# APPENDIX E

## SMAQMD - Draft Recommended Protocol for Evaluating the Location of Sensitive Land Uses Adjacent to Major Roadways

# Recommended Protocol for Evaluating the Location of Sensitive Land Uses Adjacent to Major Roadways

January 2007

Version 1.0

SACRAMENTO METROPOLITAN
AIR QUALITY
MANAGEMENT DISTRICT

# Foreword

This *Recommended Protocol for Evaluating the Location of Sensitive Land Uses Adjacent to Major Roadways* (Protocol) provides a methodology for the assessment and disclosure of potential cancer risk from diesel particulate matter attributable to siting sensitive land uses adjacent to major roadways.

There are several purposes of this Protocol. One is to assist local land use jurisdictions in assessing the potential cancer risk of siting sensitive land uses adjacent to major roadways. The second purpose is to provide a disclosure mechanism for those risks. The third is to show the relationship between potential cancer risk from diesel particulate matter exposure and distance from the major roadway.

This document does *not* provide an acceptable cancer risk level or a regulatory threshold; therefore it does not establish which projects are acceptable and which are not. Local land use jurisdictions retain all authority and decide after considering all relevant factors whether the project is appropriate.

Emissions and traffic data used in the screening tables are specific to the region encompassing the Sacramento Metropolitan Air Quality Management District; therefore, the screening tables should only be applied to projects contemplated within its boundaries.

The District recommends that the Protocol be applied to project applications deemed complete on or after the date of SMAQMD Board endorsement date of January 25, 2007. The District does not recommend that projects whose environmental documents have already been certified as of that date be re-opened.

We invite users of this Protocol to contact SMAQMD planning staff or visit the District offices for consultation on the use of this Protocol.

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# Introduction

In April 2005, the California Air Resources Board (ARB) issued a guidance document on air quality and land use[1]. This document specifically offered guidance on siting sensitive land uses in proximity to sources of air toxics. Sensitive land uses include residential communities, schools and school yards, day care centers, parks and playgrounds, hospitals and medical facilities.[2] One particular source of air toxics treated in the guidance is freeways and high traffic roadways. These roadways are sources of diesel particulate matter (PM), which ARB has listed as a toxic air contaminant. The specific guidance recommends that sensitive land uses be sited no closer than 500 feet from a freeway or other high traffic roadway. This recommendation was based on traffic related studies that showed a 70 percent drop in PM concentrations at a distance of 500 feet from the roadway. Presumably, the lifetime cancer risk from exposure to the PM is lowered proportionately.

The ARB land use siting recommendation has major implications relative to land development projects. In particular, new residence development projects would be especially constrained if the nearest new residence in the project were required to be at least 500 feet from a nearby freeway. The ARB guidance is advisory in nature, and suggests that a site specific health risk assessment (HRA) be performed to characterize the health risks of a given development project. However, local officials faced with land use siting decisions question the need to require a separate site specific health risk assessment for every sensitive land use project (e.g., new housing) proposed that deviates from the ARB guidance. Such questions are indeed valid given that the ARB guidance does not require a specific health risk assessment protocol. Moreover, even in instances in which a site specific HRA is appropriate, there is currently little guidance regarding how such an HRA be performed.

The purpose of this document is to provide land use decision makers with a methodology to make informed land use decisions on siting new residential projects and other sensitive land uses in proximity to a freeway or other high traffic volume roadway. This methodology is intended to give local officials the information needed to assess health risk issues within the spectrum of other land use issues that must be considered in the land use planning process. These other issues include housing and transportation needs, the benefits of urban infill, and community economic development priorities. The Protocol was not designed to be applied retroactively and should not be applied to project applications submitted and deemed complete on or before SMAQMD Board endorsement (anticipated to be January 25, 2007).

The methodology defines a stepwise process that indicates the need for and methodology to conduct a site specific HRA. In this stepwise process, project site

[1] California Air Resources Board (ARB). Air Quality and Land Use Handbook: A Community Health Perspective. April 2005.
[2] Ibid. Page 2.

specific characteristics are used to evaluate the potential cancer risk posed within the project and to determine whether a site specific HRA is warranted. In cases for which a site specific HRA is indicated, this methodology gives guidance regarding how the HRA should be performed.

The section entitled *Project Screening* describes the stepwise project evaluation process that includes screening steps that can be used to decide whether a site specific HRA is recommended for a particular land use project. The section entitled *Methodology for Completing a Site Specific Health Risk Assessment* describes the methodology recommended for completing a site specific HRA in instances in which the screening steps conclude that one should be done. The *Calculating Potential Cancer Risk* section describes how to calculate potential cancer risk from the values that the air dispersion model produces, and provides a sample risk calculation. The *Site Specific HRA Reporting* section outlines the information from the air dispersion model run and resulting HRA that should be included in the staff report of environmental document. The *Resources* section provides a list of resources for use in the project screening, air dispersion modeling, and HRA calculation process. The technical discussion that provides the background and justification for many aspects of the Protocol, screening table development, and health risk evaluation procedures is given in the Appendix (available upon request).

The methodology developed in this effort assumes that the roadway is a limited-access freeway, with no traffic signals and associated traffic queues. Ways to incorporate multiple roadways, freeway intersections, controlled traffic roadways (i.e. with traffic signals and intersections), and other, non-roadway, toxic air contaminant sources into the HRA process may be the subject of future efforts.

While the Protocol provides a methodology for assessing cancer risk only, potential short term health risks of living near freeways and major roadways should be discussed qualitatively in the project's staff report or environmental document. Studies have shown that living near major roadways is associated not only with increased cancer risk, but with short term adverse health impacts such as reduced lung function and increased asthma hospitalizations.[3] At this time, very little information exists on how to quantify the adverse short term health impacts of living near freeways; however under CEQA, known environmental impacts must be disclosed.

Also worth noting is that, as stricter emissions regulations and improved technologies phase in over the years, actual emissions are projected to decline which may result in reduced exposure to toxic air contaminants. However, such declines may be offset by increases in vehicle miles traveled.

[3] ARB, Air Quality and Land Use Handbook.

# Project Screening

The stepwise approach recommended for assessing the potential cancer risk of a proposed land use project is illustrated in Figure 2. The approach is summarized as follows:

1. Determine if the nearest person affected by the project (receptor) is at least 500 feet from the nearest high traffic volume roadway (defined as a freeway, urban roadway with greater than 100,000 vehicles/day, or rural roadway with 50,000 vehicles/day).[4] If the building envelopes are known and included in the application to the land use authority, the receptor should be placed at the building. Otherwise, the receptor should be placed at the edge of the property boundary. If the project is outside of the 500 foot distance, then the proposed project meets the ARB guidance distance and no further roadway-related air quality evaluations are recommended under this Protocol. If no, proceed to step 2.

2. Using the screening process described in this section, determine if the nearest receptor has a cancer risk level lower than the evaluation criterion (discussed on page 10) for recommending a site specific HRA. If lower risk, then no further roadway-related air quality evaluations are recommended under this Protocol and the projected cancer risk value and screening table used should be recorded in the environmental documentation. If higher risk, continue to step 3.

3. Complete a site specific HRA using procedures in accordance with those described in the *Methodology for Completing a Site Specific Health Risk Assessment* section, and submit records in the environmental documentation.

If the project proceeds to step 2, this Protocol recommends the use of a pair of screening tables to determine if the project distance exposes receptors to greater risk than the Protocol's cancer risk evaluation criterion (discussed on page 10). The information needed to screen a project is shown in Figure 1.

**Figure 1: Information Needed to Screen a Project**

1. Compass orientation (direction) of the roadway
2. Compass orientation (direction) of the project
3. Peak hourly traffic volume on the roadway at the project location

Peak hourly traffic volumes information provided by Caltrans[5]. Select the location (milepost) nearest the project. Select the back peak hour for projects south or west of the nearest milepost location; the ahead peak hour volume for projects north or east of the nearest milepost location. For projects near roadways not tabulated by Caltrans, consult SMAQMD.

[4] ARB, Air Quality and Land Use Handbook.
[5] http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/, viewed July 2006

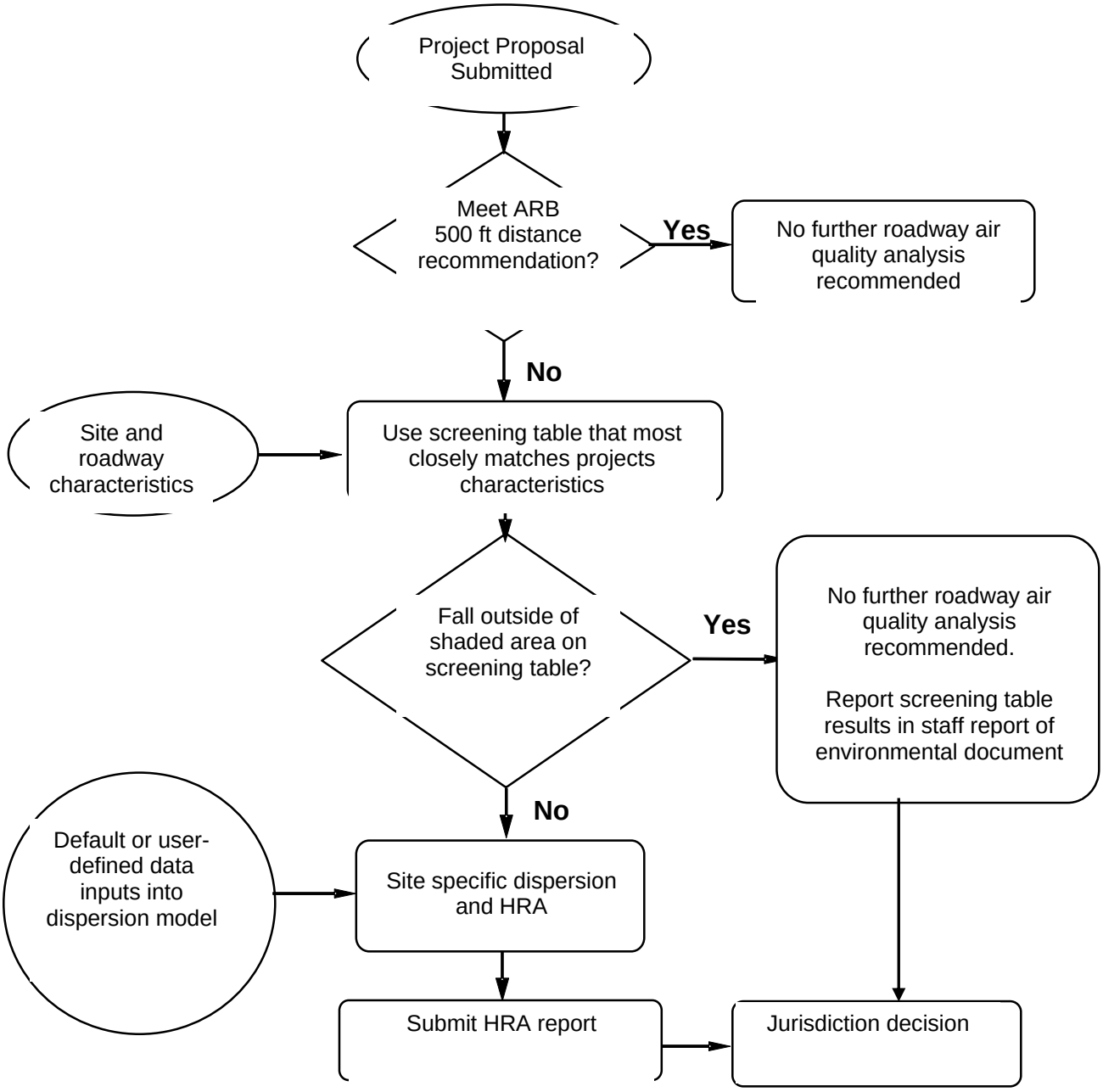


**Figure 2: Stepwise Approach to Evaluating Sensitive Land Use Projects Adjacent to Major Roadways**

During screening process, the agency or its consultant uses project information to locate the appropriate cell in the screening table that will determine whether or not to move on to step 3. One determines the appropriate cell by referencing the roadway and project direction, and traffic volume in the tables. There are two tables to choose from: one is for East-West roadways and one is for North-South roadways. Within each table, there are matrices for projects that are upwind and downwind of the roadway. The upwind or downwind designation corresponds to the annual average general wind direction taken from the SMAQMD standard meteorological data set.

One should locate the cell that most closely represents the project screening risk by first choosing the correct table. If the roadway is predominantly East-West, choose Table 1. If the roadway is predominantly North-South, choose Table 2. If the predominant compass orientation of the roadway is subject to dispute, then an east-west orientation should be assumed, and Table 2 selected. Next, if the project is downwind of the roadway, look to the upper matrix in the table. If the project is upwind, look to the lower matrix. Now, the appropriate row in the matrix is determined according to peak traffic volume at the roadway near the project.

The traffic volume at the roadway, using the Caltrans data, should be rounded up to the nearest entry in the matrix selected. The agency or its consultant notes the increased cancer risk shown in the cell that corresponds to the proposed distance from the roadway of the nearest affected receptor. For example, for a new housing development, the appropriate distance is that of the nearest new residence. If the building envelopes are known and included in the application to the land use authority, the receptor should be placed at the building. Otherwise, the receptor should be placed at the edge of the property boundary. If the cell is not shaded (the increased risk is less than the evaluation criterion of 446/million, as discussed in the following paragraph), a site specific HRA is not recommended. Nevertheless, the results of the analysis should be recorded in the environmental documentation or a staff report with the table included for reference. If the cell is shaded (the increased risk is greater than the evaluation criterion), SMAQMD recommends that a site specific HRA be performed. The evaluation criterion of 446/million was selected as that level of risk corresponding to a 70 percent reduction form the highest predicted risk in either of the two screening tables.

**Table 1: Diesel PM Cancer Risk (Potential Incremental Cancer Cases per Million People) North and South of an East-West Roadway**

| PROJECTS NORTH AND SOUTH OF AN EAST-WEST ROADWAY Version 1.0 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Peak Hour Traffic (vehicle/hr) | Receptor Distance from Edge of Nearest Travel Lane (feet) | | | | | | | |
| | **10** | **25** | **50** | **100** | **200** | **300** | **400** | **500** |
| Incremental Cancer Risk Per Million: North (downwind) | | | | | | | | |
| **4000** | 210 | 186 | 153 | 114 | 75 | 57 | 45 | 39 |
| **8000** | 420 | 372 | 309 | 228 | 150 | 114 | 90 | 75 |
| **12000** | 630 | 558 | 462 | 339 | 222 | 168 | 135 | 114 |
| **16000** | 837 | 741 | 615 | 453 | 297 | 225 | 180 | 153 |
| **20000** | 1047 | 927 | 768 | 567 | 372 | 279 | 228 | 192 |
| **24000** | 1257 | 1113 | 924 | 681 | 447 | 336 | 273 | 228 |
| Incremental Cancer Risk Per Million: South (upwind) | | | | | | | | |
| **4000** | 117 | 96 | 75 | 54 | 36 | 27 | 21 | 18 |
| **8000** | 234 | 192 | 153 | 108 | 69 | 51 | 42 | 36 |
| **12000** | 351 | 291 | 228 | 165 | 105 | 78 | 63 | 54 |
| **16000** | 468 | 387 | 306 | 219 | 138 | 105 | 84 | 69 |
| **20000** | 582 | 486 | 381 | 273 | 177 | 132 | 105 | 87 |
| **24000** | 699 | 582 | 459 | 327 | 210 | 159 | 126 | 105 |

**Table 2: Diesel PM Cancer Risk (Potential Incremental Cancer Cases per Million People) East and West of a North-South Roadway**

| PROJECTS EAST AND WEST OF A NORTH-SOUTH ROADWAY Version 1.0 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Peak Hour Traffic (vehicle/hr) | Receptor Distance from Edge of Nearest Travel Lane (feet) | | | | | | | |
| | **10** | **25** | **50** | **100** | **200** | **300** | **400** | **500** |
| Incremental Cancer Risk Per Million: East (downwind) | | | | | | | | |
| **4000** | 249 | 213 | 168 | 117 | 75 | 57 | 45 | 36 |
| **8000** | 495 | 423 | 336 | 237 | 150 | 111 | 90 | 72 |
| **12000** | 744 | 636 | 504 | 354 | 225 | 168 | 132 | 111 |
| **16000** | 990 | 849 | 672 | 474 | 303 | 222 | 177 | 147 |
| **20000** | 1239 | 1062 | 840 | 591 | 378 | 279 | 222 | 183 |
| **24000** | 1488 | 1272 | 1008 | 711 | 453 | 336 | 267 | 219 |
| Incremental Cancer Risk Per Million: West (upwind) | | | | | | | | |
| **4000** | 159 | 123 | 93 | 63 | 39 | 27 | 21 | 18 |
| **8000** | 315 | 249 | 183 | 126 | 78 | 57 | 45 | 36 |
| **12000** | 474 | 375 | 276 | 189 | 117 | 87 | 69 | 54 |
| **16000** | 633 | 501 | 369 | 252 | 156 | 114 | 90 | 75 |
| **20000** | 792 | 627 | 459 | 315 | 198 | 144 | 114 | 93 |
| **24000** | 948 | 750 | 552 | 378 | 237 | 174 | 135 | 111 |

**Figure 3: Screening Responsibilities and Reporting**

**1. The project proponent should provide the following information for the screening effort to the agency requesting the analysis:**

- General project information (town and nearest road intersection of project, map showing relative location of affecting roadway, type of project, project timeline, contact information for project proponent, name of consultant if relevant)
- Roadway compass orientation, project compass orientation
- Distance from the edge of the nearest travel lane to the nearest receptor
- Peak hour traffic volume and reference/source, ideally from Caltrans

**2. The local agency or its consultant should screen the project and report the project inputs provided by the proponent as well as the following results:**

- Cancer risk value (cases/million) at the nearest receptor
- The screening matrix used in the process showing risk varying by distance to roadway

## The Evaluation Criterion

The evaluation criterion of 446/million was selected as that level of risk corresponding to a 70 percent reduction from the highest risk calculated at 10 feet from the edge of the nearest travel lane to the nearest receptor for the highest peak traffic volume reported by Caltrans for Sacramento County (24,000 vehicle per hour) east (downwind) of a north-south roadway. The highest risk represents the worst case siting situation within the boundaries of the SMAQMD.

The screening table cancer risk values do not include the existing background cancer risk for Sacramento County of 360/million.[6]

Note that the evaluation criterion does *not* represent a “safe” risk level or a regulatory threshold; it is simply the point at which a site specific health risk assessment is recommended.

[6] ARB, http://www.arb.ca.gov/diesel/documents/rrstudy/rrstudy101404/pdf, viewed October 2006.

# Methodology for Completing a Site Specific Health Risk Assessment

If the project falls within the shaded area of the appropriate screening table, SMAQMD recommends that local land use jurisdiction or its consultant complete a site specific HRA. This HRA is intended to provide additional project specific information to the local land use jurisdiction for decision making purposes.

Performing a site specific HRA requires calculating estimated ambient pollutant concentrations resulting from the mass emission rate of a pollutant from a source. The pollutant source is the exhaust emissions from the vehicle traffic traveling the freeway or major roadway that will likely affect sensitive receptors at a proposed land use project. The pollutant of interest is diesel PM, although PM10 is used as a proxy for the relative measure of diesel PM at varying distances. The choice to base the HRA on PM10 is further discussed in the Appendix (see *Resources*).

The line source model CAL3QHCR should be used as the dispersion model for estimating ambient concentration as a function of distance from the source. CAL3QHCR is a refined version of the original CALINE (California Line Source Dispersion Model) that was developed as a modeling tool to predict roadside CO concentrations. CAL3QHCR can be used to estimate PM10 concentrations at defined receptor locations by processing hourly meteorological data over a year, hourly emissions, and traffic volume. The model can be obtained at no cost from EPA[7].

To run CAL3QHCR, one needs meteorological, traffic, and vehicle emissions data at specified intervals over some time period, such as hourly average data for a year. For meteorological data, SMAQMD recommends the 1987 set as the risk values generated from that set came closest to the average of all five years and the model only accepts one year of meteorological data. SMAQMD can supply data files that contain hourly meteorological data over a year for each of five years (1985, 86, 87, 88, and 89)[8]. These data are considered the “standard SMAQMD met data” for specified use in point source dispersion model analyses performed for the SMAQMD region (e.g., air toxics hot spots analyses to comply with AB 2588).

The CAL3QHCR model requires emissions data. Year 2007 average hourly emissions (grams/vehicle mile) for input into the model are shown in Table 3. These emissions have been produced from EMFAC2007 and were calculated based on the SMAQMD area for year 2007. If needed, future year emissions should be calculated using the most current version of EMFAC2007.

[7] http://www.epa.gov/scram001/dispersion_prefrec.htm, viewed June 2006
[8] ASCII data files SACOAK85.ASC, SACOAK86.ASC, SACOAK87.ASC, SACOAK 88.ASC, and SACOAK89.ASC obtained from B. Krebs of SMAQMD.

CAL3QHCR also takes as input the hourly traffic volume (vehicles/hour) as determined by the relative VMT. The relative VMT is the ratio of the VMT for the hour to the peak VMT over the 24 hour day and was developed from the corresponding vehicle miles traveled (VMT) for each hour of the day for a number of vehicle types (e.g., light duty passenger cars equipped with and without a 3-way catalyst, heavy-duty diesel trucks, urban buses, and so forth) per EMFAC. This relative VMT is also shown in Table 3 and represents 2007 values. The hourly traffic volume supplied will be the product of the relative VMT in Table 3 with the roadway peak traffic volume, obtained from the Caltrans as discussed in the section entitled *Project Screening*. If needed, future traffic volumes should be calculated using the most current version of EMFAC2007.

CAL3QHCR also requires geographical data that defines the calculational domain. The x-y coordinates of the beginning and end of the roadway section being modeled need to be specified. The length of the roadway modeled should be at least 10,000 feet (5,000 for each link) to ensure pollutant capture. The link width (mixing zone) of the roadway need to be specified (in feet, arbitrary origin, y axis aligned with north). For example, a six-lane freeway might consist of six 12-feet wide lanes, and a 62-feet wide median, or 134 feet. Add to this an additional 10 feet on each side of the roadway to account for the wake of moving vehicles, and the total link width becomes 154 feet. The user should supply to the model the roadway width (including an assumed 10 feet on both sides of the roadway) applicable to the project site. One also needs to specify the elevation of the roadway compared to the surrounding area. For roadways at grade, this height is 0; for elevated and depressed roadways, this is the positive or negative relative height, respectively.

A set of receptors at varying distances from the roadway needs to be specified in terms of their x, y and z coordinates as well. SMAQMD recommends the standard receptor height of 6 feet (z coordinate), even when considering multistory projects. If the building envelopes are known and included in the application to the land use authority, the receptor should be placed at the building. Otherwise, the receptor should be placed at the edge of the property boundary. All parameters are specific to the project site subject to the HRA, and need to be defined and noted by the modeler accordingly.

Other parameters needing specification for a CAL3QHCR model run, along with default values, are listed in Table 4. These defaults were used in the calculations that produced the screening tables.

CAL3QHCR has many other features that allow modeling traffic intersections, traffic signaling, and traffic queuing. Employing these features is quite site specific. If these features must be employed, the CAL3HQCR User's Guide[9] should be consulted.

[9] User's Guide to CAL3QHC Version 2.0, EPA-454/R-92-006 (Revised, with CAL3QHCR addendum), September 1995.

The output from the CAL3QHCR dispersion modeling run will be PM10 concentrations expressed in micrograms per cubic meter (µg/m$^3$) at the defined receptor locations. The local agency or its consultant should complete the risk assessment for eight receptor distances from the roadway (10, 24, 50, 100, 200, 300, 400, and 500 feet) and the receptor location that is the site of the nearest potentially affected population. This is to show the relationship between cancer risk and receptor distance from the freeway or major roadway.

**Table 3: EMFAC2007 Relative Traffic Volume and Vehicle PM10 Emission Rates for SMAQMD in 2007 for Default Inputs into CAL3QHCR**

| Time of day | Relative VMT | PM10 emission rate (g/vehicle-mile) |
|---|---|---|
| Hr 00 | 0.15 | 0.072 |
| Hr 01 | 0.061 | 0.059 |
| Hr 02 | 0.071 | 0.101 |
| Hr 03 | 0.039 | 0.367 |
| Hr 04 | 0.067 | 0.106 |
| Hr 05 | 0.12 | 0.089 |
| Hr 06 | 0.465 | 0.062 |
| Hr 07 | 0.938 | 0.034 |
| Hr 08 | 0.887 | 0.036 |
| Hr 09 | 0.56 | 0.051 |
| Hr 10 | 0.587 | 0.049 |
| Hr 11 | 0.734 | 0.044 |
| Hr 12 | 0.757 | 0.038 |
| Hr 13 | 0.747 | 0.038 |
| Hr 14 | 0.858 | 0.029 |
| Hr 15 | 0.873 | 0.029 |
| Hr 16 | 0.918 | 0.031 |
| Hr 17 | 1 | 0.025 |
| Hr 18 | 0.692 | 0.021 |
| Hr 19 | 0.517 | 0.021 |
| Hr 20 | 0.398 | 0.036 |
| Hr 21 | 0.405 | 0.035 |
| Hr 22 | 0.303 | 0.024 |
| Hr 23 | 0.228 | 0.031 |

**Table 4: Other CAL3QHCR Parameters**

| Parameter | Default | |
|---|---|---|
| Calculation averaging time (min) | 60 | |
| Surface roughness (cm, from 3 to 400). For mixed uses and others not listed here, the modeler should make a reasonable assumption. | single family | 108 |
| | offices | 170 |
| | apartments | 370 |
| Settling velocity (cm/s) | 0 | |
| Deposition velocity (cm/s) | 0 | |
| Site setting (U=urban, R=rural) | U | |
| Form of traffic volume, emission rate data (1=one hour's data, 2=one week of hourly data) | 2 | |
| Pollutant (P for PM10 to give output in $\mu g/m^3$) | P | |
| Hourly ambient background concentration ($\mu g/m^3$) | 0 | |
| Roadway height indicator (AG=at grade, FL=elevated and filled, BR=bridge, DP=depressed) | AG | |
| Roadway height (ft, 0 if AG, relative height if FL, BR, or DP) | 0 | |

## Calculating Potential Cancer Risk

The local agency or its consultant should complete the risk assessment for eight receptor distances from the roadway (10, 24, 50, 100, 200, 300, 400, and 500 feet) and one receptor location that is the site of the nearest potentially affected population.

The inputs into the HRA should represent traffic and emissions data for the first year of exposure.

The PM10 concentrations modeled from CAL3QHCR are used in conjunction with the diesel PM Unit Risk Factor established by the State of California Office of Environmental Health Hazard Assessment (OEHHA) to determine the incremental increased cancer risk. The value for diesel PM as established by OEHHA is $3 \times 10^{-4}$ per $\mu g/m^3$.[10] The factor is a value established via lab studies and represents the increased chance of developing cancer based on concentration exposure. The value incorporates many worst case assumptions including a constant exposure to diesel PM (24 hours a day) and a 70 year life span.

[10] Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, can be obtained from www.arb.ca.gov/toxics/healthval/healthval.htm, April 2005

Guidance exists for calculating risks based on 9 year (EPA) and 30 year (Census Bureau) exposure timeframes. SMAQMD recommends, at this time, using the standard Office of Environmental Health and Hazard Assessment (OEHHA) 70 year timeframe as the basis for the site specific health risk assessment.[11]

The Unit Risk Factor is multiplied by the concentration results from CAL3QHCR to determine the increased cancer risk. The calculated value represents the increased chance of developing cancer over a person's lifetime. Increased cancer risk is typically discussed and presented in increased number of cases per one million people. To convert the calculated risk into typically discussed terminology, the calculated risk is then multiplied by one million ($1 \times 10^6$) and the denominator is changed from per person to per one million people.

A sample calculation is performed below for reference.

Concentration at 100 feet $0.0025\ \mu g/m^3$
Unit risk factor for diesel PM $3 \times 10^{-4}\ (\mu g/m^3)^{-1}$
Calculated increased risk = $(0.0025\ \mu g/m^3) * (3 \times 10^{-4}\ (\mu g/m^3)^{-1}) * (1 \times 10^6)$
= 0.75 cases per million people

The land use agency or its consultant should report the potential cancer risk numbers for the recommended specified distances.

[11] According to the Air Toxics Hot Spots Program Risk Assessment Guidelines: The Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments (Guidelines) published by the Office of Environmental Health and Hazard Assessment (0EHHA), the 9-year exposure scenario coincides with the U.S. EPA's estimates of average residence time. The 9-year exposure timeframe is for the first 9 years of life and is therefore protective of children. Children have higher intake rates on a per kilogram body weight basis and thus receive a higher dose of the pollutants. The 30-year exposure timeframe coincides with the U.S. EPA's high-end estimate of residence time. The 70-year exposure timeframe is considered to be the typical lifetime. According to the Guidelines, "OEHHA recommends the 70-year exposure duration be used for determining residential cancer risks. This will ensure that the person residing in the vicinity of the facility for a lifetime will be included in the evaluation of risk posed by that facility. Exposure durations of 9-years and 30-years may also be evaluated as supplemental information to show the range of cancer risk based on residency periods." For more information, please refer to the Air Toxics Hot Spots Program Risk Assessment Guidelines: The Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments. August, 2003.

## Site Specific HRA Reporting

In the report of the HRA results, detail on the dispersion modeling inputs as well as the risk results by distance should be provided.

**Figure 4: Site Specific HRA Reporting**

At a minimum, SMAQMD recommends the HRA report include the same information reported in the screening evaluation as well as the following:

- Emissions input data and calculation year for PM10, if different from Table 3. The HRA should represent emissions and VMT data for the first year of exposure from the most recent version of EMFAC.
- List of CAL3QHCR parameters used in the modeling, in the format of Table 4; explanation or references for parameters
- Name and source of meteorological data set used in CAL3QHCR
- Table indicating varying cancer risk per million from 10 to 500 feet from modeled roadway for PM10 (10, 24, 50, 100, 200, 300, 400, and 500 feet)
- Incremental cancer risk value (potential cases/million people) for the receptor nearest the edge of the nearest travel lane based on PM10.

## Potential Mitigation Measures

At this time, very little information exists on quantifiable mitigation measures. Exposure to diesel PM is best reduced by increasing project distance from the major roadway.

Nevertheless, potential measures could include electrostatic air filtering systems and vegetative barriers such as plantings of finely-needled trees to disperse and catch pollutants.

The SMAQMD is, and will continue, actively supporting and encouraging research to identify effective and quantifiable mitigation measures that reduce exposure to air toxics from mobile sources.

# Resources

The following are sources of information for use by the local agency or its consultant that may prove useful in the risk screening and site specific HRA process:

- The Caltrans website reports peak traffic volumes at various intersection or milepost locations for all numbered roadways in the state: http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/

- Table 3 gives the appropriate VMT and emission factor data for use in CAL3QHCR. That information was extracted from ARB's emission factor model; the most recent version is EMFAC2007, released November 2006, http://www.arb.ca.gov/msei/onroad/latest_version.htm.

- The line source dispersion model CAL3QHCR can be obtained from the EPA website: http://www.epa.gov/scram001/dispersion_prefrec.htm. User guides for employing the model can be found on the same website

- Cancer unit risk factors are provided by ARB on the following website: www.arb.ca.gov/toxics/healthval/healthval.htm

- The Appendix to this document contains information extracted from a report prepared by our consultant that provides more discussion of the Protocol development, including the site specific evaluation process. The Appendix can be found at www.airquality.org. You may also request a copy by contacting Rachel DuBose at 916.874.4876 or rdubose@airquality.org.

# Glossary of Terms

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| Ahead Peak Hour | Ahead peak hour usually represents traffic north or east of a traffic count location. |
| Ambient Background Concentration | The annual average of PM10 already present in the air. |
| Back Peak Hour | Back Peak Hour represents traffic south or west of a traffic count location. |
| Background concentration | See “Ambient” |
| Calculation Averaging Time | Expressed in minutes. The most common value is 60 minutes which represents calculations of averages over one hour periods. |
| Calculational Domain | The geographical area over which a simulation (air dispersion model run) is performed |
| Cancer Risk Value | Potential cancer cases per million |
| Compass Orientation | The location of a project expressed as being located north, south, east or west of a freeway or major roadway |
| Concentration | The concentration of particulate matter per a measure of air, usually expressed as micrograms per cubic meter of air ($\mu g/m^3$). |
| Deposition Velocity | The rate at which material leaving the air is deposited on the ground (cm/s). |
| Dispersion | The process or result of the spreading of pollutants from one place to another |
| Downwind | The direction toward which the wind is blowing; in the path of pollutant dispersal |
| EMFAC (on-road) | ARB’s on-road motor vehicle emissions model which estimates the amounts and types of pollutants emitted from on road vehicles in California |
| Evaluation Criterion | The point at which SMAQMD recommends performing a site specific health risk assessment |

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| Freeway | A divided arterial highway designed for the unimpeded flow of large traffic volumes |
| Health Risk Assessment (HRA) | Scientific evaluation of the probability of harm resulting from exposure to toxic or hazardous materials. |
| High Traffic/Volume Roadway | A freeway, urban road with 100,000 vehicles per day, or rural road with 50,000 vehicles per day |
| Incremental (cancer cases) | Cancer cases in addition to the ambient background |
| Line Source | A source of air pollution that emanates from linear (one-dimensional) geometry, such as vehicle emissions from a roadway |
| Major Roadway | See “High Traffic/Volume Roadway” |
| Mass Emission Rate | The rate of pollutant output expressed in mass, as in grams per second (g/s) |
| Mixing Zone | The mixing zone is considered to be the area of uniform emissions and turbulence |
| Peak Hour Traffic | The measure of the peak traffic volume for the year |
| PM 10 (diesel) | An air pollutant consisting of small particles with an aerodynamic diameter less than or equal to a nominal 10 microns (about 1/7 the diameter of a single human hair). Their small size allows them to make their way to the air sacs deep within the lungs where they may be deposited and result in adverse health effects such as the aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense systems against foreign materials, damage to lung tissue, carcinogenesis and premature death (see Toxic Air Contaminant) |
| Receptor | A hypothetical individual exposed to diesel particulate matter |
| Receptor Height | Breathing height (receptors should be placed at the standard breathing height of 6 feet) |
| Risk Value | The result of a health risk assessment that produces an estimate of cancer cases/million people due to exposure to diesel particulate matter |
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| Rural Road | A roadway located in a rural area with 50,000 vehicles per day or greater. |
| Rural Area | Per the Health and Safety Code, Section 50101: "'Rural area' means any open country or any place, town, village, or city which by itself and taken together with any other places, towns, villages, or cities that it is part of or associated with: (a) has a population not exceeding 10,000; or (b) has a population not exceeding 20,000 and is contained within a nonmetropolitan area. "Rural area" additionally includes any open country, place, town, village, or city located within a Standard Metropolitan Statistical Area if the population thereof does not exceed 20,000 and the area is not part of, or associated with, an urban area and is rural in character." |
| Sensitive Land Use | See "Sensitive Receptor" |
| Sensitive Receptor | Those segments of the population most susceptible to poor air quality such as children, elderly, and those with compromised immune systems. Land uses where sensitive receptors are most likely to spend time include residential communities, schools and school yards, day care centers, parks and playgrounds, hospitals and medical facilities. |
| Settling Velocity | The velocity of material falling towards the ground (cm/s) |
| Surface Roughness | A measure of the roughness of a surface and the amount of air mixing due to mechanical turbulence as air moves over surface features (cm) |
| Toxic Air Contaminant | As defined by California Health and Safety Code, Section 39655 (a): "an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health" |
| Upwind | In the direction from which the wind is blowing; in the path of pollutant dispersal |
| Unit Risk Factor | A toxicity factor that is used to estimate the increase risk of developing cancer associated exposure to a concentration of a chemical |
| $\mu g/m^3$ | Micrograms per cubic meter of air. A measure of concentration of a pollutant |
| VMT | Vehicle miles traveled are total miles traveled by all vehicles in a particular geographic area, often measured over a 24-hr period |