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

SF_6 analyzer in mobile van continuously measuring air concentrations.

Purpose and Sponsors of this Study:

An atmospheric dispersion study will be held in Oklahoma City, Oklahoma, from June 28 through July 31, 2003. This study will advance knowledge about movement of contaminants in and around cities and into and within building interiors. The resulting data will also be used to improve, refine and verify computer models that simulate the atmospheric transport of contaminants in urban areas. The study is sponsored in part by the U.S. Department of Energy, the U.S. Department of Homeland Security and the U.S. Department of Defense - Defense Threat Reduction Agency (DTRA).

For many years, the U.S. government has been developing, improving and validating atmospheric models to simulate contaminant dispersal in and around cities, into building interiors and into the surrounding regions. These models allow emergency management, law enforcement and other personnel to adequately plan for, train for and respond to potential terrorists attacks and accidents involving toxic industrial chemicals. In addition to generating data to validate models, the results from studies such as the one planned for Oklahoma City are used to identify and explain the physical processes governing dispersion in urban environments and through the interior of buildings. This planned study will build on the knowledge gained from the comprehensive field study conducted during October 2000 in Salt Lake City, Utah. More information on the Salt Lake City study is described in the April 2002 issue of the *Bulletin of the American Meteorological Society* [1].

The study will include a series of experiments conducted for several days between June 28 and July 31, 2003. To evaluate outdoor atmospheric dispersion models, researchers need to learn how air flows through the urban area both day and night, and about the concentrations in the air of safe, inert tracer gases that are released for the experiment. In the Oklahoma City study, approximately 200 portable wind stations and more than 200 small portable tracer samplers will be placed in and around the urban core (within about a one mile radius) to measure winds and outdoor tracer concentrations. This equipment will be placed on sidewalks, buildings, within secure areas and on light or other tall poles.

The safe, inert tracer gas, sulfur hexafluoride (SF_6), will be released for a short time (up to 1 hour) from one of three outdoor locations, and the portable tracer samplers will collect outdoor air samples for up to several hours after SF_6 is released to track its movement throughout Oklahoma City. At the end of an experiment, the tracer samples will be collected and taken to a laboratory for analysis. All of the portable wind stations will continuously record data for later computer

Safe, inert tracer gases to be used:

There are two types of innocuous tracer gases to be used in Oklahoma City - sulfur hexafluoride (SF_6) and perfluorocarbon tracer (PFT) gases. Both are stable, colorless, odorless gases that have been used extensively and safely as atmospheric tracers since the mid-1960s. At the low concentrations used for atmospheric studies, SF_6 tracer gas causes no known environmental impact or health risk. It is easily detected, easily handled and is relatively inexpensive. It will be released in carefully metered amounts.

There are no ambient air quality standards or regulatory restrictions on the use or emission of SF_6. PFT gases will be used for testing airflow outside buildings and within a building. Like SF_6, these gases have been safely applied within the medical and industrial fields for many years.

[1] *Allwine, K. J., J. H. Shinn, G. E. Streit, K. L. Clawson, and M. Brown. 2002. "An Overview Of URBAN 2000: A Multi-Scale Field Study Of Dispersion Through An Urban Environment." Bul. Amer. Meteor. Soc., Vol. 83, 521-536.*

retrieval. SF_6 tracer samplers also will be located in building interiors to study the infiltration of outdoor air (and contaminants).

To understand how outdoor air enters buildings, a study that determines indoor airflow patterns must be conducted in conjunction with the outdoor study. The interior building study involves releasing three safe, inert PFT gases in very small amounts for short times from various locations in the buildings. Researchers plan to place PFT samplers at various locations in the buildings for short periods of time to measure the movement of tracers within the facilities.

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

A question that often arises about gaseous tracer studies is the safety of the tracer materials. Government and private organizations in the U.S. and Europe have safely and successfully used these tracer gases for many years in both indoor and outdoor studies. SF_6 is commonly used as a gaseous insulator in high voltage electrical equipment, in foam insulation, gas-filled athletic shoes, tennis balls, loudspeakers, shock absorbers, sound-insulating windows, in the semiconductor industry and in many other applications. PFT's are extremely chemically and physically stable and are biologically very inert. These compounds can be inhaled and ingested with no concern and are safe for human exposure at high concentrations.

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 city has been very cooperative in hosting the study. City representatives have provided vital support and assistance in preparing for the effort. Additionally, the University of Oklahoma and its research partners are providing local expertise and assistance.

Benefits of the study will be both national and local in scope. Ultimately, our nation benefits from the improvement of its emergency response capability and from the testing and refining of outdoor and indoor air quality models that can be applied to most cities. Locally, Oklahoma City will have access to an unparalleled site-specific data set useful for improving local emergency response as well as testing air quality models. Precise information on local winds and temperature may also greatly assist in local weather forecasting and in emergency response planning by the fire department and other city or state agencies. The local university 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.

Major participants in the research come from the U.S. Department of Energy national laboratories, research laboratories operated by the National Oceanic and Atmospheric Administration and the Department of Defense, the University of Oklahoma, and the State of Oklahoma, Oklahoma Climatological Survey.

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