Appendix B
Health Risk Assessment

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Construction Health Risk Assessment

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to	Bill Roth, City of Fremont
from	Stan Armstrong, ESA
subject	Mission Clay Products Soil Remediation Project – Construction Period Health Risk Assessment

Introduction

The Mission Clay Products Soil Remediation Project (proposed project) includes the excavation and relocation of approximately 20,693 cubic yards of contaminated soil from the Mission Clay property at 2225 Old Canyon Road in the City of Fremont to the Newby Island Landfill at 1601 Dixon Landing Road in City of San Jose. The Project will result in approximately 2,760 one-way trips during soil transport and 20 one-ways associated with the transport of other materials over a 60-day period from July 13, 2018 to August 29, 2018.

The purpose of this construction health risk assessment (HRA) is to determine the potential cancer risks and chronic hazards faced by offsite residences and other sensitive receptors[1] that are located in the vicinity of the Project site. This HRA uses the latest significance threshold found in the Bay Area Air Quality Management District (BAAQMD) Air Quality CEQA guidance when evaluating potential cancer risks, particulate matter with an aerodynamic diameter equal to or less than 2.5 microns ($PM_{2.5}$) exhaust concentrations, and chronic hazards. These thresholds are 10 in 1 million for cancer, 0.3 micrograms per cubic meter ($\mu g/m^3$) for $PM_{2.5}$ exhaust concentrations, and the noncancer chronic and acute health hazard index of 1.0 (BAAQMD, 2017).

According to BAAQMD 2017 Air Quality CEQA Guidance, projects that are located beyond 1,000 feet from a sensitive receptor (e.g., residences, hospitals, schools, elderly homes and day-care centers) are not required to evaluate its potential to result in a health risk (BAAQMD, 2017). Since the Project site is located approximately 1,930 feet from the nearest sensitive receptor, any potential health risks associated with use of onsite construction equipment (e.g., backhoe, loaders, etc.) and operation of the site would be screened-out.

Although the Project would not expose nearby sensitive receptors to pollutant emissions that would result in a health risk during onsite construction and operation, there are sensitive receptors within 115 feet from Project-related haul routes between the Project site and the Newby Island Landfill that could be exposed to mobile diesel particulate matter (DPM) concentrations that may result in a potential health risk. Diesel exhaust is a complex

1 The BAAQMD generally defines a sensitive receptor as a facility or land use that houses or attracts members of the population who are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Examples of sensitive receptors include residences, schools, and hospitals.

mixture of pollutants, including more than 40 cancer-causing substances in addition to very small carbon particles, or "soot" coated with numerous organic compounds. In 1998, California identified DPM as a toxic air contaminant (TAC) based on its potential to cause cancer (CARB, 1998). Other agencies, such as the National Toxicology Program, the U.S. Environmental Protection Agency, and the National Institute of Occupational Safety and Health, concluded that exposure to diesel exhaust likely causes cancer (CARB, 2016). The most recent assessment (2012) came from the World Health Organization's International Agency for Research on Cancer (IARC). IARC's extensive literature review led to the conclusion that diesel engine exhaust is "carcinogenic to humans," thereby substantiating and further strengthening California's earlier TAC determination (CARB, 2016).

In March 2015, the Office of Environmental Health Hazard Assessment (OEHHA) adopted a revised guidance manual for use in the Air Toxics Hot Spots Program or for the permitting of existing, new, or modified stationary sources, the *Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments*. Unlike previous iterations of this manual, the revised manual provides considerations for short-term temporary exposure for durations as short as two months, such as during construction activities, while noting that there is "considerable uncertainty in trying to evaluate the cancer risk from projects that will only last a small fraction of a lifetime." The revised OEHHA's guidance also considers more conservative assumptions and updated scientific research. Health risk impacts calculated in accordance with the OEHHA's revised manual are approximately two to ten times higher than those calculated in accordance with the previous methodology.

A screening-level HRA was conducted to estimate the potential health risk impacts associated with the Project-related haul truck route. The methodology used to evaluate the potential health risks from on-road heavy truck haul trips is summarized below, along with the results of the HRA. Due to the short-term nature of haul truck activities, the screening-level approach is appropriate to estimate the worst-case health risks associated with Project construction.

Methods

The methods and assumptions used in this HRA are consistent with the guidance recommended by OEHHA's *Air Toxic Hot Spots Program Risk Assessment Guidelines* (OEHHA, 2015). This HRA also follows the approach recommended by the Bay Area Air Quality Management District (BAAQMD) *Recommended Methods for Screening and Modeling Local Risks and Hazards* (BAQMD, 2012) and the BAAQMD's *Air Toxics NSR Program Health Risk Assessment Guidelines* (BAQMD, 2016). The HRA also uses technical information from California Air Pollution Control Officer's Association (CAPCOA), the California Air Resources Board (CARB), and the U.S. Environmental Protection Agency (USEPA). The OEHHA methodology used in this assessment uses a dose-response assessment to characterize risk from cancer due to inhaled TACs. Refer to Attachment A for the calculation and modeling files used in the screening HRA.

Based on the OEHHA guidance, the evaluation of potential health risks uses the following standard four-step risk assessment process:

1. hazard identification;
2. exposure assessment;
3. dose-response assessment; and

4. risk characterization.

Each step is described in detail below.

Hazard Identification

The hazard identification process is undertaken to determine what TACs would potentially be present in the assessment area, and if present, identifies what the pollutants of concern are along with their potential adverse health effects. In this HRA, the primary hazard is DPM emissions from operation of on-road haul trucks. DPM from off-road construction equipment was not considered, since the off-road construction emissions would occur outside of the BAAQMD screening distance of 1,000 feet from the nearest sensitive receptor.

DPM historically has been used as a surrogate measure of exposure for whole diesel exhaust emissions. Diesel exhaust is a complex mixture of thousands of gases and fine particles (commonly known as soot). Diesel exhaust particles and gases are suspended in the air due to thermal buoyancy and the small size of the particles. The composition of diesel exhaust varies depending on engine type, operating conditions, fuel composition, lubricating oil, and presence of an emission control system. One of the main characteristics of diesel exhaust is the release of particles at a relative rate approximately 20 times greater than from gasoline exhaust, on an equivalent fuel basis. Diesel particulates are mainly aggregates of spherical carbon particles coated with inorganic and organic substances. The inorganic fraction primarily consists of small carbon (elemental carbon) particles ranging from 0.01 to 0.08 micron in diameter. The organic fraction consists of soluble organic compounds (CARB, 1998).

Exposure Assessment

The degree of the residences exposure to DPM emissions from Project on-road construction haul trips was evaluated under the exposure assessment portion of the HRA. This assessment involves the quantification of DPM emissions and dispersion modeling. The amount of DPM and entrained fugitive dust emissions generated by construction activities was determined using particulate matter with an aerodynamic diameter equal to or less than 10 microns (PM_{10}) from diesel exhaust as a surrogate. OEHHA guidance indicates that the cancer potency factor to be used to evaluate cancer risks were developed based on whole (gas and particulate matter) diesel exhaust, and that the surrogate for whole diesel exhaust is DPM, with PM_{10} serving as the basis for the potential risk calculations (OEHHA, 2003). In addition to evaluating the effects of TAC concentrations and associated cancer risk, this screening HRA also evaluates non-cancer chronic risk. This is consistent with BAAQMD’s CEQA Guidelines (BAAQMD, 2017).

The greatest potential for TAC emissions would be related to DPM emissions associated with off-road heavy equipment operations during demolition, grading and excavation, and construction activities. The potential exposure through other pathways (e.g., ingestion) requires substance and site-specific data, and the specific parameters for DPM are not known for these pathways (CARB, 1998). OEHHA developed necessary data to evaluate carcinogenicity of DPM through the inhalation pathway only. Once determined, the dose is multiplied by the compound-specific inhalation cancer potency factor to derive the cancer risk estimate. The dose takes into account the concentration at a sensitive receptor. The cancer potency factor is compound-specific.

Emissions Inventory

Emissions analyzed in the HRA were based on the air quality emissions estimates for the Project prepared for the Initial Study (IS). The on-road construction emissions were estimated using the California Emissions Estimator Model (CalEEMod) (version 2016.3.2). The air quality analysis prepared for the IS estimated heavy truck emissions using emission factors obtained from CARB's 2017 EMission FACtors model (EMFAC2017) for the year 2018. Total DPM and $PM_{2.5}$ emissions for all years of construction for each component and site are presented in **Table 1, Total Construction DPM and $PM_{2.5}$ Emissions along Haul Route**.

TABLE 1
TOTAL ANNUAL DPM AND $PM_{2.5}$ EMISSIONS FROM HAUL TRUCKS

Source	Total Annual Emissions (pounds)	
	DPM	$PM_{2.5}$ (exhaust)
Construction		
On-road truck travel [a]	66.3	63.4

NOTES:
a The roadway segment modeled in AERSCREEN (see Table 5) was represented only by the anticipated traveled road length that would directly impact nearby receptors, which is 200 meters (0.124 miles) in length. Thus, total estimated emissions from haul trucks were multiplied by scaling factors to determine emissions associated with trucks operating near the proposed project site. This scaling is necessary to estimate the actual on-road emissions to which nearby sensitive receptors would be exposed. The scaling factor = 0.12 miles ÷ 35 miles = 0.004.

Emission calculations are provided in Attachment A.

ABBREVIATIONS:
DPM = diesel particulate matter
$PM_{2.5}$ =particulate matter less than or equal to 2.5 microns in diameter

Emission Rates

Haul truck DPM and $PM_{2.5}$ (exhaust) concentrations were modeled using AERSCREEN (see section below) using a unitized emission rate of 1 gram/second (g/s). The modeled concentration at each receptor ([μ/m^3]/[g/s]) represents a "dispersion factor," which was then multiplied by the actual emission rate to determine actual concentrations, and the final result was superimposed. This approach is called the "Summation Concept," where the concentration and deposition fluxes at each receptor are the linear addition of the resulting values from a particular source.

Actual emission rates from Project-related on-road haul trucks were based on 111,800 annual miles. A total emission rate in terms of grams per second was calculated for each emission source to multiply with the AERSCREEN dispersion factors to estimate actual concentrations for each source. The emission rates would vary day to day, with some days having no emissions. Since material would be haul from the Project site for a duration of 77 calendar days, the model assumed a constant emission rate for 0.21 years, and is based on the total duration of construction activities, 24 hours per day, and 3,600 seconds per hour, consistent with AERSCREEN dispersion parameters.

Dispersion Modeling

Dispersion modeling predicts the air pollutant concentrations due to emissions from a source at defined receptor point locations. Dispersion modeling was performed using the USEPA approved AERSCREEN model. The model estimates "worst-case" 1-hour concentrations for a single source. AERSCREEN is based on the American Meteorological Society/USEPA regulatory air dispersion model (AERMOD version 9.3.0). AERSCREEN is intended to produce concentration estimates that are equal to or greater than the estimates produced by AERMOD with a fully developed set of meteorological and terrain data, but the degree of conservatism will vary depending on the application. The AERSCREEN model requires numerous inputs, such as general meteorological data, source parameters, topographical data, and receptor characteristics. Where project-specific information is not available, ESA used default parameter sets that are designed to produce conservative (i.e., overestimates of) air concentrations (USEPA 2016a, 2016b). **Table 2**, **Overall AERSCREEN Modeling Parameters**, summarizes the overall modeling parameters used in AERSCREEN. For values not listed, defaults were used. Refer to Attachment A for the AERSCREEN modeling outputs used in the screening HRA.

TABLE 2
OVERALL AERSCREEN MODELING PARAMETERS

Pathway	Description	Parameter
Control	Rural/Urban	Urban
	Urban Population	234,962 [a]
	Model Version	AERSCREEN v 16216
Receptor	Receptor Height	1.5 m [b]
Meteorology	Minimum ambient temperature	42° F [c]
	Maximum ambient temperature	77° F [c]
	Dominant surface profile	7 (Urban)
	Dominant climate profile	1 (Average Moisture)

NOTES:
a For July 1, 2017, Fremont City, California (US Census Bureau, 2018).
b From BAAQMD (2012).
c From Intellicast (2018).

ABBREVIATIONS: m = meters; F = Fahrenheit

SOURCES:
1. United States Census Bureau. 2018. QuickFacts: Fremont City, California. Available: https://www.census.gov/quickfacts/fact/table/fremontcitycalifornia,US/PST045217. Accessed June 1, 2018.
2. Bay Area Air Quality Management District. 2012. *Recommended Methods for Screening and Modeling Local Risks and Hazards*. Available: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf. Accessed January 2018.
3. Intellicast. 2018. *Historic Average: Fremont, CA*. Available: http://www.intellicast.com/Local/History.aspx?location=USCA0403. Accessed June 1, 2018.

Source Parameters

Source parameters are required to model the dispersion of emissions. Parameters for on-road truck trips were modeled as single area source with a release height of 2.55 meters. **Table 3**, **Source Modeling Parameters**, summarizes the source modeling parameters used in AERSCREEN for source type. For values not listed, AERSCREEN defaults were used.

TABLE 3
SOURCE MODELING PARAMETERS

Source Type	Source Type	Source Dimension [m] [a]	Release Height [m] [b]	Initial Vertical Dimension [m] [c]	Stack Diameter [m]	Stack Temperature [K]	Exit Velocity (m/s)
On-Road Construction Trucks	Area	200 x 8	2.55	2.37	n/a	n/a	n/a

NOTES:
a Based on information from the project sponsor and Google Earth
b For on-road construction trucks, the release height is equal to 0.5 * top of plume height, which is equal to 1.7 * the vehicle height, which is equal to 3 meters; equation = 0.5 * 1.7 * 3 = 2.55 (USEPA 2012).
c Initial vertical dimension for on-road trucks from the CRRP-HRA (BAAQMD, SF DPH & SF Planning, 2012). Initial vertical dimension for on-road construction trucks and operational loading truck idling is equal to the top of the plume height ÷ 2.15 = 1.7 * 3 / 2.15 = 2.37 (USEPA 2012).

ABBREVIATIONS:
m = meters
K = Kelvin
m/s = meters per second

SOURCES:
1. United States Environmental Protection Agency. 2012. *Haul Road Workgroup Final Report Submission to EPA-OAQPS*. March. Available: https://www3.epa.gov/scram001/reports/Haul_Road_Workgroup-Final_Report_Package-20120302.pdf. Accessed June, 1 2018.
2. Bay Area Air Quality Management District, San Francisco Department of Public Health, and San Francisco Planning Department. 2012. *The San Francisco Community Risk Reduction Plan: Technical Support Documentation*. December. Available: http://www.gsweventcenter.com/Appeal_Response_References/2012_1201_BAAQMD.pdf. Accessed June 2018.

Sensitive Receptors

Table 4, Sensitive Receptor Locations, presents the sensitive receptors within 1,000 feet of the haul truck route considered in this HRA. Receptor heights were set at 1.5 meters to represent flagpole receptor concentrations, consistent with BAAQMD modeling guidance (BAAQMD, 2012). The Project does not include any residential uses and will not include any sensitive receptors on site. Consequently, no onsite receptors were modeled.

TABLE 4
SENSITIVE RECEPTOR LOCATIONS

Haul Route Segment	Residential Receptors	Daycare Receptors	School Receptors
Canyon Heights Drive, from Pickering Avenue to Orangewood Drive	40 ft. west and east (single-family homes)	100 ft. west (Adventure Time Vallejo Mill Day Care Center)	115 ft. west (Vallejo Mill Elementary School)

ABBREVIATIONS:
ft. = feet

Dose-Response Assessment

The dose-response assessment is the process of characterizing the relationship between exposure to diesel exhaust and the incidence of an adverse health effect in exposed populations.

The estimation of potential inhalation cancer risk posed by exposure to DPM requires a cancer potency factor. Cancer potency factors are expressed as the upper bound probability of developing cancer assuming continuous lifetime exposure to diesel exhaust at a dose of one milligram per kilogram of body weight, and are expressed in units of inverse dose as a potency slope (i.e., $[mg/kg/day]^{-1}$). A cancer potency factor when multiplied by the dose of a carcinogen gives the associated lifetime cancer risk. OEHHA's recommended cancer potency factor for DPM is 1.1 $(mg/kg/day)^{-1}$. The estimation of potential inhalation chronic non-cancer effects posed by exposure to DPM requires a chronic reference exposure level (REL). A chronic REL is a concentration level (that is expressed in units of $\mu g/m^3$ for inhalation exposures), at or below which no adverse health effects are anticipated following long-term exposure. OEEHA's recommended chronic REL for DPM is 5 $\mu g/m^3$ (CARB & OEHHA, 2017). The chronic hazard index target organ for DPM is the respiratory system.

Risk Characterization

Risk characterization combines the maximum annual average ground-level DPM concentration from the exposure assessment and the cancer potency factor and chronic REL from the dose-response analysis to estimate the potential inhalation cancer risk from exposure to DPM emissions.

In performing health risk calculations, carcinogenic compounds are not considered to have threshold levels (i.e., dose levels below which there are no risks). Any exposure, therefore, will have some associated risk. Incremental health risks associated with exposure to carcinogenic compounds is defined in terms of the probability of developing cancer as a result of exposure to a chemical at a given concentration. Under a deterministic approach (i.e., point estimate methodology), the cancer risk probability is determined by multiplying the chemical's annual concentration by its unit risk factor (URF). The URF for DPM recommended by the Scientific Review Panel[2] is 3.0×10^{-4} $\mu g/m^3$ (CARB, 1998). This value corresponds to a Cancer Potency Factor (CPF) of 1.1 per milligram/ kilogram (body weight) per day (mg/kg(bw)-day) (CARB & OEHHA, 2017). The URF for DPM means that for receptors with an annual average concentration of 1 $\mu g/m^3$ in the ambient air, the probability of contracting cancer over a 70-year lifetime of exposure is 300 in 1 million. The URF also assumes that a person is exposed continuously for a 70-year lifetime. This approach for calculating cancer risk is intended to result in conservative (i.e., health protective) estimates of health impacts and is used for assessing risks to sensitive receptors. The estimation of cancer risk generally uses the following algorithms (OEHHA, 2015):

$$\textbf{Cancer Risk} = \textbf{Dose inhalation} \times \textbf{Inhalation CPF} \times \textbf{ASF} \times \textbf{ED/AT} \times \textbf{FAH} \qquad \textbf{(Equation 1)}$$

Where:

Cancer Risk = residential inhalation cancer risk

$$\textbf{Dose inhalation (mg/kg-day)} = \mathbf{C_{AIR}} \times \textbf{DBR} \times \textbf{A} \times \textbf{EF} \times \mathbf{10^{-6}} \qquad \textbf{(Equation 2)}$$

Inhalation CPF = inhalation cancer potency factor ($[mg/kg/day]^{-1}$)

ASF = age sensitivity factor for a specified age group (unitless)

ED = exposure duration for a specified age group (years)

AT = averaging time period over which exposure is averaged in days (years)

FAH = fraction of time at home (unitless)

2 The Scientific Review Panel is charged with evaluating the risk assessments of substances proposed for identification as toxic air contaminants by CARB, OEHHA, and the Department of Pesticide Regulation (DPR), and the review of guidelines prepared by OEHHA.

Where:

C_{AIR} = concentration of compound in air in micrograms per cubic meter (μg/m^3)

DBR = daily breathing rate in liter per kilogram of body weight per day (L/kg-body weight/day)

A = inhalation absorption factor (1 for DPM, unitless)

EF = exposure frequency in days per year (unitless, days/365 days)

10^{-6} = micrograms to milligrams conversion, liters to cubic meters conversion

The OEHHA-recommended values for the parameters listed above were used in the HRA analysis. The daily breathing rate (DBR) used in the analysis was based on OEHHA recommendations, which vary depending on age, as shown in **Table 5, Daily Breathing Rates, Fraction of Time at Home, and Age Sensitivity Factors**. The recommended residential exposure frequency (EF) is 350 days per year, which is equivalent to 0.96 (350 days/365 days a year). The recommended daycare exposure frequency (EF) is 250 days per year, which is equivalent to 0.68 (250 days/365 days a year). The recommended school exposure frequency (EF) is 180 days per year, which is equivalent to 0.49 (180 days/365 days a year). The inhalation absorption factor (A) is assumed to be 1 for inhalation based risk assessment. As indicated in Equation 1 above, each age group has different exposure parameters that require cancer risk to be calculated separately for each age group. Values for fraction of time at home (FAH) also vary depending on age, as shown in Table 5. Once dose is calculated, cancer risk is calculated by accounting for cancer potency of the specific pollutant, and the age sensitivity factor (ASF), which also varies by age as shown in Table 5.

TABLE 5
DAILY BREATHING RATES, FRACTION OF TIME AT HOME, AND AGE SENSITIVITY FACTORS

Parameter	Age Group		
	3rd Trimester	Age 0 to < 2	Age 2 to < 9
Daily Breathing Rate (DBR) (L/kg-body weight/day)			
Residential Child Receptor [a]	361	1,090	631
Day Care Center Child Receptor [b]	n/a	1,200	640
School Receptor [b]	n/a	n/a	640
Exposure Frequency (EF)			
Residential Child Receptor [c]	0.96	0.96	0.96
Day Care Center Child Receptor [d]	n/a	0.68	0.68
School Receptor [e]	n/a	n/a	0.49
Exposure Duration (ED) (years)			
Residential Child Receptor [f]	0	0.21	0
Day Care Center Child Receptor	n/a	0.21	n/a
School Receptor	n/a	n/a	0.21
Fraction of Time at Home (FAH) for residential receptors [g]	1	1	1
Age Sensitivity Factor (ASF) [h]	10	10	3

TABLE 5
DAILY BREATHING RATES, FRACTION OF TIME AT HOME, AND AGE SENSITIVITY FACTORS

NOTES:
[a] Daily breathing rate for residential receptors are based on the OEHHA 95th percentile values (Table 5.6).
[b] Daily breathing rate for school and daycare receptor is based on the OEHHA 95th percentile 8-hour moderate intensity breathing rates (Table 5.8). School receptor assumed to start exposure as early as age 5 (e.g. Kindergarten) and day care center is assumed to start exposure as early as 4 months.
[c] The recommended residential exposure frequency (EF) is 350 days per year, which is equivalent to 0.96 (350 days / 365 days a year).
[d] The recommended day care EF is 250 days per year, which is equivalent to 0.68 (250 days / 365 days a year).
[e] The recommended school EF is 180 days per year, which is equivalent to 0.49 (180 days / 365 days a year).
[f] Assumed all of the residential exposure would occur in the 0-2 age group, which would result in higher heath risks.
[g] Fraction of time at home is set to 1.0 for residential since the nearest school has a cancer risk of greater than one million (see Table 9 below), per OEHHA Table 5.8. FAH is not applicable to other receptors.
[h] ASF is the same for all receptors.

ABBREVIATIONS:
DBR = daily breathing rate
EF = exposure frequency
ED = exposure duration
FAH = fraction of time at home
ASF = age sensitivity factor
n/a = not applicable

SOURCE: Office of Environmental Health Hazard Assessment, 2015. *Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments*. February. Available at http://oehha.ca.gov/air/hot_spots/hotspots2015.html. Accessed June 1, 2018.

The estimation of non-cancer inhalation chronic risk uses the following algorithm (OEHHA, 2015):

$$\textbf{Hazard Quotient} = C_{air} / \textbf{REL} \qquad \textbf{(Equation 3)}$$

Where:

Hazard Quotient = chronic non-cancer hazard

C_{AIR} = concentration of compound in air in micrograms per cubic meter (μg/m^3)

REL = Chronic non-cancer Reference Exposure Level for substance (μg/m^3)

As noted above, the REL for DPM is 5 μg/m^3 (CARB & OEHHA, 2017). The chronic hazard index target organ for DPM is the respiratory system.

Health Risk Calculations

The resulting health risk calculations were performed using a spreadsheet tool consistent with the OEHHA guidance. The spreadsheet tool incorporates the algorithms, equations, and the variables described above as well as in the OEHHA guidance, and incorporates the results of the AERSCREEN dispersion model.

Table 6, Maximum Increase in Health Risk from Construction Emissions for Off-Site Sensitive Receptors - Unmitigated summarizes the Maximum Annual Average $PM_{2.5}$ Concentration (μg/m3), carcinogenic and non-cancer chronic risk for the maximum impacted sensitive receptors for the unmitigated scenario.

TABLE 6
MAXIMUM INCREASE IN HEALTH RISK FROM CONSTRUCTION EMISSIONS FOR OFF-SITE SENSITIVE RECEPTORS

Receptor Type / Threshold	Lifetime Excess Cancer Risk	Maximum Annual Average $PM_{2.5}$ Concentration ($\mu g/m^3$)	Maximum Non-Cancer Risk (Chronic Hazard Index)
Maximum Cancer Risk(# in one million)			
Residential Receptor	0.27	0.0075	0.0016
Daycare Receptor	0.22	0.0077	0.0016
Elementary School Receptor	0.03	0.0077	0.0016
Maximum	0.27	0.0077	0.0016
BAAQMD Threshold	10	0.3	1
Exceeds Threshold?	No	No	No

ABBREVIATIONS:
$\mu g/m^3$ = microgram per cubic meter
$PM_{2.5}$ =particulate matter less than or equal to 2.5 microns in diameter
BAAQMD = Bay Area Air Quality Management District

SOURCES: CalEEMod modeling, EMFAC2017 modeling, AERSCREEN modeling, and other off-model calculations discussed in the memo and presented in Attachment A.

For carcinogenic exposures, the cancer risk from DPM emissions for the unmitigated construction scenario is estimated to result in a maximum carcinogenic risk of approximately 0.27 per one million. The non-cancer chronic risk from DPM emissions for the unmitigated construction scenario is estimated to be a maximum hazard index of approximately 0.0016. The highest maximum annual average $PM_{2.5}$ concentration is estimated to be 0.0077 $\mu g/m^3$.

As discussed previously, the lifetime exposure under OEHHA guidelines takes into account early life (infant and children) exposure. It should be noted that the calculated cancer risk assumes sensitive receptors (residential uses) would not have any emission controls such as mechanical filtration and exposure would occur with windows open. This HRA focuses specifically on residential, daycare, and school sensitive receptors located along the Project haul route and does not include impacts for on-site workers. On-site workers would be exposed to DPM from off-road construction equipment exhaust during the onsite construction activities, which are not evaluated in this HRA because workers are not considered sensitive receptors by the BAAQMD (BAAQMD, 2017). In addition, on-site workers' intermittent exposure duration would be less than that of a residence (8 hours compared to 24 hours) and adult breathing rates compared to children are also lower (e.g. 261 for age 16<30 versus 1,090 for age 0<2 years). Due to the limited construction period of three months and the limited time construction workers would be exposed to onsite DPM and $PM_{2.5}$ emissions, it is unlikely that the maximum increase in health risk from construction emissions to on-site workers would exceed the BAAQMD thresholds.

The process of assessing health risks and impacts includes a degree of uncertainty. The level of uncertainty is dependent on the availability of data and the extent to which assumptions are relied upon in cases where the data are incomplete or unknown. All HRAs rely upon scientific studies in order to reduce the level of uncertainty; however, it is not possible to completely eliminate uncertainty from the analysis. Where assumptions are used to substitute for incomplete or unknown data, it is standard practice in performing HRAs to error on the side of health protection in order to avoid underestimating or underreporting the risk to the public by assessing risk on the most sensitive populations, such as children and the elderly.

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Attachment A: Modeling Outputs and Emission Calculations

Tables for Tech Memo

Updated: 6/4/2018

Source	SCALED Total Annual Emissions (grams per second)	
	DPM	$PM_{2.5}$
Construction		
On-road truck travel	0.0000161	0.0000154

Receptor Type	SCALED Concentration (µg/m^3)	
	DPM	$PM_{2.5}$
Residents	0.008	0.008
Daycare	0.008	0.008
Elementary School	0.008	0.008

Receptor Type	Cancer Risk (DPM)	Chronic Hazard Index (DPM)	Maximum Annual PM2.5 Concentration
Residents	0.27	0.00157	0.0075
Daycares	0.22	0.00161	0.0077
Schools	0.03	0.00161	0.0077
Maximum	0.27	0.00161	0.0077
BAAQMD Threshold	10	1	0.3
Exceed Threshold (yes or no)?	No	No	No

On-Road Haul Emissions

Updated	6/6/2018	
Offsite Truck Travel - hauling		
Start Date	6/13/2018	
End Date	8/29/2018	
Total Number of Work Days	56	days
Total Calendar Days	77	days
Total Years	0.21	years
Average One-Way Trips length Soil	20	miles
Average One-Way Trips Length Othe	35	miles
Total One-Way Trips Soil	2760	trips
Total One-Way Trips Other	20	trips
Annual Miles	111,800	miles

EMFAC2017 Emission Factors for year 2018 (g/mi)

	DPM	PM2.5 Exhaust
HHDT	0.2691	0.2574

Emissions

Emissions (tons/year)	DPM	PM2.5 Exhaust
Onsite Travel	0.033	0.032

HRA - Screening

Updated: 6/4/2018

Emission Rates / Scaling Factors

	Construction On-Road Trucks	NOTES
DPM g/s		
Unmitigated	1.61E-05	
Mitigated	0.00E+00	
PM2.5 g/s		
Unmitigated	1.54E-05	
Mitigated	0.00E+00	

Cancer Risk Calculations

	Construction On-Road Trucks	NOTES
Average Annual Scaler Concentrations (ug/m3)		
Residents:	489.35	
Daycares:	501.22	
Schools	501.22	
Average Annual SCALED Concentrations (ug/m3)		
Unmitigated		
Residents:	0.00786	
Daycares:	0.00805	
Schools	0.00805	
Mitigated		
Residents:	0.00E+00	
Daycares:	0	
Schools	0	
Risk Factors		
Residents:	34.65	
Daycares:	27.25	
Schools	3.14	

	Construction On-Road Trucks
Cancer Risk - Unmitigated	
Residents:	0.27
Daycares:	0.22
Schools	0.03
Cancer Risk - Mitigated	
Residents:	0.00
Daycares:	
Schools	

ESTIMATED PM2.5 Concentrations - Average Annual (ug/m3)

	Construction On-Road Trucks	NOTES
Average Annual Scaler Concentration (ug/m3)		
Residents:	489.35	
Daycares:	501.22	
Schools	501.22	
Average Annual SCALED Concentrations (ug/m3)		
Unmitigated		
Residents:	0.0075	
Daycares:	0.0077	
Schools	0.0077	
Mitigated		
Residents:	0.0000	
Daycares:	0.0000	
Schools	0.0000	

Chronic Hazard Index DPM

Chronic REL (µg/m3) 5.0

California Air Resources Board, "Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values" and "OEHHA/ARB Approved Chronic Reference Exposure Levels and Target Organs," http://www.arb.ca.gov/toxics/healthval/healthval.htm.

Table last updated: February 23, 2017. Downloaded 10/9/17

Chronic Hazard Index	Construction On-Road Trucks	NOTES
Unmitigated		
Residents:	0.00157	
Daycares:	0.00161	
Schools	0.00161	

4.12.2.1 Non-Continuous Sources

When modeling a non-continuously emitting source (e.g., operating for eight hours per day and five days per week), the modeled long-term average concentrations are based on 24 hours a day and seven days per week for the period of the meteorological data set. Even though the emitting source is modeled using a non-continuous emissions schedule, the long-term concentration is still based on 24 hours a day and seven days per week. Thus, this concentration includes the zero hours when the source was not operating. For the offsite worker inhalation risk, we want to determine the long-term concentration the worker is breathing during their work shift. Therefore, the long-term concentration needs to be adjusted so it is based only on the hours when the worker is present. For example, assuming the emitting source and worker's schedules are the same, the adjustment factor is 4.2 = (24 hours per day/8 hours per shift)x(7 days in a week/5 days in a work week). In this example, the long term residential exposure is adjusted upward to represent the exposure to a worker. Additional concentration adjustments may be appropriate depending on the work shift overlap. These adjustments are discussed below.

4.12.2.2 Continuous Sources

If the source is continuously emitting, then the worker is assumed to breathe the long-term annual average concentration during their work shift. Equation 4.1 becomes one and no concentration adjustments are necessary in this situation when estimating the inhalation cancer risk. Note however, if an assessor does not wish to apply the assumption the worker breathes the long-term annual average concentration during the work shift, then a refined concentration can be post-processed as described in Appendix M. All alternative assumptions should be approved by the reviewing authority and supported in the presentation of results.

2.1.3.2 Short Term Projects

In the 2015 HRA Guidelines, OEHHA recommends using actual project duration for short term projects, but cautions that the risk manager should consider a lower cancer risk threshold for very short term projects, because a higher exposure over a short period of time may pose a greater risk than the same total exposure spread over a much longer period of time. To ensure that short-term projects do not result in unanticipated higher cancer impacts due to short-duration high-exposure rates, the Air District recommends that the cancer risk be evaluated assuming that the average daily dose for short-term exposure lasts a minimum of three years for projects lasting three years or less. For residential exposures, the cancer risk calculations should include the most sensitive age groups (beginning with the third trimester of pregnancy) and should use the 95th percentile breathing rates. The Air District recommends following OEHHA guidelines for other aspects of short term projects. In summary, the Air District recommends:

- use of actual emission rates over a minimum 3-year duration for cancer risk assessments involving projects lasting 3 years or less, and
- use of actual project duration for cancer risk assessments on projects lasting longer than 3 years.

8.3.1 *Calculation of Noncancer Inhalation Hazard Quotient and Hazard Index*

To calculate the acute HQ, the maximum 1-hour ground level concentration (in $\mu g/m^3$) of a substance at a receptor is divided by the acute 1-hour REL (in $\mu g/m^3$) for the substance:

$$\text{Acute Hazard Quotient} = \frac{\text{1-Hour Max Concentration } (\mu g/m^3)}{\text{Acute REL } (\mu g/m^3)}$$

To calculate the chronic HQ, the annual average ground level concentration of a substance is divided by the chronic REL for the substance:

$$\text{Chronic Hazard Quotient} = \frac{\text{Annual Average Concentration } (\mu g/m^3)}{\text{Chronic REL } (\mu g/m^3)}$$

To calculate the 8-hour HQ, the adjusted annual average ground level concentration of a substance (represented as "Adjusted C_{air}" in EQ 5.4.1.4 A) is divided by the 8-hour REL for the substance:

Risk Factors

Updated: 6/4/2018

Notes

Normally, we use a worker adjustment factor to estimate risk for school and daycare receptors, but this is used if AERMOD models sources using a non-continuous emissions schedule (e.g. work hours). However, because we use AERSCREEN, which assumes rate based on the actual construction schedule of 5 days per week and 8 hrs/day (and estimates maximum 1-hr concentrations), concentrations are based on continuous emissions, and we don't need the adjustment factor.

Dose Calculation

NOT USED = grey

Dose Factors	3rd Trimester	Age 0<2 Years	Age 2<9 Years	Notes / Source
Daily Breathing Rate (DBR) [L/kg-day or L/kg-8hrs]				
Residential	361	1090	631	95th percentile 24-hour breathing rates (OEHHA Table 5.6) for 3rd trimester and age 0<2 years and 80th percentile 24-hou
Hospital	361	1090	631	Same as residential
Daycare		1200	640	95th percentile 8-hour moderate intensity breathing rates (OEHHA Table 5.8) for 3rd trimester, age 0<2 years, and age 2<9
School		1200	640	95th percentile 8-hour moderate intensity breathing rates (OEHHA Table 5.8) for age 2<16 years.
Inhalation Absorption Factor (A)	1	1	1	Recommended Factor
Exposure Frequency (EF) [days/365 days]				
Residential	0.96	0.96	0.96	
Hospital	1.00	1.00	1.00	assume 100% in hospital
Daycare		0.68	0.68	250 days/yr
School		0.49	0.49	180 days/yr
Conversion	0.000001	0.000001	0.000001	

Dose Factor (no concentration)	3rd Trimester	Age 0<2 Years	Age 2<9 Years
Residential	0.000346164	0.001045205	0.000605068
Hospital	0.000361	0.00109	0.000631
Daycare	0	0.000821918	0.000438356
School	0	0.000591781	0.000315616

Risk Calculation

Risk Factors	3rd Trimester	Age 0<2 Years	Age 2<9 Years	
Inhalation Cancer Potency Factor (CPF)	1.1	1.1	1.1	
Age Sensitivity Factor (ASF) [unitless]	10	10	3	
Exposure Duration (ED) [years]				
Construction				
Residential	0.00	0.21	0.00	
Daycare		0.21		
School			0.21	
Operation				
Residential	0.25	2		
Hospital	0.25	2		
Daycare		2	7	Only assume 9 years of exposure (probably actually less b/c only goes to kindergarden prep)
School				
Averaging Time (AT) [years]	70	70	70	
Fraction of Time at Home (FAH) [unitless]	1	1	1	Fraction of time at home are set to 1.0 for all age groups less than 16 years, since there are potentially schools within cancer risk isopleths of one in a million or greater, per BAAQMD guidance (2016). For age groups greater than 16 years, values from OEHHA (2015) Table 8.4 were used
Chances per Million	1,000,000	1,000,000	1,000,000	

Risk Factor (no concentration)	3rd Trimester	Age 0<2 Years	Age 2<9 Years
Construction			
Residential	0.00	34.65	0.00
Hospital	0.00	0.00	0.00
Daycare	0.00	27.25	0.00
School	0.00	0.00	3.14
Operation			
Residential	13.60	328.49	0.00
Hospital	14.18	342.57	0.00
Daycare	0.00	258.32	144.66
School	0.00	0.00	0.00

Multiply risk factors by concentration to determine risk

Table 8.3 Age Sensitivity Factors by Age Group for Cancer Risk Assessment

Age Group	Age Sensitivity Factor (unitless)
3rd Trimester	10
0<2 years	10
2<9 years	3
2<16 years	3
16<30 years	1
16-70 years	1

8.2.4 *Calculating Residential and Offsite Worker Inhalation Cancer Risk*

Residential Receptors

For residential inhalation exposure, cancer risk must be separately calculated for specified age groups (Eq. 8.2.4A, see Section 8.2.1), because of age differences in sensitivity to carcinogens and age differences in intake rates (per kg body weight). Separate risk estimates for these age groups provide a health-protective estimate of cancer risk by accounting for greater susceptibility in early life, including both age-related sensitivity and amount of exposure. The following equation illustrates the formula for calculating residential inhalation cancer risk. See Appendix I for a detailed example calculation.

A. Equation 8.2.4 A: $RISK_{inh\text{-}res} = DOSE_{air} \times CPF \times ASF \times ED/AT \times FAH$

7. $RISK_{inh\text{-}res}$ = Residential inhalation cancer risk
8. $DOSE_{air}$ = Daily inhalation dose (mg/kg-day)
9. CPF = Inhalation cancer potency factor (mg/kg-day^{-1})
10. ASF = Age sensitivity factor for a specified age group (unitless)
11. ED = Exposure duration (in years) for a specified age group
12. AT = Averaging time for lifetime cancer risk (years)
13. FAH = Fraction of time spent at home (unitless)

a: Recommended default values for EQ 8.2.4 A:

5. $DOSE_{air}$ = Calculated for each age group from Eq. 5.4.1
6. CPF = Substance-specific (see Table 7.1)
7. ASF = See Section 8.2.1
8. ED = 0.25 years for 3rd trimester, 2 years for 0<2, 7 years for 2<9, 14 years for 2<16, 14 years for 16<30, 54 years for 16-70
9. AT = 70 years*
10. FAH = See Table 8.4

ough AT actually sums to 70.25 years when the 3rd trimester (0.25 years) is ded, OEHHA recommends rounding AT = 70 years (and rounding residential sure durations at 9- and 30-years rather than 9.25- and 30.25-years) to simplify the calculation without causing a significant adjustment. Note that the dose for the 3rd trimester is based on the breathing rate of pregnant women using the assumption that the dose to the fetus during the 3rd trimester is the same as that to the mother.

Table 5.6 Point Estimates of Residential Daily Breathing Rates for 3rd trimester, 0<2, 2<9, 2<16, 16<30 and 16-70 years (L/kg BW-day)

	3rd Trimester[a]	0<2 years	2<9 years	2<16 years	16<30 years	16<70 years
	L/kg-day					
Mean	225	658	535	452	210	185
95th Percentile	361	1090	861	745	335	290

[a] 3rd trimester **breathing rates** based on breathing rates of pregnant women using the assumption that the dose to the fetus during the 3rd trimester is the same as that to the mother.

Table 5.7 Daily Breathing Rate Distributions by Age Group for Residential Stochastic Analysis (L/kg BW-day)

	3rd Trimester	0<2 years	2<9 years	2<16 years	16<30 years	16-70 years
Distribution	Max extreme	Max extreme	Max extreme	Log-normal	Logistic	Logistic
Minimum	78	196	156	57	40	13
Maximum	491	2,584	1,713	1,692	635	860
Scale	59.31	568.09	125.59		40.92	36.19
Likeliest	191.50	152.12	462.61			
Location				-144.06		
Mean	225	658	535	452	210	185
Std Dev	72	217	168	172	75	67
Skewness	0.83	2.01	1.64	1.11	0.83	1.32
Kurtosis	3.68	10.61	7.88	6.02	5.17	10.83
Percentiles						
5%	127	416	328	216	96	86
10%	142	454	367	259	118	104
25%	179	525	427	331	161	141
50%	212	618	504	432	207	181
75%	260	723	602	545	252	222
80%	273	758	631	572	261	233
90%	333	934	732	659	307	262
95%	361	1090	861	745	335	290
99%	412	1430	1140	996	432	361

5-25

Table 7.1 Inhalation and Oral Cancer Potency Factors

Substance	Chemical Abstract Service Number (CAS)	Inhalation Potency Factor (mg/kg-day)$^{-1}$	Oral Slope Factor (mg/kg-day)$^{-1}$
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	$1.3 \times 10^{+3}$	$1.3 \times 10^{+3}$
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	$1.3 \times 10^{+3}$	$1.3 \times 10^{+3}$
1,2,3,4,,6,7,8,9-Octachlorodibenzofuran	39001-02-0	$3.9 \times 10^{+1}$	$3.9 \times 10^{+1}$
Chlorinated paraffins	108171-26-2	8.9×10^{-2}	
Chloroform	67-66-3	1.9×10^{-2}	
4-Chloro-*o*-phenylenediamine	95-83-0	1.6×10^{-2}	
p-Chloro-*o*-toluidine	95-69-2	2.7×10^{-1}	
Chromium (hexavalent)	18540-29-9	$5.1 \times 10^{+2}$	5×10^{-1}
Chrysene [BaP]	218-01-9	3.9×10^{-2}	1.2×10^{-1}
Creosote	8001-58-9	*	
p-Cresidine	120-71-8	1.5×10^{-1}	
Cupferron	135-20-6	2.2×10^{-1}	
2,4-Diaminoanisole	615-05-4	2.3×10^{-2}	
2,4-Diaminotoluene	95-80-7	$4.0 \times 10^{+0}$	
Dibenz[*a,h*]acridine [BaP]	226-36-8	3.9×10^{-1}	$1.2 \times 10^{+0}$
Dibenz[*a,j*]acridine [BaP]	224-42-0	3.9×10^{-1}	$1.2 \times 10^{+0}$
Dibenz[*a,h*]anthracene [BaP]	53-70-3	$4.1 \times 10^{+0}$	$4.1 \times 10^{+0}$
Dibenzo[*a,e*]pyrene [BaP]	192-65-4	$3.9 \times 10^{+0}$	$1.2 \times 10^{+1}$
Dibenzo[*a,h*]pyrene [BaP]	189-64-0	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
Dibenzo[*a,i*]pyrene [BaP]	189-55-9	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
Dibenzo[*a,l*]pyrene [BaP]	191-30-0	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
7H-Dibenzo[*c,g*]carbazole [BaP]	194-59-2	$3.9 \times 10^{+0}$	$1.2 \times 10^{+1}$
1,2-Dibromo-3-chloropropane	96-12-8	$7.0 \times 10^{+0}$	
1,4-Dichlorobenzene	106-46-7	4.0×10^{-2}	
3,3'-Dichlorobenzidine	91-94-1	$1.2 \times 10^{+0}$	
1,1-Dichloroethane	75-34-3	5.7×10^{-3}	
Diesel exhaust [B]	NA	$1.1 \times 10^{+0}$	
Diethylhexylphthalate	117-81-7	8.4×10^{-3}	8.4×10^{-3}
p-Dimethylaminoazobenzene	60-11-7	$4.6 \times 10^{+0}$	
7,12-Dimethylbenz[*a*]anthracene [BaP]	57-97-6	$2.5 \times 10^{+2}$	$2.5 \times 10^{+2}$
1,6-Dinitropyrene [BaP]	42397-64-8	$3.9 \times 10^{+1}$	$1.2 \times 10^{+2}$
1,8-Dinitropyrene [BaP]	42397-65-9	$3.9 \times 10^{+0}$	$1.2 \times 10^{+1}$
2,4-Dinitrotoluene	121-14-2	3.1×10^{-1}	
1,4-Dioxane	123-91-1	2.7×10^{-2}	
Epichlorohydrin	106-89-8	8.0×10^{-2}	
Ethyl benzene	100-41-4	8.7×10^{-3}	1.1×10^{-2}
Ethylene dibromide	106-93-4	2.5×10^{-1}	
Ethylene dichloride	107-06-2	7.2×10^{-2}	
Ethylene oxide	75-21-8	3.1×10^{-1}	

Table 5.8. Eight-Hour Breathing Rate (L/kg per 8 Hrs) Point Estimates for Males and Females Combined[a,b]

	0<2 years	2<9 years	2<16 years	16<30 years	16-70 years
	Sedentary & Passive Activities (METS ≤ 1.5)				
Mean	200	100	80	30	30
95th Percentile	250	140	120	40	40
	Light Intensity Activities (1.5 < METs ≤ 3.0)				
Mean	490	250	200	80	80
95th Percentile	600	340	270	100	100
	Moderate Intensity Activities (3.0 < METs ≤ 6.0)				
Mean	890	470	380	170	170
95th Percentile	1200	640	520	240	230

[a] For pregnant women, OEHHA recommends using the mean and 95th percentile 8-hour breathing rates based on moderate intensity activity of 16<30 year-olds for 3rd trimester.
[b]. Breathing rates in the table may be used for worker, school, or residential exposures

5-30

Table 8.4 Recommendations for Fraction of Time at Home (FAH) for Evaluating Residential Cancer Risk

Age Range	Fraction of Time at Residence
3rd Trimester, and 0<2 years	0.85[1]
2<16 years[2]	0.72[1]
16-70 years[3]	0.73

[1] Use FAH = 1 if a school is within the 1×10^{-6} (or greater) cancer risk isopleth

pathway in order to avoid underestimating cancer risk to the public, including children. A possible exception for using high-end breathing rates are when there is exposure to multipathway substances and two of the non-inhalation pathways drive the risk, rather than the inhalation pathway (see Chapter 8).

A. Equation 5.4.1.1: $Dose\text{-}air = C_{air} \times \{BR/BW\} \times A \times EF \times 10^{-6}$

1. Dose-air = Dose through inhalation (mg/kg/d)
2. C_{air} = Concentration in air (μg/m^3)
3. {BR/BW} = Daily Breathing rate normalized to body weight (L/kg body weight - day)
4. A = Inhalation absorption factor (unitless)
5. EF = Exposure frequency (unitless), days/365 days
6. 10^{-6} = Micrograms to milligrams conversion, liters to cubic meters conversion

a: Recommended default values for EQ 5.4.1.1:

1. {BR/BW} = Daily breathing rates by age groupings, see As supplemental information, the assessor may wish to evaluate the inhalation dose by using the mean point estimates in Table 5.6 to provide a range of breathing rates for cancer risk assessment to the risk manager.
2. Table (point estimates) and Table 5.7 (parametric model distributions for Tier III stochastic risk assessment). For Tier 1 residential estimates, use 95th percentile breathing rates in Table 5.6.
3. A = 1
4. EF = 0.96 (350 days/365 days in a year for a resident)

b: Assumption for EQ 5.4.1.1:

1. The fraction of chemical absorbed (A) is the same fraction absorbed in the study on which the cancer potency or Reference Exposure Level is based.

B. Equation 8.2.4 B: $RISK_{inh\text{-}work} = DOSE_{air} \times CPF \times ASF \times ED/AT$

1. $RISK_{inh\text{-}work}$ = Worker inhalation cancer risk

a: Recommended default values for EQ 8.2.4 B:

1. $DOSE_{air}$ = Calculated for workers in Eq. 5.4.1.2
2. CPF = Substance specific (see Table 7.1)
3. ASF = 1 for working age 16-70 yrs (See Section 8.2.1)
4. ED = 25 years
5. AT = 70 yrs for lifetime cancer risk

DPM and PM2.5 Emission Rates

Updated: 6/4/2018

HRA Notes:

BAAQMD recommends short-term projects "use of actual emission rates over a minimum 3-year duration for cancer risk assessments involving projects lasting 3 years or less." This was not done to be conservative.

Since AERSCREEN calculates maximum 1-hr concentration based on continuous emissions (which is then converted to annual), the 1-hr emission rate should be based on the emission rate during the entire construction period (24 hrs/day, 7 days per week).

To estimate annual average PM2.5 concentrations, divided PM2.5 exhaust emissions by the full 24hrs/day and 7 days/week when construction is occurring. This is still conservative because emissions would not occur for 2-4 months of the year (depending on the year). Could divide by the full 365 days/year for the entire year to be less conservative, but did not do this.

DPM Exhaust Emission Rates

	Construction On-Road Trucks	NOTES
DPM Emissions (lbs)		
Unmitigated	66.3	
Scaling Factors for onroad sources		
Hauling	0.004	haul trip = 35 miles one-way trip (35 miles each way, default); assume 200 meter onsite segment
Time Values for Emission Rates		
Total Days	77	Construction: total calendar days (7 days/week); see note above.
Hours per day	24	24 hrs/day; see note above
Emission Rates - Scaling Factors (g/s)		
Unmitigated	1.61E-05	Scaled on-road emissions by the scaling factors

PM2.5 Exhaust Emission Rates

	Construction On-Road Trucks	NOTES
PM2.5 Exhaust Emissions (lbs)		
Unmitigated	63.4	
Emission Rates - Scaling Factors (g/s)		
Unmitigated	1.54E-05	
Mitigated	0.00E+00	

4.12.2.2 Continuous Sources

If the source is continuously emitting, then the worker is assumed to breathe the long-term annual average concentration during their work shift. Equation 4.1 becomes one and no concentration adjustments are necessary in this situation when estimating the inhalation cancer risk. Note however, if an assessor does not wish to apply the assumption the worker breathes the long-term annual average concentration during the work shift, then a refined concentration can be post-processed as described in Appendix M. All alternative assumptions should be approved by the reviewing authority and supported in the presentation of results.

4.12.2.1 Non-Continuous Sources

When modeling a non-continuously emitting source (e.g., operating for eight hours per day and five days per week), the modeled long-term average concentrations are based on 24 hours a day and seven days per week for the period of the meteorological data set. Even though the emitting source is modeled using a non-continuous emissions schedule, the long-term concentration is still based on 24 hours a day and seven days per week. Thus, this concentration includes the zero hours when the source was not operating. For the offsite worker inhalation risk, we want to determine the long-term concentration the worker is breathing during their work shift. Therefore, the long-term concentration needs to be adjusted so it is based only on the hours when the worker is present. For example, assuming the emitting source and worker's schedules are the same, the adjustment factor is 4.2 = (24 hours per day/8 hours per shift)x(7 days in a week/5 days in a work week). In this example, the long term residential exposure is adjusted upward to represent the exposure to a worker. Additional concentration adjustments may be appropriate depending on the work shift overlap. These adjustments are discussed below.

2.1.3.2 Short Term Projects

In the 2015 HRA Guidelines, OEHHA recommends using actual project duration for short term projects, but cautions that the risk manager should consider a lower cancer risk threshold for very short term projects, because a higher exposure over a short period of time may pose a greater risk than the same total exposure spread over a much longer period of time. To ensure that short-term projects do not result in unanticipated higher cancer impacts due to short-duration high-exposure rates, the Air District recommends that the cancer risk be evaluated assuming that the average daily dose for short-term exposure lasts a minimum of three years for projects lasting three years or less. For residential exposures, the cancer risk calculations should include the most sensitive age groups (beginning with the third trimester of pregnancy) and should use the 95th percentile breathing rates. The Air District recommends following OEHHA guidelines for other aspects of short term projects. In summary, the Air District recommends:

- use of actual emission rates over a minimum 3-year duration for cancer risk assessments involving projects lasting 3 years or less, and
- use of actual project duration for cancer risk assessments on projects lasting longer than 3 years.

AERSCREEN Inputs and Outputs

Updated: 6/1/2018

Notes

Concentrations modeled using AERSCREEN worst-case 1-hr, scaled to annual

Input

	Construction On-Road Trucks	Notes
Title	Cons-Onroadv2	
Units	M	
Source Type	A	
DPM emission rate (g/s)	1	Unit emission rate for scaling
Release Height above ground OR stack height (meters)	2.55	On-road construction trucks and operational loading truck idling: the release height is equal to 0.5 * top of plume height, which is equal to 1.7 * the vehicle height, which is equal to 2.5 meters; equation = 0.5 * 1.7 * 3 = 2.55 (USEPA 2012).
Maximum horizontal dimension of area source (meters)	200	Construction trucks: 9m width (USEPA Haul Roads workgroup 2012 = VW [3] + 6m for single lane roadways) by 200m length
Minimum horizontal dimension of area source (meters)	13.4	width = two-lane roadway = Road Width +6 m for two lane roadwasy = 3.17*2+6=13.4m
Initial Vertical Dimension (meters)	2.37	Initial vertical dimension for off-road construction equipment from the CRRP-HRA (BAAQMD, SF DPH & SF Planning, 2012). Initial vertical dimension for on-road construction trucks is equal to the top of the plume height ÷ 2.15 = 1.7 * 3 / 2.15 = 2.37.
Stack diameter (meters)	n/a	From the CRRP-HRA (Table 13) (BAAQMD, SF DPH & SF Planning, 2012)
Stack temperature (K)	n/a	""
Exit velocity (m/s)	n/a	""
rural/urban	urban	Although CRRP uses rural (page 31), AERSCREEN is already exceedingly conservative, so per the AQTR SOW used urban instead.
population of urban area	*234,962*	https://www.census.gov/quickfacts/fact/table/fremontcitycalifornia,US/PST045217
min distance to ambient air (meters)	default	
NO2 chemistry	1	
Include building downwash?	n/a	
Include terrain heights?	n/a	
max distance to probe	default	
include discrete receptors	no	
use flagpole receptors	yes	
flagpole receptor height (meters)	1.5	BAAQMD 2012, Recommended Methods for Screening and Modeling Local Risks and Hazards
source elevation	default	
min ambient temperature (F)	*42*	http://www.intellicast.com/Local/History.aspx?location=USCA0403
max ambient temperature (F)	*77*	http://www.intellicast.com/Local/History.aspx?location=USCA0403
min ambient temperature (K)	279	
max ambient temperature (K)	298	
min wind speed (m/s)	default	
anemometer height (m)	default	
surface characteristics	2	
Dominant surface profile	7	
dominant climate profile	1	
adjust	no	
debug	no	
Output file name	Cons-Onroadv2.out	

"VH" means vehicle height [~3m for typical haul trucks; ~10m for large mining trucks]
"VW" means vehicle width [~3m for typical haul trucks; ~10m for large mining trucks]
"VL" means vehicle length [~10m for typical haul trucks; ~20m for large mining trucks]

Recommended Area Source Configuration

- Length – length of roadway segment (Aspect ratio in AERMOD extended to 100:1 before warning is issued. See Model Change Bulletin #3, Miscellaneous item #10)
- Width – VW + 6m for single lane / Road Width + 6m for two-lane (same comment as for volume, two single-lanes is an option)
- Top of plume height – 1.7 x VH
- Release height – 0.5 x top of plume height
- Sigma Z – Top of Plume height / 2.15
- Emissions input as $g/s/m^2$

Outputs

	Construction On-Road Trucks	
Closest Receptors		
Distance (m)		
Residents:	12	see SensitiveReceptors tab
Daycares:	30	
Schools	35	
Distance for lookup (m)		
Residents:	1	closest whole number from AERSCREEN output distances below
Daycares:	25	
Schools	25	
Concentrations - Maximum 1-hr (ug/m3)		
Residents:	*4,893.5*	
Daycares:	*5,012.2*	
Schools	*5,012.2*	
Concentrations - Average Annual (ug/m3)		
Residents:	489.35	
Daycares:	501.22	
Schools	501.22	

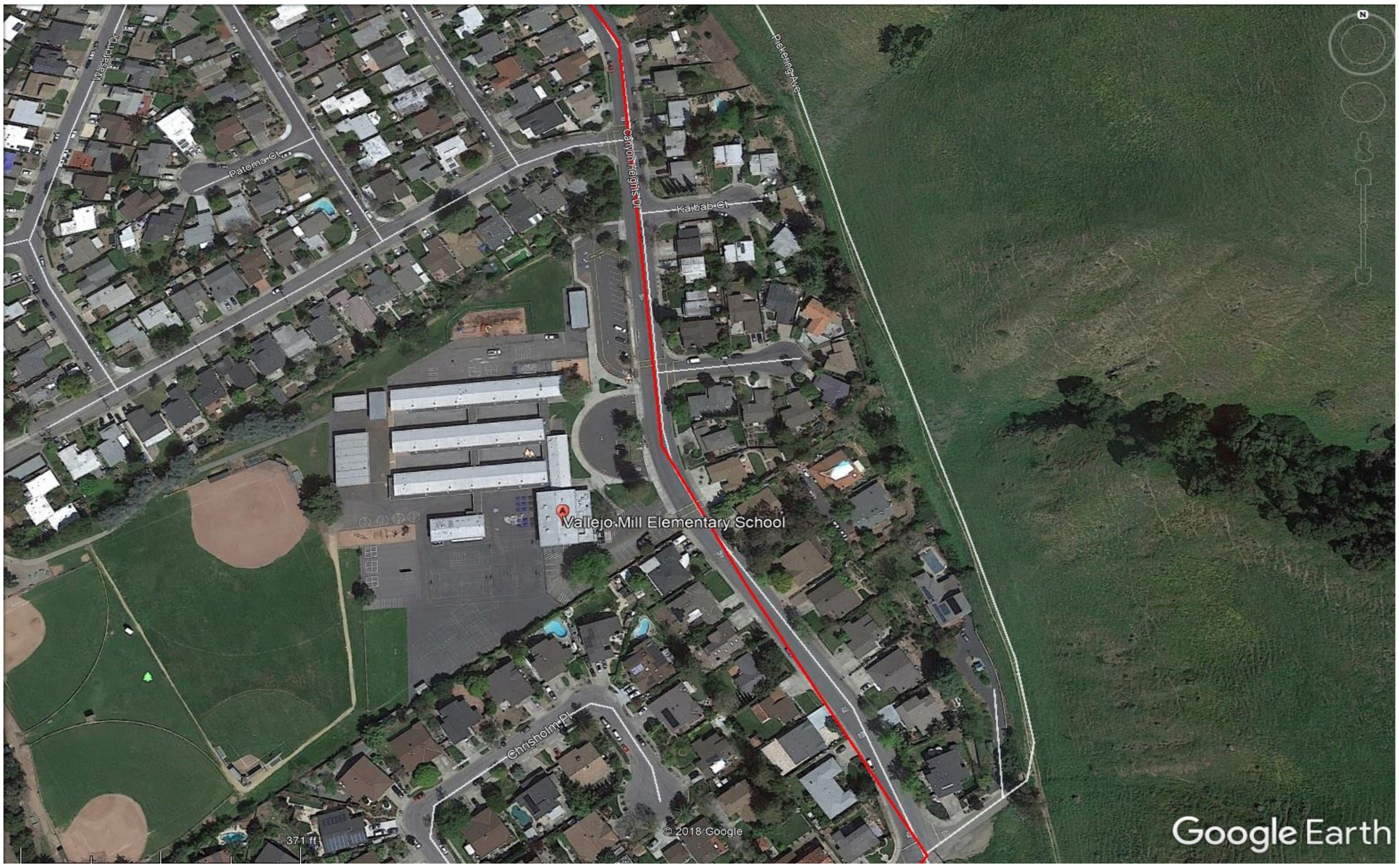
AERSCREEN Output

Distance (m)	Concentration
1	4893.5
25	5012.2
50	5223.4
75	5309.8
100	5382.1
101	5384.9
125	2208.6
150	1280.6
175	959.14
200	759.93
225	624.84
250	527.84
275	455.01
300	398.42
325	353.27
350	316.48
375	285.99
400	260.33
425	238.44
450	219.58
475	203.2
500	188.85

Sensitive Receptors

Updated: 6/1/2018

Type	Description	Address	Distance from Haul Route
Residents:	Single-Family Residences	Nearest Residence to Haul Route	40
Daycares:	Adventure Time Vallejo Mill	38569 Canyon Heights Dr., Fremont, CA	100
Schools	Vallejo Mill Elementary School	38569 Canyon Heights Dr., Fremont, CA	115



Constants

Updated:	12/7/2017	
grams per ton	907,185	
grams per MT	1,000,000	
grams per kg	1,000	
lbs per ton	2,000	
hrs/day	24	
work hrs/day	10	12 hour construciton window per day, but max of 8 hrs of equipment operation: Construction Data Needs - AQ-GHG (BAAQMD)
hrs/min	0.0166667	
seconds/hr	3,600	
grams per lb	453.592	
1hr to annual concentration	0.1	https://www3.epa.gov/ttn/scram/models/screen/aerscreen_userguide.pdf
square feet per acre	43,560	
feet per mile	5,280	
feet per meter	3.28084	
therms per BTU	1.00E-05	
PM Fractions		
PM10 Fraction of Total PM - diesel	0.976	Table A - Updated CEIDARS Table with PM2.5 Fractions, INTERNAL COMBUSTION - DISTILLATE AND DIESEL-EXCEPT ELECTRIC GENERATION
PM2.5 Fraction of Total PM - diese	0.967	Table A - Updated CEIDARS Table with PM2.5 Fractions, INTERNAL COMBUSTION - DISTILLATE AND DIESEL-EXCEPT ELECTRIC GENERATION
NMHC frac - diesel	5%	Policy: CARB Emission Factors for CI Diesel Engines – Percent HC in Relation to NMHC + Nox: http://www.baaqmd.gov/~/media/Files/Engineering/policy_and_procedures/Engines/EmissionFactorsforDieselEngines.ashx
NOX frac - deisel	95%	Policy: CARB Emission Factors for CI Diesel Engines – Percent HC in Relation to NMHC + Nox: http://www.baaqmd.gov/~/media/Files/Engineering/policy_and_procedures/Engines/EmissionFactorsforDieselEngines.ashx

```
Start date and time  06/04/18 16:20:32
                              AERSCREEN 16216


Cons-Onroadv2


            Cons-Onroadv2



         -----------------  DATA ENTRY VALIDATION  -----------------
                        METRIC              ENGLISH
 ** AREADATA **  ---------------     ----------------


 Emission Rate:       1.0000 g/s             7.937 lb/hr
 Area Height:           2.55 meters           8.37 feet
 Area Source Length:  200.00 meters         656.17 feet
 Area Source Width:    13.40 meters          43.96 feet
 Vertical Dimension:    2.37 meters           7.78 feet
 Model Mode:           URBAN
 Population:          234962
 Dist to Ambient Air:           1.0 meters             3. feet



 ** BUILDING DATA **
```

No Building Downwash Parameters

** TERRAIN DATA **

No Terrain Elevations

Source Base Elevation: 0.0 meters   0.0 feet

Probe distance: 5000. meters   16404. feet

Flagpole Receptor Height: 1.5 meters   5. feet

No discrete receptors used

** FUMIGATION DATA **

No fumigation requested

** METEOROLOGY DATA **

Min/Max Temperature: 279.0 / 298.0 K   42.5 / 76.7 Deg F

Minimum Wind Speed: 0.5 m/s

Anemometer Height: 10.000 meters

Dominant Surface Profile: Urban

Dominant Climate Type: Average Moisture

Surface friction velocity (u*): not adjusted

DEBUG OPTION OFF

AERSCREEN output file:

Cons-Onroadv2.out

*** AERSCREEN Run is Ready to Begin

No terrain used, AERMAP will not be run

****

SURFACE CHARACTERISTICS & MAKEMET

Obtaining surface characteristics...

Using AERMET seasonal surface characteristics for Urban with Average Moisture

Season	Albedo	Bo	zo
Winter	0.35	1.50	1.000
Spring	0.14	1.00	1.000
Summer	0.16	2.00	1.000
Autumn	0.18	2.00	1.000

Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl

Creating met files aerscreen_02_01.sfc & aerscreen_02_01.pfl

Creating met files aerscreen_03_01.sfc & aerscreen_03_01.pfl

Creating met files aerscreen_04_01.sfc & aerscreen_04_01.pfl

Buildings and/or terrain present or rectangular area source, skipping probe

FLOWSECTOR started 06/04/18 16:22:48

****

Running AERMOD

Processing Winter

Processing surface roughness sector 1

****

Processing wind flow sector 1

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector 0

******** WARNING MESSAGES ********

*** NONE ***

****

Processing wind flow sector 2

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector 5

******** WARNING MESSAGES ********

*** NONE ***

****

Running AERMOD

Processing Spring

Processing surface roughness sector 1

****

Processing wind flow sector   1

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   0

******** WARNING MESSAGES ********

*** NONE ***

****

Processing wind flow sector   2

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   5

******** WARNING MESSAGES ********

*** NONE ***

****

Running AERMOD

Processing Summer

Processing surface roughness sector 1

```
*****************************************************

Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   0


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   5


    ********   WARNING MESSAGES   ********

               ***  NONE  ***

 ********************************************


  Running AERMOD

 Processing Autumn


Processing surface roughness sector  1


*****************************************************

Processing wind flow sector   1
```

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   0

******** WARNING MESSAGES ********

*** NONE ***

****

Processing wind flow sector   2

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   5

******** WARNING MESSAGES ********

*** NONE ***

FLOWSECTOR   ended 06/04/18 16:22:53

REFINE   started 06/04/18 16:22:53

AERMOD Finishes Successfully for REFINE stage 3 Winter sector   0

******** WARNING MESSAGES ********

*** NONE ***

REFINE   ended 06/04/18 16:22:56

****

AERSCREEN Finished Successfully

With no errors or warnings

Check log file for details

****

Ending date and time 06/04/18 16:22:57

Cons-Onroadv2_max_conc_distance

```
 Concentration     Distance Elevation  Diag  Season/Month   Zo sector       Date
 H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS     HT
REF TA     HT
   0.48935E+04         1.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.50122E+04        25.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.52234E+04        50.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.53098E+04        75.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.53821E+04       100.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
*  0.53849E+04       101.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.22086E+04       125.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.12806E+04       150.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.95914E+03       175.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.75993E+03       200.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.62484E+03       225.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.52784E+03       250.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.45501E+03       275.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.39842E+03       300.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.35327E+03       325.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
```

```
  0.31648E+03       350.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.28599E+03       375.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.26033E+03       400.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.23844E+03       425.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.21958E+03       450.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.20320E+03       475.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.18885E+03       500.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.17588E+03       525.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.16468E+03       550.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.15468E+03       575.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.14569E+03       600.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.13758E+03       625.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.13022E+03       650.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.12353E+03       675.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.11742E+03       700.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
  0.11181E+03       725.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
```

```
   0.10665E+03       750.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.10189E+03       775.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.96901E+02       800.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.92887E+02       825.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.89153E+02       850.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.85671E+02       875.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.82419E+02       900.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.79376E+02       925.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.76524E+02       950.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.73845E+02       975.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.71327E+02      1000.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.68955E+02      1025.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.66719E+02      1050.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.64608E+02      1075.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.62612E+02      1100.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.60723E+02      1125.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
```

```
   0.58935E+02      1150.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.57238E+02      1175.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.55629E+02      1200.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.54100E+02      1225.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.52646E+02      1250.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.51263E+02      1275.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.49947E+02      1300.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.48693E+02      1325.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.47497E+02      1350.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.46356E+02      1375.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.45268E+02      1400.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.44228E+02      1425.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.43235E+02      1450.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.42285E+02      1475.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.41377E+02      1500.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.40508E+02      1525.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.39675E+02      1550.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.38878E+02      1575.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.38115E+02      1600.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.37382E+02      1625.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.36680E+02      1650.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.36006E+02      1675.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.35359E+02      1700.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.34738E+02      1725.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.34141E+02      1750.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.33568E+02      1775.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.33016E+02      1800.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.32486E+02      1825.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.31976E+02      1850.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.31484E+02      1875.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.31011E+02      1900.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.30556E+02      1924.99      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.30116E+02      1950.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.29693E+02      1975.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.29284E+02      2000.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.28890E+02      2025.00      0.00   5.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.28509E+02      2050.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.28142E+02      2075.00      0.00   5.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.27787E+02      2100.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.27444E+02      2125.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.27112E+02      2150.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.26791E+02      2175.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.26480E+02      2200.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.26179E+02      2225.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.25888E+02      2250.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.25606E+02      2275.00      0.00   5.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.25332E+02      2300.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.25067E+02      2325.00      0.00   0.0         Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.       5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.24810E+02      2350.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.24560E+02      2375.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.24318E+02      2400.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.24082E+02      2425.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.23853E+02      2450.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.23631E+02      2475.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.23414E+02      2500.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.23204E+02      2525.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.22999E+02      2550.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.22799E+02      2575.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.22605E+02      2600.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.22416E+02      2625.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.22231E+02      2650.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.22051E+02      2675.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.21875E+02      2700.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.21704E+02      2725.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.21537E+02      2750.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.21373E+02      2775.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.21213E+02      2800.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.21057E+02      2825.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.20905E+02      2850.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.20755E+02      2875.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.20609E+02      2900.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.20466E+02      2925.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.20326E+02      2950.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.20189E+02      2975.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.20055E+02      3000.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.19923E+02      3025.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.19794E+02      3050.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.19667E+02      3075.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.19543E+02      3100.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.19421E+02      3125.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.19302E+02      3150.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.19184E+02      3175.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.19069E+02      3200.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18955E+02      3225.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18844E+02      3250.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18735E+02      3275.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18627E+02      3300.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18521E+02      3325.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18417E+02      3350.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18315E+02      3375.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18214E+02      3400.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18115E+02      3425.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.18017E+02      3450.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17921E+02      3475.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17826E+02      3500.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17733E+02      3525.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.17640E+02      3550.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17550E+02      3575.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17461E+02      3600.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17372E+02      3625.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17285E+02      3650.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17200E+02      3675.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17115E+02      3700.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.17032E+02      3725.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16949E+02      3750.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16868E+02      3775.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16788E+02      3800.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16709E+02      3825.00      0.00   5.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16631E+02      3850.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16553E+02      3875.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16477E+02      3900.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.16402E+02      3925.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.16327E+02      3950.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.16254E+02      3975.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.16181E+02      4000.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.16109E+02      4025.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.16038E+02      4050.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15968E+02      4075.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15899E+02      4100.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15830E+02      4125.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15762E+02      4150.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15695E+02      4175.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15629E+02      4200.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15563E+02      4225.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15498E+02      4250.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15434E+02      4275.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15370E+02      4300.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
   0.15307E+02      4325.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35   0.50   10.0
298.0    2.0
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   0.15245E+02      4350.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.15184E+02      4375.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.15123E+02      4400.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.15062E+02      4425.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.15002E+02      4450.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14943E+02      4475.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14885E+02      4500.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14827E+02      4525.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14769E+02      4550.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14712E+02      4575.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14656E+02      4600.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14600E+02      4625.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14545E+02      4650.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14490E+02      4675.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14436E+02      4700.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14382E+02      4725.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
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   0.14329E+02      4750.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14276E+02      4775.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14224E+02      4800.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14172E+02      4825.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14121E+02      4850.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14070E+02      4875.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.14019E+02      4900.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.13969E+02      4925.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.13920E+02      4950.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.13871E+02      4975.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
   0.13822E+02      5000.00      0.00   0.0        Winter       0-360   10011001
-1.27  0.043 -9.000  0.020 -999.   21.      5.9 1.000   1.50   0.35    0.50   10.0
298.0    2.0
```