APPENDIX C

RISK ASSESSMENT METHODOLOGIES

METHODOLOGIES FOR RISK ASSESSMENT

The following presents the methodologies the SCAQMD used to estimate the toxic risks associated with the implementation of PAR 1113. The reader referred to the attached spreadsheets for the variables and assumptions used in these methodologies. The reader is also referred to the SCAQMD's Risk Assessment Procedures for Rules 1401 and 212 (November 1998) for a more detailed discussion of risk assessment procedures.

Health risk assessment is used to estimate the likelihood that an individual would contract cancer or experience other adverse health effects as a result of exposure to toxic air contaminants. Risk assessment is a methodology for estimating the probability or likelihood that an adverse health effect will occur. The risk assessment procedures for PAR 1401 are consistent with current recommendations by Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA). OEHHA is the state agency with primary responsibility for developing and recommending risk assessment methods

Carcinogenic Analysis

The equation for calculating MICR is:

$$MICR = Qyr \times U \times \left(\frac{X}{Q}\right) \times MET \times MP \times LEA$$

$$Qyr = \text{Amount of Toxic Emissions}, \frac{\text{tons}}{\text{yr}}$$

$$U = \text{Toxic Unit Risk Factor}, \left(\frac{\mu g}{m^3}\right)^{-1}$$

$$\left(\frac{X}{Q}\right) = \text{Dispersion Factor}, \left(\frac{\frac{\mu g}{m^3}}{\frac{\text{tons}}{\text{yr}}}\right)$$

$$MET = \text{Metrological Correction Factor}$$

$$MP = \text{Multi-Pathway Adjustment Factor}$$

$$LEA = \text{Life Time Exposure Adjustment Factor}$$

Knowing that the SCAQMD significance threshold for toxics is MICR $>10x10^{-6}$, the following equation is used to estimate the yearly toxic emissions that would have to be emitted to exceed this threshold.

$$Qyr = \frac{MICR}{U \times \left(\frac{X}{Q}\right) \times MET \times MP \times LEA}$$

To calculate the amount of daily toxic emissions that would have to be emitted to exceed a MICR >10x10^{-6}, the following equation is used.

$$Qday, \frac{lbs}{day} = \frac{Qyr}{Days} \times \frac{2000\,lbs}{ton}$$

$$Qyr = Amount\ of\ Toxic\ Emissions, \frac{tons}{yr}$$

$$Days = Coating\ Application, \frac{days}{yr}$$

Knowing the daily toxic emissions, the daily coating usage necessary to exceed a MICR >10x10^{-6} can be estimated using the following equation.

$$Usage, \frac{gal}{day} = \frac{Qday}{Density \times \left(\frac{\%Tox}{100}\right)}$$

$$Qday = Amount\ of\ Toxic\ Emissions, \frac{lbs}{day}$$

$$Density = Density\ of\ Coating, \frac{lbs}{gal}$$

$$\%Tox = Percentage\ of\ Toxic\ Compound\ in\ Coating, \%$$

Chronic Analysis

The equation for calculating HIC is:

$$HIC = \frac{Qyr \times \left(\frac{X}{Q}\right) \times MET \times MP}{REL}$$

$$Qyr = Amount\ of\ Toxic\ Emissions, \frac{tons}{yr}$$

$$\left(\frac{X}{Q}\right) = Dispersion\ Factor, \left(\frac{\frac{\mu g}{m^3}}{\frac{tons}{yr}}\right)$$

$$MET = Metrological\ Correction\ Factor$$

$$MP = Multi\text{-}Pathway\ Adjustment\ Factor$$

$$REL = Reference\ Exposure\ Level$$

Knowing that the SCAQMD significance threshold for toxics is HI >1, the following equation is used to estimate the yearly toxic emissions that would have to be emitted to exceed this threshold.

$$Qyr = \frac{HIC \times REL}{\left(\frac{X}{Q}\right) \times MET \times MP}$$

To calculate the amount of daily toxic emissions that would have to be emitted to exceed a HI >1, the following equation is used.

$$Qday, \frac{lbs}{day} = \frac{Qyr}{Days} \times \frac{2000\,lbs}{ton}$$

$$Qyr = Amount\ of\ Toxic\ Emitted, \frac{tons}{yr}$$

$$Days = Coating\ Application, \frac{days}{yr}$$

Knowing the daily toxic emissions, the daily coating usage necessary to exceed a HI >1 can be estimated using the following equation.

$$Usage, \frac{gal}{day} = \frac{Qday}{Density \times \left(\frac{\%Tox}{100}\right)}$$

$$Qday = Amount\ of\ Toxics\ Emitted, \frac{lbs}{day}$$

$$Density = Density\ of\ Coating, \frac{lbs}{gal}$$

$$\%Tox = Percentage\ of\ Toxic\ Compound\ in\ Coating, \%$$

Acute Analysis

The equation for calculating HIA is:

$$HIC = \frac{Qhr \times \left(\frac{X}{Q}\right)_{max}}{REL}$$

$$Qhr = \text{Amount of Toxic Emitted}, \frac{lbs}{hr}$$

$$\left(\frac{X}{Q}\right)_{max} = \text{Dispersion Factor}, \left(\frac{\frac{\mu g}{m^3}}{\frac{tons}{yr}}\right)$$

$$REL = \text{Reference Exposure Level}$$

Knowing that the SCAQMD significance threshold for toxics is HI > 1, the following equation is used to estimate the hourly toxic emissions that would have to be emitted to exceed this threshold.

$$Qhr = \frac{HI \times REL}{\left(\frac{X}{Q}\right)_{max}}$$

Knowing the hourly toxic emissions, the daily coating usage necessary to exceed a HIA > 1 can be estimated using the following equation.

$$\text{Usage}, \frac{gal}{day} = \frac{Qhr \times Hours}{Density \times \left(\frac{\%Tox}{100}\right)}$$

$$Qhr = \text{Amount of Toxic}, \frac{lbs}{hrs}$$

$$Hours = \text{Coating Application}, \frac{hrs}{day}$$

$$Density = \text{Density of Coating}, \frac{lbs}{gal}$$

$$\%Tox = \text{Percentage of Toxic Compound in Coating}, \%$$

Real-Case Analysis

Compound	% by wt.	Unit Risk Factor 1/(ug/m3)	Chronic REL ug/m3	Acute REL ug/m3	MICR MP	Chronic MP	Target Organs
Toluene	10		3.00E+02	3.70E+04		1	CNS/PNS, Repr
Xylene	10		7.00E+02	2.20E+03		1	Repr, Resp
Isopropyl Alcohol	4		7.00E+03	3.20E+03		1	CV/BL, CNS/PNS, Immun
Ethylene Glycol	6		4.00E+02			1	Resp, Skin, Kidn, Repr
Propylene Glycol	5		7.00E+03			1	Liver
EGEE	10		7.00E+01	3.70E+02		1	Repr, CV/BL
EGME	10		6.00E+01	9.30E+01		1	Repr
EGBE	5			1.40E+04		1	CV/BL
Methyl Ethyl Ketone	10			1.30E+04			Repr
Toluene Diisocyanate (TDI)	1	1.10E-05	7.00E-02		1	1	Resp
Methylene Phenyl Diisocyanate	1		7.00E-01			1	Resp
Styrene	1		9.00E+02	2.10E+04		1	Eye, Resp

Assumptions

Coating	Density	9	lbs/gal
	hrs/day	8	
	days/yr	260	
	Stack Ht	Ground Level	
	Receptor	Residential	
	Location	West LA	
Signficance Threshold for	MICR	1.00E-05	
Signficance Threshold for	HIC	1	
Signficance Threshold for	HIA	1	

Input Variables (Point Source)

Distance to Receptor meters	X/Q ug/m3 / tons/yr	MET	LEA	X/Q max ug/m3 /lb/hr
25	51.18	1	1	2000
50	16.88	1	1	1000.6
100	4.51	1	1	373.5

Carcinogenic Analysis (MICR)

		25m			**50m**			**100m**	
Compound	QYR tons/yr	QDAY lbs/day	Usage gals/day	QYR tons/yr	QDAY lbs/day	Usage gals/day	QYR tons/yr	QDAY lbs/day	Usage gals/day
Toluene Diisocyante (TDI)	0.02	0.14	1.52	0.05	0.41	4.60	0.20	1.55	17.23

Chronic Exposure Analysis (HIC)

	25m			50m			100m		
Compound	QYR tons/yr	QDAY lbs/day	Usage gals/day	QYR tons/yr	QDAY lbs/day	Usage gals/day	QYR tons/yr	QDAY lbs/day	Usage gals/day
Toluene	5.86	45.09	50.10	17.77	136.71	151.90	66.52	511.68	568.54
Xylene	13.68	105.21	116.90	41.47	318.99	354.44	155.21	1193.93	1326.59
Isopropyl Alcohol	136.77	1052.09	2922.48	414.69	3189.94	8860.94	1552.11	11939.28	33164.67
Ethylene Glycol	7.82	60.12	111.33	23.70	182.28	337.56	88.69	682.24	1263.42
Propylene Glycol	136.77	1052.09	2337.99	414.69	3189.94	7088.75	1552.11	11939.28	26531.73
EGEE	1.37	10.52	11.69	4.15	31.90	35.44	15.52	119.39	132.66
EGME	1.17	9.02	10.02	3.55	27.34	30.38	13.30	102.34	113.71
Toluene Diisocyante (TDI)	0.00	0.01	0.12	0.00	0.03	0.35	0.02	0.12	1.33
Methylene Phenyl Diisocyanate	0.01	0.11	1.17	0.04	0.32	3.54	0.16	1.19	13.27
Styrene	17.58	135.27	1502.99	53.32	410.13	4557.05	199.56	1535.05	17056.11

Acute Exposure Analysis (HIA)

	25m		50m		100m	
Compound	QHR lbs/hr	Usage gals/day	QHR lbs/hr	Usage gals/day	QHR lbs/hr	Usage gals/day
Toluene	18.50	20.56	36.98	41.09	99.06	110.07
Xylene	1.10	1.22	2.20	2.44	5.89	6.54
Isopropyl Alcohol	1.60	4.44	3.20	8.88	8.57	23.80
EGEE	0.19	0.21	0.37	0.41	0.99	1.10
EGME	0.05	0.05	0.09	0.10	0.25	0.28
EGBE	7.00	15.56	13.99	31.09	37.48	83.30
Methyl Ethyl Ketone	6.50	7.22	12.99	14.44	34.81	38.67
Styrene	10.50	116.67	20.99	233.19	56.22	624.72

Target Organs: CNS/PNS = Central or Peripheral Nervous System
Repr = Reproductive System/Development
Resp = Respiratory System
CV/BL = Cardiovascular or Blood System
Immun = Immune System
Skin = Skin
Kidn = Kidney
Eye = Eye