Cumulative Effects of Exposure

Overburdened Environmental Justice Communities

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Exposures in Communities
Cumulative Environmental Impacts
Cumulative Environmental Impacts

- Direct: air, water, seafood
- Indirect: traffic due to industrial activity

Cumulative: multiple landscape changes
Health Effects from Environmental Exposures

- Asthma
- Lung Disease
- Cardiovascular Disease
- Autism
- Breast Cancer
- Cancer
- Lupus
- Parkinson’s Disease
- Neurologic Disorders
- Reproductive Impacts
Combined Effects of Environmental Exposure

- Asthma
- Nitrogen oxides
- Ozone
- Particulates (PM 2.5)
- Sulfur dioxide
- Pollen
- Mold
- Cockroach allergens
- Smoking

Hazardous Air Pollutants

Aldehydes, Anhydrides, Isocyanates, Metals, Chlorine, Styrene
Exposome

- Measure of all exposures of an individual in a lifetime and how these exposures relate to health

- Begins before birth
- Environmental sources
- Occupational sources

- Challenges- Everyone’s exposome is different
  How do we measure all exposures? Impact of exposure varies throughout life

- Biomarkers- measure of internal exposure or effect

**Goal**: Understand the exposures and see the effects of cumulative exposures in order to prevent disease
How are Cumulative Exposures regulated now?
Regulators use standards to determine compliance

Standards are set using a risk assessment model that is focused on the chemical or industrial process

Focus: Singular chemical or process

There is no requirement for a regional or cumulative approach

Regional assessment does occur in areas of noncompliance with NAAQS for example
EPA Recommended Approach

Consider Cumulative Exposures when:

- A resource is especially vulnerable to incremental effects
- The proposed action is one of several similar actions in the same geographic area
- Other activities in the area have similar effects on the resource
- These effects have been historically significant for this resource
- Other analyses in the area have identified a cumulative effects concern

Recommended Not Required
Exposome of the Community

- Identify, quantify and prioritize exposures
- Describe health disparities
- Determine community vulnerabilities
- Associate exposed communities with vulnerable communities and those with health disparities
- Inform policy change to prioritize at risk communities
California Communities Environmental Health Screening Tool, Version 2.0 (CalEnviroScreen 2.0)

Guidance and Screening Tool

August 2014

Matthew Rodriquez, Secretary
California Environmental Protection Agency

George V. Alexeeff, Ph.D., Director
Office of Environmental Health Hazard Assessment
“Cumulative impacts means exposures, public health or environmental effects from the combined emissions and discharges, in a geographic area, including environmental pollution from all sources, whether single or multi-media, routinely, accidentally, or otherwise released. Impacts will take into account sensitive populations and socioeconomic factors, where applicable and to the extent data are available.”
CalEnviroScreen 2.0

Population Burden

- Ozone concentrations
- PM2.5 concentrations
- Diesel PM emissions
- Pesticide use
- Toxic releases from facilities
- Traffic density

- Drinking water contaminants
- Cleanup sites
- Groundwater threats
- Hazardous waste
- Impaired water bodies
- Solid waste sites and facilities
Population Characteristics

- Children and elderly
- Educational attainment
- Linguistic isolation
- Poverty
- Unemployment
- Low birth-weight births
- Asthma emergency department visits
Applying this Approach in Pennsylvania

- Identify, quantify and prioritize exposures
- EPA’s EnviroMapper

http://www.epa.gov/emefdata/em4ef.home
EPA’s EJView: Prioritize Communities

http://epamap14.epa.gov/ejmap/entry.html
eMapPA: Environmental Justice Areas
Describing Health Disparities

Figure 3-9: Age-Adjusted Rates for Inpatient Hospitalization with Asthma as the Primary Discharge Diagnosis by Urban vs. Rural County, PA 2006-2010

Data Source: Pennsylvania Health Care Cost Containment Council (PHC4)
Note: according to Center for Rural Pennsylvania Definition there are 19 urban and 48 rural counties. The Center considers a county to be rural when its population density or the number of people per square land mile is below the statewide average of 284. County is urban when its population density is at or above the statewide density.
# Rates of Hospitalization for Asthma in PA

## 10 Highest Counties
- Philadelphia County 53.9
- Lawrence County 26.2
- Delaware County 25.5
- Allegheny County 20.6
- Fayette County 20.3
- Westmoreland County 19.8
- Indiana County 19.5
- Wyoming County 18.8
- Greene County 17.4
- Beaver County 16.8

## 10 Lowest Counties
- Sullivan County 3.5
- Union County 3.5
- Snyder County 3.9
- Warren County 5.0
- Perry County 5.7
- Pike County 6.0
- Bedford County 6.1
- Tioga County 6.8
- Franklin County 7.0
- York County 7.1

Red represents counties with Environmental Justice Communities
## Cancer Rates in PA

### Counties Significantly higher than expected

- Philadelphia
- Lawrence
- Delaware
- Allegheny
- Chester
- Montgomery
- Berks
- Crawford
- Washington
- Cambria

### Counties Significantly lower than expected

**Men**
- Adams
- Cumberland
- Juniata
- Dauphin
- Pike
- Wayne

**Women**
- Wayne
- Indiana

Red represents counties with Environmental Justice Communities
Lung Cancer Rates in PA

Counties Significantly higher than expected
- Philadelphia
- Delaware
- Allegheny
- Crawford
- Washington
- Erie
- McKean
- Monroe

Counties Significantly lower than expected
- Men
- NONE
- Women
- Snyder
- Somerset
- Bedford
- Fulton
- Lancaster
- Cambria
- Indiana

Red represents counties with Environmental Justice Communities
Cumulative Impacts Assessment in PA

- We have evidence of cumulative impacts of exposure on health in PA

- We have some exposure data that is tracked geographically

- We have some data documenting health disparities tracked geographically

- We know where EJ communities are in PA
So what are the barriers to a cumulative impacts approach to regulation in PA and how do we overcome them?
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