

STANDARD OPERATING PROCEDURE (SOP)

Title: General Maintenance of Continuous Water Quality Monitoring Stations

Unit Leader: _____ Date: _____

Quality Control Review: _____ Date: _____

Section Manager: _____ Date: _____

Effective Date: 4/18/03

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1.0 PURPOSE

This SOP describes activities associated with maintaining a continuous water monitoring station. Methods and procedures described within this SOP are carried out by the site operator. Maintenance procedures are necessary to ensure the integrity of equipment associated with data collection and reporting, including infrastructure established to support the monitoring activities and equipment, are performed according to the monitoring objective for which it is deployed.

2.0 SCOPE AND APPLICABILITY

The scope of this procedure covers the maintenance of continuous water quality monitoring stations established by or for the Monitoring Operations (MOps) Division.

The United States Geological Survey (USGS) has published a method for the operation of continuous water quality stations (USGS, 2000). The USGS guidance document describes portions of the maintenance process and was used to develop the procedures included in this SOP.

A well-maintained continuous monitoring station will produce an un-interrupted record of quality data consistent with its monitoring objective. Adequate maintenance can ensure the quality of data produced by routinely inspecting equipment and correcting any problems that are observed.

The Surface Water Quality Monitoring (SWQM) Procedures Manual provides suggestions for performing routine maintenance on water quality monitoring multiprobes. Follow equipment manufacturer suggestions on frequency and type of maintenance for instruments not included in the *SWQM Procedures Manual*.

3.0 METHOD SUMMARY

3.1 Review equipment function daily.

3.2 Inspect field equipment for fouling, corrosion, or damage. Return equipment that is

suspected to be faulty to the laboratory for re-calibration.

- 3.3 Change the dissolved oxygen membrane, polish the dissolved oxygen electrodes to remove corrosive residue, replace dissolved oxygen electrolyte, brush conductivity cell blocks clean, and clean the pH bulb. If the site operator discovers a problem that prevents the sonde from functioning within its specifications, send the equipment to a contracted repair facility, or order replacement equipment for re-deployment.
- 3.4 Inspect the monitoring site for signs of physical damage or disruption.
- 3.5 Ensure all power sources are operational and functioning properly. Ensure all communications equipment is operational and functional.
- 3.6 Maintain the shelter housing communications and monitoring equipment. Trim vegetation.

4.0 LIMITATIONS

Equipment deployed in the field for extensive time periods should be calibrated and maintained with sufficient frequency to achieve data quality objectives. The most efficient frequency of maintenance is difficult to predict. The environment into which monitoring equipment is deployed greatly influences the ability to maintain calibration and collect representative data. Changing seasons will require different maintenance schedules, particularly during summer months when eutrophication is likely to occur. The monitoring station may be vulnerable to vandalism and weather events, and may require maintenance and repair by the site operator during non-work hours. The site operator will be required to troubleshoot equipment and communication problems, and report discrepancies to the data validator and/or the Engineering Support and Development Team.

5.0 SAFETY

- 5.1 Maintenance of monitoring station requires physical labor during all seasons, including inclement weather. Staff must be trained to recognize signs of heat stress and avoid these symptoms with proper hydration, dress, and work schedules.
- 5.2 Staff should use caution when working in aquatic environments, and must be equipped with proper personal protective equipment. This may include personal flotation devices (PFDs), waders, and safety glasses (for use when handling chemicals).
- 5.3 Material Safety Data Sheets (MSDSs), appropriate first-aid, and spill control supplies must be immediately available for all chemicals used in this procedure. Examples of chemicals include standards to calibrate equipment, reagents for analysis, electrolyte solutions to maintain performance of monitoring sensors, herbicides used to clear ground for site preparation, etc.
- 5.4 All chemicals must be stored according to procedures recommended in the MSDS.

- 5.5 Refer to Section 12.0, Pollution Prevention and Waste Management, for proper waste disposal procedures.

6.0 EQUIPMENT

Equipment required for maintenance activity will vary depending on monitoring equipment deployed at the station. A well-supplied technician's tool kit should contain the necessary tools for diagnostic analysis and routine repairs. Grounds maintenance may require general lawn-care tools.

- 6.1 Maintenance of multiprobe water quality monitoring sondes may require the following items: National Institute of Standards and Technology (NIST) certified calibration standards, dissolved oxygen membranes, dissolved oxygen electrode sanding disks, dissolved oxygen electrolyte solution, brushes to clean conductivity cell blocks and sensor bodies, and appropriate tools to remove sensors from the multiprobe bulkhead. All equipment should be approved by the manufacturer and used according to their guidelines.
- 6.2 Repair of polyvinyl chloride (PVC) pipe used for *in situ* deployment of multiprobes will require replacement pieces of PVC, as well as PVC glue and surface treatments.
- 6.3 Cleaning materials such as mops, brooms, paper towels, and cleaning solutions may be used to keep the station clean.
- 6.4 Grounds maintenance may require items such as lawnmowers, trimmers, hedge-clippers, and machetes.
- 6.5 A technician's tool kit containing assorted screwdrivers, sockets, nut-drivers, pliers, and wrenches may be needed to perform general repairs. A volt-meter, wire cutters, wire snips, and cable ties, are helpful to perform repairs and diagnostic analysis of communications equipment.

7.0 PROCEDURES

Perform the following general maintenance activities at a continuous water quality monitoring station.

- 7.1 Review equipment function daily. Ensure the equipment is collecting data as programmed, and the data record should be viewable over the Daily Status Report website (<http://dsr>). Alert the Engineering Support and Development Team with any discrepancies.
- 7.2 Inspect field equipment for fouling, corrosion, or damage. Return equipment that is suspected to be faulty back to the laboratory for re-calibration. Calibration of monitoring equipment should be performed in accordance with procedures described in the SOP for the *Operation of Continuous Water Quality Monitoring Equipment*, Monitoring Operations Division SOP # AMPM-008.

Send monitoring equipment that cannot be re-calibrated or repaired in the laboratory to a contracted repair facility that has been approved by the manufacturer.

- 7.3 Maintain monitoring equipment to ensure long-term operation. The *SWQM Procedures Manual* provides detailed instruction on the maintenance of multiprobes. Perform the following activities as part of the maintenance procedure.
- 7.3.1 Change the dissolved oxygen membrane at least once every 30 days, or more frequently if bubbles appear under the membrane, deposits of potassium chloride (KCl) appear on the membrane or O-ring, the measurements are unstable, or the dissolved oxygen charge is higher than 75 or lower than 25.
 - 7.3.2 Polish the dissolved oxygen electrodes to remove corrosive residue only if residue is observed, or dissolved oxygen charge is higher than 75 or lower than 25.
 - 7.3.3 Replace dissolved oxygen electrolyte (KCl) with every changed membrane.
 - 7.3.4 Brush conductivity cell blocks clean at least once every 30 days, or if deposits form on the electrode, or when the conductivity cell constant is higher than 5.5 or lower than 4.5.
 - 7.3.5 Clean the pH bulb at least once every 30 days, whenever deposit/contaminants appear on the glass bulb, or when response time of sensor decreases. Use clean water and a moistened cotton swab to remove all foreign material from the glass bulb. Removal of deposits may require the probe to be soaked for 10 - 15 minutes in clean water containing a few drops of commercial dishwashing liquid. The bulb can be gently cleaned with a cotton swab moistened with the dishwashing liquid.
 - 7.3.6 Ensure all maintenance procedures and materials are manufacturer-approved.
 - 7.3.7 Maintain an adequate stock of NIST certified calibration standards.
 - 7.3.8 If the site operator discovers a problem that prevents the sonde from functioning within its specifications, send the equipment to a contracted repair facility, or order replacement equipment for re-deployment.
- 7.4 Inspect the monitoring site for signs of physical damage or disruption. Repair all site damage. Consult or employ a contractor if the site operator cannot repair the damage. If damage is beyond repair, order replacement equipment for re-deployment. Re-position the *in situ* monitoring equipment if it is disrupted due to weather events. Position *in situ* monitoring equipment to capture information representative of ambient conditions, preferably in the centroid of flow. Notify the data validator if the accuracy of the data record could be effected by faulty equipment, and or disruptions.

- 7.5 Inspect the power supply. Ensure all power sources are operational and functioning properly. In the event of power failure, contact the local power company if power cannot be restored. If power is not supplied by an electric utility (i.e., solar, or battery power), contact the Engineering Support and Development Team for repair or replacement options.
- 7.6 Inspect communications equipment. Ensure all communications equipment is operational and functional. If a problem is suspected with the data-logger, modem, or sonde telemetry, consult a member of the Monitoring Operations (MOps) Engineering Support and Development Team. If a problem is suspected with communications service, contact the local telecommunications company.
- 7.7 Maintain the shelter housing communications and monitoring equipment. Keep the shelter clean of debris. Perform all maintenance procedures according to MOps Ambient Monitoring Section recommendations. Consult a member of the Systems Planning and Implementation Team if damage to housing is observed and needs repair or replacement.

Replace security locks as needed. Consult the Systems Planning and Implementation Team to select locks and combinations. All locks and combinations used in the Continuous Ambient Monitoring Station (CAMS) network should be consistent to ensure access by Texas Commission on Environmental Quality staff if necessary.

- 7.8 Inspect the immediate landscape surrounding the station. Trim vegetation when necessary to ensure access to the station and equipment and maintain a neat appearance. Ensure the security fence (if present), is intact. Consult the fence contractor if repairs are necessary.

8.0 CALCULATIONS

Not Applicable

9.0 QUALITY CONTROL

All events observed during maintenance activities that could possibly effect the quality of data produced by the station should be reported to the data validator. The instrument specific quality control checks and acceptance criteria that define minimum acceptable instrument performance are documented in SOP# AMPM-008.

10.0 DEFINITIONS

Not Applicable

11.0 REFERENCES

TNRCC. *Surface Water Quality Monitoring Procedures Manual*, June 1999.

USGS. *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Site Selection, Field Operation, Record Computation, and Reporting*, Water-Resources Investigations Report 00-4252. 2000.

TCEQ *Operating Policies and Procedures*, Chapter 6.13

Monitoring Operations Hazardous Waste Disposal Plan

12.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

Supervisors, sampling personnel, and laboratory analysts should identify and implement innovative and cost-saving waste reduction procedures as part of the method development, and review and revision of SOP's. Wastes that do result from these procedures are managed and disposed in accordance with appropriate state and federal regulations.

Refer to the TCEQ *Operating Policies and Procedures Chapter 6.13* for guidelines on general recycling, waste reduction, and water and energy conservation. Review the procedures for specific employee responsibilities and mechanisms for office related waste prevention and management. Consult the *Monitoring Operations Hazardous Waste Disposal Plan* for laboratory specific waste minimization recommendations and requirements for proper handling of hazardous waste that results from laboratory procedures.

13.0 SHORTHAND PROCEDURE

Refer to table 13-1 for a condensed version of procedures described in this SOP.

Table 13-1: Maintenance Checklist

MAINTENANCE ACTION	EQUIPMENT	OUTCOME	RESPONSE ACTION
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Review equipment function and communications via the internet	<ul style="list-style-type: none"> Water quality monitoring sondes Communications equipment 	<ul style="list-style-type: none"> Data is reported as expected Sensors or communication equipment not reporting data as programmed 	<ul style="list-style-type: none"> Report communications discrepancy to Engineering Support and Development Team and data validator Investigate the problem with a site visit
Inspect field equipment	<ul style="list-style-type: none"> Water quality monitoring sondes 	<ul style="list-style-type: none"> No problems observed Equipment is suspected to be faulty 	<ul style="list-style-type: none"> Check calibration in laboratory Contract repair services for damaged equipment
Perform routine maintenance on monitoring equipment	<ul style="list-style-type: none"> Water quality monitoring sondes 	<ul style="list-style-type: none"> Sonde is performing within accuracy range, and no problems were noted during maintenance Sonde is measuring outside of accuracy specifications Equipment problems discovered during maintenance procedure 	<ul style="list-style-type: none"> Contract repair services for damaged equipment Order replacement equipment
Inspect monitoring site	<ul style="list-style-type: none"> Equipment housing Deployment equipment 	<ul style="list-style-type: none"> No damage observed Damage observed 	<ul style="list-style-type: none"> Repair equipment Contract repair services, if damage is extensive Replace equipment that cannot be repaired
Inspect power supply	<ul style="list-style-type: none"> Connections to power sources Power source 	<ul style="list-style-type: none"> Power is functional Power failure observed 	<ul style="list-style-type: none"> Contact local power company if power is supplied by electrical utility Contact Engineering Support and Development Team if power is from another source
Inspect communications equipment	<ul style="list-style-type: none"> Data logger Modem Sonde telemetry 	<ul style="list-style-type: none"> No problems noted Communications failure 	<ul style="list-style-type: none"> Contact Engineering Support and Development Team for repair and/or replacement options
Maintain equipment housing	<ul style="list-style-type: none"> Equipment housing or shelter 	<ul style="list-style-type: none"> Housing and/or shelter are free of debris and in working order 	<ul style="list-style-type: none"> Perform maintenance as needed

