Status of Transboundary Radiation Monitoring in Alaska

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Abstract Arctic areas of Alaska are especially vulnerable to nuclear accidents releasing radioactivity into the atmosphere within the circumpolar north. Atmospheric fallout and the resultant bioconcentration in the lichen-caribou-human food chain are of great concern for those living a subsistence lifestyle. The situation with the aging Former Soviet Union (FSU) nuclear reactors is a reality underscoring this concern. For Alaska, it is believed that the actual health threat from such accidents will be minor, the perceived risk will be great. A project, Neighborhood Environmental Watch Network (NEWNET), was initiated to provide an opportunity for Alaska Native undergraduate college students to participate in environmental monitoring of the atmosphere and communication of the results. The URL for the NEWNET system is: http://newnet.jdola.lanl.gov. The URL for the UAF site is: http://www.ims.uaf.edu:8000/NEWNET/

Introduction NEWNET is a network of meteorological and radiological monitoring stations, central data storage, and processing systems. Access to the data can be gained via the Internet or through an onsite readout directly from the Data Collection Platform (DCP). Interested citizens, schools or researchers have access to the stations and can observe the results at any time. NEWNET (DCP) sites in Alaska are located in Fairbanks, Seward, Nome, Point Hope and Kotzebue. Data products are wind direction and speed, ambient temperature, atmospheric pressure, humidity, and gamma radiation. Each (DCP) station transmits the data to a satellite, which then transmits the data to earth stations at Los Alamos, New Mexico, or Las Vegas, Nevada. At Los Alamos the data are processed and made available over the Internet.

Below is a diagram of a typical Data Collection Platform. There are 5 in Alaska and 26 total in the USA. Figure 1 provides a display of the data from the Fairbanks (DCP) station for June 17 – June 22, 1999. Figure 2 shows a tabulation of the hourly data for June 21, 1999.

Wind data is measured by a Met One Wind Finder System, model 6266/037, which consists of a wind speed sensor (cup anemometer) and wind direction sensor (vane).

Temperature is measured by a Met One temperature sensor, model 064-2, mounted in an 075 radiation shield to reflect solar radiation.

Barometric Pressure is measured by a Met One Barometric Pressure Sensor model 090C. This is available in a number of calibration ranges, determined by the elevation of the station. Barometric pressure decreases by about 1" Hg per 1000 ft of elevation. The value is converted to millibars of barometric pressure, and is reported unadjusted for elevation. (Values normally reported in weather reports have been adjusted to pressure at sea level.)

Humidity is measured by a Rotronic Hygrometer, model HT225W.

Gamma Radiation is measured by a Reuter-Stokes High Pressure Ionization Chamber, model RSS-120. This instrument has an ionization chamber filled with argon to a pressure of 25 atmospheres.

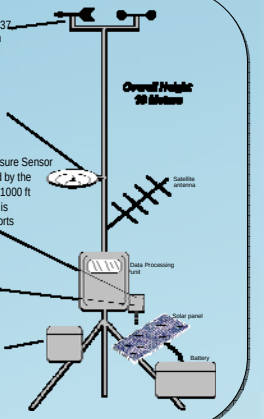


FIGURE 1

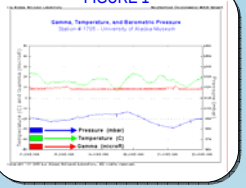
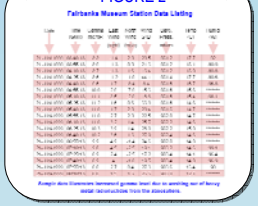


FIGURE 2



AISES

The American Indian Science and Engineering Society (AISES) is a private, nonprofit organization that works towards bridging science and technology with traditional Native values. AISES provides opportunities for Alaska Natives and American Indians in fields of science, engineering and technology while providing support for students as they work towards achieving their goals. NEWNET in Alaska is an AISES project. Doug Dasher (ADEC), Dr. John Kelley (UAF/IMS) and members of the UAF chapter of AISES stand in front of the Fairbanks NEWNET station at the University of Alaska Fairbanks Museum.

Trajectory Analysis The Bilibino Nuclear Power Plant (BNPP) in Northeastern Siberia is the closest Russian nuclear power station to Alaska. It is located 1300 km from Nome and 2200 km from Anchorage. There are concerns about potential accidents at this facility and subsequent release and transport of radionuclides. Analysis of air trajectories using an isentropic trajectory model yielded more 73,000 trajectories for the years 1991-1995. From this modeling effort, trajectories were selected for atmospheric transport and deposition modeling. Averaged over the entire year[1], these calculations indicate that the probability that the air in the Bilibino region will be transported to Alaska is approximately 6-16% (summer-fall: 12-33%). Mean annual transport time from Bilibino to Alaska is 4 days.

FIGURE 3

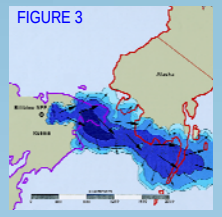
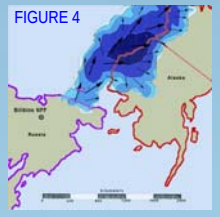


FIGURE 4



Two cases of rapid transport from the Bilibino region to Alaska are shown in Figure 3 and 4 using a full 3 dimensional telescopic model of atmospheric transport and deposition. The scenario included 1 curie (Ci) each of ^{131}I, ^{133}Xe, and ^{137}Cs released over a one hour period at a height of 10 meters with a deposition velocity of 0.1 cm/sec. This analysis was performed using the U.S. Department of Energy's (DOE) Lawrence Livermore National Laboratory (LLNL) Atmospheric Release Advisory Capability (ARAC). The LLNL/ARAC and the isentropic trajectory model gave broadly similar results.

[1] References: Jaffe, D.(djaffe@gi.washington.edu), Mahura, A and Andres, R. Atmospheric Transport Pathways to Alaska from Potential Radionuclide Sites in the Former Soviet Union. Joint project report, UAF-ADEC, Geophysical Institute, University of Alaska Fairbanks, 71pp, February, 1997.

Conclusions

The integration of the NEWNET gamma radiation monitoring station into the American Indian Science and Engineering student chapter at the University of Alaska has resulted in opportunities for the students and benefits to the NEWNET system. Some students have gained summer employment and training at the Los Alamos National Laboratory. Others have participated in periodic maintenance and testing of the Fairbanks station. The NEWNET sensors have operated reliably through the cold Alaskan winters however the power systems have had numerous failures. The combination of short sun light hours (less solar power available) and temperatures lower than -40°C (too cold for regular 12-volt battery) reduced power generation/storage below power consumption levels. This imbalance of power consumption versus production caused system failure. Modifications to both are planned for the coming season and should lead to more reliable operation.

Acknowledgements

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Poster designed by W. Splain