



Ohio Department of Health
Bureau of Environmental Health
and Radiation Protection
Residential Water and
Sewage Program

"To protect and improve the health of all Ohioans"

Procedure for the Collection and Testing of Grab Samples as Required by NPDES General Permit for Discharging Household Sewage Treatment Systems

July 2017

Purpose

Statewide guidance concerning the collection and testing of effluent grab samples collected as part of the monitoring requirements in the Ohio Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit has been developed by the Ohio Department of Health with input from local health departments, system and component manufacturers, and the Ohio Sewage Treatment System Technical Advisory Committee. This guidance has been developed as a mechanism to ensure consistent, accurate, and safe sample collection across the state of Ohio.

In no way should the procedures outlined in this document be construed as contradictory or as a replacement to 40 CFR Part 136, *The Standard Methods for the Examination of Water and Wastewater*, or the US Environmental Protection Agency's *National Pollutant Discharge Elimination System Compliance Inspection Manual*. The mention of trade names or commercial products in this document does not constitute endorsement or recommendation for use by the Ohio Department of Health.

Discharging sewage treatment systems operating under the coverage of the Ohio EPA NPDES general permit must be operated and maintained in compliance with the requirements outlined within the permit. One monitoring requirement outlined in the general permit is the annual collection and testing of grab samples from all systems installed under their coverage. Design standard limitations and monitoring requirements are outlined in Part IV (A) of the general permit and are provided in Appendix A of this document.

Sampling procedures and methods shall conform to 40 CFR Part 136.3, *The Standard Methods for the Examination of Water and Wastewater*, and the US Environmental Protection Agency's *National Pollutant Discharge Elimination System Compliance Inspection Manual* in all cases. Analysis of improperly collected or contaminated effluent samples will result in data that could lead to an incorrect conclusion regarding treatment systems operation and ultimately unnecessary homeowner expense.

Safety

Occupational Safety and Health Administration (OHSA) standards must be understood and followed when collecting wastewater samples. Eye protection, suitable and sterilized disposable gloves, and protective clothing must be worn and scrapes, cuts, and burns must be covered. Care should be taken to disinfect equipment, dispose of gloves properly, and wash hands thoroughly following sample collection. Always avoid eating, drinking, or smoking near samples, at the sampling location, and in the laboratory.

Qualified Laboratory

Choose a laboratory that is qualified to perform the testing required by the permit. A qualified laboratory is one that is familiar with and capable of following *The Standard Methods for the Examination of Water and Wastewater*. Contact the local health department, system distributor, local wastewater plants, and / or the sanitary engineer to locate a qualified laboratory. It should be noted that some laboratories will collect the grab samples themselves before performing the analyses. Ensure that the collection time and location will conform to the required holding times. Travel time to the laboratory, the laboratory's operating hours, and weekend or holiday schedules all need to be considered when collecting samples.

Methods for Grab Sample Analysis

Flow Rate (Daily)

When the system does not include flow measuring devices the flow rate should be calculated by multiplying the estimated daily flow rate of 60 gallons per day per capita by the number of residents living within the dwelling. When an accurate count of residents is not available, the flow rate should be calculated by multiplying the estimated daily flow rate of 120 gallons per day per bedroom by the number of bedrooms in the dwelling. An estimation of the systems daily flow rate should be accompanied with the calculations used to derive the estimation.

Total Suspended Solids (TSS), Carbonaceous Biochemical Oxygen Demand (CBOD₅), Nitrogen, Ammonia (NH₃), fecal coliform, and E. coli

TSS, CBOD₅, NH₃, and bacterial concentrations are determined through the analysis of a correctly collected and preserved grab sample at a qualified laboratory. The appropriate laboratory procedures for testing for pollutants are outlined in 40 CFR Part 136.3 and *The Standard Methods for the Examination of Water and Wastewater*.

Dissolved Oxygen

The dissolved oxygen concentration may be determined by utilization of either the Winkler (Azide modification) or the electrometric method using membrane electrodes. When utilized, an electrode must be submerged into a sample collected directly from the effluent pipe in the inspection box within 15 minutes of the collection of the sample. Do not obtain a dissolved oxygen calculation from stagnant water inside the inspection

port. Discard sample effluent into the inspection box after attaining dissolved oxygen concentration.

Fats, oil, grease, or other floating material

The presence of sludge deposits, fats, oil, grease or other floating material must also be observed and recorded at the sampling site. Part VI, (I) of the general permit states:

1. General Effluent Limitations. *The effluent shall, at all times, be free of substances:*

- 1. in amounts that will settle to form putrescent, or otherwise objectionable sludge deposits; or that will adversely affect aquatic life or water fowl;*
- 2. of an oily, greasy, or surface-active nature, and of other floating debris, in amounts that will form noticeable accumulations of inappropriate scum, foam or sheen;*
- 3. in amounts that will alter the natural color or odor of the receiving water to such degree as to create a nuisance;*
- 4. in amounts that either singly or in combination with other substances are toxic to human, animal, or aquatic life;*
- 5. in amounts that are conducive to the growth of aquatic weeds or algae to the extent that such growths become inimical to more desirable forms of aquatic life, or create conditions that are unsightly, or constitute a nuisance in any other fashion; and*
- 6. in amounts that will impair designated instream or downstream water uses.*
- 7. that may result in public health nuisances, as defined by OAC 3745-1-04, associated with raw or poorly treated sewage.*

Chlorine

Residual total chlorine may be determined by using a variety of methods including Methods 4500-Cl B-G *The Standard Methods for the Examination of Water and Wastewater*.

Temperature

Although an effluent temperature reading is not required by the NPDES general permit, identification of the temperature at the time of collection may be considered advantageous in some situations. When a temperature reading is identified it shall be determined by submersing a thermometer to its indicated immersion distance (typically a line etched around the stem of a partial-immersion thermometer) into a sample collected directly from the effluent pipe in the inspection box and taking a reading from the thermometer once it has reached equilibrium. A reading must be taken within 15 minutes of the collection of the sample. Do not obtain a temperature reading from stagnant water inside the inspection port. Discard sample effluent into the inspection box after attaining temperature reading.

Equipment

Ensure that you have access to the required instruments and that they are properly calibrated. Follow the *Quality Control Procedures in National Pollutant Discharge Elimination System Compliance Inspection Manual* Chapter 5 Table 5-4 and the manufacturer's instructions to ensure equipment is properly calibrated. All maintenance and calibration of testing instruments should be documented and submitted to the local health department with testing results.

Sampling Bottles

When collecting samples for bacteriological testing, it is important to use clean and sterilized glass or plastic sampling bottles. Use bottles with sufficient volume to collect the sample and provide an adequate air space. 40 CFR Part 136 outlines requirements for sampling bottle materials. Sampling bottles and caps should be obtained from the laboratory performing the analysis on the samples. It may be advantageous keep a supply of extra bottles of each size in case a bottle becomes contaminated during sample collection.

Dissolved Oxygen Meter

When the dissolved oxygen concentration is determined using the membrane electrode method, the meter must be capable of accuracy of ± 0.1 mg/L and a precision of ± 0.05 mg/L. Follow the manufacturer's calibration procedure exactly to obtain guaranteed precision and accuracy.

Reagents

Ensure that all chemical reagents are prepared correctly and do not have an expired shelf life. Ensure that all reagents are stored correctly and safely.

Thermometer

A thermometer must have a scale marked for every .1C, with markings etched on the capillary glass and a minimal thermal capacity to permit rapid equilibration. Use a thermometer with a metal case to prevent breakage. Since the entire thermometer will not be submerged in most cases a partial-immersion thermometer is preferred.

Observations and Grab Sample Collection

Part IV B of the general permit states that ***grab samples shall be conducted to determine performance of the system relative to the design standards established in Part IV (A) and as an aid in determining operations of the system as installed.***

Grab samples must be collected from a sampling port installed after final treatment of the effluent. Although other sample ports within the treatment train may be required by the manufacturer for maintenance purposes, all NPDES systems must have a sample port installed after final treatment. The local health department must be contacted if an appropriate sample port is not available.

A grab sample cannot be taken during periods of low or no flow. Contact the system manufacturer to determine the recommended procedure for inducing or capturing flow in these situations. If the manufacturer recommends inducing flow by turning on a faucet in the dwelling or by adding water prior to the first treatment component of the system, it must be representative of normal flow from the residence (typically no more than 5 gpm).

The presence of sludge deposits, fats, oil, grease or other floating material must also be observed and recorded at the sampling site.

The temperature, dissolved oxygen concentration, and chlorine concentration must be measured using the appropriate methods and recorded immediately, on-site.

The presence of chlorine will affect bacterial testing results. If chlorine is detected it must be removed or stabilized prior to storage and transport of the sample for laboratory analysis. Sample bottles containing Sodium thiosulfate, a dechlorinating agent, are available from the laboratory. The presence of a dechlorinating agent must be identified on the sample bottle.

All grab samples measurement should be collected over a period of time not to exceed 15 minutes. The sample volume depends on the type and number of analyses to be performed. 40 CFR Part 136.3 outlines requirements for sample sizes. Consult with the testing laboratory to determine the volume of effluent needed and appropriate bottle for each analysis.

Care must be taken when collecting the grab samples for laboratory analysis. The grab samples must be collected from a free falling stream at the end of the effluent pipe in the inspection port provided in all approved NPDES household sewage treatment systems. Do not collect the grab samples from stagnant water inside the inspection port.

Mark the sample bottles with the site address, time and date of collection, any additives introduced to the sample, and whether chlorine was detected before collecting the sample.

1. Do not remove the cap from the sample bottle until you are ready to take the sample.
2. Remove the cap from the sample bottle holding the exterior of the cap. Do not touch the rim or mouth of the bottle. Some sample bottles are sealed to ensure they remain sterilized. Be sure to remove the tape completely before collecting a sample. Contamination of samples to be analyzed for fecal coliform or E. coli will affect sample results.
3. Carefully fill the sample bottle.

- a. Sample bottles to be analyzed for fecal coliform or *E. coli* must be filled without rinsing. Leave ample air space in the bottle (at least 2.5 cm) to facilitate mixing by shaking, before examination. Do not allow the sample bottle rim to touch the effluent piping or any other source of contamination.
 - b. Overflow the airtight sample bottle to be analyzed for CBOD₅. The presence of oxygen in the airspace will affect these samples.
4. Recap the sample bottle. The bottle should only be open during the collection of the sample.
 5. If there is any question whether the sample to be analyzed for fecal coliform or *E. coli* was contaminated during collection, discard the sample and start over at the first step.

Storage and Transport

The sample must be packed in ice and held at <4°C for less than six hours for transport to the testing laboratory. Re-freezable ice packs are not sufficient to ensure compliance with the required holding temperature and are prohibited. Preferred holding times, from collection to analysis, are provided in the following table:

Table II— Collection and Preservation Techniques with Holding Times
 derived from 40CFR (1998) Part 136, and Norweco, Inc.'s *Effluent Sampling For Residential Treatment Systems*, and *The Standard Methods for the Examination of Water and Wastewater*

| Parameter Name | Preservation* (temperature, reagents) | Holding Time** | Sample Size*** | Appropriate Air Space in Sample Bottle |
|---|--|---------------------------|---------------------------|---|
| Fecal Coliform or <i>E. coli</i> | Cool, <10°C 0.0008% Na ₂ S ₂ O ₃ | 6 hours | N/A | ≥ 2.5 cm |
| Ammonia (NH ₃) | Cool, ≤4 °C H ₂ SO ₄ to pH<2 | 24 hours | 500 mL | N/A |
| Carbonaceous biochemical oxygen demand (CBOD ₅) | Cool, ≤4°C | 6 hours | 1,000 mL | 0 cm - The sample must be void of airspace. |
| Total Suspended Solids (TSS) | Cool, ≤4°C | 24 hours | 200mL | N/A |

* Reagents may be needed in the presence of chlorine. Discuss reagent use with the qualified laboratory.

**Preferred holding time from collection to analysis. Consider laboratory hours and schedule when delivering samples. All samples should be analyzed as soon as possible after collection

***Check with the qualified laboratory for sample bottle size; sample size may be dependant on analysis methods

Chain of Custody

Written records must accurately trace the custody of each sample through all phases of the monitoring program. The primary objective of a chain of custody is to create an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through its analysis. A chain of custody form may be obtained from the laboratory performing the analysis on the samples or sample

chain of custody forms can be found in the USEPA *National Pollutant Discharge Elimination System Compliance Inspection Manual* Chapter 5, Appendix M or in Appendix B of this document.

Reporting and Records Retention

The results of all analyses and measurements shall be submitted to the local health district having jurisdiction and shall be retained by the health district for inspection. The results of all analyses and measurements must be accompanied by the site address, homeowners name, time, and date of the sampling, the specific sampling location within the treatment train, the name of the person(s) and company collecting the samples and measurements, the name of the person(s) and laboratory who performed the analyses, and the analytical techniques or methods used. Maintenance and calibration schedules and records for all testing instruments must accompany the testing results.

Part VI (N) Records Retention of the general permit states that the local health district shall retain all of the following records for a minimum of three years (unless otherwise noted), including:

1. all sampling and analytical records (including internal sampling data not reported)
2. all original recording for any continuous monitoring instrumentation;
3. all instrumentation, calibration and maintenance records;
4. all plant operation and maintenance records;
5. all reports required by the permit;
6. records of all data used to complete the application for this permit shall be maintained until such time as the system is abandoned, and;
7. A copy of the service contract in place for the installed system

Inspection

Whether or not the sample collection is done in conjunction with an inspection of the system, obvious malfunctions in the operation of the system must be recorded and reported to the homeowner and local health district. Conditions causing human, pet, or insect exposure to wastewater must be reported to the board of health immediately.

Samples that Exceed Design Standards Limitations

Grab sample results that exceed design standard limitations may be due to a number of environmental, operational, system, and collection conditions or a combination of these conditions. The local health district will receive testing results and they are required to review the results to see if there is compliance with the design standard limitations outlined in the general permit.

When it is determined that the reported results exceed the design standard limitations then the local health district must consider the sampling procedures used to collect the results and the homeowners use and operation.

Follow-up system maintenance by a service provider, additional monitoring, and / or the collection of additional samples may be necessary.

Although compliance and enforcement action may be necessary to determine the cause of poor testing results in some situations, it must be noted that grab sample results only reflect performance at the time that the sample was collected, and then only if the sample was collected properly. The function and operation of the individual system or an approved treatment train cannot be predicted through analysis of the results from a single grab sample. This type of analysis can only be conducted while analyzing a sufficient amount of results, collected over time.

For more information on sewage treatment systems, contact the ODH Bureau of Environmental Health at 614-644-1390, BEH@odh.ohio.gov, or visit the ODH Sewage Program Website <http://www.odh.ohio.gov/odhPrograms/eh/sewage/sewage1.aspx>

References and Resources:

American Public Health Association, American Waterworks Association Water Environmental Federation. *Standard Methods for the Examination of Water and Wastewater, 21st edition.*

Consolidated Treatment Systems, (2008) Sampling Protocol for Multi-Flo Systems.

Norweco, Inc. Effluent Sampling For Residential Treatment Systems.

Ohio EPA. (2009) *Manual of OEPA Surveillance Methods and Quality Assurance Practices.* http://www.epa.state.oh.us/dsw/documents/Field_Manual_1-9-09_revision.pdf

US Environmental Protection Agency. *National Pollutant Discharge Elimination System Compliance Inspection Manual.*
<http://www.epa.gov/compliance/resources/publications/monitoring/cwa/inspections/npdesinspect/npdesmanual.html>

US Environmental Protection Agency. Rules and Regulations 40CFR (1998) Part 136.
<http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=abc63a76fcb37a07bf241073489c541e&rgn=div5&view=text&node=40:22.0.1.1.1&idno=40>

Appendix A

The table and information provided in this appendix are from the Ohio Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit and is provided for the convenience of individuals, companies, and agencies performing the monitoring requirements outlined within them.

Part IV. DESIGN STANDARDS, DIAGNOSTIC SAMPLING and BEST MANAGEMENT PRACTICES.

- A. **Discharging Household Sewage Treatment System Design Standards.** Any HSTS to be installed under the terms and conditions of this HSTS General NPDES permit must be capable of achieving the following design effluent standards and be approved by the Ohio Department of Health in accordance with the provisions of Ohio Administrative Code 3701-29:

| <u>Parameter</u> | <u>Design effluent standard</u> |
|---|--------------------------------------|
| Total Suspended Solids | 18 mg/L |
| Nitrogen, Ammonia (NH ₃) Summer | 2 mg/L |
| Nitrogen, Ammonia (NH ₃) Winter | 4.5 mg/L |
| CBOD ₅ | 15 mg/L |
| <i>E. coli</i> | 410 #/100ml |
| Dissolved Oxygen | Not less than 6.0 mg/L at any time |
| Chlorine, total residual ^(a) | Not to exceed 0.038 mg/L at any time |

^(a) See Part V, paragraph F.

Appendix B

The sample chain of custody form with instructions and collection checklist with a key point summary in this appendix are provided for the convenience of individuals, companies, and agencies performing the monitoring requirements outlined in the Ohio Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit.

SAMPLE CHAIN OF CUSTODY RECORD

| | | | | | | | |
|-----------------------|------|-----------------|--------------|--------------------|--|---|------|
| Homeowner | | | | | | Sample Chain of Custody Record for Discharging Household Sewage Treatment Systems Ohio Department of Health 2009 | |
| Address | | | | | | | |
| Collected by | | | | | | | |
| Company name | | | | | | | |
| Date | | | | | | | |
| Date | Time | Sample ID | Preservative | Analysis Requested | | Remarks | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Relinquished by: Name | | Company | | Signature | | Date | Time |
| Received by: Name | | Company | | Signature | | Date | Time |
| Relinquished by: Name | | Company | | Signature | | Date | Time |
| Received by: Name | | Company | | Signature | | Date | Time |
| Relinquished by: Name | | Company | | Signature | | Date | Time |
| Received by: Name | | Laboratory Name | | Signature | | Date | Time |

SAMPLE CHAIN OF CUSTODY FORM INSTRUCTIONS

This document ensures that the sample taken in the field is the same sample that is received by the laboratory and provides an explanation of all individuals who handled the sample between its collection and submission to the laboratory. It is therefore important that the form be filled out as accurately and completely as possible.

Homeowner information:

The homeowner, his or her address, and phone number must be printed on the form. The individual collecting the sample must print his or her name, the company name (if applicable) and the date of the collection.

The individual collecting the sample must also print his or her name, company name (if applicable) signature, date, and time of the collection on the first line labeled:

Relinquished by

Sample Information:

- For each sample, indicate the date and time of the collection.
- When collecting a number of samples for laboratory analysis it may be advantageous to number or letter the samples to avoid confusion. Any identification should be labeled on the sample bottle and on the chain of custody form.
- Under Preservative, indicate the type of preservative in the containers submitted to the lab.
- Include what analyses are to be performed.
- Include any remarks for the laboratory, special instructions, or any necessary documentation related to the sample or its collection.

Verifying Chain of Custody

Each time the sample changes hands, the person relinquishing the sample must print and sign his or her name, company name (if applicable), the date and time the sample was transferred. The person receiving the sample should do likewise.

Key points

- Read and understand the Ohio Department of Health's ***Procedure for the Collection and Testing of Grab Samples as Required by NPDES General Permit for Discharging Household Sewage Treatment Systems***, all references, and all manufacturer manuals before implementing a sampling and monitoring program.
- Collect all samples in a manner to limit contact with the effluent and ensure your safety. Use proper safety equipment.
- Choose a laboratory qualified to perform the testing required by the permit. Determine the laboratory's operating hours and weekend or holiday schedule before collecting samples.
- TSS, CBOD₅, NH₃, and bacterial concentrations must be determined through the analysis of a correctly collected effluent sample at the qualified laboratory.
- Flow rate, dissolved oxygen and chlorine concentrations must be measured or calculated in the field.
- All equipment must be calibrated and reagents must be fresh.
- Obtain sampling bottles from the qualified laboratory whenever possible. Have extra sampling bottles available in case a sample is contaminated.
- Collect all samples from the sample port after final treatment. Do not collect water pooled in the sample port.
- Follow manufacturer instructions during times of low or no flow.
- Collect samples for laboratory analysis correctly:
 - Mark the sample bottles with the site address, time and date of collection, any additives introduced to the sample, and whether chlorine was detected.
 - Do not remove the cap from the sample bottle until you are ready to take the sample.
 - Remove the cap from the sample bottle holding the exterior of the cap. Do not touch the rim or mouth of the bottle. Some sample bottles are sealed to ensure they remain sterilized. Be sure to remove the tape completely before collecting a sample. Contamination of samples to be analyzed for fecal coliform or E. coli will affect sample results.
- Carefully fill the sample bottle.
 1. Sample bottles to be analyzed for fecal coliform or E. coli must be filled without rinsing. Leave ample air space in the bottle (at least 2.5 cm) to facilitate mixing by shaking, before examination. Do not allow the sample bottle rim to touch the effluent piping or any other source of contamination.
 2. Overflow the airtight sample bottle to be analyzed for CBOD₅. The presence of oxygen in the airspace will affect these samples. Do not allow the sample bottle rim to touch the effluent piping or any other source of contamination.

- Recap the sample bottle. The bottle should only be open during the collection of the sample.
- If there is any question whether the sample to be analyzed for fecal coliform or E. coli was contaminated during collection, discard the sample and start over at the first step.
- Pack the sample in ice for transport. Do not use re-freezable ice packs.
- Consider travel time to the laboratory, known laboratory operating hours and required holding times when collecting samples. Do not collect samples when they cannot be analyzed within the required holding times.
- Follow chain of custody procedures. Fill out a chain of custody form.
- Report the laboratories analysis, all calculations and measurements made in the field, site address, homeowners name, time and date of the collection, collection location, your name, your companies name, laboratory name, analytical techniques or methods used, and instrument maintenance and calibration schedules to the local health department.

Where can I get more information?

**Ohio Department of Health
Residential Sewage Program
246 N. High Street
Columbus, Ohio 43215
Phone: (614) 644-7551
Fax: (614) 466-4556
BEH@odh.ohio.gov**