Environmental Justice Screening Method (EJSM)

Purpose of Screening

- Develop indicators of cumulative impact that:
  - Reflect research on air pollution, environmental justice, and health
  - Are transparent and relevant to policy-makers and communities
  - Reviewed by community EJ groups, California Air Resources Board, academic peers and other agencies

- Can apply “screening method” to multiple uses:
  - Local land use planning
    - (e.g. Los Angeles, City of Commerce & Richmond – community plans)
  - Regulatory decision-making and enforcement
  - Community outreach
Focus of Screening

- Developed with specific reference to ambient air quality in neighborhoods
  - Not screening for occupational, indoor, water or pesticides.

- Developed to incorporate land use information into environmental decision-making
  - Performs best with detailed and high spatial resolution land use data.

- Developed using secondary databases, not micro-studies
  - This is screening not assessment

Categories of Impact & Vulnerability

- Proximity to hazards & sensitive land uses
  - Based on EJ literature
  - ARB land use guidelines (sensitive receptors)
  - State data on environmental disamenities

- Health risk & exposure
  - Based on EJ literature
  - Available state and national data
  - Modeling from emissions inventories

- Social & health vulnerability
  - Based on social epidemiological literature on social determinants of health
  - Based on EJ literature on area-level measures of community vulnerability
Current Coverage

- Two regions; 6 air basins
  - 7 Southern California counties
  - 9 Bay Area counties
  - So. California – higher quality land use data
- Map where people are exposed
  - Residential land use
  - Sensitive land use categories
    (ARB land use guidelines, 2005)
Intersect Land Use Polygons with Blocks

Result: Cumulative Impact (CI) Polygons, each associated with a specific block and land use
Each CI Polygon or Host Tract (Neighborhood) can receive a Cumulative Impacts Score

Category 1:
Proximity to Hazards & Sensitive Land Uses
Sensitive Land Use Component

- Sensitive land uses as defined by ARB
  - Air Quality and Land Use Handbook, 2005
  - Childcare facilities (SCAG 2005, geocoded)
  - Healthcare facilities (ARB/CaSIL/SCAG 2005)
  - Schools (SCAG 2005, geocoded from CA DOE)
  - Urban Playgrounds & Parks (SCAG 2005)
  - Land use data layer - SCAG 2005 polygons

- Polygons receive a score of 1 if they contain at least one sensitive land use category

Geocoded Point Sensitive Land Uses

- Some sensitive receptor locations identified as geocoded points must be converted into polygons to create CI polygons, but actual area unknown

- Points buffered to create circle polygons
  - Area equal to that of the smallest equivalent land use in the SCAG data
    - Childcare = 1013 m²
    - Schools = 2279 m²
    - Healthcare = 5524 m²

- These polygons added to CI Polygon base map using GIS Union to avoid area overlap
15 Geocoded Sensitive Land Uses - Polygons from points
(City of Maywood)

16 Geocoded Sensitive Receptor Land Uses
Polygons from points
17 Proximity to Air Pollution Sources & Hazardous Land Uses

- CHAPIS (CARB)
- Chrome Platers (CARB)
- Hazardous Waste TSDs (DTSC)
  - Federal Response (includes Superfund)
  - State response
  - Voluntary cleanup
  - Military evaluation
  - School investigations and cleanup
- Rail
- Ports
- Airports
- Refinery
- Intermodal distribution facilities

Number of sites within various buffers of polygon edge are counted, with those closer having a stronger weight (i.e., distance weighting)

18 Defining Hazard Proximity

1,000 ft. Buffers

- Buffer CI polygon boundaries at different distances
- Hazard proximity based on number of facilities (point-sources) and hazardous land uses inside the buffer

PH = Point hazards
LH = Land use hazards

1 PH + 0 LH = 1 proximate hazard
0+1
Because of the potential for inaccurate hazard locations, a distance weighted approach is used to get the hazard count for each CI polygon:

Distance Weighted Hazard Count =

\[(1 \times \text{#Hazards within 1,000ft}) + (0.5 \times \text{#Hazards 1,000-2,000ft}) + (0.1 \times \text{#Hazards 2,000-3,000ft})\]

* The above weights can be set to any desired value

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Defining Proximity – Distance Buffers

**1000-3000 Foot Buffers, Distance Weighted Hazard Count**

- Buffer CI polygon boundaries at different distances
- Hazard proximity based on number of facilities (point-sources) and hazardous land uses inside the buffer
There is error in reported location of some facilities

Facilities represented as points in the GIS are actually much larger polygon areas

Both of these factors introduce error into facility proximity/buffering procedure

Effect is to “underscore” hazard proximity for some CI polygons

Distance-weighted hazard scoring is an method to address these problems
Error in Reported Facility Locations

Facilities Mapped as Points Using Available Data But Actual Facility Area is Much Larger
25 **Hazard Proximity & Sensitive Land Use Scores Then Taken to the Tract Level**

**Why the Tract Level?**

- It is a consistent level of geography for many sources of data
- All of the health risk and social vulnerability measures (discussed later) are available at the tract level
- Also helps with issues of geographic accuracy

To get hazard proximity and sensitive land use scores at the census tract level:

- Estimate population in each CI polygon, based on its share of the total residential and sensitive land use area in the census block
- Take the population weighted average of the hazard and sensitive land use counts across the CI Polygons within each census tract

26 **Hazard Proximity & Sensitive Land Use Scores at the Tract Level**

- Take the resulting total figures at the tract-level and rank all tracts in the region into quintiles (1-5) to get the final hazard proximity and sensitive land use score at the tract level

- Quintile distribution is used here and throughout the CI Screening Method because it is an accessible and normal ranking procedure
  - No “right” distribution to follow (magnitudes of hazards unknown)
  - Other distributions could easily be applied
Category 2:

Health Risk and Exposure
Health Risk & Exposure Indicators (Tract Level)

- **RSEI** (Risk Screening Environmental Indicators)
  - (2005) toxic conc. hazard scores from TRI facilities

- **NATA 1999** (National Air Toxics Assessment)
  - Respiratory hazard from mobile & stationary sources

- **CARB Estimated Inhalation Cancer Risk 2001**
  - Calculated from modeled air toxics concentrations using emissions from CHAPIS (mobile & stationary)
  - Corrected version of this data

- **CARB estimated PM$_{2.5}$ concentration**

- **CARB estimated Ozone concentration**

Health Risk & Exposure Scores (Tract Level)

- Each health risk indicator is ranked into quintiles (1-5) across all tracts in the region

- Quintile rank values are added up across indicators for each tract and the sum is ranked once again into quintiles (1-5) across all tracts in the region

- The resulting quintile rank for each tract is its final health risk score
Health Risk & Exposure Score at the Tract Level
Mapped on CI Polygons (quintile distribution)

Category 3:
Social and Health Vulnerability
Social & Health Vulnerability Indicators

Census Tract Level Metrics (2000)

- % residents of color
- % residents below twice national poverty level
- Home ownership - % living in rented households
- Housing value – median housing value
- Educational attainment – % population > age 24 with less than high school education
- Age of residents (% <5)
- Age of residents (% >60)
- Birth outcomes – % preterm or SGA infants 1996-03
- Linguistic isolation - % pop. >age 4 in households where no one >age 15 speaks English well
- Voter turnout - % votes cast among all registered voters in 2000 general election

Social & Health Vulnerability Scores

- Each social and health vulnerability metric is ranked into quintiles (1-5) across all tracts in the region

- Final score is derived by taking average ranking (across all metrics) for each tract, and ranking the average once again into quintiles (1-5)
Social Health & Vulnerability Score at the Tract Level
Mapped on CI Polygons (quintile distribution)

Bringing it all together:
Cumulative Impact (CI) Scores
Cumulative Impact Scores at the Tract Level

Combine three categories of tract level impact and vulnerability to get Cumulative Impact Score

**Cumulative Impact Score =**

Hazard Proximity and Sensitive Land Use Score (1-5) +

Health Risk and Exposure Score (1-5) +

Social and Health Vulnerability Score (1-5)

Final Cumulative Impact Score Ranges from 3-15
Tract Level Cumulative Impact Score – South LA Area
Distance weighted hazard proximity, mapped on CI Polygons

Tract Level Cumulative Impact Score – Inland Empire
Distance weighted hazard proximity, mapped on CI Polygons
Tract Level Cumulative Impact Score, San Diego County
Distance weighted hazard proximity, mapped on CI Polygons

Tract Level Cumulative Impact Score, 9-County Bay Area
Distance weighted hazard proximity, mapped on CI Polygons
Important Caveats

- The Method was developed with specific reference to air quality and not screening for other concerns (such as water or pesticides)
- Performs best with high spatial resolution land use data which is not available for all areas of the state
  - Central Valley – lower quality land use data (currently attempting to address this data challenge)
- This is screening not assessment, so neighborhood monitoring and ground truth verification is needed.

Potential Contributions

- Screening provides a way of drilling down regionally and highlighting communities of potential regulatory concern
- Transparent approach and metrics that use publicly available data and is not too difficult to implement & update
- Open to modification by sophisticated users (change scoring weights, indicators, scoring approaches)