Joint Urban 2003

Atmospheric Dispersion Study

Oklahoma City, June 28 – July 31, 2003

"Together, we will confront the threat of terrorism. We will take strong precautions aimed at preventing terrorist attacks and prepare to respond effectively if they might come again."

—President George W. Bush
Swearing-in of Governor Tom Ridge as the Director of Homeland Security
October 8, 2001

The two figures show a typical sampler with and without the cover. After sample collection, the bags are taken to a laboratory for chemical analysis of the tracers.

Questions and Answers

Will gases be released in this study? What kind?

The study calls for the release of two types of innocuous tracer gases. The first of these, sulfur hexafluoride (SF_6), will be released within or above the city. The U.S., as well as many other countries, has relied on SF_6 for decades for dispersion studies. Three perfluorocarbon tracer (PFT) gases will be used for interior studies to measure the flow of air within a building, and for flow outside a building. Both SF_6 and the PFT's are colorless, odorless, biologically inert, non-toxic and non-combustible gases.

Are these gases safe?

Yes. These gases have been used worldwide as tracers and in many other applications for decades by both government and private organizations, including the Centers for Disease Control and Prevention in their studies of buildings. For SF_6, many federal agencies and health organizations have established a limit or threshold of 1000 parts per million (ppm), set as a conservative precaution against possible oxygen deficiency in enclosed spaces. For example, during Salt Lake City tracer studies in October 2000, a small quantity of SF_6 (1 to 2 grams per second) was released to provide measurable maximum concentrations less than 1 ppm through the city. The maximum tracer gas concentrations are therefore about 1000 times smaller than the health agency exposure limits, and decrease very rapidly with distance from the tracer source. These concentrations also dissipate with the wind. The scientists who operate the tracer source and the samplers do not have to take any special precautions such as protective clothing or masks, despite working within the regions of maximum concentrations. There is no known health risk from these exposures.

PFT tracer gases are safely used for many industrial applications including determining the air tightness of a building (for energy efficiency reasons) and the airflow patterns within the interior of building. Additionally, perfluorocarbons are sometimes used for medical purposes as described below.

Does this study pose a potential health risk to OKC residents?

No. The study calls for the release of two types of stable and inert tracer gases (SF_6 and PFT's) which are colorless, odorless, biologically inert, non-toxic and non-combustible gases. They have been safely used for decades in conducting atmospheric studies and for many other purposes (*e.g.,* medical, industrial). Scientists working directly with the tracer gases do not have to take any special precautions such as protective clothing or masks, despite working within the regions of maximum concentrations. Likewise, the public will not be exposed to any health risk as a result of the study.

What impacts will this study have on the environment?

SF_6 and PFT tracer gases have no known environmental impacts when used at the minute concentrations released for atmospheric studies. The amount of these released in tracer studies is a tiny fraction of that used in industry and in other applications annually. There are currently no regulatory restrictions on the use or emission of these gases.

What else are these gases used for?

Among its many uses, perfluorocarbon has many biomedical applications. For instance, it is used in certain eye surgeries to fill the interior of the eye to hold the retina or other membranes in place until they have healed. It also can be very useful in improving the breathing capability of patients such as the aged with acute respiratory distress. In other applications, specific PFT's may be used in the treatment of babies born prematurely and suffering from incompletely formed lungs. Perfluorocarbon also can be used in conducting indoor air quality testing and when testing for proper laboratory hood airflow.

SF_6 is used worldwide as a gaseous insulator in high voltage electrical equipment and routinely used as an inert gaseous "cover" to prevent molten metals such as aluminum and magnesium from coming in contact with air. SF_6 has also been used in the semiconductor industry, in gas-filled athletic shoes, in foam insulation, in laser systems, in sound-insulating windows, tennis balls, loudspeakers and shock absorbers.

When is the proposed study planned?

The study is scheduled to occur from June 28 – July 31, 2003. About one week before the study begins, the majority of the instruments and equipment will be set up. Approximately one additional week will be needed for removal of the instruments and equipment.

This planned study will build on the knowledge gained from the comprehensive field study conducted during October 2000 in Salt Lake City, Utah.

What types of equipment will be used for the study?

Meteorological instrumentation and tracer samplers will be installed at various locations throughout and around the city to provide detailed measurements of the winds, temperatures, other key meteorological variables and tracer gas concentrations. Various types of standard meteorological equipment will be used to measure winds and temperatures in the city and above the building tops.

Who will participate?

Among organizations participating are the U.S. Department of Energy, the Department of Homeland Security (DHS), the Biological Countermeasures office, and the Department of Defense (DoD). Up to 150 scientists, engineers and student assistants are expected to be involved.

Why was Oklahoma City selected for the study?

Oklahoma City was selected as the experimental site because of its flat terrain, well-defined central city, moderate size, well-characterized climatology, and world-class supporting meteorological instrumentation already in use throughout the surrounding countryside. The University of Oklahoma and its research partners are providing local expertise and assistance for conducting the study and analyzing the data. Oklahoma City representatives and officials are providing vital support in the planning and execution of the effort.

Who will benefit from this study?

Benefits of this experiment will be both national and local in scope. The nation will benefit because the emergency response and air quality models to be tested and refined can ultimately be applied to most cities. Oklahoma City will have access to an unparalleled data set for testing and improving local emergency response and air quality models, as well as much better site-specific information on the effects of the city on the local winds and temperature, which could greatly assist local weather forecasting and emergency response planning by the fire department and other city or state agencies. The local universities will be able to use the experiment and data to leverage additional research funds, to enhance the reputation of their research faculty in urban meteorology, to test and improve their air quality models, and to provide a wide range of training experiences for undergraduate and graduate students.

Why is this research and study needed?

Despite years of research, prediction of airflows and atmospheric transport within an urban area remains a difficult and inexact science. Without data such as that collected in Salt Lake City and the data to be provided by this study in Oklahoma City, existing models for airflow, transport and dispersion cannot be tested and refined to provide more accurate and credible predictions.

What is the cost of this study?

The combined budget from the U.S. Department of Energy, the U.S. Department of Homeland Security and the U.S. Department of Defense - Defense Threat Reduction Agency and other participating federal agencies will be approximately $6.5M.

Which buildings will be selected for the indoor airflow study?

Several buildings have been evaluated and would be suitable for the study. Program personnel are coordinating with the building owners, managers and occupants. For updated information, refer to the study website at http://JU2003.pnl.gov.

What do tracer samplers look like?

The tracer samplers are portable, programmable, battery-operated boxes with a pump that fills 12 small sample bags with air sequentially based on a specified sampling program. The two figures (on the previous page) show a typical sampler with and without the cover. After sample collection, the bags are taken to a laboratory for chemical analysis of the tracers.

Will this study be evaluated under the National Environmental Policy Act?

A single integrated review under the National Environmental Policy Act has been conducted for the meteorological research field operations. The NEPA review evaluated potential environmental impacts of the overall field project, and addressed issues such as potential impacts to sensitive cultural and biological resources, air emissions, land use, and human health. The NEPA review conducted provides information about legal and regulatory requirements and identifies mitigation measures that need to be implemented. A NEPA Categorical Exclusion (CX) was prepared to address potential environmental impacts of the field research study in accordance with the DOE NEPA Implementing Procedures found in 10 CFR 1021. The CX was reviewed by an interdisciplinary DOE review team and approved by a DOE NEPA Compliance Officer on May 29, 2003.

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Joint Urban Website: http://JU2003.pnl.gov