Health Risk Assessments & Land Use

May 3, 2010

CAPCOA Guidance Document

CAPCOA developed this guidance document to assist lead agencies insure compliance with CEQA.

"Health Risk Assessments for Proposed Land Use Projects"

http://www.capcoa.org/rokdownloads/HRA/CAPCOA_HRA_LU_Guidelines_8-6-09.pdf

Presentation Overview

- An explanation of how the Document evolved.
- A description of the 2 main parts of the Document:
  - CEQA risk assessment policy issues.
  - Modeling and risk assessment procedures.
- A discussion of the implications of the Document.

How Guidance Evolved

The CAPCOA Document evolved from the 2005 ARB document titled:

“**Air Quality & Land Use Handbook**”

- This was part of ARB’s Community Health Initiative.

- It contained recommended <u>buffer distances</u> for:
  - High volume roadways
  - Distribution centers
  - Rail yards
  - Ports
  - Refineries
  - Chrome plating facilities
  - Dry cleaners
  - Large gas dispensing facilities

- This document recommended a need for risk assessments to be prepared to evaluate various new projects.

How CAPCOA Responded

- Districts began discussing how and when risk assessments should be prepared for CEQA.
- In 2005, CAPCOA began discussing the need for consistency in assessing proposed development projects throughout California.
- In 2006, CAPCOA formed a Subcommittee consisting of planning managers, and staff skilled in evaluating health risks for other programs, to discuss when and how risk assessments should be prepared.

Goal of Subcommittee

Prepare guidance document which describes a statewide uniform protocol for determining:

- **When** risk assessments should be prepared.
- **How** risk assessments should be prepared.
- What to do with the results.

Components of the Guidance Document

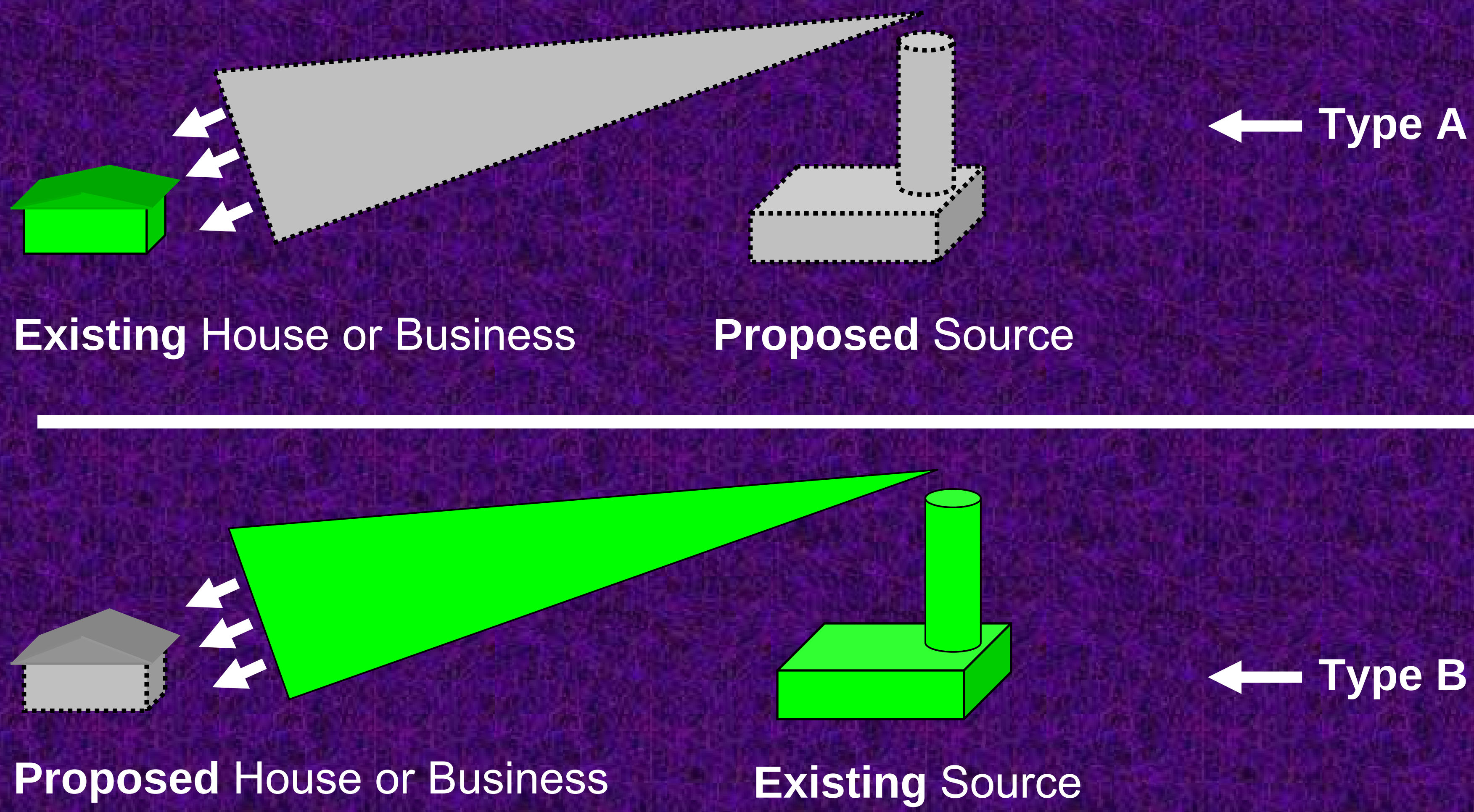
- Legal justification.
- When should a risk assessment be prepared.
- How a risk assessment should be prepared.
- What to do with results.
- Mitigation measures.
- Public participation guidance.

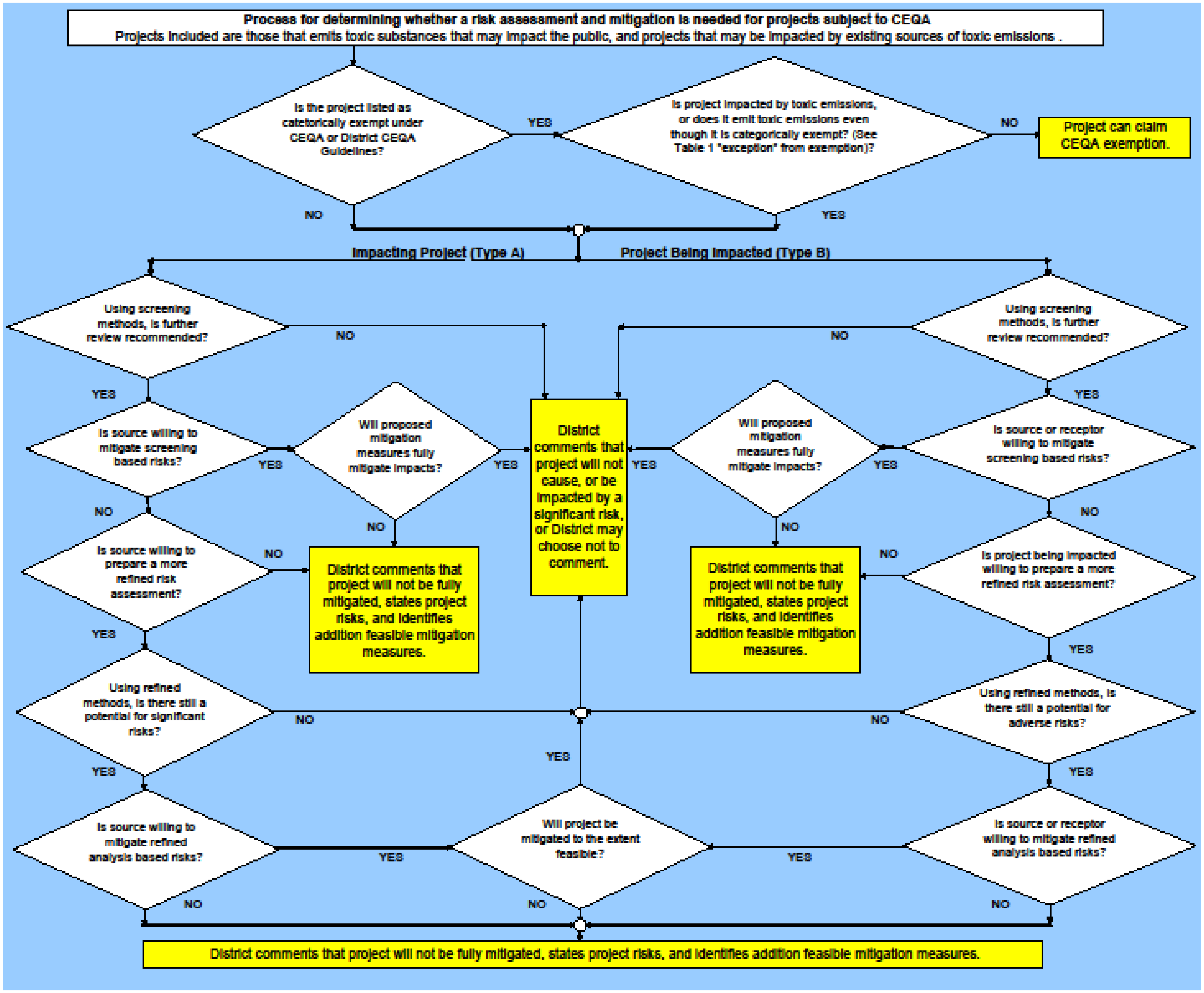
Legal justification

Section 15126.2(a) requires environmental impacts to be identified for two types of projects:

- Projects that can cause an adverse health impact on the people already living or working nearby (Type A).
- Projects, such as new residential developments, that will be located in an area that can cause adverse health impacts to those residents (Type B).

Types of projects addressed by CEQA




Process for determining whether a risk assessment and mitigation is needed for projects subject to CEQA
Projects included are those that emits toxic substances that may impact the public, and projects that may be impacted by existing sources of toxic emissions .
Is the project listed as catetorically exempt under CEQA or District CEQA Guidelines?
YES
Is project impacted by toxic emissions, or does it emit toxic emissions even though it is categorically exempt? (See Table 1 "exception" from exemption)?
NO
Project can claim CEQA exemption.
NO
YES
Impacting Project (Type A)
Project Being Impacted (Type B)
Using screening methods, is further review recommended?
NO
NO
Using screening methods, is further review recommended?
YES
YES
Is source willing to mitigate screening based risks?
YES
Will proposed mitigation measures fully mitigate impacts?
YES
District comments that project will not cause, or be impacted by a significant risk, or District may choose not to comment.
YES
Will proposed mitigation measures fully mitigate impacts?
YES
Is source or receptor willing to mitigate screening based risks?
NO
NO
NO
NO
Is source willing to prepare a more refined risk assessment?
NO
District comments that project will not be fully mitigated, states project risks, and identifies addition feasible mitigation measures.
District comments that project will not be fully mitigated, states project risks, and identifies addition feasible mitigation measures.
NO
Is project being impacted willing to prepare a more refined risk assessment?
YES
YES
Using refined methods, is there still a potential for significant risks?
NO
NO
Using refined methods, is there still a potential for adverse risks?
YES
YES
YES
Is source willing to mitigate refined analysis based risks?
YES
Will project be mitigated to the extent feasible?
YES
Is source or receptor willing to mitigate refined analysis based risks?
NO
NO
NO
District comments that project will not be fully mitigated, states project risks, and identifies addition feasible mitigation measures.

When should a risk assessment be prepared?

- First step - Determine if project is subject to CEQA.
- Second step - Determine if toxic substances will be emitted, or impacted project.
- Third step – Screening Assessment.
- Fourth step – Refined Assessment.

First Step – Exempt Projects

Projects can be subject to CEQA unless they are:

- Statutorily exempt, for example:
  - Ministerial projects, such as issuance of building permits, or approval of final subdivision maps.
  - Issuance, modification, amendment, or renewal of Title V air quality permits.
- Categorically exempt, for example:
  - Actions by regulatory agencies for protection of the environment.
  - Cogeneration projects at existing facilities.

(See Section 4.0, Table 1 of the CAPCOA Guidelines)

Second Step – Toxics Emitted?

- Nearly all combustion processes, & mobile sources.
- Processes that use toxic substances.
- Many EPA, CARB, and district resources are available to indicate whether toxic substances will be released from a project.

Contact District for guidance

Third Step - Screening Tools

Various tools can be used to determine if a significant risk may result from project:

- Prioritization or other spreadsheet calculations.
- SCREEN3 modeling.
- ARB's 2005 AQ & LU Handbook.
- Other tools are under development.

Contact District for guidance

Fourth Step - Refined Assessment

Sometimes refined modeling can be done nearly as easily as other screening procedures.

Stationary sources.

AERMOD
ISCST3

Road vehicles emissions.

CAL3QHCR
AERMOD
ISCST3

(These procedures will be discuss later in the presentation.)

Contact District for guidance

What to do with results?

Suggested levels of significance:

Type A (new source)

>10 per million cancer risk

>1 Hazard Index

Type B (new receptor)

Varies by district

Contact District for specific guidance.

Mitigation Measures

CEQA Guidelines Section 15364, requires all "Feasible" Measures must be applied within a reasonable period of time accounting for:

- Economic,
- Environmental,
- Legal,
- Social, and
- Technological Factors.

Mitigation Measures
Air Toxic Control Measures (ATCMs)

Emission reductions created by accelerating the implementation of ATCMs, or by expanding the applicability of ATCMs can be considered mitigation measures, if they are <u>enforceable</u>.

<u>Contact District for guidance</u>

Mitigation Measures - Project Placement

Project Placement is an effective way to mitigate risks:

Type A (new source)

- Emission sources may be located further from receptors.

Type B (new receptor)

- Receptors may be located further from emission sources

Mitigation Measures
Quantifiable & Unquantifiable

Mitigations measures can be quantifiable or Unquantifiable:

- Quantifiable measures:

  Example:

  Verified diesel particulate filters.

- Unquantifiable measures*:

  Example:

  Trees and hedges along roadways.

*Unquantifiable measures - are measures based on limited data / studies indicating emissions may be reduced, but information is insufficient to quantify the reductions at this time.

Mitigation Monitoring

The Lead agency may need to require mitigation monitoring for the life of project.

(CEQA Public Resources Code 21081.6)

Examples:

- Vegetation barrier maintenance.
- Diesel particulate filters maintenance.
- Indoor air filtration systems maintenance.

Public Participation Guidance

- Public participation can be critical.
- Early community discussions can reduce the potential for disagreements or challenges that can delay or stop projects, even when a project can meet risk thresholds.
- ARB’s 2005 AQ & LU Handbook provides some guidance.
- Other public participation guidance documents.

Misc. Policy Issues

The CAPCOA Guidelines also includes discussion on these issues:

- Smart Growth.
- Less than Lifetime Cancer Risk Exposures.
- Mitigating Roadway Toxics.
- Existing Background Risks.
- Inappropriate Discounting of Risks.
- Misleading Comparison of Cancer Risks.
- Experts Disagree.

Potential Conflict – “Smart Growth”

Sometimes infill (smart growth) results in residences being located in areas near existing sources of toxic emissions.

Example:

- Residential units placed next to freeways or industrial sources.

Potential Conflict - Mitigating Roadway Toxics

Potential conflicts can occur when existing zoning allows houses adjacent to freeways regardless of risks.

Less than Lifetime Cancer Risk Exposures

Inappropriate and appropriate risk calculations based on less than lifetime exposures.

Residential Receptor example:

Exposure Period – 9 years

Average residence.

Ignores 50% of the population!

OEHHA "Hot Spots" Program Guidance:

- Residential receptors - 70 years
- Worker receptors - 40 years

* New OEHHA Guidelines will account for the greater exposures to infants and children.

<u>Contact District for guidance</u>

Inappropriate Discounting of Risks

The CAPCOA Guidelines were meant to minimize inappropriate risk assessment methodologies designed to downplay health impacts.

Experts Disagree

- Controversy can delay project decisions.

- Section 15151 of the CEQA Guidelines states that disagreement among experts “does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among experts.”

Discussion

Modeling and Risk Assessment Preparation Guidance Section

(Technical Section)

This section describes basic procedures used to calculate risk*

Cancer Risks – probability per million, 70 years

Chronic Hazard Index – 1 year aver. conc.

Acute Hazard Index – 1 & 8 hour max. conc.

* More detailed descriptions can be found in OEHHA's risk assessment and modeling guidance documents.

Cancer Risk Calculation

$$\text{Cancer Risk} = \text{Slope} * \underbrace{\frac{C_{air} * \{DBR\} * A * EF * ED * 10^{-6}}{AT}}_{\text{Inhalation Dose}}$$

Slope =	**1.1** $(mg/kg\text{-}day)^{-1}$	Diesel Particulate
Inhalation Dose =		Dose through inhalation (mg/kg-d)
10^{-6} =		Micrograms to milligrams conversion, liters to cubic meters conversion
C_{air} =		Concentration in air ($\mu g/m^3$), modeled annual average concentration
{DBR} =	**302** L/kg-day	Daily breathing rate (L/kg body weight - day) (80%ile)
A =	**1**	Inhalation absorption factor
EF =	**350** days/year	Exposure frequency (days/year)
ED =	**70** years	Exposure duration (years)
AT =	**25,550** days	Averaging time period over which exposure is averaged, in days (70 years * 365 = 25,550 days)

Risk @ 100 feet = 1.1 (mg/kg-day)-1 * 0.05 ug/m3 * 302 L/kg-day * 1 * 350 days/yr * 70 yrs / 25,550 days
= 159 / million

Acute and Chronic Hazard Index

$$HI_{acute} = \sum HQ_i = Conc_i / REL_{i,\,a}$$

(Only substances that affect the same body parts or organs are summed)

Ammonia – eye & respiratory
Toluene – eye, respiratory, developmental, nervous, reproductive
Methyl chloroform – nervous system

$$HI_{chronic} = \sum HQ_i = Conc_i / REL_{i,\,ch}$$

(Only substances that affect the same body parts or organs are summed)

Formaldehyde – respiratory
Acrolein – respiratory
Isopropyl Alcohol – kidney, developmental

Steps to prepare a Risk Assessment

1. Determine emissions.

2. Model emissions (Main Focus of Guidelines).

3. Determine exposures (dose).

4. Calculate risks.

Determine Emissions*

<u>Stationary Sources</u>

- Mass Balances
- Emissions Factors (AP-42 and other sources)
- Source Testing of Similar Devices

<u>Mobile Onsite Sources</u>

- ARB Emission Factors from ATCM reports

<u>Roadway Vehicles</u>

- ARB Emission Factors from ATCM reports
- Traffic Counts – Caltrans, Local Agency data
- EMFAC Emissions Model

*Emissions estimating procedures are not included in this document.

Modeling - Source types covered by the Guidance

Point sources:

- Traditional stacks

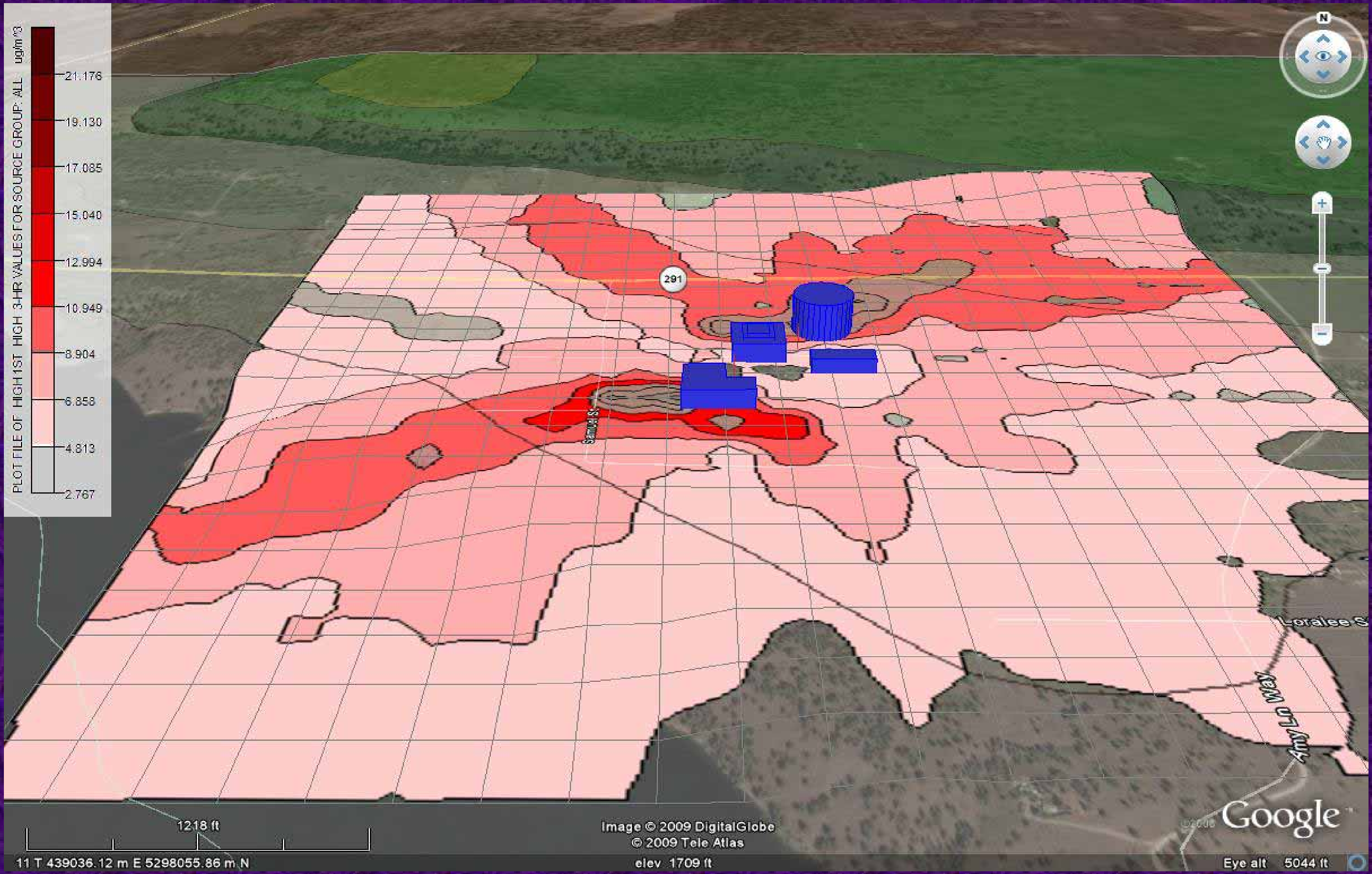
Area sources:

- Truck Stops (alternatively, volume source)
- Construction projects
- Quarries
- Evaporation ponds

Volume sources:

- Roads and Railways
- Gas stations
- Dry cleaners
- Various building configurations

Dispersion Modeling - Main Focus of Guidelines



Modeling Emissions

Modeling is often an iterative process working with air district staff.

Simple screening methods → refined methods.

As complexity increases,
risk levels tend to drop, but
preparation & review costs tend to increase.

Modeling Emissions

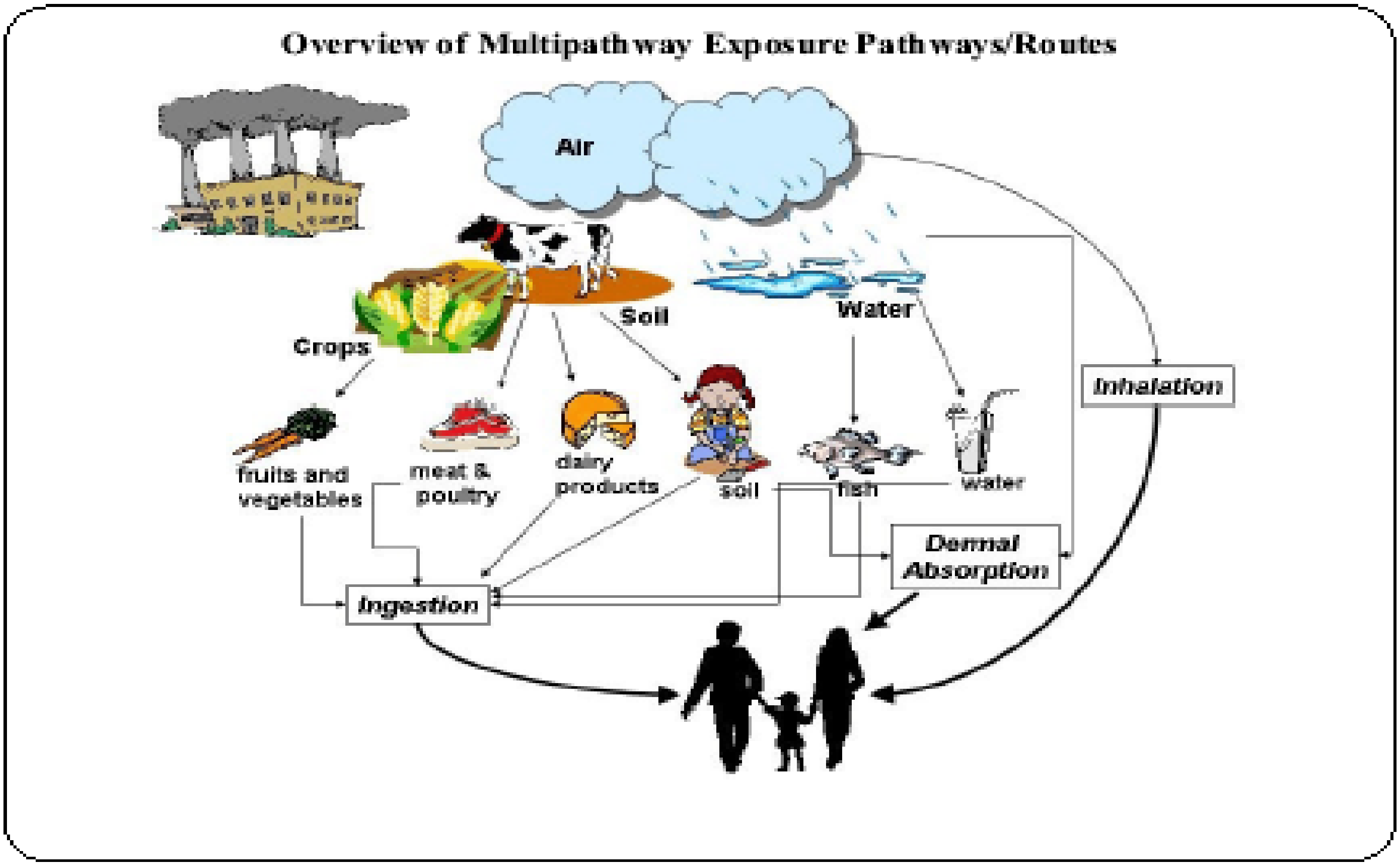
Modeling is concluded once the proponent and their consultant have, to their best ability, included all sources of toxic emissions that are reasonably expected to be present in modeled runs.

To streamline the modeling process, some local air districts allow for modeling protocols to be submitted for review before commencement of actual modeling runs.

<u>contact air district for guidance.</u>

Exposures Assessments

Exposure Assessments calculate the dose from various pathways. CAPCOA Guidelines defer to OEHHA procedures.



Exposure Assessment

Dose can be determined for each Exposure Pathway

- Inhalation*
- Dermal (skin) absorption*
- Ingestion:*
  - Water
  - Soil*
  - Food:
    - Plants* (home grown gardens)
    - Fish and Animals
    - Mother's Milk*

*Minimum Pathway required by OEHHA in a health risk assessment

Calculate Risk

- **For substances involving only the <u>inhalation</u> <u>pathway</u>, risks can be calculated using the formulae in Chapter 8.**

- **For substances involving <u>multiple</u> <u>pathways</u>, risks can only be calculated using ARB's HARP program.**

Health Risk Disclosure & Mitigation

- All health risk must be disclosed.
- All possible mitigation measures must be identified.
- Degree of proposed mitigation implementation must be identified.

Mitigation Measures

The CAPCOA Guidelines include:

- General and specific mitigation measures.
- Project location / site design guidance.
- Unquantifiable mitigation measures.

  Unquantifiable measures - are measures where there are limited data / studies that indicate that emissions may be reduced, but information is insufficient to quantify the reductions at this time.

- Mitigation monitoring measures.

Living Document

As science of risks improves, modification to the Guidance will be needed.

Potential improvements:

- Exposure Assessment Methods,
- Modeling Procedures,
- Screening Methodologies.

Discussion

District Roadway Modeling

Road Modeling Using AERMOD

AERMOD

User friendly commercial product examples:

- Lakes Environmental Inc. - AERMOD View
- Trinity Consultants – Breeze AERMOD
- ORIS Solutions – Beest

EPA developed.

Fortran language based model.

Road Modeling

Roadways & Commercial / Industrial Properties

- Diesel Travel, Idle, & TRU emissions.

Residential project:

- Roadways (major arteries, hwys, & freeways)
- Nearby commercial / industrial operations

(May include other emission sources)

Mixed Use projects:

- Can include all of the above.

Contact District

Diesel Truck Emissions

- Truck Travel
- Truck Idling
- Diesel engines powering trailer refrigeration units (TRUs)

Guidance Documents

"Health Risk Assessment Guidance for Analyzing Cancer Risks from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis“

http://www.aqmd.gov/ceqa/handbook/mobile_toxic/mobile_toxic.html

AERMOD User's Guide

http://www.epa.gov/scram001/dispersion_prefrec.htm

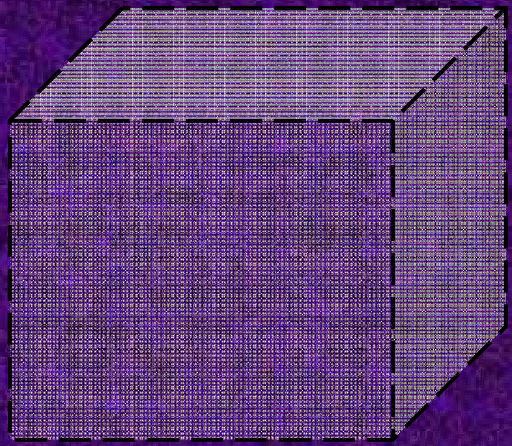
OEHHA "Air Toxics Hot Spots Program Risk Assessment Guidelines Part IV Technical Support Document for Exposure Assessment and Stochastic Analysis"

http://www.oehha.ca.gov/air/hot_spots/pdf/Stoch4f.pdf

Series of Volume Sources

Truck Traveling

- Modeled as a Series of Volume Sources following the path of travel



Example **Volume** Parameters

- **Height** = Truck Height (assume ~15 ft)
- Initial Vertical Dimension = Height / 4.3

- **Width** (W) = Truck Width (assume ~12 ft)
- Initial Lateral Dimension = 2W / 2.15

- **Release height** = based on truck configuration.

- **Traveling Emission Factors** = from EMFAC.

- Site specific data should be used, if known.

- See AERMOD Users Guide.

Truck Idling

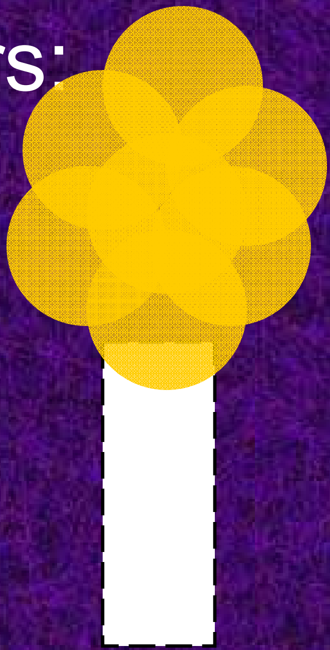
Can be modeled as a:

- Point,
- Area, or
- Volume Source

depending on the circumstance, contact the District for guidance.

Diesel Idling - Example Modeling Parameters

Vertical Exhaust Stack Parameters:



- Height = 3.84 meters
- Diameter = 0.1 meters
- Velocity = 51.71 m/s
- Temperature = 366 K

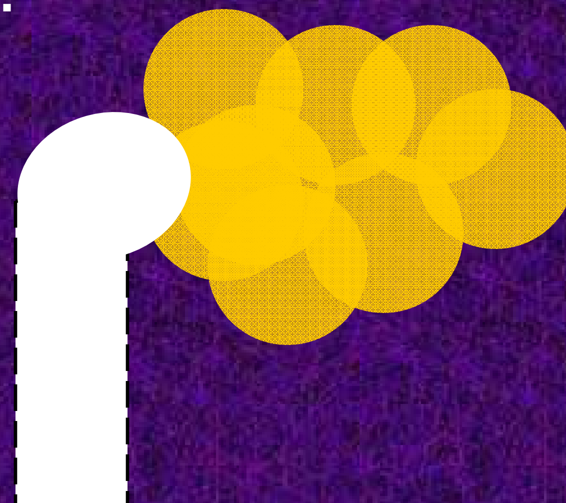
- Emission Factors derived from EMFAC run

- Project specific data should be used when available, contact the District for guidance.

Diesel Idling - Example Modeling Parameters

High Horizontal Exhaust Parameters:

- Height = 3.84 meters
- Diameter = 0.1 meters
- Velocity = 0.001 m/s
- Temperature = 366 K



- Emission Factor derived from EMFAC run

- Project specific data should be used when available, contact the District for guidance.

Diesel Idling - Example Modeling Parameters

Low Horizontal Exhaust Parameters:

- Height = 0.183 meters
- Diameter = 0.1 meters
- Velocity = 0.001 m/s
- Temperature = 366 K

- Emission Factor derived from EMFAC run

- Project specific data should be used when available, contact the District for guidance.

TRU Emissions

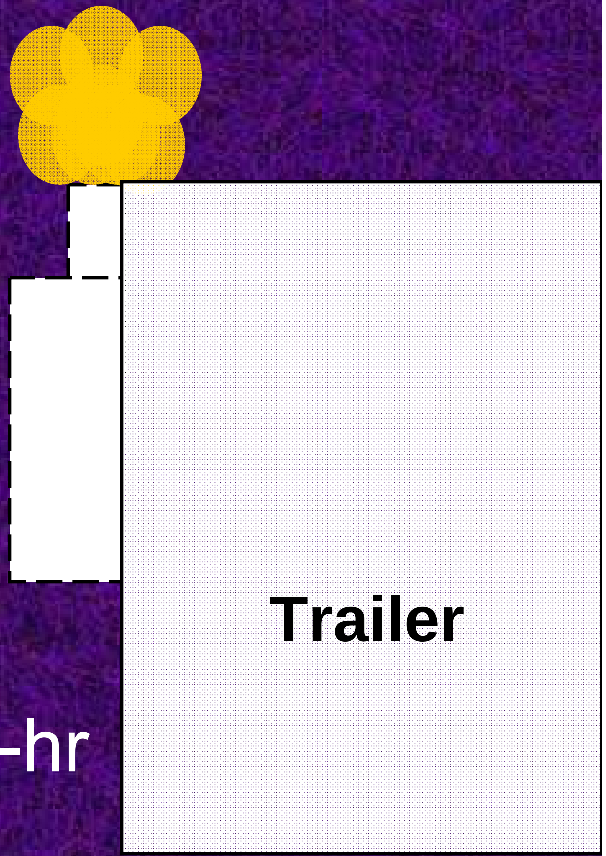
Can be modeled as a:

- Point,
- Area, or
- Volume Source

depending on the circumstance, contact the District for guidance.

TRU Example Stack Parameters

- Height = 3.96 meters
- Diameter = 0.04445 meters
- Velocity = 49 m/s
- Temperature = 501 K



- Emission Factor = 0.76 g/BHP-hr

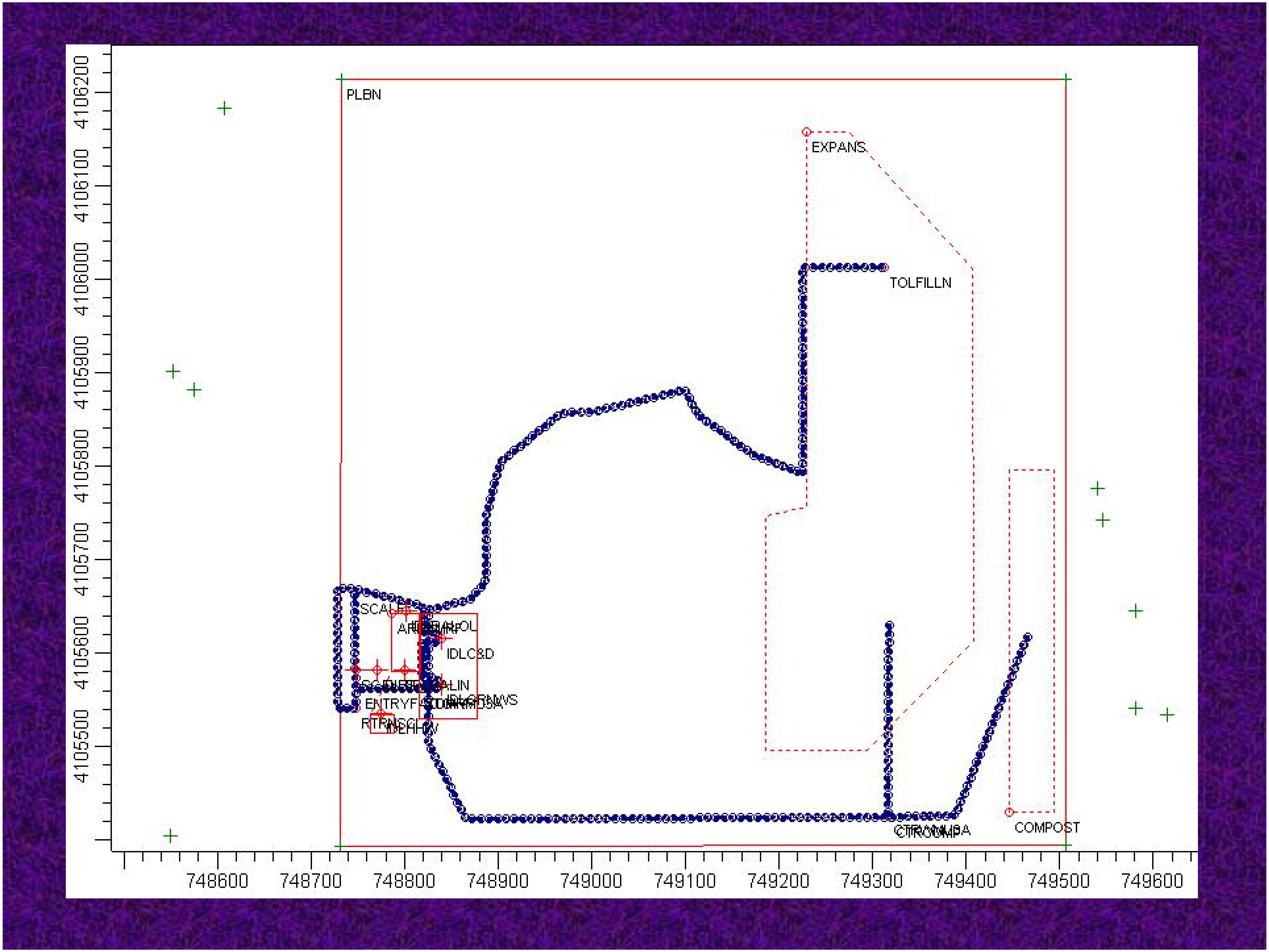
- Unit specific data should be used, if known.

Example Project

Example Project

<u>Landfill Sources:</u>

- Composting
- Expansion of Existing Landfill
- Waste Recycling / Separation
- Truck Unloading
- Scale Area
- Truck Travel
- Truck Idling



PLBN
EXPANS
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4106200
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99
Rd 19 1/2
Ave 21-1/2
© 2010 Google
©2009 Google
37°03'54.71" N 120°11'52.47" W elev 247 ft
Eye alt 2446 ft

Discussion

Roadway Modeling using CAL3QHCR

Example Project Location

CAL3QHCR Model

Line source model

Inhalation pathway only

Inputs:

- Roadway link information – above/below grade, UTM coordinates, etc…
- Emission factors – derived From EMFAC.
- ISCST3 met files are compatible with CAL3QHCR.
- Traffic data – from CALTRANS.
- Receptor locations.

Methodology for Preparing Traffic Data Inputs

Procedure described in detail in the Guidelines.

Data sources:

- Peak hourly traffic volumes from CALTRANS. (http://www.dot.ca.gov/hq/traffops/saferesr/traffdata)
- EMFAC "Burden" results for hourly PM10 and VMT data.

Key assumptions:

- Gasoline PM toxic = Diesel PM toxicity.
- Ratio of cars to trucks is the same on all roadways throughout the county.

(Actual segment VMT use can result in greater accuracy.)

Standard Inputs

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 μg/m^3)	P	
Hourly ambient background concentration (μg/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	

Cancer Risk Calculation

(Inhalation pathway - Diesel PM)

Cancer Risk = Slope * Inhalation Dose

$$\underbrace{\qquad\qquad}_{} \quad \frac{\mathbf{Cair * \{DBR\} * A * EF * ED * 10^{-6}}}{\mathbf{AT}}$$

Slope =	**1.1** $(mg/kg\text{-}day)^{-1}$	Diesel Particulate
Inhalation Dose =		Dose through inhalation (mg/kg-d)
10^{-6} =		Micrograms to milligrams conversion, liters to cubic meters conversion
Cair =		Concentration in air (ug/m3), modeled annual average concentration
{DBR} =	**302** L/kg-day	Daily breathing rate (L/kg body weight - day) (80%ile)
A =	**1**	Inhalation absorption factor
EF =	**350** days/year	Exposure frequency (days/year)
ED =	**70** years	Exposure duration (years)
AT =	**25,550** days	Averaging time period over which exposure is averaged, in days (70 years * 365 days = 25,550 days)

Risk @ 100 feet = 1.1 $(mg/kg\text{-}day)^{-1}$ * 0.05 ug/m^3 * 302 L/kg-day * 1 * 350 days/yr * 70 yrs / 25,550 days

= 159 / million

Cancer Risk Results

CAL3QHCR modeling results

Location: South of Hwy 80 @ B Street

Distance from Edge of Nearest Travel Lane (feet)	Annual Average PM Concentrations (ug/m3)	Cancer Risk per million
0	1.20	382
10	1.07	341
25	0.89	284
50	0.70	223
100	0.50	159
200	0.32	102
300	0.24	76
400	0.19	61
500	0.16	51

Other CAL3QHCR Features

CAL3QHCR can only be used for modeling roadway segments.

When adding CAL3QHCR Road results to AERMOD Stationary Source results, a separate calculation is needed to determine total risks.

This step is not needed when using AERMOD for Road and Stationary Source results.

Model Comparisons

AERMOD

- EPA preferred.
- More current than ISCST3.
- Met data not always available.

ISCST3

- Commonly used.
- Many met data sets available.

CAL3QHCR

- Can use ISCST3 met data.
- Fewer people have experience using model.

Comparison of Modeling Results

Roadway modeling scenarios were applied to the AERMOD, ISCST3, & CAL3QHCR model.

The modeling results showed relatively insignificant differences.

Contact district for their model preference.

Discussion