FRD ACTIVITIES REPORT
October - December 2008

RESEARCH PROGRAMS

Roadside Barrier Tracer Study

The EPA Roadside Barrier field study was conducted in October. It consisted of a shakedown test and 5 regular tests. Each regular test spanned a 3 hour period broken into 15 minute tracer sampling intervals. Of the 5 regular tests, one was conducted in unstable conditions, one in neutral conditions, and three in stable conditions. The principal elements of the experiment were a SF_6 tracer line source representing pollution sources from a roadway on the upwind side of the barrier; a 6 m high straw stack representing a roadside sound barrier; an array of 6 sonic anemometers for making wind and turbulence measurements; a mobile real-time tracer analyzer; and a gridded array of tracer bag samplers downwind of the line source and barrier for measuring mean 15 minute concentrations. To better understand the effects introduced by the roadside barrier, tracer measurements were made on two separate grids so that results could be compared. These two grids were identical to each other with the exception that one grid had the barrier and one did not. They had a large crosswind separation to eliminate any possible interference.

The SF_6 tracer release was started from the line source for each grid before the sampling measurements began in order to establish a quasi-steady state concentration field. The release continued until the end of each test. One anemometer was located upwind of the non-barrier sampling grid at a height of 3 m and served as a reference for the approach flow. Another anemometer was located at a height of 3 m upwind of the barrier for measuring the effects of the barrier on the approach flow. Three anemometers were located on a tower at heights of 3, 6, and 9 m in the wake zone downwind of the barrier and a fourth was located farther downwind near the end of the wake zone effects. The mobile tracer analyzer drove a set route with multiple crosswind and alongwind traverses through the sampling grid. The route took about 15 minutes to complete and one mobile analyzer was assigned to each grid. Each of the sampling grids

consisted of 58 locations marked by metal fence posts. The bag samplers were attached to the fence posts at 1.5 m height. In addition to the 58 regular samplers on each grid, an additional 9 samplers were deployed for quality control purposes. These included field duplicates, field controls, and field blanks. (Dennis.Finn@noaa.gov and staff)

Data analysis for the fast response tracer analyzers has been completed and all quality control (QC) steps completed. Final data files for release will be generated within the next couple weeks. The bag sampler data are in the final steps of QC. The last review steps should be completed within about a week and final data files for release will be generated for them. Preparation of the final report is underway. (Roger.Carter@noaa.gov)

Analysis of the 54 meter long release line data is complete. Mass flow meter data indicates that regulation of the flow of tracer to the two release lines was maintained to less than $\pm$1% of the average release rate using instantaneous one second readings. Using 10 second smoothing through the full range of the releases typically brought the variation, from the beginning to the end of the test, to less than $\pm$0.25% with no long term drift throughout the 3-hour period. This is very good considering the fact that the mass flow controllers were operating at 10 to 25% of the full scale operating range. (Randy Johnson@noaa.gov)

Preliminary data analysis for the roadside barrier study indicates the following:
a) The areal extent of the concentration footprint downwind of the barrier was a function of atmospheric stability with the footprint expanding as stability increased.
b) The magnitudes of the normalized concentrations were a function of atmospheric stability. The normalized (and actual) concentrations increased on both the barrier and non-barrier grids as atmospheric stability increased.
c) Lateral dispersion was significantly greater on the barrier grid than the non-barrier grid. Plumes on the non-barrier grid tended to have much sharper and better defined boundaries as opposed to the more diffuse and lower concentration gradient patterns observed on the barrier grid. It is likely that at least part of the greater horizontal plume spread on the barrier grid can be attributed to edge effects. However, there are many cases where edge effects appeared to be minimal or negligible.
d) There was invariably a concentration deficit in the wake zone of the barrier with respect to concentrations at the same grid locations for the non-barrier release. This was due to (1) vertical movement and dispersion forced by the barrier, (2) turbulence above the wake zone generated by shear flow across the barrier enhancing turbulent dispersion, (3) horizontal plume spread (with or without edge effects), and (4) edge effects.
e) The barrier tended to trap high concentrations in the “roadway” in low wind speed conditions, mainly during the stable tests.
f) Edge effects were evident in many of the individual 15-minute sampling periods. They ranged from negligible or minor to severe. The importance of the edge effects was related to mean wind direction, the extent of wind meander, wind speed, and atmospheric stability. Lower wind speeds and/or the damped vertical motions and turbulence associated with increased atmospheric stability contributed to the development of edge effects.
g) The barrier decelerated and deflected the approach flow.
h) The anemometers on the tower array in the wake zone provided strong evidence for the presence of a rotor in the wake of the barrier and a higher turbulence region above the wake zone

induced by shear across the top of the barrier. (Kirk.Clawson@noaa.gov and staff)

Low Cost Tracer Detector

A prototype of the low cost tracer analyzer was operated during the final test of the EPA Roadside Barrier Tracer Study. A preliminary look at the data collected indicated it did collect some tracer concentrations, but further analysis is, of necessity, being delayed until the data analysis required for the project and the final report have been completed. (Roger.Carter@noaa.gov)

ET Probe

There is a good chance that ARL will receive NOAA funding for the ET probes this fiscal year as part of the Hurricane Forecast Improvement Project (HFIP). A primary research thrust for HFIP is to improve hurricane intensity forecasts, and limited knowledge of air-sea turbulent exchange in hurricane conditions is a major source of uncertainty. The focus of the ET probe effort will be to obtain measurements of air-sea fluxes in hurricane conditions. To this end, the first task will be to upgrade the current probes so they are better suited for extended deployments. Upgraded probes will then be deployed at near-shore sites to test their performance after extended exposure in a marine environment. For the longer term, the plan is to deploy probes on deepwater platforms and eventually on buoys. (Richard.Eckman@noaa.gov)

Nuclear Radiation Safety

Earlier this year, the US Nuclear Regulatory Commission (NRC) began an audit of the NRC Materials License that was issued to the NOAA laboratories in Boulder, CO and Idaho Falls, ID. As part of this audit, two NRC inspectors visited FRD on Dec 3, 2008. They reviewed our complete nuclear materials program including storage, handling, inventories, wipe tests, records, procedures, etc. No violations of NRC regulations were found. We continue to work with the other NOAA laboratories to ensure that all NRC regulations are followed and all nuclear materials are handled responsibly and safely. (Roger.Carter@noaa.gov, Kirk Clawson, Dennis Finn)

NOAA/IDAHO NATIONAL LABORATORY METEOROLOGICAL RESEARCH PARTNERSHIP

Emergency Operations Center (EOC)

A quarterly assessment drill was held at the EOC on November 20th. The drill was intended to practice working closely with the BEA Assessment Specialists in case of a real emergency. This particular tabletop drill centered on a bomb that was planted at an in-town facility by a disgruntled neighbor. MDIFF was used to plot the trajectory of the plume during the drill. (Jason.Rich@noaa.gov)

New INL Hazardous Weather Alert System

Seven weather statements/alerts were issued by the new INL Hazardous Weather Alert System during the last quarter. Four of the alerts/statements were issued due to high winds. The other three alerts/statements were issued for blowing snow. (Neil.Hukari@noaa.gov and Jason Rich)

Transport and Dispersion Modeling

A major goal of FRD this fiscal year is to develop a prototype dispersion modeling system for INL applications that is based on HYSPLIT. This new system will eventually replace the current one based on the MDIFF puff model. There are several subtasks that must be completed in developing the new system, and work is starting on some of these subtasks. One of these is to derive a three-dimensional wind field that is largely based on the INL Mesonet data and is suitable for use by HYSPLIT. Another is to develop a modern user interface and display capability that contains the information needed by INL decision makers. Other subtasks will receive more attention once the post processing activities associated with the EPA roadway tracer study are completed.

The subtask related to producing wind fields suitable for HYSPLIT is part of a broader data-assimilation effort within NOAA. It is widely recognized that the near-surface wind fields provided by the NOAA operational forecast models often contain large errors that make them marginally useful in emergency-response activities involving toxic plumes. Other NOAA activities such as aviation weather and fire weather could also benefit from improved estimates of surface winds. Several groups in NOAA are therefore investigating data-assimilation methods of varying complexity for providing improved wind estimates. The simplest methods are based on interpolation and can be appropriate in areas with dense observation networks. More complex methods such as variational analysis are useful where observations are limited and in rugged terrain. As a first step, FRD is focusing on simpler interpolation methods that can use the high density of observations available from the INL Mesonet. (Richard.Eckman@noaa.gov)

For certain regulatory applications, INL is now required to use the EPA AERMOD plume model. FRD has therefore been asked to provide NOAA/INL Mesonet data in a format readable by AERMOD (more precisely, readable by the AERMET preprocessor that comes with AERMOD). This initially seemed to be a relatively simple task but has turned out to be difficult and time-consuming. Part of the problem is that some of the model features listed in the user guides don't

appear to be implemented in the code or have errors. It is also unclear whether the 915 MHz profiler at INL provides wind and temperature profiles that go up high enough for use by AERMOD. A solution to these problems should be ready in the second quarter of the fiscal year. (Richard.Eckman@noaa.gov, Dennis Finn)

Presentations

On November 11, Jason Rich teamed up with Vern Preston from the NWS forecast office in Pocatello to give a presentation at an Idaho National Laboratory safety meeting held at CFA. Approximately 30-40 craftsmen, administrative, and management were in attendance at the meeting. Vern presented information about NWS 101 and Jason presented information about our new Hazard Weather Alert System and the NOAA/INL Weather Center web page.

On December 12, Jason Rich gave an invited presentation to the Idaho National Laboratory in-town facilities safety group. Approximately 50 people attend the 35-minute presentation. The presentation focused on the NOAA INL Meteorological Research Partnership, with special emphasis on our Hazardous Weather Alert System and the NOAA/INL Weather Center (NIWC) home page at http://niwc.noaa.inel.gov/.

Jason Rich and Kirk Clawson gave a presentation at the National Weather Service forecast office in Pocatello. It focused on various meteorological products that FRD has developed in its partnership with the Idaho National Laboratory that may be of use to the local NWS forecasters. The visit is part of an ongoing collaboration and coordination effort between FRD and the Pocatello forecast office.

On October 8 Kirk Clawson gave an invited presentation to the gathering of scientists and administrators responsible for preparing annual site environmental reports across the U.S. DOE complex. The INL was the host of this year's meeting. Kirk's presentation focused on the NOAA/INL Meteorological Research Partnership, including the NOAA/INL Weather Center and associated web pages, and a brief overview of some of the research conducted by NOAA at the INL.

Dennis Finn gave a presentation for the December ARL Science Seminar titled "Plume Dispersion Anomalies in a Nocturnal Boundary Layer in Complex Terrain". The talk highlighted some of the unusual and unexpected dispersion characteristics found in the URBAN 2000 tracer study conducted in Salt Lake City in October, 2000.

OTHER ACTIVITIES

Outreach

Several articles were written for the ask-a-scientist section of the Idaho Falls Post Register newspaper. Answers were provided to questions submitted by readers that included: 1) How does weather change, 2) How hot is the sun, and 3) How does it warm the earth? (Jason.Rich@noaa.gov)

On 2 October about 15 teachers from the Idaho Teacher's Science Conference were given a tour of FRD. This included a brief presentation, demonstrations of our capabilities, and a visit to one of the INL Mesonet towers in Idaho Falls. (Richard.Eckman@noaa.gov)

Papers

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, and K.J. Allwine, 2008: Plume Dispersion Anomalies in a Nocturnal Urban Boundary Layer in Complex Terrain. *Journal of Applied Meteorology and Climatology* 47(11): 2857-2878, doi:10.1175/2008JAMC1864.1

Safety

As a group the FRD employees reviewed the Radiation Section of the FRD Health and Safety Manual.

At the December staff meeting Shane Beard gave a presentation on our office Lock Out - Tag Out policy.

In December, Duane Nelson with the Idaho Falls Fire Department completed a fire inspection for our facility. No findings were reported.

Training

Dennis Finn and Donna Harris completed the NOAA Radiation Safety and Health Protection Training program.

Shane Beard, Neil Hukari, Kirk Clawson, Jason Rich, Brad Reese, Rick Eckman, Tom Strong, and Dennis Finn completed the FRD Fast Response Analyzer Training and the FRD Sampler Training.

All FRD employees completed the mandatory on-line No FEAR Act Training (The Notification and Federal Employee Antidiscrimination and Retaliation Act of 2002) in December.

Diversity

At the November staff meeting employees discussed the book *Strong at the Broken Places*. The book includes remarkable stories of five ordinary people trapped in the complex world of serious chronic illness.

Visitors

14 October, Steve Fine NOAA ARL
15 October, Vlad Isakov, EPA

03 December, Jason Razo and Michael Vasquez from the U.S. NRC, who completed an audit

and inspection of FRD's nuclear materials. Rhonda Carpenter of NOAA also accompanied the visit and completed a safety walk through of the FRD laboratory.