By JOHN BARTLIT
New Mexico Citizens
for Clean Air & Water

Modeling is a task with 101 aspects

In people's minds, a "model" plays many roles. See a pretty girl parading the new fashion trends.

Or see a perfect toy train keep circling through a spotless toy town. Nifty models at work are fun to watch.

Still other models estimate how badly adding some air emissions would harm the air. The work is a far cry from pretty, new fashions or spotless scenes. Few words have meanings that differ as greatly as "model."

Air pollution models are mathematical tools that tell us how emissions move with and in the air. Numbers account for wind speed, wind direction, mixing of air, stack height, terrain, and more.

Counting emissions from all around, how bad is the air at any spot?

Air dispersion modeling, by its formal name, is used by air bureaus to help keep our air cleaner than legal limits.

As with all good science, models improve. To find ways, computations are compared with air quality readings. Steps are slow, but careful.

Air dispersion models began to evolve in the 1930's. As the decades passed, the science evolved along three broad lines of interest. In chronological order, they are radioactive releases, local industry and auto pollution, and global effects.

In 1948, the U.S. Weather Bureau added a "Special Projects Section." Its mission was to study and predict the spread of airborne radioactive releases from nuclear testing worldwide. As models improved, the story grew clear. The 1963 U.S.-Soviet test ban treaty declared all testing would be underground.

Through the ‘60's and ‘70's, the growing concern was air pollution from smokestacks and tailpipes. State hearings to set emission limits for power plants were long wars of modeling.

Competing models had various merits, flaws, and pedigrees. Models varied in technical design and amount of verification. "Verification," or "validation," means comparing computed results with a measurement for the same point, using key local conditions as they are.

The models varied in details, as in how high terrain affects air flow.

Modeling air quality had a large role then, and always will, because models have aspects that help us more than air monitors alone. Models can find pollution levels in ways monitors cannot.

Models can estimate pollutants where enough monitors can never be placed, such as in every block of every street in all directions.

Models can predict pollutant concentrations in the future, from plants not yet built.

Models can project pollutant concentrations for the worst events of the year, at the worst spot. Models can do it as if the worst weather conditions and worst emissions all come together, which they won't.

In short, models do things that no amount of monitoring can ever do.

The model war for each of the largest polluters in New Mexico lasted most of a decade. Other states with similar sources fought the same war for just as long.

To avoid fighting the model wars over and over, the EPA adopted an open process to approve validated air models for regulatory use. Currently, a few such models are approved by the EPA

process. Using these models, and limits set by other rules, bureaus in each state grant or deny permits to build and operate plants.

Models and air monitors both have the same use: to determine the local air quality. Both tools help estimate the highest concentration of pollutants in the air people might breathe.

But air quality is only half the story. Models and monitors at a given site do not say what air is safe enough to breathe. That job is different.

Learning the health effects from whichever pollutants, at what levels, breathed how long, is a separate science. The legal limits for pollutants are set from studies of large, diverse populations, thus mainly in large cities.

The most recent use of modeling is to explore global effects on nature. Ozone holes in the stratosphere were the subject of modeling. If you worry about CO2 and climate change, you believe in modeling. Global models are more complex, so less certain, than the regulatory models.

Overall, modeling is a large picture, with countless useful aspects.

Column for Jan. 15, 2008