Appendix E

Comprehensive Exposure Assessment and Risk Characterization Results

E.1 Risk Characterization Results for Electroless Copper, Non-Conveyorized, Line Operator Scenario

E.2 Risk Characterization Results for Electroless Copper, Non-Conveyorized, Laboratory Technician Scenario

E.3 Risk Characterization Results for Electroless Copper, Non-Conveyorized, Surrounding Population Scenario

E.4 Risk Characterization Results for Electroless Copper, Conveyorized, Line Operator Scenario

E.5 Risk Characterization Results for Electroless Copper, Conveyorized, Laboratory Technician Scenario

E.6 Risk Characterization Results for Electroless Copper, Conveyorized, Surrounding Population Scenario

E.7 Risk Characterization Results for Carbon, Conveyorized, Line Operator Scenario

E.8 Risk Characterization Results for Carbon, Conveyorized, Laboratory Technician Scenario

E.9 Risk Characterization Results for Carbon, Conveyorized, Surrounding Population Scenario

E.10 Risk Characterization Results for Conductive Polymer, Conveyorized, Line Operator Scenario

E.11 Risk Characterization Results for Conductive Polymer, Conveyorized, Laboratory Technician Scenario

E.12 Risk Characterization Results for Conductive Polymer, Conveyorized, Surrounding Population Scenario

E.13 Risk Characterization Results for Graphite, Conveyorized, Line Operator Scenario

E.14 Risk Characterization Results for Graphite, Conveyorized, Laboratory Technician Scenario

E.15 Risk Characterization Results for Graphite, Conveyorized, Surrounding Population Scenario

E.16 Risk Characterization Results for Non-Formaldehyde Electroless Copper, Non-Conveyorized, Line Operator Scenario

E.17 Risk Characterization Results for Non-Formaldehyde Electroless Copper, Non-Conveyorized, Laboratory Technician Scenario

E.18 Risk Characterization Results for Non-Formaldehyde Electroless Copper, Non-Conveyorized, Surrounding Population Scenario

E.19 Risk Characterization Results for Organic-Palladium, Non-Conveyorized, Line Operator Scenario

E.20 Risk Characterization Results for Organic-Palladium, Non-Conveyorized, Laboratory Technician Scenario

E.21 Risk Characterization Results for Organic-Palladium, Non-Conveyorized, Surrounding Population Scenario

E.22 Risk Characterization Results for Organic-Palladium, Conveyorized, Line Operator Scenario

E.23 Risk Characterization Results for Organic-Palladium, Conveyorized, Laboratory Technician Scenario

E.24 Risk Characterization Results for Organic-Palladium, Conveyorized, Surrounding Population Scenario

E.25 Risk Characterization Results for Tin-Palladium, Non-Conveyorized, Line Operator Scenario

E.26 Risk Characterization Results for Tin-Palladium, Non-Conveyorized, Laboratory Technician Scenario

E.27 Risk Characterization Results for Tin-Palladium, Non-Conveyorized, Surrounding Population Scenario

E.28 Risk Characterization Results for Tin-Palladium, Conveyorized, Line Operator Scenario

E.29 Risk Characterization Results for Tin-Palladium, Conveyorized, Laboratory Technician Scenario

E.30 Risk Characterization Results for Tin-Palladium, Conveyorized, Surrounding Population Scenario

Table E 1. Risk Characterization Results for Electroless Copper, Non-Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
AMMONIUM CHLORIDE	NA	NA	NA	1640		0.0E+00	NE (2)	NE (2)	8.4E-02	NE (1)	1.9E+04
BENZOTRIAZOLE	NA	NA	NA	21.8		6.6E-04	NE (1)	NE (1)	2.5E-03	NE (1)	8.8E+03
BORIC ACID	NA	NA	NA	56.2		9.2E-04	NE (1)	NE (1)	3.3E-02	NE (1)	1.7E+03
COPPER (I) CHLORIDE	NA	0.6	NA	0.042		4.0E-04	NE (1)	4.2E+02	4.4E-02	NE (1)	9.6E-01
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA	NA	NA		4.4E-04	NE (1)	NE (1)	4.9E-02	NE (1)	NE (1)
DIMETHYLAMINOBORANE	NA	NA	NA	NA	H	1.0E-02	NE (1)	NE (1)	3.9E-03	NE (1)	NE (1)
DIMETHYLFORMAMIDE	0.03	NA	NA	25		7.6E-03	8.8E-01	NE (3)	1.1E-03	NE (1)	2.2E+04
ETHANOLAMINE	NA	12.7	NA	64		5.3E-02	NE (1)	6.8E+01	1.0E-02	NE (1)	6.3E+03
2-ETHOXYETHANOL	0.2	NA	0.4	NA		7.8E+00	1.4E+02	NE (3)	1.4E-01	3.4E-01	NE (3)
ETHYLENE GLYCOL	NA	31	2	NA		1.8E-02	NE (1)	5.0E+02	2.5E-03	1.2E-03	NE (3)
ETHYLENEDIAMINE-TETRAACETIC ACID (EDTA	NA	NA	NA	NA	LM	2.7E-03	NE (1)	NE (1)	1.7E-05	NE (1)	NE (1)
FLUOROBORIC ACID	NA	NA	NA	0.77	H	1.2E-02	NE (1)	NE (1)	3.9E-01	NE (1)	2.0E+00
FORMALDEHYDE	NA	100	0.002	NA		7.4E-02	NE (1)	4.8E-01	1.1E-02	1.5E+01	NE (3)
FORMIC ACID	NA	59.2	NA	NA		1.9E-01	NE (1)	1.0E+02	3.5E-02	NE (1)	NE (1)
HYDROCHLORIC ACID	0.007	15	NA	NA		2.9E-05	1.4E-02	NE (3)	9.0E-01	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	79	NA	31.5		8.9E-04	NE (1)	2.5E+04	1.3E-01	NE (1)	2.4E+02
HYDROXYACETIC ACID	NA	NA	NA	50		1.7E-04	NE (1)	NE (1)	2.4E-02	NE (1)	2.1E+03
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980	NA	20		2.8E+00	NE (1)	1.0E+02	3.1E-02	NE (1)	6.4E+02
M-NITROBENZENE SULFONIC ACID	NA	NA	NA	NA	M	4.9E-06	NE (1)	NE (1)	8.8E-07	NE (1)	NE (1)
MAGNESIUM CARBONATE	NA	NA	NA	NA	LM	5.4E-05	NE (1)	NE (1)	7.8E-03	NE (1)	NE (1)
METHANOL	NA	1596	0.5	NA		1.2E+00	NE (1)	3.7E+02	1.1E-02	2.3E-02	NE (3)
p-TOLUENE SULFONIC ACID	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	4.0E-03	NE (1)	NE (1)
PALLADIUM	NA	NA	NA	0.0475		0.0E+00	NE (2)	NE (2)	2.4E-03	NE (1)	2.0E+01
PEROXYMONOSULFURIC ACID; OR POTASSIUM	NA	NA	NA	NA	M	1.2E-03	NE (1)	NE (1)	1.7E-01	NE (1)	NE (1)
POTASSIUM BISULFATE	NA	NA	NA	NA	M	6.2E-04	NE (1)	NE (1)	9.0E-02	NE (1)	NE (1)
POTASSIUM CYANIDE	NA	NA	0.0025	NA		1.4E-05	NE (1)	NE (1)	1.5E-03	5.8E-01	NE (3)
POTASSIUM HYDROXIDE	NA	7.1	NA	NA		1.2E-05	NE (1)	1.6E+05	5.4E-03	NE (1)	NE (1)
POTASSIUM PERSULFATE	NA	NA	NA	NA	M	4.4E-04	NE (1)	NE (1)	6.4E-02	NE (1)	NE (1)
POTASSIUM SULFATE	NA	15	NA	NA	L	8.6E-04	NE (1)	5.0E+03	1.3E-01	NE (1)	NE (1)
POTASSIUM-SODIUM TARTRATE	NA	NA	NA	NA		1.9E-03	NE (1)	NE (1)	2.1E-01	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	4.6E-01	NE (1)	NE (1)
SODIUM CARBONATE	NA	10	NA	NA		3.0E-06	NE (1)	9.4E+05	3.3E-04	NE (1)	NE (1)
SODIUM CHLORITE	NA	NA	NA	0.5		0.0E+00	NE (2)	NE (2)	3.0E-02	NE (1)	1.7E+01
SODIUM CYANIDE	NA	NA	0.002	NA		1.4E-05	NE (1)	NE (1)	1.5E-03	7.6E-01	NE (3)
SODIUM HYDROXIDE	NA	2	NA	NA		6.3E-04	NE (1)	9.1E+02	8.5E-02	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	5.6E-02	NE (1)	NE (1)
SODIUM SULFATE	NA	NA	NA	420		0.0E+00	NE (2)	NE (2)	8.3E-02	NE (1)	5.1E+03
STANNOUS CHLORIDE	NA	NA	0.0186	NA		0.0E+00	NE (2)	NE (2)	6.7E-02	3.6E+00	NE (3)
SULFURIC ACID	NA	0.066	NA	NA		5.6E-02	NE (1)	2.8E+00	1.2E+00	NE (1)	NE (1)
TARTARIC ACID	NA	NA	NA	1.74		6.2E-05	NE (1)	NE (1)	5.7E-05	NE (1)	3.0E+04
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETH	NA	NA	NA	32		0.0E+00	NE (2)	NE (2)	3.5E-03	NE (1)	9.3E+03

Table E 1. Risk Characterization Results for Electroless Copper, Non-Conveyorized, Line Operator Scenario

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

(3) HQ could be calculated

Table E 2. Risk Characterization Results for Electroless Copper, Non-Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
AMMONIUM CHLORIDE	NA	1640		2.1E-03	NE (1)	7.9E+05
BENZOTRIAZOLE	NA	21.8		6.1E-05	NE (1)	3.6E+05
BORIC ACID	NA	56.2		8.0E-04	NE (1)	7.0E+04
COPPER (I) CHLORIDE	NA	0.042		1.1E-03	NE (1)	3.9E+01
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		1.2E-03	NE (1)	NE (1)
DIMETHYLAMINOBORANE	NA	NA	H	9.6E-05	NE (1)	NE (1)
DIMETHYLFORMAMIDE	NA	25		2.8E-05	NE (1)	9.0E+05
ETHANOLAMINE	NA	64		2.5E-04	NE (1)	2.6E+05
2-ETHOXYETHANOL	0.4	NA		3.4E-03	8.4E-03	NE (3)
ETHYLENE GLYCOL	2	NA		6.0E-05	3.0E-05	NE (3)
ETHYLENEDIAMINE-TETRAACETIC ACID (EDTA)	NA	NA	LM	4.1E-07	NE (1)	NE (1)
FLUOROBORIC ACID	NA	0.77	H	9.6E-03	NE (1)	8.0E+01
FORMALDEHYDE	0.002	NA		2.6E-04	3.7E-01	NE (3)
FORMIC ACID	NA	NA		8.5E-04	NE (1)	NE (1)
HYDROCHLORIC ACID	NA	NA		2.2E-02	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	31.5		3.2E-03	NE (1)	9.8E+03
HYDROXYACETIC ACID	NA	50		5.9E-04	NE (1)	8.4E+04
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	20		7.7E-04	NE (1)	2.6E+04
MAGNESIUM CARBONATE	NA	NA	LM	1.9E-04	NE (1)	NE (1)
METHANOL	0.5	NA		2.8E-04	5.6E-04	NE (3)
p-TOLUENE SULFONIC ACID	NA	NA	LM	9.8E-05	NE (1)	NE (1)
PALLADIUM	NA	0.0475		5.8E-05	NE (1)	8.2E+02
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	4.2E-03	NE (1)	NE (1)
POTASSIUM BISULFATE	NA	NA	M	2.2E-03	NE (1)	NE (1)
POTASSIUM CYANIDE	0.0025	NA		3.6E-05	1.4E-02	NE (3)
POTASSIUM HYDROXIDE	NA	NA		1.3E-04	NE (1)	NE (1)
POTASSIUM PERSULFATE	NA	NA	M	1.6E-03	NE (1)	NE (1)
POTASSIUM SULFATE	NA	NA	L	3.1E-03	NE (1)	NE (1)
POTASSIUM-SODIUM TARTRATE	NA	NA		5.1E-03	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	M	1.1E-02	NE (1)	NE (1)
SODIUM CARBONATE	NA	NA		8.0E-06	NE (1)	NE (1)
SODIUM CHLORITE	NA	0.5		7.3E-04	NE (1)	6.9E+02
SODIUM CYANIDE	0.002	NA		3.7E-05	1.9E-02	NE (3)
SODIUM HYDROXIDE	NA	NA		2.1E-03	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	LM	1.4E-03	NE (1)	NE (1)
M-NITROBENZENE SULFONIC ACID	NA	NA	M	2.2E-08	NE (1)	NE (1)
SODIUM SULFATE	NA	420		2.0E-03	NE (1)	2.1E+05
STANNOUS CHLORIDE	0.0186	NA		1.6E-03	8.9E-02	NE (3)

Table E 2. Risk Characterization Results for Electroless Copper, Non-Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
SULFURIC ACID	NA	NA		2.9E-02	NE (1)	NE (1)
TARTARIC ACID	NA	1.74		1.4E-06	NE (1)	1.2E+06
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	32		8.5E-05	NE (1)	3.8E+05

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

(3) HQ could be calculated

Table E 3. Risk Characterization Results for Electroless Copper, Non-Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
AMMONIUM CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)
BENZOTRIAZOLE	NA	NA		NE (2)	NE (2)	NE (2)
BORIC ACID	NA	NA		NE (2)	NE (2)	NE (2)
COPPER CHLORIDE(I)	NA	0.6		NE (2)	NE (2)	NE (2)
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
DIMETHYLAMINOBORANE	NA	NA	H	NE (2)	NE (2)	NE (2)
DIMETHYLFORMAMIDE	0.03	NA		NE (2)	NE (2)	NE (2)
ETHANOLAMINE	NA	12.7		NE (2)	NE (2)	NE (2)
2-ETHOXYETHANOL	0.2	NA		6.5E-04	1.1E-02	NE (3)
ETHYLENE GLYCOL	NA	31		NE (2)	NE (2)	NE (2)
ETHYLENEDIAMINE-TETRAACETIC ACID (EDTA)	NA	NA	LM	NE (2)	NE (2)	NE (2)
FLUOROBORIC ACID	NA	NA	H	NE (2)	NE (2)	NE (2)
FORMALDEHYDE	NA	100		7.4E-06	NE (1)	2.8E+06
FORMIC ACID	NA	59.2		NE (2)	NE (2)	NE (2)
HYDROCHLORIC ACID	0.007	15		NE (2)	NE (2)	NE (2)
HYDROGEN PEROXIDE	NA	79		NE (2)	NE (2)	NE (2)
HYDROXYACETIC ACID	NA	NA		NE (2)	NE (2)	NE (2)
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980		2.4E-04	NE (1)	1.2E+06
MAGNESIUM CARBONATE	NA	NA	LM	NE (2)	NE (2)	NE (2)
METHANOL	NA	1596		1.0E-04	NE (1)	4.4E+06
p-TOLUENE SULFONIC ACID	NA	NA	LM	NE (2)	NE (2)	NE (2)
PALLADIUM	NA	NA		NE (2)	NE (2)	NE (2)
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
POTASSIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
POTASSIUM CYANIDE	NA	NA		NE (2)	NE (2)	NE (2)
POTASSIUM HYDROXIDE	NA	7.1		NE (2)	NE (2)	NE (2)
POTASSIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
POTASSIUM SULFATE	NA	15	L	NE (2)	NE (2)	NE (2)
POTASSIUM-SODIUM TARTRATE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM CARBONATE	NA	10		NE (2)	NE (2)	NE (2)
SODIUM CHLORITE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM CYANIDE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM HYDROXIDE	NA	2		NE (2)	NE (2)	NE (2)
SODIUM HYPOPHOSPHITE	NA	NA	LM	NE (2)	NE (2)	NE (2)
M-NITROBENZENE SULFONIC ACID	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
STANNOUS CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)

Table E 3. Risk Characterization Results for Electroless Copper, Non-Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
SULFURIC ACID	NA	0.066		NE (2)	NE (2)	NE (2)
TARTARIC ACID	NA	NA		NE (2)	NE (2)	NE (2)
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	NA		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

(3) HQ could be calculated

Table E 4. Risk Characterization Results for Electroless Copper, Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
AMMONIUM CHLORIDE	NA	NA	NA	1640		0.0E+00	NE (2)	NE (2)	2.1E-02	NE (1)	7.8E+04
BENZOTRIAZOLE	NA	NA	NA	21.8		0.0E+00	NE (2)	NE (2)	6.3E-04	NE (1)	3.5E+04
BORIC ACID	NA	NA	NA	56.2		0.0E+00	NE (2)	NE (2)	9.2E-03	NE (1)	6.1E+03
COPPER (I) CHLORIDE	NA	0.6	NA	0.042		0.0E+00	NE (2)	NE (2)	9.8E-03	NE (1)	4.3E+00
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	1.1E-02	NE (1)	NE (1)
DIMETHYLAMINOBORANE	NA	NA	NA	NA	H	0.0E+00	NE (2)	NE (2)	1.1E-03	NE (1)	NE (1)
DIMETHYLFORMAMIDE	0.03	NA	NA	25		0.0E+00	NE (2)	NE (2)	2.8E-04	NE (1)	8.9E+04
ETHANOLAMINE	NA	12.7	NA	64		0.0E+00	NE (2)	NE (2)	2.5E-03	NE (1)	2.5E+04
2-ETHOXYETHANOL	0.2	NA	0.4	NA		0.0E+00	NE (2)	NE (2)	3.5E-02	8.7E-02	NE (3)
ETHYLENE GLYCOL	NA	31	2	NA		0.0E+00	NE (2)	NE (2)	6.5E-04	3.2E-04	NE (3)
ETHYLENEDIAMINE-TETRAACETIC ACID (EDTA	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	3.8E-06	NE (1)	NE (1)
FLUOROBORIC ACID	NA	NA	NA	0.77	H	0.0E+00	NE (2)	NE (2)	9.4E-02	NE (1)	8.2E+00
FORMALDEHYDE	NA	100	0.002	NA		0.0E+00	NE (2)	NE (2)	2.4E-03	3.4E+00	NE (3)
FORMIC ACID	NA	59.2	NA	NA		0.0E+00	NE (2)	NE (2)	8.6E-03	NE (1)	NE (1)
HYDROCHLORIC ACID	0.007	15	NA	NA		0.0E+00	NE (2)	NE (2)	2.1E-01	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	79	NA	31.5		0.0E+00	NE (2)	NE (2)	3.7E-02	NE (1)	8.6E+02
HYDROXYACETIC ACID	NA	NA	NA	50		0.0E+00	NE (2)	NE (2)	6.0E-03	NE (1)	8.3E+03
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980	NA	20		0.0E+00	NE (2)	NE (2)	7.8E-03	NE (1)	2.6E+03
MAGNESIUM CARBONATE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	2.2E-03	NE (1)	NE (1)
METHANOL	NA	1596	0.5	NA		0.0E+00	NE (2)	NE (2)	2.6E-03	5.2E-03	NE (3)
p-TOLUENE SULFONIC ACID	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	9.9E-04	NE (1)	NE (1)
PALLADIUM	NA	NA	NA	0.0475		0.0E+00	NE (2)	NE (2)	5.2E-04	NE (1)	9.2E+01
PEROXYMONOSULFURIC ACID; OR POTASSIUM	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	4.7E-02	NE (1)	NE (1)
POTASSIUM BISULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	2.5E-02	NE (1)	NE (1)
POTASSIUM CYANIDE	NA	NA	0.0025	NA		0.0E+00	NE (2)	NE (2)	3.3E-04	1.3E-01	NE (3)
POTASSIUM HYDROXIDE	NA	7.1	NA	NA		0.0E+00	NE (2)	NE (2)	1.4E-03	NE (1)	NE (1)
POTASSIUM PERSULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	1.8E-02	NE (1)	NE (1)
POTASSIUM SULFATE	NA	15	NA	NA	L	0.0E+00	NE (2)	NE (2)	3.5E-02	NE (1)	NE (1)
POTASSIUM-SODIUM TARTRATE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	4.6E-02	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	1.0E-01	NE (1)	NE (1)
SODIUM CARBONATE	NA	10	NA	NA		0.0E+00	NE (2)	NE (2)	7.3E-05	NE (1)	NE (1)
SODIUM CHLORITE	NA	NA	NA	0.5		0.0E+00	NE (2)	NE (2)	7.0E-03	NE (1)	7.1E+01
SODIUM CYANIDE	NA	NA	0.002	NA		0.0E+00	NE (2)	NE (2)	3.4E-04	1.7E-01	NE (3)
SODIUM HYDROXIDE	NA	2	NA	NA		0.0E+00	NE (2)	NE (2)	1.9E-02	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	1.3E-02	NE (1)	NE (1)
M-NITROBENZENE SULFONIC ACID	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	2.2E-07	NE (1)	NE (1)
SODIUM SULFATE	NA	NA	NA	420		0.0E+00	NE (2)	NE (2)	1.8E-02	NE (1)	2.3E+04
STANNOUS CHLORIDE	NA	NA	0.0186	NA		0.0E+00	NE (2)	NE (2)	1.5E-02	7.9E-01	NE (3)
SULFURIC ACID	NA	0.066	NA	NA		0.0E+00	NE (2)	NE (2)	3.2E-01	NE (1)	NE (1)
TARTARIC ACID	NA	NA	NA	1.74		0.0E+00	NE (2)	NE (2)	1.3E-05	NE (1)	1.4E+05
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETH	NA	NA	NA	32		0.0E+00	NE (2)	NE (2)	8.6E-04	NE (1)	3.7E+04

Table E 4. Risk Characterization Results for Electroless Copper, Conveyorized, Line Operator Scenario

Notes and Abbreviations

RfC: Reference Concentration
NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level
RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

(3) HQ could be calculated

Table E 5. Risk Characterization Results for Electroless Copper, Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
AMMONIUM CHLORIDE	NA	1640		2.1E-03	NE (1)	7.9E+05
BENZOTRIAZOLE	NA	21.8		6.1E-05	NE (1)	3.6E+05
BORIC ACID	NA	56.2		8.0E-04	NE (1)	7.0E+04
COPPER (I) CHLORIDE	NA	0.042		1.1E-03	NE (1)	3.9E+01
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		1.2E-03	NE (1)	NE (1)
DIMETHYLAMINOBORANE	NA	NA	H	9.6E-05	NE (1)	NE (1)
DIMETHYLFORMAMIDE	NA	25		2.8E-05	NE (1)	9.0E+05
ETHANOLAMINE	NA	64		2.5E-04	NE (1)	2.6E+05
2-ETHOXYETHANOL	0.4	NA		3.4E-03	8.4E-03	NE (3)
ETHYLENE GLYCOL	2	NA		6.0E-05	3.0E-05	NE (3)
ETHYLENEDIAMINE-TETRAACETIC ACID (EDTA)	NA	NA	LM	4.1E-07	NE (1)	NE (1)
FLUOROBORIC ACID	NA	0.77	H	9.6E-03	NE (1)	8.0E+01
FORMALDEHYDE	0.002	NA		2.6E-04	3.7E-01	NE (3)
FORMIC ACID	NA	NA		8.5E-04	NE (1)	NE (1)
HYDROCHLORIC ACID	NA	NA		2.2E-02	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	31.5		3.2E-03	NE (1)	9.8E+03
HYDROXYACETIC ACID	NA	50		5.9E-04	NE (1)	8.4E+04
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	20		7.7E-04	NE (1)	2.6E+04
MAGNESIUM CARBONATE	NA	NA	LM	1.9E-04	NE (1)	NE (1)
METHANOL	0.5	NA		2.8E-04	5.6E-04	NE (3)
p-TOLUENE SULFONIC ACID	NA	NA	LM	9.8E-05	NE (1)	NE (1)
PALLADIUM	NA	0.0475		5.8E-05	NE (1)	8.2E+02
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	4.1E-03	NE (1)	NE (1)
POTASSIUM BISULFATE	NA	NA	M	2.2E-03	NE (1)	NE (1)
POTASSIUM CYANIDE	0.0025	NA		3.6E-05	1.4E-02	NE (3)
POTASSIUM HYDROXIDE	NA	NA		1.3E-04	NE (1)	NE (1)
POTASSIUM PERSULFATE	NA	NA	M	1.6E-03	NE (1)	NE (1)
POTASSIUM SULFATE	NA	NA	L	3.1E-03	NE (1)	NE (1)
POTASSIUM-SODIUM TARTRATE	NA	NA		5.1E-03	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	M	1.1E-02	NE (1)	NE (1)
SODIUM CARBONATE	NA	NA		8.0E-06	NE (1)	NE (1)
SODIUM CHLORITE	NA	0.5		7.3E-04	NE (1)	6.9E+02
SODIUM CYANIDE	0.002	NA		3.7E-05	1.9E-02	NE (3)
SODIUM HYDROXIDE	NA	NA		2.1E-03	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	LM	1.4E-03	NE (1)	NE (1)
M-NITROBENZENE SULFONIC ACID	NA	NA	M	2.2E-08	NE (1)	NE (1)
SODIUM SULFATE	NA	420		2.0E-03	NE (1)	2.1E+05
STANNOUS CHLORIDE	0.0186	NA		1.6E-03	8.9E-02	NE (3)

Table E 5. Risk Characterization Results for Electroless Copper, Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
SULFURIC ACID	NA	NA		2.9E-02	NE (1)	NE (1)
TARTARIC ACID	NA	1.74		1.4E-06	NE (1)	1.2E+06
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	32		8.5E-05	NE (1)	3.8E+05

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

(3) HQ could be calculated

Table E 6. Risk Characterization Results for Electroless Copper, Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
AMMONIUM CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)
BENZOTRIAZOLE	NA	NA		NE (2)	NE (2)	NE (2)
BORIC ACID	NA	NA		NE (2)	NE (2)	NE (2)
COPPER (I) CHLORIDE	NA	0.6		NE (2)	NE (2)	NE (2)
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
DIMETHYLAMINOBORANE	NA	NA	H	NE (2)	NE (2)	NE (2)
DIMETHYLFORMAMIDE	0.03	NA		NE (2)	NE (2)	NE (2)
ETHANOLAMINE	NA	12.7		NE (2)	NE (2)	NE (2)
2-ETHOXYETHANOL	0.2	NA		7.0E-04	1.2E-02	NE (3)
ETHYLENE GLYCOL	NA	31		NE (2)	NE (2)	NE (2)
ETHYLENEDIAMINE-TETRAACETIC ACID (EDTA)	NA	NA	LM	NE (2)	NE (2)	NE (2)
FLUOROBORIC ACID	NA	NA	H	NE (2)	NE (2)	NE (2)
FORMALDEHYDE	NA	100		2.0E-05	NE (1)	1.0E+06
FORMIC ACID	NA	59.2		3.5E-05	NE (1)	4.8E+05
HYDROCHLORIC ACID	0.007	15		NE (2)	NE (2)	NE (2)
HYDROGEN PEROXIDE	NA	79		NE (2)	NE (2)	NE (2)
HYDROXYACETIC ACID	NA	NA		NE (2)	NE (2)	NE (2)
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980		4.6E-04	NE (1)	6.0E+05
MAGNESIUM CARBONATE	NA	NA	LM	NE (2)	NE (2)	NE (2)
METHANOL	NA	1596		1.9E-04	NE (1)	2.4E+06
p-TOLUENE SULFONIC ACID	NA	NA	LM	NE (2)	NE (2)	NE (2)
PALLADIUM	NA	NA		NE (2)	NE (2)	NE (2)
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
POTASSIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
POTASSIUM CYANIDE	NA	NA		NE (2)	NE (2)	NE (2)
POTASSIUM HYDROXIDE	NA	7.1		NE (2)	NE (2)	NE (2)
POTASSIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
POTASSIUM SULFATE	NA	15	L	NE (2)	NE (2)	NE (2)
POTASSIUM-SODIUM TARTRATE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM CARBONATE	NA	10		NE (2)	NE (2)	NE (2)
SODIUM CHLORITE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM CYANIDE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM HYDROXIDE	NA	2		NE (2)	NE (2)	NE (2)
SODIUM HYPOPHOSPHITE	NA	NA	LM	NE (2)	NE (2)	NE (2)
M-NITROBENZENE SULFONIC ACID	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
STANNOUS CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)

Table E 6. Risk Characterization Results for Electroless Copper, Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
SULFURIC ACID	NA	0.066		NE (2)	NE (2)	NE (2)
TARTARIC ACID	NA	NA		NE (2)	NE (2)	NE (2)
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	NA		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

(3) HQ could be calculated

Table E 7. Risk Characterization Results for Carbon, Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	1.7E-02	NE (1)	NE (1)
ETHANOLAMINE	NA	12.7	NA	64		0.0E+00	NE (2)	NE (2)	9.6E-03	NE (1)	6.7E+03
POTASSIUM HYDROXIDE	NA	7.1	NA	NA		0.0E+00	NE (2)	NE (2)	7.3E-02	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	7.0E-01	NE (1)	NE (1)
SULFURIC ACID	NA	0.066	NA	NA		0.0E+00	NE (2)	NE (2)	6.4E-03	NE (1)	NE (1)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 8. Risk Characterization Results for Carbon, Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		1.4E-04	NE (1)	NE (1)
ETHANOLAMINE	NA	64		1.3E-04	NE (1)	5.0E+05
POTASSIUM HYDROXIDE	NA	NA		1.2E-03	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	M	5.7E-03	NE (1)	NE (1)
SULFURIC ACID	NA	NA		5.3E-05	NE (1)	NE (1)

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

Table E 9. Risk Characterization Results for Carbon, Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
ETHANOLAMINE	NA	12.70		NE (2)	NE (2)	NE (2)
POTASSIUM HYDROXIDE	NA	7.10		NE (2)	NE (2)	NE (2)
SODIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SULFURIC ACID	NA	0.0660		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 10. Risk Characterization Results for Conductive Polymer, Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
SODIUM CARBONATE	NA	10	NA	NA		0.0E+00	NE (2)	NE (2)	2.5E-02	NE (1)	NE (1)
PHOSPHORIC ACID	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	1.0E-01	NE (1)	NE (1)
1H-PYRROLE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	2.6E-02	NE (1)	NE (1)
PEROXYMONOSULFURIC ACID; OR POTASSIUM	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	7.0E-01	NE (1)	NE (1)
SODIUM HYDROXIDE	NA	2	NA	NA		0.0E+00	NE (2)	NE (2)	2.7E-03	NE (1)	NE (1)
SULFURIC ACID	NA	0.066	NA	NA		0.0E+00	NE (2)	NE (2)	1.4E-01	NE (1)	NE (1)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 11. Risk Characterization Results for Conductive Polymer, Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
SODIUM CARBONATE	NA	NA		3.3E-04	NE (1)	NE (1)
PHOSPHORIC ACID	NA	NA	M	1.3E-03	NE (1)	NE (1)
1H-PYRROLE	NA	NA		3.3E-04	NE (1)	NE (1)
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	8.8E-03	NE (1)	NE (1)
SODIUM HYDROXIDE	NA	NA		3.9E-05	NE (1)	NE (1)
SULFURIC ACID	NA	NA		1.8E-03	NE (1)	NE (1)

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

Table E 12. Risk Characterization Results for Conductive Polymer, Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
SODIUM CARBONATE	NA	10		NE (2)	NE (2)	NE (2)
PHOSPHORIC ACID	NA	NA	M	NE (2)	NE (2)	NE (2)
1H-PYRROLE	NA	NA		NE (2)	NE (2)	NE (2)
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM HYDROXIDE	NA	2		NE (2)	NE (2)	NE (2)
SULFURIC ACID	NA	0.066		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(2) exposure expected to be negligible

Table E 13. Risk Characterization Results for Graphite, Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
AMMONIA	0.1	NA	NA	NA		0.0E+00	NE (2)	NE (2)	4.2E-03	NE (1)	NE (1)
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	1.1E-02	NE (1)	NE (1)
ETHANOLAMINE	NA	12.7	NA	64		0.0E+00	NE (2)	NE (2)	5.3E-03	NE (1)	1.2E+04
GRAPHITE	NA	56	NA	NA	LM	0.0E+00	NE (2)	NE (2)	9.8E-02	NE (1)	NE (1)
POTASSIUM CARBONATE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	2.1E-02	NE (1)	NE (1)
PEROXYMONOSULFURIC ACID; OR POTAS	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	1.2E-01	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	2.3E-01	NE (1)	NE (1)
SULFURIC ACID	NA	0.066	NA	NA		0.0E+00	NE (2)	NE (2)	2.4E-01	NE (1)	NE (1)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 14. Risk Characterization Results for Graphite, Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
AMMONIA	NA	NA		3.3E-04	NE (1)	NE (1)
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		4.5E-04	NE (1)	NE (1)
ETHANOLAMINE	NA	64		3.2E-04	NE (1)	2.0E+05
GRAPHITE	NA	NA	LM	7.7E-03	NE (1)	NE (1)
POTASSIUM CARBONATE	NA	NA	LM	1.3E-03	NE (1)	NE (1)
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	5.1E-03	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	M	9.7E-03	NE (1)	NE (1)
SULFURIC ACID	NA	NA		1.0E-02	NE (1)	NE (1)

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

Table E 15. Risk Characterization Results for Graphite, Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
AMMONIA	0.1	NA		NE (2)	NE (2)	NE (2)
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
ETHANOLAMINE	NA	12.7		NE (2)	NE (2)	NE (2)
GRAPHITE	NA	56	LM	NE (2)	NE (2)	NE (2)
POTASSIUM CARBONATE	NA	NA	LM	NE (2)	NE (2)	NE (2)
PEROXYMONOSULFURIC ACID; OR POTASSIUM PEROXYMONOSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SULFURIC ACID	NA	0.066		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(2) exposure expected to be negligible

Table E 16. Risk Characterization Results for Non-Formaldehyde Electroless Copper, Non-Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA	NA	NA		1.5E-03	NE (1)	NE (1)	1.7E-01	NE (1)	NE (1)
HYDROCHLORIC ACID	0.007	15	NA	NA		0.0E+00	NE (2)	NE (2)	2.2E-02	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	79	NA	31.5		5.0E-04	NE (1)	4.5E+04	1.2E-01	NE (1)	2.7E+02
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980	NA	20		3.9E-01	NE (1)	7.1E+02	1.3E-02	NE (1)	1.5E+03
POTASSIUM HYDROXIDE	NA	7.1	NA	NA		8.0E-06	NE (1)	2.5E+05	2.2E-03	NE (1)	NE (1)
POTASSIUM PERSULFATE	NA	NA	NA	NA	M	3.0E-04	NE (1)	NE (1)	7.2E-02	NE (1)	NE (1)
SODIUM CHLORITE	NA	NA	NA	0.5		0.0E+00	NE (2)	NE (2)	3.3E-02	NE (1)	1.5E+01
SODIUM HYDROXIDE	NA	2	NA	NA		9.3E-06	NE (1)	6.1E+04	2.2E-03	NE (1)	NE (1)
STANNOUS CHLORIDE	NA	NA	0.0186	NA		0.0E+00	NE (2)	NE (2)	6.9E-02	3.7E+00	NE (3)
SULFURIC ACID	NA	0.066	NA	NA		7.9E-04	NE (1)	2.4E+01	1.7E-01	NE (1)	NE (1)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

(3) HQ could be calculated

Table E 17. Risk Characterization Results for Non-Formaldehyde Electroless Copper, Non-Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		2.7E-04	NE (1)	NE (1)
HYDROCHLORIC ACID	NA	NA		3.4E-05	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	31.5		1.9E-04	NE (1)	1.7E+05
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	20		2.1E-05	NE (1)	9.6E+05
POTASSIUM HYDROXIDE	NA	NA		3.5E-06	NE (1)	NE (1)
POTASSIUM PERSULFATE	NA	NA	M	1.1E-04	NE (1)	NE (1)
SODIUM CHLORITE	NA	0.5		5.2E-05	NE (1)	9.5E+03
SODIUM HYDROXIDE	NA	NA		3.5E-06	NE (1)	NE (1)
STANNOUS CHLORIDE	0.0186	NA		1.1E-04	5.9E-03	NE (1)
SULFURIC ACID	NA	NA		2.6E-04	NE (1)	NE (1)

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

Table E 18. Risk Characterization Results for Non-Formaldehyde Electroless Copper, Non-Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
HYDROCHLORIC ACID	0.007	15		NE (2)	NE (2)	NE (2)
HYDROGEN PEROXIDE	NA	79		NE (2)	NE (2)	NE (2)
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980		3.3E-05	NE (1)	8.5E+06
POTASSIUM HYDROXIDE	NA	7.1		NE (2)	NE (2)	NE (2)
POTASSIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM CHLORITE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM HYDROXIDE	NA	2		NE (2)	NE (2)	NE (2)
STANNOUS CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)
SULFURIC ACID	NA	0.066		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 19. Risk Characterization Results for Organic-Palladium, Non-Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
HYDROCHLORIC ACID	0.007	15	NA	NA		0.0E+00	NE (2)	NE (2)	6.4E-02	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	7.8E-01	NE (1)	NE (1)
SODIUM CARBONATE	NA	10	NA	NA		0.0E+00	NE (2)	NE (2)	2.3E-01	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	3.2E-02	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	7.8E-01	NE (1)	NE (1)
TRISODIUM CITRATE 5.5-HYDRATE; OR SODIUM	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	6.7E-03	NE (1)	NE (1)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 20. Risk Characterization Results for Organic-Palladium, Non-Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
HYDROCHLORIC ACID	NA	NA		2.2E-04	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	M	2.7E-03	NE (1)	NE (1)
SODIUM CARBONATE	NA	NA		7.8E-04	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	LM	1.1E-04	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	M	2.7E-03	NE (1)	NE (1)
TRISODIUM CITRATE 5.5-HYDRATE; OR SODIUM CITRATE	NA	NA		2.3E-05	NE (1)	NE (1)

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

Table E 21. Risk Characterization Results for Organic-Palladium, Non-Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
HYDROCHLORIC ACID	0.007	15		NE (2)	NE (2)	NE (2)
SODIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM CARBONATE	NA	10		NE (2)	NE (2)	NE (2)
SODIUM HYPOPHOSPHITE	NA	NA	LM	NE (2)	NE (2)	NE (2)
SODIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
TRISODIUM CITRATE 5.5-HYDRATE; OR SODIUM CITRATE	NA	NA		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(2) exposure expected to be negligible

Table E 22. Risk Characterization Results for Organic-Palladium, Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
HYDROCHLORIC ACID	0.007	15	NA	NA		0.0E+00	NE (2)	NE (2)	1.8E-02	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	1.5E-01	NE (1)	NE (1)
SODIUM CARBONATE	NA	10	NA	NA		0.0E+00	NE (2)	NE (2)	4.8E-02	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	6.1E-03	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	1.5E-01	NE (1)	NE (1)
TRISODIUM CITRATE 5.5-HYDRATE; OR SODIUM (	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	1.4E-03	NE (1)	NE (1)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 23. Risk Characterization Results for Organic-Palladium, Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
HYDROCHLORIC ACID	NA	NA		2.2E-04	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	M	2.7E-03	NE (1)	NE (1)
SODIUM CARBONATE	NA	NA		7.8E-04	NE (1)	NE (1)
SODIUM HYPOPHOSPHITE	NA	NA	LM	1.1E-04	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	M	2.7E-03	NE (1)	NE (1)
TRISODIUM CITRATE 5.5-HYDRATE; OR SODIUM CITRATE	NA	NA		2.3E-05	NE (1)	NE (1)

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

Table E 24. Risk Characterization Results for Organic-Palladium, Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
HYDROCHLORIC ACID	0.007	15		NE (2)	NE (2)	NE (2)
SODIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM CARBONATE	NA	10		NE (2)	NE (2)	NE (2)
SODIUM HYPOPHOSPHITE	NA	NA	LM	NE (2)	NE (2)	NE (2)
SODIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
TRISODIUM CITRATE 5.5-HYDRATE; OR SODIUM CITRATE	NA	NA		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(2) exposure expected to be negligible

Table E 25. Risk Characterization Results for Tin-Palladium, Non-Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
1,3-BENZENEDIOL	NA	NA	NA	100		0.0E+00	NE (2)	NE (2)	9.7E-03	NE (1)	1.0E+04
COPPER (I) CHLORIDE	NA	0.6	NA	0.042		0.0E+00	NE (2)	NE (2)	2.3E-02	NE (1)	1.9E+00
COPPER SULFATE; OR CUPRIC SULFA	NA	NA	NA	NA		4.0E-04	NE (1)	NE (1)	1.3E-01	NE (1)	NE (1)
ETHANOLAMINE	NA	12.7	NA	64		1.1E-01	NE (1)	3.4E+01	2.7E-02	NE (1)	2.4E+03
FLUOBORIC ACID	NA	NA	NA	0.77	H	9.4E-03	NE (1)	NE (1)	1.7E-01	NE (1)	4.6E+00
HYDROCHLORIC ACID	0.007	15	NA	NA		0.0E+00	NE (2)	NE (2)	2.9E-01	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	79	NA	31.5		5.2E-04	NE (1)	4.3E+04	1.6E-01	NE (1)	2.0E+02
ISOPROPYL ALCOHOL; OR 2-PROPAN	NA	980	NA	20		1.6E+00	NE (1)	1.8E+02	1.6E-02	NE (1)	1.2E+03
LITHIUM HYDROXIDE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	1.8E-01	NE (1)	NE (1)
PALLADIUM	NA	NA	NA	0.0475		0.0E+00	NE (2)	NE (2)	8.5E-03	NE (1)	5.6E+00
PALLADIUM CHLORIDE	NA	NA	NA	0.0475	MH	0.0E+00	NE (2)	NE (2)	5.3E-03	NE (1)	8.9E+00
POTASSIUM CARBONATE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	2.9E+00	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	7.9E-01	NE (1)	NE (1)
SODIUM CHLORIDE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	9.0E+00	NE (1)	NE (1)
SODIUM HYDROXIDE	NA	2	NA	NA		0.0E+00	NE (2)	NE (2)	2.6E-01	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	NA	NA	M	4.5E-03	NE (1)	NE (1)	1.3E+00	NE (1)	NE (1)
STANNOUS CHLORIDE	NA	NA	0.0186	NA		0.0E+00	NE (2)	NE (2)	2.8E-01	1.5E+01	NE (3)
SULFURIC ACID	NA	0.066	NA	NA		6.2E-04	NE (1)	3.0E+01	1.9E+00	NE (1)	NE (1)
TRIETHANOLAMINE; OR 2,2,2-NITRIL	NA	NA	NA	32		0.0E+00	NE (2)	NE (2)	2.4E-03	NE (1)	1.4E+04
VANILLIN	NA	NA	NA	3.84		4.3E-04	NE (1)	NE (1)	3.0E-03	NE (1)	1.3E+03

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

(3) HQ could be calculated

Table E 26. Risk Characterization Results for Tin-Palladium, Non-Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
1,3-BENZENEDIOL	NA	100		9.7E-05	NE (1)	1.0E+06
COPPER (I) CHLORIDE	NA	0.042		2.3E-04	NE (1)	1.9E+02
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		1.2E-03	NE (1)	NE (1)
ETHANOLAMINE	NA	64		2.7E-04	NE (1)	2.4E+05
FLUOBORIC ACID	NA	0.77	H	1.7E-03	NE (1)	4.6E+02
HYDROCHLORIC ACID	NA	NA		2.9E-03	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	31.5		1.5E-03	NE (1)	2.0E+04
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	20		1.6E-04	NE (1)	1.2E+05
LITHIUM HYDROXIDE	NA	NA		1.8E-03	NE (1)	NE (1)
PALLADIUM	NA	0.0475		8.5E-05	NE (1)	5.6E+02
PALLADIUM CHLORIDE	NA	0.0475	MH	5.3E-05	NE (1)	8.9E+02
POTASSIUM CARBONATE	NA	NA	LM	2.9E-02	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	M	7.9E-03	NE (1)	NE (1)
SODIUM CHLORIDE	NA	NA		9.0E-02	NE (1)	NE (1)
SODIUM HYDROXIDE	NA	NA		2.6E-03	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	M	1.3E-02	NE (1)	NE (1)
STANNOUS CHLORIDE	0.0186	NA		2.8E-03	1.5E-01	NE (3)
SULFURIC ACID	NA	NA		1.9E-02	NE (1)	NE (1)
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	32		2.4E-05	NE (1)	1.4E+06
VANILLIN	NA	3.84		3.0E-05	NE (1)	1.3E+05

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

(3) HQ could be calculated

Table E 27. Risk Characterization Results for Tin-Palladium, Non-Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
1,3-BENZENEDIOL	NA	NA		NE (2)	NE (2)	NE (2)
COPPER (I) CHLORIDE	NA	0.6		NE (2)	NE (2)	NE (2)
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
ETHANOLAMINE	NA	12.7		NE (2)	NE (2)	NE (2)
FLUOBORIC ACID	NA	NA	H	NE (2)	NE (2)	NE (2)
HYDROCHLORIC ACID	0.007	15		NE (2)	NE (2)	NE (2)
HYDROGEN PEROXIDE	NA	79		NE (2)	NE (2)	NE (2)
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980		1.3E-04	NE (1)	2.1E+06
LITHIUM HYDROXIDE	NA	NA		NE (2)	NE (2)	NE (2)
PALLADIUM	NA	NA		NE (2)	NE (2)	NE (2)
PALLADIUM CHLORIDE	NA	NA	MH	NE (2)	NE (2)	NE (2)
POTASSIUM CARBONATE	NA	NA	LM	NE (2)	NE (2)	NE (2)
SODIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM HYDROXIDE	NA	2		NE (2)	NE (2)	NE (2)
SODIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
STANNOUS CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)
SULFURIC ACID	NA	0.066		NE (2)	NE (2)	NE (2)
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	NA		NE (2)	NE (2)	NE (2)
VANILLIN	NA	NA		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

Table E 28. Risk Characterization Results for Tin-Palladium, Conveyorized, Line Operator Scenario

Chemical Name	Human health toxicity data					Exposure and risk indicator results					
	Inhalation		Dermal		SAT	Inhalation			Dermal Contact		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE	ADD (mg/kg-day)	HQ	MOE
1,3-BENZENEDIOL	NA	NA	NA	100		0.0E+00	NE (2)	NE (2)	2.7E-03	NE (1)	3.7E+04
COPPER (I) CHLORIDE	NA	0.6	NA	0.042		0.0E+00	NE (2)	NE (2)	8.1E-03	NE (1)	5.2E+00
COPPER SULFATE; OR CUPRIC SULFA	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	4.9E-02	NE (1)	NE (1)
ETHANOLAMINE	NA	12.7	NA	64		0.0E+00	NE (2)	NE (2)	1.2E-02	NE (1)	5.2E+03
FLUOROBORIC ACID	NA	NA	NA	0.77	H	0.0E+00	NE (2)	NE (2)	6.0E-02	NE (1)	1.3E+01
HYDROCHLORIC ACID	0.007	15	NA	NA		0.0E+00	NE (2)	NE (2)	1.1E-01	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	79	NA	31.5		0.0E+00	NE (2)	NE (2)	6.1E-02	NE (1)	5.2E+02
ISOPROPYL ALCOHOL; OR 2-PROPAN	NA	980	NA	20		0.0E+00	NE (2)	NE (2)	8.4E-03	NE (1)	2.4E+03
LITHIUM HYDROXIDE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	6.5E-02	NE (1)	NE (1)
PALLADIUM	NA	NA	NA	0.0475		0.0E+00	NE (2)	NE (2)	2.4E-03	NE (1)	2.0E+01
PALLADIUM CHLORIDE	NA	NA	NA	0.0475	MH	0.0E+00	NE (2)	NE (2)	1.5E-03	NE (1)	3.2E+01
POTASSIUM CARBONATE	NA	NA	NA	NA	LM	0.0E+00	NE (2)	NE (2)	1.0E+00	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	3.3E-01	NE (1)	NE (1)
SODIUM CHLORIDE	NA	NA	NA	NA		0.0E+00	NE (2)	NE (2)	3.3E+00	NE (1)	NE (1)
SODIUM HYDROXIDE	NA	2	NA	NA		0.0E+00	NE (2)	NE (2)	9.2E-02	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	NA	NA	M	0.0E+00	NE (2)	NE (2)	5.2E-01	NE (1)	NE (1)
STANNOUS CHLORIDE	NA	NA	0.0186	NA		0.0E+00	NE (2)	NE (2)	7.9E-02	4.2E+00	NE (3)
SULFURIC ACID	NA	0.066	NA	NA		0.0E+00	NE (2)	NE (2)	1.2E+00	NE (1)	NE (1)
TRIETHANOLAMINE; OR 2,2,2-NITRIL	NA	NA	NA	32		0.0E+00	NE (2)	NE (2)	1.2E-03	NE (1)	2.6E+04
VANILLIN	NA	NA	NA	3.84		0.0E+00	NE (2)	NE (2)	8.4E-04	NE (1)	4.6E+03

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

RfD: reference dose

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible

(3) HQ could be calculated

Table E 29. Risk Characterization Results for Tin-Palladium, Conveyorized, Laboratory Technician Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Dermal		SAT	Dermal Contact		
	RfD (mg/kg-day)	NOAEL/LOAEL (mg/kg-day)		ADD (mg/kg-day)	HQ	MOE
1,3-BENZENEDIOL	NA	100		9.7E-05	NE (1)	1.0E+06
COPPER (I) CHLORIDE	NA	0.042		2.3E-04	NE (1)	1.9E+02
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		1.2E-03	NE (1)	NE (1)
ETHANOLAMINE	NA	64		2.7E-04	NE (1)	2.4E+05
FLUOROBORIC ACID	NA	0.77	H	1.7E-03	NE (1)	4.6E+02
HYDROCHLORIC ACID	NA	NA		2.9E-03	NE (1)	NE (1)
HYDROGEN PEROXIDE	NA	31.5		1.5E-03	NE (1)	2.0E+04
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	20		1.6E-04	NE (1)	1.2E+05
LITHIUM HYDROXIDE	NA	NA		1.8E-03	NE (1)	NE (1)
PALLADIUM	NA	0.0475		8.5E-05	NE (1)	5.6E+02
PALLADIUM CHLORIDE	NA	0.0475	MH	5.3E-05	NE (1)	8.9E+02
POTASSIUM CARBONATE	NA	NA	LM	2.9E-02	NE (1)	NE (1)
SODIUM BISULFATE	NA	NA	M	7.9E-03	NE (1)	NE (1)
SODIUM CHLORIDE	NA	NA		9.0E-02	NE (1)	NE (1)
SODIUM HYDROXIDE	NA	NA		2.6E-03	NE (1)	NE (1)
SODIUM PERSULFATE	NA	NA	M	1.3E-02	NE (1)	NE (1)
STANNOUS CHLORIDE	0.0186	NA		2.8E-03	1.5E-01	NE (3)
SULFURIC ACID	NA	NA		1.9E-02	NE (1)	NE (1)
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	32		2.4E-05	NE (1)	1.4E+06
VANILLIN	NA	3.84		3.0E-05	NE (1)	1.3E+05

Notes and Abbreviations

RfD: reference dose

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: risk indicator not evaluated for the following reason:

(1) toxicity data not available

(3) HQ could be calculated

Table E 30. Risk Characterization Results for Tin-Palladium, Conveyorized, Surrounding Population Scenario

Chemical Name	Human health toxicity data			Exposure and risk indicator results		
	Inhalation		SAT	Inhalation		
	RfC (mg/m3)	NOAEL/LOAEL (mg/m3)		ADD (mg/kg-day)	HQ	MOE
1,3-BENZENEDIOL	NA	NA		NE (2)	NE (2)	NE (2)
COPPER (I) CHLORIDE	NA	0.6		NE (2)	NE (2)	NE (2)
COPPER SULFATE; OR CUPRIC SULFATE	NA	NA		NE (2)	NE (2)	NE (2)
ETHANOLAMINE	NA	12.7		2.3E-05	NE (1)	1.6E+05
FLUOROBORIC ACID	NA	NA	H	NE (2)	NE (2)	NE (2)
HYDROCHLORIC ACID	0.007	15		NE (2)	NE (2)	NE (2)
HYDROGEN PEROXIDE	NA	79		NE (2)	NE (2)	NE (2)
ISOPROPYL ALCOHOL; OR 2-PROPANOL	NA	980		1.0E-04	NE (1)	2.7E+06
LITHIUM HYDROXIDE	NA	NA		NE (2)	NE (2)	NE (2)
PALLADIUM	NA	NA		NE (2)	NE (2)	NE (2)
PALLADIUM CHLORIDE	NA	NA	MH	NE (2)	NE (2)	NE (2)
POTASSIUM CARBONATE	NA	NA	LM	NE (2)	NE (2)	NE (2)
SODIUM BISULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
SODIUM CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)
SODIUM HYDROXIDE	NA	2		NE (2)	NE (2)	NE (2)
SODIUM PERSULFATE	NA	NA	M	NE (2)	NE (2)	NE (2)
STANNOUS CHLORIDE	NA	NA		NE (2)	NE (2)	NE (2)
SULFURIC ACID	NA	0.066		NE (2)	NE (2)	NE (2)
TRIETHANOLAMINE; OR 2,2,2-NITRILOTRIS ETHANOL	NA	NA		NE (2)	NE (2)	NE (2)
VANILLIN	NA	NA		NE (2)	NE (2)	NE (2)

Notes and Abbreviations

RfC: Reference Concentration

NOAEL/LOAEL: no-observed adverse effect level / lowest-observed adverse effect level

SAT: Structure-Activity Team Rank. Overall concern levels were ranked as follows:

L: Low; LM: Low Moderate; M: Moderate; MH: Moderate High; H: High.

ADD: average daily dose

HQ: hazard quotient (unitless ratio)

MOE: margin of exposure (unitless ratio)

NA: data not available

NE: ADD or risk indicator not evaluated for the following reasons:

(1) toxicity data not available

(2) exposure expected to be negligible