TITLE
Assessment of the Environmental Public Health Indicators for Houston

THEME
Disseminate Credible Information to Guide Policy, Practice and Other Actions to Improve the Nation's Health

KEYWORDS
environmental, public health, health indicators, air pollution, ozone, air toxics, cancer incidence rates, asthma, bronchitis

BACKGROUND
The environmental public health issues of the Houston, Texas region are directly related to the environmental history and current status of environmental quality in the area. The first oil field was discovered in the area in 1908. The Port of Houston was connected to the Gulf of Mexico by ship channel in 1914. The first refinery was built along that channel near Houston in 1918. Today the Houston region is host to more than 50% of the petrochemical production in the U.S.

Petrochemical plants, barges, pipelines and other infrastructure release large quantities of volatile organics into the air. Combustion of fuel in on-road vehicles and off-road equipment contributes some Volatile Organic Compounds (VOCs) and considerable Nitrogen Oxides (NOx). All of the industrial processes that burn fossil fuel also contribute NOx. These emissions are precursors of ozone, which can be produced in the atmosphere over Houston faster than anywhere else in the country.

Air quality can be very low in the Houston region. It is a major hazard for public health. While air quality is not the only health hazard around Houston, this presentation will focus on indicators of the spatial and temporal relationships among air pollution hazards and health impacts.

OBJECTIVE(S)
To produce a set of environmental public health indicators on an interactive web site that will be informative for the public and decision makers.

METHOD(S)
Houston has a large number of air quality monitors that permit a crude spatial mapping of the air pollution hazards. We estimated the distribution of ozone, nitrogen oxides and representative air toxics on high pollution days. We focused on hazards that have been detected at concentrations likely to cause health impacts. For ozone, this meant selecting data from days when one monitor exceeded the one-hour standard of 125 ppb. From the monitor data selected, we estimated (using Kriging in ArcGIS) the ozone concentration in zip codes covering a large portion of the Houston metropolitan area. A benzene indicator was created by Kriging the annual average concentrations of air toxic monitors to produce regional annual concentrations. Kriging did not produce a satisfactory map of regional concentrations of 1,3 butadiene. The hazard indicator for this and other air toxics released by specific industrial processes employs a map of monitor sites with

ephtcdc.gov
www.cdc.gov/nceh/tracking

information on annual average concentrations. Maps of estimated annual air pollutant concentrations are used to illustrate the hazard risks in geographic regions of the metropolitan area.

Health impact indicators were created with data from the Texas Cancer Registry and a hospital discharge database obtained from the Texas Department of State Health Services. The cases of cancer and respiratory diseases were identified by zip code. Age-adjusted incidence rates were calculated for 12 large multi-zip-code geographic regions. The maps were color-coded by relative incidence rate. Examples for several cancers and respiratory disorders are used as illustrations.

RESULT(S)

The indicators show that there is a spatial distribution to air pollution hazards and to cancer and respiratory disease incidence rates. The ozone hazard indicator is a map of estimated annual maximum concentration on unhealthy days in 12 regions. These estimated concentrations range from 92 ppb in a region near downtown containing many petrochemical plants to 77 ppb in a suburban region south of downtown. The benzene indicator ranges from 0.84 ppb in a region containing industrial plants to 0.48 ppb in a northwestern suburban region. Average annual concentrations of 1,3 butadiene at air toxic monitoring sites ranged from 2.1 ppb near some of the older petrochemical facilities to 0.006 ppb in a northwest suburban area.

The range of incidence rates among the 12 regions varies dramatically for some diseases. Age-adjusted annual incidence rates for bladder cancer over a three-year period (1999–2001) range from 11.4 to 23.3 per 100,000 in different geographic regions of the Houston area. Age adjusted rates for hospitalization due to bronchitis in 2002 change from 821.9 per 100,000 in a northeast region to 252.1 in a western region. Spatial patterns for lung cancer, bladder cancer and bronchitis are similar. Maps of incidence rates compared to Texas averages have also been produced for asthma, non-Hodgkin's lymphoma, and leukemia. While incidence rates exhibit strong spatial patterns in some cases, no conclusions are drawn about relationships to environmental risk factors.

DISCUSSION/RECOMMENDATION(S)

Users of the indicators will be able to provide their own interpretation of the relationship between diseases and air pollution concentrations. This will be the first opportunity for Houston area residents to view a combination of maps on air pollution hazards and potentially related diseases. We hope that the reporting of the results from the environmental public health tracking network will encourage hazard reductions and better targeting of public health services.

AUTHOR(S)

Debo Awosika-Olumo M.D., M.S., M.P.H.
Epidemiologist Manager
Bureau of Epidemiology
Houston Health Department & Human Services
8000 N. Stadium Drive, 4th Floor
Houston, TX 77054
713-558-9685
Awosika-Olumo.Adebowale@cityofhouston.net

James Lester, Ph.D.
Director, Environment Group, Houston Advanced Research Center (HARC)

Arafat R. Raouf
Office of Surveillance and Public Health Preparedness, Houston Department of Health and Human Services