

## **DATA QUALITY CRITERIA FOR FIXED MONITORING STATIONS**

### **INTRODUCTION:**

The development of data quality criteria for fixed monitoring stations in the Pacific Northwest could be involved in meeting some of the requirements of RPA (Reasonable and Prudent Alternative) 131 and 198.

The NMFS 2000 Biological Opinion RPA 131 stipulates that the "Action Agencies shall monitor the effects of TDG." Further explanation of the RPA includes a discussion of Quality Control and Quality Assurance including redundant and backup monitoring, bi-weekly calibration, and spot-checking of monitoring equipment. In an effort to address these concerns the US Army Corps of Engineers has drafted Data Quality Criteria for the fixed monitoring stations at its projects. The Data Quality Criteria describe the accuracy, precision and completeness of the data needed at each station. The fixed monitoring stations will be assessed at the end of the monitoring season against these criteria and a performance report will be created. Adjustments will be made to the individual fixed monitoring stations that do not perform to the objectives described. The Data Quality Criteria approach is being recommended instead of the redundant and backup monitoring, and spot-checking approach described in the BiOp since it will provide greater flexibility with equipment and has less impact on program cost escalation.

The NMFS 2000 Biological Opinion RPA 198 stipulates "The Action Agencies, in coordination with NMFS, USFWS, and other Federal agencies, NWPPC, state, and Tribes, shall develop a common data management system for fish population, water quality, and habitat data." NWPPC's February 15, 2002 draft Data Management in Support of the Fish and Wildlife Program Summary encourages the development of regional data standards in support of a consistent and standardized database. The development of data quality criteria for TDG monitoring stations could be one of the regional standards towards the long-term goal of a consistent, standardized regional database.

The US Army Corps of Engineers, NW Division (USACE-NWD) developed the following data quality criteria for fixed monitoring stations in cooperation with the USGS-Portland office, which maintains many of the USACE's fixed monitoring stations on the Columbia River. The USACE-NWD is proposing the following Data Quality Criteria as an alternative to the redundant stations in RPA 131 and as a regional standard for fixed monitoring stations.

### **GENERAL OVERVIEW**

As a general overview, the Data Quality criteria for fixed monitoring stations (FMS) include having two dedicated TDG probes (hydrolab) for each site, which provides redundancy instead of redundant stations. The "extra" TDG probes (hydrolab) for each site is lab calibrated before its bi-monthly rotation into the field. Once it is deployed, it is again calibrated and/or checked. The data from the FMS is sent to USGS and USACE-NWD. USGS reviews the data and performs corrections. There is a goal of 95% data completeness.

### **PROPOSED DATA QUALITY CRITERIA**

The proposed data quality criteria for fixed monitoring station cover three main parts:

1. **Calibration Protocols:** laboratory and field calibrations
2. **Reviewing Data Quality:** data quality checks and dealing with suspect data

### 3. Completeness of Data

The items are described as following:

#### **CALIBRATION PROTOCOLS:**

There are two general types of calibrations performed on Fixed monitoring stations (FMS): lab calibrations and field calibration.

##### **1. Laboratory calibration:**

There are four data quality criteria associated with laboratory calibration, including -calibration of the secondary TDG standard; the secondary barometric pressure standard; the field instrument TDG sensor; and secondary standard thermistor. Each is described as follows:

###### 1. Calibration of Secondary TDG Standard

Calibrate the TDG sensor at two points using the primary National Institute of Standards and Technology (NIST) standard. The TDG pressure must be +/- 2 mm Hg at both pressures; otherwise the secondary standard is recalibrated. Pressures at which the sensor is calibrated must bracket the expected range of field measurements. For an index of primary and secondary standards, see Table 1.

###### 2. Calibration of Secondary Barometric Pressure Standard

Calibrate the secondary standard barometer at ambient barometric pressure to the NIST standard. The barometer must be +/- 1 mm Hg of the primary standard (NIST certified instrument) otherwise the secondary standard is recalibrated.

###### 3. Calibration of Field Instrument TDG sensor

The two point TDG sensor calibration must agree within +/- 2 mmHg at both pressures, otherwise the sensor is recalibrated. Pressures at which the sensor is calibrated must bracket the expected range of field measurements.

###### 4. Calibration of Secondary Standard Thermistor

The instrument's thermistor must agree within +/- 0.2°C with the primary NIST standard. This variance will be monitored and if the probe performs outside this range, it will be returned to the manufacturer for maintenance. A check or verification still constitutes a calibration and should be documented in records.

#### **Field calibration**

There are two data quality criteria associated with field calibration: Calibrations and Performance checks. Calibrations include two fixed points and two point TDG sensor calibration.

#### **Calibrations:**

1. Two Fixed Points: In order to reduce TDG calibration variability, two fixed points should be chosen and incorporated in the TDG calibration protocol. For example, calibrate the first point to ambient barometric pressure, and the second point to 200 mmHg over barometric pressure. The calibrated range for this example brackets 100-126 % TDG saturation. This ensures the same calibration curve is established each time for every instrument.

2. Two Point TDG Sensor Calibration: Following a two-week deployment, a two point TDG sensor calibration must agree within +/- 4 mmHg at both pressures. Pressures at which the

sensor is calibrated must bracket the expected range of field measurements. If the pressure is not +/- 4 mmHg of the standard, the data will be considered "suspect" and handled as described in "Reviewing Data Quality".

**Performance checks:**

There are four data quality criteria associated with performance checks: TDG pressure compared to secondary standard; standby probes deployed; thermistor compared to secondary standard; and field barometer compared to secondary standard. Each is described as follows:

1. TDG Pressure Compared to Secondary Standard: After the deployment period, prior to removal of the field instrument, the TDG pressure will be compared to the secondary standard. The actual decision point regarding adjusting the data would be in the lab following the two point TDG sensor calibration described in field instrument post calibration. The field comparison actually involves sampling precision and should not be used as a decision point for shifting data.
2. Standby Probe Deployed: During initial deployment of a new TDG probe, after sufficient time for equilibration (up to one hour), the TDG pressure must be +/- 10 mmHg of the secondary standard otherwise another (standby) probe is deployed.
3. Thermistor Compared to Secondary Standard: During initial deployment of the new instrument, the thermistor will be +/- 0.4°C of the secondary standard, corrected for calibration, or the instrument will be replaced with a standby.
4. Field Barometer Compared to Secondary Standard: At each visit the field barometer reading should be the same as the secondary standard or the field barometer will be calibrated.

**REVIEWING DATA QUALITY**

The data from the fixed monitoring stations is sent to the USACE-NWD's CROHMS database which stores the raw data. At the same time, the same data is sent to the USGS's ADAP database. The USGS performs the review, correction and deletion process described below on ADAP's data, thus it stores corrected data. USACE-NWD created a copy of CROHMS called WQAL where the same corrections are made.

Reviewing the fixed monitored station data involves two steps: reviewing the data and dealing with suspect data.

**Reviewing Data:**

Once data are received, one or more of the following review processes occur:

- **Visually look at the tables of data:** There are certain signs in the data that may indicate mechanical problems. An instance, when the TDG pressure rises to 1,000 mmHg suddenly, and remains at that level, there may be a membrane tear. If there are extreme changes in any parameter, this shows that the data is erroneous.
- **A data checklist is completed.** The data quality checklist shown below provides an example of questions that can be used to assist in identifying problems with data.

- **Review graphs of the data.** Creating graphs of the data can show unusual spikes in a parameter and draw your attention to the data quickly. Spikes in graphed data can suggest further investigation may be necessary. For instance, a sudden rise of 5 °C in one hour stands out and is suspect. The graph shown below is an example of what is currently used.

**Dealing with Suspect Data:**

Once suspect data are identified, one of the following actions can be taken:

**Correct the data:** If there is a constant amount of shift or a continual drift, the data can be corrected using the USGS NWIS software. This is not usually the case. Sensor drift can be handled using a linearly prorated correction.

**Delete the data:** If there appears to be no means of correcting the data, then it is deleted from the USGS ADAPS database and they inform the Corps of the erroneous data. The Corps can decide what to do with the erroneous data.

**COMPLETENESS OF DATA:**

Completeness of data includes how completeness is calculated and the data quality criteria goal.

**Completeness Calculation:**

- The calculation of data set completeness is based on temperature and %TDG, which encompasses barometric pressure and TDG pressure.
- Data completeness is not based on the completeness of one parameter but of an entire suite.

**Completeness Goal:** Data collected at each site will be 95% of the data that could have been collected during the defined monitoring period.

**Glossary - Definitions and Acronyms**

NIST - National Institute of Standards and Technology

Primary Standard - NIST certified instrument

RPA - Reasonable and Prudent Alternative

Secondary Standard - Instrument calibrated with a primary standard, often used for checking instrumentation in the field

**TABLE 1**

**PRIMARY AND SECONDARY STANDARDS**

<b>PARAMETER</b>	<b>PRIMARY STANDARD</b>	<b>SECONDARY STANDARD</b>
Temperature	Mercury thermometer	Lab Hydrolab
Barometer Pressure	National Weather Service barometer	Hand held barometer
Total Gas Pressure	Digital pressure gauge calibrated to NIST	Lab Hydrolab checked to 4 pressures and calibrated to a 2-point curve.

## DATA QUALITY CHECKLIST

CHECKLIST FOR TDG DAILY CHECKS - attach to daily graphs

Date 3/4/02

Checked by H. Bragg

Check the 33 intersite comparison graphs back to the last day checked.  
(For example, check back to Friday on Monday).

Pt - No more than 25% of the hourly values are missing or anomalous  
(Intersite comparisons differ < 20 mm Hg unless spill explains difference)

B.P. - No more than 25% of the hourly values are missing or anomalous  
(Intersite comparisons differ < 14 mm Hg)

If these conditions are not met, an emergency trip needs to be taken within the next 48 hours.

Temp. - Check for intersite variations > 2.0 deg C, note to COE, but no emergency-trip is needed.

Y or  N Is replot needed to clearly see data variations on any plot?  
If yes - replot data and put the new plot with the daily check.

Y or  N Are spill data needed to explain any Pt values?  
If yes - put the data with the daily check.

Y or  N Are any data missing from ADAPS but present at COE website?  
If yes - put COE data with site file.  
- immediately contact our computer section to restore data to ADAPS if possible.

Y or  N Were any graphs marked to explain or note any potential anomalies?  
If yes - make a copy and put copy in site file.

Send email to COE describing site status, including planned emergency trips.

If any site is other than satisfactory, include the hour of missing or questionable data, and put a copy of the email in site file.

### GRAPHS FOR CHECKING DATA

