Development of a Screening-Level Emission Inventory of Toxic Air Pollutants (TAPs) for the Bay Area

Presented to the CARE Task Force
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Introduction

Purpose of the TAP Emission Inventory: Support screening-level assessments of population exposures and selection of a study community.

Objective: Develop a first draft emission inventory for the Bay Area using existing information suitable for use with dispersion and exposure models.

General Approach

- Apply a top-down approach (as opposed to a bottom-up approach).
- Examples for dry cleaning facilities
  - Top-down approach
    - Estimate total solvent usage
    - Disaggregate according to employment, population, sales, or another appropriate variable
  - Bottom-up approach: option 1
    - Survey dry cleaning facilities for solvent usage and emission controls (if any)
    - Develop an extrapolation technique based on a known variable (e.g., sales, employment, etc.) that can be used for non-respondents and for the next few years
  - Bottom-up approach: option 2
    - Require drycleaners to report solvent use and emission controls (if any)

General Approach

1. Begin with existing criteria pollutant inventories.
2. Apply available chemical speciation profiles.
3. Apply available cancer and non-cancer unit risk factors.
4. Spatially allocate emissions.

Existing Inventories

BAAQMD has provided year-2000 inventories.

- County-level TOG and PM inventories for area and non-road sources (annual average)
- Gridded TOG and PM on-road mobile source inventories (summer weekday) and EMFAC inputs, which were prepared using the Direct Travel Impact Model (DTIM)
- Facility-specific TAP emission inventories for point sources

General Approach Behind the Existing Inventories

- Emissions = (Emission Factor) x (Activity Data)
- Emission Factor examples
  - pounds of emissions per gallon of oil burned
  - grams of emissions per mile traveled (vehicles)
  - pounds of emissions per gallon of paint
  - grains of emissions per cubic foot of air emitted
- Need activity data in units that match emission factors

Chemical Speciation

Existing speciation profile libraries

- ARB
- EPA (Speciate 3.2)
- Desert Research Institute (DRI)

Chemical Speciation

CAS No.	Pollutant	Percent
67641	ACETONE	2.14
123864	N-BUTYL ACETATE	2.6
71363	N-BUTYL ALCOHOL	1.82
	C-9 CYCLOPARAFFINS	7.3
	C10 PARAFFINS	16.78
	C4 SUBSTITUTED CYCLOHEXANE	17.04
	C7-C16 PARAFFINS	2.82
	C9 PARAFFIN	5.32
141786	ETHYL ACETATE	0.74
64175	ETHYL ALCOHOL	2.44
67630	ISOPROPYL ALCOHOL	2.84
67561	METHYL ALCOHOL	0.08
78933	METHYL ETHYL KETONE	4.16
108101	METHYL ISOBUTYL KETONE	1.4
	PARAFFINS/OLEFINS (C12-C16)	6.7
109604	N-PROPYL ACETATE	0.18
108883	TOLUENE	6.7
71556	1,1,1-TRICHLOROETHANE	1.76
	ISOMERS OF UNDECANE	9.62
	UNIDENTIFIED	4.44
1330207	ISOMERS OF XYLENE	3.12

EPA TOG Profile #6003: Architectural Coatings

Chemical Speciation

Cross-Reference Table

EIC Code	Description	Profile#
52052091050000	Primers & Sealers	6003
53053032250000	Pesticides	1000
54059004000000	Asphalt Roofing	2400

Speciation Profile Library

Profile#	CAS#	Pollutant	Percent
6003	67641	ACETONE	2.15
6003	123864	N-BUTYL ACETATE	2.60
6003	71363	N-BUTYL ALCOHOL	1.82

Unit Risk Factors

Risk from air pollution is assessed by multiplying ambient concentrations by inhalation unit risk factors (URF).

Risk is approximated as a linear function of ambient concentration.

URF Units of Measure =

(No. Cases of Effects) ÷ (Ambient Concentration)

Example: benzene

- ambient concentration of 2 $\mu g/m^3$
- URF = 7.8×10^{-6} $(\mu g/m^3)^{-1}$
- risk = 1.6×10^{-5} or "16 in a million"

Unit Risk Factors

Sources of Inhalation URFs

- ARB Approved Risk Assessment Health Values
- EPA Office of Environmental Health Hazard Assessment (OEHHA)
- EPA Integrated Risk Information System (IRIS)
- Risk Assessment Information System

Unit Risk Factors

- Best available factors were selected for each TAP in speciated inventories.
- URF-weighted emissions were calculated.
- Uncertainty ranges were documented where applicable.
- A database of risk-weighted emissions by TAP and source category was prepared.

Spatial Allocation

Area and Non-road Sources
- Apply spatial allocation factors (SAFs)

On-road Mobile Sources
- Already resolved to 2 km x 2 km grid

Point Sources
- Assign to facility location coordinates

Spatial Allocation

Spatial Allocation Factors were developed from geographic information systems (GIS) databases.
- Demographic data (e.g., population density)
- Landuse/Landcover datasets (e.g., residential versus agricultural land use)
- Line Length (railroad tracks)
- Facility locations
- Other available GIS databases

Spatial Allocation: Cross-References

Summary Category Name; Source Category Name	Spatial Surrogate
Oil and gas production (combustion); I.C. reciprocating engines	Locations of oil wells
Coatings and related process solvents; Auto refinishing	Locations of auto body shops
Waste burning and disposal; Agricultural burning of prunings	Agricultural land
Off-road equipment; Lawn and garden equipment	Land use for residential, service, and commercial use, and golf courses

Spatial Allocation: Cross-References

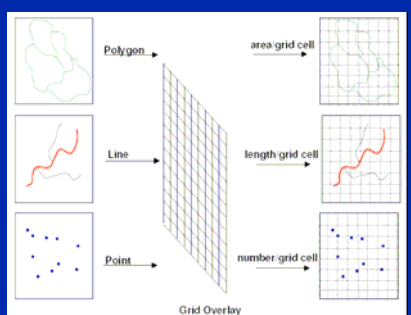
Cross-Reference Table

EIC Code	Description	SAF#
52052091050000	Primers & Sealers	1000
53053032250000	Pesticides	2000
54059004000000	Asphalt Roofing	3000

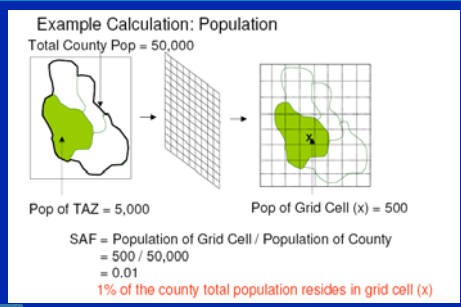
Spatial Allocation Factors

SAF#	XCELL	YCELL	Percent
1000	10	20	20.0
1000	11	20	50.0
1000	12	20	30.0

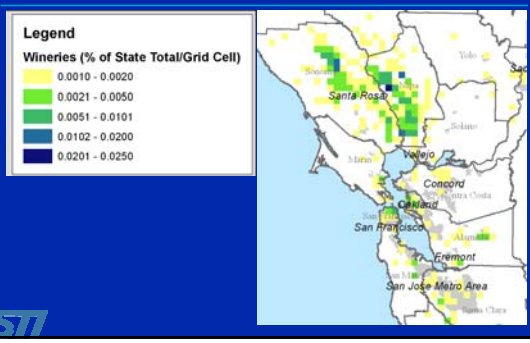
Spatial Allocation: Gridding Procedure



Gridding Example Calculation



Spatial Allocation—Example Results



In Closing

- Draft and Interim Technical Memoranda were delivered for BAAQMD's review.
  - Chemical speciation profile cross-references
  - Unit risk factors
  - Spatial allocation cross-references
- Risk-weighted emissions for point, area, and non-road mobile sources have been prepared for internal STI review.

In Closing

- On-road mobile source TAP emissions are currently being prepared.
- Spatial allocations are currently being processed.
- Model-ready emission inventories, graphical and tabular summaries are due by June 30, 2005.