3.4 AIR QUALITY COURSE FOR SCIENCE TEACHERS AT THE UNIVERSITY OF NORTHERN IOWA

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1. INTRODUCTION

The Science center for Teaching, Outreach, and Research on Meteorology (The STORM Project) has been funded by the National Oceanic and Atmospheric Administration since 2000. STORM seeks to improve public understanding of atmospheric science, especially among those who must make weather-related decisions. An example of audiences for whom STORM has developed programming is school superintendents. The Project has also worked with and for science educators in the development of classroom activities that make use of real-time weather information. Summer programming for teachers on the topic of weather forecasting was delivered for several years.

More recently, STORM has added programming for teachers on the topic of air quality. This addition was partly in response to feedback from middle and high school science teachers who noted that environmental science topics were of direct relevance to both physical and life science courses.

2. SUMMER AIR QUALITY COURSE

An intensive, one-week course on air quality has been delivered by STORM in the summers of 2006, 2007, and 2008. The target audience has been middle and high school science teachers. In 2008, greater efforts to attract teachers from other states were successful in that 15 of the 24 participants were from outside of Iowa. States represented in 2008 included Arizona, Arkansas, Connecticut, Iowa, Kentucky, Maryland, Missouri, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, and Tennessee.

About 50 applications were received for the 24 positions in the 2008 course. Participants were selected based primarily on their ability to develop outstanding classroom activities. The teachers received 2 graduate credits from the University of Northern Iowa, reimbursement of travel expenses, and a stipend. In return, classroom activities developed during the week become the property of the STORM Project, which is now working to make them available nationwide.

Air quality topics were presented to the class in order to give participants a common background of knowledge. The National Ambient Air Quality Standards (NAAQS), which pertain to a set of 6 'criteria' pollutants, were presented. The scientific bases for the standards were examined. Measurement and analysis of air quality were explored through hands-on activities. Participants gained experience with a variety of sampling equipment for gases and particulates. Field olfactometers were used to help understand the special sampling and regulatory challenges associated with odors, a dominant air quality problem in many parts of the country.

The Clean Air Act was examined, with special focus on the issues of NAAQS attainment, the use of pollution allowances to address acid rain, and the complexity of urban smog. Participants learned of the planetary boundary layer's structure and how the depth of the mixed layer can be quantified and predicted. Dispersion modeling techniques explored included the Gaussian plume model, the box model, and gradient transport theory. Specific dispersion models used in the course included CAMEO, AERMOD, and HYSPLIT.

Participants also toured the University's 7.5 MW coal fired power plant. Techniques to minimize stack and fugitive emissions through fuel choice and operational strategies were presented by plant operators.

3. DEVELOPMENT OF CLASSROOM ACTIVITIES

Each participant developed a unit or activity on air quality. Rather than being specific to the developers' classrooms, activities were to be constructed so as to be useful by teachers in many parts of the country. Topics addressed by the activities include: concentration measurements of trace constituents; the NAAQS; the Clean Air Act; the Air Quality Index; urban smog; air quality and human health; air quality and visibility in national parks; calculated coal needs of a power plant; constructing scale models of plumes; the planetary boundary layer; constructing a particulate separator; use of HYSPLIT to follow balloon releases and volcanic emissions; and indoor air quality. A subset of activities is available on the STORM Project homepage (http://www.uni.edu/storm/). More activities will become available after ongoing refinement by STORM staff. Activities may be freely shared with teachers, and feedback on the activities is appreciated.

4. UPCOMING PROGRAMMING

A new installment of "Studies in Air Quality for Science Educators" will be offered June 21-26, 2009. Application materials are available on the STORM Project homepage.

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