

APPENDIX F: NOAA/INL MESONET INSTRUMENTATION



Figure F-1. Example NOAA INL Mesonet station layout, with the addition of the community monitoring station kiosk (foreground) on the Idaho Falls Greenbelt at the John's Hole Bridge and Forebay.

1. Wind Speed - Wind speed is measured using a cup anemometer. Most cup anemometers consist of three (or more) hemispherical cups mounted on a vertical shaft. The difference in wind pressure from one side of a cup to the other causes the cups to spin about the shaft. The rate at which they rotate is directly proportional to the speed of the wind measured in miles per hour.

Wind speed gust - The wind gust is the highest 3-second wind speed average measured at the tower during the last five minutes.

Wind Chill - Is a measurement of how much heat is lost by your body based on the current temperature and wind speed.

2. Wind Direction - Wind direction is measured with an instrument called a wind vane. The vane always points into the wind and always gives the wind direction in compass degrees *from* which the wind is blowing.

3. Top Temperature - The temperature is measured using a thermocouple placed inside a metal housing (aspirator). This housing provides aspiration and shielding to eliminate the effects of radiative heating and cooling. The temperature is measured at two heights on the tower to provide information necessary to calculate the stability of the atmosphere.

4. Pyranometer - The pyranometer measures the electromagnetic radiation emitted by the sun or solar radiation. It is measured using solar cells that collect sunlight and converts it into electrical energy measured in watts per meter squared.

5. 6 - Foot (2 m) Temperature - The temperature is measured using a precision platinum resistance sensor placed inside a metal housing (aspirator). This housing provides aspiration and shielding to eliminate the effects of radiative heating and cooling. The temperature at 6 feet (2 m) is a true air temperature without the effects of

radiative and convective heating and cooling. The temperature is measured at two heights on the tower to provide information necessary to calculate the stability of the atmosphere.

Relative Humidity - Sensors also located inside the metal housing (aspirator) measure the amount of moisture in the air. The amount of moisture in the air versus how much the air could hold at the current temperature is called relative humidity.

Dew Point Temperature - The humidity sensor's output is used to calculate the temperature at which the current moisture in the air would condense to form dew.

6. Heated Tipping Bucket Rain Gauge - Rain and snow is collected using a heated tipping bucket rain gauge. When the amount of water equivalent to 0.01 inch of precipitation has been collected in the bucket, it tips over emptying the bucket. The accumulated precipitation in a given time period is calculated from the number of tips.

7. Weighing Rain Gauge - Rain gauge used to measure the amount of precipitation based on its weight. This rain gauge is setup temporarily only at the Idaho Falls station.

8. Pressurized Ionized Chamber (PIC) - Nuclear radiation in the form of gamma rays is measured using a high-pressurized ion chamber. The PIC is capable of measuring background levels of radiation in the environment as well as additional contributions from manmade activities. The units for the measurement of gamma radiation are micro-Roentgens (μR) per hour on the number of ionizations in the air that occur during an hour-long period. The PIC is owned and maintained by the State of Idaho.

9. Electronics Box - The electronics box, located on the tower behind the HiVol, contain the datalogger and barometric pressure sensor. The datalogger collects data from the meteorological

instrumentation and transmits it via radio back to the ARLFRD office storage computers.

Barometric Pressure - The barometric pressure is measured in inches of mercury. The values are reported in actual pressure. Local weather reports will often convert the actual pressure to adjusted sea-level measured values.

10. High Volume Air Sampler (HiVol) - An auxiliary air sampler that is capable of drawing large quantities of air through a particulate filter is placed on each monitoring tower. The high volume air sampler can be activated remotely in the unlikely event that an accidental release occurs at the INL facility. By sampling large quantities of air over a short period of time, the ability to detect low-level radioactivity in the atmosphere is increased. In essence, the larger quantity of air drawn, the lower the measurement sensitivity becomes.

11. Community Monitoring Station (CMS) kiosk- Several stations, called Community Monitoring Stations (CMS), are sited at schools and other places frequented by the public to enhance relations with the local communities. The CMS stations include a walk-up kiosk that displays current meteorological parameters and

describes each of the measured variables. These stations are located in Terreton, Big Lost River Rest Area, Fort Hall, Blackfoot, Idaho Falls, and Rexburg.

Instruments not shown

Nrad - The Nrad uses Geiger-Muller tubes to measure the total radiation present in the environment from naturally occurring cosmic and mineral sources, as well as any incidental man-made activities. The values report in microRoentgens (μR) per hour, which is proportional to the number of atoms ionized in air per hour.

Air Sampler - Particulate matter in the atmosphere is collected by an air sampler that is operated continuously around the clock. Each week the filter used to collect and retain the particulate matter is removed from the sampler and exchanged with a new filter. The used filter is sent to a laboratory where it can be analyzed for the gross or total amount of radioactivity collected from the atmosphere at this location. Air samplers are operated at several locations throughout southeast Idaho to evaluate the air quality both from the natural contributions of background sources and any manmade sources.

INSTRUMENT SPECIFICATIONS

Met One Instruments, Inc. Model 010C - Wind Speed Summary

Maximum Operating Range:	0 to 125 mph (0 to 60 m/s)
Starting Speed:	0.6 mph (0.27 m/s)
Calibrated Range:	0 to 100 mph (0 to 50 m/s)
Accuracy:	±1% or 1 mph
Temperature Range:	-58°F to +185°F (-50° C to +85° C)
Response:	Distance Constant less than 5 feet (1.5 meters)* of the flow

* The distance traveled by the air after a sharp-edged gust has occurred for the anemometer rate to reach 63% of the new speed.

Met One Instruments, Inc. Model 020C - Wind Direction (Azimuth) Summary

Azimuth:	0 to 360° mechanical, 0 to 356° electrical
Threshold:	0.6 mph (0.27 m/s)
Linearity:	±½% of full scale
Accuracy:	±3°
Damping Ratio:	0.4 to 0.6
Delay Distance:	less than 3 ft. (0.91 m)
Temperature Range:	-58°F to +185°F (-50° C to +85° C)

Campbell Scientific Inc. Model HMP45C - Temperature and Relative Humidity Probe Summary

Temperature Sensor Specifications

Temperature and Measurement

Range:	-40°F to +140°F (-40° C to +60° C)
Temperature Accuracy:	±0.5° C

Relative Humidity Sensor Specifications

Relative Humidity Measurement

Range:	0 to 100% non-condensing
Accuracy at 20° C (68° F):	±2% RH (0 to 90% Relative Humidity) ±3% RH (90 to 100% Relative Humidity)

Temperature Dependence of

Relative Humidity Measurement:	±0.05% RH/° C
Typical Long Term Stability:	Better than 1% RH per year

Campbell Scientific Inc. Model 076B - Fan Aspirated Radiation Shield Summary

Errors Reduced: < 0.05° F (0.028° C)

LICOR Model LI200X - PYRANOMETER Summary

Stability: <± change over a 1 year period
Response Time: 10 μs
Cosine Correction: Cosine corrected up to 80°
Operating Temperature: -40° + 149°F (-40 to +65° C)
Temperature Dependence: 0.15% per °C
Relative Humidity: 0 to 100%
Accuracy: Absolute error in natural daylight is ±5% maximum; 3% typical
Sensitivity: 0.2 kW⁻² mV⁻¹
Linearity: Maximum deviation of 1% up to 3000 W⁻²

Setra Systems Model 270 - Barometric Pressure Summary

Range: 800 to 1100 hPa/mb
Accuracy: ±0.05% FS

Friez Engineering Company Model 7405 7405H - Tipping Bucket Rain Gauge Summary

Accuracy: ±2% to 2" (5.08 cm) per hour
±4% to 10" (25.4 cm) per hour
Sensitivity: 0.01 inch (0.2 mm) per tip