-day}{mg}\right)(ASF)(FAH)\left(\frac{EDyrs}{ATyrs}\right)$$

Where:

Cancer Risk	=	Unitless expression of risk (see below)
Inhalation Dose	=	In mg/kg-d
Cancer Potency	=	Chemical specific (in $(mg/kg\text{-}d)^{-1}$ or as kg-d/mg)
ASF	=	Age sensitivity factor (unitless)
FAH	=	Fraction of time spent at home (unitless)
ED	=	Exposure duration (years)
AT	=	Averaging time period over which exposure duration is averaged (always 70 years).

The age sensitivity factor, exposure duration, and fraction of time spent at home are shown for each age range in **Error! Reference source not found.**. However, if it is determined there is a school located within the cancer risk isopleths of $1x10^{-6}$ (one chance per million) or greater, then the fraction of time at the residence is assumed to be one (1) for ages 3rd trimester to less than 16. Thus, cancer risks and the associated isopleths must first be determined using one (1) as the fraction of time at the residence before the FAH values between ages 3rd trimester to less than 16 in Table I.4 can be utilized. See Chapter 8 for more information on calculating a zone of impact, isopleths, and population exposure. In this example, we assume there is no school located within the cancer risk isopleth of $1x10^{-6}$ or greater; therefore, the FAH factors in Table I.4 are used.

TABLE I.4 INPUTS FOR AGE SENSITIVITY FACTOR, EXPOSURE DURATION, AND THE FRACTION OF TIME SPENT AT HOME

	3rd Tri.	0<2 yrs	2<9 yrs	2<16 yrs	16<30 yrs	16-70 yrs
Age Sensitivity Factor	10	10	3	3	1	1
Exposure Duration (years)	0.25	2	7	14	14	54
Fraction of Time Spent at Home (FAH)	0.85*	0.85*	0.72*	0.72*	0.73	0.73

*Assume the FAH is 1 for ages 3rd trimester to less than 16 unless it is determined there is no school located within the cancer risk isopleth of $1x10^{-6}$ or greater.

The equation below shows the calculation of the cancer risk from arsenic for the third trimester:

$$\text{Arsenic Cancer Risk}_{\text{(third trimester)}} = \left(\frac{5.2\times10^{-7}mg}{kg-d}\right)\left(\frac{12kg-d}{mg}\right)(10)(0.85)\left(\frac{0.25yrs}{70yrs}\right)$$

$$\text{Arsenic Cancer Risk}_{\text{(third trimester)}} = 1.9\times10^{-7}$$

To estimate the 30-year cancer risk from arsenic, the cancer risk calculation is repeated for the age bins 0<2, 2<16, and 16<30 years using the appropriate age-related inputs for average daily inhalation dose, ASF, FAH and ED in **Error! Reference source not found.**, respectively**Error! Reference source not found.**:

$$\text{Arsenic Cancer Risk}_{(0<2\,\text{yrs})} = \left(\frac{1.6\times10^{-6}mg}{kg-d}\right)\left(\frac{12kg-d}{mg}\right)(10)(0.85)\left(\frac{2yrs}{70yrs}\right)$$

Arsenic Cancer Risk $_{(0<2\text{ yrs})}$ = 4.7×10^{-6}

$$\text{Arsenic Cancer Risk}_{(2<16\,\text{yrs})} = \left(\frac{1.1\times10^{-6}mg}{kg-d}\right)\left(\frac{12kg-d}{mg}\right)(3)(0.72)\left(\frac{14yrs}{70yrs}\right)$$

Arsenic Cancer Risk $_{(2<16\text{ yrs})}$ = 5.7×10^{-6}

$$\text{Arsenic Cancer Risk}_{(16<30\,\text{yrs})} = \left(\frac{4.8\times10^{-7}mg}{kg-d}\right)\left(\frac{12kg-d}{mg}\right)(1)(0.73)\left(\frac{14yrs}{70yrs}\right)$$

Arsenic Cancer Risk $_{(16<30\text{ yrs})}$ = 8.4×10^{-7}

Calculated arsenic cancer risks for each age range are then summed together as shown in the example below to estimate the total 30-year cancer risk from arsenic:

Total Arsenic Cancer Risk $_{(30\text{-year})}$ = Arsenic Cancer Risk $_{(\text{third trimester})}$ +

Arsenic Cancer Risk $_{(0<2\text{ yrs})}$ +

Arsenic Cancer Risk $_{(2<16\text{ yrs})}$ +

Arsenic Cancer Risk $_{(16<30\text{ yrs})}$

$$= (1.9 \times 10^{-7}) + (4.7 \times 10^{-6}) + (5.7 \times 10^{-6}) + (8.4 \times 10^{-7}) = 1.1 \times 10^{-5}$$

To estimate the 70-year cancer risk from arsenic, the cancer risk calculation is repeated for the last trimester to birth, ages 0<2, 2<16, and 16<70 using the appropriate age-related inputs from Tables I.3 and I.4. The calculated arsenic cancer risks for each age range from the third trimester to age 70 are then summed together to estimate the total 70-year cancer risk from arsenic.

To estimate the 9-year cancer risk from arsenic, the cancer risk calculation is repeated for the last trimester to birth, ages 0<2 and 2<9 using the appropriate age-related inputs from Tables I.3 and I.4. The calculated arsenic cancer risks for each age range from the third trimester to age 9 are then summed together to estimate the 9-year cancer risk from arsenic.

Step four – Express cancer risk in chances per million.

The final step converts the cancer risk in scientific notation to a whole number that expresses the cancer risk in "chances per million"; to complete this step, multiply the estimated cancer risk by a factor of $1x10^6$ (i.e., 1 million).

(Total Cancer Risk) ($1x10^6$) = Total Cancer Risk in chances per million

For a hypothetical facility, the equation below shows the calculation for the inhalation cancer risk of arsenic as a result of 30-year exposure to arsenic:

$$\left(1.1\times10^{-5}\right)\left(1\times10^{6}\right)=11\,\text{chances per million}$$

Use the substance-specific inhalation dose and inhalation cancer potency factor to determine the cancer risk for each substance by repeating these steps. Sum the individual substance cancer risks to give you the total facility (inhalation) cancer risk. Table I.5 shows the individual substance and total facility inhalation cancer risk. In this example, a hypothetical facility poses a (inhalation) cancer risk of 658 chances per million at the MEIR. Note, although not presented here, a facility emitting arsenic or dioxins should also evaluate cancer risk from noninhalation exposure pathways. Note that although rounding was utilized for ease throughout this example, rounding should not take place until the final answer.

TABLE I.5 HYPOTHETICAL FACILITY INHALATION 30-YEAR CANCER RISK

Substance	Cancer risk (chances per million)
Ammonia	N/A*
Arsenic	11
Benzene	310
Chlorine	N/A*
Chlorobenzene	N/A*
2,3,7,8-TCDD (dioxin)	326
Nickel	11
Total Facility Inhalation Cancer Risk	**658**

* N/A: Inhalation cancer potency factor is not available.

While this example illustrates the steps used to calculate cancer risk using the inhalation dose algorithm, steps one through four can also be used to calculate noninhalation cancer risk and ultimately multipathway (inhalation and noninhalation pathway) cancer risk. To determine noninhalation cancer risk, an assessor should use the appropriate exposure pathway algorithm presented in Chapter 5. For example, equation 5.4.3.1.1 (Chapter 5) would be used to determine dose for the soil ingestion pathway. Once the assessor has determined the ingestion dose, the cancer risk for that pathway is calculated using the substance-specific oral slope factor. Oral slope factors can be found in Appendix L and Chapter 7. To calculate multipathway cancer risk, the cancer risks for all substances and exposure pathways are summed. See Chapter 8 for further discussion.

I.2 Sample Calculation of Noncancer Acute Hazard Indices

Risk characterization for noncancer health impacts are expressed as a hazard quotient (for individual substances) or a hazard index (for multiple substances). In addition, all hazard quotients (HQ) and hazard indices (HI) must be determined by target organ system. The example below illustrates the approach for calculating a noncancer acute HQ and HI at the MEIR. The steps involved in this sample calculation include:
1) determining the 1-hour maximum concentration, the acute reference exposure level (REL), and the target organ systems for each substance; 2) calculating the acute HQ for each substance and applying the calculated HQ to the specified target organs for each substance; and 3) calculating the acute HI by summing each HQ from each substance by target organ system. As discussed in Chapter 8, the following example is provided to assist the risk assessor in understanding how to calculate an acute HQ and HI. Using HARP, both the acute HQ and HI will automatically be calculated at each receptor. No exposure duration adjustment should be made for acute noncancer assessments. Specific requirements for risk assessment under the Hot Spots Program can be found in Chapters 8 and 9.

Step one - Determine the 1-hour maximum concentration at the MEIR, the acute reference exposure level, and the target organ systems for each emitted substance.

The risk assessor would obtain the 1-hour maximum concentrations from the air dispersion modeling results. This step has been completed for this example. Table I.6 presents the maximum 1-hour concentrations, target organ systems, and acute RELs for seven substances. Note that where an acute REL has not been developed for a substance, the tables in this example have been annotated with “N/A”.

TABLE I.6 CONCENTRATIONS, ACUTE RELS, AND TARGET ORGAN SYSTEM(S) FOR SUBSTANCES AT THE MEIR

Substance	1-hour Maximum Concentration ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)	Target Organ System(s)
Ammonia	1900	3200	Respiratory System; Eye
Arsenic	0.03	0.20	Reproductive/Development ; Cardiovascular System; Nervous System
Benzene	20	1300	Reproductive/Development; Immune System; Hematologic System
Chlorine	140	210	Respiratory System; Eye
Chlorobenzene	60	N/A	N/A
2,3,7,8-TCDD (dioxin)	0.00001	N/A	N/A
Nickel	0.08	0.20	Immune System

In this example, chlorobenzene and 2,3,7,8-TCDD (dioxin) do not have acute REL values. The acute RELs and their corresponding target organ system(s) can be found in Table 6.1 (Chapter 6) and also in Appendix L.

Step two - Determine the hazard quotient for each substance.

The hazard quotients for each substance are calculated by taking the acute maximum 1-hour concentration and dividing by the substance-specific acute REL. The following equation shows how to calculate the hazard quotient for ammonia.

$$\text{Acute Hazard Quotient} = \frac{\begin{pmatrix} Maximum\ 1-hr \\ Concentration \end{pmatrix}}{\begin{pmatrix} Acute \\ REL \end{pmatrix}} \Rightarrow \text{Acute Hazard Quotient}_{(ammonia)} = \frac{(1900\ \mu g/m^3)}{(3200\ \mu g/m^3)} = 0.6$$

Step three – Determine the acute HI for all emitted substances.

The acute HQ calculated above for a substance applies to all the target organs listed under that substance. The acute HI is calculated by summing each hazard quotient for each substance by target organ system. For example, add the HQs for all substances that impact the respiratory system, then repeat this step for the next target organ system (e.g., reproductive/development system). This step is repeated until all target organs (for the substances emitted) are individually totaled. See Table 6.1 for target organ system information. Note, do not add together the HQs or HIs for different target organ systems (e.g., do not add the impacts for the respiratory system to that for

reproductive/development). Table I.7 shows individual hazard quotients for each substance and total hazard index.

TABLE I.7 INDIVIDUAL HAZARD QUOTIENTS AND TOTAL HAZARD INDEX FOR ACUTE EXPOSURE

Substance	Immune System	Reproductive/ Development	Hematologic System	Nervous System	Cardiovascular System	Respiratory System	Eye
Ammonia						0.6	0.6
Arsenic		0.2		0.2	0.2		
Benzene	0.02	0.02	0.02				
Chlorine						0.7	0.7
Chlorobenzene							
2,3,7,8-TCDD (dioxin)							
Nickel	0.4						
Total Acute Hazard Index	**0.42**	**0.22**	**0.02**	**0.2**	**0.2**	**1.3**	**1.3**

In this example, an HQ of one was not equaled or exceeded for any individual substance. However, an HI (the sum of the hazard quotients for each target organ) of one was exceeded for the respiratory system and eyes. Exceeding a hazard index of one may indicate that there is the potential for adverse acute health impacts at this receptor location. Therefore, there is increased concern that exposed individuals may experience respiratory system and eye irritation, particularly among sensitive individuals. The District and OEHHA should be consulted when a hazard index exceeds one (see Section 8.3).

I.3 Sample Calculation of Noncancer 8-Hour Hazard Indices

The 8-hour RELs are used to evaluate impacts to offsite workers. The 8-hour RELs also apply to exposure of children during school hours if the children's schedules coincide with the facility's operating schedule. Although not required in the HRA, 8-hour exposure modeling could also be performed at the discretion of the District to a residential scenario (i.e., the MEIR) where a facility operates only a portion of the day and exposure to residences are not adequately reflected by averaging concentrations over a 24 hour day.

The example below illustrates the approach for calculating a noncancer 8-hour HQ and HI at the maximum exposed individual worker (MEIW) from a noncontinuously emitting facility. An HQ expresses the noncancer 8-hour health impacts for an individual substance and an HI expresses the cumulative potential impacts for multiple substances. All HQs and hazard indices HIs must be determined by target organ system.

The steps involved in this sample calculation include: 1) estimating the daily 8-hour annual average concentration, determining the 8-hour reference exposure level (REL) and the target organ systems for each substance; 2) calculating the 8-hour HQ for each substance and applying the calculated HQ to the specified target organs for each substance; and 3) calculating the 8-hour HI by summing each HQ from each substance by target organ system. As discussed in Chapter 8, the following example is provided to assist the risk assessor in understanding the calculation of noncancer 8-hour HQ and HI. Using the HARP software, both the 8-hour HQ and HI will be automatically calculated at each receptor. Specific requirements for risk assessment under the Hot Spots Program can be found in Chapters 8 and 9.

In this example, it is assumed the facility emits for eight hours per day and five days per week. It will also assume that the offsite worker's shift coincides with the facility's emission schedule.

Step one – Estimate the daily 8-hour annual average concentrations at the MEIW from the annual average using an adjustment factor; determine the 8-hour REL and target organ systems for each emitted substance

The risk assessor would obtain the annual average concentrations from the air dispersion modeling results. Since this is a noncontinuously emitting facility, the annual average concentration is adjusted to represent daily 8-hour average concentration. These steps have been completed for this example. However for completeness, the following equation shows how to calculate the adjustment factor. See Chapter 4 for more explanation.

$$AF = \frac{H_{residential}}{H_{source}} \times \frac{D_{residential}}{D_{source}} = \frac{24}{8} \times \frac{7}{5} = 4.2$$

Where:

AF = the adjustment factor
$H_{residential}$ = the number of hours per day the long-term residential concentration is based on (24)
H_{source} = the number of hours the source operates per day. In this example, we are assuming 8 hours per day.
$D_{residential}$ = the number of days per week the long-term residential concentration is based on (7).

D_{source} = the number of days the source operates per week. In this example, we are assuming 5 days per week.

The daily 8-hour annual average inhalation concentration is then estimated by multiplying the AF with the annual average concentration:

$$\text{Concentration}_{(8\text{-hour average})} = \text{Concentration}_{(\text{annual average})} \times (\text{AF})$$

Table I.8 shows the daily 8-hour annual average inhalation concentrations at a MEIW, target organ systems, and 8-hour RELs for seven substances. Note that where an 8-hour REL has not been developed for a substance, the tables in this example have been annotated with "N/A"; therefore, Table I.8 lists 8-hour RELs for arsenic and nickel. The 8-hour RELs and their corresponding target organ system(s) can be found in Table 6.2 (Chapter 6) and also in Appendix L.

TABLE I.8 ANNUAL AVERAGE CONCENTRATIONS AND ADJUSTED (AVERAGE DAILY) 8-HOUR CONCENTRATIONS FOR A FACILITY OPERATING 8 HRS/DAY, 5 DAYS/WEEK, AND THE 8-HOUR RELS AND TARGET ORGAN SYSTEM(S) FOR SUBSTANCES

Substance	Annual Average Conc. ($\mu g/m^3$)	Adjusted (Average Daily) 8-Hour Conc. ($\mu g/m^3$)	8-Hour REL ($\mu g/m^3$)	Target Organ System(s)
Ammonia	16	67	N/A	N/A
Arsenic	0.0015	0.0063	0.015	Cardiovascular System; Reproductive/Development; Nervous System: Respiratory System; Skin
Benzene	5	21	N/A	N/A
Chlorine	0.08	0.3	N/A	N/A
Chlorobenzene	20	84	N/A	N/A
2,3,7,8-TCDD (dioxin)	0.000001	0.000004	N/A	N/A
Nickel	0.01	0.04	0.06	Respiratory System; Immune System

Step two - Determine the 8-hour hazard quotient for each substance.

Similar to the acute hazard quotient (HQ) calculation shown above, the 8-hour HQs are calculated by taking the noncontinuous source concentration (assumed to be based on an 8-hour facility operation in the example in Table I.8) and dividing by the substance-specific 8-hour REL. The following equation shows how to calculate the hazard quotient for arsenic using the values presented in Table I.8:

$$\text{8-Hour Hazard Quotient} = \frac{\begin{pmatrix}\text{Average daily}\\ \text{concentration}\end{pmatrix}}{\begin{pmatrix}\text{8-Hour}\\ \text{REL}\end{pmatrix}} \Rightarrow \text{8-Hour Hazard Quotient}_{(\text{arsenic})} = \frac{(0.0063\ \mu g/m^3)}{(0.015\ \mu g/m^3)} = 0.4$$

Step three – Determine the HI for all emitted substances.

The 8-hour HQ calculated above for a substance applies to all the target organs listed under that substance. The 8-hour HIs are calculated by summing each HQ for each substance by target organ system. Similar to the example calculation for the acute HI, add the HQs for all substances that impact a specific organ system, then repeat this step for the next target organ system (e.g., respiratory system). This step is repeated until all target organs (for the substances emitted) are individually totaled. See Table 6.2 for target organ system information for 8-hour RELs. Note: do not add together the HQs or HIs for different target organ systems (e.g., do not add the impacts for the respiratory system to the reproductive/developmental system). Table I.9 shows individual hazard quotients for each substance and total hazard index for each organ system using the information presented in Table I.8.

TABLE I.9 INDIVIDUAL HAZARD QUOTIENTS AND TOTAL HAZARD INDEX FOR 8-HOUR EXPOSURE

Substance	Respiratory System	Reproductive/ Development	Nervous System	Cardiovascular System	Skin	Immune System
Ammonia						
Arsenic	0.4	0.4	0.4	0.4	0.4	
Benzene						
Chlorine						
Chloro-benzene						
2,3,7,8-TCDD (dioxin)						
Nickel	0.7					0.7
Hazard Index	**1.1**	**0.4**	**0.4**	**0.4**	**0.4**	**0.7**

In this example, an HQ of one was not equaled or exceeded for any individual substance. However, an HI (the sum of the hazard quotients for each target organ) of one was exceeded for the respiratory system. Exceeding a hazard index of one may indicate that there is the potential for an adverse health impact at this receptor location

with repeated daily 8-hour exposures. Therefore, there is increased concern that exposed individuals may experience respiratory system irritation, particularly among sensitive individuals. The District and OEHHA should be consulted when a hazard index exceeds one (see Section 8.3).

For the MEIW, ideally only an 8-hour noncancer hazard assessment is required. However, development of 8-hour RELs is an ongoing process and many substances that have chronic RELs do not have 8-hour RELs yet. If 8-hour RELs have not been developed yet for all of the emitted chemicals with a chronic REL as in the example above, then a chronic noncancer hazard assessment is also performed to ensure the health protection of the worker from exposure.

I.4 Sample Calculation of Noncancer Chronic Hazard Indices

The example below illustrates the approach for calculating a noncancer chronic HQ and HI at the MEIR. An HQ expresses the noncancer health impacts for an individual substance and an HI expresses the potential impacts for multiple substances. All hazard quotients (HQ) and hazard indices (HI) must be determined by target organ system. The steps involved in this sample calculation include: 1) determining the annual average concentration, the inhalation and oral chronic RELs, and the target organ systems for each substance; 2) calculating the inhalation chronic HQ for each substance and applying the calculated HQ to all target organs for each substance; 3) calculating the noninhalation chronic HQ for each substance and applying the calculated HQ to all target organs for each substance; and 4) calculating the chronic HI by summing each HQ (inhalation and noninhalation) from each substance by target organ system.

As discussed in Chapter 8, the following example is provided to assist the risk assessor in understanding the calculation of a chronic HQ and HI. Using the HARP software, both the chronic HQ and HI will be automatically calculated at each receptor. No exposure adjustments are applied to chronic noncancer assessments. Specific requirements for risk assessment under the Hot Spots Program can be found in Chapters 8 and 9.

Step one - Determine the annual average concentrations at the MEIR and inhalation and oral chronic RELs for each emitted substance.

The risk assessor would obtain the substance-specific annual average concentrations from the air dispersion modeling results. This step has been completed for this example. Table I.10 presents the annual average concentrations, target organ systems, and chronic RELs for seven substances. All of the substances have a chronic REL value associated with them. In addition, arsenic, dioxins, and nickel are multipathway substances; therefore, oral and dermal exposure must be included as potential exposure pathways. The chronic RELs and their corresponding target organ system(s) can be found in Tables 6.3 and 6.4 (Chapter 6) and also in Appendix L.

Step two – Determine the inhalation chronic hazard quotient for each substance.

For inhalation exposure, the individual hazard quotients for each substance are calculated by taking the annual average concentration and dividing by its corresponding chronic inhalation REL. Using the information contained in Table I.10, the equation below is used to calculate the inhalation hazard quotient for arsenic.

$$\text{Chronic Hazard Quotient} = \frac{\left(\begin{array}{c} Annual\,Avg. \\ Concentration \end{array}\right)}{\left(\begin{array}{c} Chronic \\ REL \end{array}\right)} \Rightarrow \text{Chronic Hazard Quotient}_{(arsenic)} = \frac{\left(0.0015\ \mu g/m^3\right)}{\left(0.015\ \mu g/m^3\right)} = 0.1$$

The inhalation chronic HQ calculated above for a substance applies to all the target organs listed under that substance.

TABLE I.10 ANNUAL AVERAGE CONCENTRATIONS, CHRONIC RELS, AND TARGET ORGAN SYSTEMS FOR SUBSTANCES AT THE MEIR.

Substance	Annual Average Conc. ($\mu g/m^3$)	Chronic Inhalation REL ($\mu g/m^3$)	Target Organ System(s) (inhalation)	Chronic Oral REL (mg/kg-day)	Target Organ System(s) (oral/dermal)
Ammonia	160	200	Respiratory System	-	-
Arsenic	0.0015	0.015	Reproductive/ Development; Cardiovascular System; Nervous System; Respiratory System; Skin	0.0000035	Reproductive/ Development; Cardiovascular system; Nervous System; Respiratory System; Skin
Benzene	5	60	Hematologic System; Reproductive/ Development; Nervous System	-	-
Chlorine	0.08	0.2	Respiratory System	-	-
Chloro-benzene	20	1000	Alimentary System; Kidney; Reproductive/ Development	-	-
2,3,7,8-TCDD (dioxin)	0.000004	0.00004	Alimentary System (Liver); Reproductive/ Development; Endocrine System; Respiratory System; Hematologic System	0.00000001	Alimentary System (Liver); Reproductive/ Development; Endocrine System; Respiratory System; Hematologic System
Nickel	0.003	0.014	Respiratory System; Hematologic System	0.011	Reproductive/ Development

Step three – Determine the noninhalation hazard quotient for each substance.

For the substances that are subject to deposition, noninhalation (i.e., oral and dermal) exposure pathways need to be considered in the chronic hazard quotient evaluation. The point-estimates and algorithms for calculating the oral dose for all of the applicable exposure pathways and receptors (e.g., workers or residents) are explained in Chapter 5. Note, the HARP software uses the appropriate information and performs all the steps discussed in these examples.

As discussed in Section 8.3.3 for noncancer assessments, Tier-1 of the tiered approach to risk assessment states that the high-end point-estimates are used for the two dominant noninhalation exposure pathways and the non-dominant exposure pathways use the average point-estimates to determine the dose and chronic health impacts at a residential receptor. The 70-year dose (i.e., from calculating and adding the exposure contributions from the age 0 through 70 year bins) is used for residential receptors and the dose from the 16 through 70 year age bin is used for the worker evaluation. To determine which exposure pathways are the two dominant ones, high-end point-estimates are used for all applicable exposure pathways to see which two pathways provide the highest impacts for each substance. Once the two dominant noninhalation pathways are determined for each substance, the doses for the remaining noninhalation exposure pathway for that substance are recalculated using the average point-estimates.

This example shows how to combine the impacts from multiple exposure pathways to obtain an oral (noninhalation) hazard quotient for a single substance. For each substance, the impacts for a specific exposure pathway are assessed by dividing the oral dose (derived from the annual average concentration) in milligrams per kilogram-day (mg/kg-day) by the oral chronic REL, expressed in units of (mg/kg-day) (Table 6.4). The next equation shows the HQ calculation for arsenic through the soil ingestion (SI) exposure pathway.

Note, prior to this point in this calculation, we are assuming several steps have taken place. These steps include: 1) the completion of air dispersion modeling to obtain the ground-level annual-average air concentration; when estimating noncancer health impacts from noninhalation pathways, no adjustments are made to the long-term annual average concentration regardless of the emitting facility's schedule. 2) identification of the existing exposure pathways at the receptor location; 3) calculation of the concentration in the exposure media (e.g., for soil - Equation 5.3.2.A); 4) determination of the dominant noninhalation exposure pathway(s) for the substance; and 5) the calculation of the substance-specific dose for that exposure pathway (e.g., Equation 5.4.3.1 is used to calculate the dose from soil ingestion). See Chapter 5 for the algorithms for calculating the oral dose for all of the applicable exposure pathways and receptors. For this example, the calculated dose for arsenic from soil ingestion is assumed to be 0.000000015 mg/kg-day.

$$\text{Chronic Oral Hazard Quotient} = \frac{\text{SI dose}}{\left(\text{Chronic Oral REL}\right)} \Rightarrow \text{Chronic Oral Hazard Quotient}_{(\text{SI arsenic})} = \frac{(0.000000015 mg/kg-day)}{(0.0000035 mg/kg-day)}$$

$$= 0.04$$

For each substance, this step is repeated for each applicable noninhalation exposure pathway. As illustrated below, the (total) oral HQ for a substance is calculated by summing the HQs for all applicable exposure pathways. In this example, the chronic oral HQ is assumed to equal 0.1.

$$\text{Chronic Oral Hazard} = [HQ_{(SI)} + HQ_{(D)} + HQ_{(DW)} + HQ_{(MI)} + HQ_{(FI)} + HQ_{(HV)}]$$

$$\text{Chronic Oral Hazard} = 0.1$$

* Noninhalation pathways:

SI = soil ingestion	FI = fisher-caught fish
DW = drinking water	HV = homegrown vegetables
D = dermal absorption	BM = breast milk (not applicable for arsenic exposure)
MI = meat, milk & egg	

The oral chronic HQ calculated above for a substance applies to all the target organs listed under that substance for the noninhalation pathway.

Step four – Determine the chronic HI

The chronic HI is calculated by summing each HQ (inhalation and noninhalation) for each substance by the target organ system(s). For example, add the HQs for all substances that impact the respiratory system, then repeat this step for the next target organ system (e.g., cardiovascular system). This step is repeated until all target organs (for the substances emitted) are individually totaled. See Tables 6.3 and 6.4 for target organ system information. Note, do not add together the HQs or HIs for different target organ systems (e.g., do not add the impacts for the respiratory system to the cardiovascular system). Table I.11 shows individual hazard quotients (inhalation and noninhalation) for each substance and the hazard index by target organ system. In this table, arsenic is highlighted in bold to identify how the information calculated above is presented and used.

In this example, an HQ of one was not equaled or exceeded for any individual substance. However, an HI (the sum of the hazard quotients for each target organ) of

one was exceeded for the respiratory system. Exceeding a hazard index of one may indicate that there is the potential for adverse chronic health impacts at this receptor location. Therefore, there is increased concern that exposed individuals may experience respiratory system irritation or injury, particularly among sensitive individuals. The District and OEHHA should be consulted when a hazard index exceeds one (see Section 8.3).

TABLE I.11 SUBSTANCE-SPECIFIC INHALATION AND NONINHALATION HAZARD QUOTIENTS AND THE HAZARD INDEX BY TARGET ORGAN SYSTEM

Substance	Respiratory System	Hematologic System	Alimentary System	Endocrine System	Reproductive/ Development	Kidney	Nervous System	Cardiovascular System	Skin
Ammonia	0.8								
Arsenic	***0.1(i)*** ***0.1(ni)***				***0.1(i)*** ***0.1(ni)***		***0.1(i)*** ***0.1(ni)***	***0.1(i)*** ***0.1(ni)***	***0.1(i)*** ***0.1(ni)***
Benzene		0.08			0.08		0.08		
Chlorine	0.4								
Chloro-benzene			0.02		0.02	0.02			
2,3,7,8-TCDD (dioxin)	0.1(i) 0.2(ni)	0.1(i) 0.2(ni)	0.1(i) 0.2(ni)	0.1(i) 0.2(ni)	0.1(i) 0.2(ni)				
Nickel	0.2(i)	0.2(i)			0.1(ni)				
Chronic Hazard Index	**1.9**	**0.58**	**0.32**	**0.3**	**0.7**	**0.02**	**0.28**	**0.2**	**0.2**

i = inhalation pathway contribution
ni = noninhalation pathway contribution

I.5 References

OEHHA, 2012a. *Air Toxics Hot Spots Program Risk Assessment Guidelines; Technical Support Document for Exposure Assessment and Stochastic Analysis*. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA Available online at http://www.oehha.ca.gov

OEHHA, 2009. Technical Support Document for Cancer Potency Factors: Methodologies for derivation, listing of available values, and adjustments to allow for

early life stage exposures. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA. May 2009. Available online at: http://www.oehha.ca.gov

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Appendix J:

Glossary of Acronyms and Definition of Selected Terms

Adverse Health Effect: As defined by U.S. EPA, an adverse health effect is a biochemical change, functional impairment, or pathologic lesion that affects the performance of the whole organism, or reduces an organism's ability to respond to an additional environmental challenge. A health effect from exposure to air contaminants may range from relatively mild temporary conditions, such as eye or throat irritation, shortness of breath, or headaches, to permanent and serious conditions, such as birth defects, cancer or damage to lungs, nerves, liver, heart, or other organs.

AERMOD: A steady-state, plume-based air dispersion model (developed by U.S. EPA) for estimating near-field impacts from a variety of industrial source types. This was designed to provide reasonable concentration estimates over a wide range of conditions with minimal discontinuities, to be easily implemented with reasonable input requirements and computer resource needs, to be based on up-to-date science that captures the essential physical processes while remaining simple, and to be easily revised as the science evolves. To the extent practicable, the structure of the input or the control file for AERMOD is the same as that for the previously used ISCST3 model.

Age Sensitivity Factor (ASF): ASFs are default weighting factors to account for potential increased sensitivity to carcinogens during early life stages including prenatal, postnatal and juvenile life stages. ASFs are applied to the cancer risk equation.

Air Dispersion Modeling: Algorithms, usually performed with a computer, that relate a mass emission rate, source configuration, and meteorological information to calculate ambient air concentrations.

Air District: The Air Pollution Control and Air Quality Management Districts are the agencies responsible for managing air quality on a regional or county basis. California is currently divided into 35 air districts.

Air monitoring: The periodic or continuous sampling and analysis of air pollutants in ambient air or from individual pollutant sources.

Air Toxics Hot Spots Act Emission Inventory Reports: Documents that contain information regarding emission sources, emitted substances, emission rates and release parameters, prepared under the Emission Inventory Criteria and Guidelines (also referred to as “Inventory Reports”).

Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588): (Health and Safety Code, Section 44300-44394) - A state law which established the "Hot Spots" Program to develop a statewide inventory of site-specific air toxic emissions, to assess the risk to public health from exposure to these emissions, to notify the public of any significant health risks and to reduce emissions below the significant risk levels.

Algorithm: A set of rules for solving a problem in a finite number of steps

California Air Resources Board (ARB): The State's lead air quality management agency consisting of an eleven-member board appointed by the Governor; in addition, the Air Resources Board has an Executive Office and a large staff of scientists and engineers to evaluate air pollution control measures. The ARB is responsible for attainment and maintenance of the state and federal air quality standards, and is fully responsible for motor vehicle pollution control. It oversees county and regional air pollution management programs.

Asthma: A chronic inflammatory disorder of the lungs characterized by wheezing, breathlessness, bronchoconstriction (resulting in chest tightness), and cough.

Atmospheric half-life: The time required for the concentration of a pollutant or reactant to fall to one-half of its initial value.

Benchmark Dose: That dose derived from linear regression, using one or more models of one or more dose-response curves, associated with a specific response rate (such as 1, 5, or 10%) in the test population. This is the starting dose (point of departure) to which uncertainty factors are applied to determine a reference exposure level (REL) using the benchmark dose approach.

Urban Block Groups (BGs): A geographical unit smaller than a census tract used for reporting census data. BGs contain roughly 1,100 persons.

Bioaccumulation: The concentration of a substance in a body or part of a body or other living tissue in a concentration higher than that of the surrounding environment

Bioconcentrate: The process of increasing contaminant concentration in biota up the food chain as contaminants are ingested and concentrated in tissues of organisms higher up in the chain.

Cancer burden: The estimated number of theoretical cancer cases in a defined population resulting from lifetime exposure to pollutants emitted from a facility.

Cancer potency factor (CPF): The theoretical upper bound probability of extra cancer cases occurring in an exposed population assuming a lifetime exposure to the chemical when the chemical dose is expressed in units of milligrams/kilogram body weight-day (mg/kg-d). The CPF is thus expressed in inverse units of mg/kg-d ($(mg/kg\text{-}d)^{-1}$).

California Air Pollution Control Officers Association (CAPCOA): A non-profit association of the air pollution control officers from all 35 air quality districts throughout California. CAPCOA was formed in 1975 to promote clean air and to provide a forum for sharing knowledge, experience, and information among the air quality regulatory agencies around the state.

Cal/EPA: The California Environmental Protection Agency is charged with developing, implementing and enforcing the state's environmental protection laws that ensure clean air, clean water, clean soil, safe pesticides and waste recycling and reduction. Its departments are at the forefront of environmental science, using cutting-edge research to shape the state's environmental laws. The Agency's boards and departments are: the Air Resources Board, the Department of Pesticide Regulation, the Department of Resources Recycling and Recovery (CalRecycle), the Department of Toxics Substances Control, the Office of Environmental Health Hazard Assessment, and the State Water Resources Control Board.

Chemical Abstract Services Registry Number (CAS): The Chemical Abstracts Service Registry Number (CAS) is a numeric designation assigned by the American Chemical Society's Chemical Abstracts Service and uniquely identifies a specific chemical compound. This entry allows one to conclusively identify a material regardless of the name or naming system used.

CCR: California Code of Regulations

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act (Superfund), a federal regulation providing direction and financial support for the clean-up of major hazardous waste sites

Centroid Locations: The location at which calculated ambient concentration is assumed to represent the entire subarea, typically the geometric centroid of an area, but possibly the population-weighted centroid of the area.

Census Tract: A physical area used by the U.S. Census Bureau to compile population and other statistical data.

Criteria Air Pollutant: A pollutant for which the U.S. Environmental Protection Agency or the Air Resources Board has established an Ambient Air Quality Standard (AAQS). Examples include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and PM_{10} and $PM_{2.5}$.

Default: A value used to account for a factor when specific information on that factor that applies to a specific situation is not available.

Developmental toxicity: Adverse effects on the developing organism that may result from exposure prior to conception (either parent), during prenatal development, or postnatally to the time of sexual maturation. Adverse developmental effects may be detected at any point in the life span of the organism. Major manifestations of developmental toxicity include: death of the developing organism; induction of structural birth defects; altered growth; and functional deficiency.

Dilution factor (χ/Q): A site-specific quantity defined as a ratio of the ground level concentration in $\mu g/m^3$ to the mass emission rate in g/s and represented by χ/Q.

Dose: A calculated amount of a substance estimated to be received by the subject, whether human or animal, as a result of exposure. Doses are generally expressed in terms of amount of chemical per unit body weight; typical units are mg/kg-day.

Dose-response assessment: The process of characterizing the relationship between the exposure to an agent and the incidence of an adverse health effect in exposed populations.

DTSC: California Department of Toxic Substances Control—DTSC regulates hazardous waste, cleans-up existing contamination, and looks for ways to reduce the hazardous waste produced in California. Its scientists, engineers, and specialized support staff make sure that companies and individuals handle, transport, store, treat, dispose of, and clean-up hazardous wastes appropriately. Through these measures, DTSC contributes to greater safety for all Californians, and less hazardous waste reaches the environment.

ED: Rural Enumeration District. A geographical unit smaller than a census tract used to report census data. EDs contain roughly 1,100 persons.

Emission Inventory Criteria and Guidelines: Regulation and Report adopted by the California Air Resources Board specifying criteria and procedures for the preparation of Air Toxics Hot Spots Act Emission Inventory Reports (Title 17, California Code or Regulations, Sections 93300-93300.5).

Endpoint: An observable or measurable biological or biochemical event including cancer used as an index of the effect of a chemical on a cell, tissue, organ, organism, etc.

Epidemiology: The study of the occurrence and distribution of a disease or physiological condition in human populations and of the factors that influence this distribution.

Exposure: Contact of an organism with a chemical, physical, or biological agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, digestive tract) and available for absorption.

Exposure Pathway: A route of exposure by which xenobiotics enter the human body, (e.g., inhalation, ingestion, dermal absorption).

Fugitive Dust: Dust particles that are introduced into the air through certain activities such as soil cultivation, or vehicles operating on open fields or dirt roadways. A subset of fugitive emissions.

Fugitive Emissions: Emissions not caught by a capture system which are often due to equipment leaks, evaporative processes, and windblown disturbances.

Gaussian Model: An air dispersion model based on the assumption that the time-averaged concentration of a species emitted from a point source has a Gaussian distribution about the mean centerline.

Genotoxic: Having an adverse effect on the genetic material (DNA) resulting in a mutation or in chromosome damage.

GLC: Estimated ground level concentration, usually for a specified averaging time (e.g., annual average, 1 hour, etc.).

GRAF: The Gastrointestinal Relative Absorption Factor**,** defined as the fraction of contaminant absorbed by the GI tract relative to the fraction of contaminant absorbed from the matrix (feed, water, other) used in the study(ies) that is the basis of either the cancer potency factor (CPF) or the Reference Exposure Level (REL)

Hot Spots Analysis and Reporting Program (HARP): A single integrated software package designed to promote statewide consistency, efficiency, and cost-effective implementation of health risk assessments and the Hot Spots Program. The HARP software package consists of three modules that include: 1) the Emissions Inventory Database Module, 2) the Air Dispersion Modeling Module, and 3) the Risk Analysis and Mapping Module.

Health Risk Assessment (HRA): The name of a computer program developed by the ARB, the OEHHA, and the University of California which was designed to aid in the computation of risk in the Hot Spots program

HSC: Health and Safety Code of the State of California

Haber's Law: The product of the concentration (C) and time of exposure (t) required to produce a specific physiologic effect is equal to a constant level or severity of response (K), or C * t = K.

Hazard identification: The process of determining whether exposure to an agent can cause an increase in the incidence of an adverse health effect including cancer.

Health Risk Assessment: Health risk assessment is the characterization of the potential adverse health effects of human exposures to environmental hazards. In the Air Toxics Hot Spots program, a health risk assessment (HRA) is an evaluation or report that a risk assessor (e.g., district, consultant, or facility operator) develops to describe the potential a person or population may have of developing adverse health effects from exposure to a facility's emissions. Some health effects that are evaluated could include cancer, developmental effects, or respiratory illness. The pathways that can be included in an HRA depend on the toxic air pollutants that a person (receptor) may be exposed to, and can include breathing, the ingestion of soil, water, crops, fish, meat, milk, and eggs, and dermal exposure.

Health Risk Guidance Value (HRGV): A numerical value with which to compare an exposure level in order to determine the probability of occurrence of an adverse health effect. In the Hot Spots program the toxicity criteria or toxicity values are known as Reference Exposure Levels (RELs) for noncancer effects and as inhalation unit risk factors and cancer potency values for cancer effects.

Hazard Index (HI): The sum of individual acute or chronic hazard quotients (HQs) for each substance affecting a particular toxicological endpoint.

Hazard Quotient (HQ): The estimated ground level concentration divided by the reference exposure level for a single substance and a particular endpoint. For an acute HQ the one hour maximum concentration is divided by the acute Reference Exposure Level (REL) for the substance. For a repeated 8 hr HQ, the 8 hr average concentration is divided by the 8 hr REL. For a chronic HQ, the annual concentration is divided by the chronic REL.

Hot Spot: A location where emissions from specific sources may expose individuals and population groups to elevated risks of adverse health effects, including but not limited to cancer, and contribute to the cumulative health risks of emissions from other sources in the area.

Individual Excess Cancer Risk: The theoretical probability of an individual person developing cancer as a result of lifetime exposure to carcinogenic substances. The Individual Excess Cancer Risk is calculated by summing the potential cancer risks due to both inhalation and noninhalation routes of exposure, generally at the off-site point of maximum impact. This "individual" is the maximally exposed individual (MEI).

Inhalation (Breathing) Rate: The amount of air inhaled in a specified time period (e.g., per minute, per hour, per day, etc.); also called breathing rate and ventilation rate. This is an example of an exposure variate.

Inhalation unit risk factor: The theoretical upper bound probability of extra cancer cases occurring in the exposed population assuming a lifetime exposure to the chemical when the air concentration is expressed in units of microgram/cubic meter ($\mu g/m^3$). The unit risk factor is thus expressed as $(\mu g/m^3)^{-1}$.

Initiator carcinogen: A substance which causes the first stage of carcinogenesis, the conversion of a normal cell to a neoplastic cell. Initiation is considered to be a rapid, irreversible change often involving a change in the DNA caused by the initiator.

Interspecies: Between different species.

Intraspecies: Within the same species.

Industrial Source Complex Dispersion model (ISC3): Air modeling software that was previously used by U.S. EPA and the Hot Spots program. It incorporates three sub-programs into a single program. These are the short-term model (ISCST), the long term model (ISCLT), and the complex terrain model (COMPLEX).

Isopleth: A line on a map connecting points of equal value (e.g., risk, concentration, etc.).

Lowest-observed adverse effect level (LOAEL): The lowest dose or exposure level of a chemical in a study at which there is a statistically or biologically significant increase in the frequency or severity of an adverse effect in the exposed population as compared with an appropriate, unexposed control group.

Margin of safety: The ratio of the no-observed-adverse-effect level (NOAEL) to the estimated human exposure.

Mean: The arithmetic average**.**

MEI: Maximum exposed individual (theoretical)

MEIR: Maximum exposed individual resident (actual)

MEIW: Maximum exposed individual worker (actual)

Meteorology: The science that deals with the phenomena of the atmosphere especially weather and weather conditions. In the area of air dispersion modeling, *meteorology* is used to refer to climatological data needed to run an air dispersion model including: wind speed, wind direction, stability class and ambient temperature.

Milligram: One one-thousandth (10^{-3}) of a gram.

Molecular formula: The formula which identifies the atoms and the number of each kind in the molecules of a compound. Elements in the molecular formula are listed according to the Hill convention (C, H, then other elements in alphabetical order).

Molecular weight: The sum of the atomic weights of the atoms in a molecule. For example, methane (CH_4) is 16.043, the atomic weights being carbon = 12.011, hydrogen = 1.008.

Monte Carlo simulation: Application of random sampling to obtain an approximate value of an expression. Monte Carlo simulations involves computational algorithms that rely on repeated random sampling to obtain numerical results by running simulations many times over in order to calculate probability of a value.

Multipathway substance: A substance or chemical that once airborne from an emission source can, under environmental conditions, be taken into a human receptor by multiple exposure routes, such as inhalation, skin contact with contaminated surfaces, ingestion of soil contaminated by the emission, etc.

No Observed Adverse Effect Level (NOAEL): The highest experimental dose at which there is no statistically or biologically significant increase in frequency or severity of adverse non-cancer health effects in the exposed population compared with an appropriate, unexposed population. Effects may be produced at this level, but they are not considered to be adverse.

Noncarcinogenic Effects: Noncancer health effects which may include birth defects, organ damage, morbidity, and death.

Office of Environmental Health Hazard Assessment (OEHHA): The office within the California Environmental Protection Agency that is responsible for evaluating chemicals for adverse health impacts and establishing safe exposure levels. OEHHA also assists in performing health risk assessments and developing risk assessment procedures for air quality management purposes.

PM_{10}, $PM_{2.5}$: PM_{10} is particulate matter less than 10 μm in diameter; $PM_{2.5}$ is particulate matter less than 2.5 μm in diameter.

PMI: Off-site point of maximum impact. A location, with or without people currently present, at which the total cancer risk, or the total noncancer risk, has the highest numerical value.

Point Estimate: A single value estimate for a given variate.

Potency: The relative effectiveness, or risk, of a standard amount of a substance to cause a toxic response. This term is used particularly to refer to carcinogens.

Potency Slope (also referred to as “Slope Factor” or “ Cancer Potency”)**:** Used to calculate the probability or risk of cancer associated with an estimated exposure, based on the assumption in cancer risk assessments that risk is directly proportional to dose and that there is no threshold for carcinogenesis. It is the slope of the dose-response curve extrapolated to low environmental exposures. It is expressed in per unit dose (usually mg per kg-day): thus cancer potency typically has the units $(mg/kg\text{-}day)^{-1}$.

Proposition 65: Safe Drinking Water and Toxic Enforcement Act of 1986, also known as Proposition 65. This Act is codified in California Health and Safety Code Section 25249.5, et seq. .The Proposition was intended by its authors to protect California citizens and the State's drinking water sources from chemicals known to cause cancer, birth defects or other reproductive harm, and to inform citizens about exposures to such chemicals.

Resource Conservation and Recovery Act (RCRA) of 1976: A federal law regulating disposal of hazardous waste.

Receptor: A location with or without people present at which the ground level concentration of an emitted chemical can be estimated.

Refined Models: Air dispersion models designed to provide more representative concentration estimates than screening models taking into account actual meteorological conditions.

Reference Concentration (RfC): An estimate, derived by the U.S. EPA (with an uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population, (including sensitive subgroups) that is likely to be without appreciable risk of deleterious non-cancer effects during a lifetime of exposure. The RfC is derived from a no or lowest observed adverse effect level from human or animal exposures, to which uncertainty factors are applied, and is expressed in units of mg or ug per m^3.

Reference Dose (RfD): An estimate delivered by the U.S. EPA (with uncertainty spanning perhaps an order of magnitude) of the daily exposure to the human population (including sensitive subpopulations) that is likely to be without deleterious non-cancer effects during a lifetime. The RfD is reported in units of mg of substance/kg body weight/day for oral exposures.

Reference exposure level (REL): The REL is an exposure level at or below which no noncancer adverse health effect is anticipated to occur in a human population, including sensitive subpopulations, exposed for a specific duration. One hour RELs are designed to be protective for infrequent one hour maximum exposures. Eight-hour RELs are designed to be protective for repeated 8 hour exposures. Chronic RELs are designed to be protective for continuous long-term exposures. RELs are used to evaluate toxicity endpoints other than cancer. RELs are expressed in units of $\mu g/m^3$ for inhalation exposures and of mg/kg-d for noninhalation exposures.

Reproductive toxicity: Harmful effects on sexual function in males or females, fertility or gestation, caused by exposure of either parent to a substance. Reproductive toxicity also includes developmental effects on the offspring. See also developmental toxicity which refers to adverse effects on the offspring.

Risk: The estimated probability of adverse effects to human health, in this instance from the exposure to environmental hazards.

Risk Assessment: The characterization of the probability of adverse health effects to people from exposure to environmental hazards, in this case of exposure to chemical emissions.

Risk Management: An evaluation of the need for and feasibility of reducing risk. It includes consideration of magnitude of risk, available control technologies, and economic feasibility.

Risk Management and Prevention Program (RMPP): A program administered by the Office of Emergency Services (OES) and local agencies to reduce the frequency and severity of accidental releases of toxic materials.

SB 25 (Children's Environmental Health Protection Act): A state law (Senate Bill 25, Escutia, 1999) that amended the existing Toxic Air Contaminant and Criteria Air Pollutant laws and established requirements for the ARB and the OEHHA to examine the impacts of air pollution more explicitly on children's health. The act required the state to evaluate all ambient air quality standards to determine whether these standards adequately protect human health, particularly that of infants and children; to identify toxic air contaminants that disproportionately impact children, and to ensure that health assessments of toxic chemicals explicitly incorporate considerations of infants and children.

Scientific Review Panel on Toxic Air Contaminants or SRP: A nine-member panel appointed to advise the Air Resources Board, the Office of Environmental Health Hazard Assessment, and the Department of Pesticide Regulation in their evaluation of the adverse health effects and toxicity of substances being evaluated as Toxic Air Contaminants.

Screening Models: Dispersion models used to provide a maximum concentration that is likely to overestimate public exposure.

Sensitive Receptor: A location such as a hospital or daycare center where the human occupants are considered to be more sensitive to pollutants than “average”.

Spatial Averaging: The method used in the Hot Spots Program for determining an average air concentration from a grid of receptors over a specified area.

Stationary source: A non-mobile source of air pollutants which can be either a point or area source.

Stochastic: A process that involves random variation.

Synergism: A pharmacologic or toxicologic interaction in which the combined effect of two or more chemicals is greater than the sum of the effects of each chemical alone.

Subcensus Tract: Smaller population unit within a census tract.

Surrogate: As used in this document refers to a single substance category used to represent a family of related chemical compounds, e.g., gasoline vapors or POM (polycyclic organic matter) in place of benzo(a)pyrene.

Threshold, Nonthreshold: A threshold dose is the minimally effective dose of any chemical that is observed in a population to produce a response (e.g., enzyme change, liver toxicity, death). For most toxic effects, except carcinogenesis, there appear to be threshold doses. (Exceptions include observed cardiovascular mortality in humans from exposure to particulate matter, and the neurotoxic effects of lead). Nonthreshold substances are those substances, including nearly all carcinogens, that are known or assumed to have some risk of response at any dose above zero.

Toxic air contaminant (TAC): As defined by California Health and Safety Code, Section 39655 (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health. Substances, which have been identified by the United States Environmental Protection Agency as hazardous air pollutants (e.g. benzene, asbestos), shall be identified by the Board as toxic air contaminants.

Toxicology: The multidisciplinary study of toxicants, their harmful effects on biological systems, and the conditions under which these harmful effects occur. The mechanisms of action, detection, and treatment of the conditions produced by toxicants are studied.

Uncertainty: True uncertainty is that which is not known about a factor that influences its value.

URF: See inhalation unit risk factor.

UTM Coordinates: Universal Transfer Mercator Coordinates. Coordinates used to define a specific location on earth by means of two values (i.e., easting and northing coordinates).

United States Environmental Protection Agency (U.S. EPA): The mission of EPA is to protect human health and the environment. The agency sets national standards that are enforced by them or that states and tribes enforce through their own regulations. The agency also provide grants to state environmental programs, non-profits, educational institutions, and others for a wide variety of projects, from scientific studies that used make decisions to community cleanups. EPA's purpose is to ensure that: 1) All Americans are protected from significant risks to human health and the environment where they live, learn and work; 2) National efforts to reduce environmental risk are based on the best available scientific information; 3) Federal laws protecting human health and the environment are enforced fairly and effectively; 4) Environmental protection is an integral consideration in U.S. policies concerning natural resources, human health, economic growth, energy, transportation, agriculture, industry, and international trade, and these factors are similarly considered in establishing environmental policy; 5) All parts of society -- communities, individuals, businesses, and state, local and tribal governments -- have access to accurate information sufficient to effectively participate in managing human health and environmental risks; 6) Environmental protection contributes to making our communities and ecosystems diverse, sustainable and economically productive; and 7) The United States plays a leadership role in working with other nations to protect the global environment.

Vapor: The gaseous phase of materials at atmospheric temperature and pressure.

Vapor Pressure: The pressure exerted by a chemical vapor in equilibrium with its liquid or solid phase at any given temperature, used to calculate the rate of evaporation of a substance.

Variability: Ability to have different numerical values of a parameter, such as height or weight.

Variate: A variable quantity associated with a probability distribution, in the case of the Hot Spots program, for example, exposure factors (e.g. inhalation rate).

Volatile: Chemicals that rapidly pass off from the liquid state in the form of vapors.

Xenobiotic: A chemical that is foreign to the species being studied.

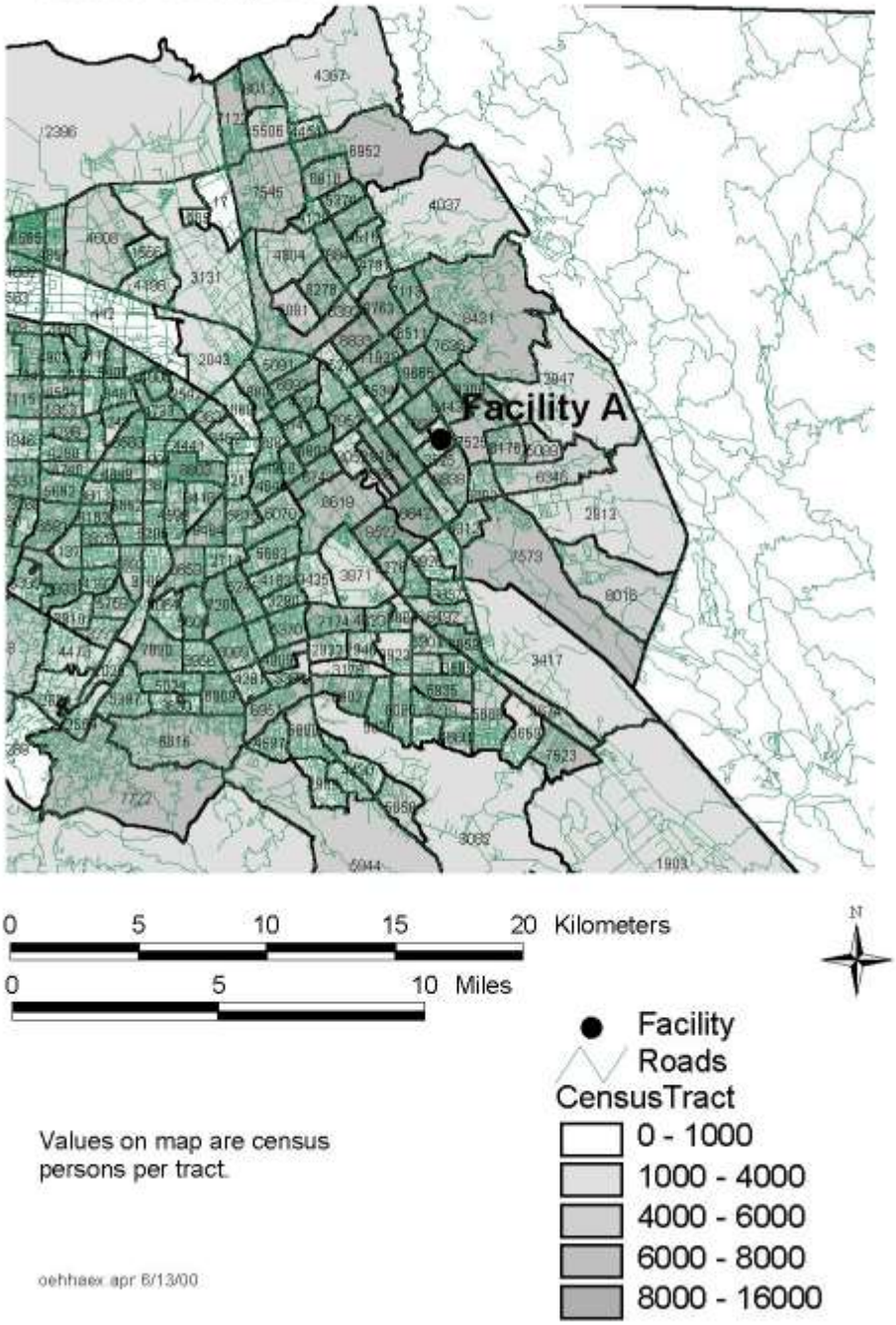
Zone of impact: The area in the vicinity of the facility in which an individual is exposed to a specified cancer risk, usually one in a million or greater.

Appendix K:

HRA Forms and Maps Used With Air Dispersion Modeling

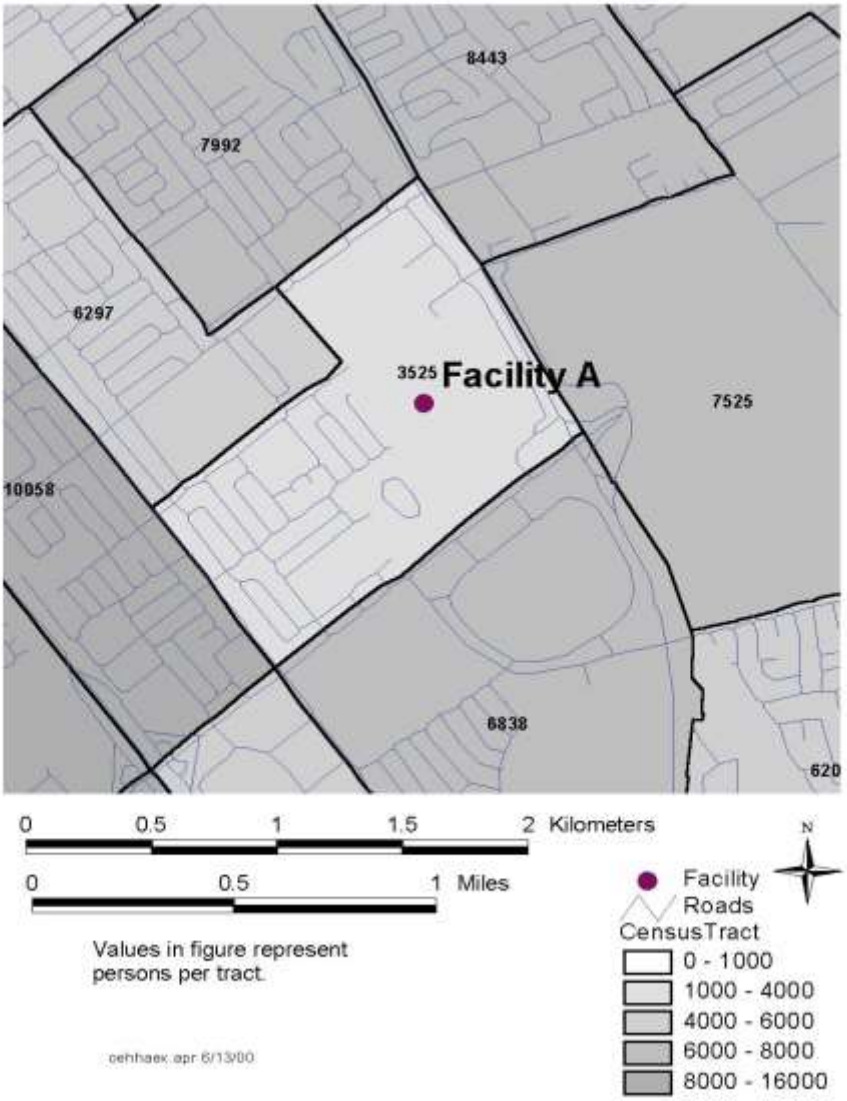
- Example of Census Tract Map
- Example of 7.5 minute Series Map
- Examples of Tables for Emissions Reporting

Figure 1
Census Tracts, View 1



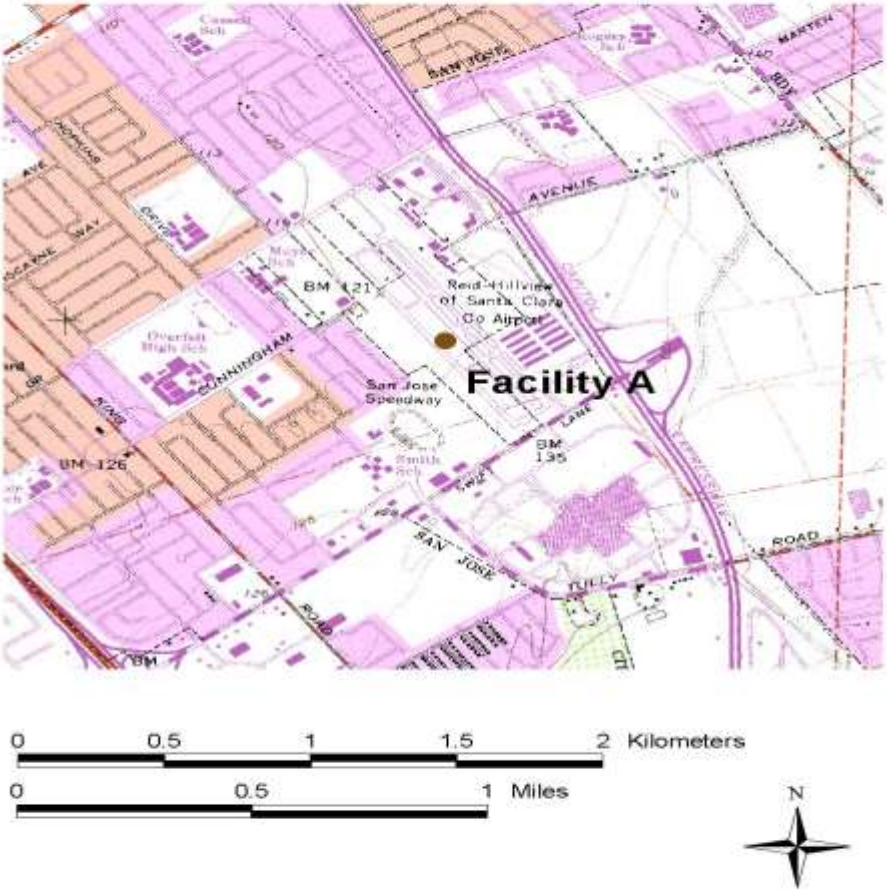
DO NOT CITE OR QUOTE

Figure 2
Census Tracts, View 2



DO NOT CITE OR QUOTE

Figure 4
USGS 7.5 Minute Topographic Map



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HEALTH RISK ASSESSMENT

EMISSION RATE BY SUBSTANCE AND SOURCE RAG-001

FACILITY NAME / FACILITY ADDRESS / SITE ID#:

SOURCE ID No.	SOURCE NAME	SUBSTANCE NAME	CAS No.	1-HOUR MAXIMUM (lb/hr)	1-HOUR MAXIMUM (g/s)	ANNUAL AVERAGE (lb/yr)	ANNUAL AVERAGE (g/s)

HEALTH RISK ASSESSMENT

EMISSION RATE BY SUBSTANCE – TOTALS – RAG-002

FACILITY NAME / FACILITY ADDRESS / SITE ID#

SUBSTANCE NAME	CAS No.	1-HOUR MAXIMUM (lb/hr)	1-HOUR MAXIMUM (g/s)	ANNUAL AVERAGE (lb/yr)	ANNUAL AVERAGE (g/s)

HEALTH RISK ASSESSMENT

SOURCE PARAMETERS – STACKS – RAG-003

FACILITY NAME / FACILITY ADDRESS / SITE ID#

SOURCE ID No.	STACK NAME	UTM Easting	UTM Northing	HEIGHT (m)	DIAMETER (m)	TEMP. (F) (K)		FLOW RATE (ACFM)	EXIT VEL. (m/s)

HEALTH RISK ASSESSMENT

SOURCE OPERATING HOURS – RAG-004

FACILITY NAME / FACILITY ADDRESS / SITE ID#

SOURCE ID No.	STACK NAME	AVERAGE OPERATING HOURS		MAXIMUM OPERATING HOURS	
		(hr/day)	(days/year)	(hr/day)	(days/year)

Appendix L:

OEHHA/ARB Approved Health Values for Use in Hot Spot Facility Risk Assessments

DO NOT CITE OR QUOTE

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical Abstract Number[b]	Noncancer Effects								Cancer Risk					
		Acute Inhalation (µg/m^3)	Date[c] Value Reviewed [Added]	8-Hour Inhalation (µg/m^3)	Date[c] Value Reviewed [Added]	Chronic Inhalation (µg/m^3)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk (µg/m^3)$^{-1}$	Inhalation[d] Cancer Potency Factor (mg/kg-d)$^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor (mg/kg-d)$^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
ACETALDEHYDE	75-07-0	4.7E+02	12/08	3.0E+02	12/08	1.4E+02	12/08			2.7E-06	1.0E-02	4/99 [5/93]			1
ACETAMIDE	60-35-5									2.0E-05	7.0E-02	4/99			1
ACROLEIN	107-02-8	2.5E+00	12/08	7.0E-01	12/08	3.5E-01	12/08								1
ACRYLAMIDE	79-06-1									1.3E-03	4.5E+00	4/99 [7/90]			1
ACRYLIC ACID	79-10-7	6.0E+03	4/99												1
ACRYLONITRILE	107-13-1					5.0E+00	12/01			2.9E-04	1.0E+00	4/99 [1/91]			1
ALLYL CHLORIDE	107-05-1									6.0E-06	2.1E-02	4/99			1
2-AMINOANTHRAQUINONE	117-79-3									9.4E-06	3.3E-02	4/99			1
AMMONIA	7664-41-7	3.2E+03	4/99			2.0E+02	2/00								1
ANILINE	62-53-3									1.6E-06	5.7E-03	4/99			1
ARSENIC AND COMPOUNDS (INORGANIC)[TAC]	7440-38-2 1016 [1015]	2.0E-01	12/08	1.5E-02	12/08	1.5E-02	12/08	3.5E-06	12/08	3.3E-03 TAC	1.2E+01	7/90	1.5E+00	10/00	1
ARSINE	7784-42-1	2.0E-01	12/08	1.5E-02	12/08	1.5E-02	12/08								1
ASBESTOS[TAC, f]	1332-21-4									1.9E-04 TAC[f]	2.2E+02	3/86			333.33
BENZENE[TAC]	71-43-2	1.3E+03	4/99			6.0E+01	2/00			2.9E-05[TAC]	1.0E-01	1/85			1
BENZIDINE (AND ITS SALTS) *values also apply to:*	92-87-5									1.4E-01	5.0E+02	4/99 [1/91]			1
Benzidine based dyes	*1020*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
Direct Black 38	*1937-37-7*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
Direct Blue 6	*2602-46-2*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
Direct Brown 95 (technical grade)	*16071-86-6*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
BENZYL CHLORIDE	100-44-7	2.4E+02	4/99							4.9E-05	1.7E-01	4/99			1
BERYLLIUM AND COMPOUNDS	7440-41-7 [1021]					7.0E-03	12/01	2.0E-03	12/01	2.4E-03	8.4E+00	4/99 [7/90]			1
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111-44-4									7.1E-04	2.5E+00	4/99			1
BIS(CHLOROMETHYL)ETHER	542-88-1									1.3E-02	4.6E+01	4/99 [1/91]			1
BROMINE AND COMPOUNDS	7726-95-6 [1040]														1

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical Abstract Number[b]	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
POTASSIUM BROMATE	7758-01-2									1.4E-04	4.9E-01	4/99 [10/93]			1
1,3-BUTADIENE[TAC]	106-99-0	6.6E+02	7/13	9.0E+00	7/13	2.0E+00	7/13			1.7E-04 TAC	6.0E-01	7/92			1
CADMIUM AND COMPOUNDS[TAC]	7440-43-9 [1045]					2.0E-02	1/01	5.0E-04	10/00	4.2E-03 TAC	1.5E+01	1/87			1
CAPROLACTAM	105-60-2	5.0E+01	10/13	7.0E+00	10/13	2.2E+00	10/13								
CARBON DISULFIDE	75-15-0	6.2E+03	4/99			8.0E+02	5/02								1
CARBON MONOXIDE	630-08-0	2.3E+04	4/99												1
CARBON TETRACHLORIDE[TAC] (Tetrachloromethane)	56-23-5	1.9E+03	4/99			4.0E+01	1/01			4.2E-05 TAC	1.5E-01	9/87			1
CHLORINATED PARAFFINS	108171-26-2									2.5E-05	8.9E-02	4/99			1
CHLORINE	7782-50-5	2.1E+02	4/99			2.0E-01	2/00								1
CHLORINE DIOXIDE	10049-04-4					6.0E-01	1/01								1
4-CHLORO-O-PHENYLENEDIAMINE	95-83-0									4.6E-06	1.6E-02	4/99			1
CHLOROBENZENE	108-90-7					1.0E+03	1/01								1
CHLOROFORM[TAC]	67-66-3	1.5E+02	4/99			3.0E+02	4/00			5.3E-06 TAC	1.9E-02	12/90			1
Chlorophenols	*1060*														*1*
PENTACHLOROPHENOL	87-86-5									5.1E-06	1.8E-02	4/99			1
2,4,6-TRICHLOROPHENOL	88-06-2									2.0E-05	7.0E-02	4/99 [1/91]			1
CHLOROPICRIN	76-06-2	2.9E+01	4/99			4.0E-01	12/01								1
p-CHLORO-o-TOLUIDINE	95-69-2									7.7E-05	2.7E-01	4/99			1
CHROMIUM 6+[TAC] *values also apply to:*[g]	18540-29-9					2.0E-01	1/01	2.0E-02	10/00	1.5E-01 TAC	5.1E+02	1/86	5.0E-01	*1/14*	1
Barium chromate	*10294-40-3*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01 TAC*	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.2053*
Calcium chromate	*13765-19-0*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01 TAC*	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.3332*
Lead chromate	*7758-97-6*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01 TAC*	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.1609*
Sodium dichromate	*10588-01-9*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01 TAC*	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.397*
Strontium chromate	*7789-06-2*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01 TAC*	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.2554*
CHROMIUM TRIOXIDE (as chromic acid mist)	1333-82-0					2.0E-03	1/01	2.0E-02	10/00	1.5E-01 TAC	5.1E+02	1/86	5.0E-01	*1/14*	0.52
COPPER AND COMPOUNDS	7440-50-8 [1067]	1.0E+02	4/99												1
p-CRESIDINE	120-71-8									4.3E-05	1.5E-01	4/99			1

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical Abstract Number[b]	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
CRESOLS (mixtures of)	1319-77-3					6.0E+02	1/01								1
m-CRESOL	108-39-4					6.0E+02	1/01								1
o-CRESOL	95-48-7					6.0E+02	1/01								1
p-CRESOL	106-44-5					6.0E+02	1/01								1
CUPFERRON	135-20-6									6.3E-05	2.2E-01	4/99			1
Cyanide Compounds (inorganic)	*57-12-5 1073*	*3.4E+02*	*4/99*			*9.0E+00*	*4/00*								*1*
HYDROGEN CYANIDE (Hydrocyanic acid)	74-90-8	3.4E+02	4/99			9.0E+00	4/00								1
2,4-DIAMINOANISOLE	615-05-4									6.6E-06	2.3E-02	4/99			1
2,4-DIAMINOTOLUENE	95-80-7									1.1E-03	4.0E+00	4/99			1
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96-12-8									2.0E-03	7.0E+00	4/99 [1/92]			1
p-DICHLOROBENZENE	106-46-7					8.0E+02	1/01			1.1E-05	4.0E-02	4/99 [1/91]			1
3,3-DICHLOROBENZIDINE	91-94-1									3.4E-04	1.2E+00	4/99 [1/91]			1
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75-34-3									1.6E-06	5.7E-03	4/99			1
1,1-DICHLOROETHYLENE … (see Vinylidene Chloride)															
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117-81-7									2.4E-06	8.4E-03	4/99 [1/92]	8.4E-03	10/00	1
DIESEL EXHAUST … (see Particulate Emissions from Diesel-Fueled Engines)															
DIETHANOLAMINE	111-42-2					3.0E+00	12/01								
p-DIMETHYLAMINOAZOBENZENE	60-11-7									1.3E-03	4.6E+00	4/99			1
N,N-DIMETHYL FORMAMIDE	68-12-2					8.0E+01	1/01								1
2,4-DINITROTOLUENE	121-14-2									8.9E-05	3.1E-01	4/99			1
1,4-DIOXANE; (1,4-Diethylene dioxide)	123-91-1	3.0E+03	4/99			3.0E+03	4/00			7.7E-06	2.7E-02	4/99 [1/91]			1
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106-89-8	1.3E+03	4/99			3.0E+00	1/01			2.3E-05	8.0E-02	4/99 [1/92]			1
1,2-EPOXYBUTANE	106-88-7					2.0E+01	1/01								1
ETHYL BENZENE	100-41-4					2.0E+03	2/00			2.5E-06	8.7E-3	11/07			1
ETHYL CHLORIDE (Chloroethane)	75-00-3					3.0E+04	4/00								1
ETHYLENE DIBROMIDE[TAC] (1,2-Dibromoethane)	106-93-4					8.0E-01	12/01			7.1E-05 TAC	2.5E-01	7/85			1
ETHYLENE DICHLORIDE[TAC] (1,2-Dichloroethane)	107-06-2					4.0E+02	1/01			2.1E-05 TAC	7.2E-02	9/85			1

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Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
ETHYLENE GLYCOL	107-21-1					4.0E+02	4/00								1
ETHYLENE GLYCOL BUTYL ETHER … (see Glycol ethers)															
ETHYLENE OXIDE[TAC] (1,2-Epoxyethane)	75-21-8					3.0E+01	1/01			8.8E-05 TAC	3.1E-01	11/87			1
ETHYLENE THIOUREA	96-45-7									1.3E-05	4.5E-02	4/99			1
Fluorides	1101	*2.4E+02*	*4/99*			1.3E+01	8/03	4.0E-02	8/03						*1*
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664-39-3	2.4E+02	4/99			1.4E+01	8/03	4.0E-02	8/03						1
FORMALDEHYDE[TAC]	50-00-0	5.5E+01	12/08	9.0E+00	12/08	9.0E+00	12/08			6.0E-06 TAC	2.1E-02	3/92			1
GLUTARALDEHYDE	111-30-8					8.0E-02	1/01								1
GLYCOL ETHERS	1115														1
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111-76-2	1.4E+04	4/99												1
ETHYLENE GLYCOL ETHYL ETHER – EGEE	110-80-5	3.7E+02	4/99[1/92]			7.0E+01	2/00								1
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA	111-15-9	1.4E+02	4/99			3.0E+02	2/00								1
ETHYLENE GLYCOL METHYL ETHER – EGME	109-86-4	9.3E+01	4/99			6.0E+01	2/00								1
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110-49-6					9.0E+01	2/00								1
HEXACHLOROBENZENE	118-74-1									5.1E-04	1.8E+00	4/99 [1/91]			1
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608-73-1									1.1E-03	4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
alpha-HEXACHLOROCYCLOHEXANE	319-84-6									1.1E-03	4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
beta-HEXACHLOROCYCLOHEXANE	319-85-7									1.1E-03	4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58-89-9									3.1E-04	1.1E+00	4/99	1.1E+00	10/00	1
n-HEXANE	110-54-3					7.0E+03	4/00								1
HYDRAZINE	302-01-2					2.0E-01	1/01			4.9E-03	1.7E+01	4/99 [7/90]			1
HYDROCHLORIC ACID (Hydrogen chloride)	7647-01-0	2.1E+03	4/99			9.0E+00	2/00								1
HYDROGEN BROMIDE … (see Bromine & Compounds)															

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Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
HYDROGEN CYANIDE … (see Cyanide & Compounds)															
HYDROGEN FLUORIDE … (see Fluorides & Compounds)															
HYDROGEN SELENIDE … (see Selenium & Compounds)															
HYDROGEN SULFIDE	7783-06-4	4.2E+01	4/99[7/90]			1.0E+01	4/00								1
ISOPHORONE	78-59-1					2.0E+03	12/01								
ISOPROPYL ALCOHOL (Isopropanol)	67-63-0	3.2E+03	4/99			7.0E+03	2/00								1
LEAD AND COMPOUNDS[TAC, h] (inorganic) *values also apply to:*	7439-92-1 1128 [1130]									1.2E-05 TAC	4.2E-02	4/97	8.5E-03	10/00	1
Lead acetate	*301-04-2*									*1.2E-05 TAC*	*4.2E-02*	*4/97*	*8.5E-03*	*10/00*	*0.637*
Lead phosphate	*7446-27-7*									*1.2E-05 TAC*	*4.2E-02*	*4/97*	*8.5E-03*	*10/00*	*0.7659*
Lead subacetate	*1335-32-6*									*1.2E-05 TAC*	*4.2E-02*	*4/97*	*8.5E-03*	*10/00*	*0.7696*
LINDANE ... (see gamma-Hexachlorocyclohexane)															
MALEIC ANHYDRIDE	108-31-6					7.0E-01	12/01								1
MANGANESE AND COMPOUNDS	7439-96-5 [1132]			1.7E-01	12/08	9.0E-02	12/08								1
MERCURY AND COMPOUNDS (INORGANIC)	7439-97-6 [1133]	6.0E-01	12/08	6.0E-02	12/08	3.0E-02	12/08	1.6E-04	12/08						1
Mercuric chloride	7487-94-7	6.0E-01	12/08	6.0E-02	12/08	3.0E-02	12/08	1.6E-04	12/08						1
METHANOL	67-56-1	2.8E+04	4/99			4.0E+03	4/00								1
METHYL BROMIDE (Bromomethane)	74-83-9	3.9E+03	4/99			5.0E+00	2/00								1
METHYL tertiary-BUTYL ETHER	1634-04-4					8.0E+03	2/00			2.6E-07	1.8E-03	11/99			1
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71-55-6	6.8E+04	4/99			1.0E+03	2/00								1
METHYL ETHYL KETONE (2-Butanone)	78-93-3	1.3E+04	4/99												1
METHYL ISOCYANATE	624-83-9					1.0E+00	12/01								1
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101-14-4									4.3E-04	1.5E+00	4/99			1
METHYLENE CHLORIDE[TAC] (Dichloromethane)	75-09-2	1.4E+04	4/99			4.0E+02	2/00			1.0E-06 TAC	3.5E-03	7/89			1
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101-77-9					2.0E+01	12/01			4.6E-04	1.6E+00	4/99	1.6E+00	10/00	1

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Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical Abstract Number[b]	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
METHYLENE DIPHENYL ISOCYANATE	101-68-8					7.0E-01	1/01								1
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90-94-8									2.5E-04	8.6E-01	4/99			1
N-NITROSODI-n-BUTYLAMINE	924-16-3									3.1E-03	1.1E+01	4/99 [1/92]			1
N-NITROSODI-n-PROPYLAMINE	621-64-7									2.0E-03	7.0E+00	4/99 [1/91]			1
N-NITROSODIETHYLAMINE	55-18-5									1.0E-02	3.6E+01	4/99 [1/91]			1
N-NITROSODIMETHYLAMINE	62-75-9									4.6E-03	1.6E+01	4/99 [1/91]			1
N-NITROSODIPHENYLAMINE	86-30-6									2.6E-06	9.0E-03	4/99			1
N-NITROSO-N-METHYLETHYLAMINE	10595-95-6									6.3E-03	2.2E+01	4/99 [7/90]			1
N-NITROSOMORPHOLINE	59-89-2									1.9E-03	6.7E+00	4/99 [7/92]			1
N-NITROSOPIPERIDINE	100-75-4									2.7E-03	9.4E+00	4/99 [7/92]			1
N-NITROSOPYRROLIDINE	930-55-2									6.0E-04	2.1E+00	4/99 [7/90]			1
NAPHTHALENE ... (see Polycyclic aromatic hydrocarbons)															
NICKEL AND COMPOUNDS[TAC] *values also apply to:*	7440-02-0 [1145]	2.0E-01	3/12	6.0E-02	3/12	1.4E-02	3/12	1.1E-02	3/12	2.6E-04 TAC	9.1E-01	8/91			1
Nickel acetate	*373-02-4*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			*0.3321*
Nickel carbonate	*3333-67-3*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			*0.4945*
Nickel carbonyl	*13463-39-3*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			*0.3438*
Nickel hydroxide	*12054-48-7*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			*0.6332*
Nickelocene	*1271-28-9*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			*0.4937*
NICKEL OXIDE	1313-99-1	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	2.0E-02	3/12	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			0.7859
Nickel refinery dust from the pyrometallurgical process	*1146*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			*1*
Nickel subsulfide	*12035-72-2*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04 TAC*	*9.1E-01*	*8/91*			*0.2443*
NITRIC ACID	7697-37-2	8.6E+01	4/99												1
NITROGEN DIOXIDE	10102-44-0	4.7E+02	4/99[1/92]												1
p-NITROSODIPHENYLAMINE	156-10-5									6.3E-06	2.2E-02	4/99			1
OZONE	10028-15-6	1.8E+02	4/99[1/92]												1

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical Abstract Number[b]	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES[TAC, i]	9901					5.0E+00 TAC	8/98			3.0E-04 TAC	1.1E+00	8/98			1
PENTACHLOROPHENOL ... (see Chlorophenols)															
PERCHLOROETHYLENE[TAC] (Tetrachloroethylene)	127-18-4	2.0E+04	4/99			3.5E+01 TAC	10/91			5.9E-06 TAC	2.1E-02	10/91			1
PHENOL	108-95-2	5.8E+03	4/99			2.0E+02	4/00								1
PHOSGENE	75-44-5	4.0E+00	4/99												1
PHOSPHINE	7803-51-2					8.0E-01	9/02								1
PHOSPHORIC ACID	7664-38-2					7.0E+00	2/00								1
PHTHALIC ANHYDRIDE	85-44-9					2.0E+01	1/01								1
PCB (POLYCHLORINATED BIPHENYLS) (unspeciated mixture)[j]	1336-36-3									2.0E-05 [lowest risk] 1.1E-04 [low risk] 5.7E-04 [high risk]	7.0E-02 [lowest risk] 4.0E-01 [low risk] 2.0E+00 [high risk]	4/99	7.0E-02 [lowest risk] 4.0E-01 [low risk] 2.0E+00 [high risk]	10/00	1
PCB (POLYCHLORINATED BIPHENYLS (speciated)[k]															
3,3',4,4'-TETRACHLOROBIPHENYL (PCB 77)	32598-13-3					4.0E-01	8/03	1.0E-04	8/03	3.8E-03	1.3E+01	8/03	1.3E+01	8/03	1
3,4,4',5-TETRACHLOROBIPHENYL (PCB 81)	70362-50-4					1.3E-01	1/11	3.3E-05	1/11	1.1E-02	3.9E+01	1/11	3.9E+01	1/11	1
2,3,3',4,4'-PENTACHLOROBIPHENYL (PCB 105)	32598-14-4					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3,4,4',5-PENTACHLOROBIPHENYL (PCB 114)	74472-37-0					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3',4,4',5-PENTACHLOROBIPHENYL (PCB 118)	31508-00-6					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3',4,4',5'-PENTACHLOROBIPHENYL (PCB 123)	65510-44-3					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
3,3',4,4',5-PENTACHLOROBIPHENYL (PCB 126)	57465-28-8					4.0E-04	8/03	1.0E-07	8/03	3.8E+00	1.3E+04	8/03	1.3E+04	8/03	1
2,3,3',4,4',5-HEXACHLOROBIPHENYL (PCB 156)	38380-08-4					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical Abstract Number[b]	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
2,3,3',4,4',5'-HEXACHLOROBIPHENYL (PCB 157)	69782-90-7					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3',4,4',5,5'-HEXACHLOROBIPHENYL (PCB 167)	52663-72-6					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
3,3',4,4',5,5'-HEXACHLOROBIPHENYL (PCB 169)	32774-16-6					1.3E-03	1/11	3.3E-07	1/11	1.1E+00	3.9E+03	1/11	3.9E+03	1/11	1
2,3,3',4,4',5,5'-HEPTACHLOROBIPHENYL (PCB 189)	39635-31-9					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
POLYCHLORINATED DIBENZO-*P*-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[TAC, k]	1085 1086					4.0E-05	2/00	1.0E-08	10/00	3.8E+01 TAC	1.3E+05	8/86	1.3E+05 TAC	8/86	1
2,3,7,8-TETRACHLORODIBENZO-*P*-DIOXIN[TAC]	1746-01-6					4.0E-05	2/00	1.0E-08	10/00	3.8E+01 TAC	1.3E+05	8/86	1.3E+05 TAC	8/86	1
1,2,3,7,8-PENTACHLORODIBENZO-*P*-DIOXIN	40321-76-4					4.0E-05	8/03	1.0E-08	8/03	3.8E+01	1.3E+05	8/03	1.3E+05	8/03	1
1,2,3,4,7,8-HEXACHLORODIBENZO-*P*-DIOXIN	39227-28-6					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,6,7,8-HEXACHLORODIBENZO-*P*-DIOXIN	57653-85-7					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,7,8,9-HEXACHLORODIBENZO-*P*-DIOXIN	19408-74-3					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-*P*-DIOXIN	35822-46-9					4.0E-03	2/00	1.0E-06	10/00	3.8E-01	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,6,7,8,9-OCTACHLORODIBENZO-*P*-DIOXIN	3268-87-9					1.3E-01	1/11	3.3E-05	1/11	1.1E-02	3.9E+01	1/11	3.9E+01	1/11	1
POLYCHLORINATED DIBENZOFURANS (PCDF)[TAC, k] (Treated as 2,3,7,8-TCDD for HRA)	1080					4.0E-05	2/00	1.0E-08	10/00	3.8E+01 TAC	1.3E+05	8/86	1.3E+05 TAC	8/86	1
2,3,7,8-TETRACHLORODIBENZOFURAN	5120-73-19					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,7,8-PENTACHLORODIBENZOFURAN	57117-41-6					1.3E-03	1/11	3.3E-07	1/11	1.1E+00	3.9E +03	1/11	3.9E +03	1/11	1
2,3,4,7,8-PENTACHLORODIBENZOFURAN	57117-31-4					1.3E-04	1/11	3.3E-08	1/11	1.1E+01	3.9E +04	1/11	3.9E +04	1/11	1
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	70648-26-9					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	57117-44-9					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	72918-21-9					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	60851-34-5					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	67562-39-4					4.0E-03	2/00	1.0E-06	10/00	3.8E-01	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	55673-89-7					4.0E-03	2/00	1.0E-06	10/00	3.8E-01	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	39001-02-0					1.3E-01	1/11	3.3E-05	1/11	1.1E-02	3.9E +01	1/11	3.9E +01	1/11	1
POLYCYCLIC AROMATIC HYDROCARBON (PAH)[l] [Treated as B(a)P for HRA][l]	1150 1151									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
BENZ(A)ANTHRACENE[l]	56-55-3									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(A)PYRENE[l]	50-32-8									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
BENZO(B)FLUORANTHENE[l]	205-99-2									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(J)FLUORANTHENE[l]	205-82-3									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(K)FLUORANTHENE[l]	207-08-9									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
CHRYSENE[l]	218-01-9									1.1E-05	3.9E-02	4/99 [4/94]	1.2E-01	10/00 [4/94]	1
DIBENZ(A,H)ACRIDINE[l]	226-36-8									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
DIBENZ(A,H)ANTHRACENE[l]	53-70-3									1.2E-03	4.1E+00	4/99 [4/94]	4.1E+00	10/00 [4/94]	1
DIBENZ(A,J)ACRIDINE[l]	224-42-0									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
DIBENZO(A,E)PYRENE[l]	192-65-4									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
DIBENZO(A,H)PYRENE[l]	189-64-0									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
DIBENZO(A,I)PYRENE[l]	189-55-9									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
DIBENZO(A,L)PYRENE[l]	191-30-0									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
7H-DIBENZO(C,G)CARBAZOLE[l]	194-59-2									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
7,12-DIMETHYLBENZ(A)ANTHRACENE[l]	57-97-6									7.1E-02	2.5E+02	4/99 [4/94]	2.5E+02	10/00 [4/94]	1
1,6-DINITROPYRENE[l]	42397-64-8									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
1,8-DINITROPYRENE[l]	42397-65-9									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
INDENO(1,2,3-C,D)PYRENE[l]	193-39-5									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
3-METHYLCHOLANTHRENE[l]	56-49-5									6.3E-03	2.2E+01	4/99 [4/94]	2.2E+01	10/00 [4/94]	1
5-METHYLCHRYSENE[l]	3697-24-3									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
NAPHTHALENE	91-20-3					9.0E+00	4/00			3.4E-05	1.2E-01	8/04			1
5-NITROACENAPHTHENE[l]	602-87-9									3.7E-05	1.3E-01	4/99 [4/94]	1.3E-01	10/00 [4/94]	1
6-NITROCHRYSENE[l]	7496-02-8									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
2-NITROFLUORENE[l]	607-57-8									1.1E-05	3.9E-02	4/99 [4/94]	1.2E-01	10/00 [4/94]	1
1-NITROPYRENE[l]	5522-43-0									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
4-NITROPYRENE[l]	57835-92-4									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
POTASSIUM BROMATE.... ... (see Bromine & Compounds)															
1,3-PROPANE SULTONE	1120-71-4									6.9E-04	2.4E+00	4/99			1
PROPYLENE (PROPENE)	115-07-1					3.0E+03	4/00								1
PROPYLENE GLYCOL MONOMETHYL ETHER	107-98-2					7.0E+03	2/00								1
PROPYLENE OXIDE	75-56-9	3.1E+03	4/99			3.0E+01	2/00			3.7E-06	1.3E-02	4/99 [7/90]			1
SELENIUM AND COMPOUNDS[m]	7782-49-2 [1170]					2.0E+01	12/01	5.0E-03	12/01						1
HYDROGEN SELENIDE	7783-07-5	5.0E+00	4/99												1
Selenium sulfide	*7446-34-6*					*2.0E+01*	*12/01*	*5.0E-03*	*12/01*						*1*

DO NOT CITE OR QUOTE

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
SILICA [CRYSTALLINE, RESPIRABLE]	1175					3.0E+00	2/05								1
SODIUM HYDROXIDE	1310-73-2	8.0E+00	4/99												1
STYRENE	100-42-5	2.1E+04	4/99			9.0E+02	4/00								1
SULFATES	9960	1.2E+02	4/99												1
SULFUR DIOXIDE	7446-09-5	6.6E+02	4/99[1/92]												1
SULFURIC ACID	7664-93-9	1.2E+02	4/99			1.0E+00	12/01								1
SULFUR TRIOXIDE	*7446-71-9*	*1.2E+02*	*4/99*			*1.0E+00*	*12/01*								*1*
OLEUM	8014-95-7	1.2E+02	4/99												1
1,1,2,2-TETRACHLOROETHANE	79-34-5									5.8E-05	2.0E-01	4/99			1
TETRACHLOROPHENOLS ... (see Chlorophenols)															
2,4,5-TRICHLOROPHENOL ... (see Chlorophenols)															
2,4,6-TRICHLOROPHENOL ... (see Chlorophenols)															
THIOACETAMIDE	62-55-5									1.7E-03	6.1E+00	4/99			1
TOLUENE	108-88-3	3.7E+04	4/99			3.0E+02	4/00								1
Toluene diisocyantates	*26471-62-5*					*7.0E-02*	*1/01*			*1.1E-05*	*3.9E-02*	*4/99*			*1*
TOLUENE-2,4-DIISOCYANATE	584-84-9					7.0E-02	1/01			1.1E-05	3.9E-02	4/99			1
TOLUENE-2,6-DIISOCYANATE	91-08-7					7.0E-02	1/01			1.1E-05	3.9E-02	4/99			1
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79-00-5									1.6E-05	5.7E-02	4/99			1
TRICHLOROETHYLENE[TAC]	79-01-6					6.0E+02	4/00			2.0E-06 TAC	7.0E-03	10/90			1
TRIETHYLAMINE	121-44-8	2.8E+03	4/99			2.0E+02	9/02								1
URETHANE (Ethyl carbamate)	51-79-6									2.9E-04	1.0E+00	4/99 [7/90]			1
Vanadium Compounds	*N/A*														*1*
Vanadium (fume or dust)	*7440-62-2*	*3.0E+01*	*4/99*												*1*
VANADIUM PENTOXIDE	1314-62-1	3.0E+01	4/99												1
VINYL ACETATE	108-05-4					2.0E+02	12/01								1
VINYL CHLORIDE[TAC] (Chloroethylene)	75-01-4	1.8E+05	4/99							7.8E-05 TAC	2.7E-01	12/90			1
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75-35-4					7.0E+01	1/01								1
XYLENES (mixed isomers)	1330-20-7	2.2E+04	4/99			7.0E+02	4/00								1
m-XYLENE	108-38-3	2.2E+04	4/99			7.0E+02	4/00								1
o-XYLENE	95-47-6	2.2E+04	4/99			7.0E+02	4/00								1
p-XYLENE	106-42-3	2.2E+04	4/99			7.0E+02	4/00								1

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

Purpose: The purpose of this reference table is to provide a quick list of all health values that have been approved by the Office of Environmental Health Hazard Assessment (OEHHA) and the Air Resources Board (ARB) for use in facility health risk assessments conducted for the AB 2588 Air Toxics Hot Spots Program. The OEHHA has developed and adopted new risk assessment guidelines that update and replace the 2003 version of the OEHHA *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. The OEHHA has adopted three technical support documents for these guidelines, which can be found on their website (http://www.oehha.ca.gov/air/hot_spots/index.html). This table lists the OEHHA adopted inhalation and oral cancer slope factors, noncancer acute Reference Exposure Levels (RELs), and inhalation and oral noncancer chronic RELs. OEHHA is still in the process of adopting new health values. Therefore, new health values will periodically be added to, or deleted from, this table. Users of this table are advised to monitor the OEHHA website (*www.oehha.ca.gov*) for any updates to the health values.

May 2008 update: The Air Resources Board adopted amendments to the AB 2588 Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines Regulation (Title 17, California Code of Regulations, Section 93300.5) on November 16, 2006. The amendments became effective on September 26, 2007, after approval from the Office of Administrative Law. Under the new amendments, the substances previously listed in Appendix A-I *(Substances For Which Emissions Must Be Quantified*) and Appendix F (*Criteria For Inputs For Risk Assessment Using Screening Air Dispersion Modeling*) of the ARB's *Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines (EICG) (July 1997)* have been removed from this table.

a The *italic* font used in this table clarify applicability of OEHHA adopted health effects values to individual or grouped substances listed in the *Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines*, Appendix A-I list of *"Substances For Which Emissions Must Be Quantified"*.

b Chemical Abstract Service Number (CAS): For chemical groupings and mixtures where a CAS number is not applicable, the 4-digit code used in the *Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines (EICG) Report* is listed. The 4-digit codes enclosed in brackets [ ] are codes that have been phased out, but may still appear on previously reported Hot Spots emissions. For information on the origin and use of the 4-digit code, see the EICG report.

υ Date Value Reviewed [Added]: These columns list the date that the health value was last reviewed by OEHHA, and/or the Scientific Review Panel, and/or approved for use in the AB 2588 Air Toxics Hot Spots Program. If the health value is unchanged since it was first approved for use in the Hot Spots Program, then the date that the value was first approved for use by CAPCOA is listed within the brackets [ ].

- April 1999 is listed for the cancer potency values and noncancer acute RELs, which have been adopted by the OEHHA as part of the AB 2588 Hot Spot Risk Assessment Guidelines.
- February 2000, April 2000, January 2001, and December 2001 are listed for the first set of 22, the second set of 16, the third set of 22, and the fourth set of 12 noncancer chronic RELs, respectively. The chronic REL for carbon disulfide was adopted in May 2002. Chronic RELs for phosphine and triethylamine were adopted in September 2002. Chronic RELs for fluorides including hydrogen fluoride were adopted August 2003. Chronic REL for silica [crystalline respirable] was adopted February 2005.
- October 2000 is listed for the oral chronic RELs and oral cancer slope factors.
- Cancer potency value adopted for naphthalene in August 2004. The inhalation and oral cancer potency values for ethyl benzene were adopted in November 2007.
- For the substances identified as Toxic Air Contaminants, the Air Resources Board hearing date is listed. The dates for acetaldehyde, benzo[a]pyrene, and methyl tertiary-butyl ether represent the dates the values were approved by the Scientific Review Panel.
- On December 19, 2008, OEHHA adopted new acute, 8-hour, and chronic RELs for acetaldehyde, acrolein, arsenic, formaldehyde, manganese, and mercury. The most current health values can be found at: http://www.oehha.ca.gov/air/allrels.html.

  Note: 1. We present the new oral RELs only in milligrams (mg/kg-d), although OEHHA has presented them in other tables in either micrograms (μg/kg-d) or milligrams.

  2. All acute RELs use a 1-hour averaging period (OEHHA, 2008). RELs which were developed using earlier guidelines and specified a different averaging time are unchanged in concentration value, but now refer to the 1-hour averaging period. As of 8/1/2013, the affected chemicals are: benzene, carbon disulfide, carbon tetrachloride, chloroform, ethylene glycol monoethyl ether, ethylene glycol monoethyl ether acetate, and ethylene glycol monomethyl ether: These may be replaced by updated RELs following the OEHHA (2008) guidelines in due course.

  3. At OEHHA's direction, the chronic oral REL for arsenic does not apply to arsine because arsine is a gas and not particle associated.
- OEHHA's adoption of the World Health Organization's 2005 Toxicity Equivalency Factors for polychlorinated dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs), and dioxin-like polychlorinated biphenyls (PCBs) occurred in January 2011. See Appendix C of OEHHA's *Air Toxics Hot Spots Program Technical Support Document for Cancer Potencies* at http://www.oehha.ca.gov/air/hot_spots/pdf/AppCdioxinTEFs013111.pdf for more information.
- On March 23, 2012, OEHHA adopted revised acute, 8-hour and chronic RELs for nickel and nickel compounds. The values of the RELs are listed in the table at: http://www.oehha.ca.gov/air/chronic_rels/032312CREL.html.
- On July 29, 2013, OEHHA adopted an acute and 8-hour REL, and a revised chronic REL for 1,3-butadiene. The REL values and summary can be found online at: http://www.oehha.ca.gov/air/hot_spots/index.html.
- On October 18, 2013 (February 2014 table update), OEHHA adopted acute, 8-hour, and chronic RELs for caprolactam. The REL values and summary can be found at: http://www.oehha.ca.gov/air/chronic_rels/pdf/Caprolactam2013.pdf.

  Changes have been made to target organs to the following substances with no change to health factors: Chloroform, Diethanolamine, Fluorides and Hydrogen Fluoride, Methylene Chloride, Styrene, Xylenes. The "date added" in this table reflects the date of the health factor only.

d Inhalation cancer potency factor: The "unit risk factor" has been replaced in the new risk assessment algorithms by a factor called the "inhalation cancer potency factor". Inhalation cancer potency factors are expressed as units of inverse dose [i.e., $(mg/kg\text{-}day)^{-1}$]. They were derived from unit risk factors [units = $(ug/m^3)^{-1}$] by assuming that a receptor weighs 70 kilograms and breathes 20 cubic meters of air per day. The inhalation potency factor is used to calculate a potential inhalation cancer risk using the new risk assessment algorithms defined in the OEHHA, *Air Toxics Hot Spots Program; Technical Support Document for Exposure Assessment and Stochastic Analysis (August 2012)*.

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

♣	Molecular Weight Adjustment Factor: Molecular weight adjustment factors (MWAF) are only to be used when a toxic metal has a cancer potency factor. For most of the Hot Spots toxic metals, the OEHHA cancer potency factor applies to the weight of the toxic metal atom contained in the overall compound. Some of the Hot Spots compounds contain various elements along with the toxic metal atom (e.g., "Nickel hydroxide", CAS number 12054-48-7, has a formula of H_2NiO_2). Therefore, an adjustment to the reported pounds of the overall compound is needed before applying the OEHHA cancer potency factor for "Nickel and compounds" to such a compound. This ensures that the cancer potency factor is applied only to the fraction of the overall weight of the emissions that are associated with health effects of the metal. In other cases, the Hot Spots metals are already reported as the metal atom equivalent (e.g., CAS 7440-02-0, "Nickel"), and these cases do not use any further molecular weight adjustment. (Refer to Note [7] in Appendix A, List of Substances in the EICG Report for further information on how the emissions of various Hot Spots metal compounds are reported.) The appropriate molecular weight adjustment factors (MWAF) to be used along with the OEHHA cancer potency factors for Hot Spots metals can be found in the MWAF column of this table. So, for example, assume 100 pounds of "Nickel hydroxide" emissions are reported under CAS number 12054-48-7. To get the Nickel atom equivalent of these emissions, multiply by the listed MWAF (0.6332) for Nickel hydroxide: a. 100 pounds x 0.6332 = 63.32 pounds of Nickel atom equivalent *This step should be completed prior to applying the OEHHA cancer potency factor for "Nickel and compounds" in a calculation for a prioritization score or risk assessment calculation.* (For more information see Chapter 4, Section 4.2.1.1.1 of OEHHA's 2014 document, *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*.) Note: The value listed in the MWAF column for Asbestos is not a molecular weight adjustment. This is a conversion factor for adjusting mass to fibers or structures. See Appendix C of OEHHA's document *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (2014)* for more information on Asbestos, or see the EICG report for reporting guidance. Also see the Asbestos footnote (designated by the letter f)
TAC	Toxic Air Contaminant: The Air Resources Board has identified this substance as a Toxic Air Contaminant.
⌑	Asbestos: The units for the Inhalation Cancer Potency factor for asbestos are (100 PCM fibers/m^3)$^{-1}$. A conversion factor of 100 fibers/0.003 µg can be multiplied by a receptor concentration of asbestos expressed in µg/m^3. Unless other information necessary to estimate the concentration (fibers/m^3) of asbestos at receptors of interest is available. A unit risk factor of 1.9 E 10^{-4} (µg/m^3)$^{-1}$ and an inhalation cancer potency factor of 2.2 E 10^{+2} (mg/kg BW * day)$^{-1}$ are available. For more information on asbestos quantity conversion factors, see Appendix F of OEHHA's *The Air Toxics Hot Spots Program Risk Assessment Guidelines; Part II; Technical Support Document for Cancer Potency Factors (May 2009)*, and Appendix C of OEHHA's document *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (2014)*.
⌑	Hexavalent Chromium: In July 2011, OEHHA developed the oral cancer slope factor for chromium 6+ and compounds for the California Public Health Goal in drinking water. As of February 2014, OEHHA states it should also be used for the Hot Spots program.
h	Inorganic Lead: Inorganic Lead was identified by the Air Resources Board as a Toxic Air Contaminant in April 1997. Since information on noncancer health effects show no identified threshold, no Reference Exposure Level has been developed. The document, *Risk Management Guidelines for New, Modified, and Existing Sources of Lead, March 2001*, has been developed by ARB and OEHHA staff for assessing noncancer health impacts from sources of lead. See Appendix F of OEHHA's document *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (2014) for an overview of how to evaluate noncancer impacts from exposure to lead using these risk management guidelines.
i	Particulate Emissions from Diesel-Fueled Engines: The inhalation cancer potency factor was derived from whole diesel exhaust and should be used only for impacts from the inhalation pathway (based on diesel PM measurements). The inhalation impacts from speciated emissions from diesel-fueled engines are already accounted for in the inhalation cancer potency factor. However, at the discretion of the risk assessor, speciated emissions from diesel-fueled engines may be used to estimate acute noncancer health impacts or the contribution to cancer risk or chronic noncancer health impacts for the non-inhalation exposure pathway. See Appendix D of OEHHA's document *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (2014)* for more information. The noncancer chronic REL for diesel exhaust is based on assumptions of contributions of diesel PM to ambient PM. It should be used with diesel PM measurement.
j	Cancer Potency Factors (CPFs) for unspeciated mixtures of Polychlorinated Biphenyls: k: For use in cases where congeners with more than four chlorines comprise more than one-half percent of total polychlorinated biphenyls. Use as default CPF for Tier 1 assessments. l: This number would not ordinarily be used in the Hot Spots program. risk: For use in cases where congeners with more than four chlorines comprise less than one-half percent of total polychlorinated biphenyls. bruary, 2014, there is no approved method that can be used to assess the noncancer hazard of an unspeciated PCB mixture. Persons preparing HRAs for the Hot Spots Program should consult with OEHHA and the local Air Pollution Control or Air Quality Management District if an assessment of the noncancer hazard for unspeciated PCB mixtures is needed.
k	Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans (also referred to as chlorinated dioxins and dibenzofurans) and dioxin-like PCB congeners: The OEHHA has adopted the World Health Organization 2005 (WHO-05) Toxicity Equivalency Factor scheme for evaluating the risk due to exposure to samples containing mixtures of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) and a number of dioxin-like PCB congeners. See Appendix A of OEHHA's Technical Support Document For Describing Available Cancer Potency Factors for more information about the scheme. See Appendix E of OEHHA's 2014 The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments for the methodology for calculating 2,3,7,8-equivalents, cancer risk, and noncancer Hazard Index for PCDD, PCDFs and a number of dioxin-like PCB congeners. The two numbers (i.e., 1085 and 1086) in the column listing Chemical Abstracts Numbers are used for reporting and risk assessment purposes. Be sure to input emissions under the proper code when using the HARP software. ID code 1085 has no health values associated with it in the HARP software; therefore, no health impacts will be calculated when using ID 1085. See the Emissions Inventory Criteria and Guidelines for more information on reporting emissions.

Table 1: CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[β]

l	Polycyclic Aromatic Hydrocarbons (PAHs): These substances are PAH or PAH-derivatives that have OEHHA-developed Potency Equivalency Factors (PEFs) which were approved by the Scientific Review Panel in April 1994 (see ARB document entitled *Benzo[a]pyrene as a Toxic Air Contaminant*). PAH inhalation slope factors listed here have been adjusted by the PEFs. See OEHHA's Technical Support Document: Methodologies for Derivation, Listing of Available Values, and Adjustments to Allow for Early Life Exposures (2009) for more information about the scheme. Appendix G of OEHHA's *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (2014)* also contains information on PAHs. The two numbers (i.e., 1150 and 1151) in the column listing Chemical Abstracts Numbers are used for reporting and risk assessment purposes. Be sure to input emissions under the proper code when using the HARP software. ID code 1150 has no health values associated with it in the HARP software; therefore, no health impacts will be calculated when using ID 1150. See the Emissions Inventory Criteria and Guidelines for more information on reporting emissions.
m	SELENIUM AND COMPOUNDS: In February 2014, an oral REL was added to the consolidated table. The REL was adopted in Dec 2001, but could not be used by the Hot Spots Program (or HARP software) until transfer factors for the oral and dermal routes were adopted. Transfer factors are included in the OEHHA's Technical Support Document for Exposure Assessment and Stochastic Analysis (August 2012) and will be added to the HARP software in the future.
N/A	Not Applicable.
Other Changes:	• 10/18/2010, removed CHLORODIFLUOROMETHANE, which should have been removed in May 2008. February 2014: • Removed applicability of oleum to the sulfuric acid chronic inhalation REL because oleum represents only an acute health hazard. • Removed "METHYL MERCURY (see Mercury & Compounds)" entry because methyl mercury has different chemical properties, potency, and toxicity compared to elemental mercury and mercury salts, and it is not emitted directly from any California facilities.

Table 2: OEHHA/ARB APPROVED ACUTE REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Service Number (CAS)	Acute REL ($\mu g/m^3$)	Date[c] Value Reviewed	Target Organs								
				Alimentary	Cardiovascular	Reproductive/[d] Development	Eye	Hematologic	Immune	Nervous	Respiratory	Skin
ACETALDEHYDE	75-07-0	4.7E+02	12/08				X				X	
ACROLEIN	107-02-8	2.5E+00	12/08				X				X	
ACRYLIC ACID	79-10-7	6.0E+03	4/99				X				X	
AMMONIA	7664-41-7	3.2E+03	4/99				X				X	
ARSENIC AND COMPOUNDS (INORGANIC)[TAC]	7440-38-2 1016 [1015]	2.0E-01	12/08		X	X				X		
ARSINE	7784-42-1	2.0E-01	12/08		X	X				X		
BENZENE[TAC]	71-43-2	1.3E+03	4/99			X		X	X			
BENZYL CHLORIDE	100-44-7	2.4E+02	4/99				X				X	
1,3-BUTADIENE[TAC]	106-99-0	6.6E+02	7/13			X						
CAPROLACTAM	105-60-2	5.0E+01	10/13				X					
CARBON DISULFIDE	75-15-0	6.2E+03	4/99			X				X		
CARBON MONOXIDE	630-08-0	2.3E+04	4/99		X							
CARBON TETRACHLORIDE[TAC] (Tetrachloromethane)	56-23-5	1.9E+03	4/99	X		X				X		
CHLORINE	7782-50-5	2.1E+02	4/99				X				X	
CHLOROFORM[TAC]	67-66-3	1.5E+02	4/99			X				X	X	
CHLOROPICRIN	76-06-2	2.9E+01	4/99				X				X	
COPPER AND COMPOUNDS	7440-50-8 [1067]	1.0E+02	4/99								X	
Cyanide Compounds (inorganic)	*57-12-5* *1073*	*3.4E+02*	*4/99*							✓		
HYDROGEN CYANIDE (Hydrocyanic acid)	74-90-8	3.4E+02	4/99							X		
1,4-DIOXANE (1,4-Diethylene dioxide)	123-91-1	3.0E+03	4/99				X				X	
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106-89-8	1.3E+03	4/99				X				X	
Fluorides and Compounds	*1101*	*2.4E+02*	*4/99*				✓				✓	
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664-39-3	2.4E+02	4/99				X				X	
FORMALDEHYDE[TAC]	50-00-0	5.5E+01	12/08				X					

Table 2: OEHHA/ARB APPROVED ACUTE REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Service Number (CAS)	Acute REL (µg/m^3)	Date[c] Value Reviewed	Target Organs								
				Alimentary	Cardiovascular	Reproductive/[d] Development	Eye	Hematologic	Immune	Nervous	Respiratory	Skin
GLYCOL ETHERS	1115											
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111-76-2	1.4E+04	4/99				X				X	
ETHYLENE GLYCOL ETHYL ETHER – EGEE	110-80-5	3.7E+02	4/99 [1/92]			X						
ETHYLENE GLYCOL ETHYL ETHER ACETATE - EGEEA	111-15-9	1.4E+02	4/99			X				X		
ETHYLENE GLYCOL METHYL ETHER – EGME	109-86-4	9.3E+01	4/99			X						
HYDROCHLORIC ACID (Hydrogen chloride)	7647-01-0	2.1E+03	4/99				X				X	
HYDROGEN CYANIDE (Hydrocyanic acid) (see Cyanide Compounds)												
HYDROGEN FLUORIDE (Hydrofluoric acid) (see Fluorides & Compounds)												
HYDROGEN SELENIDE (see Selenium & Compounds)												
HYDROGEN SULFIDE	7783-06-4	4.2E+01	4/99 [7/90]							X		
ISOPROPYL ALCOHOL (Isopropanol)	67-63-0	3.2E+03	4/99				X				X	
MERCURY AND COMPOUNDS (INORGANIC)	7439-97-6 [1133]	6.0E-01	12/08			X				X		
Mercuric chloride	*7487-94-7*	*6.0E-01*	*12/08*			✓				✓		
METHANOL	67-56-1	2.8E+04	4/99							X		
METHYL BROMIDE (Bromomethane)	74-83-9	3.9E+03	4/99			X				X	X	
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71-55-6	6.8E+04	4/99							X		
METHYL ETHYL KETONE (2-Butanone)	78-93-3	1.3E+04	4/99				X				X	
METHYLENE CHLORIDE[TAC] (Dichloromethane)	75-09-2	1.4E+04	4/99		X					X		
NICKEL AND COMPOUNDS[TAC]	7440-02-0 [1145]	2.0E-01	3/12						X			
Nickel acetate	*373-02-4*	*2.0E-01*	*3/12*						✓			
Nickel carbonate	*3333-67-3*	*2.0E-01*	*3/12*						✓			
Nickel carbonyl	*13463-39-3*	*2.0E-01*	*3/12*						✓			
Nickel hydroxide	*12054-48-7*	*2.0E-01*	*3/12*						✓			
Nickelocene	*1271-28-9*	*2.0E-01*	*3/12*						✓			
NICKEL OXIDE	*1313-99-1*	*2.0E-01*	*3/12*						✓			

Table 2: OEHHA/ARB APPROVED ACUTE REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Service Number (CAS)	Acute REL ($\mu g/m^3$)	Date[c] Value Reviewed	Target Organs								
				Alimentary	Cardiovascular	Reproductive[d]/ Development	Eye	Hematologic	Immune	Nervous	Respiratory	Skin
Nickel refinery dust from the pyrometallurgical process	*1146*	*2.0E-01*	*3/12*						✓			
Nickel subsulfide	*12035-72-2*	*2.0E-01*	*3/12*						✓			
NITRIC ACID	7697-37-2	8.6E+01	4/99								X	
NITROGEN DIOXIDE	10102-44-0	4.7E+02	4/99 [1/92]								X	
OZONE	10028-15-6	1.8E+02	4/99 [1/92]				X				X	
PERCHLOROETHYLENE[TAC] (Tetrachloroethylene)	127-18-4	2.0E+04	4/99				X			X	X	
PHENOL	108-95-2	5.8E+03	4/99				X				X	
PHOSGENE	75-44-5	4.0E+00	4/99								X	
PROPYLENE OXIDE	75-56-9	3.1E+03	4/99			X	X				X	
Selenium and Compounds	*7782-49-2 [1170]*											
HYDROGEN SELENIDE	7783-07-5	5.0E+00	4/99				X				X	
SODIUM HYDROXIDE	1310-73-2	8.0E+00	4/99				X				X	X
STYRENE	100-42-5	2.1E+04	4/99			X	X				X	
SULFATES	9960	1.2E+02	4/99								X	
SULFUR DIOXIDE	7446-09-5	6.6E+02	4/99 [1/92]								X	
SULFURIC ACID	7664-93-9	1.2E+02	4/99								X	
SULFUR TRIOXIDE	*7446-71-9*	*1.2E+02*	*4/99*								✓	
OLEUM	8014-95-7	1.2E+02	4/99								X	
TOLUENE	108-88-3	3.7E+04	4/99			X	X			X	X	
TRIETHYLAMINE	121-44-8	2.8E+03	4/99				X			X		
Vanadium Compounds	*N/A*											
Vanadium (fume or dust)	*7440-62-2*	*3.0E+01*	*4/99*				✓				✓	
VANADIUM PENTOXIDE	1314-62-1	3.0E+01	4/99				X				X	
VINYL CHLORIDE[TAC] (Chloroethylene)	75-01-4	1.8E+05	4/99				X			X	X	
XYLENES (mixed isomers)	1330-20-7	2.2E+04	4/99				X			X	X	

Table 2: OEHHA/ARB APPROVED ACUTE REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Service Number (CAS)	Acute REL ($\mu g/m^3$)	Date[c] Value Reviewed	Target Organs								
				Alimentary	Cardiovascular	Reproductive[d]/ Development	Eye	Hematologic	Immune	Nervous	Respiratory	Skin
m-Xylene	108-38-3	2.2E+04	4/99				X			X	X	
o-Xylene	95-47-6	2.2E+04	4/99				X			X	X	
p-Xylene	106-42-3	2.2E+04	4/99				X			X	X	

Purpose: The purpose of this reference table is to provide a quick list of all health values that have been approved by the Office of Environmental Health Hazard Assessment (OEHHA) and the Air Resources Board (ARB) for use in facility health risk assessments conducted for the AB 2588 Air Toxics "Hot Spots" Program. The OEHHA has developed and adopted new risk assessment guidelines that update and replace the 2003 version of the OEHHA *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. The OEHHA has adopted three technical support documents for these guidelines, which can be found on their website (http://www.oehha.ca.gov/air/hot_spots/index.html). This table lists the OEHHA adopted noncancer acute Reference Exposure Levels (RELs). OEHHA is still in the process of adopting new health values. Therefore, new health values will periodically be added to, or deleted from, this table. Users of this table are advised to monitor the OEHHA website (*www.oehha.ca.gov*) for any updates to the health values.

May 2008 update: The Air Resources Board adopted amendments to the AB 2588 Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines Regulation (Title 17, California Code of Regulations, Section 93300.5) on November 16, 2006. The amendments became effective on September 26, 2007, after approval from the Office of Administrative Law. Under the new amendments, the substances previously listed in Appendix A-I *(Substances For Which Emissions Must Be Quantified*) and Appendix F (*Criteria For Inputs For Risk Assessment Using Screening Air Dispersion Modeling*) of the ARB's *Air Toxics* "*Hot Spots" Emission Inventory Criteria and Guidelines (EICG) (July 1997)* have been removed from this table.

a The checkmarks included in this table clarify applicability of OEHHA adopted heath effects values to individual or grouped substances listed in the *Air Toxics* "*Hot Spots" Emission Inventory Criteria and Guidelines*, Appendix A-I list of *"Substances For Which Emissions Must Be Quantified"*.

b Chemical Abstract Service Number (CAS): For chemical groupings and mixtures where a CAS number is not applicable, the 4-digit code used in the *Air Toxics* "*Hot Spots" Emission Inventory Criteria and Guidelines (EICG) Report* is listed. The 4-digit codes enclosed in brackets [ ] are codes that have been phased out, but may still appear on previously reported Hot Spots emissions. For information on the origin and use of the 4-digit code, see the EICG report.

Table 2: OEHHA/ARB APPROVED ACUTE REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

C	Date Value Reviewed [Added]: This column lists the date that the health value was last reviewed by OEHHA and the Scientific Review Panel, and/or approved for use in the AB 2588 Air Toxics Hot Spots Program. If the health value is unchanged since it was first approved for use in the "Hot Spots" Program, then the date that the value was first approved for use by CAPCOA is listed within the brackets [ ]. • April 1999 is listed for the noncancer acute RELs which have been adopted by the OEHHA as part of the AB 2588 Hot Spot Risk Assessment Guidelines. • On December 19, 2008, OEHHA adopted new acute RELs for acetaldehyde, acrolein, arsenic, formaldehyde, and mercury. The most current health values can be found at: http://www.oehha.ca.gov/air/allrels.html. Note: All acute RELs use a 1-hour averaging period (OEHHA, 2008). RELs which were developed using earlier guidelines and specified a different averaging time are unchanged in concentration value, but now refer to the 1-hour averaging period. As of 8/1/2013, the affected chemicals are: benzene, carbon disulfide, carbon tetrachloride, chloroform, ethylene glycol monoethyl ether, ethylene glycol monoethyl ether acetate, and ethylene glycol monomethyl ether: These may be replaced by updated RELs following the OEHHA (2008) guidelines in due course. • On March 23, 2012, OEHHA adopted revised acute, 8-hour and chronic RELs for nickel and nickel compounds. The values of the RELs are listed in the table at: http://www.oehha.ca.gov/air/chronic_rels/032312CREL.html. • On July 29, 2013, OEHHA adopted an acute and an 8-hour REL and a revised chronic REL for 1,3-butadiene. The REL value and summary can be found online at: http://www.oehha.ca.gov/air/hot_spots/index.html. • On October 18, 2013 (February 2014 table update), OEHHA adopted acute, 8-hour, and chronic RELs for caprolactam. The REL values and summary can be found at: http://www.oehha.ca.gov/air/chronic_rels/pdf/Caprolactam2013.pdf. Changes have been made to target organs to the following substances with no change to health factors: Chloroform, Methylene Chloride, Styrene, and Xylenes. The "date added" in this table reflects the date of the health factor only. See footnotes below that discuss changes to substance target organs only.
C	February 2014. Per OEHHA's current policy, substances with Reproductive System and/or Development as the hazard Index target organ(s) are represented under the single endpoint "Reproductive/Development"
TAC	Toxic Air Contaminant: The Air Resources Board has identified this substance as a Toxic Air Contaminant.
N/A	Not Applicable.
Other Changes: February 2014 corrections based on original REL summaries: • Chloroform – added respiratory system as a target organ. • Methylene chloride – the cardiovascular system was added as a target organ. • Entry of SULFURIC ACID AND OLEUM is removed to be consistent with Consolidated Table 1. This entry is removed from Table 1 because oleum represents only an acute health hazard. • Styrene – added reproductive/development as a target organ. • Xylenes – add nervous system as a target organ.	

Table 3: OEHHA/ARB APPROVED 8-HOUR REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical Abstract Number[b]	8-Hour Inhalation REL ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Target Organs											
				Alimentary	Bone and Teeth	Cardiovascular	Reproductive/[d] Development	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
ACETALDEHYDE	75-07-0	3.0E+02	12/08											X	
ACROLEIN	107-02-8	7.0E-01	12/08											X	
ARSENIC AND COMPOUNDS (INORGANIC)[TAC]	7440-38-2 1016	1.5E-02	12/08			X	X						X	X	X
ARSINE	7784-42-1	1.5E-02	12/08			X	X						X	X	X
1,3-BUTADIENE[TAC]	106-99-0	9.0E+00	7/13				X								
CAPROLACTAM	105-60-2	7.0E+00	10/13											X	
FORMALDEHYDE[TAC]	50-00-0	9.0E+00	12/08											X	
MANGANESE AND COMPOUNDS	7439-96-5 [1132]	1.7E-01	12/08										X		
MERCURY AND COMPOUNDS (INORGANIC)	7439-97-6 [1133]	6.0E-02	12/08				X					X	X		
Mercuric chloride	*7487-94-7*	*6.0E-02*	*12/08*				✓					✓	✓		
NICKEL AND COMPOUNDS[TAC]	7440-02-0 [1145]	6.0E-02	3/12								X			X	
Nickel acetate	*373-02-4*	*6.0E-02*	*3/12*								✓			✓	
Nickel carbonate	*3333-67-3*	*6.0E-02*	*3/12*								✓			✓	
Nickel carbonyl	*13463-39-3*	*6.0E-02*	*3/12*								✓			✓	
Nickel hydroxide	*12054-48-7*	*6.0E-02*	*3/12*								✓			✓	
Nickelocene	*1271-28-9*	*6.0E-02*	*3/12*								✓			✓	
NICKEL OXIDE	*1313-99-1*	*6.0E-02*	*3/12*								✓			✓	
Nickel refinery dust from the pyrometallurgical process	*1146*	*6.0E-02*	*3/12*								✓			✓	
Nickel subsulfide	*12035-72-2*	*6.0E-02*	*3/12*								✓			✓	

Table 3: OEHHA/ARB APPROVED 8-HOUR REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Purpose:	The purpose of this reference table is to provide a quick list of all health values that have been approved by the Office of Environmental Health Hazard Assessment (OEHHA) and the Air Resources Board (ARB). The OEHHA has developed and adopted new risk assessment guidelines that update and replace the 2003 version of the OEHHA *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. The OEHHA has adopted three technical support documents for these guidelines, which can be found on their website (http://www.oehha.ca.gov/air/hot_spots/index.html). This table lists the OEHHA adopted 8-hour RELs. The methodology for the development and use of 8-hour RELs in Health Risk Assessments can be found in the OEHHA 2008 document *Air Toxics Hot Spots Program Technical Support Document for the Derivation of Noncancer Reference Exposure Levels* online at: http://oehha.ca.gov/air/hot_spots/rels_dec2008.html. OEHHA is still in the process of adopting new health values. Therefore, new health values will periodically be added to, or deleted from, this table. Users of this table are advised to monitor the OEHHA website (*www.oehha.ca.gov*) for any updates to the health values.
a	The checkmarks included in this table clarify applicability of OEHHA adopted health effects values to individual or grouped substances listed in the *Air Toxics* "*Hot Spots" Emission Inventory Criteria and Guidelines*, Appendix A-I list of *"Substances For Which Emissions Must Be Quantified"*.
b	Chemical Abstract Service Number (CAS): For chemical groupings and mixtures where a CAS number is not applicable, the 4-digit code used in the *Air Toxics* "*Hot Spots" Emission Inventory Criteria and Guidelines (EICG) Report* is listed. The 4-digit codes enclosed in brackets [ ] are codes that have been phased out, but may still appear on previously reported Hot Spots emissions. For information on the origin and use of the 4-digit code, see the EICG report.
c	Date Value Reviewed [Added]: This column lists the date that the health value was last reviewed by OEHHA and the Scientific Review Panel, and/or approved for use in the AB 2588 Air Toxics Hot Spots Program. If the health value is unchanged since it was first approved for use in the "Hot Spots" Program, then the date that the value was first approved for use by CAPCOA is listed within the brackets [ ]. • On December 19, 2008, OEHHA adopted new 8-hour RELs for acetaldehyde, acrolein, arsenic, formaldehyde, manganese, and mercury. The most current health values can be found at: http://www.oehha.ca.gov/air/allrels.html. • On March 23, 2012, OEHHA adopted revised acute, 8-hour and chronic RELs for nickel and nickel compounds. The values of the RELs are listed in the table at: http://www.oehha.ca.gov/air/chronic_rels/032312CREL.html. • On July 29, 2013, OEHHA adopted an acute and an 8-hour REL and a revised chronic REL for 1,3-butadiene. The REL value and summary can be found online at: http://www.oehha.ca.gov/air/hot_spots/index.html. • On October 18, 2013, OEHHA adopted acute, 8-hour, and chronic RELs for caprolactam. The REL values and summary can be found at: http://www.oehha.ca.gov/air/chronic_rels/pdf/Caprolactam2013.pdf.
d	February 2014. Per OEHHA's current policy, substances with Reproductive System and/or Development as the hazard Index target organ(s) are represented under the single endpoint "Reproductive/Development".
TAC	Toxic Air Contaminant: The Air Resources Board has identified this substance as a Toxic Air Contaminant.

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Number	Chronic Inhalation REL (µg/m³)	Chronic Oral REL (mg/kg-d)	Date[c] Value Reviewed [Added]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive[d]/ Development	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
ACETALDEHYDE	75-07-0	1.4E+02		12/08											X	
ACROLEIN	107-02-8	3.5E-01		12/08											X	
ACRYLONITRILE	107-13-1	5.0E+00		12/01											X	
AMMONIA	7664-41-7	2.0E+02		2/00											X	
ARSENIC AND COMPOUNDS (INORGANIC)[TAC]	7440-38-2 1016 [1015]	1.5E-02		12/08			X	X						X	X	X
			3.5E-06	12/08			X	X						X	X	X
ARSINE	7784-42-1	1.5E-02		12/08			X	X						X	X	X
BENZENE[TAC]	71-43-2	6.0E+01		2/00				X			X			X		
BERYLLIUM AND COMPOUNDS	7440-41-7 [1021]	7.0E-03		12/01								X			X	
			2.0E-03	12/01	X											
1,3-BUTADIENE[TAC]	106-99-0	2.0E+00		7/13				X								
CADMIUM AND COMPOUNDS[TAC]	7440-43-9 [1045]	2.0E-02		1/01									X		X	
			5.0E-04	10/00									X			
CAPROLACTAM	105-60-2	2.2E+00		10/13											X	
CARBON DISULFIDE	75-15-0	8.0E+02		5/02				X						X		
CARBON TETRACHLORIDE[TAC] (Tetrachloromethane)	56-23-5	4.0E+01		1/01	X			X						X		
CHLORINE	7782-50-5	2.0E-01		2/00											X	
CHLORINE DIOXIDE	10049-04-4	6.0E-01		1/01											X	
CHLOROBENZENE	108-90-7	1.0E+03		1/01	X			X					X			
CHLOROFORM[TAC]	67-66-3	3.0E+02		4/00	X			X					X			
CHLOROPICRIN	76-06-2	4.0E-01		12/01											X	
CHROMIUM 6+[TAC]	18540-29-9	2.0E-01		1/01											X	
			2.0E-02	10/00							X					
Barium chromate	*10294-40-3*	*2.0E-01*		*1/01*											✓	
			2.0E-02	*10/00*							✓					
Calcium chromate	*13765-19-0*	*2.0E-01*		*1/01*											✓	
			2.0E-02	*10/00*							✓					
Lead chromate	*7758-97-6*	*2.0E-01*		*1/01*											✓	

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Number	Chronic Inhalation REL (µg/m^3)	Chronic Oral REL (mg/kg-d)	Date[c] Value Reviewed [Added]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive[d]/ Development	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
			2.0E-02	*10/00*							✓					
Sodium dichromate	*10588-01-9*	*2.0E-01*		*1/01*											✓	
			2.0E-02	*10/00*							✓					
Strontium chromate	*7789-06-2*	*2.0E-01*		*1/01*											✓	
			2.0E-02	*10/00*							✓					
CHROMIUM TRIOXIDE (as chromic acid mist)	1333-82-0	2.0E-03		1/01											X	
			2.0E-02	*10/00*							✓					
CRESOLS (mixtures of)	1319-77-3	6.0E+02		1/01										X		
m-CRESOL	108-39-4	6.0E+02		1/01										X		
o-CRESOL	95-48-7	6.0E+02		1/01										X		
p-CRESOL	106-44-5	6.0E+02		1/01										X		
Cyanide Compounds (inorganic)	*57-12-5 1073*	*9.0E+00*		*4/00*			✓		✓					✓		
HYDROGEN CYANIDE (Hydrocyanic acid)	74-90-8	9.0E+00		4/00			X		X					X		
p-DICHLOROBENZENE	106-46-7	8.0E+02		1/01	X								X	X	X	
1,1,-DICHLOROETHYLENE … (see Vinylidene Chloride)																
DIESEL EXHAUST … (see Particulate Emissions from Diesel-Fueled Engines)																
DIETHANOLAMINE	111-42-2	3.0E+00		12/01							X				X	
N,N-DIMETHYL FORMAMIDE	68-12-2	8.0E+01		1/01	X										X	
1,4-DIOXANE; (1,4-Diethylene dioxide)	123-91-1	3.0E+03		4/00	X		X						X			
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106-89-8	3.0E+00		1/01						X					X	
1,2-EPOXYBUTANE	106-88-7	2.0E+01		1/01			X								X	
ETHYL BENZENE	100-41-4	2.0E+03		2/00	X			X	X				X			
ETHYL CHLORIDE (Chlorethane)	75-00-3	3.0E+04		4/00	X			X								
ETHYLENE DIBROMIDE[TAC] (1,2-Dibromoethane)	106-93-4	8.0E-01		12/01				X								
ETHYLENE DICHLORIDE[TAC] (1,2-Dichloroethane)	107-06-2	4.0E+02		1/01	X											
ETHYLENE GLYCOL	107-21-1	4.0E+02		4/00				X					X		X	

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Number	Chronic Inhalation REL (µg/m^3)	Chronic Oral REL (mg/kg-d)	Date[c] Value Reviewed [Added]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive[d]/ Development	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
ETHYLENE OXIDE[TAC] (1,2-Epoxyethane)	75-21-8	3.0E+01		1/01										X		
Fluorides	1101	1.3E+01				X									X	
			4.0E-02	8/03		X										
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664-39-3	1.4E+01				X									X	
			4.0E-02	8/03		X										
FORMALDEHYDE[TAC]	50-00-0	9.0E+00		12/08											X	
GLUTARALDEHYDE	111-30-8	8.0E-02		1/01											X	
GLYCOL ETHERS	1115															
ETHYLENE GLYCOL ETHYL ETHER – EGEE	110-80-5	7.0E+01		2/00				X			X					
ETHYLENE GLYCOL ETHYL ETHER ACETATE - EGEEA	111-15-9	3.0E+02		2/00				X								
ETHYLENE GLYCOL METHYL ETHER – EGME	109-86-4	6.0E+01		2/00				X								
ETHYLENE GLYCOL METHYL ETHER ACETATE - EGMEA	110-49-6	9.0E+01		2/00				X								
n-HEXANE	110-54-3	7.0E+03		4/00										X		
HYDRAZINE	302-01-2	2.0E-01		1/01	X				X							
HYDROCHLORIC ACID (Hydrogen chloride)	7647-01-0	9.0E+00		2/00											X	
HYDROGEN CYANIDE (Hydrocyanic acid) (see Cyanide Compounds)																
HYDROGEN BROMIDE ... (see Bromine & Compounds)																
HYDROGEN FLUORIDE (Hydrofluoric acid) (see Fluorides & Compounds)																
HYDROGEN SULFIDE	7783-06-4	1.0E+01		4/00											X	
ISOPHORONE	78-59-1	2.0E+03		12/01	X			X								
ISOPROPYL ALCOHOL (Isopropanol)	67-63-0	7.0E+03		2/00				X					X			
LINDANE ... (see gamma-Hexachlorocyclohexane)																
MALEIC ANHYDRIDE	108-31-6	7.0E-01		12/01											X	
MANGANESE AND COMPOUNDS	7439-96-5 [1132]	9.0E-02		12/08										X		

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Number	Chronic Inhalation REL (µg/m^3)	Chronic Oral REL (mg/kg-d)	Date[c] Value Reviewed [Added]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive[d]/ Development	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
MERCURY AND INORGANIC COMPOUNDS	7439-97-6 [1133]	3.0E-02		12/08				X					X	X		
			1.6E-04	12/08				X					X	X		
Mercuric chloride	*7487-94-7*	*3.0E-02*		*12/08*				✓					✓	✓		
			1.6E-04	*12/08*				✓					✓	✓		
METHANOL	67-56-1	4.0E+03		4/00				X								
METHYL BROMIDE (Bromomethane)	74-83-9	5.0E+00		2/00				X						X	X	
METHYL tertiary-BUTYL ETHER	1634-04-4	8.0E+03		2/00	X					X			X			
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71-55-6	1.0E+03		2/00										X		
METHYL ISOCYANATE	624-83-9	1.0E+00		12/01				X							X	
METHYLENE CHLORIDE[TAC] (Dichloromethane)	75-09-2	4.0E+02		2/00			X							X		
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101-77-9	2.0E+01		12/01	X					X						
METHYLENE DIPHENYL ISOCYANATE	101-68-8	7.0E-01		1/01											X	
NAPHTHALENE	91-20-3	9.0E+00		4/00											X	
NICKEL AND COMPOUNDS[TAC]	7440-02-0 [1145]	1.4E-02		3/12							X				X	
			1.1E-02	3/12				X								
Nickel acetate	*373-02-4*	*1.4E-02*		*3/12*							✓				✓	
			1.1E-02	*3/12*				✓								
Nickel carbonate	*3333-67-3*	*1.4E-02*		*3/12*							✓				✓	
			1.1E-02	*3/12*				✓								
Nickel carbonyl	*13463-39-3*	*1.4E-02*		*3/12*							✓				✓	
			1.1E-02	*3/12*				✓								
Nickel hydroxide	*12054-48-7*	*1.4E-02*		*3/12*							✓				✓	
			1.1E-02	*3/12*				✓								
Nickelocene	*1271-28-9*	*1.4E-02*		*3/12*							✓				✓	
			1.1E-02	*3/12*				✓								

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical Abstract Number[b]	Chronic Inhalation REL (µg/m³)	Chronic Oral REL (mg/kg-d)	Date Value Reviewed [Added][c]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive/ Development[d]	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
NICKEL OXIDE	1313-99-1	2.0E-02		3/12											X	
			1.1E-02	*3/12*				✓								
Nickel refinery dust from pyrometallurgical process	*1146*	*1.4E-02*		*3/12*							✓				✓	
			1.1E-02	*3/12*				✓								
Nickel subsulfide	*12035-72-2*	*1.4E-02*		*3/12*							✓				✓	
			1.1E-02	*3/12*				✓								
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES[TAC, e]	9901	5.0E+00 TAC		8/98											X	
PERCHLOROETHYLENE[TAC] (Tetrachloroethylene)	127-18-4	3.5E+01 TAC		10/91	X								X			
PHENOL	108-95-2	2.0E+02		4/00	X		X						X	X		
PHOSPHINE	7803-51-2	8.0E-01		9/02	X						X		X	X	X	
PHOSPHORIC ACID	7664-38-2	7.0E+00		2/00											X	
PHTHALIC ANHYDRIDE	85-44-9	2.0E+01		1/01											X	
DIOXIN-LIKE POLYCHLORINATED BIPHENYLS (PCBS)[f, g]	1336-36-3															
3,3',4,4'-TETRACHLOROBIPHENYL (PCB 77)	32598-13-3	4.0E-01		8/03	X			X	X		X				X	
			1.0E-04	8/03	X			X	X		X				X	
3,4,4',5-TETRACHLOROBIPHENYL (PCB 81)	70362-50-4	1.3E-01		1/11	X			X	X		X				X	
			3.3E-05	1/11	X			X	X		X				X	
2,3,3',4,4'-PENTACHLOROBIPHENYL (PCB 105)	32598-14-4	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
2,3,4,4',5-PENTACHLOROBIPHENYL (PCB 114)	74472-37-0	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
2,3',4,4',5-PENTACHLOROBIPHENYL (PCB 118)	31508-00-6	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
2,3',4,4',5'-PENTACHLOROBIPHENYL (PCB 123)	65510-44-3	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
3,3',4,4',5-PENTACHLOROBIPHENYL (PCB 126)	57465-28-8	4.0E-04		8/03	X			X	X		X				X	

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical Abstract Number[b]	Chronic Inhalation REL (µg/m³)	Chronic Oral REL (mg/kg-d)	Date Value Reviewed [Added][c]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive/ Development[d]	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
			1.0E-07	8/03	X			X	X		X				X	
2,3,3',4,4',5-HEXACHLOROBIPHENYL (PCB 156)	38380-08-4	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
2,3,3',4,4',5'-HEXACHLOROBIPHENYL (PCB 157)	69782-90-7	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
2,3',4,4',5,5'-HEXACHLOROBIPHENYL (PCB 167)	52663-72-6	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
3,3',4,4',5,5'-HEXACHLOROBIPHENYL (PCB 169)	32774-16-6	1.3E-03		1/11	X			X	X		X				X	
			3.3E-07	1/11	X			X	X		X				X	
2,3,3',4,4',5,5'-HEPTACHLOROBIPHENYL (PCB 189)	39635-31-9	1.3E+00		1/11	X			X	X		X				X	
			3.3E-04	1/11	X			X	X		X				X	
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[TAC, f]	1085 1086	4.0E-05		2/00	X			X	X		X				X	
			1.0E-08	10/00	X			X	X		X				X	
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN[TAC]	1746-01-6	4.0E-05		2/00	X			X	X		X				X	
			1.0E-08	10/00	X			X	X		X				X	
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	40321-76-4	4.0E-05		8/03	X			X	X		X				X	
			1.0E-08	8/03	X			X	X		X				X	
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	39227-28-6	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	57653-85-7	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	19408-74-3	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	35822-46-9	4.0E-03		2/00	X			X	X		X				X	
			1.0E-06	10/00	X			X	X		X				X	
1,2,3,4,6,7,8,9-OCTACHLORODIBENZO-P-DIOXIN	3268-87-9	1.3E-01		1/11	X			X	X		X				X	
			3.3E-05	1/11	X			X	X		X				X	

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Number	Chronic Inhalation REL (µg/m^3)	Chronic Oral REL (mg/kg-d)	Date[c] Value Reviewed [Added]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive/[d] Development	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) [TAC, f]	1080	4.0E-05		2/00	X			X	X		X				X	
			1.0E-08	10/00	X			X	X		X				X	
2,3,7,8-TETRACHLORODIBENZOFURAN	5120-73-19	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
1,2,3,7,8-PENTACHLORODIBENZOFURAN	57117-41-6	1.3E-03		1/11	X			X	X		X				X	
			3.3E-07	1/11	X			X	X		X				X	
2,3,4,7,8-PENTACHLORODIBENZOFURN	57117-31-4	1.3E-04		1/11	X			X	X		X				X	
			3.3E-08	1/11	X			X	X		X				X	
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	70648-26-9	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	57117-44-9	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	72918-21-9	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	60851-34-5	4.0E-04		2/00	X			X	X		X				X	
			1.0E-07	10/00	X			X	X		X				X	
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	67562-39-4	4.0E-03		2/00	X			X	X		X				X	
			1.0E-06	10/00	X			X	X		X				X	
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	55673-89-7	4.0E-03		2/00	X			X	X		X				X	
			1.0E-06	10/00	X			X	X		X				X	
1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	39001-02-0	1.3E-01		1/11	X			X	X		X				X	
			3.3E-05	1/11	X			X	X		X				X	
POTASSIUM BROMATE ... (see Bromine & Compounds)																
PROPYLENE (PROPENE)	115-07-1	3.0E+03		4/00											X	
PROPYLENE GLYCOL MONOMETHYL ETHER	107-98-2	7.0E+03		2/00	X											
PROPYLENE OXIDE	75-56-9	3.0E+01		2/00											X	

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Substance	Chemical[b] Abstract Number	Chronic Inhalation REL (µg/m³)	Chronic Oral REL (mg/kg-d)	Date[c] Value Reviewed [Added]	Target Organs											
					Alimentary	Bone and Teeth	Cardiovascular	Reproductive/[d] Development	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Respiratory	Skin
SELENIUM AND COMPOUNDS (other than hydrogen selenide)[h]	7782-49-2 [1170]	2.0E+01		12/01	X		X							X		
			5.0E-03	12/01	X		X							X		
Selenium sulfide	*7446-34-6*	*2.0E+01*		*12/01*	✓		✓							✓		
			5.0E-03	*12/01*	✓		✓							✓		
SILICA [CRYSTALLINE, RESPIRABLE]	1175	3.0E+00		2/05											X	
STYRENE	100-42-5	9.0E+02		4/00										X		
Sulfuric Acid	7664-93-9	1.0E+00		12/01											X	
Sulfuric Trioxide	*7446-71-9*	*1.0E+00*		*12/01*											✓	
TOLUENE	108-88-3	3.0E+02		4/00				X						X	X	
Toluene diisocyanates	*26471-62-5*	*7.0E-02*		*1/01*											✓	
TOLUENE-2,4-DIISOCYANATE	584-84-9	7.0E-02		1/01											X	
TOLUENE-2,6-DIISOCYANATE	91-08-7	7.0E-02		1/01											X	
TRICHLOROETHYLENE[TAC]	79-01-6	6.0E+02		4/00						X				X		
TRIETHYLAMINE	121-44-8	2.0E+02		9/02						X						
VINYL ACETATE	108-05-4	2.0E+02		12/01											X	
VINYLIDENE CHLORIDE (1,1,-Dichloroethylene)	75-35-4	7.0E+01		1/01	X											
XYLENES (mixed isomers)	1330-20-7	7.0E+02		4/00						X				X	X	
m-XYLENE	108-38-3	7.0E+02		4/00						X				X	X	
o-XYLENE	95-47-6	7.0E+02		4/00						X				X	X	
p-XYLENE	106-42-3	7.0E+02		4/00						X				X	X	

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

Purpose: The purpose of this reference table is to provide a quick list of all health values that have been approved by the Office of Environmental Health Hazard Assessment (OEHHA) and the Air Resources Board (ARB) for use in facility health risk assessments conducted for the AB 2588 Air Toxics "Hot Spots" Program. The OEHHA has developed and adopted new risk assessment guidelines that update and replace the 2003 version of the OEHHA *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. The OEHHA has adopted three technical support documents for these guidelines, which can be found on their website (http://www.oehha.ca.gov/air/hot_spots/index.html). This table lists the OEHHA adopted inhalation and oral noncancer chronic RELs. OEHHA is still in the process of adopting new health values. Therefore, new health values will periodically be added to, or deleted from, this table. Users of this table are advised to monitor the OEHHA website (*www.oehha.ca.gov*) for any updates to the health values.

May 2008 update: The Air Resources Board adopted amendments to the AB 2588 Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines Regulation (Title 17, California Code of Regulations, Section 93300.5) on November 16, 2006. The amendments became effective on September 26, 2007, after approval from the Office of Administrative Law. Under the new amendments, the substances previously listed in Appendix A-I *(Substances For Which Emissions Must Be Quantified*) and Appendix F (*Criteria For Inputs For Risk Assessment Using Screening Air Dispersion Modeling*) of the ARB's *Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines (EICG) (July 1997)* have been removed from this table.

a The checkmarks included in this table clarify applicability of OEHHA adopted health effects values to individual or grouped substances listed in the *Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines*, Appendix A-I list of *"Substances For Which Emissions Must Be Quantified"*.

b Chemical Abstract Service Number (CAS): For chemical groupings and mixtures where a CAS number is not applicable, the 4-digit code used in the *Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines (EICG) Report* is listed. The 4-digit codes enclosed in brackets [ ] are codes that have been phased out, but may still appear on previously reported Hot Spots emissions. For information on the origin and use of the 4-digit code, see the EICG report.

c Date Value Reviewed [Added]: This column lists the date that the health value was last reviewed by OEHHA and the Scientific Review Panel, and/or approved for use in the AB 2588 Air Toxics Hot Spots Program. If the health value is unchanged since it was first approved for use in the "Hot Spots" Program, then the date that the value was first approved for use by CAPCOA is listed within the brackets [ ].

- February 2000, April 2000, January 2001, and December 2001 are listed for the first set of 22, the second set of 16, the third set of 22, and the fourth set of 12 noncancer chronic RELs, respectively. The chronic REL for carbon disulfide was adopted in May 2002. Chronic RELs for phosphine and triethylamine were adopted in September 2002. Chronic RELs for fluorides including hydrogen fluoride were adopted August 2003. Chronic REL for silica [crystalline respirable] was adopted February 2005.
- October 2000 is listed for the oral chronic RELs.
- For the substances identified as Toxic Air Contaminants, the Air Resources Board hearing date is listed. The date for acetaldehyde represents the date the value was approved by the Scientific Review Panel.
- On December 19, 2008, OEHHA adopted new chronic RELs for acetaldehyde, acrolein, arsenic, formaldehyde, manganese, and mercury. The most current health values can be found at: http://www.oehha.ca.gov/air/allrels.html.

  Note: 1. We present the new oral RELs only in milligrams (mg/kg-d), although OEHHA has presented oral RELs in other tables in either micrograms (μg/kg-d) or mg/kg-d .

  2. At OEHHA's direction, the chronic oral REL for arsenic does not apply to arsine, because arsine is a gas and not particle associated.
- January 2011 is listed to reflect OEHHA's adoption of the World Health Organization's 2005 Toxicity Equivalency Factors for polychlorinated dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs), and dioxin-like polychlorinated biphenyls (PCBs). See Appendix C of OEHHA's *Air Toxics Hot Spots Program Technical Support Document for Cancer Potencies* at: http://www.oehha.ca.gov/air/hot_spots/pdf/AppCdioxinTEFs013111.pdf for more information.
- On March 23, 2012, OEHHA adopted revised acute, 8-hour and chronic RELs for nickel and nickel compounds, a separate chronic inhalation REL for nickel oxide, and a revised chronic oral REL for nickel and nickel compounds (including nickel oxide). The values of the RELs are listed in the table at: http://www.oehha.ca.gov/air/chronic_rels/032312CREL.html.
- On July 29, 2013, OEHHA adopted an acute and an 8-hour REL and a revised chronic REL for 1,3-butadiene. The REL value and summary can be found online at: http://www.oehha.ca.gov/air/hot_spots/index.html.
- On October 18, 2013 (February 2014 table update), OEHHA adopted acute, 8-hour, and chronic RELs for caprolactam. The REL values and summary can be found at:

  http://www.oehha.ca.gov/air/chronic_rels/pdf/Caprolactam2013.pdf. Changes have been made to target organs to the following substances with no change to health factors: Diethanolamine, Fluorides and Hydrogen Fluoride, and Xylenes. The "date added" in this table reflects the date of the health factor only. See footnotes below that discuss changes to substance target organs only.

d February 2014. Per OEHHA's current policy, substances with Reproductive System and/or Development as the hazard Index target organ(s) are represented under the single endpoint "Reproductive/Development".

TAC Toxic Air Contaminant: The Air Resources Board has identified this substance as a Toxic Air Contaminant.

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

e	Particulate Emissions from Diesel-Fueled Engines: The inhalation cancer potency factor was derived from whole diesel exhaust and should be used only for impacts from the inhalation pathway (based on diesel PM measurements). The inhalation impacts from speciated emissions from diesel-fueled engines are already accounted for in the inhalation cancer potency factor and REL. However, at the discretion of the risk assessor, speciated emissions from diesel-fueled engines may be used to estimate acute noncancer health impacts or the contribution to cancer risk or chronic noncancer health impacts for the non-inhalation exposure pathway. The noncancer chronic REL for diesel exhaust is based on assumptions of contributions of diesel PM to ambient PM. It should be used with diesel PM measurement. There is not an oral chronic REL for diesel exhaust. See Appendix D of OEHHA's document *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* for more information.
f	Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans (also referred to as chlorinated dioxins and dibenzofurans) and dioxin-like PCB congeners: The OEHHA has adopted the World Health Organization 2005 (WHO-05) Toxicity Equivalency Factor scheme for evaluating the risk due to exposure to samples containing mixtures of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) and a number of dioxin-like PCB congeners. See Appendix A of OEHHA's Technical Support Document For Describing Available Cancer Potency Factors for more information about the scheme. See Appendix E of OEHHA's 2014 The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments for the methodology for calculating 2,3,7,8-equivalents, cancer risk, and noncancer Hazard Index for PCDD, PCDFs and a number of dioxin-like PCB .
g	Polychlorinated Biphenyls (unspeciated): As of February, 2014, there is no approved method that can be used to assess the noncancer hazard of an unspeciated PCB mixture. Persons preparing HRAs for the Hot Spots Program should consult with OEHHA and the local Air Pollution Control or Air Quality Management District if an assessment of the noncancer hazard for unspeciated PCB mixtures is needed.
h	SELENIUM AND COMPOUNDS: In February 2014, an oral REL was added to the consolidated table. The REL was adopted in Dec 2001, but could not be used by the Hot Spots Program (or HARP software) until transfer factors for the oral and dermal routes were adopted. Transfer factors are included in the OEHHA's Technical Support Document for Exposure Assessment and Stochastic Analysis (August 2012) and will be added to the HARP software in the future.
Other Changes:	February 2014 corrections based on original REL summaries: • Removed applicability of oleum to the sulfuric acid chronic inhalation REL because oleum represents only an acute health hazard. • Diethanolamine – deleted cardiovascular and nervous system as target organs, and added hematologic and respiratory systems as target organs. • Fluorides and Hydrogen Fluoride – target organ for these substances was reconfigured so that "Bone and Teeth" are a combined target organ. • Xylenes (mixed isomers) – added eye as a target organ. • Removed "METHYL MERCURY …(see Mercury & Compounds)" entry because methyl mercury has different chemical properties, potency, and toxicity compared to elemental mercury and mercury salts, and it is not emitted directly from any California facilities.

Table 4: OEHHA/ARB APPROVED CHRONIC REFERENCE EXPOSURE LEVELS AND TARGET ORGANS[a]

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Appendix M:

How to Post-Process Offsite Worker Concentrations using the Hourly Raw Results from AERMOD

This appendix describes how to calculate refined offsite worker concentrations using the hourly raw results from the AERMOD air dispersion model. In some cases, a better representation of what the offsite worker breathes during their work shift is needed for the health risk analysis. To obtain a better representation, the hourly raw results contain enough information to allow the risk assessor to evaluate the concentrations that occurs during the offsite worker's shift. However, since the hourly raw results include all the concentrations for every hour of meteorological data at each receptor for each source in the air dispersion analysis, the results must be filtered and processed to obtain the refined offsite worker concentrations. The basic steps include: 1) determining the averaging periods needed for the offsite worker analysis; 2) outputting the hourly raw results from the AERMOD air dispersion model; 3) extracting the hourly concentrations based on when the receptor is present; and 4) identifying or calculating the required concentration. The calculation methods described in this appendix can be used for assessing acute, 8-hour non-cancer chronic, and inhalation cancer health impacts.

M.1 Determine the Averaging Periods Required for the Offsite Worker Health Risk Analysis

Before any refined offsite worker concentrations can be calculated, the first step is to determine which type of refined concentrations or averaging periods are needed for the health risk analysis. The refined averaging periods needed for the analysis are based on the pollutant-specific health values emitted by the source or sources. Specifically, refined offsite worker concentrations can only be used for pollutants that have inhalation cancer potency factors, 8-hour RELs, and/or acute RELs. This section describes the refined averaging periods required for assessing acute RELs, 8-hour RELs, and inhalation cancer potency factors.

M.1.1 Averaging Period Required for Acute RELs

The maximum 1-hour concentration is typically required for the acute health hazard index calculation. AERMOD can determine and output the maximum 1-hour concentration at each receptor location for each source in the air dispersion analysis. However, if more refined concentrations for the offsite worker are needed, the maximum1-hour concentration that occurs during the offsite worker's shift may be used.

This type of refinement can be processed using the hourly raw results from the air dispersion analysis.

If there are multiple sources in the analysis, an additional refinement step is to examine the coincident acute health impacts at each receptor from all sources at each hour during the offsite worker's shift and identify the total maximum acute health impacts from all sources. For example, if there are two sources that emit a single pollutant for ten hours per day and the offsite worker's shift is from hour three to hour seven, the risk assessor may evaluate the total acute risk from all sources during the offsite worker's shift. Assuming the acute REL is 50 µg/m^3, the highest acute health impact occurs at hour three with a Health Hazard Index of 0.3 (see Table M.1). This approach is also known as a refined acute analysis.

TABLE M.1. EXAMPLE OF A REFINED ACUTE CALCULATION

Hour	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Source 1 Concentration (µg/m^3)	5	7	8	0	9	11	5	1	12	3
Source 2 Concentration(µg/m^3)	4	6	7	0	2	1	3	4	5	2
Total Acute Health Hazard Index from All Sources	0.18	0.26	**0.3**	0	0.22	0.24	0.16	0.1	0.34	0.1

M.1.2 Averaging Period Required for Inhalation Cancer Potency Values

The period average is typically required for cancer risk assessments. AERMOD calculates this average by summing all the hourly concentrations and dividing it by the number of processed hours over the entire time period of the air dispersion analysis. However, the period averages calculated from AERMOD typically represent exposures for receptors (i.e., residential receptors) that are present 24 hours a day and seven days per week. For the offsite worker, the period average should represent what the worker breathes during their work shift when assessing the cancer inhalation pathway.

To estimate the offsite worker's concentration, there are two approaches. The simple approach is to obtain the period average concentration as calculated by AERMOD and approximate the worker's inhalation exposure using an adjustment factor (See Chapter 4.12.2. for more information). For a more representative concentration, the second approach is to calculate a refined period average using the hourly raw results from the air dispersion analysis. This refined period average should reflect only the concentrations that occur during the offsite worker's shift. It is calculated by summing all of the hourly concentrations that occurs during the offsite worker's shift and dividing it by the number of hours that occurs during the offsite worker's shift. The equation for calculating the refined offsite worker concentration is shown in Section 4.3.

M.1.3 Averaging Period Required for 8-Hour RELs

For 8-hour noncancer health impacts, we evaluate if the worker is exposed to a daily (e.g., 8-hour) average concentration that exceeds the 8-hour REL. The daily average concentration is intended to represent the long term average concentration the worker is breathing during their work shift. The long-term 8-hour daily average concentration is required for 8-hour health hazard index calculations. Specifically, this concentration represents the long-term average of repeated 8-hour daily averages that occur when the source's emission schedule and offsite worker's schedule overlap. For example, the 8-hour averages are first calculated for each day in the air dispersion analysis. The 8-hour averages should represent the eight hour sequential concentration for when the source's emission schedule and offsite worker's schedule overlap. All the 8-hour averages are then averaged over the entire time period of the air dispersion analysis.

There are two approaches for calculating the average 8-hour daily concentration. The simple approach is to obtain the long-term concentration (i.e., period average) as calculated by AERMOD and approximate the average 8-hour daily concentration using an adjustment factor. For a more representative concentration, the second approach is to calculate the offsite worker concentration using the hourly raw results from the air dispersion analysis.

Please note that although the duration of work shifts or period of overlap with the source's emission schedule can vary from eight hours, the calculated long-term daily average concentrations can still be applied to the 8-hour RELs. However, the risk assessor may wish to calculate the 8-hour hazard index using the adjustment factor approach as a screening assessment before proceeding with the post-processing approach. Based on the results of the screening assessment, the risk assessor can contact OEHHA for assistance in determining whether further evaluation may be necessary.

M.2 Output the Hourly Raw Results from AERMOD

The hourly raw results from the air dispersion analysis are needed to calculate the refined offsite worker concentrations as described above. AERMOD can output the hourly raw results to a file for post-processing. In order to output a file suitable for post-processing, the AERMOD input file must be modified. The AERMOD input file contains the modeling options, source location and parameter data, receptor locations, meteorological data file specifications, and output options. It is organized into five main sections that include the Control (CO), Source (SO), Receptor (RE), Meteorology (ME), and Output (OU) pathways (U.S. EPA, 2004). This section describes how to modify the pathways in the AERMOD input file to allow the hourly raw results to be saved to a file.

M.2.1 Modify the Control (CO) Pathway to Identify Calm and Missing Hours

By default, AERMOD disregards calm and missing hours when calculating the long-term and short-term averages. When calculating the refined offsite worker concentrations, the calm and missing hours must also be disregarded. However, the hourly raw results from AERMOD do not identify which hours are calm or missing. Since this is the case, an additional file from AERMOD must also be saved in order to post-process the hourly raw results correctly. The AERMOD Detailed Error Listing File will report all calm and missing hours from the air dispersion analysis. The syntax for creating a Detailed Error Listing File in the CO pathway is shown below. This modification in the CO pathway will create a file which will be used to assist with calculating the refined offsite worker concentrations. This process is described in the subsequent sections of this appendix.

Syntax for Creating the Detailed Error Listing File

CO ERRORFIL [Filename]

M.2.2 Modify the Source (SO) Pathway if Unit Emission Rates are used

In an air dispersion analysis, it is typical to use non-substance specific unit emission rates (e.g., 1 g/s) for evaluating multiple pollutants. This precludes modelers from having to run the air dispersion model for each individual pollutant that is emitted from a source. Unit emission rates allow the air dispersion modeling results to be expressed as dilution factors in (µg/m^3)/(g/s). When these dilution factors are combined with the pollutant specific emission rate (g/s), it will yield the ground level concentrations (µg/m^3) for each pollutant in the analysis. When there are multiple sources in the air dispersion analysis and unit emission rates are used, the individual source contributions must be provided in the modeling results so the ground level concentrations can be correctly scaled for each pollutant. To do this, the air dispersion input file must be modified to create individual source groups for each source. The example below shows how individual source groups for two sources (S001 and S002) are specified in the SO pathway of an AERMOD input file. This modification in the SO pathway will allow the individual source contributions to be saved in the hourly raw results.

```
SO STARTING

**S001 and S002 location and source parameters are not shown.**

SRCGROUP SRCGP1 S001

SRCGROUP SRCGP2 S002

SO FINSHED
```

This parameter identifies the sources tied to the source group. Use only one source ID per source group.

This section specifies the name of your source group. The source group name is what is specified when you output the required concentrations files.

Please note that a separate input file is needed for evaluating acute health impacts when unit emission rates are used and the source has a variable emission schedule (e.g., emissions vary by hour-of-day and day-of-week). Acute health impacts are based on maximum hourly emissions whereas cancer and chronic health impacts are based on average hourly emissions. To correctly simulate unit emissions for the acute impacts, a duplicate source with a variable emission rate of "on" (1) or "off" (0) should be used so the maximum hourly inventory is correctly calculated separately from the emission factors placed in the annual file. The example below shows how the variable emission rates should be modified. Alternatively, a source can be duplicated in the same input file instead of rerunning the source using a separate input file.

First Run with Unmodified Emission Rate Factors for Long-Term

```
EMISFACT S002  HROFDY   0.000   0.000   0.000   0.000   0.000
         S002  HROFDY   0.000   2.667   2.667   2.667   2.667
         S002  HROFDY   2.667   2.667   1.333   1.333   1.333
         S002  HROFDY   1.333   1.333   1.333   0.000   0.000
         S002  HROFDY   0.000   0.000   0.000   0.000
```

Second Run with Modified Emission Rates Factors for Acute

```
EMISFACT S002  HROFDY   0.000   0.000   0.000   0.000   0.000
         S002  HROFDY   0.000   1.000   1.000   1.000   1.000
         S002  HROFDY   1.000   1.000   1.000   1.000   1.000
         S002  HROFDY   1.000   1.000   1.000   0.000   0.000
         S002  HROFDY   0.000   0.000   0.000   0.000
```

M.2.3 Modify the Receptor (RE) Pathway to Reduce the Processing Time

AERMOD is capable of outputting the hourly raw results from the air dispersion analysis. However, without taking appropriate precautions, outputting the hourly raw results can produce extremely large file sizes especially when evaluating multiple years of meteorological data, a large number of receptors, and short-term averaging periods (e.g., 1-hour). To minimize the amount of processing time and hard disk space, it is recommended to use only a single discrete receptor representing the off-site worker location. The proper syntax for specifying a discrete receptor is shown below.

Sample Syntax for Creating a Single Discrete Receptor

```
RE DISCCART XcoordYcoord (ZelevZhill) (Zflag)
```

M.2.4 Modify the Output (OU) Pathway to Output the Hourly Raw Results

To create a file containing the hourly raw results, modify the OU pathway to include the POSTFILE keyword and parameters. The sample below shows the syntax for outputting the hourly raw results for a single source. The POSTFILE will list in order the concentration for each receptor and for each hour of meteorological data regardless of the source's emission schedule. Use Table M.2 to help construct the proper syntax for the POSTFILE option. This step must be repeated for each source in the analysis which will result in additional files.

Please note that if the data are outputted as binary file (UNFORM), a separate computer program will be needed to read and parse the data.

Sample Syntax for Outputting the

Hourly Concentrations for a Single Source

```
OU POSTFILE 1 SRCGP1PLOT PSTS001.TXT
```

TABLE M.2. DESCRIPTIONS OF THE POSTFILE PARAMETERS

Keyword	**Parameters**	
POSTFILE	AveperGrpid Format Filnam (Funit)	
where:	Aveper	Specifies averaging period to be output to file. Set this value to 1 to output 1-hour raw results.
	Grpid	Specifies source group to be output to file. If there are multiple sources, you will need to repeat the POSTFILE option for each source. You can combine the different outputs to a single file using the Funit parameter.
	Format	Specifies format of file, either UNFORM for binary files or PLOT for formatted files. Unformatted files offer a smaller file size; however, this file requires programming expertise in order to view and parse the data. Selecting the PLOT option will allow you to view the file in any text editor.
	Filnam	Specifies filename for output file
	Funit (optional)	The file unit is an optional parameter. If the filename and the file unit number are the same, the results for different source groups can be combined into a single file.

M.3 Extract the Hourly Concentrations when the Offsite Worker is Present

To calculate the refined offsite worker concentrations, it is necessary to extract the hourly concentrations based on the offsite worker's schedule. This section provides information on how to extract the hourly concentrations for the offsite worker including the calm and missing hours that may occur during the offsite worker's shift.

At this point, it is recommended the hourly raw results be imported into a spreadsheet or database to assist with the extraction process. Spreadsheets and database contain preprogrammed functions to assist with deciphering data. **Use the information in Section M.3.1 as a guide to help import the hourly raw results into a database or spreadsheet.**

M.3.1 Description of the POSTFILE File Format

AERMOD was created using FORTRAN, a type of programming language. When the AERMOD output files are created, it is based on a specified FORTRAN format. The variables provided on each data record in the POSTFILE include the X and Y coordinates of the receptor location, the concentration value for that location, receptor terrain elevation, hill height scale, flagpole receptor height, the averaging period, the source group ID, and the date for the end of the averaging period (in the form of YYMMDDHH) (U.S. EPA, 2004). Table M.3 shows the equivalent data types based on the POSTFILE format. The POSTFILE will list in order the concentration for each receptor and for each hour of meteorological data regardless of the source's emission schedule (see Figure M.3.1). Use the information in this section as a guide to help import the hourly raw results into a database or spreadsheet.

TABLE M.3. POSTFILE VARIABLES AND EQUIVALENT DATA TYPES

Column Name	Fortran Format	Equivalent Data Type
X	F13.5	Number/Double Precision
Y	F13.5	Number/Double Precision
AVERAGE_CONC	F13.5	Number/Double Precision
ZELEV	F8.2	Number/Double Precision
ZHILL	F8.2	Number/Double Precision
ZFLAG	F8.2	Number/Double Precision
AVE	A6	6-Character String/Text
GRP	A8	8-Character String/Text
NUM_HRS OR DATE	I8.8	8-Character String/Text
NET_ID	A8	8-Character String/Text

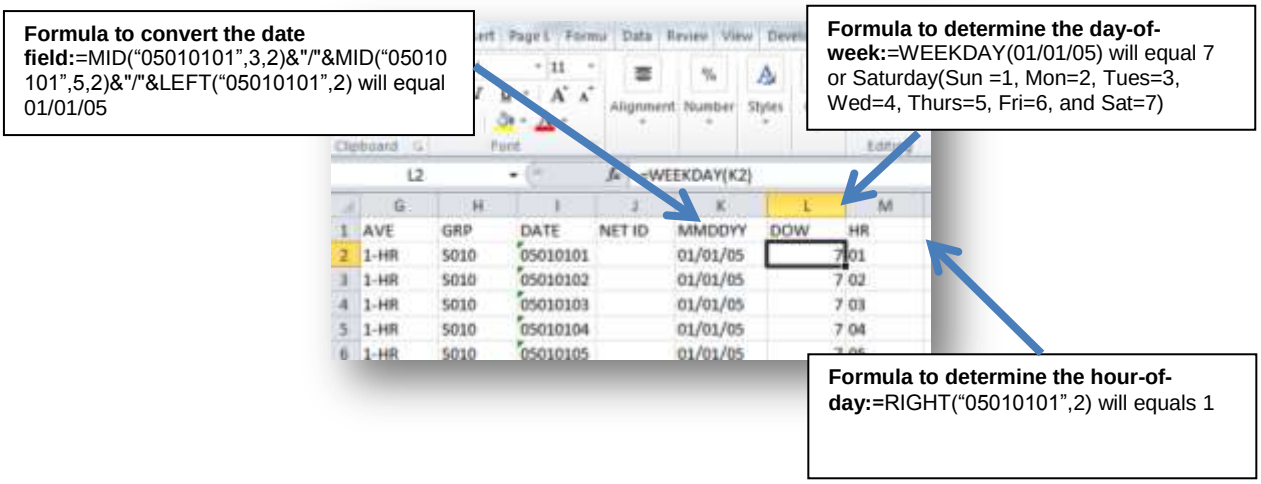
FIGURE M.3.1. SAMPLE OF AN AERMOD POSTFILE

```
AERMOD (09292): LARGE PS                                                                    08/24/10
MODELING OPTIONS USED:                                                                      07:39:24
NonDFAULT CONC                                  FLAT                FLGPOL
        POST/PLOT FILE OF CONCURRENT  1-HR VALUES FOR SOURCE GROUP: S010
        FOR A TOTAL OF     1 RECEPTORS.
        FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)
       X            Y       AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE     GRP       DATE      NET ID
 ___________  ___________  ___________  ________  ________  ________  ______  ______  ________  ________
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010101
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010102
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010103
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010104
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010105
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010106
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010107
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010108
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010109
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010110
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010111
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010112
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010113
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010114
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010115
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010116
   100.00000      0.00000      0.00000     10.00     10.00      1.20   1-HR   S010   05010117
```

M.3.2 Determine the Day-of-Week and Hour-of-Day

In order to extract only the hourly concentrations that occur when an offsite worker is present, the risk assessor must first determine the day-of-week and hour-of-day for each hourly record using the date field. Since the date outputted by AERMOD cannot be directly interpreted by the day-of-week function in a database or spreadsheet, the date must be first converted. For example, the date field can be first converted using the LEFT and MID functions in Microsoft Excel (See Column K in Figure M.3.2). After which, the WEEKDAY function in Microsoft Excel can be used to determine the day-of-week (See Column L in Figure M.3.2). The hour-of-day can be extracted using the RIGHT function (See Column M in Figure M.3.2).

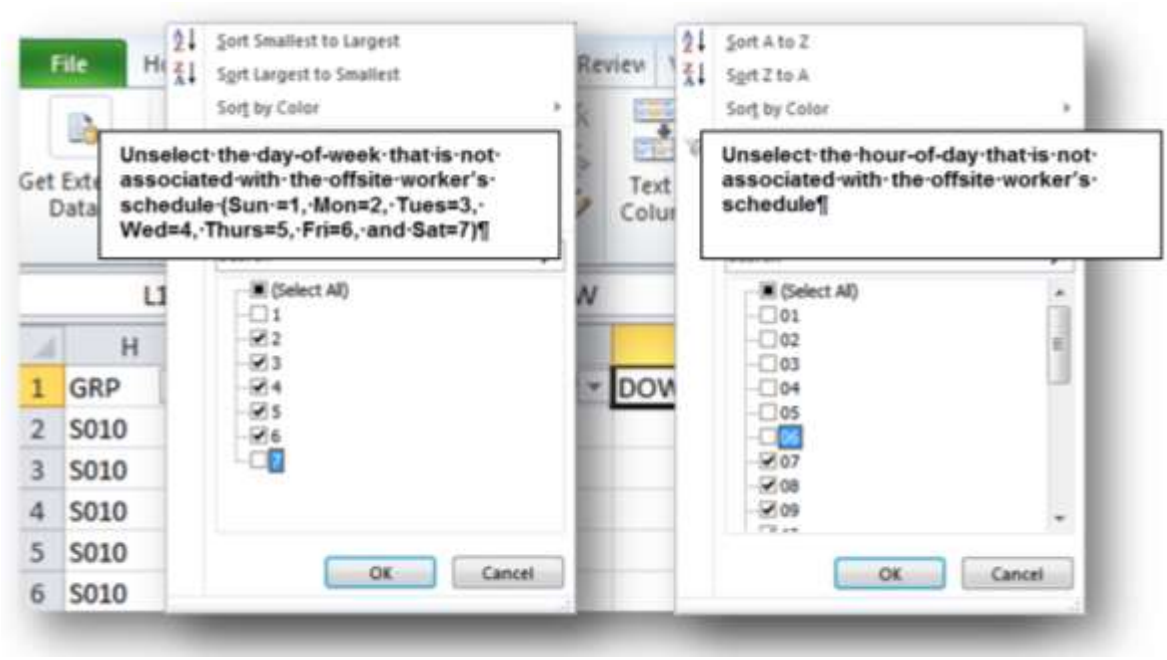
FIGURE M.3.2. HOW TO DETERMINE THE DAY-OF-WEEK AND HOUR-OF-DAY IN MICROSOFT EXCEL



M.3.3 Extract the Hourly Concentrations Based on the Offsite Worker's Schedule

After the day-of-week and hour-of-day have been determined, the concentrations can now be extracted or filtered. Based on the offsite worker's schedule, filter or query the hourly concentrations using a spreadsheet or database. For example, in Microsoft Excel, you can filter the data by selecting the data filter option (see Figure M.3.3). Then unselect the records that are not associated with the offsite worker's schedule using the day-of-week and hour-of-day fields that were created in previous section. If the data contains information for multiple receptors, filter the X and Y coordinates to get the concentrations that are specific to each receptor. The results from the filter will now only show hourly concentrations for times when the offsite worker is present.

FIGURE M.3.3. HOW TO FILTER THE DATA IN MICROSOFT EXCEL



M.3.4 Count the Number of Calm and Missing Hours that Occur During the Offsite Worker's Schedule

If calm hour processing was used in the air dispersion analysis, then calm and missing hours must also be considered when post-processing the long-term and short-term averages for the offsite worker. To assist in this calculation, the Detailed Error Listing File that was created from the air dispersion analysis (Section 2.1) can be used to count the number of calm and missing hours that occurred during the worker's shift.

To identify the calm and missing hours, it is recommended to import the Detailed Error Listing File into a spreadsheet or database. Then follow the instructions from Sections 3.2 and 3.3 to determine the number of calm and missing hours that occur during the offsite worker's schedule. This information is needed to calculate the averaging periods for the offsite worker.

M.4 How to Identify or Calculate the Refined Concentrations for the Offsite Worker Analysis

Depending on which averaging periods are needed (as determined by Section 1.0), use Sections 4.1 through 4.3 below to identify or calculate refined concentrations for estimating the acute, 8-hour, and cancer health impacts. The equations are based on how the long-term and short-term averages are calculated in AERMOD. These equations also account for how calm and missing hours are handled by AERMOD (U.S. EPA, 2005). After calculating the appropriate averaging periods, the refined concentrations can be used to assess the health impacts for the offsite worker's inhalation pathway.

Please note that if unit emission rates were used in the air dispersion analysis, each averaging period calculated using the methods below must be combined with the pollutant specific emission rate (g/s) to yield the actual ground level concentrations (µg/m^3) for each pollutant in the analysis before the health impacts can be assessed.

M.4.1 How to Determine the Maximum 1-Hour Average for a Simple Acute Assessment

The maximum 1-hour average concentration represents the highest concentration that occurs during the offsite worker's schedule. To determine the maximum 1-hour average, sort the extracted hourly concentrations in descending order using a spreadsheet or a database. The maximum hourly concentration will be at the top of the list (Figure M.4.1). This process must be repeated at each receptor for all sources of interest.

FIGURE M.4.1. IDENTIFYING THE MAXIMUM 1-HOUR CONCENTRATION

A	B	C	D	E	F	G	H	I	J	K	L
X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP	DATE	NET ID	MMDD'	DOW
100	0	110.2656	10	10	1.2	1-HR	S010	05082610		08/26/05	
100	0	105.365	10	10	1.2	1-HR	S010	05082315		08/23/05	
100	0	105.1168	10	10	1.2	1-HR	S010	05080512		08/05/05	
100	0	103.7613	10	10	1.2	1-HR	S010	05071310		07/13/05	
100	0	103.6595	10	10	1.2	1-HR	S010	05082314		08/23/05	
100	0	103.6498	10	10	1.2	1-HR	S010	05071113		07/11/05	
100	0	103.2635	10	10	1.2	1-HR	S010	05082413		08/24/05	
100	0	103.0836	10	10	1.2	1-HR	S010	05012012		01/20/05	
100	0	102.8738	10	10	1.2	1-HR	S010	05052310		05/23/05	

M.4.2 How to Determine the Long-Term Average of 8-Hour Daily Concentrations for an 8-Hour Assessment

To calculate the long-term 8-hour daily average concentration, the 8-hour averages are first calculated for each day in the air dispersion analysis. All the 8-hour averages are then averaged over the entire time period of the air dispersion analysis. However, since the 8-hour daily average is considered a short-term average, the total number of valid hours (i.e., not calm or not missing) must be considered. The total number of valid hours should be 75% of the 8-hour average. If the total number of valid hours in an 8-hour average is less than six (6), the 8-hour total concentration should be divided by six (6) (U.S. EPA, 2005). The following steps below are an example that shows how the average of 8-hour daily concentration is calculated.

- Using the extracted hourly concentrations based on the steps from Section 3.0, identify any calm and missing hours with a “1”. To do this, use the Detailed Error Listing File that was created from the air dispersion analysis (See Section 2.1 for more information).The Detailed Error Listing File will list the calm and missing hours by date. Place a “1” where the dates match up with the extracted hourly concentrations (See Column N in Figure M.4.2.1). Please note that some of the columns are hidden in Figure M.4.2.1 for presentation purposes.

FIGURE M.4.2.1. IDENTIFY CALM AND MISSING HOURS

```
************ Error Message List *************

PW      --- Pathway
Code    --- Error Type + Error Code
L#      --- The Line Number Where Error Occurs
ModNam  --- Module Name In Which Error Occurs
Hints   --- Hints For The Possible Solution
*********************************************

PW CODE   L#  MODNAM                ERROR MESSAGES                    HINTS
-- ---- ----- ------ ------------------------------------------------ --------

MX I440    95 CHKCLM:Calm Hour Identified in Meteorology Data File at  05010309
```

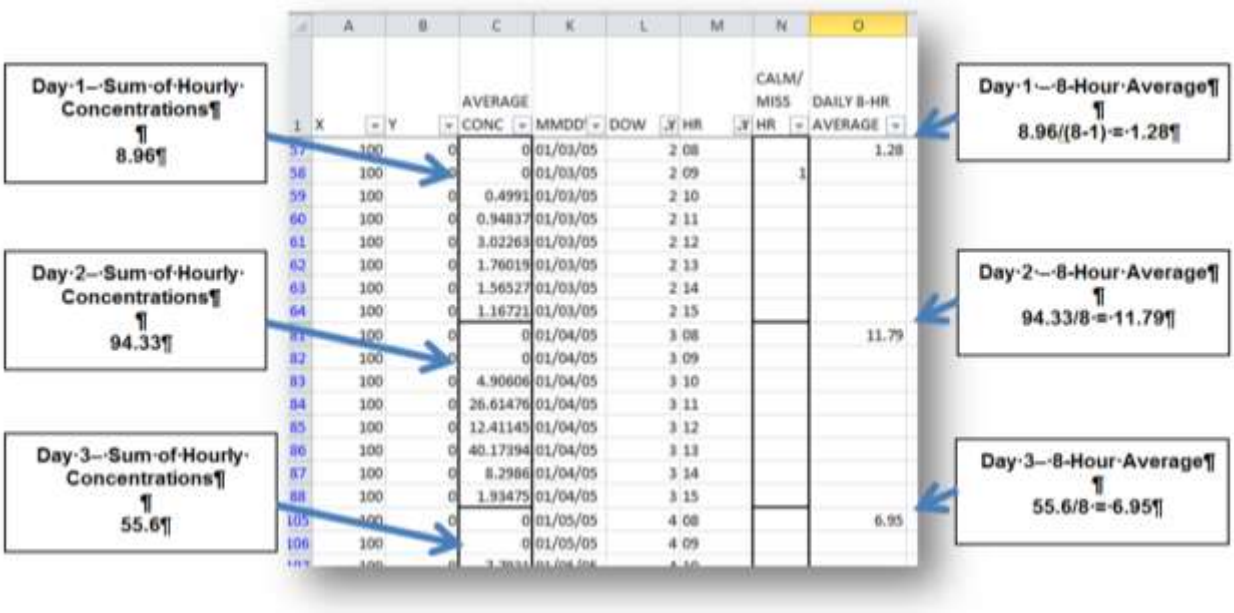
A calm hour identified in the AERMOD Detailed Error Listing File

A "1" is place next to the matching extracted hourly concentration record to indicate that a calm hour was identified.

	A	B					N	O
1	X	Y	AVERAGE CONC	MMDD	DOW	HR	CALM/ MISS HR	
57	100	0	0	01/03/05		2 08		
58	100	0	0	01/03/05		2 09	1	
59	100	0	0.4991	01/03/05		2 10		
60	100	0	0.94837	01/03/05		2 11		
61	100	0	3.02263	01/03/05		2 12		
62	100	0	1.76019	01/03/05		2 13		
63	100	0	1.56527	01/03/05		2 14		
64	100	0	1.16721	01/03/05		2 15		
81	100	0	0	01/04/05		3 08		
82	100	0	0	01/04/05		3 09		
83	100	0	4.90606	01/04/05		3 10		
84	100	0	26.61476	01/04/05		3 11		

- Then calculate the 8-hour average for each day throughout the file. The 8-hour average is the sum of the hourly concentrations in a day divided by eight (see Figure M.4.2.2). However, if there are any calm or missing hours in the time period, the sum of hourly concentrations should be divided by total number of valid hours. The total number of valid hours is eight minus the total number of calm and missing hours. If the total number of valid hours is less than six, then the sum of hourly concentrations should be divided by six.

FIGURE M.4.2.2. 8-HOUR DAILY AVERAGE CALCULATION



- Assuming that there were only three days in the entire time period of the air dispersion analysis, the average of 8-hour daily concentrations is (1.28 11.79 + 6.95) /3 = 6.78.

M.4.3 Equation for Calculating the Average Concentration for the Inhalation Cancer Pathway

Below is the equation for calculating the period average for the inhalation cancer pathway. This calculation must be repeated at each receptor for each source of interest.

$$C_{worker_period_average} = \frac{\sum C_{hourly}}{N_{total_hrs} - N_{calm_hrs} - N_{missing_hrs}}$$

Where:

C_{hourly} = the concentration that occurs during the worker's shift. To obtain the sum of the hourly concentrations for the offsite worker, sum the extracted worker concentrations from Section 3.0.

N_{total_hrs} = the number of processed hours that occur during worker's shift. To obtain the number of processed hours, use the COUNT function to return the total number of extracted worker concentrations from Section 3.0.

N_{calm_hrs}= the number of calm hours that occur during the worker's shift. To obtain the number of calm and missing hours, use the COUNT function to return the total number of missing and calm hours from Section 3.0. Since the total will include missing hours, it is not necessary to repeat this step for the variable below.

$N_{missing_hrs}$ = the number of missing hours that occur during worker's shift.

M.5 References

U.S. EPA (2004). User's Guide for the AMS/EPA Regulatory Model – AERMOD. EPA-454/B-03-001.U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. EPA (2005). Guideline on Air Quality Models (Revised). 40 CFR 51, Appendix W.

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Appendix N:

Sensitivity Study of the Worker Adjustment Factor using AERMOD

N.1. Introduction

The offsite worker health risk analysis begins with estimating the pollutant concentration at a receptor location. To estimate this concentration, the typical approach is to use the residential annual concentration that is modeled based on the adjacent facility's emission schedule. However, if the facility emissions are non-continuous, the residential concentration may not represent what the worker breathes during their work shift. In lieu of conducting additional special case modeling which can be time-consuming, the residential annual concentration is adjusted upwards using a worker adjustment factor based on the facility's emission schedule with respect to the worker's schedule. For an 8-hour work shift that coincides with an adjacent facility that emits eight hours per day, a worker adjustment factor of 4.2 (24 hours / 8 hours * 7 days / 5 days) is typically used for cancer risk assessment.

A possible problem with using this approach is that wind direction, wind speed, and atmospheric stability can vary throughout the day and night and straight scaling as above may skew the results. If the diurnal variation is considerable, the 4.2 adjustment could be an under- or overestimate depending on the time of day that the offsite worker shift begins and ends. The goal of this study is to test the validity of the 4.2 adjustment using five meteorological data sets from five different locations in California and with three different size point sources. The modeling is performed with 8-hour emissions coinciding with the offsite workers' schedule. The 8-hour shifts are modeled as starting every hour around the clock.

To perform this study, the AERMOD air dispersion model, meteorological data from five locations (i.e., Kearny Mesa, Palomar, Pomona, Redlands, and San Bernardino), and three different size point sources (small, medium, and large) are used. The AERMOD-ready meteorological datasets are selected to represent a range of meteorological conditions around the state. To mirror the assumptions used in the 4.2 worker adjustment factor, the emission rate of each source is simulated for eight continuous hours with 24 different start times for five days a week (Monday through Friday). This will simulate the conditions that result during an 8-hour work schedule starting any hour of the day. In addition, the emitting source and offsite worker are assumed to have coincident schedules.

Using the AERMOD air dispersion modeling results, the Point of Maximum Impact (PMI) is identified and the hourly raw concentrations are post-processed to calculate the long-term offsite worker concentration for each scenario. To test the validity of the worker adjustment factor, the calculated long-term offsite worker concentration is

divided by the long term residential average to obtain a quotient that is unique to each meteorological data location. The quotient is then compared to the 4.2 worker adjustment factor to see which is higher or more health protective.

Although this study is primarily based on an 8-hour work schedule, the actual duration that an offsite worker is present near the emitting source may vary when considering a lunch break or a longer work shift. Thus, 10-hour scenarios are also evaluated. The worker adjustment factor for ten hours is 3.4 (24 hours / 10 hours * 7 days / 5 days).

N.2. Background on the Worker Adjustment Factor for Inhalation Cancer Assessments

There are basically two approaches that can be used to calculate the offsite worker inhalation exposure for cancer assessments. One approach is to post-process the hourly dispersion modeling results and examine the coincident hours between the source's emission schedule and the worker's schedule. The second, and more commonly used approach, is to apply a worker adjustment factor to the modeled long-term residential concentration. While post-processing the hourly modeling output will offer a more representative worker concentration, it is very time consuming and requires the management of large amounts of data. Thus, the simplistic approach of applying a worker adjustment factor to estimate the worker inhalation exposure is typically used.

The worker adjustment factor is used together with the long-term residential concentration to estimate the offsite worker's inhalation exposure. This calculation is summarized below.

a. Obtain the long-term concentrations from air dispersion modeling as is typical for residential receptors (all hours of a year or multi-year analysis are used).

b. Determine the coincident hours per day and days per week between the source's emission schedule and the offsite worker's schedule.

c. Calculate the worker adjustment factor using Equation N.1. When assessing inhalation cancer health impacts, a discount factor (*DF*) may also be applied if the offsite worker's schedule partially overlaps with the source's emission schedule. The discount factor is based on the number of coincident hours per day and days per week between the source's emission schedule and the offsite worker's schedule (see Equation N.2).

Please note that worker adjustment factor does not apply if the source's emission schedule and the offsite worker's schedule do not overlap. Since the worker is not around during the time that the source is emitting, the worker is not exposed to the source's emission (i.e., the DF in Equation N.2 becomes 0).

$$WAF = \frac{H_{residentid}}{H_{source}} \times \frac{D_{residentid}}{D_{source}} \times DF$$

Eq. N.1

Where:

WAF = the worker adjustment factor

$H_{residential}$ = the number of hours per day the long-term residential concentration is based on (24)

H_{source} = the number of hours the source operates per day

$D_{residential}$ = the number of days per week the long-term residential concentration is based on (7).

D_{source} = the number of days the source operates per week.

DF = a discount factor for when the offsite worker's schedule partially overlaps the source's emission schedule. Use 1 if the offsite worker's schedule occurs within the source's emission schedule. If the offsite worker's schedule partially overlaps with the source's emission schedule, then calculate the discount factor using Equation N.2 below.

$$DF = \frac{H_{coincident}}{H_{worker}} \times \frac{D_{coincident}}{D_{worker}}$$

Eq. N.2

Where:

DF = *the discount factor for assessing cancer impacts*

$H_{coincident}$ = *the number of hours per day the offsite worker's schedule and the source's emission schedule overlap*

$D_{coincident}$ = *the number of days per week the offsite worker's schedule and the source's emission schedule overlap.*

H_{worker} = *the number of hours the offsite worker works per day*

D_{worker} = *the number of days the offsite worker works per week.*

d. The final step is to estimate the offsite worker inhalation exposure by multiplying the worker adjustment factor with the long-term residential concentration.

N.3. Method and Modeling Parameters

For this study, all scenarios are simulated using the AERMOD (Version 09292) air dispersion model. The modeling parameters input to AERMOD and methods used to process the model outputs are discussed below.

N.3.1. Point Source Release Parameters

This study uses three different size point sources representing small, medium, and large. The point source release parameters are shown in Table N.1.

TABLE N.1. POINT SOURCE MODELING PARAMETERS

Source Size	Emission Rate (g/s)	Release Ht (m)	Diameter (m)	Exit Temp (K)	Exit Vel (m/s)	Building Dimensions L (m) x W (m) x H (m)	XBADJ YBADJ [1]
Large	1	30	3	400	10	15 x 15 x 6	7.5
Medium	1	10	1	400	10	12 x 12 x 6	6
Small	1	2.15	0.1	400	10	6 x 6 x 2	3

1 – The XBADJ and YBADJ are keywords defining the along-flow and across-flow distances from the stack to the center of the upwind face of the projected building, respectively (U.S. EPA, 2004).

N.3.2. Temporal Emission Rate

Each point source (i.e., small, medium, and large) is simulated with continuous emissions for eight hours a day from Monday through Friday. In addition, all starting hour combinations (24 scenarios) are evaluated by duplicating each source 24 times with unique start times. Table N.2 shows the 8-hour operating schedule for each scenario. All emissions for Saturday and Sunday are set at zero. This process will also be repeated for the 10-hour evaluation. Table N.3 shows the 10-hour operating schedule for each scenario.

TABLE N.2. 8-HOUR OPERATING SCHEDULE

Time	Scenario																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
12:00 AM	ON																	ON	ON	ON	ON	ON	ON	ON
1:00 AM	ON	ON																	ON	ON	ON	ON	ON	ON
2:00 AM	ON	ON	ON																	ON	ON	ON	ON	ON
3:00 AM	ON	ON	ON	ON																	ON	ON	ON	ON
4:00 AM	ON	ON	ON	ON	ON																	ON	ON	ON
5:00 AM	ON	ON	ON	ON	ON	ON																	ON	ON
6:00 AM	ON	ON	ON	ON	ON	ON	ON																	ON
7:00 AM	ON	ON	ON	ON	ON	ON	ON	ON																
8:00 AM		ON	ON	ON	ON	ON	ON	ON	ON															
9:00 AM			ON	ON	ON	ON	ON	ON	ON	ON														
10:00 AM				ON	ON	ON	ON	ON	ON	ON	ON													
11:00 AM					ON	ON	ON	ON	ON	ON	ON	ON												
12:00 PM						ON	ON	ON	ON	ON	ON	ON	ON											
1:00 PM							ON	ON	ON	ON	ON	ON	ON	ON										
2:00 PM								ON	ON	ON	ON	ON	ON	ON	ON									
3:00 PM									ON	ON	ON	ON	ON	ON	ON	ON								
4:00 PM										ON	ON	ON	ON	ON	ON	ON	ON							
5:00 PM											ON	ON	ON	ON	ON	ON	ON	ON						
6:00 PM												ON	ON	ON	ON	ON	ON	ON	ON					
7:00 PM													ON	ON	ON	ON	ON	ON	ON	ON				
8:00 PM														ON	ON	ON	ON	ON	ON	ON	ON			
9:00 PM															ON	ON	ON	ON	ON	ON	ON	ON		
10:00 PM																ON	ON	ON	ON	ON	ON	ON	ON	
11:00 PM																	ON	ON	ON	ON	ON	ON	ON	ON

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TABLE N.3. 10-HOUR OPERATING SCHEDULE

Time	Scenario																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
12:00 AM	ON															ON	ON	ON	ON	ON	ON	ON	ON	ON
1:00 AM	ON	ON															ON	ON	ON	ON	ON	ON	ON	ON
2:00 AM	ON	ON	ON															ON	ON	ON	ON	ON	ON	ON
3:00 AM	ON	ON	ON	ON															ON	ON	ON	ON	ON	ON
4:00 AM	ON	ON	ON	ON	ON															ON	ON	ON	ON	ON
5:00 AM	ON	ON	ON	ON	ON	ON															ON	ON	ON	ON
6:00 AM	ON	ON	ON	ON	ON	ON	ON															ON	ON	ON
7:00 AM	ON	ON	ON	ON	ON	ON	ON	ON															ON	ON
8:00 AM	ON	ON	ON	ON	ON	ON	ON	ON	ON															ON
9:00 AM	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON														
10:00 AM		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON													
11:00 AM			ON	ON	ON	ON	ON	ON	ON	ON	ON	ON												
12:00 PM				ON	ON	ON	ON	ON	ON	ON	ON	ON	ON											
1:00 PM					ON	ON	ON	ON	ON	ON	ON	ON	ON	ON										
2:00 PM						ON	ON	ON	ON	ON	ON	ON	ON	ON	ON									
3:00 PM							ON	ON	ON	ON	ON	ON	ON	ON	ON	ON								
4:00 PM								ON	ON	ON	ON	ON	ON	ON	ON	ON	ON							
5:00 PM									ON	ON	ON	ON	ON	ON	ON	ON	ON	ON						
6:00 PM										ON	ON	ON	ON	ON	ON	ON	ON	ON	ON					
7:00 PM											ON	ON	ON	ON	ON	ON	ON	ON	ON	ON				
8:00 PM												ON	ON	ON	ON	ON	ON	ON	ON	ON	ON			
9:00 PM													ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
10:00 PM														ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	
11:00 PM															ON	ON	ON	ON	ON	ON	ON	ON	ON	ON

N.3.3. Receptor Grid Parameters

A 1000 meter by 1000 meter receptor grid is centered over each source. The receptors are spaced in 50 meter increments resulting in 441 receptor points. All receptor flagpole heights are set at 1.2 meters above ground.

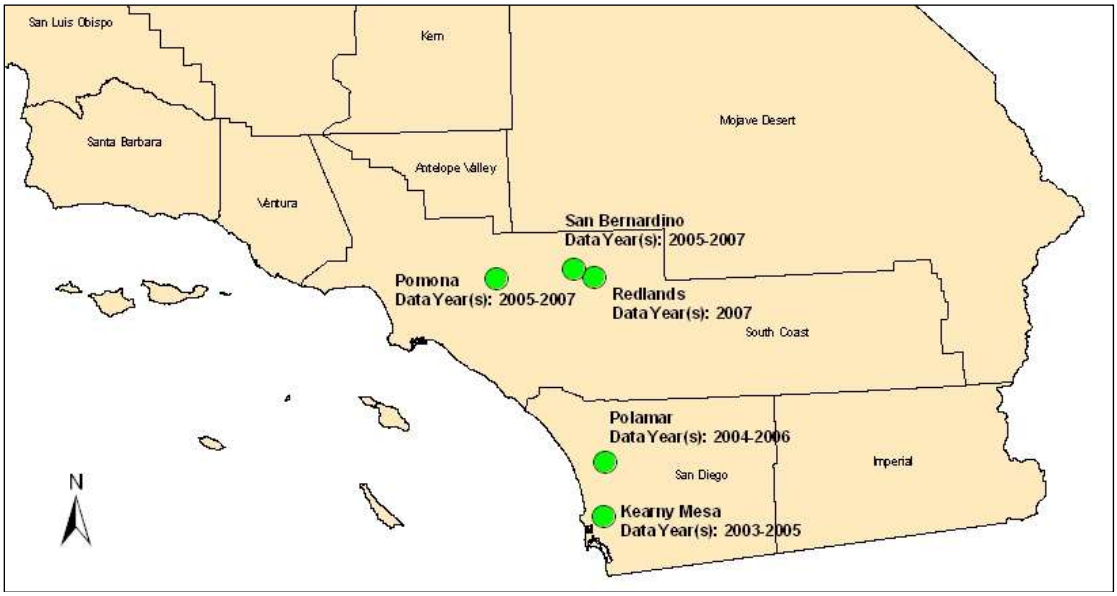
N.3.4. Meteorological Data

The meteorological data input to AERMOD were requested from two local air districts in California (ARB 2009a and ARB 2009b). The meteorological data that were provided by the Districts are, based on the Districts' observations and expertise, datasets that were likely to result in higher than average long-term impacts. The data includes four multi-year files and one single year file. Table N.4 shows the meteorological datasets used in this study. Figure N.1 shows the location of the meteorological station. The AERMOD profile base is defaulted to 10 meters above mean sea level for each meteorological file.

TABLE N.4. METEOROLOGICAL DATASETS

Data Provider	Area	Data Year(s)	Total Hours	Percent of Calm and Missing Hours	Avg. Wind Speed (m/s)
San Diego Air Pollution Control District	Kearny Mesa	2003-2005	26304	6.9	1.36
	Palomar	2004-2006	26304	8.7	1.36
South Coast Air Quality Management District	Pomona	2005-2007	26280	1.6	1.18
	Redlands	2007	8760	5.5	0.94
	San Bernardino	2005-2007	26280	4.9	1.44

FIGURE N.1. METEOROLOGICAL DATA SET LOCATIONS



N.3.5. Post-Processing the Period Average Concentrations for the Offsite Worker

The period average concentration represents the average concentration of all hours processed within the meteorological set. Equation N.3 shows how the period average is calculated in AERMOD including how calm and missing hours are processed (U.S. EPA, 2005).

$$C_{period_average} = \frac{\sum C_{hourly}}{N_{total_hrs} - N_{calm_hrs} - N_{missing_hrs}} \qquad \textbf{Eq. N.3}$$

Where:

C_{hourly} = the concentration that occurs at a given hour

N_{total_hrs} = the number of processed hours reported by AERMOD (e.g., 1 yr = 8760 hours)

N_{calm_hrs} = the number of calm hours reported by AERMOD

$N_{missing_hrs}$ = the number of missing hours reported by AERMOD

Normally to post-process hourly data, the off-site worker hours are extracted from the hourly model output files and then averaged. However, this sensitivity study assumes the hourly emissions are coincident with the off-site worker schedule. Since this is the case, the 8-hour period average for the offsite worker can simply be scaled from the period average reported by AERMOD (see Equation N.4). To make sure this calculation is accurate, a check was performed by processing the hourly concentrations

for one receptor with the Pomona data. If the emission schedule was not 100% coincident with the offsite worker, then all post-processing would have to be completed on an hourly basis. See Appendix M for more information on how to post-process worker concentrations using hourly raw results.

$$C_{worker_period_average} = C_{period_average} \times \frac{N_{total_hrs} - N_{calm_hrs} - N_{missing_hrs}}{N_{worker_hrs} - N_{worker_calm_hrs} - N_{worker_missing_hrs}}$$ **Eq. N.4**

Where:

$C_{period_average}$	=	the period concentration reported by AERMOD
N_{total_hrs}	=	the total number of processed hours reported by AERMOD
N_{calm_hrs}	=	the total number of calm hours reported by AERMOD
$N_{missing_hrs}$	=	the total number of missing hours reported by AERMOD
N_{worker_hrs}[a]	=	the total number of hours that occurred during the worker's shift
$N_{worker_calm__hrs}$[b]	=	the number of calm hours that occurs during the worker's shift
$N_{worker_missing_hrs}$[b]	=	the number of missing hours that occurred during the worker's shift

a. The worker hours are determined by multiplying the number of weekdays (Monday through Friday) that occurs in the meteorological data set by the work shift duration (8 hours). For example, a meteorological data set ranging from 1/1/2003 to 12/31/2005 contains 783 weekdays. If you multiply the number weekdays by the work shift duration (8 hour/day), this will equal 6264 worker hours. The number of weekdays varies depending on the day of the week January 1st starts on.

b. Calm and missing hours are reported in the AERMOD Detailed Message Listing File. To determine the number of worker calm and missing hours, the calm and missing hours that occur during the worker shift are isolated and summed.

N.4. Results

To test the validity of the worker adjustment factor, the post-processed period average concentration for the offsite worker was divided by the modeled period residential average to obtain a quotient. This calculation was performed at the PMI of each scenario. If the quotient is smaller or equal to the worker adjustment factor, the worker adjustment factor is considered a suitable health protective approximation. If the quotient is greater, the worker adjustment factor will underestimate the long-term average concentration and would not be the most conservative estimation of what the worker breathes. For these scenarios, the 8-hour and 10-hour worker adjustment factors are 4.2 and 3.4, respectively. The results for this study are summarized in the figures and tables below. To view the details for every scenario, see Appendix N-1.

Figure N.2 shows how the post-processed period averages changes over 8-hour rolling work shifts. The value at each 8-hour work shift represents the quotient average across the five meteorological data sets. Values that fall on or below the thick dashed line (i.e., the 4.2 worker adjustment factor) indicate that the worker adjustment factor would be a health protective value. Based on the five metrological data sets, the worker adjustment factor is health protective for work shifts that start approximately between 8 am and 3 pm (i.e., 8-hour work shifts starting at 8 am and ending by 11 pm).

FIGURE N.2. SUMMARY OF THE 8-HOUR SCENARIOS

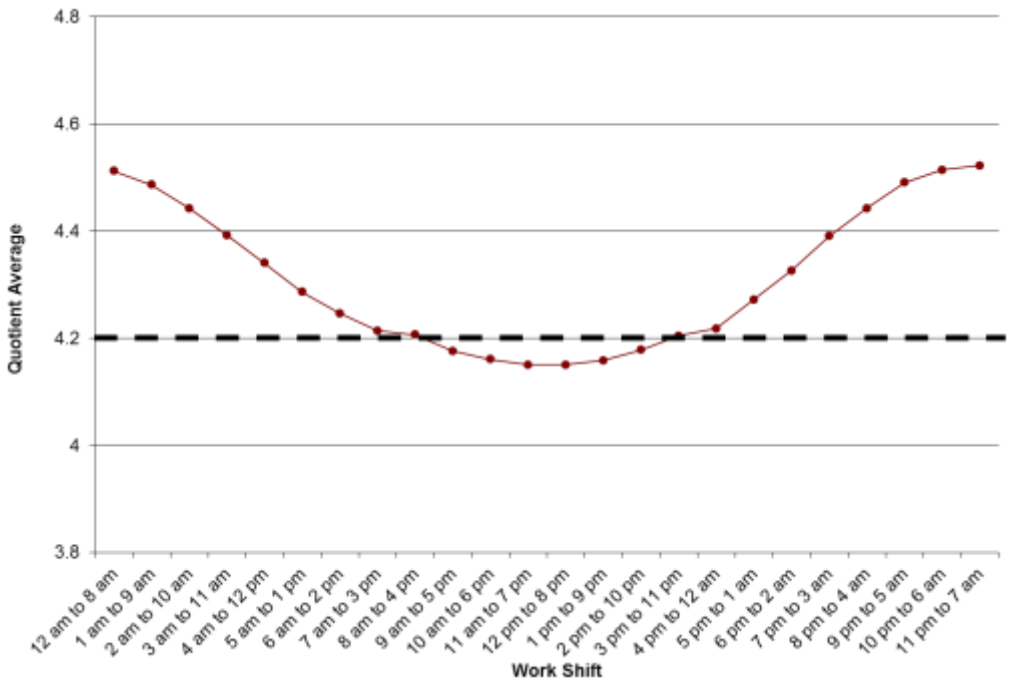


Figure N.3 shows relationship between the worker schedule and the percent of calm and missing hours that occurred during 8-hr work shifts. The figure shows the percent of calm and missing hours are higher during the early morning and evening hour start hours.

FIGURE N.3. AVERAGE PERCENT OF CALM AND MISSING HOURS FOR 8-HOUR WORK SHIFTS

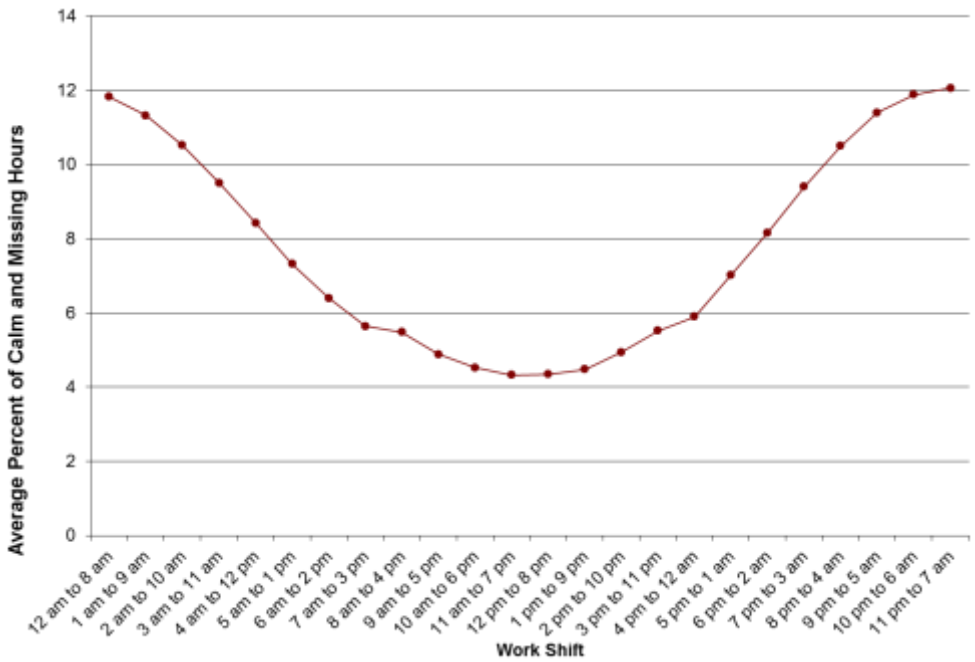


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Figure N.4 shows how the post-processed period averages change over 10-hour rolling work shifts. The value at each 10-hour work shift represents the quotient average across the five meteorological data sets. Values that fall on or below the thick dashed line (i.e., the 3.4 worker adjustment factor) indicate that the worker adjustment factor would be a health protective value. Based on the five metrological data sets, the worker adjustment factor is health protective for work shifts that start approximately between 5 am and 4 pm (i.e., 10-hour work shifts starting at 5 am and ending by 2 am).

FIGURE N.4. SUMMARY OF THE 10-HOUR SCENARIOS

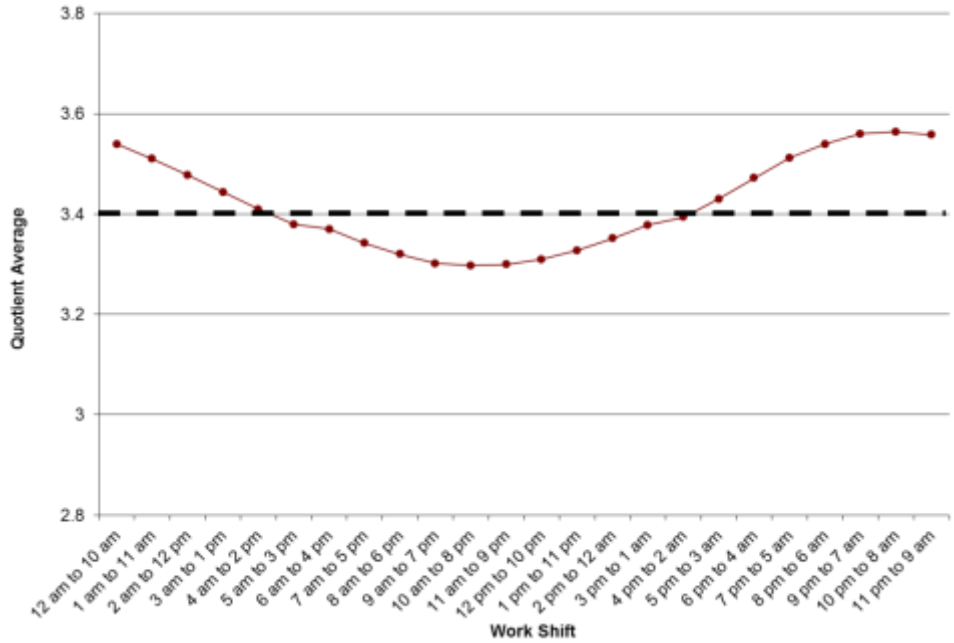

Figure N.5 shows relationship between the worker schedule and the percent of calm and missing hours that occurred during 10-hr work shifts. The figure shows the percent of calm and missing hours are higher during the early morning and evening hour start hours.

FIGURE N.5. AVERAGE PERCENT OF CALM AND MISSING HOURS FOR 10-HOUR WORK SHIFTS

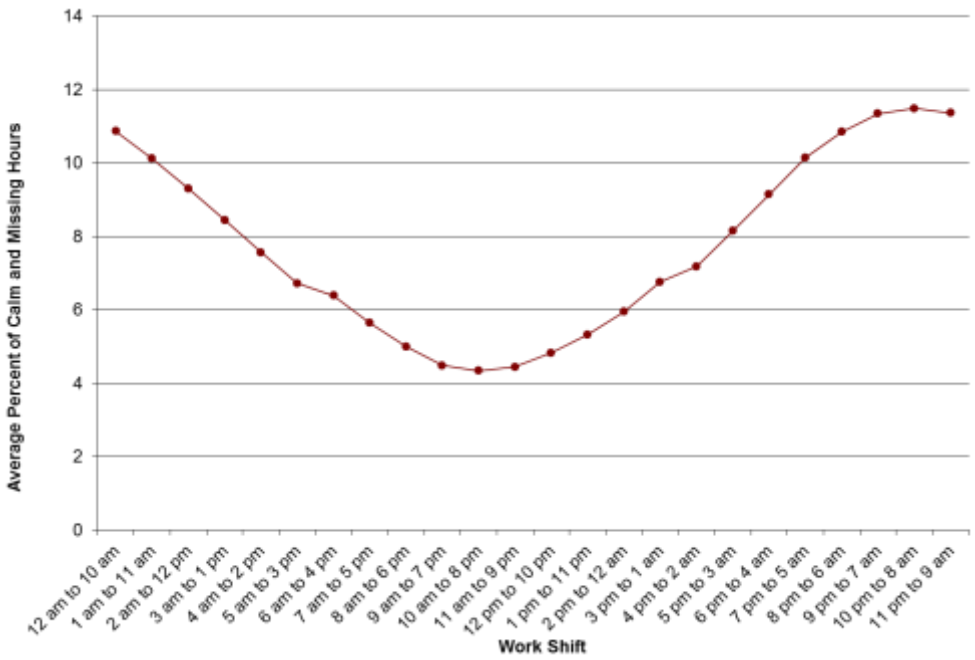

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Table N.5 shows the average, minimum, and maximum quotients across all 24 8-hour work shifts for each point source size (i.e., small, medium, and large). The values in the parentheses are the range across the 24 work shifts for each meteorological data set.

TABLE N.5. SUMMARY OF THE AVERAGE 8-HOUR SCENARIOS BY POINT SOURCE SIZE

Meteorological Set	Point Source Size			% Calm/Missing Hours During the Worker's Shift
	Small	Medium	Large	
Kearny Mesa	4.33 (4.19 to 4.43)	4.33 (4.19 to 4.43)	4.33 (4.19 to 4.43)	9.6 (6.8 to 11.8)
Palomar	4.38 (4.18 to 4.65)	4.38 (4.18 to 4.65)	4.38 (4.18 to 4.65)	12.2 (8.2 to 17.5)
Pomona	4.24 (4.23 to 4.25)	4.24 (4.23 to 4.25)	4.24 (4.23 to 4.25)	2.3 (2.1 to 2.5)
Redlands	4.31 (4.00 to 4.75)	4.31 (4.00 to 4.75)	4.31 (4.00 to 4.75)	7.6 (1.0 to 16.5)
San Bernardino	4.31 (4.06 to 4.65)	4.31 (4.06 to 4.65)	4.31 (4.06 to 4.65)	6.9 (1.4 to 14.1)

Table N.6 shows the average, minimum, and maximum quotients across all 24 10-hour work shifts for each point source size (i.e., small, medium, and large). The values in the parentheses are the range across the 24 work shifts for each meteorological data set.

TABLE N.6. SUMMARY OF THE AVERAGE 10-HOUR SCENARIOS BY POINT SOURCE SIZE

Meteorological Set	Point Source Size			% Calm/Missing Hours During the Worker's Shift
	Small	Medium	Large	
Kearny Mesa	3.46 (3.38 to 3.54)	3.46 (3.38 to 3.54)	3.46 (3.38 to 3.54)	9.6 (7.5 to 11.6)
Palomar	3.50 (3.34 to 3.70)	3.50 (3.34 to 3.70)	3.50 (3.34 to 3.70)	12.2 (8.0 to 17.1)
Pomona	3.39 (3.38 to 3.39)	3.39 (3.38 to 3.39)	3.39 (3.38 to 3.39)	2.3 (2.2 to 2.5)
Redlands	3.45 (3.21 to 3.74)	3.45 (3.21 to 3.74)	3.45 (3.21 to 3.74)	7.6 (1.1 to 15.2)
San Bernardino	3.31 (3.12 to 3.54)	3.31 (3.12 to 3.54)	3.31 (3.12 to 3.54)	6.9 (1.5 to 13.1)

N.5. Conclusions

The goal of this study was to determine if the worker adjustment factor of 4.2 (8 hours/day, 5 days/week) or 3.4 (10 hours/day, 5 days/week) would always yield a more conservative or health protective approximation using five meteorological data sets. This study demonstrated that the worker adjustment factor does not always represent the most health protective approximation of long-term hourly model predictions. This is primarily observed during night conditions. Air Districts may wish to evaluate their meteorological data to determine an appropriate worker adjustment factor for their area using the methods described in this appendix.

Although the meteorological data used in this study are site-specific, several general conclusions and recommendations can be made. These conclusions and recommendations are summarized below.

- ***The worker adjustment factor is generally a suitable health protective approximation for daytime work shifts.***

  For the meteorological data used in this study, the results show that the worker adjustment factor is a suitable health protective approximation for work shifts that occur during the daytime hours. When comparing the 8-hour and 10-hour scenarios, the results show that the range of work shifts that were considered a more health protective approximation increased with the longer work shift duration.

- ***The size of the emitting source did not affect the long-term concentration approximated with the worker adjustment factor.***

  The size of the source was inconsequential in determining whether the worker adjustment factor is health protective. This is because the worker adjustment factor is applied to the modeling results after the air dispersion analysis has been completed. However, it should be noted that the size of the source does affect the location of the PMI during a specific time of day. This is shown in the scenario details in Appendix N-1.

- ***The worker adjustment factor may not represent the most conservative estimation of the worker's inhalation exposure for nighttime work shifts.***

  In most cases, the worker adjustment factor will represent a health protective approximation for work shifts that occur during the daytime. However, the worker adjustment factor may not represent the most conservative estimation when the source's emission schedule and offsite worker's schedules are 100% coincident at night. It is recommended that the offsite worker long-term average concentrations be post-processed using the hourly dispersion modeling results when examining work shifts occurring at night. Alternatively, a more conservative worker adjustment factor can be used to account for the calm hours (see the next bullet point below).

- ***Recommended worker adjustment factor for 8 and 10-hour work shifts***

  Based on the five meteorological data sets used in this study, the range of worker adjustment factors (WAF) was between 4.2 and 4.8. We recommend using the 4.2 WAF for most cases. In the event of predominant night time emissions and worker schedule or if only one year of meteorological data are available, then we recommend using 4.8 for the 8-hour WAF.

N.6. References

ARB (2009a). Harris, Gregory. "Aermod met data in San Diego." Email to Ralph Desina, San Diego Air Pollution Control District.

ARB (2009b). Harris, Gregory. "Aermod met data in SC." Email to Tom Chico, South Coast Air Quality Management District.

U.S. EPA (2004). User's Guide for the AMS/EPA Regulatory Model – AERMOD. EPA-454/B-03-001. U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. EPA (2005). Guideline on Air Quality Models (Revised). 40 CFR 51, Appendix W.

APPENDIX N-1 – SCENARIO DATA DETAILS

KEARNY MESA - 8-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-50	500	0.02584	26304	1813	632.84744	6264	723	11.5	0.11421	**4.42**
2	0	300	0.05638	26304	1813	1380.80258	6264	739	11.8	0.24992	**4.43**
3	150	-150	0.10366	26304	1813	2538.73706	6264	729	11.6	0.45867	**4.42**
4	150	-100	0.19993	26304	1813	4896.48563	6264	718	11.5	0.88289	**4.42**
5	200	-100	0.33363	26304	1813	8170.93233	6264	700	11.2	1.46854	**4.40**
6	200	-100	0.48136	26304	1813	11788.98776	6264	688	11.0	2.11424	**4.39**
7	200	-100	0.62685	26304	1813	15352.18335	6264	684	10.9	2.75129	**4.39**
8	200	-100	0.76245	26304	1813	18673.16295	6264	681	10.9	3.34465	**4.39**
9	200	-100	0.85443	26304	1813	20925.84513	6264	665	10.6	3.73743	**4.37**
10	250	-100	0.89012	26304	1813	21799.92892	6264	618	9.9	3.86113	**4.34**
11	250	-100	0.85448	26304	1813	20927.06968	6264	568	9.1	3.67399	**4.30**
12	250	-100	0.76187	26304	1813	18658.95817	6264	517	8.3	3.24673	**4.26**
13	250	-100	0.63409	26304	1813	15529.49819	6264	488	7.8	2.68863	**4.24**
14	250	-100	0.48738	26304	1813	11936.42358	6264	467	7.5	2.05907	**4.22**
15	300	-150	0.34902	26304	1813	8547.84882	6264	454	7.2	1.47123	**4.22**
16	300	-150	0.20978	26304	1813	5137.72198	6264	433	6.9	0.88110	**4.20**
17	300	-150	0.09739	26304	1813	2385.17849	6264	425	6.8	0.40849	**4.19**
18	350	-200	0.02843	26304	1813	696.27913	6264	456	7.3	0.11988	**4.22**
19	0	500	0.00479	26304	1813	117.31189	6264	516	8.2	0.02041	**4.26**
20	-50	500	0.00491	26304	1813	120.25081	6264	578	9.2	0.02115	**4.31**
21	0	500	0.00512	26304	1813	125.39392	6264	625	10.0	0.02224	**4.34**
22	0	500	0.00513	26304	1813	125.63883	6264	658	10.5	0.02241	**4.37**
23	0	500	0.00528	26304	1813	129.31248	6264	675	10.8	0.02314	**4.38**
24	0	500	0.01002	26304	1813	245.39982	6264	699	11.2	0.04410	**4.40**

KEARNY MESA - 8-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	0	100	0.48213	26304	1813	11807.84583	6264	723	11.5	2.13100	**4.42**
2	0	100	0.99949	26304	1813	24478.50959	6264	739	11.8	4.43050	**4.43**
3	50	50	1.69544	26304	1813	41523.02104	6264	729	11.6	7.50190	**4.42**
4	50	50	2.6458	26304	1813	64798.28780	6264	718	11.5	11.68379	**4.42**
5	50	50	3.51528	26304	1813	86092.72248	6264	700	11.2	15.47317	**4.40**
6	50	50	4.24949	26304	1813	104074.25959	6264	688	11.0	18.66468	**4.39**
7	100	-50	5.33685	26304	1813	130704.79335	6264	684	10.9	23.42380	**4.39**
8	100	-50	6.51541	26304	1813	159568.90631	6264	681	10.9	28.58121	**4.39**
9	100	-50	7.325	26304	1813	179396.57500	6264	665	10.6	32.04082	**4.37**
10	100	-50	7.60514	26304	1813	186257.48374	6264	618	9.9	32.98928	**4.34**
11	100	-50	7.28086	26304	1813	178315.54226	6264	568	9.1	31.30540	**4.30**
12	100	-50	6.51093	26304	1813	159459.18663	6264	517	8.3	27.74651	**4.26**
13	100	-50	5.53256	26304	1813	135497.92696	6264	488	7.8	23.45878	**4.24**
14	100	-50	4.37499	26304	1813	107147.88009	6264	467	7.5	18.48333	**4.22**
15	100	-50	3.13098	26304	1813	76680.83118	6264	454	7.2	13.19808	**4.22**
16	100	-50	1.92339	26304	1813	47105.74449	6264	433	6.9	8.07850	**4.20**
17	150	-50	0.97341	26304	1813	23839.78431	6264	425	6.8	4.08285	**4.19**
18	200	-100	0.37344	26304	1813	9145.91904	6264	456	7.3	1.57471	**4.22**
19	0	150	0.19509	26304	1813	4777.94919	6264	516	8.2	0.83124	**4.26**
20	0	150	0.18348	26304	1813	4493.60868	6264	578	9.2	0.79029	**4.31**
21	0	150	0.17623	26304	1813	4316.04893	6264	625	10.0	0.76539	**4.34**
22	0	150	0.16448	26304	1813	4028.27968	6264	658	10.5	0.71857	**4.37**
23	0	150	0.16295	26304	1813	3990.80845	6264	675	10.8	0.71405	**4.38**
24	0	150	0.22443	26304	1813	5496.51513	6264	699	11.2	0.98769	**4.40**

KEARNY MESA - 8-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	0	50	56.94704	26304	1813	1394689.95664	6264	723	11.5	251.70366	**4.42**
2	0	50	63.90855	26304	1813	1565184.29805	6264	739	11.8	283.29128	**4.43**
3	0	50	72.78622	26304	1813	1782607.31402	6264	729	11.6	322.06094	**4.42**
4	0	50	80.59339	26304	1813	1973812.71449	6264	718	11.5	355.89843	**4.42**
5	0	50	86.44869	26304	1813	2117214.86679	6264	700	11.2	380.52029	**4.40**
6	50	0	96.25147	26304	1813	2357294.75177	6264	688	11.0	422.75731	**4.39**
7	50	0	117.66867	26304	1813	2881823.39697	6264	684	10.9	516.45581	**4.39**
8	50	0	138.64904	26304	1813	3395653.63864	6264	681	10.9	608.21308	**4.39**
9	50	0	156.76654	26304	1813	3839369.33114	6264	665	10.6	685.72412	**4.37**
10	50	0	172.75048	26304	1813	4230832.00568	6264	618	9.9	749.35034	**4.34**
11	50	0	184.10847	26304	1813	4509000.53877	6264	568	9.1	791.60824	**4.30**
12	50	0	190.80885	26304	1813	4673099.54535	6264	517	8.3	813.13721	**4.26**
13	50	0	183.97723	26304	1813	4505786.33993	6264	488	7.8	780.08766	**4.24**
14	50	0	168.91026	26304	1813	4136781.17766	6264	467	7.5	713.60724	**4.22**
15	50	0	150.42213	26304	1813	3683988.38583	6264	454	7.2	634.07717	**4.22**
16	50	-50	146.48297	26304	1813	3587514.41827	6264	433	6.9	615.24857	**4.20**
17	50	-50	144.08415	26304	1813	3528764.91765	6264	425	6.8	604.34405	**4.19**
18	50	-50	130.6006	26304	1813	3198539.29460	6264	456	7.3	550.71269	**4.22**
19	50	-50	111.9118	26304	1813	2740831.89380	6264	516	8.2	476.83227	**4.26**
20	50	-50	86.25428	26304	1813	2112453.57148	6264	578	9.2	371.51839	**4.31**
21	50	-50	65.37008	26304	1813	1600978.62928	6264	625	10.0	283.91180	**4.34**
22	0	50	56.60048	26304	1813	1386202.35568	6264	658	10.5	247.27120	**4.37**
23	0	50	53.20196	26304	1813	1302969.20236	6264	675	10.8	233.13101	**4.38**
24	-100	-100	54.24037	26304	1813	1328400.90167	6264	699	11.2	238.70636	**4.40**

PALOMAR - 8-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-50	250	0.02363	26304	2291	567.42719	6256	1096	17.5	0.10997	**4.65**
2	100	150	0.0631	26304	2291	1515.22030	6256	1090	17.4	0.29331	**4.65**
3	150	50	0.14317	26304	2291	3437.94121	6256	1050	16.8	0.66038	**4.61**
4	150	50	0.27432	26304	2291	6587.24616	6256	971	15.5	1.24640	**4.54**
5	200	50	0.42859	26304	2291	10291.73167	6256	879	14.1	1.91403	**4.47**
6	200	50	0.58751	26304	2291	14107.87763	6256	788	12.6	2.58008	**4.39**
7	200	0	0.73867	26304	2291	17737.68271	6256	701	11.2	3.19310	**4.32**
8	200	0	0.87304	26304	2291	20964.30952	6256	628	10.0	3.72500	**4.27**
9	250	0	0.96493	26304	2291	23170.86409	6256	679	10.9	4.15472	**4.31**
10	250	0	0.99791	26304	2291	23962.81283	6256	589	9.4	4.22848	**4.24**
11	250	0	0.9484	26304	2291	22773.92920	6256	540	8.6	3.98424	**4.20**
12	250	0	0.83614	26304	2291	20078.22982	6256	518	8.3	3.49917	**4.18**
13	250	0	0.68595	26304	2291	16471.71735	6256	517	8.3	2.87014	**4.18**
14	250	0	0.51501	26304	2291	12366.93513	6256	523	8.4	2.15715	**4.19**
15	300	0	0.34888	26304	2291	8377.65544	6256	550	8.8	1.46822	**4.21**
16	300	-50	0.20229	26304	2291	4857.58977	6256	596	9.5	0.85823	**4.24**
17	300	-100	0.10109	26304	2291	2427.47417	6256	516	8.2	0.42290	**4.18**
18	300	-150	0.0311	26304	2291	746.80430	6256	612	9.8	0.13232	**4.25**
19	-450	-200	0.00583	26304	2291	139.99579	6256	701	11.2	0.02520	**4.32**
20	-400	-150	0.00576	26304	2291	138.31488	6256	802	12.8	0.02536	**4.40**
21	-400	-200	0.00503	26304	2291	120.78539	6256	895	14.3	0.02253	**4.48**
22	-400	-200	0.00427	26304	2291	102.53551	6256	980	15.7	0.01943	**4.55**
23	-400	-200	0.00323	26304	2291	77.56199	6256	1040	16.6	0.01487	**4.60**
24	-500	-500	0.0081	26304	2291	194.50530	6256	1067	17.1	0.03748	**4.63**

PALOMAR - 8-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-50	50	0.39916	26304	2291	9585.02908	6256	1096	17.5	1.85756	**4.65**
2	50	50	1.1355	26304	2291	27266.76150	6256	1090	17.4	5.27812	**4.65**
3	50	50	2.23922	26304	2291	53770.38986	6256	1050	16.8	10.32854	**4.61**
4	50	50	3.46481	26304	2291	83200.48253	6256	971	15.5	15.74276	**4.54**
5	100	0	5.01511	26304	2291	120427.83643	6256	879	14.1	22.39685	**4.47**
6	100	0	7.1387	26304	2291	171421.60310	6256	788	12.6	31.34996	**4.39**
7	100	0	9.3361	26304	2291	224187.76930	6256	701	11.2	40.35783	**4.32**
8	100	0	11.30065	26304	2291	271362.50845	6256	628	10.0	48.21651	**4.27**
9	100	0	12.55274	26304	2291	301428.94562	6256	679	10.9	54.04858	**4.31**
10	100	0	12.9907	26304	2291	311945.67910	6256	589	9.4	55.04600	**4.24**
11	100	0	12.32253	26304	2291	295900.91289	6256	540	8.6	51.76713	**4.20**
12	100	0	10.99232	26304	2291	263958.58016	6256	518	8.3	46.00184	**4.18**
13	100	0	9.16435	26304	2291	220063.53655	6256	517	8.3	38.34528	**4.18**
14	100	0	7.04288	26304	2291	169120.67744	6256	523	8.4	29.49951	**4.19**
15	100	0	4.85232	26304	2291	116518.76016	6256	550	8.8	20.42039	**4.21**
16	100	0	2.83666	26304	2291	68116.71658	6256	596	9.5	12.03476	**4.24**
17	150	0	1.4789	26304	2291	35512.82570	6256	516	8.2	6.18690	**4.18**
18	150	0	0.51952	26304	2291	12475.23376	6256	612	9.8	2.21035	**4.25**
19	500	100	0.16252	26304	2291	3902.59276	6256	701	11.2	0.70254	**4.32**
20	-100	-50	0.13578	26304	2291	3260.48514	6256	802	12.8	0.59782	**4.40**
21	-100	-50	0.12284	26304	2291	2949.75692	6256	895	14.3	0.55023	**4.48**
22	-100	-50	0.10491	26304	2291	2519.20383	6256	980	15.7	0.47748	**4.55**
23	-150	-50	0.08895	26304	2291	2135.95635	6256	1040	16.6	0.40950	**4.60**
24	-100	0	0.15313	26304	2291	3677.11069	6256	1067	17.1	0.70864	**4.63**

PALOMAR - 8-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-50	0	62.23758	26304	2291	1494511.00854	6256	1096	17.5	289.63392	**4.65**
2	-50	0	67.07392	26304	2291	1610646.04096	6256	1090	17.4	311.77817	**4.65**
3	-50	0	69.58692	26304	2291	1670990.70996	6256	1050	16.8	320.97401	**4.61**
4	50	0	76.6273	26304	2291	1840051.35490	6256	971	15.5	348.16487	**4.54**
5	50	0	101.35151	26304	2291	2433753.80963	6256	879	14.1	452.62299	**4.47**
6	50	0	132.881	26304	2291	3190871.45300	6256	788	12.6	583.55367	**4.39**
7	50	0	166.85749	26304	2291	4006748.90737	6256	701	11.2	721.28693	**4.32**
8	50	0	199.35655	26304	2291	4787148.83515	6256	628	10.0	850.59503	**4.27**
9	50	0	227.0465	26304	2291	5452067.60450	6256	679	10.9	977.59864	**4.31**
10	50	0	258.20597	26304	2291	6200299.95761	6256	589	9.4	1094.10622	**4.24**
11	50	0	284.95975	26304	2291	6842738.47675	6256	540	8.6	1197.12010	**4.20**
12	50	0	306.84919	26304	2291	7368369.59947	6256	518	8.3	1284.13552	**4.18**
13	50	0	305.48615	26304	2291	7335638.91995	6256	517	8.3	1278.20856	**4.18**
14	50	0	284.9321	26304	2291	6842074.51730	6256	523	8.4	1193.45448	**4.19**
15	50	0	255.29701	26304	2291	6130447.10113	6256	550	8.8	1074.38610	**4.21**
16	50	0	222.46841	26304	2291	5342133.92933	6256	596	9.5	943.83992	**4.24**
17	50	0	190.65477	26304	2291	4578192.99201	6256	516	8.2	797.59460	**4.18**
18	50	0	149.99496	26304	2291	3601828.97448	6256	612	9.8	638.16956	**4.25**
19	50	0	109.43689	26304	2291	2627908.03957	6256	701	11.2	473.07075	**4.32**
20	50	0	71.34752	26304	2291	1713267.99776	6256	802	12.8	314.13055	**4.40**
21	50	0	47.98635	26304	2291	1152296.22255	6256	895	14.3	214.94054	**4.48**
22	-50	50	46.33971	26304	2291	1112755.45623	6256	980	15.7	210.90892	**4.55**
23	-50	0	48.61618	26304	2291	1167420.33034	6256	1040	16.6	223.81525	**4.60**
24	-50	0	55.01306	26304	2291	1321028.60978	6256	1067	17.1	254.58250	**4.63**

POMONA - 8-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	300	-100	0.0378	26280	432	977.05440	6248	138	2.2	0.15991	**4.23**
2	200	-50	0.08941	26280	432	2311.06968	6248	140	2.2	0.37837	**4.23**
3	200	-50	0.18145	26280	432	4690.11960	6248	142	2.3	0.76812	**4.23**
4	200	-50	0.30538	26280	432	7893.46224	6248	145	2.3	1.29337	**4.24**
5	200	-50	0.4489	26280	432	11603.16720	6248	147	2.4	1.90185	**4.24**
6	200	0	0.59344	26280	432	15339.23712	6248	152	2.4	2.51628	**4.24**
7	200	0	0.72765	26280	432	18808.29720	6248	154	2.5	3.08636	**4.24**
8	250	0	0.84968	26280	432	21962.52864	6248	157	2.5	3.60573	**4.24**
9	250	0	0.93127	26280	432	24071.46696	6248	159	2.5	3.95327	**4.25**
10	250	0	0.9478	26280	432	24498.73440	6248	158	2.5	4.02278	**4.24**
11	250	0	0.89255	26280	432	23070.63240	6248	157	2.5	3.78766	**4.24**
12	250	0	0.7753	26280	432	20039.95440	6248	154	2.5	3.28847	**4.24**
13	300	0	0.63398	26280	432	16387.11504	6248	149	2.4	2.68685	**4.24**
14	300	0	0.49462	26280	432	12784.93776	6248	145	2.3	2.09486	**4.24**
15	300	50	0.35974	26280	432	9298.55952	6248	142	2.3	1.52286	**4.23**
16	350	50	0.22753	26280	432	5881.19544	6248	139	2.2	0.96271	**4.23**
17	350	50	0.11619	26280	432	3003.27912	6248	135	2.2	0.49129	**4.23**
18	400	0	0.03912	26280	432	1011.17376	6248	134	2.1	0.16539	**4.23**
19	0	-50	0.0042	26280	432	108.56160	6248	133	2.1	0.01775	**4.23**
20	0	-50	0.00468	26280	432	120.96864	6248	133	2.1	0.01978	**4.23**
21	0	-50	0.0052	26280	432	134.40960	6248	136	2.2	0.02199	**4.23**
22	0	-50	0.00567	26280	432	146.55816	6248	135	2.2	0.02397	**4.23**
23	0	-50	0.00623	26280	432	161.03304	6248	136	2.2	0.02635	**4.23**
24	500	-250	0.01616	26280	432	417.70368	6248	136	2.2	0.06834	**4.23**

POMONA - 8-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	100	-50	0.59146	26280	432	15288.05808	6248	138	2.2	2.50214	**4.23**
2	100	0	1.20437	26280	432	31130.55576	6248	140	2.2	5.09669	**4.23**
3	100	0	2.08811	26280	432	53973.46728	6248	142	2.3	8.83941	**4.23**
4	100	0	3.14746	26280	432	81355.54608	6248	145	2.3	13.33042	**4.24**
5	100	0	4.34608	26280	432	112337.47584	6248	147	2.4	18.41296	**4.24**
6	100	0	5.57952	26280	432	144219.43296	6248	152	2.4	23.65804	**4.24**
7	100	0	6.79151	26280	432	175546.95048	6248	154	2.5	28.80652	**4.24**
8	100	0	7.82163	26280	432	202173.49224	6248	157	2.5	33.19217	**4.24**
9	100	0	8.41525	26280	432	217517.38200	6248	159	2.5	35.72301	**4.25**
10	100	0	8.44758	26280	432	218353.04784	6248	158	2.5	35.85436	**4.24**
11	100	0	7.8987	26280	432	204165.59760	6248	157	2.5	33.51922	**4.24**
12	100	0	6.84909	26280	432	177035.27832	6248	154	2.5	29.05075	**4.24**
13	100	0	5.65066	26280	432	146058.25968	6248	149	2.4	23.94790	**4.24**
14	100	0	4.41875	26280	432	114215.85000	6248	145	2.3	18.71471	**4.24**
15	100	0	3.20379	26280	432	82811.56392	6248	142	2.3	13.56233	**4.23**
16	150	0	2.10868	26280	432	54505.16064	6248	139	2.2	8.92211	**4.23**
17	150	0	1.168	26280	432	30190.46400	6248	135	2.2	4.93873	**4.23**
18	200	0	0.48016	26280	432	12411.17568	6248	134	2.1	2.02996	**4.23**
19	500	-200	0.19471	26280	432	5032.86408	6248	133	2.1	0.82304	**4.23**
20	500	0	0.07366	26280	432	1903.96368	6248	133	2.1	0.31136	**4.23**
21	0	-50	0.04644	26280	432	1200.38112	6248	136	2.2	0.19640	**4.23**
22	0	-50	0.05041	26280	432	1302.99768	6248	135	2.2	0.21315	**4.23**
23	0	-50	0.05369	26280	432	1387.77912	6248	136	2.2	0.22706	**4.23**
24	100	-50	0.21115	26280	432	5457.80520	6248	136	2.2	0.89297	**4.23**

POMONA - 8-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	100	-50	65.9476	26280	432	1704613.56480	6248	138	2.2	278.98749	**4.23**
2	50	0	58.23568	26280	432	1505275.85664	6248	140	2.2	246.44333	**4.23**
3	50	0	70.24739	26280	432	1815754.53672	6248	142	2.3	297.37218	**4.23**
4	50	0	88.80241	26280	432	2295364.69368	6248	145	2.3	376.10432	**4.24**
5	50	0	111.03137	26280	432	2869938.85176	6248	147	2.4	470.40466	**4.24**
6	50	0	135.13711	26280	432	3493024.01928	6248	152	2.4	573.00263	**4.24**
7	50	0	158.47651	26280	432	4096300.83048	6248	154	2.5	672.18589	**4.24**
8	50	0	179.27428	26280	432	4633881.58944	6248	157	2.5	760.77517	**4.24**
9	50	0	197.23857	26280	432	5098222.55736	6248	159	2.5	837.28405	**4.25**
10	50	0	218.81575	26280	432	5655949.50600	6248	158	2.5	928.72734	**4.24**
11	50	0	244.03622	26280	432	6307848.21456	6248	157	2.5	1035.60141	**4.24**
12	50	0	270.93265	26280	432	7003067.13720	6248	154	2.5	1149.17413	**4.24**
13	50	0	285.34864	26280	432	7375691.64672	6248	149	2.4	1209.32803	**4.24**
14	50	0	285.77704	26280	432	7386764.92992	6248	145	2.3	1210.34982	**4.24**
15	50	0	275.07823	26280	432	7110222.08904	6248	142	2.3	1164.46480	**4.23**
16	50	0	256.69684	26280	432	6635099.92032	6248	139	2.2	1086.11883	**4.23**
17	50	0	236.76058	26280	432	6119787.47184	6248	135	2.2	1001.11033	**4.23**
18	50	0	207.98698	26280	432	5376047.45904	6248	134	2.1	879.30119	**4.23**
19	50	0	170.7548	26280	432	4413670.07040	6248	133	2.1	721.77761	**4.23**
20	100	-50	154.35448	26280	432	3989754.59904	6248	133	2.1	652.45374	**4.23**
21	100	-50	130.80712	26280	432	3381102.43776	6248	136	2.2	553.19084	**4.23**
22	100	-50	109.58201	26280	432	2832475.79448	6248	135	2.2	463.35282	**4.23**
23	100	-50	93.63298	26280	432	2420225.26704	6248	136	2.2	395.97926	**4.23**
24	100	-50	78.6095	26280	432	2031898.35600	6248	136	2.2	332.44410	**4.23**

REDLANDS - 8-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-500	0	0.04181	8760	478	346.27042	2088	291	13.9	0.19269	**4.61**
2	150	-100	0.08511	8760	478	704.88102	2088	250	12.0	0.38350	**4.51**
3	150	-100	0.18241	8760	478	1510.71962	2088	209	10.0	0.80400	**4.41**
4	150	-100	0.31173	8760	478	2581.74786	2088	167	8.0	1.34396	**4.31**
5	150	-100	0.45602	8760	478	3776.75764	2088	125	6.0	1.92397	**4.22**
6	200	-100	0.60555	8760	478	5015.16510	2088	84	4.0	2.50258	**4.13**
7	200	-50	0.75634	8760	478	6264.00788	2088	51	2.4	3.07511	**4.07**
8	200	-100	0.88379	8760	478	7319.54878	2088	31	1.5	3.55836	**4.03**
9	200	-50	0.9679	8760	478	8016.14780	2088	25	1.2	3.88568	**4.01**
10	250	-50	0.99231	8760	478	8218.31142	2088	20	1.0	3.97404	**4.00**
11	250	-50	0.94769	8760	478	7848.76858	2088	20	1.0	3.79534	**4.00**
12	250	-50	0.83365	8760	478	6904.28930	2088	21	1.0	3.34025	**4.01**
13	250	-50	0.69935	8760	478	5792.01670	2088	35	1.7	2.82125	**4.03**
14	300	-50	0.54905	8760	478	4547.23210	2088	53	2.5	2.23451	**4.07**
15	300	-50	0.40803	8760	478	3379.30446	2088	83	4.0	1.68544	**4.13**
16	300	-50	0.27569	8760	478	2283.26458	2088	120	5.7	1.16020	**4.21**
17	350	-50	0.15386	8760	478	1274.26852	2088	162	7.8	0.66161	**4.30**
18	400	-50	0.05645	8760	478	467.51890	2088	208	10.0	0.24868	**4.41**
19	-50	0	0.00342	8760	478	28.32444	2088	249	11.9	0.01540	**4.50**
20	-50	0	0.00391	8760	478	32.38262	2088	290	13.9	0.01801	**4.61**
21	-50	0	0.0043	8760	478	35.61260	2088	318	15.2	0.02012	**4.68**
22	-50	0	0.0046	8760	478	38.09720	2088	341	16.3	0.02181	**4.74**
23	-50	0	0.00521	8760	478	43.14922	2088	344	16.5	0.02474	**4.75**
24	-500	50	0.01975	8760	478	163.56950	2088	327	15.7	0.09288	**4.70**

REDLANDS - 8-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	WORKER PERIOD AVE CONC	% WORKER CALM & MISSING HRS	QUOTIENT (FACTOR)
1	-50	0	0.52894	8760	478	4380.68108	2088	291	2.43777	13.9	**4.61**
2	50	-50	1.22841	8760	478	10173.69162	2088	250	5.53520	12.0	**4.51**
3	50	-50	2.14057	8760	478	17728.20074	2088	209	9.43491	10.0	**4.41**
4	50	-50	3.12441	8760	478	25876.36362	2088	167	13.47026	8.0	**4.31**
5	100	-50	4.19282	8760	478	34724.93524	2088	125	17.68973	6.0	**4.22**
6	100	-50	5.31036	8760	478	43980.40152	2088	84	21.94631	4.0	**4.13**
7	100	-50	6.45196	8760	478	53435.13272	2088	51	26.23227	2.4	**4.07**
8	100	-50	7.43242	8760	478	61555.30244	2088	31	29.92479	1.5	**4.03**
9	100	-50	7.96745	8760	478	65986.42090	2088	25	31.98566	1.2	**4.01**
10	100	-50	7.90056	8760	478	65432.43792	2088	20	31.64044	1.0	**4.00**
11	100	-50	7.20298	8760	478	59655.08036	2088	20	28.84675	1.0	**4.00**
12	100	-50	6.14084	8760	478	50858.43688	2088	21	24.60495	1.0	**4.01**
13	100	0	5.07104	8760	478	41998.35328	2088	35	20.45706	1.7	**4.03**
14	150	-50	4.07763	8760	478	33770.93166	2088	53	16.59505	2.5	**4.07**
15	150	0	3.14168	8760	478	26019.39376	2088	83	12.97725	4.0	**4.13**
16	150	0	2.23696	8760	478	18526.50272	2088	120	9.41387	5.7	**4.21**
17	150	0	1.32077	8760	478	10938.61714	2088	162	5.67945	7.8	**4.30**
18	150	0	0.517	8760	478	4281.79400	2088	208	2.27755	10.0	**4.41**
19	500	-100	0.07352	8760	478	608.89264	2088	249	0.33110	11.9	**4.50**
20	-50	0	0.04779	8760	478	395.79678	2088	290	0.22013	13.9	**4.61**
21	-50	0	0.05202	8760	478	430.82964	2088	318	0.24341	15.2	**4.68**
22	-50	0	0.05512	8760	478	456.50384	2088	341	0.26131	16.3	**4.74**
23	-50	0	0.05897	8760	478	488.38954	2088	344	0.28004	16.5	**4.75**
24	-50	0	0.18742	8760	478	1552.21244	2088	327	0.88144	15.7	**4.70**

REDLANDS - 8-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-300	50	45.47894	8760	478	376656.58108	2088	291	13.9	209.60299	**4.61**
2	-50	0	45.80464	8760	478	379354.02848	2088	250	12.0	206.39501	**4.51**
3	-50	0	53.94402	8760	478	446764.37364	2088	209	10.0	237.76710	**4.41**
4	50	0	74.29323	8760	478	615296.53086	2088	167	8.0	320.30012	**4.31**
5	50	0	96.44381	8760	478	798747.63442	2088	125	6.0	406.90149	**4.22**
6	50	0	123.94464	8760	478	1026509.50848	2088	84	4.0	512.23029	**4.13**
7	50	0	151.19332	8760	478	1252183.07624	2088	51	2.4	614.71923	**4.07**
8	50	0	175.86202	8760	478	1456489.24964	2088	31	1.5	708.06478	**4.03**
9	50	0	200.54185	8760	478	1660887.60170	2088	25	1.2	805.08367	**4.01**
10	50	0	230.43001	8760	478	1908421.34282	2088	20	1.0	922.83431	**4.00**
11	50	0	263.81094	8760	478	2184882.20508	2088	20	1.0	1056.51944	**4.00**
12	50	0	299.22627	8760	478	2478191.96814	2088	21	1.0	1198.93177	**4.01**
13	50	0	298.91289	8760	478	2475596.55498	2088	35	1.7	1205.84343	**4.03**
14	50	0	277.77399	8760	478	2300524.18518	2088	53	2.5	1130.47872	**4.07**
15	50	0	252.24911	8760	478	2089127.12902	2088	83	4.0	1041.95867	**4.13**
16	50	0	224.21967	8760	478	1856987.30694	2088	120	5.7	943.59111	**4.21**
17	50	0	190.84881	8760	478	1580609.84442	2088	162	7.8	820.66970	**4.30**
18	50	0	147.20039	8760	478	1219113.62998	2088	208	10.0	648.46470	**4.41**
19	50	0	96.70574	8760	478	800916.93868	2088	249	11.9	435.51764	**4.50**
20	100	-50	65.67926	8760	478	543955.63132	2088	290	13.9	302.53372	**4.61**
21	100	-50	44.74535	8760	478	370580.98870	2088	318	15.2	209.36779	**4.68**
22	-300	50	46.41385	8760	478	384399.50570	2088	341	16.3	220.03406	**4.74**
23	-300	50	48.26296	8760	478	399713.83472	2088	344	16.5	229.19371	**4.75**
24	-300	50	48.06504	8760	478	398074.66128	2088	327	15.7	226.05035	**4.70**

SAN BERNARDINO - 8-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	200	350	0.04085	26280	1292	1020.75980	6248	872	14.0	0.18987	**4.65**
2	100	200	0.09946	26280	1292	2485.30648	6248	823	13.2	0.45812	**4.61**
3	100	150	0.20057	26280	1292	5011.84316	6248	744	11.9	0.91058	**4.54**
4	100	150	0.33332	26280	1292	8329.00016	6248	636	10.2	1.48414	**4.45**
5	150	150	0.48464	26280	1292	12110.18432	6248	526	8.4	2.11643	**4.37**
6	150	150	0.64456	26280	1292	16106.26528	6248	414	6.6	2.76076	**4.28**
7	150	150	0.79252	26280	1292	19803.48976	6248	312	5.0	3.33617	**4.21**
8	150	150	0.92034	26280	1292	22997.45592	6248	206	3.3	3.80627	**4.14**
9	200	200	1.02323	26280	1292	25568.47124	6248	138	2.2	4.18469	**4.09**
10	200	200	1.0794	26280	1292	26972.04720	6248	99	1.6	4.38641	**4.06**
11	200	200	1.04725	26280	1292	26168.68300	6248	87	1.4	4.24747	**4.06**
12	200	200	0.92541	26280	1292	23124.14508	6248	91	1.5	3.75575	**4.06**
13	200	200	0.78218	26280	1292	19545.11384	6248	92	1.5	3.17497	**4.06**
14	250	250	0.6348	26280	1292	15862.38240	6248	109	1.7	2.58387	**4.07**
15	250	250	0.49254	26280	1292	12307.58952	6248	150	2.4	2.01830	**4.10**
16	250	250	0.34312	26280	1292	8573.88256	6248	208	3.3	1.41952	**4.14**
17	300	300	0.19921	26280	1292	4977.85948	6248	282	4.5	0.83437	**4.19**
18	300	300	0.08024	26280	1292	2005.03712	6248	370	5.9	0.34111	**4.25**
19	500	500	0.0042	26280	1292	104.94960	6248	461	7.4	0.01814	**4.32**
20	500	-400	0.00275	26280	1292	68.71700	6248	565	9.0	0.01209	**4.40**
21	-50	0	0.00279	26280	1292	69.71652	6248	674	10.8	0.01251	**4.48**
22	-50	0	0.00305	26280	1292	76.21340	6248	769	12.3	0.01391	**4.56**
23	500	-450	0.00363	26280	1292	90.70644	6248	830	13.3	0.01674	**4.61**
24	500	-400	0.01549	26280	1292	387.06412	6248	878	14.1	0.07208	**4.65**

SAN BERNARDINO - 8-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	50	100	0.61923	26280	1292	15473.31924	6248	872	14.0	2.87822	**4.65**
2	50	50	1.30694	26280	1292	32657.81672	6248	823	13.2	6.01987	**4.61**
3	50	50	2.2765	26280	1292	56885.18200	6248	744	11.9	10.33524	**4.54**
4	50	50	3.33493	26280	1292	83333.23084	6248	636	10.2	14.84911	**4.45**
5	50	50	4.37187	26280	1292	109244.28756	6248	526	8.4	19.09198	**4.37**
6	50	50	5.37512	26280	1292	134313.49856	6248	414	6.6	23.02254	**4.28**
7	50	100	6.31892	26280	1292	157897.17296	6248	312	5.0	26.59993	**4.21**
8	100	100	7.24372	26280	1292	181006.07536	6248	206	3.3	29.95797	**4.14**
9	100	100	8.1813	26280	1292	204434.32440	6248	138	2.2	33.45897	**4.09**
10	100	100	8.82249	26280	1292	220456.38012	6248	99	1.6	35.85240	**4.06**
11	100	100	8.99277	26280	1292	224711.33676	6248	87	1.4	36.47319	**4.06**
12	100	100	8.30546	26280	1292	207536.83448	6248	91	1.5	33.70746	**4.06**
13	100	100	7.26975	26280	1292	181656.51300	6248	92	1.5	29.50886	**4.06**
14	100	100	6.13035	26280	1292	153185.18580	6248	109	1.7	24.95279	**4.07**
15	100	100	4.96832	26280	1292	124148.38016	6248	150	2.4	20.35887	**4.10**
16	100	100	3.72613	26280	1292	93108.53644	6248	208	3.3	15.41532	**4.14**
17	100	100	2.45722	26280	1292	61401.01336	6248	282	4.5	10.29182	**4.19**
18	150	150	1.45646	26280	1292	36394.02248	6248	370	5.9	6.19157	**4.25**
19	250	300	0.78676	26280	1292	19659.55888	6248	461	7.4	3.39719	**4.32**
20	400	500	0.34453	26280	1292	8609.11564	6248	565	9.0	1.51489	**4.40**
21	400	500	0.1543	26280	1292	3855.64840	6248	674	10.8	0.69172	**4.48**
22	150	-100	0.09964	26280	1292	2489.80432	6248	769	12.3	0.45443	**4.56**
23	150	-100	0.1332	26280	1292	3328.40160	6248	830	13.3	0.61432	**4.61**
24	150	-100	0.22779	26280	1292	5692.01652	6248	878	14.1	1.05997	**4.65**

SAN BERNARDINO - 8-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	50	100	63.46595	26280	1292	1585887.15860	6248	872	14.0	294.99389	**4.65**
2	0	50	55.96467	26280	1292	1398445.17396	6248	823	13.2	257.77791	**4.61**
3	0	50	65.81835	26280	1292	1644668.92980	6248	744	11.9	298.81340	**4.54**
4	0	50	76.94855	26280	1292	1922790.36740	6248	636	10.2	342.62123	**4.45**
5	0	50	88.11255	26280	1292	2201756.39940	6248	526	8.4	384.78791	**4.37**
6	0	50	98.59945	26280	1292	2463803.05660	6248	414	6.6	422.31797	**4.28**
7	0	50	107.32754	26280	1292	2681900.56952	6248	312	5.0	451.80266	**4.21**
8	0	50	112.73519	26280	1292	2817026.92772	6248	206	3.3	466.24080	**4.14**
9	50	50	120.54293	26280	1292	3012126.73484	6248	138	2.2	492.98310	**4.09**
10	50	50	141.77071	26280	1292	3542566.50148	6248	99	1.6	576.12075	**4.06**
11	50	50	169.40463	26280	1292	4233082.89444	6248	87	1.4	687.07724	**4.06**
12	50	50	207.02118	26280	1292	5173045.24584	6248	91	1.5	840.18926	**4.06**
13	50	50	237.14305	26280	1292	5925730.53340	6248	92	1.5	962.59430	**4.06**
14	50	50	260.28953	26280	1292	6504114.77564	6248	109	1.7	1059.47463	**4.07**
15	50	50	274.82077	26280	1292	6867221.40076	6248	150	2.4	1126.14323	**4.10**
16	50	50	274.32052	26280	1292	6854721.15376	6248	208	3.3	1134.88761	**4.14**
17	50	50	267.24594	26280	1292	6677941.54872	6248	282	4.5	1119.33315	**4.19**
18	50	50	247.00929	26280	1292	6172268.13852	6248	370	5.9	1050.06263	**4.25**
19	50	50	216.76584	26280	1292	5416544.80992	6248	461	7.4	935.98493	**4.32**
20	50	100	173.1904	26280	1292	4327681.71520	6248	565	9.0	761.51359	**4.40**
21	50	100	149.39248	26280	1292	3733019.29024	6248	674	10.8	669.72000	**4.48**
22	50	100	121.76981	26280	1292	3042784.01228	6248	769	12.3	555.35390	**4.56**
23	50	100	100.07427	26280	1292	2500655.85876	6248	830	13.3	461.54593	**4.61**
24	50	100	79.55709	26280	1292	1987972.56492	6248	878	14.1	370.19973	**4.65**

KEARNY MESA - 10-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	150	-150	0.08297	26304	1813	2032.01827	7830	910	11.6	0.29364	**3.54**
2	150	-100	0.15998	26304	1813	3918.07018	7830	907	11.6	0.56595	**3.54**
3	200	-100	0.26694	26304	1813	6537.62754	7830	886	11.3	0.94148	**3.53**
4	200	-100	0.38512	26304	1813	9431.97392	7830	872	11.1	1.35556	**3.52**
5	200	-100	0.50152	26304	1813	12282.72632	7830	856	10.9	1.76122	**3.51**
6	200	-100	0.61064	26304	1813	14955.18424	7830	848	10.8	2.14196	**3.51**
7	200	-100	0.69021	26304	1813	16903.93311	7830	849	10.8	2.42142	**3.51**
8	250	-100	0.73932	26304	1813	18106.68612	7830	817	10.4	2.58187	**3.49**
9	250	-100	0.75042	26304	1813	18378.53622	7830	755	9.6	2.59767	**3.46**
10	250	-100	0.72932	26304	1813	17861.77612	7830	685	8.7	2.49990	**3.43**
11	250	-100	0.68371	26304	1813	16744.74161	7830	645	8.2	2.33051	**3.41**
12	250	-100	0.60961	26304	1813	14929.95851	7830	621	7.9	2.07102	**3.40**
13	250	-100	0.50731	26304	1813	12424.52921	7830	610	7.8	1.72085	**3.39**
14	250	-100	0.38994	26304	1813	9550.02054	7830	593	7.6	1.31961	**3.38**
15	300	-150	0.27924	26304	1813	6838.86684	7830	590	7.5	0.94459	**3.38**
16	300	-150	0.16786	26304	1813	4111.05926	7830	592	7.6	0.56798	**3.38**
17	300	-150	0.07795	26304	1813	1909.07345	7830	606	7.7	0.26427	**3.39**
18	350	-200	0.02278	26304	1813	557.90498	7830	645	8.2	0.07765	**3.41**
19	0	500	0.00482	26304	1813	118.04662	7830	702	9.0	0.01656	**3.44**
20	0	500	0.00483	26304	1813	118.29153	7830	762	9.7	0.01674	**3.47**
21	0	500	0.00496	26304	1813	121.47536	7830	797	10.2	0.01727	**3.48**
22	-50	500	0.00874	26304	1813	214.05134	7830	825	10.5	0.03056	**3.50**
23	-50	500	0.02154	26304	1813	527.53614	7830	859	11.0	0.07568	**3.51**
24	0	300	0.04544	26304	1813	1112.87104	7830	898	11.5	0.16054	**3.53**

KEARNY MESA - 10-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	50	50	1.35817	26304	1813	33262.94147	7830	910	11.6	4.80678	**3.54**
2	50	50	2.11813	26304	1813	51875.12183	7830	907	11.6	7.49316	**3.54**
3	50	50	2.81323	26304	1813	68898.81593	7830	886	11.3	9.92206	**3.53**
4	50	50	3.40099	26304	1813	83293.64609	7830	872	11.1	11.97092	**3.52**
5	100	-50	4.27704	26304	1813	104748.98664	7830	856	10.9	15.01993	**3.51**
6	100	-50	5.2404	26304	1813	128342.63640	7830	848	10.8	18.38193	**3.51**
7	100	-50	6.03015	26304	1813	147684.40365	7830	849	10.8	21.15519	**3.51**
8	100	-50	6.5101	26304	1813	159438.85910	7830	817	10.4	22.73476	**3.49**
9	100	-50	6.57622	26304	1813	161058.20402	7830	755	9.6	22.76441	**3.46**
10	100	-50	6.3076	26304	1813	154479.43160	7830	685	8.7	21.62063	**3.43**
11	100	-50	5.84464	26304	1813	143141.07824	7830	645	8.2	19.92221	**3.41**
12	100	-50	5.22149	26304	1813	127879.51159	7830	621	7.9	17.73887	**3.40**
13	100	-50	4.43399	26304	1813	108592.84909	7830	610	7.8	15.04056	**3.39**
14	100	-50	3.50471	26304	1813	85833.85261	7830	593	7.6	11.86042	**3.38**
15	100	-50	2.50936	26304	1813	61456.73576	7830	590	7.5	8.48850	**3.38**
16	100	-50	1.54547	26304	1813	37850.10577	7830	592	7.6	5.22936	**3.38**
17	150	-50	0.78926	26304	1813	19329.76666	7830	606	7.7	2.67577	**3.39**
18	200	-100	0.30774	26304	1813	7536.86034	7830	645	8.2	1.04897	**3.41**
19	0	150	0.18342	26304	1813	4492.13922	7830	702	9.0	0.63021	**3.44**
20	0	150	0.16993	26304	1813	4161.75563	7830	762	9.7	0.58882	**3.47**
21	0	150	0.16545	26304	1813	4052.03595	7830	797	10.2	0.57615	**3.48**
22	0	150	0.21125	26304	1813	5173.72375	7830	825	10.5	0.73858	**3.50**
23	0	100	0.41536	26304	1813	10172.58176	7830	859	11.0	1.45927	**3.51**
24	0	100	0.83705	26304	1813	20500.19155	7830	898	11.5	2.95733	**3.53**

KEARNY MESA - 10-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	0	50	68.76835	26304	1813	1684205.65985	7830	910	11.6	243.38232	**3.54**
2	0	50	74.07187	26304	1813	1814094.16817	7830	907	11.6	262.03874	**3.54**
3	0	50	78.4778	26304	1813	1921999.79980	7830	886	11.3	276.78569	**3.53**
4	50	0	81.98311	26304	1813	2007848.34701	7830	872	11.1	288.56688	**3.52**
5	50	0	99.45639	26304	1813	2435786.44749	7830	856	10.9	349.26677	**3.51**
6	50	0	117.63254	26304	1813	2880938.53714	7830	848	10.8	412.62368	**3.51**
7	50	0	134.71148	26304	1813	3299218.85668	7830	849	10.8	472.59975	**3.51**
8	50	0	151.26253	26304	1813	3704570.62223	7830	817	10.4	528.24335	**3.49**
9	50	0	164.57775	26304	1813	4030673.67525	7830	755	9.6	569.70653	**3.46**
10	50	0	175.05832	26304	1813	4287353.31512	7830	685	8.7	600.04945	**3.43**
11	50	0	176.15086	26304	1813	4314110.71226	7830	645	8.2	600.43295	**3.41**
12	50	0	169.94269	26304	1813	4162066.42079	7830	621	7.9	577.34310	**3.40**
13	50	0	158.91434	26304	1813	3891971.10094	7830	610	7.8	539.05417	**3.39**
14	50	0	144.4592	26304	1813	3537950.26720	7830	593	7.6	488.86973	**3.38**
15	50	-50	129.79889	26304	1813	3178904.61499	7830	590	7.5	439.07522	**3.38**
16	50	-50	127.14583	26304	1813	3113928.52253	7830	592	7.6	430.21947	**3.38**
17	50	-50	122.72119	26304	1813	3005564.66429	7830	606	7.7	416.05269	**3.39**
18	50	-50	111.89165	26304	1813	2740338.40015	7830	645	8.2	381.39713	**3.41**
19	50	-50	97.37192	26304	1813	2384735.69272	7830	702	9.0	334.55888	**3.44**
20	50	-50	76.25987	26304	1813	1867680.47617	7830	762	9.7	264.24455	**3.47**
21	0	50	59.92054	26304	1813	1467513.94514	7830	797	10.2	208.66116	**3.48**
22	0	50	56.81233	26304	1813	1391390.77403	7830	825	10.5	198.62823	**3.50**
23	0	50	58.33987	26304	1813	1428801.75617	7830	859	11.0	204.96367	**3.51**
24	0	50	63.14546	26304	1813	1546495.46086	7830	898	11.5	223.09513	**3.53**

PALOMAR - 10-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	150	50	0.11461	26304	2291	2752.12993	7820	1313	16.8	0.42295	**3.69**
2	150	50	0.21952	26304	2291	5271.33376	7820	1235	15.8	0.80051	**3.65**
3	200	50	0.34291	26304	2291	8234.29783	7820	1156	14.8	1.23564	**3.60**
4	200	50	0.47006	26304	2291	11287.55078	7820	1071	13.7	1.67248	**3.56**
5	200	0	0.59099	26304	2291	14191.44287	7820	985	12.6	2.07629	**3.51**
6	200	0	0.70014	26304	2291	16812.46182	7820	902	11.5	2.43025	**3.47**
7	250	0	0.78328	26304	2291	18808.90264	7820	951	12.2	2.73823	**3.50**
8	250	0	0.83593	26304	2291	20073.18709	7820	858	11.0	2.88325	**3.45**
9	250	0	0.84409	26304	2291	20269.13317	7820	757	9.7	2.86976	**3.40**
10	250	0	0.8161	26304	2291	19597.00930	7820	663	8.5	2.73816	**3.36**
11	250	0	0.75885	26304	2291	18222.26505	7820	623	8.0	2.53193	**3.34**
12	250	0	0.66899	26304	2291	16064.45687	7820	623	8.0	2.23210	**3.34**
13	250	0	0.54882	26304	2291	13178.81466	7820	656	8.4	1.83959	**3.35**
14	250	0	0.41206	26304	2291	9894.79678	7820	710	9.1	1.39167	**3.38**
15	300	0	0.27978	26304	2291	6718.35714	7820	766	9.8	0.95242	**3.40**
16	300	-50	0.16245	26304	2291	3900.91185	7820	842	10.8	0.55903	**3.44**
17	300	-100	0.08094	26304	2291	1943.61222	7820	779	10.0	0.27604	**3.41**
18	300	-150	0.02496	26304	2291	599.36448	7820	876	11.2	0.08631	**3.46**
19	-450	-200	0.00494	26304	2291	118.62422	7820	978	12.5	0.01734	**3.51**
20	-400	-150	0.00466	26304	2291	111.90058	7820	1085	13.9	0.01661	**3.57**
21	-400	-200	0.00408	26304	2291	97.97304	7820	1179	15.1	0.01475	**3.62**
22	-500	-250	0.00734	26304	2291	176.25542	7820	1254	16.0	0.02684	**3.66**
23	-50	250	0.01896	26304	2291	455.28648	7820	1312	16.8	0.06996	**3.69**
24	100	150	0.05053	26304	2291	1213.37689	7820	1336	17.1	0.18713	**3.70**

PALOMAR - 10-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	50	50	1.79401	26304	2291	43079.56213	7820	1313	16.8	6.62050	**3.69**
2	50	50	2.7745	26304	2291	66624.06850	7820	1235	15.8	10.11755	**3.65**
3	100	0	4.02097	26304	2291	96555.55261	7820	1156	14.8	14.48913	**3.60**
4	100	0	5.71297	26304	2291	137185.54861	7820	1071	13.7	20.32680	**3.56**
5	100	0	7.47105	26304	2291	179402.32365	7820	985	12.6	26.24760	**3.51**
6	100	0	9.08402	26304	2291	218134.57226	7820	902	11.5	31.53145	**3.47**
7	100	0	10.25315	26304	2291	246208.89095	7820	951	12.2	35.84348	**3.50**
8	100	0	10.98429	26304	2291	263765.75577	7820	858	11.0	37.88649	**3.45**
9	100	0	11.11226	26304	2291	266838.69938	7820	757	9.7	37.77980	**3.40**
10	100	0	10.70486	26304	2291	257055.80318	7820	663	8.5	35.91670	**3.36**
11	100	0	9.8762	26304	2291	237157.19060	7820	623	8.0	32.95223	**3.34**
12	100	0	8.79903	26304	2291	211291.10739	7820	623	8.0	29.35822	**3.34**
13	100	0	7.34081	26304	2291	176274.87053	7820	656	8.4	24.60565	**3.35**
14	100	0	5.64239	26304	2291	135490.71107	7820	710	9.1	19.05636	**3.38**
15	100	0	3.89019	26304	2291	93415.13247	7820	766	9.8	13.24286	**3.40**
16	100	0	2.28302	26304	2291	54822.15926	7820	842	10.8	7.85643	**3.44**
17	150	0	1.19218	26304	2291	28627.81834	7820	779	10.0	4.06587	**3.41**
18	150	0	0.42743	26304	2291	10263.87659	7820	876	11.2	1.47809	**3.46**
19	500	100	0.13519	26304	2291	3246.31747	7820	978	12.5	0.47447	**3.51**
20	-100	-50	0.11603	26304	2291	2786.22839	7820	1085	13.9	0.41369	**3.57**
21	-100	-50	0.1019	26304	2291	2446.92470	7820	1179	15.1	0.36846	**3.62**
22	-100	0	0.13253	26304	2291	3182.44289	7820	1254	16.0	0.48469	**3.66**
23	-50	50	0.32155	26304	2291	7721.38015	7820	1312	16.8	1.18644	**3.69**
24	50	50	0.91054	26304	2291	21864.79702	7820	1336	17.1	3.37212	**3.70**

PALOMAR - 10-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-50	0	64.60191	26304	2291	1551285.66483	7820	1313	16.8	238.40259	**3.69**
2	50	0	67.16566	26304	2291	1612848.99358	7820	1235	15.8	244.92771	**3.65**
3	50	0	86.7754	26304	2291	2083737.68020	7820	1156	14.8	312.68573	**3.60**
4	50	0	111.35187	26304	2291	2673892.45431	7820	1071	13.7	396.19091	**3.56**
5	50	0	139.09175	26304	2291	3340010.19275	7820	985	12.6	488.66279	**3.51**
6	50	0	167.58523	26304	2291	4024224.12799	7820	902	11.5	581.70340	**3.47**
7	50	0	194.22411	26304	2291	4663903.55343	7820	951	12.2	678.97853	**3.50**
8	50	0	224.85236	26304	2291	5399379.72068	7820	858	11.0	775.55009	**3.45**
9	50	0	252.42285	26304	2291	6061429.89705	7820	757	9.7	858.19480	**3.40**
10	50	0	275.34655	26304	2291	6611896.70515	7820	663	8.5	923.83634	**3.36**
11	50	0	282.82242	26304	2291	6791414.77146	7820	623	8.0	943.64524	**3.34**
12	50	0	277.9957	26304	2291	6675510.74410	7820	623	8.0	927.54075	**3.34**
13	50	0	262.24815	26304	2291	6297364.82595	7820	656	8.4	879.02915	**3.35**
14	50	0	239.25516	26304	2291	5745234.15708	7820	710	9.1	808.04981	**3.38**
15	50	0	213.26193	26304	2291	5121058.72509	7820	766	9.8	725.97941	**3.40**
16	50	0	185.3631	26304	2291	4451124.12030	7820	842	10.8	637.87964	**3.44**
17	50	0	158.33517	26304	2291	3802102.43721	7820	779	10.0	539.99467	**3.41**
18	50	0	125.85979	26304	2291	3022271.13727	7820	876	11.2	435.23490	**3.46**
19	50	0	93.2437	26304	2291	2239060.96810	7820	978	12.5	327.25241	**3.51**
20	50	0	62.12509	26304	2291	1491809.78617	7820	1085	13.9	221.50108	**3.57**
21	-50	0	47.17899	26304	2291	1132909.08687	7820	1179	15.1	170.59315	**3.62**
22	-50	0	51.9114	26304	2291	1246548.44820	7820	1254	16.0	189.84899	**3.66**
23	-50	0	57.95502	26304	2291	1391673.89526	7820	1312	16.8	213.84049	**3.69**
24	-50	0	62.2143	26304	2291	1493951.98590	7820	1336	17.1	230.40592	**3.70**

POMONA - 10-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	100	0	1.67498	26280	432	43294.88304	7810	175	2.2	5.67058	**3.39**
2	100	0	2.52254	26280	432	65202.61392	7810	179	2.3	8.54444	**3.39**
3	100	0	3.48087	26280	432	89973.52776	7810	183	2.3	11.79671	**3.39**
4	100	0	4.46874	26280	432	115507.99152	7810	188	2.4	15.15455	**3.39**
5	100	0	5.44049	26280	432	140625.78552	7810	189	2.4	18.45241	**3.39**
6	100	0	6.37933	26280	432	164892.92184	7810	192	2.5	21.64517	**3.39**
7	100	0	7.16963	26280	432	185320.59624	7810	193	2.5	24.32987	**3.39**
8	100	0	7.58985	26280	432	196182.44280	7810	193	2.5	25.75587	**3.39**
9	100	0	7.54073	26280	432	194912.78904	7810	194	2.5	25.59254	**3.39**
10	100	0	7.03831	26280	432	181926.23688	7810	193	2.5	23.88424	**3.39**
11	100	0	6.33091	26280	432	163641.36168	7810	190	2.4	21.47524	**3.39**
12	100	0	5.48577	26280	432	141796.18296	7810	188	2.4	18.60354	**3.39**
13	100	0	4.52666	26280	432	117005.10768	7810	184	2.4	15.34292	**3.39**
14	100	0	3.53869	26280	432	91468.05912	7810	179	2.3	11.98638	**3.39**
15	100	0	2.56683	26280	432	66347.42184	7810	174	2.2	8.68877	**3.39**
16	150	0	1.68973	26280	432	43676.14104	7810	170	2.2	5.71677	**3.38**
17	150	0	0.93943	26280	432	24282.38664	7810	168	2.2	3.17749	**3.38**
18	200	0	0.38972	26280	432	10073.48256	7810	168	2.2	1.31817	**3.38**
19	500	-200	0.15933	26280	432	4118.36184	7810	169	2.2	0.53898	**3.38**
20	500	0	0.06427	26280	432	1661.25096	7810	169	2.2	0.21741	**3.38**
21	0	-50	0.04922	26280	432	1272.23856	7810	171	2.2	0.16655	**3.38**
22	100	-50	0.17372	26280	432	4490.31456	7810	170	2.2	0.58774	**3.38**
23	100	-50	0.47768	26280	432	12347.07264	7810	170	2.2	1.61611	**3.38**
24	100	0	0.96732	26280	432	25003.28736	7810	171	2.2	3.27311	**3.38**

POMONA - 10-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	200	-50	0.14539	26280	432	3758.04072	7810	175	2.2	0.49221	**3.39**
2	200	-50	0.24454	26280	432	6320.86992	7810	179	2.3	0.82831	**3.39**
3	200	-50	0.35936	26280	432	9288.73728	7810	183	2.3	1.21788	**3.39**
4	200	0	0.475	26280	432	12277.80000	7810	188	2.4	1.61084	**3.39**
5	200	0	0.58245	26280	432	15055.16760	7810	189	2.4	1.97548	**3.39**
6	250	0	0.68649	26280	432	17744.39352	7810	192	2.5	2.32927	**3.39**
7	250	0	0.77125	26280	432	19935.27000	7810	193	2.5	2.61721	**3.39**
8	250	0	0.81936	26280	432	21178.81728	7810	193	2.5	2.78047	**3.39**
9	250	0	0.82376	26280	432	21292.54848	7810	194	2.5	2.79577	**3.39**
10	250	0	0.78241	26280	432	20223.73368	7810	193	2.5	2.65508	**3.39**
11	250	0	0.7142	26280	432	18460.64160	7810	190	2.4	2.42266	**3.39**
12	250	0	0.62035	26280	432	16034.80680	7810	188	2.4	2.10375	**3.39**
13	300	0	0.50729	26280	432	13112.43192	7810	184	2.4	1.71944	**3.39**
14	300	0	0.39583	26280	432	10231.41384	7810	179	2.3	1.34077	**3.39**
15	300	50	0.28793	26280	432	7442.41464	7810	174	2.2	0.97465	**3.39**
16	350	50	0.18215	26280	432	4708.21320	7810	170	2.2	0.61626	**3.38**
17	350	50	0.09308	26280	432	2405.93184	7810	168	2.2	0.31483	**3.38**
18	400	0	0.03142	26280	432	812.14416	7810	168	2.2	0.10627	**3.38**
19	0	-50	0.00464	26280	432	119.93472	7810	169	2.2	0.01570	**3.38**
20	0	-50	0.00508	26280	432	131.30784	7810	169	2.2	0.01718	**3.38**
21	0	-50	0.00569	26280	432	147.07512	7810	171	2.2	0.01925	**3.38**
22	500	-250	0.01302	26280	432	336.54096	7810	170	2.2	0.04405	**3.38**
23	300	-100	0.0304	26280	432	785.77920	7810	170	2.2	0.10285	**3.38**
24	200	-50	0.07176	26280	432	1854.85248	7810	171	2.2	0.24281	**3.38**

POMONA - 10-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKE HRS PROCESSE D	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	50	0	66.88293	26280	432	1728789.97464	7810	175	2.2	226.42960	**3.39**
2	50	0	78.93616	26280	432	2040341.86368	7810	179	2.3	267.37542	**3.39**
3	50	0	94.94525	26280	432	2454144.82200	7810	183	2.3	321.77066	**3.39**
4	50	0	113.62804	26280	432	2937057.57792	7810	188	2.4	385.33949	**3.39**
5	50	0	133.76259	26280	432	3457495.42632	7810	189	2.4	453.68002	**3.39**
6	50	0	155.21512	26280	432	4012000.42176	7810	192	2.5	526.64747	**3.39**
7	50	0	174.83572	26280	432	4519153.69056	7810	193	2.5	593.29837	**3.39**
8	50	0	196.43289	26280	432	5077397.34072	7810	193	2.5	666.58755	**3.39**
9	50	0	221.2805	26280	432	5719658.36400	7810	194	2.5	751.00556	**3.39**
10	50	0	249.09373	26280	432	6438574.73304	7810	193	2.5	845.29011	**3.39**
11	50	0	267.02625	26280	432	6902094.51000	7810	190	2.4	905.78668	**3.39**
12	50	0	271.20773	26280	432	7010177.40504	7810	188	2.4	919.72939	**3.39**
13	50	0	265.00007	26280	432	6849721.80936	7810	184	2.4	898.20637	**3.39**
14	50	0	252.4629	26280	432	6525661.03920	7810	179	2.3	855.15149	**3.39**
15	50	0	237.46298	26280	432	6137943.10704	7810	174	2.2	803.81654	**3.39**
16	50	0	219.40304	26280	432	5671129.77792	7810	170	2.2	742.29447	**3.38**
17	50	0	200.09348	26280	432	5172016.27104	7810	168	2.2	676.78831	**3.38**
18	50	0	174.28381	26280	432	4504887.92088	7810	168	2.2	589.49070	**3.38**
19	100	-50	148.72624	26280	432	3844275.85152	7810	169	2.2	503.11162	**3.38**
20	100	-50	136.06151	26280	432	3516917.91048	7810	169	2.2	460.26932	**3.38**
21	100	-50	116.42089	26280	432	3009247.16472	7810	171	2.2	393.93208	**3.38**
22	100	-50	95.89973	26280	432	2478816.22104	7810	170	2.2	324.45238	**3.38**
23	100	-50	79.98215	26280	432	2067378.61320	7810	170	2.2	270.59929	**3.38**
24	100	-50	67.81091	26280	432	1752776.40168	7810	171	2.2	229.45103	**3.38**

REDLANDS - 10-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	150	-100	0.14613	8760	478	1210.24866	2610	303	11.6	0.52460	**3.59**
2	150	-100	0.24958	8760	478	2067.02156	2610	258	9.9	0.87884	**3.52**
3	150	-100	0.36502	8760	478	3023.09564	2610	216	8.3	1.26278	**3.46**
4	200	-100	0.4846	8760	478	4013.45720	2610	172	6.6	1.64621	**3.40**
5	200	-50	0.6053	8760	478	5013.09460	2610	128	4.9	2.01978	**3.34**
6	200	-100	0.71152	8760	478	5892.80864	2610	86	3.3	2.33471	**3.28**
7	200	-50	0.79696	8760	478	6600.42272	2610	54	2.1	2.58233	**3.24**
8	250	-50	0.85358	8760	478	7069.34956	2610	36	1.4	2.74645	**3.22**
9	250	-50	0.87022	8760	478	7207.16204	2610	32	1.2	2.79564	**3.21**
10	250	-50	0.82892	8760	478	6865.11544	2610	29	1.1	2.65987	**3.21**
11	250	-50	0.75826	8760	478	6279.90932	2610	42	1.6	2.44545	**3.23**
12	250	-50	0.66701	8760	478	5524.17682	2610	58	2.2	2.16465	**3.25**
13	250	-50	0.55959	8760	478	4634.52438	2610	86	3.3	1.83618	**3.28**
14	300	-50	0.43933	8760	478	3638.53106	2610	122	4.7	1.46243	**3.33**
15	300	-50	0.32652	8760	478	2704.23864	2610	165	6.3	1.10603	**3.39**
16	300	-50	0.22066	8760	478	1827.50612	2610	213	8.2	0.76241	**3.46**
17	350	-50	0.12319	8760	478	1020.25958	2610	256	9.8	0.43342	**3.52**
18	400	-50	0.04524	8760	478	374.67768	2610	299	11.5	0.16213	**3.58**
19	-50	0	0.0038	8760	478	31.47160	2610	340	13.0	0.01386	**3.65**
20	-50	0	0.00417	8760	478	34.53594	2610	378	14.5	0.01547	**3.71**
21	-50	0	0.00479	8760	478	39.67078	2610	395	15.1	0.01791	**3.74**
22	-500	50	0.01591	8760	478	131.76662	2610	396	15.2	0.05952	**3.74**
23	-500	0	0.03356	8760	478	277.94392	2610	373	14.3	0.12425	**3.70**
24	150	-100	0.06827	8760	478	565.41214	2610	343	13.1	0.24941	**3.65**

REDLANDS - 10-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	50	-50	1.71658	8760	478	14216.71556	2610	303	11.6	6.16243	**3.59**
2	50	-50	2.50366	8760	478	20735.31212	2610	258	9.9	8.81603	**3.52**
3	100	-50	3.35706	8760	478	27803.17092	2610	216	8.3	11.61369	**3.46**
4	100	-50	4.25095	8760	478	35206.36790	2610	172	6.6	14.44068	**3.40**
5	100	-50	5.1653	8760	478	42779.01460	2610	128	4.9	17.23570	**3.34**
6	100	-50	6.01292	8760	478	49799.00344	2610	86	3.3	19.73019	**3.28**
7	100	-50	6.72041	8760	478	55658.43562	2610	54	2.1	21.77560	**3.24**
8	100	-50	7.11772	8760	478	58948.95704	2610	36	1.4	22.90169	**3.22**
9	100	-50	7.01506	8760	478	58098.72692	2610	32	1.2	22.53636	**3.21**
10	100	-50	6.50262	8760	478	53854.69884	2610	29	1.1	20.86583	**3.21**
11	100	-50	5.76643	8760	478	47757.57326	2610	42	1.6	18.59719	**3.23**
12	100	-50	4.91534	8760	478	40708.84588	2610	58	2.2	15.95174	**3.25**
13	100	0	4.05934	8760	478	33619.45388	2610	86	3.3	13.31991	**3.28**
14	150	-50	3.26436	8760	478	27035.42952	2610	122	4.7	10.86633	**3.33**
15	150	0	2.51516	8760	478	20830.55512	2610	165	6.3	8.51965	**3.39**
16	150	0	1.79145	8760	478	14836.78890	2610	213	8.2	6.18973	**3.46**
17	150	0	1.05852	8760	478	8766.66264	2610	256	9.8	3.72416	**3.52**
18	150	0	0.41545	8760	478	3440.75690	2610	299	11.5	1.48886	**3.58**
19	500	-100	0.05953	8760	478	493.02746	2610	340	13.0	0.21719	**3.65**
20	-50	0	0.05022	8760	478	415.92204	2610	378	14.5	0.18635	**3.71**
21	-50	0	0.05482	8760	478	454.01924	2610	395	15.1	0.20497	**3.74**
22	-50	0	0.15882	8760	478	1315.34724	2610	396	15.2	0.59410	**3.74**
23	-50	0	0.43321	8760	478	3587.84522	2610	373	14.3	1.60386	**3.70**
24	50	-50	0.98664	8760	478	8171.35248	2610	343	13.1	3.60448	**3.65**

REDLANDS - 10-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	-50	0	45.3508	8760	478	375595.32560	2610	303	11.6	162.80682	**3.59**
2	50	0	60.52773	8760	478	501290.65986	2610	258	9.9	213.13378	**3.52**
3	50	0	78.2791	8760	478	648307.50620	2610	216	8.3	270.80514	**3.46**
4	50	0	100.35242	8760	478	831118.74244	2610	172	6.6	340.90186	**3.40**
5	50	0	123.30279	8760	478	1021193.70678	2610	128	4.9	411.43985	**3.34**
6	50	0	147.25117	8760	478	1219534.18994	2610	86	3.3	483.17519	**3.28**
7	50	0	173.53484	8760	478	1437215.54488	2610	54	2.1	562.29090	**3.24**
8	50	0	204.41071	8760	478	1692929.50022	2610	36	1.4	657.70377	**3.22**
9	50	0	237.08429	8760	478	1963532.08978	2610	32	1.2	761.64938	**3.21**
10	50	0	270.99063	8760	478	2244344.39766	2610	29	1.1	869.56389	**3.21**
11	50	0	274.80034	8760	478	2275896.41588	2610	42	1.6	886.25250	**3.23**
12	50	0	263.13703	8760	478	2179300.88246	2610	58	2.2	853.95803	**3.25**
13	50	0	247.94703	8760	478	2053497.30246	2610	86	3.3	813.58847	**3.28**
14	50	0	227.47119	8760	478	1883916.39558	2610	122	4.7	757.20112	**3.33**
15	50	0	205.25923	8760	478	1699956.94286	2610	165	6.3	695.27891	**3.39**
16	50	0	181.48141	8760	478	1503029.03762	2610	213	8.2	627.04591	**3.46**
17	50	0	154.0154	8760	478	1275555.54280	2610	256	9.8	541.86727	**3.52**
18	50	0	118.85346	8760	478	984344.35572	2610	299	11.5	425.93871	**3.58**
19	50	0	78.48865	8760	478	650042.99930	2610	340	13.0	286.36255	**3.65**
20	100	-50	55.02469	8760	478	455714.48258	2610	378	14.5	204.17316	**3.71**
21	-300	50	46.19985	8760	478	382627.15770	2610	395	15.1	172.74364	**3.74**
22	-300	50	45.56241	8760	478	377347.87962	2610	396	15.2	170.43716	**3.74**
23	-300	50	43.32203	8760	478	358793.05246	2610	373	14.3	160.39028	**3.70**
24	-300	50	40.49639	8760	478	335391.10198	2610	343	13.1	147.94491	**3.65**

SAN BERNARDINO - 10-HOUR ANALYSIS - LARGE POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	100	150	0.16062	26280	2291	3853.11318	7810	945	12.1	0.56127	**3.49**
2	100	150	0.26681	26280	2291	6400.50509	7810	857	11.0	0.92054	**3.45**
3	150	150	0.38784	26280	2291	9303.89376	7810	768	9.8	1.32120	**3.41**
4	150	150	0.51578	26280	2291	12373.04642	7810	659	8.4	1.73025	**3.35**
5	150	150	0.63431	26280	2291	15216.46259	7810	547	7.0	2.09507	**3.30**
6	150	150	0.74255	26280	2291	17813.03195	7810	433	5.5	2.41467	**3.25**
7	200	200	0.84805	26280	2291	20343.87145	7810	332	4.3	2.72050	**3.21**
8	200	200	0.92818	26280	2291	22266.11002	7810	229	2.9	2.93709	**3.16**
9	200	200	0.95389	26280	2291	22882.86721	7810	160	2.0	2.99122	**3.14**
10	200	200	0.91165	26280	2291	21869.57185	7810	125	1.6	2.84575	**3.12**
11	200	200	0.83833	26280	2291	20110.69837	7810	116	1.5	2.61382	**3.12**
12	200	200	0.74042	26280	2291	17761.93538	7810	132	1.7	2.31335	**3.12**
13	200	200	0.6259	26280	2291	15014.71510	7810	171	2.2	1.96553	**3.14**
14	250	250	0.50812	26280	2291	12189.29068	7810	227	2.9	1.60745	**3.16**
15	250	250	0.39411	26280	2291	9454.30479	7810	302	3.9	1.25923	**3.20**
16	250	250	0.27457	26280	2291	6586.65973	7810	393	5.0	0.88805	**3.23**
17	300	300	0.15944	26280	2291	3824.80616	7810	483	6.2	0.52202	**3.27**
18	300	300	0.06426	26280	2291	1541.53314	7810	591	7.6	0.21354	**3.32**
19	500	500	0.00341	26280	2291	81.80249	7810	703	9.0	0.01151	**3.38**
20	-50	0	0.00273	26280	2291	65.48997	7810	810	10.4	0.00936	**3.43**
21	500	-400	0.00355	26280	2291	85.16095	7810	909	11.6	0.01234	**3.48**
22	500	-400	0.01276	26280	2291	306.09964	7810	996	12.8	0.04492	**3.52**
23	200	350	0.03276	26280	2291	785.87964	7810	1024	13.1	0.11581	**3.54**
24	100	200	0.07971	26280	2291	1912.16319	7810	1008	12.9	0.28112	**3.53**

DO NOT CITE OR QUOTE

SAN BERNARDINO - 10-HOUR ANALYSIS - MEDIUM POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	50	50	1.82487	26280	2291	43776.80643	7810	945	12.1	6.37681	**3.49**
2	50	50	2.67182	26280	2291	64094.28998	7810	857	11.0	9.21822	**3.45**
3	50	50	3.50148	26280	2291	83997.00372	7810	768	9.8	11.92800	**3.41**
4	50	50	4.30472	26280	2291	103265.92808	7810	659	8.4	14.44077	**3.35**
5	50	100	5.06866	26280	2291	121592.08474	7810	547	7.0	16.74130	**3.30**
6	100	100	5.91978	26280	2291	142009.60242	7810	433	5.5	19.25032	**3.25**
7	100	100	6.91876	26280	2291	165974.13364	7810	332	4.3	22.19499	**3.21**
8	100	100	7.75458	26280	2291	186024.61962	7810	229	2.9	24.53827	**3.16**
9	100	100	8.257	26280	2291	198077.17300	7810	160	2.0	25.89244	**3.14**
10	100	100	8.0456	26280	2291	193005.89840	7810	125	1.6	25.11463	**3.12**
11	100	100	7.431	26280	2291	178262.25900	7810	116	1.5	23.16900	**3.12**
12	100	100	6.66787	26280	2291	159955.53343	7810	132	1.7	20.83297	**3.12**
13	100	100	5.82847	26280	2291	139819.16683	7810	171	2.2	18.30333	**3.14**
14	100	100	4.91446	26280	2291	117892.98094	7810	227	2.9	15.54701	**3.16**
15	100	100	3.97902	26280	2291	95452.71078	7810	302	3.9	12.71347	**3.20**
16	100	100	2.9845	26280	2291	71595.17050	7810	393	5.0	9.65285	**3.23**
17	100	100	1.96987	26280	2291	47255.21143	7810	483	6.2	6.44946	**3.27**
18	150	150	1.16932	26280	2291	28050.81748	7810	591	7.6	3.88569	**3.32**
19	250	300	0.63256	26280	2291	15174.48184	7810	703	9.0	2.13515	**3.38**
20	400	500	0.28079	26280	2291	6735.87131	7810	810	10.4	0.96227	**3.43**
21	400	500	0.14007	26280	2291	3360.13923	7810	909	11.6	0.48691	**3.48**
22	150	-100	0.19283	26280	2291	4625.79887	7810	996	12.8	0.67887	**3.52**
23	50	100	0.50387	26280	2291	12087.33743	7810	1024	13.1	1.78122	**3.54**
24	50	50	1.0492	26280	2291	25169.25880	7810	1008	12.9	3.70027	**3.53**

SAN BERNARDINO - 10-HOUR ANALYSIS - SMALL POINT SOURCE

SCENARIO	X	Y	MODELED PERIOD AVE CONC	TOTAL HRS PROCESSED REPORTED BY AERMOD	NO. CALM & MISSING HRS REPORTED BY AERMOD	SUM HRLY CONC	TOTAL WORKER HRS PROCESSED	WORKER NO. CALM & MISSING HRS	% WORKER CALM & MISSING HRS	WORKER PERIOD AVE CONC	QUOTIENT (FACTOR)
1	0	50	60.43292	26280	2291	1449725.31788	7810	945	12.1	211.17630	**3.49**
2	0	50	69.41259	26280	2291	1665138.62151	7810	857	11.0	239.48492	**3.45**
3	0	50	77.69048	26280	2291	1863716.92472	7810	768	9.8	264.65733	**3.41**
4	0	50	85.534	26280	2291	2051875.12600	7810	659	8.4	286.93541	**3.35**
5	0	50	93.35436	26280	2291	2239477.74204	7810	547	7.0	308.34060	**3.30**
6	0	50	100.18756	26280	2291	2403399.37684	7810	433	5.5	325.79631	**3.25**
7	50	50	106.42361	26280	2291	2552995.98029	7810	332	4.3	341.40091	**3.21**
8	50	50	125.22838	26280	2291	3004103.60782	7810	229	2.9	396.26746	**3.16**
9	50	50	150.67387	26280	2291	3614515.46743	7810	160	2.0	472.48568	**3.14**
10	50	50	184.43774	26280	2291	4424476.94486	7810	125	1.6	575.72895	**3.12**
11	50	50	211.62126	26280	2291	5076582.40614	7810	116	1.5	659.81055	**3.12**
12	50	50	232.56731	26280	2291	5579057.19959	7810	132	1.7	726.62897	**3.12**
13	50	50	246.19103	26280	2291	5905876.61867	7810	171	2.2	773.12169	**3.14**
14	50	50	248.55743	26280	2291	5962644.18827	7810	227	2.9	786.31731	**3.16**
15	50	50	246.83969	26280	2291	5921437.32341	7810	302	3.9	788.68371	**3.20**
16	50	50	238.7665	26280	2291	5727769.56850	7810	393	5.0	772.24883	**3.23**
17	50	50	227.65219	26280	2291	5461148.38591	7810	483	6.2	745.34576	**3.27**
18	50	50	209.04015	26280	2291	5014664.15835	7810	591	7.6	694.64803	**3.32**
19	50	50	182.12183	26280	2291	4368920.57987	7810	703	9.0	614.73485	**3.38**
20	50	100	150.39433	26280	2291	3607809.58237	7810	810	10.4	515.40137	**3.43**
21	50	100	130.14718	26280	2291	3122100.70102	7810	909	11.6	452.41280	**3.48**
22	50	100	105.33813	26280	2291	2526956.40057	7810	996	12.8	370.84773	**3.52**
23	50	100	85.36188	26280	2291	2047746.13932	7810	1024	13.1	301.76041	**3.54**
24	50	100	68.96638	26280	2291	1654434.48982	7810	1008	12.9	243.22765	**3.53**

DO NOT CITE OR QUOTE