APPENDIX I

MATES V

FINAL REPORT

Cancer Potency Factors and Chronic RELs

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Cancer Potency Factors and Chronic RELs

The estimated concentration of a substance is combined with the cancer potency factors and Reference Exposure Levels (RELs) to estimate the potential for health effects. The calculations used in MATES multiplies the estimated or measured annual average levels for potential carcinogens by the cancer potency factor, molecular weight adjustment factor, combined exposure factor, and multi-pathway adjustment factor to determine cancer risks.

The equations below show the cancer risk and chronic hazard index calculations.

$$Potential\ Cancer\ Risk = Concentration * Cancer\ Potency\ Factor * Cancer\ Multi\ pathway\ Factor * Molecular\ Weight\ Adjustment\ Factor * Exposure\ Duration$$

$$Hazard\ Index = \frac{Concentration * Chronic\ Multi\ pathway\ Factor * Molecular\ Weight\ Adjustment\ Factor}{Chronic\ Inhalation\ REL}$$

The molecular weight adjustment factor is only used when a toxic metal has a cancer potency factor and applies only to the fraction of the overall weight of the emissions that are associated with health effects of the metal (California Office of Environmental Health Hazard Assessment, 2015). The combined exposure factor accounts for the exposure factor for each assigned age bin. Each assigned age bin is made up of the daily breathing rate, exposure duration of the age bin, fraction of time at home, and an age sensitivity factor. The daily breathing rate is calculated using the California Air Resources Board (CARB) and California Air Pollution Control Officer Association's Risk Management Policy (RMP) Using the Derived Method methodology. The method assumes a 95th percentile breathing rate for children from the last trimester through age 2 and an 80th percentile daily breathing rate for other age groups.

The multi-pathway adjustment factor is used to account for substances that may contribute to risk from exposure pathways other than inhalation, such as ingestion of soil or homegrown vegetables (South Coast Air Quality Management District, 2017). The multi-pathway adjustment factors used in MATES V are shown in Table I-1.

For chronic non-cancer hazard index calculations, the annual average concentrations for each pollutant were multiplied by the molecular weight adjustment factor and multi-pathway adjustment factor, and then divided by the applicable chronic REL to determine a hazard quotient. The hazard quotients are then summed for each target organ for all applicable toxic substances, and the maximum hazard quotient from all the target organ is reported as the hazard index. A hazard index of less than one indicates that the levels of that pollutant (or group of pollutants) are unlikely to cause chronic non-cancer risk health effects for any of the target organs. A hazard index greater than one does not mean that adverse health effects will occur, but rather that the risk of chronic non-cancer health effects increases with increasing levels of the pollutant.

The potential cancer risk for a given substance is expressed as the incremental number of potential cancer cases that could be developed per million people, assuming that the population is exposed to the substance at a constant annual average concentration over a presumed 30-year period. These risks are usually presented in chances per million. For example, if the incremental air toxics cancer risks were estimated to be 100 per million, the probability of an individual developing cancer due to a lifetime exposure would be increased by a hundred in a million above background levels of cancer risk (e.g. based on other factors, such as age, diet, genetics, etc). This would predict an additional 100 cases of cancer in a population of a million people over a 70-year lifetime period.

Table I-1. OEHHA Cancer Potency Factors, Chronic RELs, and Multipathway Adjustment Factors for species analyzed in MATES V.

Species	**CAS/CARB Emittant ID**	**Inhalation Cancer Potency Factor (mg/kg-d)$^{-1}$**	**Multipathway Adjustment Factor for Cancer Risk**	**Chronic Inhalation REL (ug/m^3)**	**Multipathway Adjustment Factor for Chronic Non-Cancer Health Impacts**
Acetaldehyde	75-07-0	0.01		140	
Acrolein	107-02-8			0.35	
Arsenic	7440-38-2	12	9.71	0.015	88.03
Benzene	71-43-2	0.1		3	
Benzo(a)anthracene	56-55-3	0.39	23.12		
Benzo(a)pyrene	50-32-8	3.9	23.12		
Benzo(b)fluoranthene	205-99-2	0.39	23.12		
Benzo(k)fluoranthene	207-08-9	0.39	23.12		
Beryllium	7440-41-7	8.4		0.007	
Bromomethane	74-83-9			5	
1,3 Butadiene	106-99-0	0.6		2	
Cadmium	7440-43-9	15		0.02	1.98
Carbon Tetrachloride	56-23-5	0.15		40	
Chlorine	7782-50-5			0.2	
Chloroform	67-66-3	0.019		300	
Chrysene	218-01-9	0.039	23.12		
Cobalt	7440-48-4	27			
Dibenz(a,h)anthracene	53-70-3	4.1	7.99		
1,2-Dibromoethane	106-93-4	0.25		0.8	
1,4-Dichlorobenzene	106-46-7	0.04		800	
1,2-Dichloroethane	107-06-2	0.072		400	
Diesel Exhaust	9901	1.1		5	

Species	CAS/CARB Emittant ID	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Multipathway Adjustment Factor for Cancer Risk	Chronic Inhalation REL (ug/m^3)	Multipathway Adjustment Factor for Chronic Non-Cancer Health Impacts
Ethyl Benzene	100-41-4	0.0087		2000	
Formaldehyde	50-00-0	0.021		9	
Hexavalent Chromium	18540-29-9	510	1.6	0.2	2.44
Indeno(1,2,3-c,d)pyrene	193-39-5	0.39	23.12		
Lead	7439-92-1	0.042	11.41		
Manganese	7439-96-5			0.09	
Methylene Chloride	75-09-2	0.0035		400	
Methyl tertiary-butyl ether (MTBE)	1634-04-4	0.0018		8000	
Naphthalene	91-20-3	0.12		9	
Nickel	7440-02-0	0.91		0.014	
Perchloroethylene	127-18-4	0.021		35	
Selenium	7782-49-2			20	195.58
Styrene	100-42-5			900	
Toluene	108-88-3			420	
Trichloroethylene	79-01-6	0.007		600	
Vinyl Chloride	75-01-4	0.27			
Xylene (m-, p-)	1330-20-7			700	

Table I-2. Species analyzed in MATES V that do not have OEHHA Risk Assessment Health Values for Cancer Potency or Chronic Non-cancer REL.

Species	**CAS/CARB Emittant ID**
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Acetone	67-64-1
Aluminum	7429-90-5
Ammonium Ion	14798-03-9
Anthracene	120-12-7
Antimony	7440-36-0
Barium	7440-39-3
Benzaldehyde	100-52-7
Benzo(e)pyrene	192-97-2
Benzo(g,h,i)perylene	191-24-2
Calcium	7440-70-2
Cesium	7440-46-2
Chloride	16887-00-6
Chromium	7440-47-3
Copper	7440-50-8
Coronene	191-07-1
Cyclopenta(c,d)pyrene	27208-37-3
1,2-Dichlorobenzene	95-50-1
1,2-Dichloropropane	78-87-5
EC1	
EC2	
EC3	
Elemental Carbon	
Fluoranthene	206-44-0

Species	CAS/CARB Emittant ID
Fluorene	86-73-7
9-Fluorenone	486-25-9
Galactosan	644-76-8
Iron	7439-89-6
Levoglucosan	498-07-7
Magnesium	7439-95-4
Mannosan	14168-65-1
Methyl Ethyl Ketone	78-93-3
Molybdenum	7439-98-7
Nitrate	14797-55-8
OC1	
OC2	
OC3	
OC4	
Organic Carbon	
PM2.5 Mass	88101
Perylene	198-55-0
Phenanthrene	85-01-8
Phosphorus	7723-14-0
Potassium	7440-09-7
Potassium Ion	24203-36-9
Propionaldehyde	123-38-6
Pyrene	129-00-0
Retene	483-65-8
Rubidium	7440-17-7
Samarium	7440-19-9

Species	CAS/CARB Emittant ID
Sodium	7440-23-5
Strontium	7440-24-6
Sulfate	14808-79-8
Sulfur	7704-34-9
Thallium	7440-28-0
Tin	7440-31-5
Titanium	7440-32-6
Total Carbon	
Uranium	7440-61-1
Vanadium	7440-62-2
Yttrium	7440-65-5

References

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