Planning and Documentary Protocols for Water Quality Assessments

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Preface

The Watershed Protection Branch (WPB) of the Georgia Environmental Protection Division (GAEPD) has created a series of standard operating procedures (SOP) establishing uniform methods for the collection of data, document control, quality assurance, safety, as well as other activities. These protocols were developed to document, and ensure, the validity of measurements, analyses, and the representativeness of samples collected. This is necessary in the event of a dispute with other parties regarding data collection techniques and the resulting quality of field information. Enforcement activities by the Branch require full documentation on particulars of data collection and the equipment used to collect it. All Branch associates who collect samples or field data are required to be familiar with the measures outlined in the appropriate SOP's.

Requirements pertaining to specifics of sample collection for certain parameters are specified in federal regulations under the authority of the Clean Water Act (CWA) and the National Pollutant Discharge Elimination System (NPDES) permitting program. The most widely applicable guidance at this level is *Title 40 of the Code of Federal Regulations (40 CFR)*. The procedures and techniques given in *40 CFR* are updated periodically by the United States Environmental Protection Agency and field workers are advised to consult the latest revision for proper procedures and new developments. In addition, the SOPs utilized by the Branch should be reviewed annually to certify their concurrence with federal statutes. Other references used in developing each SOP are cited at the conclusion of the individual documents.

The collection protocols in *40 CFR* are in many instances based on the concern for quality assurance. As such, each SOP will contain a section devoted to maintaining and improving the quality of data collected. 'Quality Assurance and Quality Control' sections contained within individual SOPs are not meant to replace the overall Quality Assurance Project Plan documents prepared for the Branch, but rather, are provided as supplemental data for each specific, standardized activity.

This document is dynamic and will be continually revised as new developments warrant. As the Branch assumes more responsibilities for studying and sampling in new investigational areas, it is anticipated that additional SOPs will be required.

A. Introduction

The water quality inspections, investigations and studies conducted by the Branch can be broadly categorized as either enforcement or non-enforcement related activities.

The enforcement related fieldwork includes water enforcement case investigations, National Pollutant Discharge Elimination System (NPDES) compliance sampling inspections (CSIs), some diagnostic evaluations of municipal and industrial wastewater treatment plants, and monitoring of sewage spills.

Field work conducted that does not have a specific enforcement objective includes compliance with water quality standards, development of water quality criteria, trend monitoring, surveys to verify issued permit limits, waste load allocation and model calibration studies, and other intensive surveys for documenting water quality. Because studies and data derived from non-enforcement type investigations could be used for enforcement purposes, both investigations follow the guidelines presented in this document.

B. Purpose and Applicability

The purpose of this SOP is to establish a uniform procedure for planning work, documenting field procedures and findings, and retaining post-work documents and collections. The procedures outlined in this SOP are applicable to all Branch associates who plan field studies, collect data, or retain field collection documents in support of water quality and compliance monitoring.

C. Summary of Method

NPDES inspections and special response investigations do not require written study plans. Routine ambient monitoring is scheduled well in advance through monthly calendars covering staffing and laboratory analytical support needs.

Detailed investigations such as for lake and coastal monitoring, model calibration studies and other intensive surveys or large-scale technical evaluations require more planning and a formalized plan of study before initiation. The WPB has "Water Quality Survey Procedures" for these types of studies that follows a step-wise process from the initial request through planning, conducting and reporting of the results. The Ambient Monitoring Unit requires additional information be provided within its work plans that cover employee health and safety.

All sample identification, Chain-of-Custody Records, and field records should be recorded with waterproof, non-erasable ink. If errors are made on any of these documents, corrections should consist of crossing a single line through the error and entering the correct information above the strikeout. All corrections should be initialed and dated. If possible, the individual making the error should provide the correction. Some data forms

may not be amenable to using indelible waterproof ink and the use of pencil is acceptable as long as the reviewing professional certifies the accuracy of the data.

When information is entered onto sample labels and field notebooks, the data should not be capable of being removed without leaving obvious indications of the attempt. Labels should never be placed over previously recorded information. Corrections to information recorded on labels should be made as stated above.

D. Definitions

1. **Clean Water Act (CWA)** – As amended in 1977, the Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave the U.S. EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The Clean Water Act also continued requirements to set water quality standards for all contaminants in surface waters. The Act made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. It also funded the construction of sewage treatment plants under the construction grants program and recognized the need for planning to address the critical problems posed by nonpoint source pollution.

2. **Compliance Sampling Inspections (CSI)** – Studies that monitor permitted discharges for compliance with NPDES permits.

3. **Hydrologic Unit Code (HUC) -** The United States is divided and sub-divided into successively smaller hydrologic units that are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged or nested within each other, from the largest geographic area (regions) to the smallest geographic area (cataloging units). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

4. **Intensive Survey** – An intensive survey is a study that incorporates many different fields of research to fully understand the complexity of a water system. In most cases, this includes tributary and lake sampling for water quality characteristics, biotic life, sediment quality, and flow status. These studies tend to be a minimum of a year in duration.

5. **National Pollutant Discharge Elimination System (NPDES)** – As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are

connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal and other facilities must obtain permits if their discharges go directly to surface waters.

6. **Special Response Investigation** – A special response investigation is a study conducted in response to a complaint or request submitted by a member of the general public, a water treatment facility operator, a member of a municipal government, a citizen's action group, etc...

E. Health and Safety Warnings

Collection and analysis of samples can involve significant risks to personal health and safety. Planning for any type of field sampling should include extensive health and safety considerations. The top priority within these considerations should be a communications plan to be included in the plan of work submitted prior to sampling activities. Recommendations for required training, personal protective equipment, and degree of personal, physical condition should also be included in accordance with Federal, State, or organizational requirements.

F. Personnel Qualifications

All Branch associates who collect samples or field data must be familiar with the measures outlined in this document. In all aspects of water quality planning and field assessment activities, safety is to be addressed and treated as a critical element of any WPB activity. The Georgia *DNR Safety Manual (*https://dnrintranet.org/hr/DNR-Safety-Manual) is to be consulted and its policies, protocols and procedures are to be incorporated and implemented in WPB field activities.

G. Equipment and Supplies

- Work Plan
- Sample labels
- Sample Chain-of-Custody (Orange sheets)
- Appropriate field sheets/field book for sampling task
- Pencils, permanent marker, waterproof ball point pen
- Sample containers/Sampling equipment

H. Procedural Steps

Pre-Plan Development

The first step in conducting any sampling activity other than routine ambient monitoring and special response investigations is the development of a brief project statement of purpose that clearly defines the goals of the project and the analytes to be measured. This

will provide a point of reference while determining and verifying sample site locations and will ultimately form the framework for the work plan.

Reconnaissance

Potential sample site locations must be verified via reconnaissance before the site list, and thus, work plan, can be finalized. When conducting site reconnaissance, make note of the following:

1. Generate a proposed site route prior to departure and follow it so as to evaluate its accuracy. Prior to recon, locate additional road crossings in the event the original coordinates are inaccessible. GPS and map should be used in the event the proposed route or monitoring locations proves to be erroneous. During the site visit a reconnaissance form should be completed.

2. Evaluate the following at each site:
    a. Safety: Where can you safely park? How wide are the shoulders on the bridge? How much traffic do you observe while visiting the site?
    b. Site Suitability: Is there a tapedown marker, gage, or USGS station at the site? Can you sample the upstream side? Is there anything at the site that would prevent you from being able to take a representative sample (e.g. debris, beaver dam)? How deep is the water (approximately)?
    c. Accessibility: Is the access to the stream bank on private or public property? If accessing the stream through private property is unavoidable, attempt to contact the owners and obtain permission prior to visiting the site.

Special Project Work Plan

Each study should have its own individual work plan. This plan will include, but is not limited to, the following items:

1. Sampling plan detailing reason for work being conducted, how it will be conducted, and expected results.
2. Detailed locations of sampling sites including GPS coordinates denoted on appropriate paperwork and work plan.
3. Schedule of dates for which sampling activities have been planned.
4. Employee schedule for associates participating in sampling activities.
5. Communication Plan/Safety Information
    a. Emergency contact information for each associate
    b. Detailed lodging information with contact numbers if study is conducted over multiple consecutive days and overnight lodging is required
    c. Job hazard analysis detailing dangers associated with specified field sampling activities and suggested recommendations for avoiding harm – signed by each participating associate, when applicable and/or required.

d. Pertinent health information if deemed necessary by manager. (i.e. diabetes, heart condition, or allergies)
e. Location and contact information for nearest emergency care facility/hospital within vicinity of sampling sites – with maps to location or nearest road serviceable by ambulance
f. Documentation of approved certification in first aid/CPR by at least one associate in field team per sampling outing if no one person will continuously be in the field

The plan of work, with all its constituent parts, should be completed and submitted to the appropriate supervisor no later than 2 weeks prior to the start of sampling activities.

Field Notes (Log book and Other Original Written Field Records)

Each study or project shall have a log book dedicated to it, shared with other related projects or studies, or with other work conducted in the same river basin, or watershed unit (HUC). Reasons for this include document control and consistency in filing original completed field records, ability to segregate records that may become legal evidence in enforcement proceedings from current study record keeping, and security of past data should a log book become damaged or lost in subsequent work.

The study leader's name, the sample team leader's name (if appropriate), names of any additional staff collecting data, the study name, and location and study dates should be entered on the inside of the front cover of the log book. It is recommended that each page in the log book be numbered and dated. The entries should be legible and contain accurate and inclusive documentation of an individual's activities. At the end of all entries for each day or at the end of an event, if appropriate, the investigator should draw a diagonal line and initial indicating the conclusion of the entry.

Since field records are the basis for later written reports, language should be objective, factual, and free of personal feelings or other terminology that might prove inappropriate. Once completed, these field log books become legal documents and must be maintained as part of the official files. All aspects of sample collection and handling, as well as visual observations, shall be documented in the field log books. The following is a list of information that should be included in the field notes log book:

1. Date and time of sample collection
2. Sample collector and data recorder
3. Weather conditions that may affect the sample (e.g. rain, extreme heat or cold, wind, etc.)
4. Monitoring location number (MonLoc)
5. Description of the sample(s) location
6. Sample collection equipment (where appropriate)
7. Serial numbers of any sampling equipment used
8. Description of the sample(s)

9. How the sample(s) was collected
10. Calculations and results for field sampling, field analytical, and field physical measurement equipment

Field data that is recorded by an instrument and saved directly into a logging component (internal or accessory) are to be downloaded and secured as an electronic file.

Sample Identification

The method of sample identification used depends on the type of sample collected. Samples collected for specific field analyses or measurement data are recorded directly in field notebooks with identifying information. Samples collected for laboratory analyses are identified by attaching pre-printed sticker labels. In some cases, particularly with biological samples, Sample labels may have to be included with or wrapped around the samples. Sample labels can be accountable documents after they are completed and attached to a sample or other physical evidence. Examples of a combination Sample label and field information form containing both sample identification and field data are provided in the Appendix. The following information may be included on the Sample label using waterproof, non-erasable ink (the first four must always be provided; additional critical information is recorded on accompanying Chain-of-Custody):

1. Study or project
2. Date and time of sample collection
3. Sampler's name
4. Monitoring location number (MonLoc)
5. Designation of the sample as a grab or composite
6. Type of sample (water, wastewater, leachate, soil, sediment, etc.) and a very brief description of the sampling location
7. Depth of sample
8. Analysis requested to be performed
9. Relevant comments (such as detectable or identifiable odor, color, or known toxic properties)

If a sample is split with a facility, state regulatory agency, or other party representative, the recipient should be provided (if enough sample is available) with an equal weight or volume of sample. The split sample should be clearly marked or identified.

Labels for blank or duplicate (or replicate) samples will be marked "blank" or "duplicate," respectively. This identifying information shall also be recorded in the field notebooks and on the Chain-of-Custody Record.

I. Data and Records Management

Photographs and Digital Media Documentation

Photographs used in investigative reports or placed in the official files shall be identified on the back of the print and on the digital file with the following information:

1. A brief, but accurate description of what the photograph shows, including the name of the facility or site and the location.
2. The date and time that the photograph was taken.
3. The name of the photographer.

When photographs are taken, a record of each photograph taken shall be kept in the field notes along with the information required. The field investigator shall then enter the required information on both the hard copy prints and the digital file where the photo is stored, using the photographic record from the field notes, to identify each photograph. For criminal investigations, the digital file (cd or external hard drive) and hard copy print shall be stored in a secure location.

Image records made with digital media are electronic graphic files that can be modified or altered using software. If a digital record is to be used for evidence in an enforcement proceeding, the original graphic file is to be saved and secured with Chain-of-Custody Record by the originator. Guidance should be obtained from the Georgia Attorney General's Office if digital image documentation for enforcement is anticipated.

Identification of Physical Evidence

Physical evidence, other than samples or images, shall be identified by utilizing a Sample label or recording the necessary information on the evidence. In addition, it is suggested that photographs of any physical evidence be taken, and the necessary information recorded in the field log book.

Occasionally, it is necessary to obtain recorder and/or instrument charts from WPB or facility owned analytical equipment (flow recorders, etc…), during field investigations and inspections. Write the following information on these charts while they are still in the instrument or recorder:

1. Starting and ending time(s) and date(s) for the chart.
2. Results of an instantaneous measurement by the recorder. The instantaneous measurement shall be entered at the appropriate location on the chart along with the date and time of the measurement.
3. A description of the location being monitored and any other information required to interpret the data such as type of flow device, chart units, factors, etc.

The field investigator should initial all of the above information. After the chart has been removed, the field investigator shall indicate on the chart who the chart (or copy of the chart) was received from and enter the date and time, as well as the investigator's initials.

Documents such as technical reports, laboratory reports, etc., should be marked with the field investigator's signature, the date, the number of pages, and from whom they were received. Confidential documents should not be accepted, except in special circumstances.

Chain-of-Custody Procedures

Chain-of-custody procedures maintain and document the sample custody record and provide documentation of samples for evidence. To document Chain-of-Custody, an accurate record must be maintained to trace the possession of each sample from the moment of collection to its introduction into evidence.

Sample Custody

A sample or other physical evidence is in custody if:

1. It is in the actual possession of an investigator
2. It is in the view of an investigator, after being in their physical possession
3. It was in the physical possession of an investigator and then they secured it to prevent tampering and/or
4. It is placed in a designated secure area

Chain-of-Custody Record

The field Chain-of-Custody Record is used to record the custody of all samples or other physical evidence collected and maintained by investigators. All physical evidence or sample sets shall be accompanied by a Chain-of-Custody Record. This Chain-of-Custody Record documents transfer of custody of samples from the sample custodian to another person, to the laboratory, or other organizational elements. To simplify the Chain-of-Custody Record and eliminate potential litigation problems, as few people as possible should have custody of the samples or physical evidence during the investigation. The Chain-of-Custody Record also serves as a sample logging mechanism for the laboratory sample custodian. In the WPB, the GA DNR Chain-of-Custody may serve as the Chain-of-Custody Record for most samples and is completed for all samples collected and submitted to the GAEPD Laboratory for analysis. The GA DNR Chain-of-Custody may be customized to a format specific to special types of samples or monitoring projects. A separate Chain-of-Custody Record may be used for special samples. Field notes should also note the sample holding and disposition concerning custody, transfer and laboratory delivery as appropriate. An example of a Chain-of Custody Record is provided in the Appendix.

The following information is recorded in the indicated spaces to complete the Chain-of-Custody Record.

1. Study or project name
2. Name of the sample collector
3. Monitoring location number (MonLoc)
4. Site name
5. Date and time of sample collection
6. Document ID (activity type, activity intent, activity media, sampling design type, and office location)
7. Required analyses should be checked off in the appropriate location.
8. Responsible party and phone number
9. The sample custodian and subsequent transferee(s) should document the transfer of the samples listed on the Chain-of-Custody Record. The person who originally relinquishes custody should be the sample custodian. Both the person relinquishing the samples and the person receiving them must sign the form. The date and time that this occurred should be documented in the proper space on the Chain-of-Custody Record.
10. Usually, the last person receiving the samples or evidence should be the laboratory sample custodian or their designee(s)

Samples should not be accepted from other sources unless the sample collection procedures used are known to be acceptable, can be documented, and the sample Chain-of-Custody can be established. If such samples are accepted, a standard Sample label containing all relevant information and the Chain-of-Custody Record shall be completed for each set of samples.

Transfer of Custody with Shipment

1. Samples shall be properly packaged for shipment.
2. All samples shall be accompanied by the Chain-of-Custody and sealed in a watertight bag. The laboratory sample custodian is responsible for receiving custody of the samples and will fill in the "Received By" section.

Document Control

The term document control refers to the maintenance of records and reports produced during and as a result of field inspection, investigation, or survey activities. All files shall be maintained in accordance with WPB guidelines. All documents as outlined below shall be kept in the WPB files when completed and approved if applicable. Investigators may keep copies of reports in their personal files, however, all official and original documents relating to inspections, investigations and surveys shall be placed in the official WPB files. The following documents shall be placed in the WPB file, if applicable:

1. Request memo from the program office
2. Copy of the study plan
3. Original bound field books
4. Records obtained during the investigation
5. Complete copy of the analytical data and memorandums transmitting analytical data
6. Official correspondence received by or issued by the Branch relating to the investigation
7. Photographs associated with the project
8. One copy of the final report and transmittal memorandum(s); and
9. Relevant documents related to the original investigation/inspection or follow-up activities related to the investigation/inspection.

J. Quality Assurance and Quality Control

Quality Control (QC) Blanks - The primary purpose of QC blanks is to trace sources of artificially introduced contamination into samples collected. The diagram below shows how comparison of different blank sample results can be used to identify and isolate the source of contamination introduced in the field or the laboratory. The source of contamination introduced in the field or laboratory can be deduced by comparing blank results. An equipment blank could potentially be contaminated in the field, during transport to the lab or in the lab. The method blank, on the other hand, could only be contaminated in the lab. Using all blanks (appropriate for the project) described in this fact sheet will facilitate the identification of contamination sources.
Below is a definition of each blank, its purpose and collection frequency.

Field Blanks

Rinsate/Equipment Blank: A sample of analyte free water poured over or through decontaminated field sampling equipment prior to the collection of environmental samples.
Purpose: Assess the adequacy of the decontamination process. This blank assesses contamination from the total sampling, sample preparation and measurement process, when decontaminated sampling equipment is used to collect samples.
Frequency: 1 blank/day/matrix or 1 blank/20 samples/matrix, whichever is more frequent.

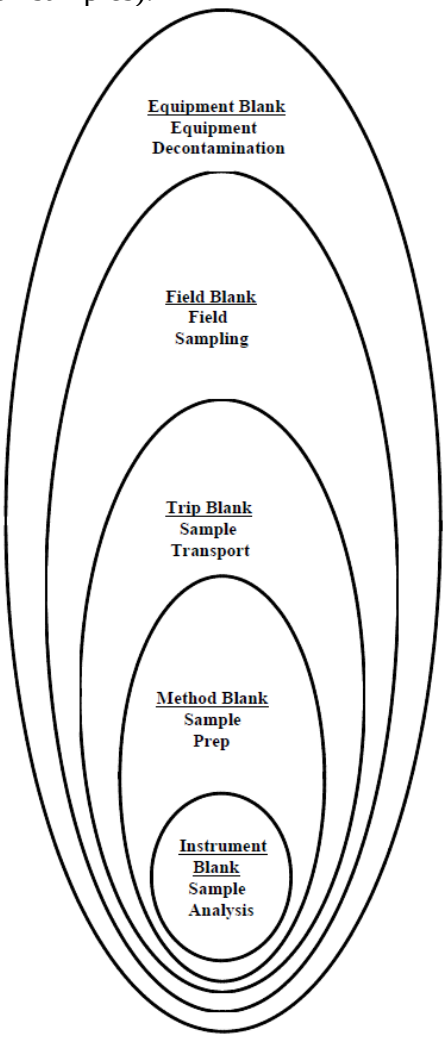
Field Blank: A sample of analyte free water handled the same way the field sample is, which may include pouring into the container in the field, preserving and shipping to the laboratory with field samples.
Purpose: Assess contamination from field conditions during sampling.
Frequency: 1 blank/day/matrix or 1 blank/20 samples/matrix, whichever is more frequent.

Trip Blank: A clean sample of a matrix that is taken from the laboratory to the sampling site and transported back to the laboratory without having been exposed to sampling procedures. Typically, analyzed only for volatile compounds.
Purpose: Assess contamination introduced during shipping and field handling procedures.
Frequency: 1 blank/cooler containing volatiles.

Laboratory Blanks

Method Blank: A blank prepared to represent the matrix as closely as possible. The method blank is prepared/extracted/digested and analyzed exactly like the field samples.
Purpose: Assess contamination introduced during sample preparation activities
Frequency: 1 blank/batch (samples prepared at one time.)

Instrument Blank: A blank analyzed with field samples.
Purpose: Assess the presence or absence of instrument contamination.
Frequency: Defined by the analytical method or at the analyst's discretion (e.g., after high concentration samples).



Field Duplicates If the project involves collection of samples, then field duplicates are useful in documenting the precision of the sampling process. Field duplicates are used to assess improper homogenization of the samples in the field; reproducibility of sample preparation and analysis; and, heterogeneity of the matrix. They are done on a minimum of 10% of the samples collected.

To maintain a quality work product, each document completed as outlined in this SOP should be reviewed upon completion. The associate conducting the review should be someone other than the associate who originally completed the Work Plan, Sample label, Chain-of-Custody, etc… Field notes and log books should also be reviewed by a second party in the field team to ensure that no pertinent information concerning the sampling activity is overlooked.

K. References

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GA Department of Natural Resources

EPD Laboratory
5804 Peachtree Corners East
Norcross, GA 30092

000000000

Collected By: _____

Office	Date Collected (m m d d y y y y)	Time	Monitor Location Number	QA/QC	Project Office Codes

Project: _____

Site: _____

Field Data

Parameter		Value
H20 Temperature	deg. C	
Air Temperature	deg. C	
Sp. Conductance	umho/cm	
Dissolved Oxygen	mg/l	
pH	units	
Depth	ft.	
Gage Height	ft.	
Photic Zone	m.	
Secchi Disk	m.	
Tapedown	ft.	
Stream Flow	cfs	
Salinity	mg/ml	
Turbidity	NTU	
chlorophyll filtration volume	mL	

Laboratory Data

U	Parameter	
	Ammonia	mg/l(N)
	Biochemical Oxygen Demand	mg/l
	Conductivity	umho/cm
	Laboratory pH	units
	Nitrate/Nitrite	mg/l(N)
	Suspended Solids	mg/l
	Total Alkalinity (pH 4.5)	mg/l,CaCO3
	Total hardness by ICP	mg/l,CaCO3
	Total Kjeldahl Nitrogen	mg/l
	Total Organic Carbon	mg/l
	Total Phosphorus	mg/l(P)
	Turbidity	NTU
	Metals Scan (TMDL)	
	Ortho-Phos	
	Pesticides(chlorinated)	
	Fecal Coliform	MPN/100ml
	Chlorophyll-a (non-acidified)	
	Volatile Organic Compounds	

U	Parameter Code	
	Chloride	mg/l
	Sulfate	
	Metals ICP	
	Metals ICPMS (U and As)	
	Fluoride	
	Oil and Grease (HEM)	
	Color	PCU
	E. Coli	MPN/100ml
	Anions	
	Total Dissolved Solids	
	Nitrite Nitrogen	mg/l
	Nitrate Nitrogen	mg/l
	Silica	mg/l
	Total Dissolved Solids	mg/l
	Mercury	ug/l
	Benthic Chl a	

Type & Number of Samples:	Delivered By & Date:	Received By & Date:	Comments:

Laboratory Sample Label

For Laboratory Use ONLY

Preservative Confirmed
pH < 2_____ >12_____
Temp _____

_____Half Gallons _____Amber Bottles _____Sulfides
_____Nutrients _____Cyanide _____Oil and Grease
_____FCOL Bottles _____Sulfates _____OPHOS
_____Metal Bottles _____VOC Vials _____Chlorophyll

Version 0.8