



CHAPTER 4 – ENVIRONMENTAL SAMPLING

4.1 OVERVIEW

The majority of environmental sampling performed by the department's regional office staff is associated with drinking water and water pollution complaint investigations and facility inspections. Investigations and inspections associated with air pollution and solid waste regulations may also necessitate the collection of environmental samples. The sampling of hazardous waste sites is generally conducted by the Environmental Services Program, not the regional office. See the information on sampling considerations for a quick review.

The Missouri Department of Natural Resources, Field Services Division, Environmental Services Program, has established several standard operating procedures related to the collection of environmental samples. The standard operating procedures are intended as guidance for departmental personnel to ensure analytical data is of sufficient quality to be scientifically valid and legally defensible. See the Environmental Services Program [Standard Operating Procedures](#) Home Page. Personnel shall be required to regularly check the Web page to ensure adherence to the most up-to-date guidance.

All department staff who may collect environmental samples for analysis must meet, at a minimum, the following requirements:

1. Attend the Environmental Services Program's "Basic Sampling" one-day training course on an annual basis to ensure familiarity with the department's standard operating procedures, proper sampling techniques, and considerations.
2. Maintain familiarity with all applicable standard operating procedures for their specific job duties.
3. Maintain proficiency with field instrumentation.
4. Participate in a quarterly QA/QC program established by the regional office.

When conducting investigations or inspections, personnel shall carry with them the equipment, supplies, and documents necessary to properly conduct a sampling event.

Regional offices shall be required to establish written quality assurance/quality control programs, and acquire and maintain specific supplies and equipment to conduct valid and defensible environmental sampling. Organized and documented training will be conducted at least quarterly.

In addition to these general requirements, brief descriptions of program-specific needs are set forth below.



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4.1.1 Water Protection Program

Regional office personnel routinely conduct site inspections in accordance with work plans or Quality Assurance Project Plans provided by the Water Protection Program. In addition, field personnel are responsible for responding to citizen complaints regarding pollution of waters of the state, which may call for on-site investigations. When conducting an inspection or investigation, field personnel determine if there is a necessity for a sampling event.

In addition to common field instruments, regional office personnel may also employ field colorimetric test kits (ammonia for example) as part of their duties. In addition to the annual "Basic Sampling" course requirement, personnel shall be responsible for becoming trained and maintaining proficiency in the use of any proprietary colorimetric test kits or field screening systems purchased and maintained in their respective region.

4.1.2 Air Pollution Control Program

Regional office personnel intermittently collect environmental samples for asbestos-containing materials or fugitive dust. Inspectors receive training to become certified asbestos inspectors through an accredited private entity and are required to attend annual refreshers to maintain that certification. In addition to the annual "Basic Sampling" course requirement, inspectors shall be responsible for maintaining their inspector certification in order to conduct work related to asbestos. Regional office personnel also need to be familiar with the sample handling procedures dictated by the private laboratory to which these types of samples are sent.

4.1.3 Public Drinking Water Program

Regional office drinking water facility inspectors intermittently perform environmental sampling at public drinking water treatment plants and distribution systems to ensure the public's safety and regulatory compliance.

In addition to common field instruments, drinking water inspectors may also employ field colorimetric tests (chlorine for example). In addition to the annual "Basic Sampling" course requirement, personnel shall be responsible for becoming trained and maintaining proficiency in the use of any proprietary colorimetric test systems purchased and maintained in their respective region.

Drinking water inspectors also intermittently conduct bacteriological sampling at drinking water facilities. Bacteriological samples are currently shipped to the Missouri Department of Health and Senior Services (DHSS) for analysis or, by special arrangement, to a local or regional contract lab. Drinking water inspectors must be aware of and follow DHSS sample handling procedures for bacteriological samples.



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4.1.4 Solid Waste Program

Regional office personnel may perform monitoring for methane gas at landfills using field-portable instruments (i.e., flame ionization detectors). Personnel shall be responsible for becoming trained and maintaining proficiency in the use of any field-portable instruments purchased and maintained in their respective region.

4.1.5 Hazardous Waste Program

Regional office personnel routinely conduct complaint investigations or inspections at permitted hazardous waste facilities where environmental sampling may be required to determine whether a material can be defined as hazardous or to ensure regulatory compliance. Personnel charged with these duties should, at a minimum, be required to attend a 40-hour hazardous materials operations course in order to carry out duties where they may become exposed to hazardous materials. Due to the inherent health and safety issues and the wide scope of potential scenarios related to hazardous materials sampling, regional office staff shall request assistance from the department's Environmental Services Program when such sampling is needed. The Environmental Services Program maintains the equipment and trained staff necessary to carry out sampling events in these environments.

4.2 REQUIRED EQUIPMENT INVENTORY AND SUPPLIES

The Field Services Division will work with the regional offices to specify the types of equipment that will be purchased and maintained in inventory.

Each regional office shall, at a minimum, maintain the following equipment and supplies to accommodate the proper collection of environmental samples:

- pH meter capable of two-point calibration and temperature compensation and calibration standards
- Specific conductivity meter capable of temperature compensation and calibration standards
- Dissolved oxygen meter and replacement membrane kits
- NIST-calibrated mercury thermometer
- Alcohol-filled thermometer
- Colorimetric spectrophotometer field kits (Example: Cl⁻, NH₃) and reagents, if used by the region
- Digital camera
- Global positioning system (GPS) receiver
- Field notebook bound, with numbered pages for field documentation, (MDNR-FSS-004)
- Indelible pens and permanent markers
- Deionized or distilled water
- Coolers for preserving and shipping
- Chemical preservatives listed in [MDNR-ESP-001](#)
- Department-issued sample labels - both numbered (for current year) and blank (MDNR-FSS-003)



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- Current department-issued chain-of-custody sheets. Instructions are found at MDNR-FSS-002.
- Department-approved sample containers, ([MDNR-ESP-001](#))
- Personal protective equipment (Sampling gloves, safety glasses, steel-toed boots, hardhats)
- Decontamination supplies (Paper towels, spray bottles, Simple Green® or equivalent)

Each region should consider having duplicate equipment in case of primary equipment malfunction or when the same equipment is needed at multiple locations simultaneously.

4.3 CARE, MAINTENANCE AND CALIBRATION OF EQUIPMENT

To ensure that good quality, defensible data are obtained, it is critical that field instruments and equipment are properly stored and maintained in good working order, that field personnel are familiar with instrument calibration and the manufacturers' operational procedures, and that instruments are calibrated regularly.

- Equipment should be assigned to individual field personnel or should be kept in a designated area and accessible to field staff. If equipment is assigned to individual staff, then care and maintenance should fall on the responsibility of the individual. If the equipment is communal, then a designated person shall be assigned to oversee care and maintenance of the equipment.
- When not in use, equipment shall be stored according to the manufacturers' instructions. Equipment probes and electrodes should be stored clean and free of debris. Equipment must be stored in a temperature-controlled building.
- Prior to the collection of field measurements, field equipment shall be calibrated using fresh calibration standards and according to the manufacturers' specifications. Instrument and calibration information should be recorded in the field notebook.
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- Field measurements shall be collected on-site either directly from the source or immediately from a secondary container. Field measurements should never be taken from a sample container that is to be submitted for chemical analysis due to the risk of contaminating the sample.

4.4 QUALITY ASSURANCE AND CONTROL

It shall be required that each regional and satellite office implements a field instrument quality control program. All personnel using field instrumentation shall participate at least quarterly in an organized, QA/AC exercise. The purpose of a quality control program is to routinely check and document the accuracy of the instruments. Implementing a quality control program will help ensure that field equipment is properly maintained and kept in good working condition. Refer to MDNR-ESP-213 *Quality Control Procedures for Checking Water*



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Quality Field Instruments for additional information and examples for establishing a field instrument quality control program.

- Each region should designate one individual to oversee the program. For consistency, a field meter quality control protocol should be written and made accessible to all field personnel.
- As part of the quality control program, the instruments should be inspected and clean of debris following field use. In addition, all used calibration standards should be discarded and replaced with fresh standards.
- All the instruments' readings (pH, specific conductivity, dissolved oxygen, pocket thermometers, flame ionization detector, and chlorine pocket colorimeter) should be checked for accuracy on a routine basis (at least monthly) against certified standards, procedures, or other certified equipment as necessary. All quality control information should be recorded and kept on record for future reference.
- The **pH meters** should be at least two-point calibrated using the pH calibration solutions (4.0, 7.0 and 10.0) and calibrated according to the manufacturer's instructions. The pH meters should be checked against certified standards purchased from an outside vendor that specializes in quality control standards. If a meter is not capable of reading within the acceptable limits of the standard, then procedures should be followed to get the instrument reading back into the acceptable range or the pH electrode replaced. See [MDNR-ESP-001](#) for more information.
- The **specific conductivity meters** should be calibrated using conductivity calibration solutions (e.g. 1413 $\mu\text{S}/\text{cm}$) and according to the manufacturer's instructions. Since there are currently no water quality standards for specific conductivity, the specific conductivity meters should be quality control checked against both high and low conductivity calibration solution(s). The conductivity readings should fall within $\pm 10\%$ of the true value. If the conductivity reading falls outside of acceptable range, then measures should be taken to get the instrument back into the acceptable range or the conductivity cell replaced. See MDNR-FSS-102 for more information.
- The **dissolved oxygen meters** should be calibrated according to the manufacturer's instructions. Obtain a water sample (e.g. aerated tap water). On an aliquot of the water, a Winkler Titration method should be conducted to determine the official oxygen concentration of the tap water. The remainder of the tap water should be used to check the dissolved oxygen meters readings. The readings should be compared back to the Winkler Titration. The instrument reading should fall within ± 0.5 mg/L of the Winkler Titration. If the readings are outside of the acceptable range, then measures should be taken to get the instrument readings back into range or dissolved oxygen probe/membrane replaced. See MDNR-WQMS-103 for more information.



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- The **pocket thermometers and instrument thermisters** should be checked at various ambient temperatures. A NIST calibrated thermometer should be used to determine the temperature of a solution. The thermometer readings should be compared back to the NIST calibrated thermometer. The temperature readings should fall within ± 1 degree of the NIST thermometer or the manufacturer's specifications. If the readings fall outside of the acceptable limits, then steps should be taken to get the instruments' readings back into range or the thermometer/thermister replaced. See MDNR-FSS-101 for more information.
- The **flame-ionization detector** should be checked and calibrated against NIST-traceable calibration gases to ensure proper operation and that response is within acceptable ranges. Generally, a range of $\pm 10\%$ of the calibration gas is considered acceptable. If the response falls outside of acceptable limits, then steps should be taken to get the instrument's response back into range, including sending the unit for servicing. See MDNR-FSS-203 for more information.
- The **chlorine pocket colorimeter** should be routinely checked against Secondary Standards (e.g. Hach SpecV™ Secondary Standard) to ensure the instrument is working consistently and to check the accuracy of the test results. The readings should be recorded and tracked in a bound notebook so that future measurements can be compared back to previous checks. If the instrument begins to show drift or falls outside the standards expected range, then the instrument should be re-calibrated. Refer to the manufacturer's instruction manual for additional information.

In addition to establishing and maintaining a quality control program for field instruments, regional personnel must be familiar with and follow ESP standard operating procedures regarding quality control for samples collected and submitted to ESP for analysis. MDNR-FSS-210 contains the basic information of the ESP quality control/quality assurance program. Regional office personnel should collect quality control samples at approximately ten percent of their total number of samples.