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Fire Weather Station Standards

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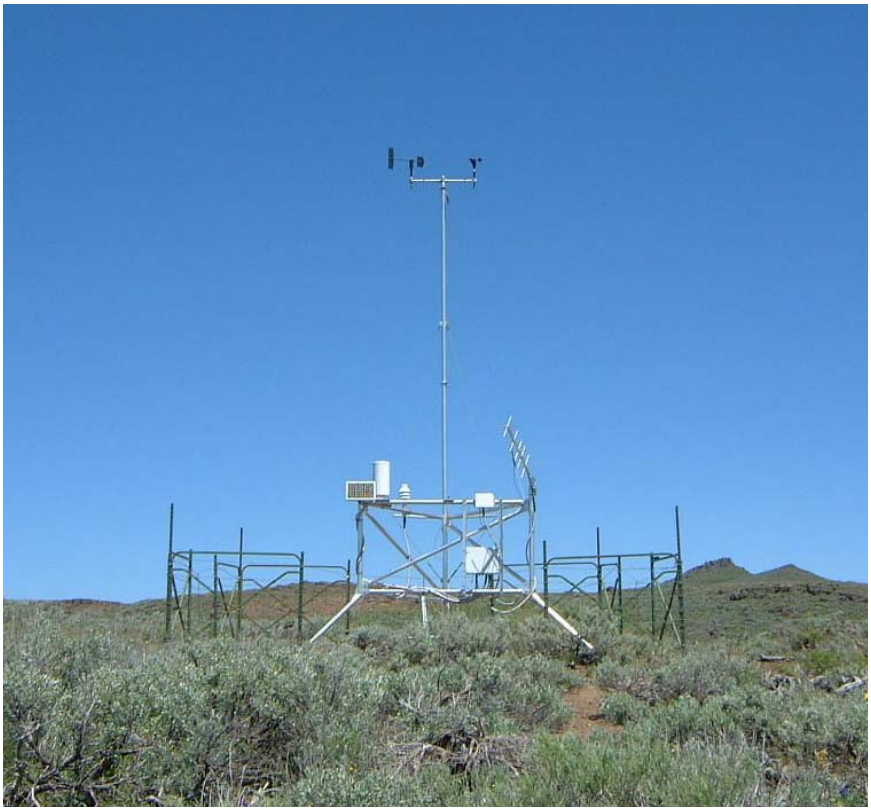

Fire Weather Station Standards

A publication of the NWCG Fire Environment Working Team (FENWT)

Fire Weather Committee (FWC)

Updates are facilitated by the FWC in partnership with interagency RAWS partners at the National Interagency Fire Center (NIFC).
Comments regarding this publication may be directed to Robyn Heffernan (robyn_heffernan@nifc.blm.gov) and Herb Arnold (herb_arnold@nifc.blm.gov).

This publication is available on line at http://www.fs.fed.us/raws/standards.shtml

FIRE WEATHER STATION STANDARDS
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INTRODUCTION

This document has been composed to provide common standards for weather stations used by the wildland fire agencies to provide weather data observations. These weather data are used for a wide variety of applications including calculation of the National Fire Danger Rating System (NFDRS) indices, fire behavior, burned area fire rehabilitation, prescribed fire, and other land management operations. **This document is intended to supplement and supersede The Weather Station Handbook: an Interagency Guide for Wildland Managers, Finklin/Fischer, (NFES 2140, PMS 426-2) with regard to NFDRS standards.**

This document is a re-title of the original NFDRS Weather Station Standards and has been modified to include standards for portable Fire RAWS in addition to NFDRS weather stations. This document has been partitioned into two sections: (1)NFDRS weather station standards and (2)Fire RAWS weather station standards. The original NFDRS weather station standards were a reflection of a cost/benefit analysis, interagency discussion and direction provided by the Fire Weather Working Team to the Weather Station Standards Task Group. The update of the standards in this document were created by the Fire Weather Committee in conjunction with the RAWS Partners Group (RPG) and reviewed by the Fire Environment Working Team (FENWT) and its Fire Danger and Fire Behavior Committees.

The original standards were approved in May 2000 and updated in March 2008. Supplemental March 2008 changes should be implemented upon NWCG approval of document update.

QUALITY ASSURANCE

The station owner, at the field level, is responsible for ensuring weather data quality by:

- Ensuring that maintenance is performed per standards, and that this maintenance and all other significant station activity is documented in CMMS.
- Visually confirm outputs from the station to check that the information is reflective of actual conditions, and notify appropriate organizations if data quality is suspect.
- Ensuring that the station is physically secure and that the site is maintained as needed.

Two methods of data quality control can be implemented. The first level is an automated oversight system, such as Watchdog, to continually monitor data for errors relating to out of range observations and performance problems from non-functional sensors. Watchdog quality control is available to the field user through coordination with the ASCADS system administrator if the station transmits data via GOES satellite. The second level is periodic review and verification by an Agency/Regional/Local Fire Weather user. Should errors or problems be detected, the station owner/user is responsible for initiating action to correct.

Ultimately, the station owner is responsible for ensuring the station is delivering acceptable weather data.

EQUIPMENT SELECTION

When selecting which type of automated weather station equipment to purchase, consider more than just the lowest bid. Consider more detailed life-cycle costs of equipment, data transmission, maintenance, data storage and retrieval, and the value of corporate (shared) data. Talk to several vendors, other users, and consult your agency weather station coordinator. The weather station owner is responsible for ensuring that equipment will meet minimum interagency fire weather station standards.

Additional fire management needs, as well as those of other multiple use interests, should be factored when selecting equipment. Expandability, serviceability (including service contract availability), transportability, and compatibility with current and future national systems must be considered.

POSITIONS, RESPONSIBILITIES AND TRAINING STANDARDS

The following positions are used in fire weather station operations and are required to implement the fire weather program. They require a level of specific skill and knowledge to perform the fire weather responsibilities. Personnel should be assigned only to positions in which they have demonstrated the ability to perform successfully. In each position, interagency coordination and communication between different levels (local/regional/national) is necessary.

Agency/Regional Fire Weather Coordinator - Responsible for agency/regional level oversight and quality control. This includes spot checks for data accuracy and WIMS station catalog status (NFDRS stations only). Ensures that ASCADS metadata and CMMS maintenance documentation is current, as appropriate. Ensures that training is available at the regional/local level as needed. Assists with station operation and lifecycle management planning.

Depot Manager - Responsible for administration of depot contract(s). Provides a maintenance summary to Agency coordinator annually.

Depot Technician - Responsible for bench rehabilitation and calibration of all station components under their contract. Provide technical support to field technicians and first responders as needed.

Field Support Technician - Responsible for performing annual site maintenance and responding to system failures in a timely manner, and documenting in CMMS. Provides status report to Station Owner/Program Manager. Required to attend basic field rehabilitation training. Training will include performing field rehabilitation standards for the specific stations within their area of responsibility.

Incident Commander/Burn Boss/Project Leader - Responsible for appropriate Fire RAWS site selection and placement, maintenance, and assurance that accurate observations are taken. V*isual checks of data on a frequent basis will ensure that station readings are reflective of actual conditions. If the station is not functioning properly obtains prompt maintenance to bring the station back to standards and/or shuts the station down until such actions can happen.*

Station Owner/Program Manager - Responsible for appropriate site selection and placement of NFDRS weather stations, maintenance, and assurance that accurate observations are taken and transmitted. This includes ~~reading and~~ assuring appropriate response to station malfunctions. *Visual checks of data on a frequent basis (preferably daily), will be done to ensure that station readings are reflective of actual conditions.* Station owners are responsible to make sure that contractors or trained agency personnel are available to perform routine station maintenance, including documentation in CMMS, and to respond to emergency breakdowns in a timely manner.

NFDRS Weather Station Standards

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PREFACE

The National Fire Danger Rating System (NFDRS) is a system used by wildland fire management agencies to assess current fire danger at local and national levels. It consists of a variety of indices that portray current potential fire danger conditions.

The weather station network supporting NFDRS has grown considerably in the last 30 years. The original RAWS network was conceived to support the coarse-scale application of fire danger rating. Today, RAWS data are routinely used to support decisions impacting firefighter safety, whether or not to initiate a fuels treatment prescription, air quality, crew readiness, and strategic seasonal and multi-year resource allocations to name a few. Demand for these data happens every day. The future use of RAWS data to support gridded, digital data products is already here and growing quickly. The current and future purpose of the RAWS network is to support point and gridded applications of fire weather for fire program analysis, fire danger rating, fire behavior prediction fire weather forecasting, and smoke management. The data from these stations support interagency fire danger predictions and provide quantification of risk elements that are critical for daily decisions regarding firefighter resource placement, staffing levels, appropriate suppression response, and strategic decisions at local, regional, and national levels. The most important value among those provided by these data is consideration for firefighter and public safety.

Stations compliant with the NFDRS standards will provide remotely sensed weather data--temperature, humidity, precipitation, wind and solar radiation on an hourly basis via the GOES satellite. Note: this does not apply to manual stations.

Use of a model to determine fuel moisture values is referred to in this document as the NFDRS Update. With the implementation of the NFDRS update, manual station will no longer be used for NFDRS calculations.

STATION CLASSIFICATIONS

This section includes station standards for NFDRS weather stations
Note: **The minimum NFDRS standard is the Seasonal Data Collection Station**.

NFDRS - Year Round Data Collection Stations - Includes all permanent 24-hour observing stations that meet the following criteria:

- operates to minimum standards year round to support designated wildland fire season
- equipped with the minimum NFDRS sensor compliment (see page 11)
- meets minimum quality assurance requirements (see page 3)
- 24-hourly readings are delivered to WIMS hourly via GOES through ASCADS
- NFDRS calculations are processed regularly in WIMS delivering historical data to the NIFMID database.
- (Optional) winterized rain gauge (weighing gauge, heated gauge, etc.) if necessary.

***NFDRS - Seasonal Data Collection Stations** - Includes all permanent 24 hour observing stations that meet the following criteria:

- operates to minimum standards to support designated wildland fire season (can operate 12 months or less)
- equipped with the minimum NFDRS sensor compliment (see page 11)
- meets minimum quality assurance requirements (see page 3)
- 24 hourly readings are delivered to WIMS hourly via GOES through ASCADS during seasonal operational period.
- NFDRS calculations are processed regularly (during seasonal operational period) in WIMS delivering historical data to the NIFMID database.

Other - Includes all resource, special purpose, portable (non-fire) and miscellaneous stations that provide accurate weather data but does not meet the fire weather station standards.

Manual Weather Stations - Includes manual stations providing basic NFDRS inputs to WIMS during operational period. One observation is delivered to WIMS every 24-hour period during operating season.

TELEMETRY POLICY

The following telemetry and input standardization will begin upon adoption of these standards. It must be stressed that **this ONLY affects stations in support of NFDRS**.

All stations designated for NFDRS use will deliver data to ASCADS via GOES Satellite telemetry and sent to WIMS on an hourly basis. The GOES transmitter and format used must be compatible with the ASCADS system.

GOES telemetry is the minimum standard; however, station owners may apply additional telemetry options as desired at the local level.

Any station operating on the High Data Rate (HDR) on the GOES satellite must use GPS (instead of WWV) per the Satellite Telemetry Interagency Working Group's (STIWG) High Data Rate Transition Plan. All stations must be transmitting on high data rate GOES channels by 2013.

Note: GOES telemetered NFDRS stations will be assigned transmission slots as near the top of the hour as possible. The intent is to have these assignments within 15 minutes either side of 00 (0045-0015). Non-NFDRS GOES telemetered stations will be assigned transmissions slots in the bottom half of the hour (0015-0045).

National Environmental Satellite, Data, and Information Service Identifiers (NESDIS ID):
This is an eight digit (letter and number) identification number assigned by NOAA/NESDIS that becomes the RAWS identification number, i.e 234567EO. NESDIS identifiers are assigned to every NFDRS RAWS, as well as some portable RAWS, which allows them to transmit data to the GOES satellites. The NESDIS ID is critical metadata for every station because that identifier ties the RAWS to a specific location on earth which is latitude/longitude. The proper assignment and tracking of NESDIS ID's is critical. Inappropriate assignment or reassignment of NESDIS ID's can result in misdirected weather data and conflicting metadata.

Interagency policy and guidelines for assignment of NESDIS ID's shall be:

1. NESDIS identifiers should not be changed unless there is a compelling reason to change them, such as the RAWS is moved to a new location.
2. Any change in NESDIS for existing NFDRS RAWS requires a change in WIMS and the appropriate station owner in WIMS must be consulted prior to this happening.
3. NESDIS ID's are not unique for any agency per the Satellite Telemetry Interagency Working Group (STIWG). Hence there is no need to assign any special set of identifiers for any given agency.

Note: For additional information on how to obtain or change a NESDIS ID, please contact the RAWS Depot at (rawsdepothelp@nifc.blm.gov).

OPERATIONAL PERIOD

The optimal operating period for all weather stations used for the NFDRS is year-round. However, the minimum operational period is dictated by the following:

1. A minimum 30-day start up period prior to the need for NFDRS indices (i.e. the wildland fire season as designated by the local manager, Region, or Geographic Area Coordination Center) is required for each seasonal weather station to properly calibrate the model

2. Annual fluctuations in season length. Use of the visual greenness (available on the WFAS home page) or Growing Season Index images (available at http://phenmon.org) is recommended to assist the local or regional fire manager.

Non-owner use. The following guidelines are recommended for any use of a weather station for NFDRS that is not owned by the user.

1. Notify the station owner that you are using this station for NFDRS or other applications.

2. When a longer operating season is required by an adjoining unit, the non-owning user should assist in the management of that station, including any additional costs for operation or maintenance.

SENSOR AND DATA REQUIREMENTS

NFDRS Station Minimum Sensor Compliment

NFDRS requires hourly measurements of precipitation duration and amount. In addition, an instantaneous air temperature reading will be taken each hour. Ten minute averages will be computed for the following variables: relative humidity, wind direction, and wind speed. Solar radiation will be recorded over a 60-minute average. Detailed data sampling requirements are listed under each specific sensor/instrument in the subsections below.

A note about automated fuel temperature/moisture measurements: The Fire Danger Committee recommended that a fuel moisture value be obtained from an automated model. Solar radiation sensors will provide input to the model that will produce derived fuel moisture/fuel temperature values that have been determined to be more reflective of actual conditions. Use of a model to determine fuel moisture values is referred to in this document as the NFDRS Update.

GOES telemetered station sensor update readings will coincide with the assigned transmission time. The instantaneous readings must be taken within the 5 minutes up to and including the transmission time. Further, if 10-minute averages are taken, the sensor average readings must be taken within the 15 minutes prior to the assigned GOES transmission time. Example: if a station transmits to GOES at 45 minutes past the hour, the sensor's instantaneous readings must be taken between 40 and 45 minutes past the hour and the averaged readings must be initiated between 30 and 35 minutes past the hour. **Sensor data must transmit in English units.**

Rain Gauge

Precipitation is the amount of water falling upon the earth as rain or in frozen form such as snow, sleet, and hail. It is expressed as the depth of water that would cover a flat surface. Rainfall output will be the cumulative total of rainfall for the rain year determined by the agency or maintenance cycle. Year-round precipitation information is not necessary for NFDRS (please see classification section of this documentation for more information). However, if the station reports year-round and the user determines the need for collecting year-round precipitation information, a winterized gauge (heated gauges, weighing-gauge, etc.) may be necessary. (Please note that stations, which do not have winterized precipitation gauges, will often show a large rain event in early spring due to normal thawing cycles.)

Sensor Standards	
Sampling Height	1-6 feet, varies with mounting tower
Measurement Units	Inches
Range	00.00 through 99.99 inches
Resolution	.01 inches
Accuracy	+/-3% of total
Data Standards	
Type Measurement	Continuous cumulative measurement
Data logged	Hourly
Data Format	XX.XX

Wind Speed

Wind speed is the rate at which air passes a given point.

Sensor Standards	
Sampling Height	20 feet
Measurement Units	Statute Miles per Hour
Range	0-100 mph
Accuracy	+/- 5% of reading
Data Standards - 10-Minute Average	
Type of measurement	10-minute average from no less than 120 samples
Data Logged	Hourly
Data Format	XXX
Optional Measurement - Peak WS - Data Format Standards	
Type Of Measurement	Maximum speed for previous 60 minutes from no less than 720 samples.
Data Logged	Hourly
Data Format	XXX

Wind Direction

Wind direction refers to the direction from which the air is moving.

Sensor Standards	
Sampling Height	20 feet
Measurement Units	Degrees from True North
Range	0-360 degrees
Accuracy	+/- 5 degrees
Data Standards - 10 Min Average	
Type of Measurement	10-minute average from no less than 120 samples
Data Logged	Hourly
Data Format	XXX

Optional Measurement - Peak WD - Data Format Standards	
Type of Measurement	Direction at Peak Wind Speed
Data Logged	Hourly
Data Format	XXX

Air Temperature

Air temperature refers to the air surrounding the weather station instrumentation.

Sensor Standards	
Sampling Height	4-8 feet
Measurement Units	Degrees Celsius or Fahrenheit
Range	-50 to +50 degrees Celsius -58 degrees to +140 degrees Fahrenheit
Accuracy	+/- 1 degree Fahrenheit +/- .6 degree Celsius

Data Standards	
Type of Measurement	Instantaneous reading
Data Logged	Hourly
Data Format	XXX

Relative Humidity

Relative humidity is the percentage ratio of the actual amount of water vapor in the air to the amount of water vapor required for saturation at existing temperature.

Sensor Standards	
Sampling Height	4-8 feet
Measurement Units	Percent
Range	0-100 %
Accuracy	0-80% - +/- 2.00% at 25 degrees Celsius 80-100% - +/- 5% at 25 degrees Celsius
Data Standards	
Type of Measurement	10-Minute average from no less than 120 samples
Sample Interval	Hourly
Data Format	XXX

Battery Voltage

Battery voltage is the DCP/DataLogger battery current voltage. This item is recorded for remote troubleshooting and data validation purposes.

Data Standards	
Range	0-15 Volts
Accuracy	.1 Volts
Type of Measurement	Instantaneous
Sample Interval	Hourly
Data Format	XX.X

Solar Radiation

Solar radiation measures the amount of sunlight exposed to the fuels.

Sensor Standards	
Sampling Height	5-8 feet (so not to be shaded during the day)
Measurement Units	Millivolts
Output	Watts per meter squared
Accuracy	+/- 5%
Data Standards	
Type of Measurement	60 minute average taken from 60 samples prior to transmit.
Data Logged	Hourly
Data Format	(-)XXXX

Universal Time Coordinated (UTC) – The station must stay synchronized with coordinated universal time. GPS units or WWV synchronization clocks are required for hourly (or more frequent) GOES transmissions. Readings from these receivers are not required as part of the data stream. If the latitude/longitude/elevation information is available, make note of the accurate location and ensure that it is recorded in ASCADS/WIMS/WRCC. Any station operating on the High Data Rate on the GOES satellite must use GPS (instead of WWV) per the Satellite Telemetry Interagency Working Group's (STIWG) High Data Rate (HDR) Transition Plan. All stations must be to HDR GOES by 2013.

Readings to be output in the following order:

Order	Sensor Name	SHEF Code
01	Rainfall	PC
02	10-Min. Avg. Wind Speed	US
03	10-Min. Avg. Wind Direction	UD
04	Air Temperature	TA
05	Fuel Temperature	MT
06	10-Min Avg. Relative Humidity	XR
07	Battery Voltage	VB

Channels beyond the first 7 are recommended to be output in the following order. Variations after the standard required sensor compliment will be facilitated on a case-by-case basis. Check with Remote Sensing Fire Weather Support Unit to be sure your application is compliant with ASCADS/WIMS.

08	Barometric Pressure	PA
09	Peak Wind Direction	UX
10	Peak Wind Speed	UG
11	Fuel Moisture	MM
12	Solar Radiation	RD

Note: The standard order for the NFDRS Update will be:

Order	Sensor Name	SHEF Code
01	Rainfall	PC
02	10-Min. Avg. Wind Speed	US
03	10-Min. Avg. Wind Direction	UD
04	Air Temperature	TA
05	10-Min Avg. Relative Humidity	XR
06	Battery Voltage	VB
07	Solar Radiation	RD

Channels beyond the first 7 are recommended to be output in the following order.

Variations after the standard required sensor compliment will be facilitated on a case-by-case basis. Check with Remote Sensing Fire Weather Support Unit to be sure your application is compliant with ASCADS/WIMS.

08	Barometric Pressure	PA
09	Peak Wind Direction	UX
10	Peak Wind Speed	UG
11	Fuel Temperature	MT
12	Fuel Moisture	MM

Note: This could be modified slightly depending upon WIMS/ASCADS interface and modifications necessary to support the NFDRS Update. An updated page to this document will be issued at that time.

SITE SELECTION

Process for Installing a New and/or Moving an Existing Station

1. When installing any station, it is particularly important to involve a fire weather forecaster and other interagency wildland fire personnel (as appropriate) in determining a new site or relocating an existing station.

2. When moving an existing station, Predictive Services or the NWS must be contacted to assist in the entire administrative process and to make contact with interagency partners and other users. It is particularly important to contact your agency weather station coordinator when moving an existing station in order to maintain integrity of historical data. Station relocation information must be updated in ASCADS, WIMS, and WRCC (wrcc@dri.edu) to clearly include the fact that the station is reporting from a new location.

3. Contact the agency or regional RAWS coordinator. To find out who your contact would be, go to the interagency web page at **http://www.fs.fed.us/raws** .

4. Obtain the following station site information: station name, legal (Township, Range, quarter-section), county, elevation and lat/long in degrees, minutes, seconds format.

5. Obtain a 6-digit National Weather Service identification number (also referred to as NWS ID or the WIMS number) for your station.

6. Transmission via GOES satellite requires a National Environmental Satellite Data Information Systems (NESDIS) Identification Number in addition to the NWS ID number. Contact your agency NESDIS ID coordinator. If you don't know your agency coordinator, visit the interagency RAWS web page **http://www.fs.fed.us/raws** or email rawsdepothelp@nifc.blm.gov.

Site Selection Considerations

The standard fire weather station should be located in a large, open area away from obstructions and sources of dust and surface moisture. The station should be on level ground where there is a low vegetative cover. Furthermore, it should be situated to receive full sun for the greatest possible number of hours per day during the fire season. If located on a slope, a south or west exposure is required to meet fire danger rating standards (Deeming, Lancaster, Fosberg, and others 1972).

Consider security (from animals and human vandalism) when selecting a site. To prevent any damage from wildlife, livestock etc., installation of a fence is highly recommended.

The following rules govern the location of an NFDRS fire weather station:

1. Locate the station in a place that is representative of the conditions existing in the general area of concern. Consider vegetative cover type, topographic features, elevation, climate, local weather patterns, etc.

2. Select a site that will provide for long-term operation and a relatively unchanged exposure. Consider site development plans, e.g., roads, buildings, parking areas; ultimate sheltering by growth of vegetation; and site accessibility during the intended operational period.

3. Arrange the station so as to give data that is representative of the area in which the station is situated. Consider exposure requirements for each instrument in relation to such things as prevailing winds, movement of the sun, topography, vegetative cover, nearby reflective surfaces, and wind obstructions.

In accordance with the above rules, the following situations should be avoided when selecting a station site:

1. **Sources of dust** such as roads and parking areas. If unavoidable, locate station at least 100 feet on the windward side of the source.

2. **Sources of surface moisture** such as irrigated lawns, pastures, gardens, lakes, swamps, and rivers. If unavoidable, locate station several hundred feet to the windward side of the source.

3. **Large reflective surfaces** such as white painted buildings. The same holds for natural reflective surfaces such as lakes, ponds, canals, and large rock surfaces. If unavoidable, locate station on north side, but far enough away so as not to be artificially shaded or influenced (at least a distance equal to the height of the reflective surface or 50 feet, whichever is greater).

4. **Extensively paved or black-topped areas.** If unavoidable, locate station at least 50 feet to the windward side.

5. **Large buildings, trees, and dense vegetation.** Locate station at least a distance equal to the height of the obstruction.

6. **Distinct changes in topography** such as gullies, peaks, ridges, steep slopes, and narrow valleys.

For additional information: Weather Station Handbook-An Interagency Guide for Wildland Managers, PMS No. 426-2, NFES No. 2140 (March 1990).

Note: Agencies that are considering buying a new weather station for use in NFDRS, should consult the local National Weather Service, Predictive Services and other interagency partners. A consensus among these groups will ensure the interagency NFDRS station network is adequate and limit the cost of needless station overlap.

TOWER SPECIFICATIONS

As identified within this standard, NFDRS Weather Stations may be located in very remote and rugged locations. These stations are or will be either permanent or semi-permanent sites. Some sites will be operated 12 months a year in severe environmental conditions.

There are several types of towers that incorporate NFDRS sensor compliments. Installation of these towers should be in accordance with manufacturer's specifications. Agency safety regulations apply to tower climbing. (See section under Tower Specifications for more information.)

The positioning of the tower is very important, and if positioned properly, greatly increases the speed of installation and future maintenance actions. Alignments, leveling and structural strength are the primary concerns with all types of tower and instrument installations.

Therefore, any tower that is purchased or used must be very sturdy, rugged and robust. Towers come in free standing, guyed, or portable configurations. Only guyed or freestanding towers should be used for NFDRS purposes. If a tower is "climbable", it must meet all applicable agency and OSHA regulations (See OSHA manuals 1926.32, 1910.66 and 1910.268) for climbing criteria. It should be noted that guyed towers may have additional construction costs at the site to facilitate excavation for concrete mounting pier and concrete anchor blocks.

If a guyed tower does not meet OSHA climbing specifications, it must have a tilting base. This will permit the tower to be laid over close to the ground to service all sensors. All non-climbable towers will have provisions (tilting or pivoting mast) for ground level service of instrumentation by maintenance personnel **or** be accessible by freestanding ladder, lift truck or bucket lift without contacting the tower. They also must provide adequate support and footing for technical staff to service and inspect all sensors while they are in place. These towers can be installed with effectively no impact on the environment.

Ensure that towers have adequate mounting locations, facilities, and hardware availability to mount all sensors securely to the tower and their respective locations and heights. Severe conditions, i.e., ice loading, deep snow, high winds may be normal for this equipment.

General Tower Specifications

- Survive 125 MPH winds
- No horizontal or vertical movement (sliding once installed)
- Withstand snow loads of typical high mountain locations of Western US (if station is located in an area susceptible to these conditions)
- Support technical personnel on the tower while servicing all sensors.
- Provide adequate mounting surface and locations to meet NFDRS sensor requirements.

INSTALLATION

Once a site is selected that meets all of the site standards, it can then be prepared for installation of a weather station. Personnel installing weather stations should have attended a Remote Automated Weather Station (RAWS) maintenance class, or be assisted by trained personnel. Trained personnel can be located through your agency weather station coordinator.

The following is a list of minimum information from the site that is necessary for station documentation. Other information about your station is valuable and needs to be stored in the Automated Sorting, Conversion and Distribution System (ASCADS). A listing of that information is available by accessing ASCADS.

ITEM	EXAMPLES
Slope	*20 %*
Aspect	*180 degrees (Compass Reading)*
Site	*Mid slope*
Antenna angle	*43 degrees* (*GOES Transmit*)
Antenna azimuth	*116 degrees (GOES Transmit)*
Elevation	*6500*
Latitude	*42 02 30* (degrees, minutes, seconds)
Longitude	*113 09 30* (degrees, minutes, seconds)
All serial #'s for sensors and DCP/DataLoggers	

Documentation. Installation and maintenance must be documented. It is required to record this information in CMMS/ASCADS, and station catalogs in WIMS*. Station owners will take digital photos of each NFDRS weather station looking toward the station from each of the four cardinal directions in accordance with the policy posted on http://www.raws.dri.edu/documents/2006_09_30_Photography_SOP.doc, and submit them for posting to Greg McCurdy at Greg.McCurdy@dri.edu. Photos should be updated every three years at a minimum. A hard copy folder will be kept for each station by the station owner. In this folder should be photos of the area and station, a map, and the information printout from CMMS/ASCADS.

* Ultimately, maintenance, station and site information will all be housed online with station metadata. Collaboration will take place between the ASCADS and WIMS managers to address and resolve metadata issues with the intent of not duplicating the storage of data and seamless access to the information for the user.

System Alignment and Leveling

It is important to include your local magnetic declination (east or west) readings when aligning the tower, GOES antenna, wind direction sensor, etc.

Once the tower has been aligned, it must be leveled. Once leveled, the tower should be staked to the ground. Staking the legs prevents the tower from being moved inadvertently in the installation process and during future maintenance visits.

The **wind speed/wind direction (WS/WD).** Install according to manufacturer instructions. For NFDRS, these will be mounted at 20 feet. Pay special attention so that the WD sensor is oriented properly, is level and gives correct readings. Route data cable in accordance with manufacturer's instructions.

Using the mounting bracket supplied by the manufacturer, the **tipping bucket** should be leveled using the leveling indicator attached to the sensor.

The **antenna (GOES, cell-phone, radio-voice)** should be assembled in accordance with manufacturer's instructions. The GOES antenna should be properly aligned for azimuth and elevation. Antenna alignment is accomplished using the compass and inclinometer. Remember to compensate for declination if required.

The **solar panel** will be mounted with a southerly exposure to maximize solar input.

The **solar radiation sensor** should be installed and leveled according to the manufacturer's instructions. Mount the instrument on the tower ensuring that it is not shaded by the tower, cables or instruments at any time of the day. For example, in the case of the Vaisala/Handar 403A tower, the instrument should be mounted in the middle of the top west rail of the tower.

Structural Integrity

All **cables** should be routed from their respective sensors to the Data Collection Platform (DCP)/DataLogger. Care should be taken in routing the cables to provide strain relief wherever required to prevent cable damage. When routing the cables, provide enough slack at both ends to permit a drip loop for moisture dissipation. When cable routing is complete, secure all cables to the tower using cable ties. Inspect all cables and ensure that rubber o-rings are used at both ends to make watertight seals.

Consider "shielded" cables (metal conduit, pvc tubing) for protection from the elements and animals.

Ensure that all guy wiring is secured and tight. Ensure that the anchor rods are secured in order to prevent the tower from moving. Make sure all tower hardware is properly tightened. The RAWS system is now ready for systems checkout for operational accuracy.

Lifecycle Management

As with any capitol investment equipment, a lifecycle management plan for the weather station network should be in place and budgeted for. Ten years is the recommended life-cycle rotation for weather station equipment.

STATION MAINTENANCE POLICY

Annual Maintenance

Annual service of NFDRS RAWS stations will provide an opportunity to ensure general station integrity, perform necessary preventative maintenance, and replace sensor and components prior to expiration of their calibrated lifetimes.

In order to ensure accurate weather readings, a program of annual (+/- 45 days from installation or previous year's maintenance date) RAWS maintenance/calibration is required. Every NFDRS RAWS must receive, at a minimum, one annual on site maintenance visit by either the local user or contracted personnel to ensure sensors are within calibration standards, and verify site and station conditions. Service contracts for this purpose can be requested through the BLM's Remote Sensing / Fire Weather Support Unit (RSFWSU) in Boise, Idaho, or any vendor that will meet the national standards for field or depot-level service as outlined in this document.

The site inspection also allows for maintaining vegetation growth or mitigating other site parameters (e.g. new irrigation systems, buildings) that may be compromising site integrity**. It is important to keep vegetation trimmed at the surface to ensure it doesn't block wind and air flow to sensors.** Reasonable attempts must be made to keep the site in accordance with siting standards. If there are regulations prohibiting appropriate site maintenance required to provide representative data, develop a plan to bring the station into compliance. This could be done by obtaining any necessary special authorizations to manage vegetation, or in the most unfavorable case, moving the station. If sites are considerably compromised, it is critical to document this in the station metadata, including photographs, so that users of the data have the opportunity to assess its value to them.

Unscheduled Maintenance / Emergency Repair

Local land managers are responsible for monitoring the quality of the data produced by the weather stations in their fire response area. In the event of system failures, bad data, or questionable data, it is the responsibility of the station owner to initiate corrective action.

1. Year-round response time to GOES systems time drift will be immediate unless it is determined that there is no interference with another station. Validation of interference can be made though agency RAWS coordinators responsible for NESDIS ID time/channel assignments or through the Remote Sensing Fire Weather Support Unit (RSFWSU).
2. All other NFDRS station failures will be responded to as appropriate in light of the following:
    a. Bad data affects the outputs of the model immediately. Responses to bad

data, during fire season where the station is located, should be initiated immediately. Failures that occur outside fire season will be repaired before the station is initiated for the following fire season.

b. Missing data for 15 consecutive days causes the NFDRS model to reset the 1000 hr fuel moisture to initial values. This in turn drives the live fuel moisture model. Response to missing data system failures during fire season where the station is located will be as soon as possible, but no more than 15 days. Outside fire season responses will be made before the station is initiated for the following fire season.

ANNUAL MAINTENANCE AND SENSOR REPLACEMENT STANDARDS

Sensors and key components of an NFDRS RAWS station must be recalibrated or replaced on a regular basis to ensure the collection of consistent and reliable weather data throughout the NFDRS RAWS network. Annual service of NFDRS RAWS stations will provide an opportunity to ensure general station integrity, perform necessary preventative maintenance, and replace sensors and components prior to expiration of their calibrated lifetimes. The entries for specific equipment below outline yearly preventative maintenance, as well as minimum replacement times for each component.

Field Service

Tipping Bucket – Remove cover. Clean cover and orifice to ensure free flow of water. Do not disassemble further. Check all connections and verify that the instrument is level. Unless the rain year is reset automatically by the DataLogger/DCP on a certain date each year, reset the tipping bucket to 00.00. Then simulate .02 inches of rain and validate that it was recorded by the DataLogger/DCP.

MINIMUM FIELD VALIDATION - 1 Year
MINIMUM DEPOT CALIBRATION/REPLACEMENT - 3 Years

Wind Speed - Check for damage and alignment of cups, ice skirt, free movement of bearings.

MINIMUM CALIBRATION/REPLACEMENT - 2 Years

Wind Direction - Check for damage of pointer and feather, free movement of bearings. Manually rotate the sensor through each of the four quadrants and scan the data for accuracy.

MINIMUM CALIBRATION/REPLACEMENT - 2 Years

Ultrasonic Wind Speed/Wind Direction – No calibration required, clear any obstruction between arms of transducers.

Relative Humidity/Air Temperature - Not field serviceable; do not open.

MINIMUM CALIBRATION/REPLACEMENT – Yearly

Battery - Perform a voltage test. Replace batteries according to manufacturer recommendations or if you suspect problems. Some manufacturers recommend yearly, others recommend every three years.

MINIMUM REPLACEMENT - 3 Years for internal
"D" cell (Supplemental Power) - yearly

WWV Receiver - Perform pass/fail functional check and replace if necessary.

MINIMUM CALIBRATION/REPLACEMENT - As Needed

GOES Antenna - Check for broken, loose, or bent elements, proper alignment, and connectors for corrosion.

* Minimum replacement time represents the optimum time to change any individual component. The servicing personnel may perform this function within +/- 45 days of the yearly expiration date and still meet NFDRS maintenance standards.

MINIMUM CALIBRATION/REPLACEMENT - As Needed

Cables - Check for cracking, deterioration, corrosion, proper routing, and security. Ensure O-rings are installed on all connectors. Replace as required for corrosion, aging, etc. Treat all connectors with moisture inhibitor.

MINIMUM CALIBRATION/REPLACEMENT - As Needed

Tower - Check for structural damage, proper alignment, and leveling. Be aware of potential risk to safety when dealing with a potentially damaged tower (i.e., tower rust, corrosion, cable fray, etc.).

MINIMUM CALIBRATION/REPLACEMENT - As Needed, if structure is compromised or as per manufacturer's specifications.

DCPs and DataLoggers - Check for security, damage, and ensure that all cables are properly connected. Verify the unit has the most recent version of the software or firmware installed. Change out as needed (defective, evidence of moisture, corrosion, rust, etc.).

MINIMUM CALIBRATION/REPLACEMENT – As needed or in accordance with manufacturer's specifications.

Solar Radiation - Sensor must be cleaned periodically using only *water* and/or a mild detergent such as dishwashing soap.

MINIMUM CALIBRATION/REPLACEMENT - 3 Years

Depot Sensor Calibration Standards

The depot or vendor's maintenance facility under contract will rehabilitate and calibrate sensors to the specifications contained in this document.

Sensor Documentation - A maintenance history record shall be kept for each component that is repaired/calibrated by any depot facility under contract. These records are kept on file by serial number and used by depot and agency staff for spotting systematic problem areas that may have impact on the program. The documentation is useful in working to develop better quality products.

Test Equipment – The test equipment and associated tools used during depot sensor calibration routines shall follow a general practice of "Traceability protocol" based on standards maintained by the National Bureau of Standards (NBS). This results in claims

of calibrations that are “traceable to NBS”.

*Minimum replacement time represents the optimum time to change any individual component. The servicing personnel may perform this function within +/- 45 days of the yearly expiration date and still meet NFDRS maintenance standards.

Complete station information (location, elevation, data measurement elements, etc.,) will be captured in the CMMS database. For latitude and longitude, NAD83 is the datum standard to be used and be recorded in degrees, minutes and seconds. CMMS users should initiate coordination with WIMS users (if not the same person) to ensure that location information matches precisely in both systems. It is especially important that this happen before WIMS managers generate the enhanced location information in WIMS.

Annual maintenance and emergency repair will be documented in CMMS. It is the responsibility of every person that visits the site to ensure that CMMS is updated and reflective of the condition of the station. This will include, at a minimum:

- Maintenance date (e.g. date that Relative Humidity / Air Temperature was changed / calibrated).
- Specific sensors and serial numbers of those sensors.
- A narrative of the site visit, including the date of the visit, the personnel at the site and what maintenance was accomplished.

The station owner will also maintain a hard copy of the documentation file for each station. This will include photos, site access instructions, purchase history and other relevant information.

Note: Basic NFDRS station metadata consists of latitude, longitude, station name, national weather service identifier, NESDIS identifier, elevation and aspect. It is critical that this basic information be shared with all systems and that it be accurate. Basic metadata resides on CMMS (ASCADS) and the WIMS system and the goal is to have automated sharing metadata between systems. This will reduce the occurrence of conflicting and inaccurate metadata.

Fire RAWS Standards

Updates are facilitated by the FWC in partnership with interagency RAWS partners at the National Interagency Fire Center (NIFC).
Comments regarding this publication may be directed to Robyn Heffernan (robyn_heffernan@nifc.blm.gov) and Herb Arnold (herb_arnold@nifc.blm.gov).

PREFACE

Portable Fire RAWS are used in prescribed fires, wildfires and on other incidents and projects to relay current weather information representative of an area of interest. Fire RAWS are extremely beneficial to fire managers as they represent micro-scale climate and weather patterns within a small geographic area. Incident Meteorologists (IMETS) and local users rely on the information from Fire RAWS to help them determine and predict small scale weather features. These forecasts are critical to firefighter safety, fire behavior forecasts, daily decisions regarding resource placement, appropriate suppression response and strategic decisions.

The portable Fire RAWS network consists of approximately 42 NFES #5869 units based at NIFC in Boise, Idaho, and more than 300 agency owned units scattered in various locations. Although most of the portable Fire RAWS currently being used in the field have similar equipment, the lack of established national standards for Fire RAWS has created ambiguity in the integrity of the network of stations. Established national standards for Fire RAWS will reduce the risk of bad data, malfunctioning sensors or stations, and potential for poor decisions based on misrepresentative data. National standards will provide the greatest opportunity for success in using Fire RAWS. Therefore in order to foster a more effective and efficient use of Fire RAWS and to mitigate the risk of potential bad data, the Fire Weather Committee in conjunction with the RAWS Partners Group has established national standards for Fire RAWS.

SENSOR AND DATA REQUIREMENTS

By definition, a Fire RAWS is a portable RAWS that conforms to standards of data collection and maintenance specified in this publication. These standards are established to ensure a reliable level of data quality is available to wildland fire management operations, and do not apply to portable RAWS used for non-fire management uses. This category includes but is not limited to Fire RAWS equipment currently available from the National Fire Equipment System Catalog (NFES 5869). Due to the mobile and transient nature of their deployments, Fire RAWS data are not suitable for NFDRS applications. These standards are the minimum required, and may be exceeded by individual organizations.

Stations that are portable or mobile or are sometimes referred to as "quick deploy" should have such an indicator in their name in ASCADS (i.e., Los Padres Portable #1). This helps other "downstream" users understand that these stations should not be considered for any long-term study or use.

Both required and optional sensor specifications follow.

STANDARDS FOR REQUIRED SENSORS AND DATA
Sensor data must transmit in English units

Wind Speed
Wind speed is the rate at which air passes a given point.

Sensor Standards	
Sampling Height	6 feet or higher
Measurement Units	Statute Miles per Hour
Resolution	1 Statute Mile per Hour
Range	0-100 mph
Accuracy	+/- 5% of reading
Data Standards - 10-Minute Average	
Type of measurement	10-minute average from no less than 120 samples
Data Logged	Hourly
*Data Format	XXX
Optional Measurement - Peak WS - Data Format Standards	
Type of Measurement	Maximum speed for previous 60 minutes from no less than 720 samples.
Data Logged	Hourly
*Data Format	XXX

Wind Direction
Wind direction refers to the direction from which the air is moving.

Sensor Standards	
Sampling Height	6 feet or higher
Measurement Units	Degrees from True North
Resolution	1 degree
Range	0-360 degrees
Accuracy	+/- 5 degrees
Data Standards - 10 Min Average	
Type of Measurement	10-minute average from no less than 120 samples
Data Logged	Hourly
*Data Format	XXX
Optional Measurement - Peak WD - Data Format Standards	
Type of Measurement	Direction at Peak Wind Speed
Data Logged	Hourly
*Data Format	XXX

Air Temperature
Air temperature refers to the air surrounding the weather station instrumentation.

Sensor Standards	
Sampling Height	4-8 feet
Measurement Units	Degrees Fahrenheit or Celsius
Resolution	1 degree Fahrenheit or .1 Celsius
Range	-58 degrees to +140 degrees Fahrenheit -50 to +50 degrees Celsius
Accuracy	+/- 1 degree Fahrenheit +/- .6 degree Celsius
Data Standards	
Type of Measurement	Instantaneous reading
Data Logged	Hourly
*Data Format	XXX

Relative Humidity
Relative humidity is the percentage ratio of the actual amount of water vapor in the air to the amount of water vapor required for saturation at existing temperature.

Sensor Standards	
Sampling Height	4-8 feet
Measurement Units	Percent
Resolution	1 Percent
Range	0-100 %
Accuracy	0-80% - +/- 2.00% at 25 degrees Celsius 80-100% - +/- 5% at 25 degrees Celsius
Data Standards	
Type of Measurement	10-Minute average from no less than 120 samples
Sample Interval	Hourly
*Data Format	XXX

STANDARDS FOR OPTIONAL SENSORS AND DATA

Rain Gauge - Optional
Precipitation is the amount of water falling upon the earth as rain or in frozen form such as snow, sleet, and hail. It is expressed as the depth of water that would cover a flat surface. Rainfall output will be the cumulative total of rainfall for the rain year determined by the agency or maintenance cycle. Year-round precipitation information is not necessary for NFDRS (please see classification section of this documentation for more information). However, if the station reports year-round and the user determines the need for collecting year-round precipitation information, a winterized gauge (heated gauges, weighing-gauge, etc.) may be necessary. (Please note that stations, which do not have winterized precipitation gauges, will often show a large rain event in early spring due to normal thawing cycles.)

Sensor Standards	
Accuracy	+/-3% of total
Sampling Height	1-6 feet, varies with mounting tower
Measurement Units	Inches
Range	00.00 through 99.99 inches
Resolution	.01 inches
Data Standards	
Type of Measurement	Continuous cumulative measurement
Data logged	Hourly
*Data Format	XX.XX

Battery Voltage – Optional
Battery voltage is the DCP/DataLogger battery current voltage. This item is recorded for remote troubleshooting and data validation purposes.

Data Standards	
Range	0-15 Volts
Resolution	1 Volt
Accuracy	+/- .1 Volts
Type of Measurement	Instantaneous
Sample Interval	Hourly
*Data Format	XX.X

Solar Radiation - Optional
Solar radiation measures the amount of sunlight exposed to the fuels.

Sensor Standards	
Sampling Height	4-8 feet (so not to be shaded during the day)
Measurement Units	Millivolts
Resolution 1	Millivolt
Output	Watts per meter squared
Accuracy	+/- 5%
Data Standards	
Type of Measurement	60 minute average taken from 60 samples prior to transmit.
Data Logged	Hourly
*Data Format	(-)XXXX

Fuel Temperature - Optional
Fuel temperature is a temperature reading imbedded within a standard pine dowel, fully exposed to sunlight, above a representative fuel bed.

Sensor Standards	
Sampling Height	10-12 inches
Measurement Units	Degrees Fahrenheit or Celsius
Range	14 to 140 degrees Fahrenheit 10 to 60 degrees Celsius
Resolution	1 degree Fahrenheit or Celsius
Accuracy	+/- 1 degree Fahrenheit or Celsius
Data Standards	
Type of Measurement	Instantaneous
Data logged	Hourly
Data Format	XXX

Fuel Moisture - Optional
Fuel moisture is the % weight of water particles present in a 100-gram '10-hour' Ponderosa pine dowel stick.

Sensor Standards	
Sampling Height	10-12 inches or as recommended by manufacturer
Range	0-25 grams
Resolution	1.0%
Accuracy	0-12% FM +/-1.9% 12-30% FM +/- 3.6% > 30% FM +/- 16%
Data Standards	
Type of Measurement	Instantaneous
Sample Interval	Hourly
Data Format	XXX

Barometric Pressure - Optional
Barometric pressures measures the force exerted by the weight of the atmosphere per unit area, adjusted for elevation.

Sensor Standards	
Sampling Height	As recommended by manufacturer
Measurement Units	Inches Mercury (Hg)
Range	23.60 to 32.50 Hg
Accuracy	+/- 0.02 Hg
Data Standards	
Type of Measurement	Instantaneous
Data logged	Hourly
*Data Format	XXX

*For those Fire RAWS that report via GOES, data format and transmission requirements are the same as NFDRS stations.

RADIO ALERT FUNCTION (optional)

The NFES 5869 FIRE RAWS has a radio voice alert function that can broadcast current weather information upon either interrogation or detection of pre-set parameters. This function should be adjusted to user requirements. Other commercially available equipment may also offer this feature, and should also be adjusted to local requirements.

SITE SELECTION

Specific fire management and/or incident requirements may dictate ~~other~~ site selection for where to setup a Fire RAWS. This should always be done in coordination with appropriate personnel. The general rule of thumb would be to locate the Fire RAWS in the area of your specific concern.

Site Selection Considerations (typical deployment)

Fire RAWS generally should be located in a large, open area away from obstructions and sources of dust and surface moisture. Consider security (from animals and human vandalism) when selecting a site. The following are guidelines for a typical fire management operation:

1. Locate the station in a place that is representative of the conditions existing in the specific area of concern. Consider vegetative cover type, topographic features, elevation, local climate and weather patterns, etc.

2. Deploy the Fire RAWS so as to give data that is representative of the specific area in which the project or wildland fire is located. Consider exposure requirements for each instrument in relation to such things as prevailing winds, movement of the sun, topography, vegetative cover, nearby reflective surfaces, and wind obstructions. Recommendations for station deployment:
    - Deploy a station where it represents the average conditions for your concerns or perhaps you might also want to consider having another station located that represents more severe conditions.
    - If an additional Fire RAWS is available, it may be beneficial to deploy it in an area that represents worst case conditions.

In accordance with the above rules, the following situations would generally be avoided when selecting a station site:

1. **Sources of dust** such as roads and parking areas. If unavoidable, locate station at least 100 feet on the windward side of the source.

2. **Sources of surface moisture** such as irrigated lawns, pastures, gardens, lakes, swamps, and rivers. If unavoidable, locate station several hundred feet to the windward side of the source.
3. **Large reflective surfaces** such as white painted buildings. The same holds for natural reflective surfaces such as lakes, ponds, canals, and large rock surfaces. If unavoidable, locate station on north side, but far enough away so as not to be artificially shaded or influenced (at least a distance equal to the height of the reflective surface or 50 feet, whichever is greater).

4. **Extensively paved or black-topped areas.** If unavoidable, locate station at least 50

feet to the windward side.

5. **Large buildings.** Locate station at least a distance equal to the height of the obstruction.

General FIRE RAWS equipment specifications

Any FIRE RAWS unit that is purchased or used must be very sturdy, rugged and robust. Requirements include:

- Survive 100 MPH winds when properly anchored
- Withstand extremes of environmental conditions
- Self supporting structure with a sturdy tripod frame or other suitable system.
- Portable, easily transportable and easy to deploy
- Powered by solar panel and/or battery system to allow for "stand alone" remote operations. Battery voltage should be checked periodically. Batteries must be changed every 3-4 years, or as needed.

Note: Prior to demobilization or movement of a fire RAWS, it is important to consult with neighboring agencies and fire teams. It is possible that these neighbors may be using the Fire RAWS data.

FIRE RAWS MAINTENANCE POLICY

Annual Maintenance

At a minimum, annual service (+/- 45 days) for FIRE RAWS must be performed to ensure general system integrity, allow necessary preventative maintenance, and to replace sensors and components prior to expiration of their calibrated lifetimes. Service contracts for this purpose can be requested through the BLM's Remote Sensing / Fire Weather Support Unit (RSFWSU) in Boise, Idaho, or any vendor that will meet the national standards for field or depot-level service as outlined in this document.

Cautionary Note: **A FIRE RAWS may be used several times in a one year period, requiring multiple unpacking and repacking actions. Care must be taken to perform this task with care, as environmental sensors are sensitive equipment that can easily be damaged and thrown out of calibration. Also, the humidity sensor is particularly susceptible to degradation when exposed to smoky or dusty conditions. When sensors are damaged or degraded by use before the annual service date, it is the responsibility of the FIRE RAWS owner to ensure proper maintenance and recalibration is performed before the equipment is redeployed. Verification of sensor performance with alternate methods (i.e., belt weather kit) is highly recommended. Significant discrepancies should encourage maintenance action.**

ANNUAL MAINTENANCE AND SENSOR REPLACEMENT STANDARDS

Sensors and key components of a FIRE RAWS must be recalibrated or replaced on a regular basis to ensure the collection of consistent and reliable weather data. The entries for specific equipment below outline yearly preventative maintenance, as well as minimum replacement times for each component.

Tipping Bucket – Remove cover. Clean cover and orifice to ensure free flow of water. Do not disassemble further. Check all connections and verify that the instrument is level. Unless the rain year is reset automatically by the DataLogger/DCP on a certain date each year, reset the tipping bucket to 00.00. Then simulate .02 inches of rain and validate that it was recorded by the DataLogger/DCP. Other rain gauge equipment should be maintained to manufacturer's specification.

MINIMUM FIELD VALIDATION - 1 Year
MINIMUM DEPOT CALIBRATION/REPLACEMENT - 3 Years

Wind Speed - Check for damage and alignment of cups, ice skirt, and free movement of bearings.

MINIMUM CALIBRATION/REPLACEMENT - 2 Years

Wind Direction - Check for damage of pointer and feather, free movement of bearings. Manually rotate the sensor through each of the four quadrants and scan the data for accuracy.

MINIMUM CALIBRATION/REPLACEMENT - 2 Years

Ultrasonic Wind Speed/Wind Direction – No calibration required, clear any obstruction between arms of transducers.

Relative Humidity/Air Temperature - Not field serviceable; do not open.

MINIMUM CALIBRATION/REPLACEMENT – Yearly

Battery - Perform a voltage test. Replace batteries according to manufacturer recommendations or if you suspect problems. Some manufacturers recommend yearly, others recommend every three years.

MINIMUM REPLACEMENT - 3 Years
for internal "D" cell (Supplemental Power) - Yearly

GOES Antenna - Check for broken, loose, or bent elements, proper alignment, and connectors for corrosion.

MINIMUM CALIBRATION/REPLACEMENT - As needed

Cables/Wiring - Check for cracking, deterioration, corrosion, proper routing, and security. Ensure O-rings are installed on all connectors. Replace as required for corrosion, aging, etc. Treat all connectors with moisture inhibitor.

MINIMUM CALIBRATION/REPLACEMENT - As needed

Masts/structural members - Check for structural damage, proper alignment, and leveling. Be aware of safety risks when dealing with a potentially damaged structure (i.e., rust, corrosion, cable fray, etc.).

MINIMUM CALIBRATION/REPLACEMENT - As needed
(or per manufacturer's specifications)

DCPs and DataLoggers - Check for security, damage, and ensure that all cables are properly connected. Verify the unit has the most recent version of the software or firmware installed. Change out as needed (defective, evidence of moisture, corrosion, rust, etc.).

MINIMUM CALIBRATION/REPLACEMENT – As needed
(or per manufacturer's specifications)

Solar Radiation - Sensor must be cleaned periodically using only *water* and/or a mild detergent such as dishwashing soap.

MINIMUM CALIBRATION/REPLACEMENT - 3 Years

Fuel Temp (optional) – Fuel stick sensor should be checked for obvious cracking, deterioration and security. Not field serviceable; do not open.

MINIMUM CALIBRATION/REPLACEMENT – As needed
(or per manufacturer's specifications)

Fuel Moisture (optional) – Fuel stick sensor should be checked for obvious cracking, deterioration and security. Not field serviceable; do not open.

MINIMUM CALIBRATION/REPLACEMENT – As needed
(or per manufacturer's specifications)

Barometric Pressure (optional) – Not field serviceable; do not open.

MINIMUM CALIBRATION/REPLACEMENT – As needed
(or per manufacturer's specifications)

Depot Sensor Calibration Standards
The maintenance service under contract will rehabilitate and calibrate sensors to the specifications contained in this document.

Sensor Documentation - A maintenance history record shall be kept for each component that is repaired/calibrated by any maintenance service under contract. These records are kept on file by serial number and used by depot and agency staff for spotting systematic problem areas that may have impact on the program.

Test Equipment – The test equipment and associated tools used during depot sensor calibration routines shall follow a general practice of "Traceability protocol" based on standards maintained by the National Bureau of Standards (NBS). This results in claims of calibrations that are "traceable to NBS".

Documentation - Documentation of FIRE RAWS annual service will be captured in Computerized Maintenance Management System (CMMS) database by the FIRE RAWS owner or service provider.

Annual maintenance and emergency repair will be documented in CMMS. This will include, at a minimum:

- Maintenance date (date that Relative Humidity / Air Temperature was changed / calibrated).
- Specific sensors and serial numbers of those sensors.
- A narrative of the annual service, including what maintenance was accomplished and any miscellaneous information.

GLOSSARY

ASCADS - Automated Sorting Conversion and Distribution System - BLM Administered Interagency system used as interagency method of retrieving data from the GOES satellite and forwarding to WIMS. It is used for metadata storage, maintenance documentation, and produces watchdog.

CMMS – Computerized Maintenance Management System – A system to track the maintenance of every RAWS providing data through ASCADS. It will track Annual maintenance, replacement sensors, status of the order and provide a record of when and what kind of maintenance was performed.

COTS – Commercial off-the-shelf, referring to a package of software or program available for purchase and use from a commercial vendor.

DCP – Data Collection Platform, also known as a DataLogger. The central processing unit for an automated weather stations through which all sensor data is gathered and forwarded to the GOES radio transmitter.

FENWT – Fire Environment Working Team chartered under the NWCG

Fire RAWS – A portable RAWS that conforms to standards of data collection and maintenance specified in the Fire Weather Station Standards document.

FTP - File Transfer Protocol - Process used to transfer files across different types of systems (i.e., internet, pc to pc, servers, etc.)

FWC – Fire Weather Committee – a subcommittee under the Fire Environment Working Team

GOES - Geostationary Operational Environmental Satellite - The satellite used for data relay from NFDRS weather stations to ASCADS.

IMET – Incident Meteorologist

NESDIS - National Environmental Satellite Data Information Service

NFDRS - National Fire Danger Rating System

NFDRS Update – Update to the NFDRS system that includes the implementation of the Nelson Model in conjunction with solar radiation sensors to automate fuel moisture calculations

NIFMID - National Interagency Fire Management Integrated Database - Data warehouse for archiving fire management information to include weather observations.

NITC - National Information Technology Center - Located in Kansas City - WIMS Host

NWCG - National Wildfire Coordinating Group

NWS - National Weather Service

RAWS - Remote Automatic Weather Station

RPG – RAWS Partners Group

RSFWSU - Remote Sensing/Fire Weather Support Unit – Operated by the BLM as an interagency weather station repair and maintenance facility located in Boise, Idaho.

Watchdog - Automated process in ASCADS for assessing weather station performance.

WFAS - Wildland Fire Assessment System

WIMS - Weather Information Management System – The national operational NFDRS calculator

WRCC - Western Regional Climate Center - One of 6 regional climate centers of the National Climatic Data Center (NCDC). The official archive location for hourly RAWS data.

WWV - Call sign for worldwide universal time radio transmission.

BIBLIOGRAPHY

Bradshaw, Larry S. 1998. Summer 1998 Field Test of Nelson's 10-hour Fuel Moisture Model Prepared for the National Advisory Group - Fire Danger Rating (NAGFDR).

Deeming, John E., J. W. Lancaster, M. A. Fosberg, R. W. Furman, and M. J. Schroeder. 1972. The National Fire-Danger Rating System. U.S. Department of Agriculture, Forest Service, Research Paper RM-84, Fort Collins, Colorado: Rocky Mountain Forest and Range Experiment Station. 165 p.

DOI, Bureau of Land Management, 1997. Remote Automatic Weather Station (RAWS) and Remote Environmental Monitoring Systems (REMS) Standards. Boise, Idaho: RAWS/REMS Support Facility. 34 p.

Finklin, Arnold I., and William C. Fischer. 1990. Weather Station Handbook –an Interagency Guide for Wildland Managers. PMS 426-2, NFES No. 2140. Boise, Idaho: National Wildfire Coordinating Group. 237 .p

USDA Forest Service, 1995. Weather Information Management System (WIMS) User's Guide. Boise, Idaho: U.S. Department of Agriculture, Forest Service, Fire and Aviation Management Staff. 80+ p. http://famweb.nwcg.gov/

NWCG Fire Danger Working Team, 2002. Gaining and Understanding of NFDRS, PMS 932, NFEWS 2665 and the Reference CD (PMS 933/NFES 2687).