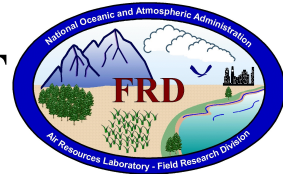


# FRD ACTIVITIES REPORT

## October-December 2007



### *Randy Johnson Receives DOC Silver Medal*

On November 15<sup>th</sup> at a ceremony in Washington, DC, Randall C. Johnson received the U.S. Department of Commerce 2007 Silver Medal from Secretary Carlos M. Gutierrez and NOAA Administrator Vice Admiral Conrad C. Lautenbacher, Jr., U.S. Navy (Ret.). The Silver Medal is the Commerce Department's second highest honorary award and is given for exceptional performance characterized by noteworthy or superlative contributions which have a direct and lasting impact within the Department.



**Randy Johnson receives the Dept. of Commerce Silver Medal from Secretary Gutierrez and NOAA Administrator Lautenbacher.**

Since 1992, Randy has developed four generations of unmanned, autonomous Smart Balloons that use state-of-the-art technology to observe air motions and air quality over extended periods of time. Randy developed the NOAA “Smart Balloon” that has been deployed in seven air quality and hurricane research experiments since 1992. These experiments have led to significant advances in the understanding of marine boundary layers and the chemistry of aerosols and various gaseous constituents of the atmosphere. In 2004, a Smart Balloon carrying a miniature ozone sensor successfully crossed the Atlantic Ocean from Long Island, New York to the African Coast of Morocco. NOAA Smart Balloons have also been used to study atmospheric dynamics within the inflow regions of hurricanes.

The data from the Smart Balloon are now being incorporated into air quality and climate change models. Many peer-reviewed journal articles have been written from the seven field experiments. In some of these experiments, the balloons were a key to success because they allowed U.S. and European research aircraft to locate and repeatedly sample the same marine air mass over several days in the vicinity of the balloons. The Smart Balloon research supports improvement in the National Weather Service air quality forecasting. It also helps the Environmental Protection Agency with its air quality assessment and regulatory functions.

### ***StormReady Supporter Award Ceremony***

In April of this year, FRD became the first NOAA entity to become a StormReady Supporter. An award ceremony to honor this accomplishment was held on October 30, at the FRD office. Vernon Preston, Warning Communication Meteorologist with the NWS in Pocatello, presented a recognition plaque and a special StormReady sign to FRD in recognition of this honor. In addition, FRD Director Kirk Clawson



**Kirk Clawson receives StormReady Supporter award from Vernon Preston.**

received a StormReady Certificate of Achievement “for improving the timeliness and effectiveness of hazardous weather warnings for the public through a diligent and proactive approach of increased communication and preparedness.” Several dignitaries from partner organizations attended the ceremony including Rick Dittmann, Meteorologist in Charge at the Pocatello WFO and Dean Hazen, Science Operations Officer at the NWS. Dave Brandon, Interim Director of NOAA's Western Region Team located in the NWS Western Region Headquarters in Salt Lake City, also attended. Representing DOE-Idaho was Ray Furstenuau, DOE-ID Deputy Manager, Teresa Perkins, Director of Environmental Technical Support, and Betsy Holmes, COR. Jim Colson, team lead of the Emergency Management Group of Battelle Energy Alliance, the INL M&O Contractor, also attended as did Bill Behymer who represented the State of Idaho Dept. of Environmental Quality. After the presentation, FRD hosted a grilled salmon and pot luck lunch in honor of the celebration. StormReady is an education program designed by NOAA’s National Weather Service to establish severe weather safety plans and actively promote weather awareness. A news release was prepared for the event and is available at <http://www.noaa.inel.gov/PR-2007-10-25-PIH01.pdf>.

### ***ARL Director and Deputy Director Visit FRD***

On October 30 and 31, FRD hosted ARL Director Steve Fine, Ph.D., and Deputy Director Rick Artz for Steve’s first visit to the office. During their visit, presentations on FRD's history, DOE partnership, world class tracer program, ET Probe program, and NOAA Smart Balloon program were given by the various principal investigators, including Rick Eckman, Randy Johnson, Dennis Finn, Roger Carter, and Kirk Clawson. Various administrative and budget matters were also discussed. Fine and Artz toured FRD's office and compound in Idaho Falls and some of the facilities at the INL site, including the FRD tracer testing field facility. They also visited the site of the first nuclear reactor to produce electricity. Also located at the decommissioned reactor are

two decommissioned prototype nuclear reactors for powering aircraft. (The project was abandoned by Pres. Kennedy in the early 1960's.)

## **RESEARCH PROGRAMS**

### ***Urban Dispersion Papers***

The peer review of the manuscript “Atmospheric Flow Decoupling and its Effects on Urban Plume Dispersion” was received from the journal *Boundary Layer Meteorology*. There were many reviewer comments that required a major reworking of the manuscript. Work on revision of this manuscript was in progress at the end of the quarter. The paper will be substantially revised and re-titled. The review of the manuscript “Plume Dispersion Anomalies in a Nocturnal Urban Boundary Layer in Complex Terrain” was received from the *Journal of Applied Meteorology and Climatology*. The comments on this paper were generally favorable although some minor edits will be required. Both of these papers have deadlines for responding to reviews in the first quarter of 2008. The draft manuscript “Probability Density Functions and Peak-to-Mean Ratios for Tracer Plumes in an Urban Boundary Layer” passed all co-author and ARL reviews and will be submitted for journal publication pending the necessary editing. (Dennis Finn, 208-526-0566)

### ***Perfluorocarbon Tracer (PFT) Analysis Development***

Final testing of the PFT analysis method has been concluded and the method is at a stage where it is ready for actual deployment and experimental work. A final report summarizing the method, procedures, protocols, and cautionary notes has been prepared for internal use.

The report lists the PFTs tested by the method (PDCB, PMCH, m-PDCH) and details about the equipment used, detection limits, the operational settings on the gas chromatograph (GC), flow rates, peak integration parameters, and the like. The report also focused on sampling and analytical artifacts that will require the use of quality control procedures and protocols to achieve quality PFT data sets. Most of these artifacts arise from the “stickiness” of the PFT; that is, their tendency to adhere to surfaces. A brief summary of the key findings in the report follows.

It was found that the gaseous PFT concentrations in the sample bags remained stable over the course of at least 7-8 months. Multiple sets of bags filled with 250, 4000, and 100,000 pptv concentrations were analyzed over the course of several months with no variation in concentration within the uncertainty of the measurement. Thus, the PFT gases do not degrade or decompose when stored for long periods. This result ensures that samples will retain their validity for a long enough time, even when samples must be stored for a time while a large project with thousands of samples needs to be analyzed.

The “stickiness” of the PFTs required development of a bag cleaning protocol to be used between deployments to ensure that bags reused in any future experiments would not be corrupted by previous exposures. It was found that the key to obtaining a completely clean bag was repeated cleaning cycles (a cleaning cycle being 5 evacuations and flushes) alternating with

a multi-day holding of zero air or UHP nitrogen. After many tests, it was determined that the following protocol was successful in cleaning bags that had held PFT concentrations of up to 100,000 pptv for up to 10 months duration: cleaning cycle, fill with UHP nitrogen and hold for 7 days, cleaning cycle, fill with UHP nitrogen and hold for 7 days, and final cleaning cycle. Other tests determined that it was possible to simply use one standard cleaning cycle to successfully clean bags that held concentrations up to 5,000 pptv.

Tests of contamination artifacts affecting the GC were also conducted. It was found that the measurement of high concentrations on one GC port did not adversely affect subsequent measurements on other GC ports. However, repeated analysis (4 times) of high concentrations on a single port did affect subsequent analysis of zero air samples on the same port. It was found that this artifact was eliminated by running one sample of room air or zero air on that port before it was used for another regular sample.

In addition, to analytical contamination artifacts related to the GC or sample bags, there was also the question as to whether the samplers themselves could be contaminated by exposure in the field to high concentrations during the course of the experiment. Relicts from this high concentration exposure could then adversely affect the reliability of concentrations measured in bag samples collected with the contaminated samplers in subsequent sampling. Tests were conducted to test for this possibility. It was found that the samplers did indeed pick up an artifact that was passed on to subsequent bag samples. This contamination artifact was successfully eliminated by allowing the samplers to sit and degas for a period of 24 hours before reuse (although the data suggest something like 6-8 hours might suffice).

Advisory notes about signal drift, the electron capture detector, and the potential for chromatogram peak interferences were also included in the report. (Dennis Finn, 208-526-0566, and Roger Carter)

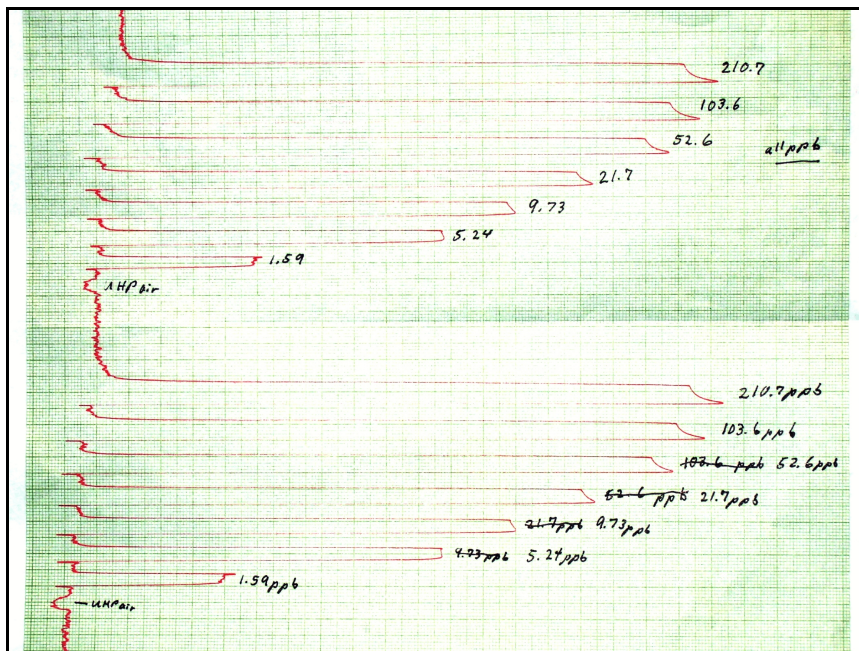
### ***Fast Response Analyzer Data System Upgrade***

A new data system is being developed for the existing fast response tracer analyzers to replace the aging systems currently in use. The new system uses an embedded microcontroller to operate the system and collect the data. Data will be stored on a compact flash card as it is collected. We are currently developing the software for the system and simultaneously building a prototype circuit board and enclosure to test the system before printed circuit boards are designed and manufactured. (Roger Carter, 208-526-2745, and Randy Johnson)

### ***Low Cost Tracer Detector***

The goal of the low cost tracer detector development is to create a tracer analyzer that will be: 1) significantly less expensive than existing fast response analyzers; 2) not require compressed gases; and 3) not require a dedicated operator. This quarter, the optimization of the prototype low cost tracer detector was completed and it was tested with the reactor/dryer from an existing continuous analyzer. The results were very promising showing a detection range of

approximately 200 ppt to 50,000 ppt for SF<sub>6</sub> and a reasonable response time (see accompanying figure). Further experimentation has shown that the detector is very sensitive to the humidity of the sample stream so that drying of the sample gas will be essential. It is apparent that a oxygen/water removal system similar to the existing fast response analyzers will be needed with this detector and several options are under consideration. Although there are obstacles to overcome, the project looks promising. (Roger Carter, 208-526-2745, Shane Beard, and Randy Johnson)



**Example strip chart record from the calibration tests conducted with the low cost tracer detector on December 20, 2007.**

### ***ET Probe***

Fiscal year 2008 is the first year in which the ET probes may have a shot at obtaining new funding for hurricane work through NOAA. The probes were included in the NOAA PPBES planning starting in the FY2008-12 planning cycle, mainly through the Science, Technology, and Infusion (ST&I) program. However, the funding outlook for hurricane research has been altered by the recent creation of the Hurricane Forecast Improvement Project (HFIP). The planning that has come out of HFIP appears to supersede what was originally done through PPBES. (Richard Eckman, 526-2740)

### ***Las Vegas Roadway Toxics Tracer Study***

The planning for the Las Vegas Roadway Toxics Tracer Study has begun. Several conference calls have been held with our ARL colleagues at the Atmospheric Sciences Modeling Division at Research Triangle Park, NC. The current draft plan calls for the release of SF<sub>6</sub> from a 150m line during 6 intensive sampling periods in October 2008. The study will utilize 50 stationary bag samplers and 1-2 real-time SF<sub>6</sub> analyzers, and several 3-d sonic anemometers. Several details remain to be worked out, including funding and a site visit. (Kirk Clawson, 208-526-2742)

## **NOAA/IDAHO NATIONAL LABORATORY METEOROLOGICAL RESEARCH PARTNERSHIP**

### ***Collaborative Research***

A paper entitled ‘Comment on “Dynamical Implications of Block Averaging” by Treviño and Andreas’ was submitted to *Boundary-Layer Meteorology*. It is comment on a previous BLM paper that made broad claims about the implications of time averaging for turbulence data based on how the time averaging affects the computed value of the integral time scale. The comment along with a reply from the authors of the original paper are expected to be published in 2008. (Richard Eckman, 208-526-2740)

### ***Emergency Operations Center (EOC)***

All FRD EOC team members completed their required annual INL EOC Emergency Response Organization classroom requalification during October and November. A particular feature of MDIFF, where red contours are not the highest concentration, was discussed at each of the sessions. This led FRD to investigate the standardization of colors for hazard material contours. Standard color isopleths have been proposed for several types of releases, with separate meanings for TEALS, ERPGS, REMs, etc. FRD is continuing to investigate the incorporation of these colors into MDIFF.

Two EOC teams participated in EOC drills this quarter. The first drill was handled by Team A, consisting of Jason Rich and Brad Reese, on October 10. The scenario centered on a propane tank explosion at the Materials and Fuels Complex (MFC) that was caused by a tank puncture with a forklift. The second drill was handled by Team B, consisting of Kirk Clawson and Dennis Finn on November 13. The scenario for this drill centered on an accidental release of Amercor 1848, a corrosion inhibitor. A refill hose ruptured connecting a tanker truck to the onsite storage tank at the Idaho Nuclear Technology and Engineering Center (INTEC), spilling about 20 gallons of material. In both drills, real-weather was used. In the second drill this proved particularly challenging to the NOAA meteorologist because of a frontal passage and resultant wind direction shift. NOAA meteorologists supplied short-term forecasts and operated the NOAA transport and diffusion model MDIFF during both drills.

Kirk Clawson participated in a quarterly Hazard Assessment Specialist Drill at the EOC on December 6. This drill is designed as an information exchange between NOAA meteorologists and BEA hazard assessment specialists. The drill scenario centered on the release of Amercor 1848 at INTEC, the same scenario as the EOC drill on November 13. This was not a scenario where MDIFF should be run and the plume plot then disseminated to emergency managers. Instead, the NOAA meteorologist and the Assessment Specialist should use either EPICODE or ALOHA for developing plume plots. The ALOHA model is another NOAA model suited to short-range transport and diffusion scenarios of less than 10 km, such as the Amercor drill scenario. FRD has obtained ALOHA model and is learning to use it. During the coming reporting quarter, FRD will be fully trained and able to use ALOHA in the EOC when it is appropriate to do so. This will be a big aid to the hazard assessment specialist and improve the quality of products delivered to the emergency manager.

In other EOC matters, a new version of WEBEOC is being installed. The hazard assessment specialist will now be able to (and expected to) send plume plots from EPICODE and ALOHA, and also text files to WEBEOC. He can also send plume plots of MDIFF, if desired. Since FRD already has the capability of sending MDIFF plume plots to WEBEOC, we will need to closely coordinate this activity with the hazard assessment specialist.

In addition, the EOC hazard assessment specialists and FRD meteorologists are participating in a new EOC Significant Event data entry process. Since many of our significant events are simply to transmit routine weather information and forecasts, we have developed a form for simple and rapid data entry to be used in place of the triple copy Significant Event form. The development of these forms has been under the supervision of the EOC Coordinator, Donna Cole. Two forms have been developed for this purpose and approved by the EOC Coordinator: one for current weather conditions, and one for the short term weather forecast.

### ***INL Climatology***

The 3<sup>rd</sup> Edition of the INL Climatology completed the ARL review process in December and is undergoing final editorial changes. The 3<sup>rd</sup> Edition will include NOAA INL Mesonet data through December 2006, and new insights on winds and temperatures aloft derived from remote sensing systems, channeled wind flows, statistical wind trajectory groupings, precipitation return periods, and evapotranspiration. Data are presented in the context of three distinct local micro-climatic regimes (INL north-end, INL southwest, and INL southeast) that have emerged in recent assessments. It is anticipated that the revised climatology will continue to be useful to planners and operations staff who support the INL and Idaho Cleanup Project (ICP) mission directives of revitalized nuclear reactor research and completion of the legacy cleanup. The report should be ready for distribution in early 2008. (Kirk Clawson, 208-526-2742, Jason Rich, and Neil Hukari)

### ***INL Weather Forecasts***

Work continues on the development of a new NOAA INL weather forecast product. The new product will include a 3-hour forecast of wind speed, wind direction, temperature, cloud cover, and percentage of precipitation out to 36 hours. The new forecast will also be divided into the three local micro-climatic regimes (INL north-end, INL southwest, and INL southeast). This new format will give INL managers in each of the three climate zones more information to make better judgments regarding the safety of personnel and in day-to-day operations. (Jason Rich, 208-526-9513, and Neil Hukari)

### ***Mesoscale Modeling***

As an outreach activity, FRD is assisting with the meteorological research being conducted by a graduate student at the University of Wyoming. The student plans to write a Ph.D. thesis on the topographically forced convergence-zone events that sometimes create enhanced snowfall in the Idaho Eastern Snake River Plain, including the INL. FRD is performing a test simulation of one such event that occurred in November 2005, using the WRF model configuration that is already in use for INL activities. The simulation has turned out to be more difficult than expected

because the archived model outputs available for initializing WRF for a 2005 case are not as complete as the model outputs used to produce the current real-time WRF forecasts. (Richard Eckman, 208-526-2740)

### ***NOAA/INL Mesonet Stations***

We received notice in July that the property on which the Roberts mesonet station sits has been sold. The new property owners have asked that the tower be removed. A new site has been identified that is within 1/4 mile of the current site on ground owned by the Market Lake Wildlife Management Area. The Market Lake WMA is operated by the Idaho Department of Fish and Game. Negotiations have been concluded with the WMA manager, and a lease is being developed with a planned signing date of January 2008. Once the lease has been approved, the tower will be relocated to the new site.

During the semiannual calibration and maintenance of the Mesonet stations, it was discovered that a large shop and garage has been built on property immediately adjoining the Richfield station. The position of the building clearly violates established separation criteria, such as those published in ANSI/ANS 3.11 (2005). When spring arrives, it will be necessary to relocate this tower.

### ***Transport and Dispersion Modeling***

Although radiological releases are the primary concern for dispersion modeling at INL, there has been increased emphasis on various types of chemical hazards that exist at the site. The hazard zones for chemical releases typically extend fairly short distances downwind, so complex dispersion models such as the NOAA HYSPLIT model tend to be overkill. FRD is therefore adding the NOAA ALOHA model as one of its standard EOC support models for INL releases. ALOHA is well tailored to the shorter range chemical releases, and it has a built-in database of common chemicals. ALOHA will not replace MDIFF as the dispersion model for radioactive releases. (Richard Eckman, 208-526-2740)

FRD continues to work toward a transition to the NOAA HYSPLIT model as its primary tool for INL dispersion applications. A major issue for FRD is to ensure that HYSPLIT can fully take advantage of the INL Mesonet observations in generating its wind fields. The standard version of the model is set up to use winds from NOAA forecast models, so it has no capability to ingest Mesonet winds to create a wind field. There does not appear to be a simple off-the-shelf solution to the data ingestion issue in HYSPLIT, so FRD may need to develop this capability in collaboration with other NOAA groups that are using HYSPLIT. We could use a simple interpolation scheme as does the current MDIFF model, but this has its own problems. Interpolation methods do not directly account for various physical constraints to the wind flow, including the effect of topography. Also, interpolation is better suited to generating a 2D wind field at a single height than to generating the 3D wind field required by HYSPLIT. (Richard Eckman, 526-2740)

## **OTHER ACTIVITIES**



## ***Outreach***

FRD is involved in an “Ask a Scientist” program in which local school students submit scientific questions that are answered by local scientists. The questions and answers are published in the Idaho Falls newspaper. FRD recently received two meteorological questions; one about the weight of clouds and why clouds don’t fall to the ground, and the other question about altitude and air temperatures. One answer appeared in the newspaper in October and the other answer will appear in January 2008. (Richard Eckman, 208-526-2740, and Kirk Clawson)

## ***Papers***

**Clawson, K.L., R.M. Eckman, N.F. Hukari, J.D. Rich,** and N.R. Ricks, 2007: Climatology of the Idaho National Laboratory 3<sup>rd</sup> Edition. *NOAA Technical Memorandum OAR ARL-259*, Air Resources Laboratory, Idaho Falls, Idaho.

**Eckman, R.M.**, 2007: Comments on “Dynamical Implication of Block Averaging” by Treviño and Andreas. Submitted to *Boundary-Layer Meteorology*.

**Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich,** C. Biltoft, K.J. Allwine, J.E. Flaherty, and M.J. Leach, 2007: Analysis of Plume Dispersion, Decay, and Peak-to-Mean Excursions for Continuous Tracer Gas Releases in an Urban Core, Oklahoma City, JU2003. (In review at *Boundary Layer Meteorology*)

**Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich,** K.J. Allwine, and J.E. Flaherty, 2007: Analysis of Plume Dispersion in a Nocturnal Urban Boundary Layer in Complex Terrain, Salt Lake City, URBAN 2000. (In review at *Journal of Applied Meteorology and Climatology*)

**Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich,** C. Biltoft, K.J. Allwine, J.E. Flaherty, and M.J. Leach, 2007: Probability Density Functions and Peak-to-Mean Ratios for Tracer Plumes in an Urban Boundary Layer. (Returned from ARL Review)

## ***Safety***

The FRD Health and Safety Manual is being updated and revised. The manual contains safety procedures and information pertinent to FRD operations. This effort is expected to be completed over the next few months. (Donna Harris, 208-526-2329, and the FRD Safety Committee)

Kirk Clawson, Jason Rich and Donna Harris attended the DOE Health Fair to obtain information on general health concerns (heart disease, diabetics, hearing loss, massage therapy, spinal alignment, and sleep apnea). This fair is held annual during the open season for federal health insurance.

The FRD Safety Committee continued their monthly safety training of FRD staff. At the October staff meeting, employees viewed a video by Digital 2000, Inc., titled Hand and Wrist Injuries. The November staff meeting included a video on winter safety driving. During the December

staff meeting, a safety team member presented information on holiday fire safety, holiday stress management, holiday food safety, and safe holiday recreation. (Donna Harris, 208-526-2329)

Donna Harris attended monthly INL Safety meetings in October and November. At the October meeting, the INL-developed office stretch and conditioning programs called iBalance, iStrength, and iStretch were demonstrated and instructional materials were distributed. The 2008 INL Safe Driving Campaign was also introduced with a presentation on “Drive for Parents”. Winter driving was the main topic at the November meeting. (Donna Harris, 208-526-2329)

### ***Travel***

Randy Johnson, to Silver Spring, MD, and Washington, DC, November 14-16, to attend the U.S. Department of Commerce Gold and Silver Awards Ceremony.

### ***Visitors***

October 30:

Rick Dittmann, Meteorologist in Charge, NWS, Pocatello, ID.

Vernon Preston, NWS Warning Communication Meteorologist, NWS, Pocatello, ID.

Dean Hazen, Science Operations Officer, NWS, Pocatello, ID.

Dave Brandon, Interim Director, NOAA's Western Region Team, Salt Lake City, UT.

Ray Furstenuau, Deputy Manager, DOE-ID, Idaho Falls, ID.

Teresa Perkins, Director of Environmental Technical Support, DOE-ID, Idaho Falls, ID.

Betsy Holmes, COR, DOE-ID, Idaho Falls, ID.

Jim Colson, Emergency Management Group, Idaho National Laboratory, Idaho Falls, ID.

Bill Behymer, State of Idaho Dept. of Environmental Quality, Idaho Falls, ID.

October 30-31:

Steve Fine, Ph.D., ARL Director, Silver Spring, MD.

Rick Artz, ARL Deputy Director, Silver Spring, MD.

### ***Miscellaneous***

In honor of Disability Month in October, FRD employees participated in a series of activities that simulated having a physical disability in the workplace. The activities improved the staff's recognition of the valuable contribution people with disabilities continue to make to our society.

In December FRD participated in the “Santa for Seniors” program. A flannel shirt and lap blanket were donated to the Idaho Falls Chamber of Commerce to be given to local seniors.

During the reporting quarter, FRD employees participated in the 2008 Combined Federal Campaign. This year, 50% of the staff participated in the Campaign. The participation rate is one of the best for this region.

On December 3, Walter Childress (OAR contractor) conducted Vital Signs with FRD staff. The effort was an attempt to determine specific areas of success and areas of improvement for OAR.

The annual FRD Christmas Dinner and Party was held at the home of Kirk Clawson. The main course was fondu-cooked meats, with a great spread of roasted vegetables, salads, and desserts. The group played the newly popular Bunko, with the person with lowest score being the first to select and open a white elephant gift. The person with the next lowest score could choose to steal the opened gift or choose an unopened gift, and so on until all gifts were opened. A gift could only be stolen 3 times, after which it was out of play. The most coveted white elephant gift was a 2008 weather calendar. A good time was had by all.