TABLES

Table 4.1-1
List of Selected Chemicals for Detailed Evaluation in the Stack Emissions Risk Assessment

Constituent	CAS NO.	Potentially Present in Spent Carbon (a) (√ /N)	PDT Methods: Included in Stack Sampling Analysis (√ / X) (c)	PDT Results: Detected in Stack Samples (Y/ND/--)	Spiked During PDT (√) (% total feed from spiked material) (d)	Selected as Chemical for Evaluation (√ /N)
Inorganic Compounds						
Aluminum	7429-90-5	N	√	Y		√
Antimony	7440-36-0	√	√	ND		√
Arsenic	7440-38-2	√	√	ND		√
Barium	7440-39-3	√	√	Y		√
Beryllium	7440-41-7	√	√	ND		√
Cadmium	7440-43-9	√	√	Y		√
Chromium (III)	7440-47-3	√	√	Y	√ (96%)	√
Chromium VI (Cr6+)	18540-29-9	√	√	Y		√
Cobalt	7440-48-4	√	√	ND		√
Copper	7440-50-8	√	√	Y		√
Lead [(b)]	7439-92-1	√	√	Y	√ (97%)	√
Manganese	7439-96-5	√	√	Y		√
Mercury (divalent)	7487-94-7	√	√	Y		√
Mercury (elemental)	7439-97-6	√	√	Y		√
Mercury (methyl)	22967-92-6	N	X	-- compound created after emission)		√
Nickel	7440-02-0	√	√	Y		√
Selenium	7782-49-2	√	√	Y		√
Silver	7440-22-4	√	√	Y		√
Thallium	7440-28-0	√	√	ND		√
Vanadium	7440-62-2	√	√	ND		√
Zinc	7440-66-6	√	√	Y		√
Organic Compounds						
1,1,1-Trichloroethane	71-55-6	√	√	ND		√
1,1,2,2-Tetrachloroethane	79-34-5	√	√	ND		√
1,1,2-Trichloroethane	79-00-5	√	√	ND		√
1,1-Dichloroethane	75-34-3	√	√	ND		√
1,1-Dichloroethene	75-35-4	√	√	ND		√
1,1-Dichloropropene	563-58-6	NC	√+	ND		√
1,2,3-Trichlorobenzene	87-61-6	NC	√+	ND		√
1,2,3-Trichloropropane	96-18-4	√	√	ND		√
1,2,4-Trichlorobenzene	120-82-1	N	√	ND		√
1,2,4-Trimethy benzene	95-63-6	√	√ (TIC)	ND		√
1,2-Dibromo-3-chloropropane	96-12-8	N	√	ND		√
1,2-Dibromoethane (ethylene dibromide)	106-93-4	√	√	ND		√
1,2-Dichlorobenzene	95-50-1	√	√	ND		√
1,2-Dichloroethane	107-06-2	√	√	Y		√
1,2-Dichloroethene	540-59-0	√	√	-- (data provided for cis- and trans-isomers)		N (evaluated separately as the individual isomers)
1,2-Dichloroethene (cis)	156-59-2	√	√	Y (*)		√
1,2-Dichloroethene (trans)	156-60-5	√	√	ND		√
1,2-Dichloropropane	78-87-5	√	√	ND		√
1,2-Diphenylhydrazine	122-66-7	NC	√+	ND		√
1,3,5-Trimethy benzene	108-67-8	NC	√+	ND		√
1,3-Dichlorobenzene	541-73-1	√	√	ND		√
1,3-Dichloropropane	142-28-9	NC	√+	ND		√
1,3-Dichloropropene (cis)	10061-01-5	NC	√+	ND		√

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1,3-Dichloropropene (trans)	10061-02-6	NC	√+	ND		√
1,3-Dinitrobenzene	99-65-0	N	√	ND		√
1,4-Dichlorobenzene	106-46-7	√	√	ND		√
1-Butanol	71-36-3	√	√ (TIC)	--		N (not reported in spent carbon during 1997-2007)
1-Hexane (n-hexane)	110-54-3	√	√ (TIC)	--		√
2,2'-oxybis (1-Chloropropane)	108-60-1	N	√	ND		√
2,2-Dichloropropane	594-20-7	NC	√+	ND		√
2,3,4,6-Tetrachlorophenol	58-90-2	√	√ (TIC)	--		N (not reported in spent carbon during 1997-2007)
2,4,5-Trichlorophenol	95-95-4	N	√	ND		√
2,4,6-Trichlorophenol	88-06-2	N	√	ND		√
2,4-Dichlorophenol	120-83-2	N	√	ND		√
2,4-Dimethylphenol	105-67-9	N	√	ND		√
2,4-Dinitrophenol	51-28-5	N	√	ND		√
2,4-Dinitrotoluene	121-14-2	N	√	ND		√
2,5-Dimethylfuran	625-86-5	NC	√+	Y (TIC)		√
2,5-Dimethylheptane	2216-30-0	NC	√+	Y (TIC)		√
2,5-Dione, 3-hexene	17559-81-8	NC	√+	Y (TIC)		√
2,6-Dinitrotoluene	606-20-2	N	√	ND		√
2-Butanol	78-92-2	√	X	--		N (not reported in spent carbon during 1997-2007)
2-Butanone (methyl ethyl ketone)	78-93-3	N	√	ND		√
2-Butoxyethanol	111-76-2	√	X	--		N (not reported in spent carbon during 1997-2007)
2-Chloronaphthalene	91-58-7	N	√	ND		√
2-Chlorophenol	95-57-8	N	√	ND		√
2-Chlorotoluene	95-49-8	NC	√+	ND		√
2-Ethyl-1-methylbenzene	611-14-3	√	√ (TIC)	--		N (not reported in spent carbon during 1997-2007)
2-Hexanone	591-78-6	N	√	ND		√
2-Methoxy-1-propanol	1589-47-5	√	X	--		N (not reported in spent carbon during 1997-2007)
2-Methyl octane	3221-61-2	NC	√+	Y (TIC)		√
2-Nitroaniline	88-74-4	N	√	ND		√
2-Nitrophenol	88-75-5	N	√	ND		√
3,3'-Dichlorobenzidine	91-94-1	N	√	ND		√
3-Ethyl benzaldehyde	34246-54-3	NC	√+	Y (TIC)		√
3-Hexen-2-one	763-93-9	NC	√+	Y (TIC)		√
3-Nitroaniline	99-09-2	N	√	ND		√

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List of Selected Chemicals for Detailed Evaluation in the Stack Emissions Risk Assessment

Constituent	CAS NO.	Potentially Present in Spent Carbon (a) (√ /N)	PDT Methods: Included in Stack Sampling Analysis (√ / X) (c)	PDT Results: Detected in Stack Samples (Y/ND/--)	Spiked During PDT (√) (% total feed from spiked material) (d)	Selected as Chemical for Evaluation (√ /N)
3-Penten-2-one (ethylidene acetone)	625-33-2	NC	√+	Y (TIC)		√
3-Penten-2-one, 4-methyl	141-79-7	NC	√+	Y (TIC)		√
4,4'-DDD	72-54-8	N	√	Y (*, COL)		√
4,4'-DDE	72-55-9	N	√	Y (*)		√
4,4'-DDT	50-29-3	N	√	Y (*, COL)		√
4,6-Dinitro-2-methylphenol	534-52-1	N	√	ND		√
4-Bromophenyl-phenyl ether	101-55-3	N	√	ND		√
4-Chloro-3-methylphenol	59-50-7	N	√	ND		√
4-Chloroaniline	106-47-8	N	√	ND		√
4-Chlorophenyl-phenyl ether	7005-72-3	N	√	ND		√
4-Chlorotoluene	106-43-4	NC	√+	ND		√
4-Ethyl benzaldehyde	4748-78-1	NC	√+	Y (TIC)		√
4-Ethyl-1-methylbenzene	622-96-8	√	√ (TIC)	--		N (not reported in spent carbon during 1997-2007)
4-Nitroaniline	100-01-6	N	√	ND		√
4-Nitrophenol	100-02-7	N	√	ND		√
9-Octadecenamide (oleamide)	301-02-0	NC	√+	Y (TIC)		√
Acenaphthene	83-32-9	√	√	Y (B)		√
Acenaphthylene	208-96-8	√	√	Y		√
Acetone	67-64-1	√	√	Y (B)		√
Acetophenone	98-86-2	NC	√+	Y		√
Acrylic Acid	79-10-7	√	X	--		√
Acrylonitrile	107-13-1	√	√	ND		√
Aldrin	309-00-2	√	√	ND		√
Aniline	62-53-3	√	√	ND		√
Anthracene	120-12-7	N	√	Y		√
Benzaldehyde	100-52-7	NC	√+	Y		√
Benzene	71-43-2	√	√	Y		√
Benzidine	92-87-5	NC	√+	ND		√
Benzo(a)Anthracene	56-55-3	√	√	Y		√
Benzo(a)pyrene	50-32-8	N	√	Y (B)		√
Benzo(b)fluoranthene	205-99-2	√	√	Y (B)		√
Benzo(e)pyrene	192-97-2	N	√	Y (B)		√
Benzo(g,h,i)perylene	191-24-2	N	√	Y		√
Benzo(k)fluoranthene	207-08-9	N	√	Y		√
Benzoic Acid	65-85-0	N	√	ND		√
Benzoic acid, methyl ester (methyl benzoate)	93-58-3	NC	√+	Y (TIC)		√
Benzonitrile	100-47-0	NC	√+	ND		√
Benzyl alcohol	100-51-6	N	√	ND		√
BHC, alpha (α-hexachlorocyclohexane)	319-84-6	N	√	Y (*)		√
BHC, beta (β-hexachlorocyclohexane)	319-85-7	N	√	Y (COL)		√
BHC, delta (δ-hexachlorocyclohexane)	319-86-8	√	√	Y (COL)		√
BHC, gamma (Lindane; γ-hexachlorocyclohexane)	58-89-9	N	√	ND		√

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Constituent	CAS NO.	Potentially Present in Spent Carbon (a) (√ /N)	PDT Methods: Included in Stack Sampling Analysis (√ / X) (c)	PDT Results: Detected in Stack Samples (Y/ND/--)	Spiked During PDT (√) (% total feed from spiked material) (d)	Selected as Chemical for Evaluation (√ /N)
Bis(2-chloroethoxy) methane	111-91-1	N	√	ND		√
Bis-(2-chloroethyl) ether	111-44-4	N	√	ND		√
Bis(2-ethylhexyl) phthalate	117-81-7	N	√	Y		√
Bromobenzene	108-86-1	NC	√+	ND		√
Bromochloromethane	74-97-5	N	√	ND		√
Bromodichloromethane	75-27-46	√	√	Y		√
Bromoform (tribromomethane)	75-25-2	N	√	Y		√
Bromomethane	74-83-9	N	√	Y (B)		√
Butane	106-97-8	√	√	--		N (not reported in spent carbon during 1997-2007)
Butyl Acetate	123-86-4	√	X	--		N (not reported in spent carbon during 1997-2007)
Buty benzene, n-	104-51-8	NC	√+	ND		√
Buty benzene, sec	135-98-8	NC	√+	ND		√
Buty benzene, tert	98-06-6	NC	√+	ND		√
Buty benzylphthalate	85-68-7	N	√	ND		√
Carbazole	86-74-8	NC	√+	ND		√
Carbon Disulfide	75-15-0	N	√	Y		√
Carbon Tetrachloride	56-23-5	√	√	Y		√
Chlordane - mixed isomers	57-74-9	N	√	-- (data provided for individual isomers)		√ (evaluated based on the sum of results for individual isomers)
Chlordane, cis (α-chlordane)	5103-71-9	N	√	Y (*, COL)		N (evaluated as mixed chlordane)
Chlordane, trans (β-chlordane)	5103-74-2	N	√	ND		N (evaluated as mixed chlordane)
Chlorine	7782-50-5	N	√	Y	√ (from several compounds)	√
Chlorobenzene	108-90-7	√	√	Y (E)	√ (>99%)	√
Chlorobenzilate	510-15-6	N	√	Y (*, COL)		√
Chlorodibromomethane	124-48-1	N	√	Y		√
Chloroethane	75-00-3	√	√	ND		√
Chloroform	67-66-3	√	√	Y		√
Chloromethane	74-87-3	√	√	Y		√
Chrysene	218-01-9	√	√	Y (B)		√
Cresol	1319-77-3	√	√	-- (data provided for o- and m&p-cresols)		N (evaluated separately as the individual isomers)
Cresol, m&p (3-/4-Methylphenol)	108-39-4 & 106-44-5	√	√	ND		√
Cresol, o- (2-Methylphenol)	95-48-7	√	√	ND		√
Cumene (Isopropy benzene)	98-82-8	√	√ (TIC)	Y (*)		√

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Constituent	CAS NO.	Potentially Present in Spent Carbon (a) (√ /N)	PDT Methods: Included in Stack Sampling Analysis (√ / X) (c)	PDT Results: Detected in Stack Samples (Y/ND/--)	Spiked During PDT (√) (% total feed from spiked material) (d)	Selected as Chemical for Evaluation (√ /N)
Diallate	2303-16-4	N	√	ND		√
D benzo(a,h)anthracene	53-70-3	N	√	ND		√
D benzofuran	132-64-9	√	√	ND		√
D bromomethane	74-95-3	N	√	ND		√
Dichlorodifluoromethane	75-71-8	N	√	Y		√
Dicyclopentadiene	77-73-6	√	√ (TIC)	--		N (not reported in spent carbon during 1997-2007)
Dieldrin	60-57-1	N	√	ND		√
Diethyl phthalate	84-66-2	N	√	ND		√
Dimethylphthalate	131-11-3	N	√	ND		√
Di-n-butylphthalate	84-74-2	N	√	ND		√
Di-n-octyl phthalate	117-84-0	N	√	ND		√
Dioxane (1,4)	123-91-1	√	√	--		√
Diphenylamine	122-39-4	N	√	ND		√
Endosulfan I	959-98-8	N	√	ND		√
Endosulfan II	33213-65-9	N	√	Y (*, COL)		√
Endosulfan sulfate	1031-07-8	N	√	ND		√
Endrin	72-20-8	N	√	ND		√
Endrin aldehyde	7421-93-4	N	√	Y (B, COL)		√
Endrin ketone	53494-70-5	N	√	ND		√
Ethanol	64-17-5	√	X	--		N (not reported in spent carbon during 1997-2007)
Ethyl Acetate	141-78-6	√	X	--		N (not reported in spent carbon during 1997-2007)
Ethy benzene	100-41-4	√	√	Y		√
Ethylene Glycol	107-21-1	√	X	--		√
Fluoranthene	206-44-0	√	√	Y (B)		√
Fluorene	86-73-7	N	√	Y (B)		√
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	76-13-1	√	√	ND		√
Heptachlor	76-44-8	N	√	Y (COL)		√
Heptachlor epoxide	1024-57-3	N	√	Y (COL)		√
Hexachlorobenzene	118-74-1	N	√	ND		√
Hexachlorobutadiene	87-68-3	N	√	ND		√
Hexachlorocyclo-pentadiene	77-47-4	N	√	ND		√
Hexachloroethane	67-72-1	N	√	ND		√
Hydrogen chloride	7647-01-0	N	√	Y	√ (from several compounds)	√
Indeno(1,2,3-cd)pyrene	193-39-5	N	√	Y (B)		√
Iodomethane	74-88-4	N	√	Y (B)		√
Isobutane	75-28-5	√	X	--		N (not reported in spent carbon during 1997-2007)

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Isodrin	465-73-6	N	√	--		N (not reported in spent carbon during 1997-2007; not in spent carbon)
Isopar C		√	X	--		N (not reported in spent carbon during 1997-2007)
Isophorone	78-59-1	N	√	ND		√
Isopropyl Alcohol	67-63-0	√	X	--		N (not reported in spent carbon during 1997-2007)
Isopropyl toluene, p-	99-87-6	NC	√+	ND		√
Methanol	67-56-1	√	X	--		N (not reported in spent carbon during 2003-2006)
Methoxychlor	72-43-5	√	√	ND		√
Methyl Isobutyl ketone (4-methyl-2-pentanone)	108-10-1	√	X	Y (*)		√
Methyl methacrylate	80-62-6	√	√ (TIC)	--		√
methyl tert-butyl ether	1634-04-4	√	X	--		√
Methylene chloride	75-09-2	√	√	Y	√ (>99%)	√
Methylnaphthalene	1321-94-4	√	√	-- (data provided for 2-methyl naphthalene)		N (2-methylnaphthalene was evaluated)
Methylnaphthalene, 2-	91-57-6	√	√	Y (B)		√
Naphthalene	91-20-3	√	√	Y (B)	√ (>99%)	√
Nitrobenzene	98-95-3	√	√	ND		√
N-nitrosodimethylamine	62-44-2	N	√	ND		√
N-Nitroso-di-n-propylamine	621-64-7	N	√	ND		√
N-Nitrosodiphenylamine	86-30-6	N	√	ND		√
Pentachlorobenzene	608-93-5	N	√	ND		√
Pentachloronitrobenzene	82-68-8	N	√	ND		√
Pentachlorophenol	87-86-5	√	√	ND		√
Perylene	198-55-0	N	√	Y (*, B)		√
Phenanthrene	85-01-8	√	√	Y (*, B)		√
Phenol	108-95-2	√	√	ND		√
Phosphine imide, P,P,P-triphenyl	2240-47-3	NC	√+	Y (TIC)		√
Polychlorinated biphenyls	1336-36-3	√	√	Y		√
Propy benzene, n-	103-65-1	√	√ (TIC)	ND		√
Propylene glycol monomethyl ether acetate	107-98-2	√	X	--		N (not reported in spent carbon during 1997-2007)
Propylene oxide	75-56-9	√	X	--		√
Pyrene	129-00-0	N	√	Y (B)		√
Pyridine	110-86-1	NC	√+	ND		√
Styrene	100-42-5	√	√	ND		√

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Tetrachlorobenzene, 1,2,4,5-	95-94-3	NC	√+	ND		√
Tetrachloroethane, 1,1,1,2-	630-20-6	√	√	Y (*)		√
Tetrachloroethylene	127-18-4	√	√	Y (E)	√ (>99%)	√
Tetrahydrofuran	109-99-9	√	√ (TIC)	ND		√
Toluene	108-88-3	√	√	Y	√ (>99%)	√
Toxaphene	8001-35-2	N	√	--		N (not reported in spent carbon during 1997-2007; not in spent carbon)
Trichloroethylene	79-01-6	√	√	Y		√
Trichlorofluoromethane	75-69-4	√	√	Y (*)		√
Triethylamine	121-44-8	√	√ (TIC)	--		N (not reported in spent carbon during 1997-2007)
Tris(hydroxymethyl) aminomethane	77-86-1	√	N	--		N (not reported in spent carbon during 1997-2007)
Vinyl Acetate	108-05-4	N	√	ND		√
Vinyl Chloride	75-01-4	√	√	Y (*)		√
Xylene, o-	95-47-6	√	√	Y (*)		√
Xylenes (mixed isomers)	1330-20-7	√	√	Y		√
Xylenes, m&p-	108-38-3 & 106-42-3	√	√	Y		√
PCDDs/PCDFs (Dioxins and Furans)						
2,3,7,8-TCDD	1746-01-6	N	√	Y (EMPC)		√
Total TCDD	NA	N	√	Y (EMPC)		N (only 2,3,7,8 congeners are evaluated)
2,3,7,8-TCDF	51207-31-9	N	√	Y (EMPC)		√
Total TCDF	NA	N	√	Y (EMPC)		N (only 2,3,7,8 congeners are evaluated)
1,2,3,7,8-PeCDD	40321-76-4	N	√	Y		√
Total PeCDD	NA	N	√	Y (EMPC)		N (only 2,3,7,8 congeners are evaluated)
1,2,3,7,8-PeCDF	57117-41-6	N	√	Y (EMPC)		√
2,3,4,7,8-PeCDF	57117-31-4	N	√	Y (EMPC)		√
Total PeCDF	NA	N	√	Y (EMPC)		N (only 2,3,7,8 congeners are evaluated)
1,2,3,6,7,8-HxCDD	57653-85-7	N	√	Y (EMPC)		√
1,2,3,4,7,8-HxCDD	39227-28-6	N	√	Y (EMPC)		√
1,2,3,7,8,9-HxCDD	19408-74-3	N	√	Y		√
Total HxCDD	NA	N	√	Y (EMPC)		N (only 2,3,7,8 congeners are evaluated)

Table 4.1-1
List of Selected Chemicals for Detailed Evaluation in the Stack Emissions Risk Assessment

Constituent	CAS NO.	Potentially Present in Spent Carbon (a) (√ /N)	PDT Methods: Included in Stack Sampling Analysis (√ / X) (c)	PDT Results: Detected in Stack Samples (Y/ND/--)	Spiked During PDT (√) (% total feed from spiked material) (d)	Selected as Chemical for Evaluation (√ /N)
1,2,3,6,7,8-HxCDF	57117-44-9	N	√	Y (EMPC)		√
1,2,3,4,7,8-HxCDF	70648-26-9	N	√	Y (EMPC)		√
1,2,3,7,8,9-HxCDF	72918-21-9	N	√	Y (B, EMPC)		√
2,3,4,6,7,8-HxCDF	60851-34-5	N	√	Y (B)		√
Total HxCDF	NA	N	√	Y (B, EMPC)		N (only 2,3,7,8 congeners are evaluated)
1,2,3,4,6,7,8-HpCDD	35822-46-9	N	√	Y (B)		√
Total HpCDD	NA	N	√	Y (B)		N (only 2,3,7,8 congeners are evaluated)
1,2,3,4,6,7,8-HpCDF	67562-39-4	N	√	Y (B, EMPC)		√
1,2,3,4,7,8,9-HpCDF	55673-89-7	N	√	Y (EMPC)		√
Total HpCDF	NA	N	√	Y (B, EMPC)		N (only 2,3,7,8 congeners are evaluated)
Total OCDD	3268-87-9	N	√	Y (B, EMPC)		√
Total OCDF	39001-02-0	N	√	Y (B, EMPC)		√
Polychlorinated Biphenyls						
3,4,3',4'-Tetrachlorobiphenyl (IUPAC 77)	32598-13-3	NoDa	√	Y (EMPC)		√ (b)
3,4,4',5-tetrachlorobiphenyl (IUPAC 81)	70362-50-4	NoDa	√	Y (*, EMPC)		√ (b)
2,3,4,3',4'-Pentachlorobiphenyl (IUPAC 105)	32598-14-4	NoDa	√	Y (B, EMPC)		√ (b)
2,3,4,5,4'-Pentachlorobiphenyl (IUPAC 114)	74472-37-0	NoDa	√	Y (*, EMPC)		√ (b)
2,4,5,3',4'-Pentachlorobiphenyl (IUPAC 118)	31508-00-6	NoDa	√	Y (B, EMPC)		√ (b)
3,4,5,2',4'-Pentachlorobiphenyl (IUPAC 123)	65510-44-3	NoDa	√	Y (B, *, EMPC)		√ (b)
3,4,5,3',4'-Pentachlorobiphenyl (IUPAC 126)	57465-28-8	NoDa	√	Y (EMPC)		√ (b)
2,3,4,5,3',4'-Hexachlorobiphenyl (IUPAC 156)	38380-98-4	NoDa	√	Y (C, EMPC)		√ (b)
2,3,4,3',4',5'-Hexachlorobiphenyl (IUPAC 157)	68782-90-7	NoDa	√	Y (C, EMPC)		√ (b)
2,4,5,3',4',5'-Hexachlorobiphenyl (IUPAC 167)	52663-72-6	NoDa	√	Y (EMPC)		√ (b)
3,4,5,3',4',5'-Hexachlorobiphenyl (IUPAC 169)	32774-16-6	NoDa	√	ND		√ (b)

Table 4.1-1
List of Selected Chemicals for Detailed Evaluation in the Stack Emissions Risk Assessment

Constituent	CAS NO.	Potentially Present in Spent Carbon (a) (√ /N)	PDT Methods: Included in Stack Sampling Analysis (√ / X) (c)	PDT Results: Detected in Stack Samples (Y/ND/--)	Spiked During PDT (√) (% total feed from spiked material) (d)	Selected as Chemical for Evaluation (√ /N)
2,3,4,5,3',4',5'-Heptachlorobiphenyl (IUPAC 189)	39635-31-9	NoDa	√	ND		√ (b)
Criteria Pollutants, Carbon Monoxide, and Total Particulate Matter						
Carbon Monoxide gas	630-08-0	N	√	Y		N (Addressed in PDT)
Nitrogen oxides	10102-44-0 & 10024-97-2	N	√	--		√
Total particulate matter (TSP)	NA	N	√	Y		N (Addressed in PDT)
Sulfur dioxide	7446-09-5	N	√	--		√

Notes:

-- = the compound was not analyzed for or not identified in the PDT sample results
* = the compound was detected very infrequently, in only one or two of the sampled fractions, from the three replicate runs
√ = yes
√+ = new compound; included in PDT sampling and analysis but not originally identified in the 2003 Workplan
√ (TIC) = compound was evaluated in the PDT analysis as a tentatively identified compound
B = one or more sample fraction results from one or more of the three replicate runs were affected by method blank contamination
C = co-eluting PCB isomer
COL = there was a greater than 40% difference between primary and confirmatory columns in one or more sample fraction results from one or more of the three replicate runs; reported result should be considered estimated.
DRE = destruction and removal efficiency
E = one or more sample fraction results from one or more of the three replicate runs exceeded the cal bration range
EMPC = one or more of the front or back half sample results from one or more of the three replicate runs were an
N = No
NC = new compound; not identified in the 2003 Workplan, but included in the PDT results
ND = not detected in any sample fraction from any of the three replicate runs
NoDa = No Data
PDT = Performance Demonstration Test (consisted of three replicate runs evaluating "worst-case" operating conditions)
TIC = tentatively identified compound
X = not included in PDT analysis
Y = yes; detected in one or more sample fractions from at least one of the three replicate runs

(a) Source: Risk Assessment Workplan - Identification of compounds based on: 1) "Spent Carbon Feed Metal Results Summary", monthly composites, July 1994 - July 2001. 2) TRI information 1998 through 2000. 3) RCRA Part B Permit Application, November 1995, Table C-2.

(b) These co-planar PCB congeners are addressed in the discussion of uncertainties section of the risk assessment.

(c) Compounds included in PDT sampling program based on analyte lists and PDT results provided by Focus Environmental.

(d) Determined by Focus from PDT report based on average concentration in spent activated carbon feed, an average spent carbon feed rate of 3,049 lb/hr during the test, and average spiked feed rates.

Table 4.2-1
Chemical Emission Rates for Reactivation Furnace Stack

Compound	CAS Number	Stack Emission Rate Used in Risk Assessment (g/sec)	Emission Rate Basis	PDT Results Detected in Stack Samples (Y or ND)	Additional Emission Rate Information
Inorganic Compounds					
Aluminum	7429-90-5	1.15E-04	PDT	Y	
Antimony	7440-36-0	3.89E-06	PDT	ND	
Arsenic	7440-38-2	1.26E-04	permit limit (a)	ND	PDT emission rate = 3.73E-06 g/sec
Barium	7440-39-3	9.01E-06	PDT	Y	
Beryllium	7440-41-7	1.26E-04	permit limit (a)	ND	PDT emission rate = 2 01E-07 g/sec
Cadmium	7440-43-9	3.12E-04	permit limit (b)	Y	PDT emission rate = 9.11E-06 g/sec
Chromium	7440-47-3	1.26E-04	permit limit (a)	Y	PDT emission rate (chromium was spiked) = 3.54E-05 g/sec
Chromium, hexavalent	18540-29-9	5.80E-06	PDT	Y	
Cobalt	7440-48-4	5.82E-07	PDT	ND	
Copper	7440-50-8	1.19E-04	PDT	Y	
Lead	7439-92-1	3.12E-04	permit limit (b)	Y	PDT emission rate (lead was spiked) = 3.83E-04 g/sec
Manganese	7439-96-5	4.61E-05	PDT	Y	
Mercuric chloride	7487-94-7	3.43E-5 (2 3E-5) (c)	permit limit (c)	Y	PDT emission rate = 2 20E-06 g/sec
Mercury, elemental	7439-97-6	1 35E-4 (1.34E-6) (c)	permit limit (c)	Y	PDT emission rate = 8 60E-06 g/sec
Nickel	7440-02-0	9.91E-06	PDT	Y	
Selenium	7782-49-2	3.76E-06	PDT	Y	
Silver	7440-22-4	2.73E-06	PDT	Y	
Thallium	7440-28-0	9.24E-06	PDT	ND	
Vanadium	7440-62-2	2.43E-06	PDT	ND	
Zinc	7440-66-6	1.51E-04	PDT	Y	
Organic Compounds					
1,1,1-Trichloroethane	71-55-6	2.78E-07	PDT	ND	
1,1,2,2-Tetrachloroethane	79-34-5	1.32E-06	PDT	ND	
1,1,2-Trichloroethane	79-00-5	8.02E-07	PDT	ND	
1,1-Dichloroethane	75-34-3	3.09E-07	PDT	ND	
1,1-Dichloroethene	75-35-4	3.52E-07	PDT	ND	
1,1-Dichloropropene	563-58-6	2.15E-07	PDT	ND	
1,2,3-Trichlorobenzene	87-61-6	1.73E-06	PDT	ND	
1,2,3-Trichloropropane	96-18-4	1.25E-06	PDT	ND	
1,2,4-Trichlorobenzene	120-82-1	9.30E-07	PDT	ND	
1,2,4-Trimethylbenzene	95-63-6	6.26E-07	PDT	ND	
1,2-Dibromo-3-chloropropane	96-12-8	2.60E-06	PDT	ND	
Ethylene dibromide	106-93-4	1.32E-06	PDT	ND	
1,2-Dichlorobenzene	95-50-1	8.43E-07	PDT	ND	
1,2-Dichloroethane	107-06-2	5.05E-07	PDT	Y	
1,2-Dichloroethene (cis)	156-59-2	4.17E-07	PDT	Y (*)	
1,2-Dichloroethene (trans)	156-60-5	2.89E-07	PDT	ND	
1,2-Dichloropropane	78-87-5	3.98E-07	PDT	ND	
1,2-Diphenylhydrazine	122-66-7	7.00E-07	PDT	ND	
1,3,5-Trimethylbenzene	108-67-8	4.05E-07	PDT	ND	
1,3-Dichlorobenzene	541-73-1	8.86E-07	PDT	ND	
1,3-Dichloropropane	142-28-9	3.77E-07	PDT	ND	
1,3-Dichloropropene	542-75-6	7.58E-07	PDT	ND	Emission rate is based on the sum of reported PDT results for (cis) + (trans) dichloropropene (10061-01-5 & 10061-02-6).
1,3-Dinitrobenzene	99-65-0	1.08E-06	PDT	ND	
1,4-Dichlorobenzene	106-46-7	1.00E-06	PDT	ND	
1-Hexane (n-hexane)	110-54-3	7.98E-10	FR&DRE	--	
2,2'-oxybis (1-Chloropropane)	108-60-1	9.72E-07	PDT	ND	
2,2-Dichloropropane	594-20-7	2.79E-07	PDT	ND	
2,4,5-Trichlorophenol	95-95-4	1.61E-06	PDT	ND	
2,4,6-Trichlorophenol	88-06-2	1.27E-06	PDT	ND	
2,4-Dichlorophenol	120-83-2	1.30E-06	PDT	ND	
2,4-Dimethylphenol	105-67-9	3.09E-06	PDT	ND	
2,4-Dinitrophenol	51-28-5	9.15E-06	PDT	ND	
2,4-Dinitrotoluene	121-14-2	1.32E-06	PDT	ND	
2,5-Dimethylfuran	625-86-5	8.43E-07	PDT	Y (TIC)	
2,5-Dimethylheptane	2216-30-0	1.68E-05	PDT	Y (TIC)	
2,5-Dione, 3-hexene	17559-81-8	9.53E-07	PDT	Y (TIC)	
2,6-Dinitrotoluene	606-20-2	1.06E-06	PDT	ND	
Methyl ethyl ketone	78-93-3	4.51E-06	PDT	ND	
2-Chloronaphthalene	91-58-7	6.53E-07	PDT	ND	
2-Chlorophenol	95-57-8	8.60E-07	PDT	ND	
2-Chlorotoluene	95-49-8	5.10E-07	PDT	ND	
2-Hexanone	591-78-6	1.88E-06	PDT	ND	
2-Methyl octane	3221-61-2	3.98E-06	PDT	Y (TIC)	
2-Methylnaphthalene	91-57-6	5.79E-08	PDT	Y (B)	
Cresol, o-	95-48-7	2.09E-06	PDT	ND	
2-Nitroaniline	88-74-4	1.04E-06	PDT	ND	

Table 4.2-1
Chemical Emission Rates for Reactivation Furnace Stack

Compound	CAS Number	Stack Emission Rate Used in Risk Assessment (g/sec)	Emission Rate Basis	PDT Results Detected in Stack Samples (Y or ND)	Additional Emission Rate Information
2-Nitrophenol	88-75-5	1.77E-06	PDT	ND	
3,3'-Dichlorobenzidine	91-94-1	4.96E-06	PDT	ND	
Cresol, m-	108-39-4	9.15E-07	PDT	ND	Value is one-half of the PDT emission rate for m&p cresol (1.83E-06 g/sec).
Cresol, p-	106-44-5	9.15E-07	PDT	ND	Value is one-half of the PDT emission rate for m&p cresol (1.83E-06 g/sec).
3-Ethyl benzaldehyde	34246-54-3	2.38E-06	PDT	Y (TIC)	
3-Hexen-2-one	763-93-9	1.14E-04	PDT	Y (TIC)	
3-Nitroaniline	99-09-2	2.91E-06	PDT	ND	
Ethylidene acetone (3-penten-2-one)	625-33-2	4.83E-06	PDT	Y (TIC)	
3-Penten-2-one, 4-methyl	141-79-7	9.30E-05	PDT	Y (TIC)	
4,4'-DDD	72-54-8	1.31E-07	PDT	Y (*, COL)	
4,4'-DDE	72-55-9	4.47E-08	PDT	Y (*)	
4,4'-DDT	50-29-3	3.34E-08	PDT	Y (*, COL)	
4,6-Dinitro-2-methylphenol	534-52-1	4.37E-06	PDT	ND	
4-Bromophenyl-phenyl ether	101-55-3	6.71E-07	PDT	ND	
4-Chloro-3-methylphenol	59-50-7	2.17E-06	PDT	ND	
4-Chloroaniline	106-47-8	4.17E-06	PDT	ND	
4-Chlorophenyl-phenyl ether	7005-72-3	1.11E-06	PDT	ND	
4-Chlorotoluene	106-43-4	4.42E-07	PDT	ND	
4-Ethyl benzaldehyde	4748-78-1	1.30E-06	PDT	Y (TIC)	
4-Nitroaniline	100-01-6	2.34E-06	PDT	ND	
4-Nitrophenol	100-02-7	2.92E-06	PDT	ND	
9-Octadecenamide	301-02-0	2.52E-06	PDT	Y (TIC)	
Acenaphthene	83-32-9	4.48E-09	PDT	Y (B)	
Acenaphthylene	208-96-8	8.11E-09	PDT	Y	
Acetone	67-64-1	6.14E-05	PDT	Y (B)	
Acetophenone	98-86-2	3.41E-06	PDT	Y	
Acrylic Acid	79-10-7	1.80E-11	FR&DRE	--	
Acrylonitrile	107-13-1	1.10E-05	PDT	ND	
Aldrin	309-00-2	2.45E-08	PDT	ND	
Aniline	62-53-3	7.19E-06	PDT	ND	
Anthracene	120-12-7	1.28E-08	PDT	Y	
Benzaldehyde	100-52-7	4.90E-06	PDT	Y	
Benzene	71-43-2	2.59E-06	PDT	Y	
Benzidine	92-87-5	4.68E-05	PDT	ND	
Benzo(a)Anthracene	56-55-3	2.84E-09	PDT	Y	
Benzo(a)pyrene	50-32-8	3.58E-09	PDT	Y (B)	
Benzo(b)fluoranthene	205-99-2	2.94E-08	PDT	Y (B)	
Benzo(e)pyrene	192-97-2	5.35E-09	PDT	Y (B)	
Benzo(g,h,i)perylene	191-24-2	1.13E-08	PDT	Y	
Benzo(k)fluoranthene	207-08-9	5.43E-09	PDT	Y	
Benzoic Acid	65-85-0	2.81E-05	PDT	ND	
Benzoic acid, methyl ester	93-58-3	8.07E-07	PDT	Y (TIC)	
Benzonitrile	100-47-0	1.87E-06	PDT	ND	
Benzyl alcohol	100-51-6	2.09E-05	PDT	ND	
Bis(2-chloroethoxy) methane	111-91-1	8.34E-07	PDT	ND	
Bis-(2-chloroethyl) ether	111-44-4	8.14E-07	PDT	ND	
Bis(2-ethylhexyl) phthalate	117-81-7	1.69E-05	PDT	Y	
Bromobenzene	108-86-1	5.00E-07	PDT	ND	
Bromochloromethane	74-97-5	1.52E-06	PDT	ND	
Bromodichloromethane	75-27-4	5.44E-06	PDT	Y	
Bromoform (tribromomethane)	75-25-2	1.38E-05	PDT	Y	
Bromomethane (methyl bromide)	74-83-9	4.72E-06	PDT	Y (B)	
Butylbenzene, n-	104-51-8	6.09E-07	PDT	ND	
Butylbenzene, sec-	135-98-8	4.89E-07	PDT	ND	
Butylbenzene, tert-	98-06-6	5.80E-07	PDT	ND	
Butylbenzylphthalate	85-68-7	1.08E-06	PDT	ND	
Carbazole	86-74-8	9.83E-07	PDT	ND	
Carbon Disulfide	75-15-0	1.24E-06	PDT	Y	
Carbon Tetrachloride	56-23-5	6.77E-07	PDT	Y	
Chlorine	7782-50-5	3.60E-02	permit limit (f)	Y	PDT emission rate (chlorine was spiked) = 1.88E-03 g/sec
Chlorobenzene	108-90-7	2.58E-04	PDT	Y (E)	
Chlorobenzilate	510-15-6	1.17E-07	PDT	Y (*, COL)	
Chlorodibromomethane	124-48-1	1.08E-05	PDT	Y	
Chloroethane	75-00-3	1.32E-06	PDT	ND	
Chloroform	67-66-3	8.24E-06	PDT	Y	
Chloromethane (methyl chloride)	74-87-3	2.41E-05	PDT	Y	

Table 4.2-1
Chemical Emission Rates for Reactivation Furnace Stack

Compound	CAS Number	Stack Emission Rate Used in Risk Assessment (g/sec)	Emission Rate Basis	PDT Results Detected in Stack Samples (Y or ND)	Additional Emission Rate Information
Chrysene	218-01-9	1.10E-08	PDT	Y (B)	
Cumene (Isopropylbenzene)	98-82-8	3.64E-07	PDT	Y (*)	
Diallate	2303-16-4	6.27E-06	PDT	ND	
Dibenzo(a,h)anthracene	53-70-3	4.67E-10	PDT	ND	
Dibenzofuran	132-64-9	1.06E-06	PDT	ND	
Dibromomethane	74-95-3	1.28E-06	PDT	ND	
Dichlorodifluoromethane (methylene bromide)	75-71-8	3.83E-06	PDT	Y	
Dieldrin	60-57-1	1.17E-08	PDT	ND	
Diethyl phthalate	84-66-2	1.01E-06	PDT	ND	
Dimethylphthalate	131-11-3	6.71E-07	PDT	ND	
Di-n-butylphthalate	84-74-2	3.71E-06	PDT	ND	
Di-n-octyl phthalate	117-84-0	1.42E-06	PDT	ND	
Dioxane (1,4)	123-91-1	8.91E-11	FR&DRE	--	
Diphenylamine	122-39-4	1.05E-06	PDT	ND	
Endosulfan I	959-98-8	1.31E-08	PDT	ND	Evaluated in risk assessment as endosulfan which is included in HHRAP (CAS #115-29-7)
Endosulfan II	33213-65-9	2.67E-08	PDT	Y (*, COL)	
Endosulfan sulfate	1031-07-8	1.52E-08	PDT	ND	
Endrin	72-20-8	4.79E-08	PDT	ND	
Endrin aldehyde	7421-93-4	5.83E-08	PDT	Y (B, COL)	
Endrin ketone	53494-70-5	1.72E-08	PDT	ND	
Ethylbenzene	100-41-4	3.13E-07	PDT	Y	
Ethylene Glycol	107-21-1	1.25E-07	FR&DRE	--	
Fluoranthene	206-44-0	4.90E-08	PDT	Y (B)	
Fluorene	86-73-7	1.26E-08	PDT	Y (B)	
Freon 113	76-13-1	3.33E-07	PDT	ND	
Heptachlor	76-44-8	4.31E-08	PDT	Y (COL)	
Heptachlor epoxide	1024-57-3	2.46E-08	PDT	Y (COL)	
Hexachlorobenzene	118-74-1	1.00E-06	PDT	ND	
Hexachlorobutadiene	87-68-3	1.12E-06	PDT	ND	
Hexachlorocyclo-pentadiene	77-47-4	7.53E-06	PDT	ND	
Hexachloroethane	67-72-1	1.39E-06	PDT	ND	
Hydrogen chloride	7647-01-0	1.60E-01	permit limit (f)	Y	PDT emission rate (chlorine was spiked) = 4.30E-02 g/sec
Indeno(1,2,3-cd)pyrene	193-39-5	5.08E-09	PDT	Y (B)	
Iodomethane	74-88-4	1.97E-06	PDT	Y (B)	
Isophorone	78-59-1	7.96E-07	PDT	ND	
Isopropyl toluene, p-	99-87-6	5.10E-07	PDT	ND	
Methoxychlor	72-43-5	5.38E-08	PDT	ND	
Methyl Isobutyl ketone (4-methyl-2-pentanone)	108-10-1	2.25E-06	PDT	Y (*)	
Methyl methacrylate	80-62-6	5.50E-09	FR&DRE	--	
methyl tert-butyl ether	1634-04-4	8.16E-08	FR&DRE	--	
Methylene chloride	75-09-2	1.74E-05	PDT	Y	
Naphthalene	91-20-3	3.58E-06	PDT	Y (B)	
Nitrobenzene	98-95-3	7.87E-07	PDT	ND	
N-nitrosodimethylamine	62-75-9	9.21E-07	PDT	ND	
N-Nitroso-di-n-propylamine	621-64-7	9.63E-07	PDT	ND	
N-Nitrosodiphenylamine	86-30-6	7.90E-07	PDT	ND	
Pentachlorobenzene	608-93-5	8.83E-07	PDT	ND	
Pentachloronitrobenzene	82-68-8	1.04E-06	PDT	ND	
Pentachlorophenol	87-86-5	1.55E-05	PDT	ND	
Perylene	198-55-0	1.34E-08	PDT	Y (*, B)	
Phenanthrene	85-01-8	1.51E-07	PDT	Y (*, B)	
Phenol	108-95-2	1.14E-06	PDT	ND	
Phosphine imide, P,P,P-triphenyl	2240-47-3	1.06E-06	PDT	Y (TIC)	
PCBs as Aroclor 1254 (d)	11097-69-1	2.34E-08	PDT	Y	
Propylbenzene, n-	103-65-1	4.15E-07	PDT	ND	
Propylene oxide	75-56-9	1.00E-09	FR&DRE	--	
Pyrene	129-00-0	4.93E-08	PDT	Y (B)	
Pyridine	110-86-1	1.85E-06	PDT	ND	
Styrene	100-42-5	2.89E-07	PDT	ND	
Tetrachlorobenzene, 1,2,4,5-	95-94-3	9.55E-07	PDT	ND	
Tetrachloroethane, 1,1,1,2-	630-20-6	2.68E-07	PDT	Y (*)	
Tetrachloroethylene	127-18-4	1.12E-04	PDT	Y (E)	
Tetrahydrofuran	109-99-9	4.59E-06	PDT	ND	
Toluene	108-88-3	1.18E-05	PDT	Y	
Trichloroethylene	79-01-6	2.63E-06	PDT	Y	
Trichlorofluoromethane (Freon 11)	75-69-4	1.27E-06	PDT	Y (*)	

Table 4.2-1
Chemical Emission Rates for Reactivation Furnace Stack

Compound	CAS Number	Stack Emission Rate Used in Risk Assessment (g/sec)	Emission Rate Basis	PDT Results Detected in Stack Samples (Y or ND)	Additional Emission Rate Information
Vinyl Acetate	108-05-4	1.52E-06	PDT	ND	
Vinyl Chloride	75-01-4	6.75E-07	PDT	Y (*)	
Xylene, o-	95-47-6	3.70E-07	PDT	Y (*)	
Xylene, m-	108-38-3	5.80E-07	PDT	Y	Value is one-half of the PDT emission rate for xylenes, m & p (1.16E-06 g/sec).
Xylene, p-	106-42-3	5.80E-07	PDT	Y	Value is one-half of the PDT emission rate for xylenes, m & p (1.16E-06 g/sec).
BHC, alpha-	319-84-6	2.14E-08	PDT	Y (*)	
Chlordane	57-74-9	5.97E-08	PDT	Y (*, COL) (alpha); ND (beta)	Emission rate is based on the sum of reported PDT results for (cis) + (trans) chlordane (CAS #5103-71-9 & 5103-74-2).
BHC, beta-	319-85-7	5.53E-08	PDT	Y (COL)	
BHC, gamma- (lindane)	58-89-9	1.17E-08	PDT	ND	
BHC, delta-	319-86-8	4.97E-08	PDT	Y (COL)	
PCDDs/PCDFs (Dioxins and Furans)					
2,3,7,8-TCDD	1746-01-6	4.37E-11	permit limit (e)	Y (EMPC)	PDT emission rate = 1.06E-11 g/sec
2,3,7,8-TCDF	51207-31-9	4.20E-10	permit limit (e)	Y (EMPC)	PDT emission rate = 1.02E-10 g/sec
1,2,3,7,8-PeCDD	40321-76-4	1.16E-10	permit limit (e)	Y	PDT emission rate = 2.82E-11 g/sec
1,2,3,7,8-PeCDF	57117-41-6	4.29E-10	permit limit (e)	Y (EMPC)	PDT emission rate = 1.04E-10 g/sec
2,3,4,7,8-PeCDF	57117-31-4	4.45E-10	permit limit (e)	Y (EMPC)	PDT emission rate = 1.08E-10 g/sec
1,2,3,6,7,8-HxCDD	57653-85-7	7.99E-11	permit limit (e)	Y (EMPC)	PDT emission rate = 1.94E-11 g/sec
1,2,3,4,7,8-HxCDD	39227-28-6	7.91E-11	permit limit (e)	Y (EMPC)	PDT emission rate = 1.92E-11 g/sec
1,2,3,7,8,9-HxCDD	19408-74-3	9.35E-11	permit limit (e)	Y	PDT emission rate = 2.27E-11 g/sec
1,2,3,6,7,8-HxCDF	57117-44-9	2.76E-10	permit limit (e)	Y (EMPC)	PDT emission rate = 6.7E-11 g/sec
1,2,3,4,7,8-HxCDF	70648-26-9	5.07E-10	permit limit (e)	Y (EMPC)	PDT emission rate = 1.23E-10 g/sec
1,2,3,7,8,9-HxCDF	72918-21-9	7.33E-11	permit limit (e)	Y (B, EMPC)	PDT emission rate = 1.78E-11 g/sec
2,3,4,6,7,8-HxCDF	60851-34-5	1.55E-10	permit limit (e)	Y (B)	PDT emission rate = 3.76E-11 g/sec
1,2,3,4,6,7,8-HpCDD	35822-46-9	8.20E-11	permit limit (e)	Y (B)	PDT emission rate = 1.99E-11 g/sec
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.98E-10	permit limit (e)	Y (B, EMPC)	PDT emission rate = 9.65E-11 g/sec
1,2,3,4,7,8,9-HpCDF	55673-89-7	9.52E-11	permit limit (e)	Y (EMPC)	PDT emission rate = 2.31E-11 g/sec
Total OCDD	3268-87-9	1.05E-10	permit limit (e)	Y (B, EMPC)	PDT emission rate = 2.54E-11 g/sec
Total OCDF	39001-02-0	5.81E-11	permit limit (e)	Y (B, EMPC)	PDT emission rate = 1.41E-11 g/sec
Combustion Gases					
Sulfur dioxide	7446-09-5	8.69E-02	miniburn data	Y	
Nitrogen dioxide	10102-44-0	3.28E-01	miniburn data	Y	

Notes:

* = The compound was detected very infrequently, in only one or two of the sampled fractions, from the three replicate runs

B = One or more sample fraction results from one or more of the three replicate runs were affected by method blank contamination

COL = There was a greater than 40% difference between primary and confirmatory columns in one or more sample fraction results from one or more of the three replicate runs; reported result should be considered estimated.

EMPC = One or more of the front or back half sample results from one or more of the three replicate runs were an estimated maximum possible concentration.

FR&DRE = Feed rate and destruction and removal efficiency. Since emission rates for this compound were not measured during the PDT, the emission rate was calculated from the annual average feed rate of the compound in received spent carbon, based on 2003-2006 Toxics Release Inventory data from the facility, conservatively assuming a 99 99% destruction and removal efficiency (DRE). The DREs reported from the PDT were all >99.99%.

HHRAP = Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (U.S. Environmental Protection Agency, 2005)

ND = Not detected in any sample fraction from any of the three replicate runs.

PDT = Performance Demonstration Test. The emission rate was calculated as the average across the three PDT test runs.

TIC = Tentatively identified compound.

Y = Yes; detected in one or more sample fractions from at least one of the three replicate runs.

(a) The proposed permit limit for arsenic, beryllium and chromium combined is 1 26E-4 g/sec (97 ug/dscm @7% O2). The emission rate for each compound was conservatively set at the total proposed permit limit.

(b) The proposed permit limit for lead and cadmium combined is 3.12E-4 g/sec (240 ug/dscm @7% O2). The emission rate for each compound was conservatively set at the total proposed permit limit.

(c) The proposed permit limit for total mercury is 1.69E-4 g/sec (130 ug/dscm @7% O2). This total was apportioned between elemental and divalent mercury based on the PDT results (79.7% and 20.3%, respectively). In the risk assessment, these emission rates wre further adjusted, per USEPA 2005 HHRAP guidance, to reflect the portion of mercury entering the global mercury cycle (85.6%) and the portion remaining available locally (14.4% overall, 1% for elemental, 36% for particulate divalent, and 68% for vapor phase divalent). The resulting emission rates available for local impacts, the input parameters used in HHRAP, were 1.34E-6 g/sec for elemental Hg, and 2.3E-5 g/sec for divalent Hg (mercuric chloride).

(d) PDT data for polychlorinated biphenyls (PCBs) (CAS #1336-36-3) was evaluated as Aroclor 1254 based on HHRAP guidance and an evaluation of the PCB homologue distribution, which showed that roughly 93% of the PCBs had 4 or less chlorines and 7% had more than 4 chlorines. Additionally, Aroclor 1254 was selected over Aroclor 1016 to represent total PCBs because it has more conservative human health toxicity criteria.

(e) Based on proposed permit limit of 0.4 ng/dscm @ 7% O2 for PCDD/F TEQs. The permit-limit based emission rate was apportioned between the congeners based on the distribution measured during the PDT.

Table 4.2-1
Chemical Emission Rates for Reactivation Furnace Stack

Compound	CAS Number	Stack Emission Rate Used in Risk Assessment (g/sec)	Emission Rate Basis	PDT Results Detected in Stack Samples (Y or ND)	Additional Emission Rate Information

(f) Based on proposed permit limit for HCl and Cl2 combined of 77 ppmv @7% O2. The permit-limit based emission rate was apportioned between the compounds based on the results from the PDT (81.68% HCl and 18.32% Cl2).

Table 4.2-2
Upsets Analysis - Calendar Year 2000

Equipment Failure Emissions Affected	Duration Basis	Event Data Time (min)	 Time (min)	Total Failure Time (min)	% of Total Failures
Power Outage Organic, Metals/PM, HCL, CL	Outage + assumed maximum 15 min	56	15	**375**	**38.8%**
		95	23		
		101	20		
		65			
WESP Failure Metals/PM	Retention Time (maximum 42 min)	15		**57**	**5.9%**
		42			
Scrubber Pump Failure Metals/PM, HCL/CL	Retention Time (maximum 42 min)	42		**84**	**8.7%**
		42			
ID Fan Failure Organic, Metals/PM, HCl/Cl	Outage + assumed maximum 15 min	65	43	**305**	**31.6%**
		45	15		
		77	60		
Burner Failure Organic, Metals/PM, HCl/Cl	Outage + assumed maximum 15 min	63	30	**145**	**15.0%**
		25			
		27			
Caustic Failure HCl/Cl	Retention Time (maximum 42 min)			**0**	**0.0%**
Venturi Actuator Failure Metals/PM	Retention Time (maximum 42 min)			**0**	**0.0%**
Quench Spray Plugged Metals/PM	Retention Time (maximum 42 min)			**0**	**0.0%**
Secondary Combustion Fan Failure Organic	Retention Time (maximum 42 min)			**0**	**0.0%**

966 Minutes	**16.10 Hours**	**0.24% Percentage for year (a)**

(a) Total operating hours for the year = 7844 hours

Scaling factor = 1.02
Basis: 0.24% opera ion during upsets and 99.76% operation under normal conditions
Per USEPA 2005 guidance, scaling factor calculated as follows: (0.0024*10) + (.9976*1) = 1.02

Table 4.2-2 (continued)
Upsets Analysis - Calendar Year 2001

Equipment Failure Emissions Affected	Duration Basis	Event Data Time (min)	Time (min)	Time (min)	Time (min)	Total Failure Time (min)	% of Total Failures	
Power Outage Organic, Metals/PM, HCL, CL	Outage + assumed maximum 15 min	16	32	40	30	**666**	**60.5%**	Note: Power outages were mainly caused by power supplier - BIA
		20	26	45	25			
		44	60	35	155			
		95	43					
WESP Failure Metals/PM	Retention Time (maximum 42 min)	42				**42**	**3.8%**	
Scrubber Pump Failure Metals/PM, HCL/CL	Retention Time (maximum 42 min)	42				**45**	**4.1%**	
		3						
ID Fan Failure Organic, Metals/PM, HCl/Cl	Outage + assumed maximum 15 min	20	52			**297**	**27.0%**	events were caused by fault bearing vibration readings.
		75	66					
		42	42					
Burner Failure Organic, Metals/PM, HCl/Cl	Outage + assumed maximum 15 min	33				**51**	**4.6%**	
		18						
Caustic Failure HCl/Cl	Retention Time (maximum 42 min)					**0**	**0.0%**	
Venturi Actuator Failure Metals/PM	Retention Time (maximum 42 min)					**0**	**0.0%**	
Quench Spray Plugged Metals/PM	Retention Time (maximum 42 min)					**0**	**0.0%**	
Secondary Combustion Fan Failure Organic	Retention Time (maximum 48 min)					**0**	**0.0%**	
						1101 **Minutes**	**18.35** **Hours**	**0.23%** **Percentage for year (a)**

(a) Total operating hours for the year = 7844 hours

Scaling factor = 1.02
Basis: 0.23% operation during upsets and 99.77% operation under normal condi ions
Per USEPA 2005 guidance, scaling factor calculated as follows: (0.0023*10) + (.9977*1) = 1 02

Table 4.2-3

Use of Dispersion and Deposition Modeling Results in the Carbon Reactivation Facility Risk Assessment

Exposure Pathway	Type of Environmental Concentration Calculated	Modeling Result Used
Air Dispersion Model		
Long-term chronic risks from inhalation of airborne compounds	Concentration in ambient air	Annual averages
Short-term inhalation risks from airborne compounds	Concentration in ambient air	1-hour averages
Air Dispersion and Deposition Model		
Long-term chronic risks from indirect pathways (e.g., ingestion of animal, products, ingestion of homegrown produce and soil ingestion)	Concentrations in ground-level and aquatic media (e.g., concentrations in plants, water, animal products, fish, soil) resulting from air concentrations and deposition of compounds	Annual averages

Table 4.2-4
Receptor Locations Evaluated for the Stack Emissions Risk Assessment

Receptor Name (a)	Description	Acute Inhalation Risk Evaluation	Chronic Multiple Pathway Risk Evaluation
Residential Receptors (developed area within and around Town of Parker)			
R_1 resident	Closest residential location to facility, residential area in town with highest hourly modeled impacts from stack emissions	√	√
R_2 resident	Residential area in town with highest annual modeled impacts from stack emissions	√	√
Farmer Receptors (residential areas with access to irrigation water and within modeling domain)			
R_3 resident farmer	Residential area with access to irrigation water with highest annual modeled impacts from stack emissions	√	√
R_4 resident farmer	Residential area with access to irrigation water with highest hourly modeled impacts from stack emissions	√	√
Maximum Impact Point (undeveloped land area)			
A_1 max hourly (stack)	Maximum stack emissions impact location for hourly concentrations. There is no residential or commercial land use in the vicinity of the maximum impact area (SW of facility).	√	--
Non-Residential Areas			
A_2 closest business (b)	Closest developed location beyond property boundary (non-residential) with highest hourly modeled impacts from stack emissions	√	--

-- = Not evaluated. These locations are not used for residential purposes.

(a) Receptor names are those used in the IRAP risk assessment software program.

(b) The County Agricultural Extension Office and CRIT Realty are located at receptor A_2. Maximum 1-hour average air concentrations due to stack emissions at all other non-residential developed land use locations were lower than at receptor A_2.

Table 4.2-5

Exposure Pathways and Receptors Quantitatively Evaluated in the Siemens Water Technology Corp. Facility Risk Assessment

Exposure Pathway	Receptors			
	Adult and Child Resident	Adult and Child Fisher	Adult and Child Livestock Farmer	Breast-Fed Infant (a)
Inhalation	✓		✓	
Incidental Soil Ingestion	✓		✓	
Ingestion of Homegrown Produce	✓		✓	
Ingestion of Fish Caught from the Main Drain		✓		
Ingestion of Fish Caught from the Colorado River		✓		
Ingestion of Locally-Raised Poultry			✓	
Ingestion of Locally-Raised Eggs			✓	
Ingestion of Locally-Raised Pork			✓	
Ingestion of Locally-Raised Beef			✓	
Ingestion of Breast-milk				✓

(a) A breast-fed infant exposure to PCDD/PCDFs was evaluated for each adult receptor.

Table 4.2-6
Site-Specific Fate and Transport Modeling Parameters for the Stack Emissions Risk Assessment

Input Parameter	Value	Units	Basis	Symbol
Global Input Parameters				
Average annual precipitation	13	cm/yr	National Climatic Data Center, Climate Summary for Parker, AZ. 1971-2000 Monthly Normals. Annual mean precipitation = 5.17 inches.year.	p
Ambient air temperature	294	K	Annual average temperature from Arizona Meteorological Network station in Parker for 2001-2005 period of record.	t
Average annual wind speed	2.38	m/sec	Annual average wind speed from Arizona Meteorological Network station in Parker for 2001-2005 period of record.	u
Fraction of mercury emissions not lost to the global cycle	.144	unitless	Fraction mercury not lost to global cycle based on PDT test results for mercury species in conjunction with USEPA default assumptions regarding percentages of mercury species lost to the global cycle (99% elemental Hg, 64% particulate Hg2+, 32% vapor Hg2+, per Figure 2-4 in USEPA's 2005 HHRAP).	merc_q_corr
Residential Receptor Area (developed area within and around Town of Parker)				
Average annual evapotranspiration	108	cm/yr	Annual evapotranspiration set at level necessary to meet IRAP program requirement P+I > E_v + RO. This reduces soil loss due to leaching to roughly 0, which will tend to overestimate soil concentrations.	E_v
Average annual irrigation	100	cm/yr	Irrigation based on water use information provided for several crop types by the University of Arizona Cooperative Extension (ag.arizona.edu/pubs/water) and the Arizona Master Gardener Manual (cals.arizona.edu/pubs/garden/mg/vegetable/index.html) in conjunction with growing season information for vegetable crops provided in U.S. Bureau of Reclamation. Lower Colorado River Accounting System Report. March 2007.	I
Average annual runoff	4.8	cm/yr	Calculated using curve number method described in Maidment (1992) and properties for soils present in non-irrigated areas within the modeling domain from SCS (1983). Sources: Maidment, D.R., Ed. 1992. Handbook of Hydrology. McGraw-Hill, Inc. and Soil Conservation Service. 1983. Soil Survey of Colorado River Indian Reservation. Arizona-California. U.S. Department of Agriculture.	RO
Farmer Receptor Area (residential areas with access to irrigation water and within modeling domain)				
Grain fraction grown on affected soil eaten by beef cattle	0	unitless	L. Masters, Director, La Paz County Agricultural Extension Office. Personal communcation with S. Foster, CPF Associates, June 26 and July 2, 2007.	beef_fi_grain
Grain fraction grown on affected soil eaten by chicken	0	unitless	L. Masters, Director, La Paz County Agricultural Extension Office. Personal communcation with S. Foster, CPF Associates, June 26 and July 2, 2007.	chick_fi_grain

Table 4.2-6
Site-Specific Fate and Transport Modeling Parameters for the Stack Emissions Risk Assessment

Input Parameter	Value	Units	Basis	Symbol
Average annual evapotranspiration	182	cm/yr	U.S. Bureau of Reclamation (USBR) calculated evapotranspiration rate for Parker, AZ area. (Source: U.S. Bureau of Reclamation. Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations. Calendar Year 2005. U.S. Dept. of Interior. March 2007.)	E_v
Average annual irrigation	230	cm/yr	Irrigation rate calculated by dividing water diverted at Headgate Rock Dam to the CRIT irrigation canal (544,600 acre-feet/yr for water year 2005) by number of acres irrigated for 2005 (73,159 acres). Source for water diverted: USGS Annual Water Report for Main Canal Near Parker, Station #09428500, Water Resources Data. Arizona. Water Year 2005. Report AZ-05-1. Source for acres irrigated: U.S. Bureau of Reclamation. Lower Colorado River Accounting System Report. March 2007. Sheet K - Colorado River Indian Reservation, Arizona.	I
Fraction of grain grown on affected soil eaten by pigs	0	unitless	L. Masters, Director, La Paz County Agricultural Extension Office. Personal communcation with S. Foster, CPF Associates, June 26 and July 2, 2007.	pork_fi_grain
Fraction of silage grown on affected soil and eaten by pigs	0	unitless	L. Masters, Director, La Paz County Agricultural Extension Office. Personal communcation with S. Foster, CPF Associates, June 26 and July 2, 2007.	pork_fi_silage
Average annual runoff	7.4	cm/yr	Calculated using curve number method described in Maidment (1992) and properties for soils present in the irrigated area within the modeling domain from SCS (1983). Sources: Maidment, D.R., Ed. 1992. Handbook of Hydrology. McGraw-Hill, Inc. and Soil Conservation Service. 1983. Soil Survey of Colorado River Indian Reservation. Arizona-California. U.S. Department of Agriculture.	RO
Parameters for the Main Drain Fate and Transport Modeling				
Universal Soil Loss Equation (USLE) cover management factor	0.08	unitless	Weighted average for major crop types grown (alfalfa, cotton, sudangrass, bermudagrass, wheat). Crop types and acreages were obtained from the CRIT Annual Irrigation Crop Report for 2000. Cover management factors (C values) were obtained from Mills et al. 1985, Table III-4 (USEPA. 1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water – Part I).	C
Universal Soil Loss Equation (USLE) erodibility factor	0.28	tons/acre	Average value based on soil types in irrigated areas, where soil types and erodibility (K) values were identified from the SCS Soil Survey of Colorado River Indian Reservation. Arizona-California. USDA 1986 (from maps and Table 13, respectively).	K
Universal Soil Loss Equation (USLE) erosivity factor	35	yr^{-1}	Obtained from Mills et al. (1985), Figure III-11 for the general Parker, Arizona region (USEPA. 1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water – Part I).	RF

Table 4.2-6
Site-Specific Fate and Transport Modeling Parameters for the Stack Emissions Risk Assessment

Input Parameter	Value	Units	Basis	Symbol
Impervious watershed area	0	m^2	Assumes the area of impervious surfaces, such as paved roads, is negligible in comparison to the entire watershed area.	AI
Watershed area	76,643,414	m^2	Surface area within modeling domain calculated by IRAP based on waterbody geometry drawn on base map within IRAP program.	AL
Water column depth	0.7	m	Average water depth of Main Drain at USGS Upper Main Drain Near Poston station (USGS #09428508), based on 2003-2007 data.	dwc
Current velocity	0.26	m/sec	Average water velocity of Main Drain at USGS Upper Main Drain Near Poston station (USGS #09428508), based on 2003-2007 data.	u
Total suspended solids concentration	2.6	mg/L	mg/L - Suspended solids concentration was estimated from turbidity measurements collected from 2002-2006 from the Colorado River at the USGS Parker Dam station #09427520. Suspended solids concentration was calculated using three regression equations that relate turbidity to suspended solids derived from studies of the Alamo River, CA, Verde River, AZ and Little Colorado River, AZ.	TSS
Flow rate	5.62E+07	m^3/yr	Average flow rate of Main Drain at USGS Upper Main Drain Near Poston station (USGS #09428508), based on 2003-2007 data (63 cfs). Flow rate measurement data were not available at any other location along the Main Drain.	Vfx
Water body surface area	86,322	m^2	Surface area within modeling domain calculated by IRAP based on waterbody geometry drawn on base map within IRAP program.	Aw
Average annual evapotranspiration	182	cm/yr	U.S. Bureau of Reclamation (USBR) calculated evapotranspiration rate for Parker, AZ area. (Source: U.S. Bureau of Reclamation. Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations. Calendar Year 2005. U.S. Dept. of Interior. March 2007.)	E_v
Average annual irrigation	230	cm/yr	Irrigation rate calculated by dividing water diverted at Headgate Rock Dam to the CRIT irrigation canal (544,600 acre-feet/yr for water year 2005) by number of acres irrigated for 2005 (73,159 acres). Source for water diverted: USGS Annual Water Report for Main Canal Near Parker, Station #09428500, Water Resources Data. Arizona. Water Year 2005. Report AZ-05-1. Source for acres irrigated: U.S. Bureau of Reclamation. Lower Colorado River Accounting System Report. March 2007. Sheet K - Colorado River Indian Reservation, Arizona.	I

Table 4.2-6
Site-Specific Fate and Transport Modeling Parameters for the Stack Emissions Risk Assessment

Input Parameter	Value	Units	Basis	Symbol
Average annual runoff	7.4	cm/yr	Calculated using curve number method described in Maidment (1992) and properties for soils present in the irrigated area within the modeling domain from SCS (1983). Sources: Maidment, D.R., Ed. 1992. Handbook of Hydrology. McGraw-Hill, Inc. and Soil Conservation Service. 1983. Soil Survey of Colorado River Indian Reservation. Arizona-California. U.S. Department of Agriculture.	RO
Parameters for the Colorado River Fate and Transport Modeling				
Universal Soil Loss Equation (USLE) cover management factor	0.2	unitless	Weighted average for major crop types grown (alfalfa, cotton, sudangrass, bermudagrass, wheat). Crop types and acreages were obtained from the CRIT Annual Irrigation Crop Report for 2000. Cover management factors (C values) were obtained from Mills et al. 1985, Table III-4 (USEPA. 1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water – Part I).	C
Universal Soil Loss Equation (USLE) erodibility factor	0.13	tons/acre	Average value based on soil types in irrigated areas, where soil types and erodibility (K) values were identified from the SCS Soil Survey of Colorado River Indian Reservation. Arizona-California. USDA 1986 (from maps and Table 13, respectively).	K
Universal Soil Loss Equation (USLE) erosivity factor	35	yr-1	Obtained from Mills et al. (1985), Figure III-11 for the general Parker, Arizona region (USEPA. 1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water – Part I).	RF
Impervious watershed area	0	m^2	Assumes the area of impervious surfaces, such as paved roads, is negligible in comparison to the entire watershed area.	AI
Watershed area	359,614,253	m^2	Surface area within modeling domain calculated by IRAP based on waterbody geometry drawn on base map within IRAP program.	AL
Water column depth	1.7	m	Average water depth of Main Drain at USGS Upper Main Drain Near Poston station (USGS #09428508), based on 2003-2007 data.	dwc
Current velocity	0.99	m/sec	Average water velocity of Main Drain at USGS Upper Main Drain Near Poston station (USGS #09428508), based on 2003-2007 data.	u
Water body temperature	292	K	Average temperature measured at inlet to Main Colorado River Irrigation Canal, which draws water from the Colorado River at Headgate Rock Dam, from USGS Station #09428500 for period 1969-1983 (years for which data were available for electronic download).	T

Table 4.2-6
Site-Specific Fate and Transport Modeling Parameters for the Stack Emissions Risk Assessment

Input Parameter	Value	Units	Basis	Symbol
Total suspended solids concentration	2.6	mg/L	mg/L - Suspended solids concentration was estimated from turbidity measurements collected from 2002-2006 from the Colorado River at the USGS Parker Dam station #09427520. Suspended solids concentration was calculated using three regression equations that relate turbidity to suspended solids derived from studies of the Alamo River, CA, Verde River, AZ and Little Colorado River, AZ.	TSS
Flow rate	6.10E+06	m^3/yr	Average flow rate of Main Drain at USGS Upper Main Drain Near Poston station (USGS #09428508), based on 2003-2007 data (63 cfs). Flow rate measurement data were not available at any other location along the Main Drain.	Vfx
Water body surface area		m^2	Surface area within modeling domain calculated by IRAP based on waterbody geometry drawn on base map within IRAP program.	Aw
Average annual evapotranspiration	8.19	cm/yr	Annual evapotranspiration set at level necessary to meet IRAP program requirement P+I > E_v + RO, assuming that irrigation = 0 cm/year for this receptor area.	E_v
Average annual irrigation	0	cm/yr	Watershed assumed to be non-irrigated. For non-irrigated areas, irrigation was set to 0, and annual evapotranspiration was set at a level necessary to meet the modeling program condition of P+I > E_v + RO.	I
Average annual runoff	4.8	cm/yr	Calculated using curve number method described in Maidment (1992) and properties for soils present in non-irrigated areas within the modeling domain from SCS (1983). Sources: Maidment, D.R., Ed. 1992. Handbook of Hydrology. McGraw-Hill, Inc. and Soil Conservation Service. 1983. Soil Survey of Colorado River Indian Reservation. Arizona-California. U.S. Department of Agriculture.	RO

Table 4.2-7
Receptor Locations and Area-Wide Receptors Evaluated for the Stack Emissions Risk Assessment

Receptor Name (a)	Description	Acute Inhalation Risk Evaluation	Chronic Multiple Pathway Risk Evaluation
Residential Receptors (developed area within and around Town of Parker)			
R_1 resident	Closest residential location to facility, residential area in town with highest hourly modeled impacts from stack emissions	√	√
R_2 resident	Residential area in town with highest annual modeled impacts from stack emissions	√	√
Town area	Average of modeled impacts across town area	**	√
Farmer Receptors (residential areas with access to irrigation water and within modeling domain)			
R_3 resident farmer	Residential area with access to irrigation water with highest annual modeled impacts from stack emissions	√	√
R_4 resident farmer	Residential area with access to irrigation water with highest hourly modeled impacts from stack emissions	√	√
Farmer area	Average of modeled impacts across area with access to irrigation water within modeling domain	**	√
Fish Ingestion Pathway			
R_only_fish_drain	Average modeled impacts across Main Drain within modeling domain	**	√
R_only_fish_river	Average modeled impacts across Colorado River within modeling domain	**	√
Maximum Impact Point (undeveloped land area)			
A_1 max hourly (stack)	Maximum stack emissions impact location for hourly concentrations. There is no residential or commercial land use in the vicinity of the maximum impact area (SW of facility).	√	--
Non-Residential Areas			
A_2 closest business (b)	Closest developed location beyond property boundary (non-residential) with highest hourly modeled impacts from stack emissions	√	--

** = Not evaluated. Acute inhalation risks were evaluated at specific modeled receptor points. The "town area" and "farmer area" receptors were assessed based on the average of the annual average ISCST3 modeling results across each of these areas, respectively, within the modeling domain, and thus these areas were not associated with any single receptor point. Similarly, the fish ingestion pathway receptors were associated with waterbody and watershed areas within the modeling domain for either the Main Drain or the Colorado River, and thus they too were not associated with any single receptor point.

-- = Not evaluated. These locations are not used for residential purposes.

(a) Receptor names are those used in the IRAP risk assessment software program.

(b) The County Agricultural Extension Office and CRIT Realty are located at receptor A_2. Maximum 1-hour average air concentrations due to stack emissions at all other non-residential developed land use locations were lower than at receptor A_2.

Table 4.3-1
Data Used to Select Chemicals for the Fugitive Emissions Evaluation

2003-2006 TRI data from Siemens Parker Facility (January 1, 2003 - December 31, 2006)							Chemical-Specific Toxicity Information			Volatility Information
compound	CAS #	number of deliveries over 4 year period	average concentration in received carbon loads (ppm)	maximum concentration in received carbon loads (ppm)	total carbon received over 4 year period (lbs)	total chemical received over 4 year period (lbs)	acute inhalation reference concentration (mg/m^3) (a)	chronic inhalation reference concentration (mg/m^3) (a)	inhalation cancer unit risk $(\mu g/m^3)^{-1}$ (a)	Henry's law constant ($atm\text{-}m^3/mol$) (b)
1,1,1-Trichloroethane	71-55-6	265	797	21,362	1,109,140	965.4	68			1.70E-02
1,1,2,2,-Tetrachloroethane	79-34-5	26	490	983	107,740	36.01	60	0.11	7.40E-06	3.40E-04
1,1,2-Trichloroethane	79-00-5	64	937	3,405	451,280	626.1	50		1.60E-05	9.10E-04
1,1-Dichlorethane	75-34-3	193	58	1,500	933,660	37.40	1250	0.5		5.60E-03
1,1-Dichloroethene	75-35-4	782	130	9,921	3,644,640	501.9	75	0.2		2.60E-02
1,2-Dichlorobenzene	95-50-1	52	6,550	78,000	274,720	684.1	300	0.2		1.90E-03
1,2,3-Trichloropropane	96-18-4	3	0.40	0.396	60,000	0.0238	60	0.021	0.002	4.10E-04
1,2,4-Trimethylbenzene	95-63-6	47	8.72	33	294,920	2.156	150			6.16E-03
1,2-Dibromoethane	106-93-4	11	152	402	18,100	3.147	200	0.009	6.00E-04	7.43E-04
1,2-Dichloroethane	107-06-2	437	166	16,000	2,476,100	528.1	202	2.4	2.60E-05	9.80E-04
1,2-Dichloroethene	540-59-0	32	196	1,700	104,700	15.41	555	0.07		9.40E-03
1,2-Dichloropropane	78-87-5	17	157	2,310	93,300	4.874	500	0.004	1.00E-05	2.80E-03
1,3-Butadiene	106-99-0	1	12,880	12,880	7,400	95.31	1481	2.00E-03	3.00E-05	7.36E-02
1,3-Dichlorobenzene	541-73-1	11	308	680	24,000	6.610	12.5	0.0032		3.10E-03
1,4-Dichlorobenzene	106-46-7	59	6,550	34,500	206,120	892.42	600	0.8	1.10E-05	2.40E-03
1,4-Dioxane	123-91-1	8	29	29	8,540	0.2477	3	3	3.10E-06	4.80E-06
2,4,Dinitrophenol	51-28-5	9	1.80	1.8	108,000	0.1944	7.5	0.007		4.43E-07
Acetone	67-64-1	63	222	720	340,140	30.74	475	0.35		3.90E-05
Acrylic Acid	79-10-7	1	25	25	2,000	0.0500	6	1.00E-03		1.17E-07
Acrylonitrile	107-13-1	9	11,500	11,500	57,000	655.5	22	0.002	6.80E-05	1.03E-04
Aldrin	309-00-2	2	2.60	2.6	3,000	0.0078	0.75	0.0001	0.0049	1.70E-04
Aniline	62-53-3	14	128	137	190,000	23.63	30.45	0.001	1.60E-06	1.90E-06
Antimony	7440-36-0	10	0.99	2.11	16,020	0.0203	1.5	0.0014		2.50E-02
Arsenic	7440-38-2	10	7.13	139	937,220	3.834	0.00019	3.00E-05	4.30E-03	
Barium	7440-39-3	302	40	920	2,361,760	78.82	1.5	5.00E-04		
Benzene	71-43-2	3443	2,057	70,000	19,245,740	67,042	1.3	0.03	7.80E-06	5.60E-03
Beryllium	7440-41-7	52	0.59	9.76	547,040	0.219	0.005	2.00E-05	2.40E-03	
Bromodichloromethane	75-27-4	3	0.82	1.2	7,280	0.00793	4	0.07	1.80E-05	1.60E-03
Cadmium	7440-43-9	63	3.31	79.3	818,120	3.576	0.03	2.00E-04	1.80E-03	
Carbon Tetrachloride	56-23-5	142	19	935	1,051,660	14.52	1.9	0.04	1.50E-05	3.00E-02
Chlorobenzene	108-90-7	109	444	5,762	764,100	1,376.04	125	0.06		3.70E-03
Chloroethane	75-00-3	3	11	11	3,000	0.0330	2500	10		8.80E-03
Chloroform	67-66-3	634	130	20,940	4,318,420	483.5	0.15	0.0003	2.30E-05	3.70E-03
Chloromethane	74-87-3	3	1,836	5,500	6,000	22.01	200	0.09	1.80E-06	8.82E-03
Chromium	7440-47-3	310	12	294	2,789,000	36.92	1.5	5.3		
cis 1,2-Dichloroethene	156-59-2	3	490	490	6,620	3.244	555	0.07		4.10E-03
Cobalt	7440-48-4	171	11	798	1,808,760	12.16	3	1.00E-04		
Copper	7440-50-8	256	119	6,820	2,075,180	56.81	0.1	3.50E-02		
Cyclohexane	110-82-7	16	8,634	46,000	48,800	231.4	1000	6		1.95E-01

Table 4.3-1
Data Used to Select Chemicals for the Fugitive Emissions Evaluation

2003-2006 TRI data from Siemens Parker Facility (January 1, 2003 - December 31, 2006)							Chemical-Specific Toxicity Information			Volatility Information
compound	CAS #	number of deliveries over 4 year period	average concentration in received carbon loads (ppm)	maximum concentration in received carbon loads (ppm)	total carbon received over 4 year period (lbs)	total chemical received over 4 year period (lbs)	acute inhalation reference concentration (mg/m^3) (a)	chronic inhalation reference concentration (mg/m^3) (a)	inhalation cancer unit risk $(\mu g/m^3)^{-1}$ (a)	Henry's law constant ($atm\text{-}m^3/mol$) (b)
Ethylbenzene	100-41-4	888	1,408	25,932	5,225,120	5,168	500	1		7.90E-03
Ethylene Glycol	107-21-1	1	87,000	87,000	4,000	348.0	100	1.3		6.00E-08
Lead	7439-92-1	768	4.31	125	3,489,880	12.01	0.15	0.0015	1.20E-05	
Lindane	58-89-9	9	78	140	11,020	0.808	1.5			1.40E-05
Mercury	7439-97-6	69	1.34	11.6	266,000	0.118	0.0018	3.00E-04		7.10E-03
Methyl ethyl ketone	78-93-3	134	1,463	31,200	642,680	398.3	13	5		5.60E-05
methyl Isobutyl ketone	108-10-1	13	11,437	46,600	13,000	100.5	300	3		1.40E-04
Methyl methacrylate	80-62-6	3	4,002	12,000	5,060	15.13	70	0.7		3.37E-04
Methyl tert-butyl ether	1634-04-4	119	336	15,000	707,960	226.9	180	3		5.90E-04
Methylene chloride	75-09-2	134	2,047	7,913	943,120	1,385	14	3	4.70E-07	2.20E-03
Molybdenum	7439-98-7	29	14	130	375,700	6.227	30			
Naphthalene	91-20-3	57	663	3,600	248,520	110.44	75	0.003		4.80E-04
n-Hexane	110-54-3	1	2,220	2,220	1,000	2.220	1500	0.7		1.80E+00
Nickel	7440-02-0	226	39	1,610	2,035,460	24.49	0.006	2.00E-04	2.40E-04	
Nitrobenzene	98-95-3	10	1,936	2,150	128,000	232.4	15			2.40E-05
o-Xylene	95-47-6	11	205	530	31,220	2.448	22	0.1		5.20E-03
Pentachlorophenol	87-86-5	13	331	3,970	128,520	24.75	1.5		4.60E-06	2.40E-08
Phenol	108-95-2	75	864	27,000	233,040	93.32	5.8	0.2		4.00E-07
Propylene oxide	75-56-9	10	40	61	61,760	2.788	3.1	0.03	3.70E-06	1.23E-04
Selenium	7782-49-2	65	2.26	18.9	330,760	0.803	1.47	0.02		
Silver	7440-22-4	25	11	262	54,480	0.666	0.3	0.018		
Styrene	100-42-5	107	20,428	84,784	775,400	22,092	21	1		2.70E-03
Tetrachloroethylene	127-18-4	1562	1,608	91,000	5,908,780	5,343	20	0.4	5.90E-06	1.80E-02
Toluene	108-88-3	1145	1,855	35,837	7,178,420	13,322	37	0.4		6.60E-03
Trichloroethylene	79-01-6	2114	606	16,667	9,283,060	6,134	698	0.6	2.00E-06	1.00E-02
Trichlorofluoromethane	75-69-4	4	7.23	7.23	11,760	0.085	2500	0.7		9.70E-02
Vanadium	7440-62-2	156	4.09	124	1,632,640	5.050	0.15	2.00E-04		
Vinyl acetate	108-05-4	7	370	2,590	7,160	2.592	23.6	0.2		5.10E-04
Vinyl Chloride	75-01-4	375	61	6,100	1,116,660	64.63	180	0.1	8.80E-06	2.70E-02
Xylene	1330-20-7	565	1,240	90,657	3,234,140	2,578	22	0.1		7.70E-03
Zinc	7440-66-6	203	25	167	1,867,280	43.95	30	5.3		

(a) Toxicity data were obtained from values compiled by USEPA in its 2005 HHRAP, if available, or from the sources recommended in the USEPA guidance if they were not available. Reference concentrations for 1,2-dichloroethene and cis-1,2-dichloroethene were based on the lowest values reported in HHRAP for either the cis- or trans- compound for the selection of compounds for evaluation.
(b) Henry's law constants were obtained from values compiled by USEPA in its 2005 HHRAP, if available, or from the sources recommended in the USEPA guidance if they were not available.
Blank spaces indicate no data were available or the parameter was not applicable.

Table 4.3-2
Top Five (5) Compound Rankings by Category

Highlighted Rows Indicate Selected Compounds for Fugitive Emissions Evaluation

Basis for selection: ranked in top five (5) in any category or classified as a known human carcinogen by the U.S. Environmetnal Protection Agency, International Agency for Research on Cancer, or the National Toxicology Program

Blank cells indicate that a compound was ranked below the top five (5) compounds or that a ranking was not calculated, either because a toxicity criterion was not available or the ranking was not applicable (i.e., volatility rank was not calculated for metals except mercury).

Compound	CAS #	Number of deliveries rank	Total lbs received rank	Volatility rank (avg conc * Henry's law constant)	Acute effect rank (avg conc / acute reference air conc)	Acute effect rank (max conc / acute reference air conc)	Chronic effect rank (avg conc / chronic reference air conc)	Chronic effect rank (max conc / chronic reference air conc)	Cancer rank (avg conc * inhal unit risk)	Cancer rank (max conc * inhal unit risk)	Known human carcinogens (2005 11th NTP ROC and IARC Group 1)	EPA's IRIS carcinogen classification	Number of deliveries if <5
1,1,1-trichloroethane	71-55-6												
1,1,2,2,-tetrachloroethane	630-20-6											C	
1,1,2-Trichloroethane	79-00-5											C	
1,1dichlorethane	75-34-3												
1,1dichloroethene	75-35-4												
1,2, dichlorobenzene	95-50-1												
1,2,3,trichloropropane	96-18-4												3
1,2,4,trimethylbenzene	95-63-6												
1,2,dibromoethane	**106-93-4**								**3**			**likely carc to humans**	
1,2,dichloroethane	107-06-2											B2	
1,2,dichloroethene	540-59-0												
1,2,dichloropropane	78-87-5												
1,3-Butadiene	**106-99-0**			**3**			**1**	**4**	**2**		√	**carc to humans**	**1**
1,3-dichlorobenzene	541-73-1												
1,4, -dichlorobenzene	**106-46-7**								**4**				
1,4-Dioxane	123-91-1											B2	
2,4,Dinitrophenol	51-28-5												
acetone	67-64-1												
Acrylic Acid	79-10-7												1
acrylonitrile	**107-13-1**						**2**	**5**	**1**	**1**		**B1**	
Aldrin	309-00-2											B2	2
Aniline	62-53-3											B2	
Antimony	7440-36-0												
Arsenic	**7440-38-2**				**1**	**1**	**4**		**5**	**2**	√	**A**	
Barium	7440-39-3												
Benzene	**71-43-2**	**1** (3444)	**1** (67,042 lbs)		**3**	**5**				**3**	√	**A**	
Beryllium	**7440-41-7**										√	**B1**	
Bromodichloromethane	75-27-4											B2	3
Cadmium	**7440-43-9**										√	**B1**	
Carbon Tetrachloride	56-23-5											B2	
Chlorobenzene	108-90-7												
chloroethane	75-00-3												3
Chloroform	**67-66-3**					**3**	**3**	**1**	**5**			**B2**	
chloromethane	74-87-3											D	3
Chromium	7440-47-3												
cis 1,2-Dichloroethene	156-60-5												3
Cobalt	**7440-48-4**							**3**					

Table 4.3-2
Top Five (5) Compound Rankings by Category

Highlighted Rows Indicate Selected Compounds for Fugitive Emissions Evaluation

Basis for selection: ranked in top five (5) in any category or classified as a known human carcinogen by the U.S. Environmetnal Protection Agency, International Agency for Research on Cancer, or the National Toxicology Program

Blank cells indicate that a compound was ranked below the top five (5) compounds or that a ranking was not calculated, either because a toxicity criterion was not available or the ranking was not applicable (i.e., volatility rank was not calculated for metals except mercury).

Compound	CAS #	Number of deliveries rank	Total lbs received rank	Volatility rank (avg conc * Henry's law constant)	Acute effect rank (avg conc / acute reference air conc)	Acute effect rank (max conc / acute reference air conc)	Chronic effect rank (avg conc / chronic reference air conc)	Chronic effect rank (max conc / chronic reference air conc)	Cancer rank (avg conc * inhal unit risk)	Cancer rank (max conc * inhal unit risk)	Known human carcinogens (2005 11th NTP ROC and IARC Group 1)	EPA's IRIS carcinogen classification	Number of deliveries if <5
Copper	**7440-50-8**				**4**	**4**							
Cyclohexane	**110-82-7**			**2**									
Ethylbenzene	**100-41-4**	**5** (888)											
Ethylene Glycol	107-21-1												1
Lead	7439-92-1											B2	
Lindane	58-89-9												
Mercury	7439-97-6												
Methyl ethyl ketone	78-93-3												
methyl Isobutyl ketone	108-10-1												
Methyl methacrylate	80-62-6												3
methyl tert-butyl ether	1634-04-4												
Methylene chloride	75-09-2											B2	
molybdenum	7439-98-7												
Naphthalene	**91-20-3**						**5**						
n-Hexane	**110-54-3**			**1**									**1**
Nickel	**7440-02-0**				**2**	**2**		**2**			√	**A** (refinery dust)	
Nitrobenzene	98-95-3												
o-Xylene	95-47-6												
Pentachlorophenol	87-86-5											B2	
Phenol	108-95-2												
Propylene oxide	75-56-9											B2	
Selenium	7782-49-2												
Silver	7440-22-4												
Styrene	**100-42-5**		**2**	**4**	**5**								
Tetrachloroethylene	**127-18-4**	**3**	**5** (5343 lbs)	**5**						**4**			
Toluene	**108-88-3**	**4**	**3**										
Trichloroethylene	**79-01-6**	**2**	**4**										
Trichlorofluoromethane	75-69-4												4
Vanadium	7440-62-2												
vinyl acetate	108-05-4												
Vinyl Chloride	**75-01-4**										√	**A**	
Xylene	1330-20-7												
Zinc	7440-66-6												

Table 4.3-3
Input Parameters For Modeling Fugitive Organic Vapor Emissions During Unloading at the Outdoor Hopper

Parameter Name (Variable, units)	Aqua Spent Carbon (used to treat liquid)	Vapor Spent Carbon (used to treat gases)	Basis
Fraction organic carbon (foc, unitless)	0.89	0.89	Kleineidam, S., Schuth, C. and Grathwohl, P. 2002. Solubility-normalized combined adsorption-partitioning sorption isotherms for organic pollutants. Environ. Sci. & Technol. 36:4689-4697.
Bulk density of spent carbon (BD, g/cm^3)	0.50	0.50	Typical bulk density for activated carbon.
Total porosity of spent carbon (Et, unitless)	0.22	0.22	Calculated based on Kleineidam at al. (2002) pore volume for activated carbon of 441 cm^3/kg and assumed density for activated carbon of 0.5 g/cm^3.
Moisture content of spent carbon (M, unitless)	0.50	0.10	Personal communication with M. McCue, Director of Plant Operations, May 2007
Water-filled porosity of spent carbon (Ew, unitless)	0.11	0.02	Calculated based on total porosity and moisture content
Air-filled porosity of spent carbon (Ea, unitless)	0.11	0.20	Calculated: air-filled porosity = (total porosity - water-filled porosity)
Mass of spent carbon unloaded per unloading event per hour at hopper (Q, kg spent carbon/hr)	3,864	3,242	Based on analysis of spent carbon containers' capacities, approximate unloading times per container type, and the average amount of spent carbon, by container type and container capacity, unloaded during 2005 and 2006 (data provided by M. McCue, Director of Plant Operations, May 2007). Amount unloaded per unloading event per hour = average amount spent carbon unloaded per event (2,975 kg aqua spent carbon or 1,783 kg vapor spent carbon) / average unloading duration (0.77 hours for aqua spent carbon containers or 0.55 hours for vapor spent carbon containers).
Hours unloading per workday (HR, hrs)	4	4	Maximum duration of unloading activities at facility during a workday (personal communication with M. McCue, Director of Plant Operations, May 2007).
Pore gas to atmosphere exchange constant (Exc, unitless)	0.10	0.33	USEPA default values. Used value for wet soils to represent aqua and value for dry, sandy soils to represent vapor spent carbon (USEPA. 1997. Air Emissions from the Treatment of Soils Contaminated with Petroleum Fuels and Other Substances. EPA-600/R-97-116)
Volume of air-filled pore spaces in spent carbon affected per hour (Vol, cm^3/hr)	850,100	1,296,800	Calculated: cm^3/hr = (air-filled porosity of spent carbon in cm^3 air/cm^3 spent carbon * amount spent carbon unloaded per event in kg/hr * 1000 g/kg) /(bu k_density g/cm^3 spent carbon)

Table 4.3-4
Chemical-Specific Input Parameters Used to Calculate Fugitive Organic Vapor Emission Rates

compound	CAS #	Average concentration in received spent carbon loads (ppm)	Maximum concentration in received carbon loads (ppm)	Henry's law constant (atm-m^3/mol) (a)	Henry's law constant (unitless) (b)	Organic carbon:water partition coefficient (Koc)	H and Koc Sources
1,2-Dibromoethane	106-93-4	1.52E+02	4.02E+02	7.43E-04	3.10E-02	92.53	HHRAP
1,3-Butadiene	106-99-0	1.29E+04	1.29E+04	7.36E-02	3.07E+00	116	Chemfate
1,4-Dichlorobenzene	106-46-7	6.55E+03	3.45E+04	2.40E-03	1.00E-01	616	HHRAP
Acrylonitrile	107-13-1	1.15E+04	1.15E+04	1.03E-04	4.29E-03	1.76	HHRAP
Arsenic	7440-38-2	7.13E+00	1.39E+02	0.00E+00	0.00E+00	NA	HHRAP
Benzene	71-43-2	2.06E+03	7.00E+04	5.60E-03	2.33E-01	61.7	HHRAP
Beryllium	7440-41-7	5.95E-01	9.76E+00	0.00E+00	0.00E+00	NA	HHRAP
Cadmium	7440-43-9	3.31E+00	7.93E+01	0.00E+00	0.00E+00	NA	HHRAP
Chloroform	67-66-3	1.30E+02	2.09E+04	3.70E-03	1.54E-01	52.5	HHRAP
Cobalt	7440-48-4	1.15E+01	7.98E+02	0.00E+00	0.00E+00	NA	HHRAP
Copper	7440-50-8	1.19E+02	6.82E+03	0.00E+00	0.00E+00	NA	HHRAP
Cyclohexane	110-82-7	8.63E+03	4.60E+04	1.95E-01	8.13E+00	482	Chemfate
Ethylbenzene	100-41-4	1.41E+03	2.59E+04	7.90E-03	3.29E-01	204	HHRAP
Naphthalene	91-20-3	6.63E+02	3.60E+03	4.80E-04	2.00E-02	1190	HHRAP
n-Hexane	110-54-3	2.22E+03	2.22E+03	1.80E+00	7.50E+01	1468	Physprop (c)
Nickel	7440-02-0	3.89E+01	1.61E+03	0.00E+00	0.00E+00	NA	HHRAP
Styrene	100-42-5	2.04E+04	8.48E+04	2.70E-03	1.13E-01	912	HHRAP
Tetrachloroethylene	127-18-4	1.61E+03	9.10E+04	1.80E-02	7.50E-01	265	HHRAP
Toluene	108-88-3	1.86E+03	3.58E+04	6.60E-03	2.75E-01	140	HHRAP
Trichloroethylene	79-01-6	6.06E+02	1.67E+04	1.00E-02	4.17E-01	94.3	HHRAP
Vinyl Chloride	75-01-4	6.08E+01	6.10E+03	2.70E-02	1.13E+00	15.38	HHRAP

(a) Unless otherwise noted, Henry's law constants and Koc values were obtained from values compiled by USEPA in its 2005 HHRAP, if available, or from the sources recommended in the USEPA guidance if they were not available.
(b) The unitless H' = (H atm-m3/mol) / (RT of 2.4E-2 atm-m3/mol)
(c) The Koc was calculated from the log Kow using HHRAP methodology, and log Kow was obtained from Physprop.

NA = Not applicable.
Chemfate = Syracuse Research Service Chemical fate database (http://www.syrres.com/eSc/chemfate.htm)
HHRAP = USEPA's 2005 Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA-530/R-05-006).
Physprop = Syracuse Research Service physical chemical properties database (http://www.syrres.com/eSc/physdemo.htm)

Table 4.3-5
Fugitive Organic Compound Emission Rates During Spent Carbon Unloading at the Outdoor Hopper (a)

Compound	CAS #	Average Concentration in spent carbon (g/g)	Aqua Spent Carbon: Concentration in air-filled pore spaces of spent carbon (g/cm^3)	Vapor Spent Carbon: Concentration in air-filled pore spaces of spent carbon (g/cm^3)	Aqua Spent Carbon: Emission Rate (g/sec)	Vapor Spent Carbon: Emission Rate (g/sec)
1,2-Dibromoethane	106-93-4	1.52E-04	5.70E-08	5.71E-08	7.69E-07	3.88E-06
1,3-Butadiene	106-99-0	1.29E-02	3.79E-04	3.78E-04	5.12E-03	2.57E-02
1,4-Dichlorobenzene	106-46-7	6.55E-03	1.19E-06	1.19E-06	1.61E-05	8.11E-05
Acrylonitrile	107-13-1	1.15E-02	2.76E-05	3.06E-05	3.73E-04	2.08E-03
Arsenic	7440-38-2	7.13E-06	NA	NA	NA	NA
Benzene	71-43-2	2.06E-03	8.70E-06	8.72E-06	1.17E-04	5.92E-04
Beryllium	7440-41-7	5.95E-07	NA	NA	NA	NA
Cadmium	7440-43-9	3.31E-06	NA	NA	NA	NA
Chloroform	67-66-3	1.30E-04	4.26E-07	4.27E-07	5.74E-06	2.90E-05
Cobalt	7440-48-4	1.15E-05	NA	NA	NA	NA
Copper	7440-50-8	1.19E-04	NA	NA	NA	NA
Cyclohexane	110-82-7	8.63E-03	1.63E-04	1.62E-04	2.20E-03	1.10E-02
Ethylbenzene	100-41-4	1.41E-03	2.55E-06	2.55E-06	3.44E-05	1.73E-04
Naphthalene	91-20-3	6.63E-04	1.25E-08	1.25E-08	1.69E-07	8.50E-07
n-Hexane	110-54-3	2.22E-03	1.26E-04	1.25E-04	1.70E-03	8.46E-03
Nickel	7440-02-0	3.89E-05	NA	NA	NA	NA
Styrene	100-42-5	2.04E-02	2.83E-06	2.83E-06	3.82E-05	1.92E-04
Tetrachloroethylene	127-18-4	1.61E-03	5.10E-06	5.10E-06	6.89E-05	3.47E-04
Toluene	108-88-3	1.86E-03	4.08E-06	4.09E-06	5.51E-05	2.78E-04
Trichloroethylene	79-01-6	6.06E-04	3.00E-06	3.00E-06	4.05E-05	2.04E-04
Vinyl Chloride	75-01-4	6.08E-05	4.83E-06	4.82E-06	6.52E-05	3.27E-04

NA = Not applicable. Organic compound vapor emissions were not calculated for inorganic compounds.
(a) See text for description of modeling method.

Table 4.3-6
Evaluation of Potential Fugitive Dust Emissions During Spent Carbon Unloading

Parameter	Value	Units	Basis	Variable Name
Input Parameters				
PM10 particle size multiplier	0.35	unitless	USEPA default for PM10 (particles less than 10 microns in diameter). This multiplier was developed based on data for material with silt content between 0.44-19%. (USEPA 2006)	kPM10
PM2.5 particle size multiplier	0.053	unitless	USEPA default for PM2.5 (particles less than 2.510 microns in diameter). This multiplier was developed based on data for material with silt content between 0.44-19%. (USEPA 2006)	kPM2.5
Mean wind speed	2.38	m/sec	Long-term average value based on Parker AZ data	U
Material moisture content	10	%	Value for vapor carbon. M. McCue, Director of Plant Operations, May 2007.	M
Mass unloaded per unloading event per hour	3,242	kg spent carbon/hr	Based on analysis of spent carbon containers' capacities, approximate unloading times per container type, and the average amount of spent carbon, by container type and container capacity, unloaded during 2005 and 2006 (data provided by M. McCue, Director of Plant Operations, May 2007). Amount unloaded per unloading event per hour = average amount spent carbon unloaded per event (1,783 kg vapor spent carbon) / average unloading duration (0.55 hours for vapor spent carbon containers).	Q
Emission Rate Calculations				
Total Dust Emission Rate				
E in kg particulate / megagram material	1.86E-04	kg/megagram	E = k * (0.0016) * [((U/2.20)^1.3) / ((M/2)^1.4)]. This equation was developed based on data for material with silt content between 0.44-19%, and moisture content between 0.25-4.8%. (USEPA 2006)	
E in g particulate / kg material unloaded	1.86E-04	g/kg	g / kg = (kg / megagram) * megagram/1,000 kg * 1,000 g/kg	
Emission rate in g/sec	1.68E-04	g/sec	g/kg * kg spent carbon/hr * hr/3,600 sec	
PM10 Emission Rate				
E in kg particulate / megagram material	6.52E-05	kg/megagram	E = k * (0.0016) * [((U/2.20)^1.3) / ((M/2)^1.4)]. This equation was devleoped based on data for material with silt content between 0.44-19%, and moisture content between 0.25-4.8%. (USEPA 2006)	
E in g particulate / kg material unloaded	6.52E-05	g/kg	g / kg = (kg / megagram) * megagram/1,000 kg * 1,000 g/kg	
Emission rate in g/sec	5.87E-05	g/sec	g/kg * kg spent carbon/hr * hr/3,600 sec	
PM2.5 Emission Rate				
E in kg particulate / megagram material	9.87E-06	kg/megagram	E = k * (0.0016) * [((U/2.20)^1.3) / ((M/2)^1.4)]. This equation was devleoped based on data for material with silt content between 0.44-19%, and moisture content between 0.25-4.8%. (USEPA 2006)	
E in g particulate / kg material unloaded	9.87E-06	g/kg	g / kg = (kg / megagram) * megagram/1,000 kg * 1,000 g/kg	
Emission rate in g/sec	8.89E-06	g/sec	g/kg * kg spent carbon/hr * hr/3,600 sec	

USEPA 2006 = U.S. Environmental Protection Agency. 2006. AP-42 Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. Aggregate Handling and Storage Piles, Section 13.2.4. November 2006.

Table 4.3-7
Inorganic Compound Emission Rates During Spent Carbon Unloading at the Outdoor Hopper (a)

Compound	CAS #	Average Concentration in spent carbon (g/g)	Inorganic Emission Rate (g/sec) (a)
1,2-Dibromoethane	106-93-4	1.52E-04	NA
1,3-Butadiene	106-99-0	1.29E-02	NA
1,4-Dichlorobenzene	106-46-7	6.55E-03	NA
Acrylonitrile	107-13-1	1.15E-02	NA
Arsenic	7440-38-2	7.13E-06	4.19E-10
Benzene	71-43-2	2.06E-03	NA
Beryllium	7440-41-7	5.95E-07	3.49E-11
Cadmium	7440-43-9	3.31E-06	1.94E-10
Chloroform	67-66-3	1.30E-04	NA
Cobalt	7440-48-4	1.15E-05	6.73E-10
Copper	7440-50-8	1.19E-04	6.99E-09
Cyclohexane	110-82-7	8.63E-03	NA
Ethylbenzene	100-41-4	1.41E-03	NA
Naphthalene	91-20-3	6.63E-04	NA
n-Hexane	110-54-3	2.22E-03	NA
Nickel	7440-02-0	3.89E-05	2.28E-09
Styrene	100-42-5	2.04E-02	NA
Tetrachloroethylene	127-18-4	1.61E-03	NA
Toluene	108-88-3	1.86E-03	NA
Trichloroethylene	79-01-6	6.06E-04	NA
Vinyl Chloride	75-01-4	6.08E-05	NA

NA = not applicable.

(a) Emission rate (g/sec) = PM10 dust emission rate (g/sec) * concentration in spent carbon (g/g), where the PM10 dust emission rate is 5.87E-5 g/sec (see text for description of PM10 emission rate calculation).

Table 4.3-8

Receptor Locations Evaluated for Fugitive Emissions During Spent Carbon Unloading at the Outdoor Hopper

Receptor Name (a)	Description	Acute Inhalation Risk Evaluation	Chronic Inhalation Risk Evaluation
Residential Receptors (developed area within and around Town of Parker)			
R_1 resident	Closest residential location to facility, residential area in town with highest hourly modeled impacts for stack emissions	√	√
R_2 resident	Residential area in town with highest annual modeled impacts for stack emissions	√	√
R_5 resident	Residential area in town with highest hourly modeled impacts for fugitive hopper emissions	√	√
R_6 resident	Residential area in town with highest annual modeled impacts for fugitive hopper emissions	√	√
Farmer Receptors (residential areas with access to irrigation water and within modeling domain)			
R_3 resident farmer	Residential area with access to irrigation water with highest annual modeled impacts (stack and fugitive hopper emissions)	√	√
R_4 resident farmer	Residential area with access to irrigation water with highest hourly modeled impacts (stack and fugitive hopper emissions)	√	√
Maximum Impact Point (undeveloped land area)			
A_1 max hourly (stack)	Maximum stack emissions impact location for hourly concentrations. There is no residential or commercial land use in the vicinity of the maximum impact area (SW of facility).	√	--
A_3 max hourly (fugitives)	Maximum fugitive hopper emissions impact location for hourly concentrations. There is no residential or commercial land use in the vicinity of the maximum impact area (immediately N of facility at property boundary).	√	--
Non-Residential Areas			
A_2 closest business (b)	Closest developed location beyond property boundary (non-residential) with highest hourly modeled impacts	√	--

-- = Not evaluated. These locations are not used for residential purposes.

(a) Receptor names are those used in the IRAP risk assessment software program.

(b) The County Agricultural Extension Office and CRIT Realty are located at receptor A_2. Maximum 1-hour average air concentrations at all other non-residential developed land use locations were lower than at receptor A_2.

Table 4.4-1
Chronic Risk Assessment Results - Reactivation Facility Stack

Receptor Name	Scenario	Description	EXCESS LIFETIME CANCER RISK (a)			TOTAL HAZARD INDEX (b)			Exposure Pathways
			Group 1 All Detected Compounds (n=95) (c)	Group 2 All Compounds (except benzidine) (n=177) (d)	Group 3 All Compounds (n=178) (e)	Group 1 All Detected Compounds (n=95) (c)	Group 2 All Compounds (except benzidine) (n=177) (d)	Group 3 All Compounds (n=178) (e)	
Residential Receptors (developed area within and around Town of Parker)									
R_1 resident	resident_adult	Closest residential location to facility	2.E-08	5.E-08	7.E-07	1.E-02	1.E-02	1.E-02	Inhalation Soil ingestion Homegrown produce ingestion (f)
	resident_child		5.E-09	1.E-08	3.E-07	1.E-02	1.E-02	1.E-02	
R_2 resident	resident_adult	Residential area in town with highest annual modeled impacts	6.E-08	2.E-07	2.E-06	5.E-02	5.E-02	5.E-02	
	resident_child		2.E-08	4.E-08	9.E-07	5.E-02	5.E-02	5.E-02	
Town area	resident_adult	Average across town area	1.E-08	3.E-08	4.E-07	1.E-02	1.E-02	1.E-02	
	resident_child		2.E-09	7.E-09	1.E-07	1.E-02	1.E-02	1.E-02	
Farmer Receptors (residential area with access to irrigation water and within modeling domain)									
R_3 resident farmer	farmer_adult	Residential area with access to irrigation water with highest annual modeled impacts	3.E-08	6.E-08	5.E-07	1.E-02	2.E-02	2.E-02	Inhalation Soil ingestion Homegrown produce ingestion Locally raised beef ingestion Locally raised poultry ingestion Locally raised egg ingestion Locally raised pork ingestion (f)
	farmer_child		4.E-09	1.E-08	1.E-07	2.E-02	2.E-02	2.E-02	
R_4 resident farmer	farmer_adult	Residential area with access to irrigation water with highest hourly modeled impacts	3.E-08	6.E-08	4.E-07	1.E-02	1.E-02	1.E-02	
	farmer_child		4.E-09	1.E-08	1.E-07	1.E-02	1.E-02	1.E-02	
Farmer area	farmer_adult	Average across residential area with access to irrigation water within modeling domain	1.E-08	2.E-08	2.E-07	6.E-03	6.E-03	6.E-03	
	farmer_child		2.E-09	4.E-09	5.E-08	6.E-03	6.E-03	6.E-03	
Fish Ingestion Pathway									
R_only fish_drain	fisher_adult	Fish ingestion evaluation for the Main Drain	1.E-08	1.E-08	2.E-08	1.E-02	1.E-02	1.E-02	Locally caught fish ingestion (f)
R_only fish_drain	fisher_child		1.E-09	2.E-09	2.E-09	1.E-02	1.E-02	1.E-02	
R_only fish_river	fisher_adult	Fish ingestion evaluation for the Colorado River	7.E-09	8.E-09	2.E-08	4.E-03	4.E-03	4.E-03	
R_only fish_river	fisher_child		1.E-09	1.E-09	2.E-09	3.E-03	3.E-03	3.E-03	

NOTES
n = Number of compounds.
PDT = Performance Demonstration Test.

(a) The additional (excess) lifetime cancer risks reflect exposure to all potential carcinogens evaluated. The regulatory target cancer risk level used by USEPA for combustion sources is 1E-5 (1 in 100,000). A value of 1E-5 is 10 times higher than 1E-6 and 100 times higher than 1E-7.

(b) The listed hazard index values for non-cancer effects reflect exposure to all evaluated compounds, regardless of the type of health effects. If a hazard index, based on the sum of hazard quotients for all compounds, is above 1, then the hazard index values are recalculated for groups of compounds having the same type of health effect and/or a more detailed evaluation may be conducted. USEPA uses a target hazard index value, for compounds grouped according to specific types of health effects, of 0.25 for combustion sources. A common regulatory target hazard index value used by most states and many other USEPA programs, for compounds grouped according to specific types of health effects, is 1.

(c) Group 1 includes 95 compounds, with chronic toxicity data, that were detected in the PDT in addition to several compounds that were not measured during the PDT but which were evaluated based on emission rates derived from feed rates. This group does not include compounds not detected in the PDT.

(d) Group 2 includes 177 compounds with chronic toxicity data, 82 of which were not detected in the PDT. This group does not include benzidine which was not detected in the PDT. There is no evidence from waste profile reports or analytical spent carbon data that benzidine has been received at the facility. Benzidine was singled out because it was found to be a significant risk driver, accounting for more than 95% of the total cancer risk when included in the risk calculations.

(e) Group 3 includes 178 compounds with chronic toxicity data, of which 83 were not detected in the PDT, including benzidine.

(f) Masters (2007) estimated that at most 20% of the produce and animal foods ingested could be homegrown or raised locally, respectively (information obtained from La Paz County Agricultural Extension Office, personal communication, 6/26/07 and 7/2/07). Information was not available for the fish ingestion pathway and, therefore, it was assumed that 100% of fish ingested was caught exclusively in either the Main Drain or the Colorado River within 10 km of the facility.

Table 4.4-2
Infant Average Daily Doses of Dioxins and Furans From Breastmilk Ingestion

Receptor Name	Scenario	Infant Average Daily Dose (pg PCDD/PCDF TEQs/ kg BW-day) (a)	Adult (Mother's) Exposure Pathways
Residential Receptors (developed area within and around Town of Parker)			
R_1 resident	resident_adult	2.E-04	Inhalation, soil ingestion, and produce ingestion
R_2 resident	resident_adult	8.E-04	
Town area	resident_adult	2.E-04	
Farmer Receptors (residential area with access to irrigation water and within modeling domain)			
R_3 resident farmer	farmer_adult	2.E-03	Inhalation, soil ingestion, and produce ingestion plus ingestion of beef, poultry, eggs, and pork
R_4 resident farmer	farmer_adult	2.E-03	
Farmer area	farmer_adult	9.E-04	
Fish Ingestion Pathway			
R_only fish_drain	fisher_adult	7.E-03	Fish ingestion
R_only fish_river	fisher_adult	5.E-03	
Comparison Target Level		60	

(a) Doses are based on the sum of all dioxin and furan congeners (PCDDs/PCDFs) expressed as 2,3,7,8-TCDD toxic equivalents (TEQs).

Table 4.4-3
Acute Inhalation Results - Reactivation Facility Stack (a)

Receptor Name	Description	Minimum Hazard Quotient (b)	Maximum Hazard Quotient (b)
Residential Receptors (developed area within and around Town of Parker)			
R_1 resident	Closest residential location to facility and residential area in town with highest hourly modeled impacts	<1E-10	0.02
R_2 resident	Residential area in town with highest annual modeled impacts	<1E-10	0.01
Farmer Receptors (residential area with access to irrigation water and within modeling domain)			
R_3 resident farmer	Residential area with access to irrigation water with highest annual modeled impacts	<1E-10	0.009
R_4 resident farmer	Residential area with access to irrigation water with highest hourly modeled impacts	<1E-10	0.02
Maximum Impact Point (undeveloped land area)			
A_1 max hourly	Maximum impact location for hourly concentrations. There is no residential or commercial land use in the vicinity of the maximum impact area (SW of facility).	<1E-10	0.08
Non-Residential Areas			
A_2 closest business (c)	Closest developed location beyond property boundary (non-residential) with highest hourly modeled impacts	<1E-10	0.04

(a) These results are conservatively based on the highest 1-hour average air concentration calculated for each specified receptor location and compound out of a total of 43,800 hours evaluated by the ISCST3 model (i.e., 5 years of hourly meteorological data from Parker, from 2001-2005, were used). The concentrations for all other hours were lower than those used to calculate these hazard quotients.

(b) The minimum and maximum results are the lowest and highest hazard quotients, respectively, calculated among all of the evaluated compounds. The typical target hazard quotient value used by regulatory agencies is 1.

(c) The County Agricultural Extension Office and CRIT Realty are located at receptor A_2. Maximum 1-hour average air concentrations at all other non-residential developed land use locations were lower than at receptor A_2.

Table 4.4-4
Chronic Inhalation Risk Assessment Results - Fugitive Hopper Emissions (a)

Receptor Name	Scenario	Description	Excess Lifetime Cancer Risk (b)	Total Hazard Index (c)
Residential Receptors (developed area within and around Town of Parker)				
R_1 resident	resident_adult	Closest residential location to facility, residential area in town with highest hourly modeled impacts for stack emissions	1.E-08	4.E-04
	resident_child		2.E-09	4.E-04
R_2 resident	resident_adult	Residential area in town with highest annual modeled impacts for stack emissions	3.E-08	1.E-03
	resident_child		6.E-09	1.E-03
R_5 resident	resident_adult	Residential area in town with highest hourly modeled impacts for fugitive hopper emissions	2.E-08	9.E-04
	resident_child		5.E-09	9.E-04
R_6 resident	resident_adult	Residential area in town with highest annual modeled impacts for fugitive hopper emissions	3.E-08	1.E-03
	resident_child		6.E-09	1.E-03
Farmer Receptors (residential area with access to irrigation water and within modeling domain)				
R_3 resident farmer	farmer_adult	Residential area with access to irrigation water with highest annual modeled impacts (stack and fugitive hopper emissions)	5.E-08	1.E-03
	farmer_child		7.E-09	1.E-03
R_4 resident farmer	farmer_adult	Residential area with access to irrigation water with highest hourly modeled impacts (stack and fugitive hopper emissions)	4.E-08	1.E-03
	farmer_child		6.E-09	1.E-03

(a) Risks were calculated for 21 compounds selected for the fugitive emissions evaluation (see text).

(b) The additional (excess) lifetime cancer risks reflect exposure to all potential carcinogens evaluated. The regulatory target cancer risk level used by USEPA for combustion sources is 1E-5 (1 in 100,000). A value of 1E-5 is 10 times higher than 1E-6 and 100 times higher than 1E-7.

(c) The listed hazard index values for non-cancer effects reflect exposure to all evaluated compounds, regardless of the type of health effects. If a hazard index, based on the sum of hazard quotients for all compounds, is above 1, then the hazard index values are recalculated for groups of compounds having the same type of health effect and/or a more detailed evaluation may be conducted. USEPA uses a target hazard index value, for compounds grouped according to specific types of health effects, of 0.25 for combustion sources. A common regulatory target hazard index value used by most states and many other USEPA programs, for compounds grouped according to specific types of health effects, is 1.

Table 4.4-5
Acute Inhalation Results - Fugitive Hopper Emissions (a)

Receptor Name	Description	Minimum Hazard Quotient (b)	Maximum Hazard Quotient (b)
Residential Receptors (developed area within and around Town of Parker)			
R_1 resident	Closest residential location to facility, residential area in town with highest hourly modeled impacts for stack emissions	<1E-9	3E-05
R_2 resident	Residential area in town with highest annual modeled impacts for stack emissions	<1E-9	3E-05
R_5 resident	Residential area in town with highest hourly modeled impacts for fugitive hopper emissions	<1E-9	3E-05
R_6 resident	Residential area in town with highest annual modeled impacts for fugitive hopper emissions	<1E-9	2E-05
Farmer Receptors (residential area with access to irrigation water and within modeling domain)			
R_3 resident farmer	Residential area with access to irrigation water with highest annual modeled impacts (stack and fugitive hopper emissions)	<1E-9	2E-05
R_4 resident farmer	Residential area with access to irrigation water with highest hourly modeled impacts (stack and fugitive hopper emissions)	<1E-9	3E-05
Maximum Impact Point (undeveloped land area)			
A_1 max hourly (stack)	Maximum stack emissions impact location for hourly concentrations. There is no residential or commercial land use in the vicinity of the maximum impact area (SW of facility)	<1E-8	2E-04
A_3 max hourly (fugitives)	Maximum fugitive hopper emissions impact location for hourly concentrations. There is no residential or commercial land use in the vicinity of the maximum impact area (immediately N of facility at property boundary).	<1E-7	0.01
Non-Residential Areas			
A_2 closest business (c)	Closest developed location beyond property boundary (non-residential) with highest hourly modeled impacts	<1E-9	5E-04

(a) These results are conservatively based on he highest 1-hour average air concentra ion calculated for each specified receptor location and compound out of a total of 43,800 hours evaluated by the ISCST3 model (i.e., 5 years of hourly meteorological data from Parker, from 2001-2005, were used). The concentrations for all other hours were lower than hose used to calculate hese hazard quotients.

(b) The minimum and maximum results are the lowest and highest hazard quotients, respectively, calculated among all of the evaluated compounds. The typical target hazard quotient value used by regulatory agencies is 1.

(c) The County Agricultural Extension Office and CRIT Realty are located at receptor A_2. Maximum 1-hour average air concentrations at all other non-residential developed land use locations were lower than at receptor A_2.

Table 4.4-6
2005 - 2006 Effluent Discharge Data From the Facility

Date	Year	Compound: / Sample Type	Aluminum (ug/L)	Arsenic (ug/L)	Barium (ug/L)	Beryllium (ug/L)	Boron (ug/L)	Cadmium (ug/L)	Chromium III (ug/L)	Lead (ug/L)	Magnesium (ug/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Selenium (ug/L)	Strontium (ug/L)	Vanadium (ug/L)	Acetone (ug/L)	Bromo-dichloro-methane (ug/L)	Bromo-form (ug/L)	Carbon disulfide (ug/L)	Chloro-dibromo-methane (ug/L)	Chloro-form (ug/L)
Metals Sampling																							
Jan	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	9.1	--	--	--	--	--	--	--	--
Feb	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	36	--	--	--	--	--	--	--	--
Mar	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	1 0	--	--	< 0.2	--	37	--	--	--	--	--	--	--	--
Apr	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	2 3	--	--	< 0.2	--	19	--	--	--	--	--	--	--	--
May	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	18	--	--	--	--	--	--	--	--
Jun	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	11	--	--	--	--	--	--	--	--
Jul	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	11	--	--	--	--	--	--	--	--
Aug	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	1 5	--	--	< 0.2	--	8.7	--	--	--	--	--	--	--	--
Sep	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	11	--	--	--	--	--	--	--	--
Oct	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	4.3	--	--	--	--	--	--	--	--
Nov	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	19	--	--	--	--	--	--	--	--
Dec	2005	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	9.6	--	--	--	--	--	--	--	--
Jan	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	7.6	--	--	--	--	--	--	--	--
Feb	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	7.8	--	--	--	--	--	--	--	--
Mar	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	12	--	--	--	--	--	--	--	--
Apr	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	21	--	--	--	--	--	--	--	--
May	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	16	--	--	--	--	--	--	--	--
Jun	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	17	--	--	--	--	--	--	--	--
Jul	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	1 2	--	--	< 0.2	--	11	--	--	--	--	--	--	--	--
Aug	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	10	--	--	--	--	--	--	--	--
Sep	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	17	--	--	--	--	--	--	--	--
Oct	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	14	--	--	--	--	--	--	--	--
Nov	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	2.2	--	--	--	--	--	--	--	--
Dec	2006	24-hr composite (a)	--	--	--	< 0.5	--	< 1.0	--	< 1.0	--	--	< 0.2	--	< 2.0	--	--	--	--	--	--	--	--
Performance Demonstration Test (detected compounds)																							
Mar	2006	4 hour composite (b)	114	13.7	247	<1.8	--	< 0.82	-- (c)	-- (c)	--	115	< 0.06	< 3.8	11	--	16 6	3.7	< 1 0	2	< 1.0	1.4	0.14
Mar	2006	6 hour composite (b)	<100	12.6	226	<1.8	--	< 0.82	-- (c)	-- (c)	--	61.2	< 0.06	< 3.8	10	--	21	4.8	0.89	2.1	< 1.0	1 3	0.15
Mar	2006	4 hour composite (b)	148	11.9	238	<1.8	--	2.4	-- (c)	-- (c)	--	85.9	< 0.06	4.8	9	--	21.1	4.07	1	2 03	0.16	1.4	0.14
Compliance Report for Categorical Pretreatment Standards (detected compounds)																							
Jun	2005	24-hour composite	--	13	--	--	--	< 5	5	< 5	--	--	< 0.2	< 10	--	--	<10	--	--	--	--	--	--
Dec	2005	24-hour composite	--	11	--	--	--	< 5	5.9	< 5	--	--	< 0.2	< 10	--	--	<10	--	--	--	--	--	--
Jun	2006	24-hour composite	--	12	--	--	--	< 5	< 5	< 5	--	--	< 0.2	< 10	--	--	31	--	--	--	--	--	--
Dec	2006	24-hour composite	--	<10	--	--	--	< 5	< 5	< 5	--	--	< 0.2	< 10	--	--	<10	--	--	--	--	--	--
Priority Pollutant Testing Report																							
Jul	2005	24-hour composite	82	5.2	75	--	640	--	--	--	29000	--	--	--	--	1700	--	--	--	--	--	--	--
Selection of Compounds for Evaluation																							
Compound Selected for Evaluation			√	√	√	NE	√	√	√	√	√	√	NE	√	√	√	√	√	√	√	√	√	√
Summary Data																							
Average (d)			99	11	197	NE	NC	NC	NC	NC	NC	87	NE	NC	13	NC	13	4.2	0.80	2.0	NC	1.4	0.14
Minimum detected level			82	5.2	75	NE	640	2.4	5	1	29000	61.2	NE	4.8	2.2	1700	16 6	3.7	0.89	2.0	0.16	1 3	0.14
Maximum			148	13.7	247	NE	640	2.4	5.9	2 3	29000	115	NE	4.8	37	1700	31	4.8	1	2.1	0.16	1.4	0.15

Source: Data obtained from M. McCue, Director of Plant Operations, May 2007.
-- = not available or not applicable
NC = not calculated due to the large percentage of samples that were non-detects
NE = not evaluated - compound was not detected
(a) One 24-hr composite sample collected per month
(b) Composite collected every 30 minutes during each test run (approximately 4 hours for runs 1 and 3, and approximately 6 hours for run 2)
(c) Lead and chromium were spiked in the Performance Demonstration Test
(d) Arithmetic average calculated using one-half the reported detection limit

Table 4.4-7
Analysis of Facility Incremental Contribution on CRSSJV POTW Concentrations

Concentrations in Facility Effluent (ug/L)				Concentrations in Facility Effluent and Entering POTW (ug/L)							
	Effluent Concentration (total ug/L)			Suspended solids:water partition coefficient for facility effluent (Kd_{sw})		Average Concentration - used to evaluate long-term (chronic) impacts			Maximum Concentration - used to evaluate acute (daily) impacts		
Compound	Average	Minimum detected level	Maximum	(L/kg)	Source (a)	Total	Dissolved (b)	Particulate (c)	Total	Dissolved (b)	Particulate (c)
Aluminum	99	82	148	9.9	2a	9.9E+01	9.8E+01	6.8E-03	1.5E+02	1.5E+02	1.0E-02
Arsenic	11	5.2	13.7	31	2b	1.1E+01	1.1E+01	2.3E-03	1.4E+01	1.4E+01	3.0E-03
Barium	197	75	247	52	2b	2.0E+02	2.0E+02	7.1E-02	2.5E+02	2.5E+02	9.0E-02
Boron	NC	640	640	3	2a	NC	NC	NC	6.4E+02	6.4E+02	1.3E-02
Cadmium	NC	2.4	2.4	4300	2b	NC	NC	NC	2.4E+00	2.3E+00	7.0E-02
Chromium III	NC	5	5.9	4.30E+06	2b	NC	NC	NC	5.9E+00	1.9E-01	5.7E+00
Lead	NC	1	2.3	900	1	NC	NC	NC	2.3E+00	2.3E+00	1.4E-02
Magnesium	NC	29000	29000	4.5	2c	NC	NC	NC	2.9E+04	2.9E+04	9.1E-01
Manganese	87	61.2	115	65	2a	8.7E+01	8.7E+01	4.0E-02	1.2E+02	1.1E+02	5.2E-02
Nickel	NC	4.8	4.8	1900	2b	NC	NC	NC	4.8E+00	4.7E+00	6.3E-02
Selenium	13	2.2	37	2.2	2b	1.3E+01	1.3E+01	2.1E-04	3.7E+01	3.7E+01	5.7E-04
Strontium	NC	1700	1700	35	2a	NC	NC	NC	1.7E+03	1.7E+03	4.2E-01
Vanadium	13	16.6	31	1000	2a	1.3E+01	1.3E+01	8.9E-02	3.1E+01	3.1E+01	2.2E-01
Acetone	4.2	3.7	4.8	0.04	1	4.2E+00	4.2E+00	1.2E-06	4.8E+00	4.8E+00	1.3E-06
Bromodichloromethane	0.80	0.89	1	0.11	2a	8.0E-01	8.0E-01	6.1E-07	1.0E+00	1.0E+00	7.7E-07
Bromoform	2.0	2	2.1	9.45	1	2.0E+00	2.0E+00	1.4E-04	2.1E+00	2.1E+00	1.4E-04
Carbon disulfide	NC	0.16	0.16	4.96	1	NC	NC	NC	1.6E-01	1.6E-01	5.6E-06
Chlorodibromomethane	1.4	1.3	1.4	5.24	1	1.4E+00	1.4E+00	5.0E-05	1.4E+00	1.4E+00	5.1E-05
Chloroform	0.14	0.14	0.15	3.94	1	1.4E-01	1.4E-01	4.0E-06	1.5E-01	1.5E-01	4.1E-06

CRSSJV POTW = Colorado River Sewage System Joint Venture Publicly Owned Treatment Works.

(a) Kdsw values were obtained from the following hierarchy of sources: (1) USEPA's HHRAP (2005) or (2) sources recommended in HHRAP (2005) consisting of (2a) USEPA's 2004 Superfund Chemical Data Matrix, (2b) USEPA's 1996 Soil Screening Guidance, and (2c) Baes et al. 1984. For pH-dependent Kd values, values provided in source (2b) were used basedon average pH levels in facility effluent (8.1) and in POTW outfall (7.0).

(b) Partitioning based on USEPA (1985): dissolved ug/L = total ug/L / [1 + (Kd L/kg * TSS mg/L * 1E-6)]

TSS in facility effluent (mg/L) = 7 Basis: Average from 2005 and 2006 sampling results at facility

TSS in POTW outfall (mg/L) = 3 Basis: Average from POTW discharge monitoring reports for 2005

(c) Particulate concentration = total concentration - dissolved concentration

Tables 4.4-8 and 4.4-9

Table 4.4-8

Incremental Facility Concentrations at POTW (ug/L)
(Concentrations reflect treatment to remove particulates and organics and effect of water flow into the POTW from other sources)

Compound	Average Concentration - used to evaluate long-term (chronic) impacts		Maximum Concentration - used to evaluate acute (daily) impacts	
	Dissolved (d)	Particulate (d)	Dissolved (d)	Particulate (d)
Aluminum	1.8E+01	2.5E-05	2.7E+01	3.7E-05
Arsenic	1.9E+00	8.4E-06	2.5E+00	1.1E-05
Barium	3.6E+01	2.6E-04	4.5E+01	3.3E-04
Boron	NC	NC	1.2E+02	4.9E-05
Cadmium	NC	NC	4.3E-01	2.6E-04
Chromium III	NC	NC	3.5E-02	2.1E-02
Lead	NC	NC	4.2E-01	5.3E-05
Magnesium	NC	NC	5.3E+03	3.3E-03
Manganese	1.6E+01	1.4E-04	2.1E+01	1.9E-04
Nickel	NC	NC	8.7E-01	2.3E-04
Selenium	2.4E+00	7.5E-07	6.8E+00	2.1E-06
Strontium	NC	NC	3.1E+02	1.5E-03
Vanadium	2.3E+00	3.2E-04	5.6E+00	7.9E-04
Acetone	1 5E-02	4.3E-09	1.8E-02	4.9E-09
Bromodichloromethane	2.9E-03	2.2E-09	3.7E-03	2.8E-09
Bromoform	7 5E-03	4.9E-07	7.7E-03	5.1E-07
Carbon disulfide	NC	NC	5.8E-04	2.0E-08
Chlorodibromomethane	5 0E-03	1.8E-07	5.1E-03	1.9E-07
Chloroform	5 2E-04	1.4E-08	5.5E-04	1.5E-08

Table 4.4-9

Incremental Concentrations Exiting in POTW Outfall (ug/L)
(Repartitioned Concentrations Between Total, Dissolved and Particulate)

Compound	Average Concentration - used to evaluate long-term (chronic) impacts	Maximum Concentration - used to evaluate acute (daily) impacts	Suspended solids water partition coefficient for POTW outfall (Kd_{sw})		Average Concentration - used to evaluate long-term (chronic) impacts		Maximum Concentration - used to evaluate acute (daily) impacts	
	Total (e)	Total (e)	(L/kg)	Source (a)	Dissolved (b)	Particulate (c)	Dissolved (b)	Particulate (c)
Aluminum	1.8E+01	2.7E+01	9.9	2a	1.8E+01	5.3E-04	2.7E+01	8.0E-04
Arsenic	1.9E+00	2.5E+00	29	2b	1.9E+00	1.7E-04	2.5E+00	2.2E-04
Barium	3.6E+01	4.5E+01	42	2b	3.6E+01	4.5E-03	4.5E+01	5.7E-03
Boron	NC	1.2E+02	3	2a	NC	NC	1.2E+02	1.1E-03
Cadmium	NC	4.3E-01	110	2b	NC	NC	4.3E-01	1.4E-04
Chromium III	NC	5.6E-02	2.50E+06	2b	NC	NC	6.5E-03	4.9E-02
Lead	NC	4.2E-01	900	1	NC	NC	4.2E-01	1.1E-03
Magnesium	NC	5.3E+03	4.5	2c	NC	NC	5.3E+03	7.2E-02
Manganese	1.6E+01	2.1E+01	65	2a	1.6E+01	3.1E-03	2.1E+01	4.1E-03
Nickel	NC	8.7E-01	88	2b	NC	NC	8.7E-01	2.3E-04
Selenium	2.4E+00	6.8E+00	4.3	2b	2.4E+00	3.1E-05	6.8E+00	8.7E-05
Strontium	NC	3.1E+02	35	2a	NC	NC	3.1E+02	3.3E-02
Vanadium	2.3E+00	5.6E+00	1000	2a	2.3E+00	6.9E-03	5.6E+00	1.7E-02
Acetone	1 5E-02	1.8E-02	0.04	1	1.5E-02	1.8E-09	1.8E-02	2.1E-09
Bromodichloromethane	2.9E-03	3.7E-03	0.11	2a	2.9E-03	9.6E-10	3.7E-03	1.2E-09
Bromoform	7 5E-03	7.7E-03	9.45	1	7.5E-03	2.1E-07	7.7E-03	2.2E-07
Carbon disulfide	NC	5.8E-04	4.96	1	NC	NC	5.8E-04	8.7E-09
Chlorodibromomethane	5 0E-03	5.1E-03	5.24	1	5.0E-03	7.9E-08	5.1E-03	8.0E-08
Chloroform	5 2E-04	5.5E-04	3.94	1	5.2E-04	6.2E-09	5.5E-04	6.5E-09

(a) Kdsw values were obtained from the following hierarchy of sources: (1) USEPA's HHRAP (2005) or (2) sources recommended in HHRAP (2005) consisting of (2a) USEPA's 2004 Superfund Chemical Data Matrix, (2b) USEPA's 1996 Soil Screening Guidance, and (2c) Baes et al. 1984. For pH-dependent Kd values, values provided in source (2b) were used basedon average pH levels in facility effluent (8.1) and in POTW outfall (7 0).

(b) Partitioning based on USEPA (1985): dissolved ug/L = total ug/L / [1 + (Kd L/kg * TSS mg/L * 1E-6)]

TSS in facility effluent (mg/L) = 7 Basis: Average from 2005 and 2006 sampling results at facility

TSS in POTW outfall (mg/L) = 3 Basis: Average from POTW discharge monitoring reports for 2005

(c) Particulate concentration = total concentration - dissolved concentration

(d) Concentrations at POTW reflect treatment (particulate and organics removal) and effect of water flow into the POTW from other sources.
Concentration at POTW (ug/L) = influent concentration (ug/L) * (1-fractional removal efficiency) * facility effluent flow rate (gpd) / POTW outfall flow rate (gpd)

Removal efficiencies for constituents as follows:

Dissolved metal constituents:	0	%	Basis: POTW does not remove dissolved constituents
Particulate metal constituents:	98	%	Basis: Average suspended solids removal % in POTW discharge monitoring reports for 2005
Dissolved and particulate organic constituents:	98	%	Basis: Average BOD % removal in POTW discharge monitoring reports for 2005

Water flow rates as follows:

RF-2 facility effluent (gpd) =	129465	gpd	Basis: Average effluent flow rate to POTW for 2006 year
POTW outfall (gpd) =	708541	gpd	Basis: Average POTW outfall flow rate for 2006 year

(e) Total concentration in outfall due to facility increment = particulate + dissolved concentrations

Table 4.4-10
Ambient Water Quality Criteria and Standards
(Concentrations in ug/L)

Compound	Joint Venture NPDES Discharge Limit (1,2)						Arizona Water Quality Standards (WQS) for Colorado River Designated Uses (1,3) (Total concentration unless otherwise noted)								
	Average (monthly)	Basis		Maximum (daily)	Basis		DWS	FC	FBC	AgI	AgL	A&Ww -C		A&Ww-A	
Inorganic Compounds															
Aluminum												87 (4)		750 (4)	
Arsenic	--	--		--	--		50	1,450	50	2,000	200	190	d	360	d
Barium	--	--		--	--		2,000	--	98,000	--	--	--		--	
Boron							630	--	126,000	1,000	--	--		--	
Cadmium	3	A&Ww -C	d	70	FBC		5	84	700	50	50	5.3	d,h	15	d,h
Chromium (III)	--	--		--	--		10,500	1,010,000	2,100,000	--	--	191	d,h	1,470	d,h
Lead	15	A&Ww -C	d	386	A&Ww-A	d	15	--	15	10,000	100	8.7	d,h	222	d,h
Magnesium															
Manganese	--	--		--	--		980	--	196,000	10,000	--	--		--	
Nickel	--	--		--	--		140	4,600	28,000	--	--	138	d,h	1,246	d,h
Selenium	2	A&Ww -C		20	A&Ww-A		50	9,000	7,000	20	50	2		20	
Strontium															
Vanadium															
Organic Compounds															
Acetone															
Bromodichloromethane							TTHM	46	TTHM	--	--	--		--	
Bromoform							TTHM	360	180	--	--	--		--	
Carbon disulfide															
Chlorodibromomethane							TTHM	34	TTHM	--	--	--		--	
Chloroform							TTHM	470	230	--	--	--		--	

Notes

-- = value not available

NPDES = National Pollution Discharge Elimination System (USEPA program)

TTHM = compound is a trihalomethane. The drinking water standard for total trihalomethanes is 100 ug/L.

(1) Water Use Codes

FC = Fish Consumption
FBC = Full-body contact
DWS = Domestic Water Supply (domestic drinking water in the area is obtained from groundwater wells)
AgI = Agricultural Irrigation
AgL = Agricultural Livestock
A&Ww-C = Aquatic & wildlife, warmwater - chronic
A&Ww-A = Aquatic and wildlife, warmwater - acute

Water quality criteria descriptors

h = hardness-dependent criterion. Calculated using hardness data reported by the U.S. Geological Survey (USGS) for October 2005 - September 2006 in Colorado River below Parker Dam (318 mg $CaCO_3$/L)

d = dissolved concentration

(2) The basis of the NPDES limits are Arizona Water Quality Standards (WQS). The specific limits are the lowest criteria for all applicable water uses in the Colorado River near the POTW that were in effect prior to March 2002 (when the standards were updated).

(3) Arizona WQS, updated March 29, 2002 and April 8, 2003 (www.azsos gov/public_services/Title_18/18-11.htm).

(4) USEPA National Recommended Water Quality Criteria (www.epa gov/waterscience/criteria/wqcriteria/html).

Table 4.4-11
POTW Outfall Evaluation: Comparison to Most Stringent Applicable Criteria or Standard (ug/L)

Compound	Potential for Acute Effects			Potential for Chronic Effects		
	Acute Criterion	Basis of Criterion	Ratio of Modeled Result to Criterion	Chronic Criterion	Basis of Criterion	Ratio of Modeled Result to Criterion
Aluminum	750	total recoverable - aquatic life	0.04	87	total recoverable - aquatic life	0.2
Arsenic	360	total - aquatic life	0.007	50	dissolved - full body contact	0.04
Barium	--		NC	98000	total - full body contact	0.0004
Boron	--		NC	1000	total - agricultural irrigation	NC
Cadmium	15	dissolved - aquatic life	0.03	5.3	dissolved - aquatic life	NC
Chromium III	1470	dissolved - aquatic life	0.000004	191	dissolved - aquatic life	NC
Lead	222	dissolved - aquatic life	0.002	8.7	dissolved - aquatic life	NC
Magnesium	--		NC	--		NC
Manganese	--		NC	10000	total - agricultural irrigation	0.002
Nickel	1246	dissolved - aquatic life	0.0007	138	dissolved - aquatic life	NC
Selenium	20	total - aquatic life	0.3	2	total - aquatic life	1.2
Strontium	--		NC	--		NC
Vanadium	--		NC	--		NC
Acetone	--		NC	--		NC
Bromodichloromethane	--		NC	46	fish consumption	0.00006
Bromoform	--		NC	180	full body contact	0.00004
Carbon disulfide	--		NC	--		NC
Chlorodibromomethane	--		NC	34	fish consumption	0.0001
Chloroform	--		NC	230	full body contact	0.000002

-- = not available.

NC = not calculated either because a criterion or standard was not available or because of the large percentage of non-detected concentrations in the Seimens facility effluent.

Table 4.4-12

Fish Ingestion Pathway Risk Assessment
Concentrations in Main Drain and in Fish at Potential Fishing Location

Compound	Average Dissolved Concentration at POTW Outfall due to Facility Effluent (ug/L) (a)	Average Dissolved Concentration in Main Drain at USGS Station (ug/L) (b)	Fish Biotransfer Factor (L/kg FW)		Fish Tissue Concentration (mg/kg FW) (c)	Fish Ingestion Intake (mg/kg body weight-day) (d)		Oral Toxicity Criterion (e)			Excess Lifetime Cancer Risk (f)		Noncancer Hazard Quotient (g)	
			Value	Source		Adult	Child	CSF (mg/kg-day)$^{-1}$	RfD (mg/kg-day)	Source	Adult	Child	Adult	Child
Aluminum	18	3.1E-01	500	(7)	1.6E-01	2.0E-04	1.4E-04	NA	1	(4)	NC	NC	2E-04	1E-04
Arsenic	1.9	3.3E-02	114	(1)	3.8E-03	4.7E-07	3.3E-07	1.5	3.00E-04	(3)	3E-07	4E-08	2E-03	1E-03
Barium	36	6.3E-01	633	(1)	4.0E-01	5.0E-04	3.5E-04	NA	0.07	(3)	NC	NC	7E-03	5E-03
Boron	NC	NC	--	--	--	NC	NC	NA	2.00E-01	(5)	NC	NC	NC	NC
Cadmium	NC	NC	907	(1)	--	NC	NC	0.38	4.00E-04	(3)	NC	NC	NC	NC
Chromium III	NC	NC	19	(1)	--	NC	NC	NA	1.5	(3)	NC	NC	NC	NC
Lead	NC	NC	0.09	(1)	--	NC	NC	8 50E-03	4.30E-04	(3)	NC	NC	NC	NC
Magnesium	NC	NC	--	--	--	NC	NC	NA	NA		NC	NC	NC	NC
Manganese	16	2.8E-01	400	(7)	1.1E-01	1.4E-04	9.8E-05	NA	0.14	(5)	NC	NC	1E-03	7E-04
Nickel	NC	NC	78	(1)	--	NC	NC	NA	2.00E-02	(3)	NC	NC	NC	NC
Selenium	2.4	4.2E-02	409	(2)	1.7E-02	2.1E-05	1.5E-05	NA	5.00E-03	(3)	NC	NC	4E-03	3E-03
Strontium	NC	NC	60	(7)	--	NC	NC	NA	6.00E-01	(5)	NC	NC	NC	NC
Vanadium	2.3	4.0E-02	--	--	--	NC	NC	NA	3.00E-03	(6)	NC	NC	NC	NC
Acetone	0.015	2.6E-04	129	(1)	3.4E-05	4.2E-08	3.0E-08	NA	0.9	(3)	NC	NC	4E-08	3E-08
Bromodichloro-methane	2.90E-03	5.0E-05	8.26	(1)	4.2E-07	5.2E-10	3.7E-10	6 20E-02	2.00E-02	(3)	1E-11	2E-12	2E-08	2E-08
Bromoform	7.50E-03	1.3E-04	13.3	(1)	1.7E-06	2.2E-09	1.5E-09	7.90E-03	2.00E-02	(3)	7E-12	1E-12	1E-07	7E-08
Carbon disulfide	NC	NC	9.86	(1)	--	NC	NC	NA	1.00E-01	(3)	NC	NC	NC	NC
Chlorodibromo-methane	5.00E-03	8.7E-05	10.4	(1)	9.0E-07	1.1E-09	8.0E-10	8.40E-02	2.00E-02	(3)	4E-11	5E-12	5E-08	4E-08
Chloroform	5.20E-04	9.0E-06	6.92	(1)	6.3E-08	7.8E-11	5.5E-11	NA	1.00E-02	(3)	NC	NC	8E-09	5E-09
									Total		3E-07	4E-08	1E-02	1E-02

NA = not available.
NC = not calculated. An average concentration was not calculated for a compound if there was a large percentage of non-detected concentrations reported in the facility effluent.
-- = not identified (because an average concentration in the Main Drain was not calculated or because the biotransfer factor is not available or not applicable).
FW = fresh weight.

(a) Average dissolved concentration (from prior table)

(b) Concentrations were calculated at the only location on the Main Drain at which water flow rate data are measured (U.S. Geological Survey Station station #09428508). This USGS station is about 10 miles downstream of the outfall and about 5 miles upstream of the Colorado River.
Concentration downstream in Main Drain (ug/L) = incremental concentration at outfall (ug/L) * flow rate at outfall (gpd) / flow rate at USGS station (gpd)
Water flow rates as follows:

gpd) = 708541 gpd Basis: Average POTW outfall flow rate for 2006 year
POTW outfall flow rate (gpd) = 4.07E+07 gpd Basis: Annual average flow rate from 2003-2007 measurements (63 ft3/sec) at USGS Station #09428508
Flow rate at USGS Main Drain station (

(c) Fish tissue concentration (mg/kg) = BCF (L/kg) * dissolved H2O concentration (ug/L) * (1 mg/1,000 ug)

(d) Fish intake (mg/kg BW-day) = fish concentration (mg/kg FW) * fish ingestion rate (kg/kg body weight-day) * fraction ingested from evaluated location, where ingestion rates were 0.00125 and 0 00088 kg/kg body weight-day for an adult and child, respectively, and the fraction ingested was assumed to be 1.0 (i.e., 100%), based on USEPA's 2005 HHRAP default assumptions.

The intake for arsenic was also adjusted to reflect the fraction of arsenic present in the inorganic form in fish, since most arsenic in fish is present in the nontoxic organic form (ATSDR 2005). Field measurements of arsenic in freshwater fish show the fraction inorganic as 0.01-0.125 (ATSDR 2003, USEPA 2003c). The State of Arizona uses a value of 0.1 fraction inorganic in calculating the State ambient water quality criterion for arsenic for fish consumption (S. Pawlowski, personal communication, May 29, 2007). In this analysis, the Arizona value of 0.1 was thus used to adjust the fish ingestion arsenic intakes.

(e) Hierarchy for chronic toxicity data as follows: USEPA's 2005 HHRAP, USEPA's IRIS, USEPA's Provisional Peer-Reviewed Toxicity Values (PPRTVs), ATSDR's chronic minimum risk level.

(f) Cancer risk = intake (mg/kg body weight-day) * exposure duration (yrs) * exposure frequency (days/yr) * CSF (mg/kg-day)^{1} / (averaging time (yrs) * 365 days/yr), with the parameters defined based on USEPA 2005 HHRAP as follows: exposure duration (30 yrs adult, 6 yrs child), exposure frequency (350 days/yr), averaging time (70 yrs).

(g) Noncancer hazard quotient = intake (mg/kg body weight-day) * exposure duration (yrs) * exposure frequency (days/yr) / (reference dose (mg/kg-day) * exposure duration (yrs) * 365 days/yr), with the parameters defined based on USEPA 2005 HHRAP as follows: exposure duration (30 yrs adult, 6 yrs child), and exposure frequency (350 days/yr).

Sources:
(1) USEPA 2005 Human Health Risk Assessment Protocol (HHRAP), Appendix A, Biotransfer Factors
(2) Geometric mean of field-derived BAF values reported in USEPA's 2004 Draft Aquatic Life Water Quality Criteria for Selenium (EPA 822-D-04-001)
(3) USEPA 2005 Human Health Risk Assessment Protocol (HHRAP), Appendix A, health benchmarks
(4) USEPA's Provisional Peer-Reviewed Toxicity Values (PPRTVs), provided by D. Crawford, USEPA, March 2007.
(5) USEPA's Integrated Risk Information System (IRIS). 2007.
(6) Chronic minimum risk level (MRL) developed by Agency for Toxic Substances and Disease Registry (ATSDR). 2007
(7) Oak Ridge National Laboratory, Risk Assessment Information System (RAIS). Rais ornl.gov/homepage/rap_tool.shtml. 2007

Table 4.4-13
Modeled Ambient Air Concentrations On Site Associated with Fugitive Emissions During Spent Carbon Unloading and Comparison to Occupational Exposure Limits

Compound	CAS #	8-Hour Average Air Concentration (mg/m3) (a)		Occupational Exposure Limits (mg/m3) (b)		Comparison of Maximum Modeled 8-Hour Average Concentrations to Occupational Exposure Limits			
						Aqua Spent Carbon (used to treat liquids)		Vapor Spent Carbon (used to treat vapors)	
		Aqua Spent Carbon (used to treat liquids)	Vapor Spent Carbon (used to treat vapors)	NIOSH Reference Exposure Limit (8-hr TWA REL)	OSHA Permissible Exposure Limit (8-hr TWA PEL)	Ratio - Air Concentration/ NIOSH REL	Ratio - Air Concentration/ OSHA PEL	Ratio - Air Concentration/ NIOSH REL	Ratio - Air Concentration/ OSHA PEL
1,2-D bromoethane	106-93-4	1.26E-05	6.37E-05	0.35	150	4E-05	8E-08	2E-04	4E-07
1,3-Butadiene	106-99-0	8.41E-02	4.22E-01	4.4 (c)	2.2	2E-02	4E-02	1E-01	2E-01
1,4-Dichlorobenzene	106-46-7	2.65E-04	1.33E-03	60 (c)	450	4E-06	6E-07	2E-05	3E-06
Acrylonitrile	107-13-1	6.12E-03	3.42E-02	2.2	4.3	3E-03	1E-03	2E-02	8E-03
Arsenic	7440-38-2	NA	6.88E-09	0.002	0.01	--	--	3E-06	7E-07
Benzene	71-43-2	1.93E-03	9.73E-03	0.32	3.2	6E-03	6E-04	3E-02	3E-03
Beryllium	7440-41-7	NA	5.74E-10	0.0005	0.002	--	--	1E-06	3E-07
Cadmium	7440-43-9	NA	3.19E-09	--	0.005	--	--	--	6E-07
Chloroform	67-66-3	9.44E-05	4.76E-04	49 (c,e)	--	2E-06	--	1E-05	--
Cobalt	7440-48-4	NA	1.11E-08	0.05	0.1	--	--	2E-07	1E-07
Copper	7440-50-8	NA	1.15E-07	1	1	--	--	1E-07	1E-07
Cyclohexane	110-82-7	3.61E-02	1.81E-01	1050	1050	3E-05	3E-05	2E-04	2E-04
Ethylbenzene	100-41-4	5.65E-04	2.85E-03	435	435	1E-06	1E-06	7E-06	7E-06
Naphthalene	91-20-3	2.77E-06	1.40E-05	50	50	6E-08	6E-08	3E-07	3E-07
n-Hexane	110-54-3	2.79E-02	1.39E-01	180	1800	2E-04	2E-05	8E-04	8E-05
Nickel	7440-02-0	NA	3.75E-08	0.015	1	--	--	3E-06	4E-08
Styrene	100-42-5	6.27E-04	3.16E-03	215	430	3E-06	1E-06	1E-05	7E-06
Tetrachloroethylene	127-18-4	1.13E-03	5.70E-03	170 (c)	680	7E-06	2E-06	3E-05	8E-06
Toluene	108-88-3	9.05E-04	4.56E-03	375	750	2E-06	1E-06	1E-05	6E-06
Trichloroethylene	79-01-6	6.65E-04	3.35E-03	134 (d)	540	5E-06	1E-06	2E-05	6E-06
Vinyl Chloride	75-01-4	1.07E-03	5.38E-03	2.6 (c)	2.6	4E-04	4E-04	2E-03	2E-03

NA = not applicable.
-- = not available or not calculated.
TWA = time-weighted average.

(a) Air concentration (mg/m3) = emission rate (g/sec) * maximum 8-hour average unit air concentration (16,426 ug/m3 per 1 g/sec) * mg/1,000 ug. The maximum 8-hour average unit air concentration among the modeled on-site receptor locations for the fugitive emissions source occurred about 10 m north of the hopper for all five years of modeled meteorological data (2001-2005 datasets). The results at this receptor ranged from 8,586 ug/m^3 per 1 g/sec (2001 meteorological data) to 16,426 ug/m^3 per 1 g/sec (2003 meteorological data).
(b) Sources: OSHA PELS - www.osha.gov/pls/oshaweb. NIOSH RELs - www.cdc.gov/niosh/npg. ACGIH TLVs - www.osha.gov/dts/chemicalsampling/toc/toc_chemsamp.html.
(c) The ACGIH TWA-threshold limit value (TLV) was used, if available, if a NIOSH REL was not available.
(d) 10-hour TWA concentration.
(e) The NIOSH REL is 9.78 mg/m^3, for a 60-minute short-term exposure period.

Table 4.5-1
Uncertainties in the Facility Risk Assessment

Uncertainty	Effect of Uncertainty on Potential Risk
Selection of Chemicals	
Over 170 compounds were evaluated quantitatively in the risk assessment, including over 80 compounds that were not detected in stack emissions	Over- or under-estimation
Toxicity Characterization	
Conservatively derived cancer slope factors and reference doses were used to assess risks	Over-estimation
Excess lifetime cancer risks for PCDDs/PCDFs other than 2,3,7,8-TCDD were evaluated using toxicity equivalency factors	Over- or under-estimation
Acute inhalation toxicity criteria were derived from a variety of sources, and incorporated safety factors to account for even sensitive members of the population	Over- or under-estimation
Chronic and acute toxicity criteria were not available for all selected compounds	Under-estimation
Quantification of Stack Emission Rates	
Emission rates for several compounds were set at proposed permit levels that are higher than actually occur at the facility	Over-estimation
Calculation of Environmental Concentrations	
The ISCST3 model was used to calculate ambient air concentrations and deposition rates	Over- or under-estimation
USEPA fate and transport mathematical equations were used to calculate environmental concentrations	Over-estimation
Numerous USEPA default input parameters were used to calculate concentrations	Over-estimation
Mercury speciation in soil, sediment and water was based on USEPA default speciation fractions	Over- or under-estimation
Chemical concentrations in produce and in animal products were based on biotransfer coefficients, often derived using regression equations	Over- or under-estimation
Input parameters used to calculate chemical concentrations in water bodies were estimated from site-specific information as well as default assumptions	Over- or under-estimation
A number of scenarios calculated concentrations in produce and animal meat products at a single point rather than across the acreages necessary to support these practices	Over-estimation
Calculation of Human Exposures	
USEPA default assumptions for exposure duration, exposure frequency, and ingestion and inhalation rates were used to calculate exposures	Over-estimation
The fish ingestion exposure scenarios assume 100% of all fish ingested come from fish caught only from specific water bodies	Over-estimation
Risk Characterization	
Potential exposure to PCDDs/PCDFs were evaluated for infants and adults by comparison with estimates of current background exposure levels	Over- or under-estimation
Acute inhalation risks were evaluated for specific chemicals although the short-term effects of some chemicals may be additive, synergistic or antagonistic	Over- or under-estimation

Table 4.5-2
Analysis of Dioxin-Like Polychlorinated Biphenyls (PCBs)

Constituent	CAS NO.	PDT Results: Detected in Stack Samples (Y/ND)	Emission Rate Based on PDT (g/sec)	Ratio: Dioxin-like Emission Rate / Total PCB Emission Rate (a)	Extrapolated Lifetime Average Daily Dose (mg/kg-day) (b)	Dioxin-like PCB TEFs (c)	Extrapolated TEQ Lifetime Average Daily Dose (mg/kg-day) (d)
3,4,3',4'-Tetrachlorobiphenyl (IUPAC 77)	32598-13-3	Y (EMPC)	1.48E-10	6.32E-03	9.49E-13	0.0001	9.49E-17
3,4,4',5-tetrachlorobiphenyl (IUPAC 81)	70362-50-4	Y (*, EMPC)	2.62E-11	1.12E-03	1.68E-13	0.0001	1.68E-17
2,3,4,3',4'-Pentachlorobiphenyl (IUPAC 105)	32598-14-4	Y (B, EMPC)	6.29E-11	2.69E-03	4.03E-13	0.0001	4.03E-17
2,3,4,5,4'-Pentachlorobiphenyl (IUPAC 114)	74472-37-0	Y (*, EMPC)	8.41E-12	3.59E-04	5.39E-14	0.0005	2.70E-17
2,4,5,3',4'-Pentachlorobiphenyl (IUPAC 118)	31508-00-6	Y (B, EMPC)	1.36E-10	5.81E-03	8.72E-13	0.0001	8.72E-17
3,4,5,2',4'-Pentachlorobiphenyl (IUPAC 123)	65510-44-3	Y (B, *, EMPC)	1.28E-11	5.47E-04	8.21E-14	0.0001	8.21E-18
3,4,5,3',4'-Pentachlorobiphenyl (IUPAC 126)	57465-28-8	Y (EMPC)	4.3E-11	1.84E-03	2.76E-13	0.1	2.76E-14
2,3,4,5,3',4'-Hexachlorobiphenyl (IUPAC 156)	38380-98-4	Y (C, EMPC)	3.84E-11	1.64E-03	2.46E-13	0.0005	1.23E-16
2,3,4,3',4',5'-Hexachlorobiphenyl (IUPAC 157)	68782-90-7	Y (C, EMPC)	3.84E-11	1.64E-03	2.46E-13	0.0005	1.23E-16
2,4,5,3',4',5'-Hexachlorobiphenyl (IUPAC 167)	52663-72-6	Y (EMPC)	1.76E-11	7.52E-04	1.13E-13	0.00001	1.13E-18
3,4,5,3',4',5'-Hexachlorobiphenyl (IUPAC 169)	32774-16-6	ND	1E-11	4.27E-04	6.41E-14	0.01	6.41E-16
2,3,4,5,3',4',5'-Heptachlorobiphenyl (IUPAC 189)	39635-31-9	ND	6.7E-12	2.86E-04	4.29E-14	0.0001	4.29E-18
Total dioxin-like PCBs							2.87E-14
Total PCBs (as Aroclor 1254)	11097-69-1	Y	2.34E-08		1.50E-10		
Total dioxin-like PCBs excess lifetime cancer risk							4.3E-09

Notes:

* = the compound was detected very infrequently, in only one or two of the sampled fractions, from the three replicate runs

B = one or more sample fraction results from one or more of the three replicate runs were affected by method blank contamination

C = co-eluting PCB isomer

EMPC = one or more of the front or back half sample results from one or more of the three replicate runs were an estimated maximum possible concentration

ND = not detected in any sample fraction from any of the three replicate runs

Y = yes; detected in one or more sample fractions from at least one of the three replicate runs

(a) Ratio = dioxin-like PCB emission rate / total PCB emission rate used in the risk assessment.

(b) Extrapolated dose = lifetime average daily dose calculated for total PCBs for the Main Drain fish ingestion pathway (1.5E-10 mg/kg-day) * ratio of dioxin-like to total PCB emission rate.

(c) Toxic equivalency factors (TEFs) for dioxin-l ke PCBs are based on WHO values as summarized in USEPA's HHRAP.

(d) Toxic equivalents (TEQ) dose = dioxin-like extrapolated lifetime average daily dose * TEF.

(e) Cancer risk = TEQ dose * TCDD cancer slope factor (1.5E+5 (mg/kg-day)^-1).

Table 4.5-3
Compounds Selected for the Risk Assessment Without Human Health Toxicity Data

Compound	CAS Number	PDT Results: Detected in Stack Samples (Y or ND)	Compound Included in USEPA (2005) HHRAP	Compound Did Not Have Chronic Toxicity Data	Compound Did Not Have Acute Toxicity Data
1,1-Dichloropropene	563-58-6	ND		X	
1,2,3-Trichlorobenzene	87-61-6	ND	√	X	
1,2,4-Trimethylbenzene	95-63-6	ND		X	
1,2-Dichloroethene (cis)	156-59-2	Y (*)	√	X	
1,3,5-Trimethylbenzene	108-67-8	ND	√	X	
2,2-Dichloropropane	594-20-7	ND		X	
2,5-Dimethylfuran	625-86-5	Y (TIC)		X	X
2,5-Dimethylheptane	2216-30-0	Y (TIC)		X	
2,5-Dione, 3-hexene	17559-81-8	Y (TIC)		X	X
2-Hexanone	591-78-6	ND		X	
2-Methyl octane	3221-61-2	Y (TIC)		X	X
2-Nitroaniline	88-74-4	ND	√	X	
2-Nitrophenol	88-75-5	ND	√	X	
3-Ethyl benzaldehyde	34246-54-3	Y (TIC)		X	
3-Hexen-2-one	763-93-9	Y (TIC)		X	X
3-Nitroaniline	99-09-2	ND	√	X	
Ethylidene acetone (3-penten-2-one)	625-33-2	Y (TIC)		X	X
3-Penten-2-one, 4-methyl	141-79-7	Y (TIC)		X	
4-Bromophenyl-phenyl ether	101-55-3	ND	√	X	
4-Chloro-3-methylphenol	59-50-7	ND	√	X	
4-Chlorophenyl-phenyl ether	7005-72-3	ND	√	X	
4-Ethyl benzaldehyde	4748-78-1	Y (TIC)		X	
4-Nitroaniline	100-01-6	ND	√	X	
9-Octadecenamide	301-02-0	Y (TIC)		X	X
Acenaphthylene	208-96-8	Y		X	
Benzo(e)pyrene	192-97-2	Y (B)		X	X
Benzo(g,h,i)perylene	191-24-2	Y		X	
Benzoic acid, me hyl ester	93-58-3	Y (TIC)		X	X
Benzonitrile	100-47-0	ND	√	X	
Benzyl alcohol	100-51-6	ND	√	X	
BHC, delta-	319-86-8	Y (COL)			X
Bromobenzene	108-86-1	ND		X	
Bromochloromethane	74-97-5	ND		X	
Butylbenzene, n-	104-51-8	ND		X	
Butylbenzene, sec-	135-98-8	ND		X	
Butylbenzene, tert-	98-06-6	ND		X	
Carbazole	86-74-8	ND		X	
Diallate	2303-16-4	ND		X	X
Dimethylphthalate	131-11-3	ND	√	X	
Di-n-octyl phthalate	117-84-0	ND	√	X	
Endosulfan II	33213-65-9	Y (*, COL)		X	X
Endosulfan sulfate	1031-07-8	ND		X	X
Endrin aldehyde	7421-93-4	Y (B, COL)		X	X
Endrin ketone	53494-70-5	ND		X	X
Iodomethane	74-88-4	Y (B)		X	
Isopropyl toluene, p-	99-87-6	ND		X	X
Perylene	198-55-0	Y (*, B)		X	X
Phenanthrene	85-01-8	Y (*, B)	√	X	
Phosphine imide, P,P,P-triphenyl	2240-47-3	Y (TIC)		X	X
Propylbenzene, n-	103-65-1	ND		X	

Notes:

* = The compound was detected very infrequently, in only 1-2 of the sampled fractions, from the three replicate runs.

B = One or more sample fraction results from one or more of he three replicate runs were affected by me hod blank contamina ion.

COL = There was a greater than 40% difference between primary and confirmatory columns in one or more sample fraction results from one or more of the three replicate runs; reported result should be considered estimated.

HHRAP = Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (U.S. Environmental Protection Agency, 2005).

ND = Not detected in any sample fraction from any of the three replicate runs.

PDT = Performance Demonstration Test.

TIC = Tentatively identified compound.

X = Compound did not have chronic or acute human health toxicity data.

Y = Yes; detected in one or more sample fractions from at least one of he three replicate runs.

Table 5.1-1
Ecological Receptors and Exposure Pathways Evaluated in the Ecological Risk Assessment

a. Creosote Bush Scrub

Receptor	Taxa	Reason for Selection	Exposure Medium & Exposure Route	
			Soil	Diet
Badger	mammal	Common in study area. Carnivorous species. Member of mustelid family, which often demonstrates a greater sensitivity to toxicants than other mammals. Digs and forages in soil. Carnivorous habit will result in greater dietary exposures than other common mammals of this habitat (e.g., jackrabbit, pocket mice).	ingestion	ingestion
Gambel's quail	bird	Common to abundant study area resident. Most important game resource in the lower Colorado River Valley (Rosenberg et al. 1991). Toxicity data available for some chemicals. Exposures will be representative of that in other seed eaters of this habitat (e.g., dove, sparrow).	ingestion	ingestion
Great horned owl	bird	Fairly common resident throughout Parker Valley. Carnivorous.	ingestion	ingestion
Desert tortoise	reptile	Species of special concern in Arizona. Potentially distributed throughout desert scrub habitat of study area.	ingestion	ingestion
Creosote bush	plant	Dominant vegetative species in desert scrub habitat. Wide-spread throughout study area. Important plant to native people, and single most widely and frequently used medicinal herb in the Sonoran desert (Phillips and Comus 2000).	root uptake	na

na = not applicable to this receptor.

Table 5.1-1 (Continued)
Ecological Receptors and Exposure Pathways Evaluated in the Ecological Risk Assessment

b. Agricultural Areas

Receptor	Taxa	Reason for Selection	Exposure Medium & Exposure Route	
			Soil	Diet
Gambel's quail	bird	Common to abundant study area resident. Most important game resource in the lower Colorado River Valley (Rosenberg et al. 1991). Toxicity data available for some chemicals. Exposures will be representative of that in other seed eaters of this habitat (e.g., dove, sparrow).	ingestion	ingestion
Burrowing owl	bird	Common resident of agricultural areas in Parker Valley (Rosenberg et al. 1991). Special concern species in the State of California. Carnivorous.	ingestion	ingestion
Alfalfa	plant	Principal crop in agricultural lands of study area. Toxicity data available for some grass species. Other crops less important economically.	root uptake	na

na = not applicable to this receptor.

Table 5.1-1 (Continued)
Ecological Receptors and Exposure Pathways Evaluated in the Ecological Risk Assessment

c. Riparian Corridors

Receptor	Taxa	Reason for Selection	Exposure Medium & Exposure Route	
			Soil	Diet
Southwestern willow flycatcher	bird	Federally endangered. Carnivorous (Insectivorous) species. Presence historically documented in study area. Entire study area population limited to riparian areas. This species will be representative of potential exposures in other insectivorous birds of this habitat.	na	ingestion
Gambel's quail	bird	Common to abundant study area resident. Most important game resource in the lower Colorado River Valley (Rosenberg et al. 1991). Toxicity data available for some chemicals. Screwbeam mesquite of riparian habitats important seasonal food source for this species. Exposures will be representative of that in other seed eaters of this habitat (e.g., dove, sparrow). Other birds in this habitat are less important economically.	ingestion	ingestion
Screwbean mesquite	plant	Ecologically important plant of study area riparian areas, providing food for resident seed eaters. Part of re-vegetation efforts by CRIT to reestablish riparian vegetation in the area. Mesquite is an important and sacred tree in the Mohave religious tradition. Exposures will be representative of that in other woody vegetation of the corridor.	root uptake	na

na = not applicable to this receptor.

Table 5.1-1 (Continued)
Ecological Receptors and Exposure Pathways Evaluated in the Ecological Risk Assessment

d. Colorado River

Receptor	Taxa	Reason for Selection	Exposure Medium & Exposure Route		
			diet	surface water	sediment
Double-crested cormorant	bird	Year-round resident. Piscivorous. Some data suggest a potentially greater sensitivity to some toxicants.	ingestion	ingestion	ingestion
Aquatic community	fish, invertebrates, amphibians, plants	Year-round residents. Some fish and amphibian species important recreationally. Aquatic community is inclusive of all potential aquatic receptors.	ne (1)	all exposure routes	all exposure routes

ne = not evaluated

(1) aquatic life dietary exposures were considered as part of overall evaluation of surface water quality.

Table 5.1-1 (Continued)
Ecological Receptors and Exposure Pathways Evaluated in the Ecological Risk Assessment

e. Riparian Backwaters

Receptor	Taxa	Reason for Selection	Exposure Medium & Exposure Route		
			diet	surface water	sediment
Yuma clapper rail	bird	Federally endangered. Carnivorous (invertivorous) species. Presence historically documented in study area. Entire study area population limited to riparian areas.	ingestion	ingestion	ingestion
Aquatic community	fish, invertebrates, amphibians, plants, benthic invertebrates	Year-round residents. Some fish and amphibian species important recreationally. Aquatic community is inclusive of all potential aquatic receptors. Exposure in benthic invertebrates assessed separately from water column species to evaluate potential impacts of chemicals that partition preferentially to sediments.	ne (1)	all routes	all routes

na = not applicable to this receptor.
ne = not evaluated

(1) aquatic life dietary exposures were considered as part of overall evaluation of surface water quality.

Table 5.1-1 (Continued)
Ecological Receptors and Exposure Pathways Evaluated in the Ecological Risk Assessment

f. Canals, Aqueducts, Main Drain

Receptor	Taxa	Reason for Selection	Exposure Medium & Exposure Route		
			diet	surface water	soil/ sediment
Double-crested cormorant	bird	Year-round resident. Piscivorous. Some data suggest a potentially greater sensitivity to some toxicants.	ingestion	ingestion	ingestion
Mule deer	Mammal	Year-round resident. Could ingest surface water from these areas. Requested by USEPA.	Ingestion	Ingestion	Ingestion
Aquatic community	fish, invertebrates, amphibians, plants	Year-round residents. Some fish and amphibian species important recreationally.	ne (1)	all routes	all routes

na = not applicable to this receptor in this habitat.
ne = not evaluated

(1) aquatic life dietary exposures were considered as part of overall evaluation of surface water quality.

Table 5.2-1
Dietary Parameters for Selected Receptor Species

Receptor	Food Items					Media		
	Terrestrial Plants	Terrestrial Invertebrates	Benthic Invertebrates	Fish	Small Mammals	Soil	Sediment	Surface Water
Southwestern willow flycatcher		X				I		
Gambel's quail	X					I		
Burrowing owl					X	I		
Great horned owl					X	I		
Badger					X	I		
Double crested cormorant				X			I	I
Yuma clapper rail			X				I	I
Mule deer	X					I		I

X - Food chain model assumes 100 percent of a receptor's diet comes from the food source indicated.

I - Food chain model assumes incidental ingestion of medium indicated.

Table 5.2-2
Ingestion Rates for Selected Receptor Species

Receptor	Receptor Body Weight		Food Ingestion Rate		Water Ingestion Rate		Soil Ingestion Rate (d)		Sediment Ingestion Rate	
	(kg)	Reference	(kg WW/ kg BW-d)	Notes	(L/ kg BW-d)	Notes	(kg DW/ kg BW-d)	Notes	(kg DW/ kg BW-d)	Notes
Southwest willow flycatcher	0.011	Sedgewick 2000	1.680	(a, b)	--		0.00	(h)	--	
Gambel's quail	1.04	Brown et al. 1998	0.478	(a, c)	--		0.002	(i)	--	
Burrowing owl	0.15	Haug et al. 1993	0.352	(a, d)	--		0.064	(i)	--	
Great horned owl	0.91	Houston et al.1998	0.188	(a, d)	--		0.010	(i)	--	
Badger	6.4	Baker 1983	0.154	(a, d)	--		0.00004	(i)	--	
Double-crested cormorant	1.2	Hatch and Weseloh 1999	0.273	(a, e)	0.056	(g)	--		0.005	(j)
Yuma clapper rail	0.16	Eddleman and Conway 1998	0.660	(a, f)	0.108	(g)	--		0.021	(k)
Mule Deer	43.7	Relyea et al. 2000	0.292	(a, c)	0.068	(g)	0.0007	(l)	--	

-- = Not applicable; BW - body weight; d –day; DW- dry weight; g – grams; kg – kilograms; L- liters; WW- wet weight.

(a) Food Ingestion Rates (Food IR) were calculated using allometric equations presented in Table 5-1 of USEPA's Screening Level Ecological Risk Assessment

Protocol (USEPA 1999):

$$IR\ (g\ DW/day) = 0.235 \times BW^{0.822}\ (g)$$

Then, the IR was divided by 1000 to convert the R from g to kg, and divided by the receptor's body weight to get an ingestion rate in kg DW/kg BW-day.

Bird: IR (g DW/day) = 0.648 x BW$^{0.651}$ (g)

Mammals: IR (kg WW/kg BW-day) = IR kg DW/g BW-day)/(1 - % moisture/100)

Finally, to convert the IR from dry weight (DW) to wet weight (WW), the following equation was used:

where % moisture of ingested material is

(b) Assumes diet consists of aquatic invertebrates.

(c) Assumes diet consists of plants.

(d) Assumes diet consists of small mammals.

(e) Assumes diet consists of fish.

(f) Assumes diet consists of benthic macroinvertebrates.

(g) Water Ingestion Rates (Water IR) were calculated using allometric equations presented in Table 5-1 of USEPA, 1999:

$$Bird:\ IR\ (L/day) = 0.059 \times BW^{0.670}\ (kg)$$

$$Mammal:\ IR\ (L/day) = 0.099 \times BW^{0.900}\ (kg)$$

Then, the bird and mammal R was divided by the receptor's body weight to get an ingestion rate in L/kg BW-day.

(h) No suitable surrogate species were found in either USEPA (1999) or Beyer et al. (1994). Soil ingestion is assumed to be zero because flycatchers forage by either aerially gleaning (capturing an insect from a substrate while hovering) or hawking (waiting on perches and capturing insects in flight) and thus have negligible incidental soil ingestion.

(i) Soil ingestion rates for Gambel's quail, Burrowing owl, Great horned owl, and Badger were based on surrogate values for Northern bobwhite, Red-tailed hawk, Red-tailed hawk, and Long-tailed weasel, respectively (USEPA, 1999) but corrected for the receptor species' body weight. Surrogates were chosen based on similarities in feeding strategy.

(j) No suitable surrogate species were found in USEPA (1999). The two highest sediment ingestion rates estimated by Beyer et al. (1994) for ducks and geese (i.e. wading and diving birds) were used to conservatively estimate the proportion of sediment ingestion for the double crested cormorant, which is a diving bird. The rounded average of these two values (10%) was assumed to be representative of the proportion of sediment ingestion for the double crested cormorant, which is a diving bird. The sediment ingestion rate was calculated by multiplying the cormorant's dry weight FIR by 10% (USEPA, 1999).

(k) The sediment ingestion rate for the Yuma clapper rail was based on a surrogate value for mallard but corrected for the Yuma clapper rail's body weight.

(l) Because a mule-deer specific soil ingestion rate (2%) was available from Beyer et al. (1994), a surrogate was not needed. The surrogate was chosen based on similarities in feeding strategy.

Table 5.2-3
Summary of Cumulative Hazard Index Values for Selected Ecological Receptors

Exposure Area	Receptor	Cumulative Hazard Index (a)
Creosote Bush Scrub Area	Badger	7.E-06
	Gambel's Quail	7.E-03
	Great Horned Owl	1.E-04
	Creosote Scrub Bush	2.E-01
Agricultural Area	Gambel's Quail	5.E-05
	Burrowing Owl	2.E-05
	Alfalfa	6.E-04
Riparian Corridor Area	Southwestern Willow Flycatcher	3.E-02
	Gambel's Quail	1.E-04
	Plant	8.E-03
Colorado River Area	Double-crested Cormorant	1.E-02
	Surface Water	1.E-04
	Sediment	8.E-05
Riparian Backwater Area	Yuma Clapper Rail	2.E-03
	Surface Water (b)	1.E-04
	Sediment (b)	8.E-05
Main Drain Area	Double-crested Cormorant	5.E-02
	Mule Deer	5.E-05
	Surface Water	8.E-05
	Sediment	3.E-04

(a) The cumulative hazard index (HI) conservatively reflects exposure to all evaluated compounds, regardless of the type or mechanism of effects. It is calculated by summing individual chemical-specific hazard quotient values. For this project, the target hazard index was specified by USEPA Region 9 at a value of 0.25. The target hazard index value used by most states and many other USEPA programs, for compounds grouped according to the mechanism of effects, is 1.0. If an HI, based on the sum of hazard quotients for all compounds, is above the target level, then the HI values are recalculated for groups of compounds having the same type of health effect and/or a more detailed evaluation may be conducted.

(b) Results for surface water and sediment for the riparian backwater were evaluated using the results for the Colorado River.