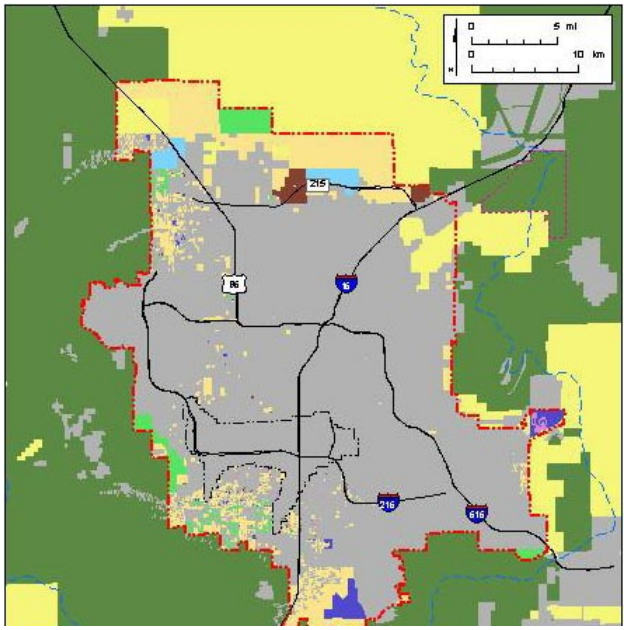
Air Quality Impacts of Federal Land Management Actions in the Las Vegas Valley

Argonne has provided the U.S. Bureau of Land Management with a comprehensive cumulative urban-valley air pollution assessment of land management actions in the Las Vegas Valley that includes application of state-of-the-science models along with development of detailed required data sets.

PROBLEM/OPPORTUNITY

The Las Vegas Valley is a fast-growing urban area with 3,000 to 4,000 new residents per month. The U.S. Bureau of Land Management (BLM), which has responsibility for managing large areas of federally owned land in the Las Vegas area, has been given a federal land and natural resource management directive that will make more than 70,000 acres of BLM land in the area available for both private and public use over the next 20 years. An environmental impact statement (EIS) prepared by the BLM will ensure that the health and welfare of the public will not be adversely affected by the federal land management actions. As a major input to its evaluation, the BLM requested that Argonne's Environmental Science Division (EVS) evaluate current and future cumulative air quality in the area, with particular attention given to quantifying air impacts associated with the disposition and conversion of BLM lands to private and public uses. For completeness, the EVS study included air quality evaluations over privately held land in the City of Las Vegas, as well as over the BLM lands within and around the urban-city center.



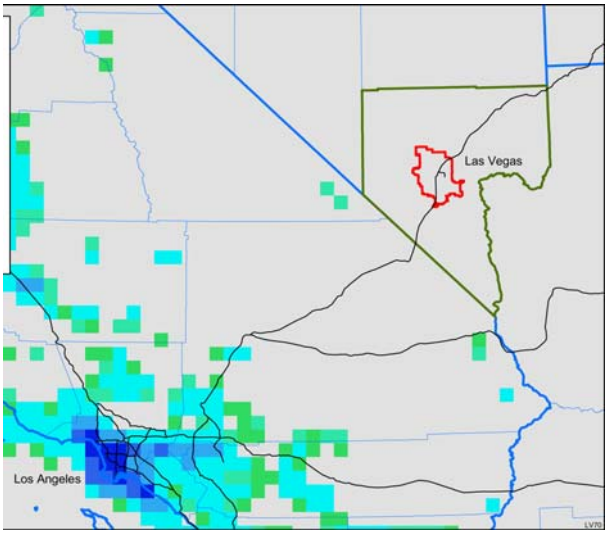
Las Vegas Air Quality Study Area
Colored (nongray) areas within the red line are BLM lands to be made available for development

APPROACH

A comprehensive three-dimensional cumulative urban-valley air pollution assessment by EVS was structured to utilize state-of-the-science computer models incorporating extensive data sets for parameters known to affect air quality. Included were multiple pollutants from a variety of local and regional sources that vary over time; multiple scales (regional and urban); varied terrain, including mountains, cities, and desert; and varied climate, soils, and vegetation.

In addition to EVS, the Argonne Mathematics and Computer Science Division (MCS) and University of Nevada at Las Vegas (UNLV) participated in the analysis. Air pollutants were modeled using an established U.S. Environmental Protection Agency computer code, SMOKE, to generate the input for the Community Multi-scale Air Quality (CMAQ) code, which Argonne had previously helped develop. The CMAQ code was adapted by MCS to run on the Argonne JAZZ supercomputer with 350 computing nodes. Using data on emissions, meteorology, and ambient monitoring with Geographic Information System (GIS) spatial characterization, SMOKE and CMAQ can track a wide variety of point sources (e.g., power plants), area sources (e.g., construction sites), and line sources (e.g., highways) of air pollution in the local region, as well as intrusions from outside the valley

(particularly, Los Angeles). A Mesoscale Meteorological Model (MM5) was used to simulate related meteorological data fields, such as for temperature, pressure, and wind dynamics.



Regional Nitrogen Oxide Emissions Sources (nongray areas) Affecting Las Vegas Ozone Levels

New types of data and models were needed, however, to model windblown dust levels. UNLV researchers used a portable wind tunnel to collect field data on windblown dust levels that Argonne then used to develop a new computer model, which was incorporated into the CMAQ code. The modified CMAQ code used input from the MM5 model on local temperature, pressure, and wind fields, along with maps of soil types, to predict dust (particulate matter less than 10 microns in diameter [PM_{10}]) concentrations.

Because of the strong link of ozone to population and transportation growth and the regional nature of the ozone nonattainment, the study included both local and regional sources of ozone precursors over a four-state region. Particular attention was given to long-range transport from the Los Angeles Basin.

RESULTS

The new analytic methodologies that were developed for modeling PM_{10}, ozone, and carbon monoxide were shown to work well in providing the needed evaluations of future air quality under different scenarios.

The specific pollutants of most concern within the valley and the focus of the EVS study included ozone, carbon monoxide, and PM_{10}, although impacts from over 40 other trace pollutant species were assessed. The dominant source of elevated PM_{10} levels within the valley is windblown dust originating from arid disturbed and unstable desert soils during moderate to high wind conditions and secondarily from both paved and unpaved roads.

High ozone levels are of local origin, primarily from vehicle exhaust emissions, but are also significantly influenced by contaminants blown in from other areas. The study found that emissions from the Los Angeles area can account for up to one-fourth of the ozone levels in the Las Vegas Valley, depending upon conditions and the time of day. Carbon monoxide levels are largely of local urban traffic origin.

A major conclusion of the study is that future anticipated reductions in emissions (such as from reformulated gasoline) will provide significant improvements in local air quality, but windblown dust will continue to be a problem. Since up to 25% of ozone levels occurring during periods of low to moderate episode days in the area result from transport from California, compliance with air quality regulations in the future will need to rely heavily on both reductions in local emissions and on the continued stringent air pollution control commitments already in place for Los Angeles.

FUTURE

Current modeling approaches for estimating air quality impacts in complex socioeconomic, topographic, and meteorological settings, combined with modern computing capabilities, have been shown to be a useful tool in environmental planning at multiple regional and local scales.

Wind Tunnel Equipment for Characterizing Surface Dust Emissions

For more information, contact: M. Lazaro • mlazaro@anl.gov • Environmental Science Division (www.EVS.anl.gov)
Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439 • 630-252-3447.