Governing bodies large and small have been regulating air emissions from industry, motor vehicles and other sources for several decades. And municipal planners are increasingly thinking of air quality when planning for urban growth.

However, regulations and plans must change with the times, to reflect the best new science about air pollution and related technologies. That science is complex. The concentration of air pollutants depends on so many factors: weather patterns, chemical interactions among different pollutants, the type and location of the key emission sources, and so on. In the face of this complexity, government agencies must decide what, where and how much to regulate. Similarly, municipal planners must decide how best to accommodate future growth of their urban areas without compromising the quality of the air. To arrive at sound plans and policies, to win over stakeholders, and to achieve the goal of improving air quality, decision makers must work from sound science that accounts for all the important factors.

**Our service**

We help government agencies evaluate scenarios for reducing emissions and impacts of air pollutants. By applying proposed regulations and urban growth strategies in a computer simulation, we can gauge their effect on regional air quality and pollution patterns. With these results, governments can develop cost-benefit analyses and make science-based decisions on air quality and urban growth and development. We also use such models to help other stakeholders make well-informed responses to government policy decisions.
This work centers on a regional-scale air quality simulation that we can customize to any place in the world. This model takes into account the complex effects of regional weather patterns, topography and chemical interactions among air pollutants. It also reflects the complex spatial distribution of the various emission sources. We use the model as a tool for looking at how much a given strategy for managing emissions within a region will actually improve the air quality there.

Our work is closely informed by current academic research, but our focus is always on our clients’ questions and practical needs. We’re sensitive to time lines and experienced with meeting our clients’ time constraints. And we’re exceptionally skilled at and passionate about making complex scientific information accessible for the nonscientists who need to act on our findings.

RWDI is a valuable partner to clients seeking to…

**Explore Innovations**
- Find creative solutions to achieve economically thriving and healthy communities
- Understand the interplay among clean air, urban growth, emerging technologies and social change
- Understand the interplay among climate change, greenhouse gas reduction strategies and air quality.
- Delineate regional airsheds and develop holistic strategies for managing the emissions sources within them.

**Create Opportunities**
- Improve stakeholder confidence and buy-in by demonstrating the scientific basis for regulatory changes
- Develop proactive urban growth strategies that are sensitive to clean air and its impact on the health of the population

**Meet Challenges**
- Choose the right sources to regulate, given the characteristics of the region
- Anticipate the effects of changes in urban development patterns and commercial activityAnticipate how future climate changes may affect regional air quality
REGIONAL AIR QUALITY

How we work

The key tool for regional air quality assessments is computer simulation. Regional air quality simulations have three main components:

- Emissions modeling
- Meteorological modeling
- Air pollutant transport and atmospheric chemistry.

Emissions modeling consists of two steps. First we estimate what the hour-by-hour emissions are from all of the various emission sources within a region. Then we determine where these emission sources are located throughout the region. We use land use data from geographic information systems (GIS), estimates of unit emission rates for different types of sources, and statistics on the activity level of the various emission sources. These sources might include industrial production, traffic on roadways and highways, aircraft activity at airports and so on. Software systems are used to integrate all of this information. Finally, we produce gridded, hourly emissions information over the region of interest and the time period of interest (one or more years). We generally use an emissions modeling system known as SMOKE, which was developed by the United States Environmental Protection Agency.

Meteorological modeling consists of developing a high-resolution, 3-D picture in space and time of the weather conditions into which the air pollutants are being emitted. Often, one or more years of hourly weather patterns are predicted over the entire region of interest. We generally use a software system known as WRF (the Weather Research and Forecasting Model), which was developed by the United States government through a collaboration among various branches of the government.

Atmospheric transport and chemistry modeling predicts how air pollutants will be transported downwind of the emission sources, as a result of the weather patterns predicted by the meteorological model. It also predicts the chemical transformations that the air pollutants undergo while in the atmosphere. It provides a 3-D picture in space and time of air pollutant levels over the region of interest, for each of the air pollutants of interest.