Water Quality Analysis

1. PROCEDURES OF WATER QUALITY ANALYSIS

The steps for water quality analysis in general is mentioned in Figure-1.

1.1 Selection of Parameters

The parameters of water quality are selected entirely according to the need for a specific use of that water. Some examples are:

Drinking: As per WHO/CPCB Standards

Irrigation:

pH Conductivity

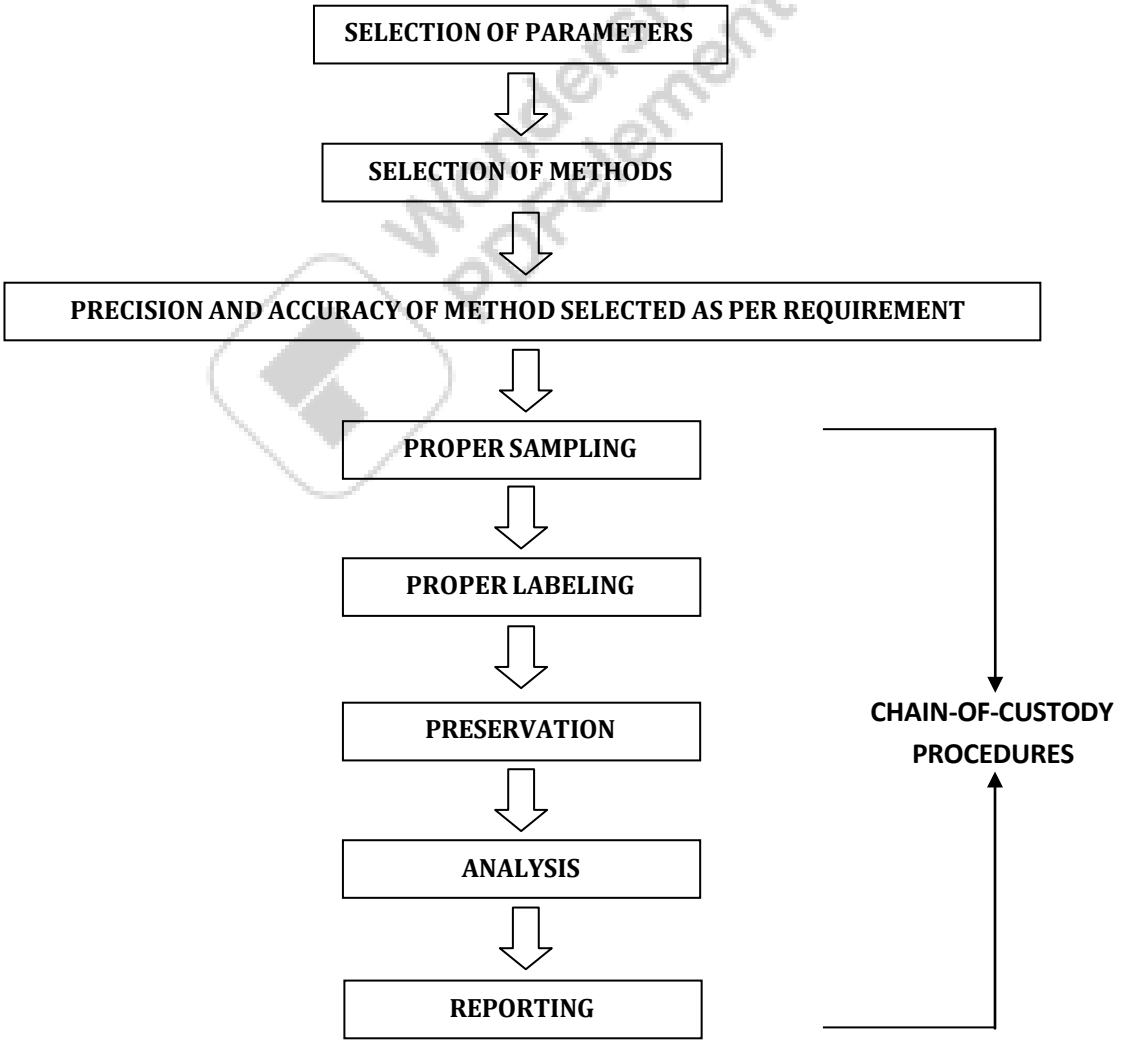
Sodium & Potassium Nutrients

Specific compounds

Industries: As per specific requirement **Domestic Consumption:** As per BIS Standards **Water Bodies:** As per CPCB guidelines

However, some of the most common parameters assessed for checking notability and industrial use in India are in Figure-2.

Figure -1: Steps for Water Quality Analysis



1.2 Selection of Methods

The methods of water quality analysis are selected according to the requirement. The factors playing key role for the selection of methods are:

(i) Volume and number of sample to be analyzed

(ii) Cost of analysis

(iii) Precision required

(iv) Promptness of the analysis as required

1.3 Precision and Accuracy of Method Selected as per Requirement

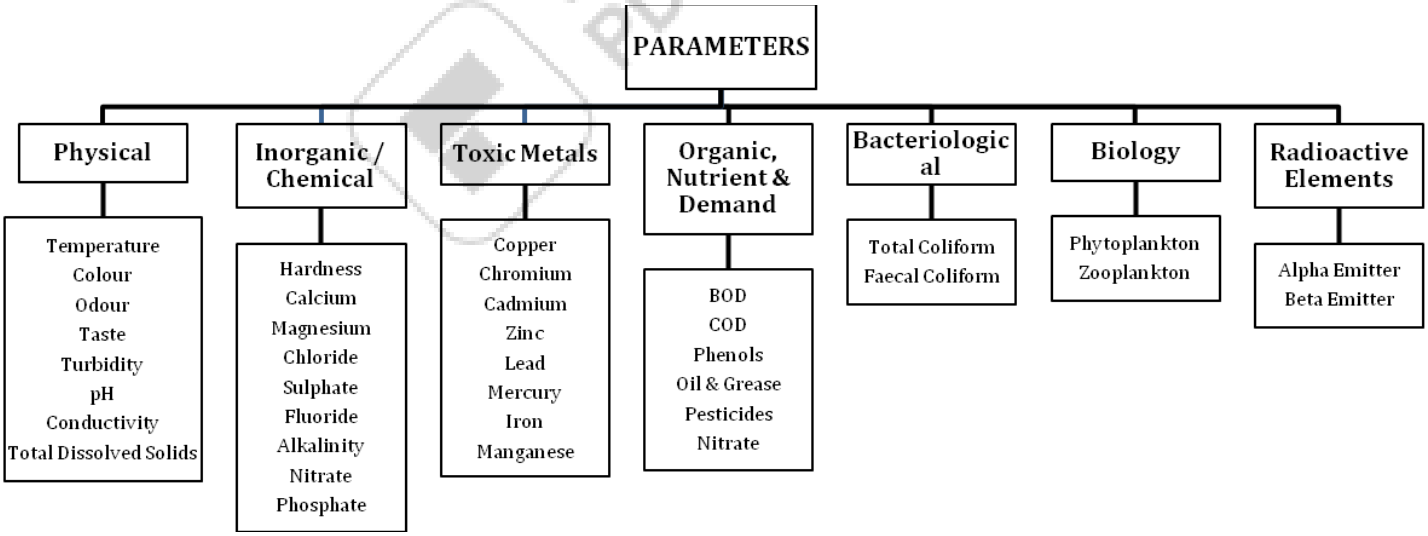
What precision and accuracy to be maintained against a particular method is decided according to the objective of the monitoring. The factors influencing this decision includes:

- Budget of Monitoring System
- Parameters to be Monitored
- Use of the Water

1.4 Chain–of–Custody Procedures

Properly designed and executed chain-of-custody forms will ensure sample integrity from collection to data reporting. This includes the ability to trace possession and handling of the sample from the time of collection through analysis and final disposition. This process is referred to as "chain-of- custody" and is required to demonstrate sample control

Figure -2: Parameters for Water Quality Analysis



when the data are to be used for regulation or litigation. Where litigation is not involved, chain-of-custody procedures are useful for routine control of samples.

A sample is considered to be under a person's custody if it is in the individual's physical possession, in the individual's sight, secured and tamper-proofed by that individual, or secured in an area restricted to authorized personnel. The following procedures summarize the major aspects of chain- of-custody:

(i) **Sample Labels:** Labels are used to prevent sample misidentification as well as to identify the collector, if required. In other words, labeling ensures the responsibility and accountability of the collector.

(ii) **Sample Seals:** Sample seals are used to detect unauthorized tampering with samples up to the time of analysis. So, it is essential to seal a sample before leaving the custody of the collector. Sealing must be done in such a way as one have to break the seal to access the sample.

(iii) **Field Log Book:** All the useful information related to a field survey or sampling should be recorded in a Log Book. At least the following data should be in the log book:

(a) Purpose of sampling
(b) Location of sampling point
(c) Name and address of field contact
(d) Producer of material being sampled and address, if different from location
(e) Type of sample
(f) Method, date, and time of preservation.

(iv) **Sample Analysis Request Sheet:** The sample analysis request sheet accompanies samples to the laboratory. The collector completes the field portion of such a form that includes most of the pertinent information noted in the log book. The laboratory portion of such a form is to be completed by laboratory personnel and includes: name of person receiving the sample, laboratory sample number, date of sample receipt, condition of each sample (i.e., if it is cold or warm, whether the container is full or not, color, if more than one phase is present, etc.) and determinations to be performed.

(v) **Sample Delivery to the Laboratory:** Sample(s) should be delivered to laboratory as soon as possible after collection, typically within 2 days. Where shorter sample holding times are required, special arrangements must be made to insure timely delivery to the laboratory. Where samples are shipped by a commercial carrier, the waybill number to be included in the sample custody documentation. Samples must be accompanied by a complete chain-of-custody record and a sample analysis request sheet.

(vi) **Receipt and Logging of Sample:** In the laboratory, the sample custodian inspects the condition and seal of the sample and reconciles label information and seal against the chain-of-custody record before the sample is accepted for analysis. After acceptance, the custodian assigns a laboratory number, logs sample in the laboratory log book and/or computerized laboratory information management system, and stores it in a secured storage room or cabinet or refrigerator at the specified temperature until it is assigned to an analyst.

(vii) **Assignment of Sample for Analysis:** The laboratory supervisor usually assigns the sample for analysis. Once the sample is in the laboratory, the supervisor or analyst is responsible for its care and custody.

(viii) **Disposal:** Samples are held for the prescribed amount and duration for the project or until the data have been reviewed and accepted. Samples are disposed usually after documentation. However, disposal must be in accordance with approved methods.

2.5 Proper Sampling

Proper sampling is a vital condition for correct measurement of water quality parameters. Even if advanced techniques and sophisticated tools are used, the parameters can give an incorrect image of the actual scenario due to improper sampling. The proper sampling should fulfill the following criteria:

(i) **Representative:** The data must represent the wastewater or water body being sampled. So, the following factors must be well planned for proper sampling:

(a) Process of Sampling
(b) Sampling size/volume
(c) Number of Sampling Locations
(d) Number of Samples
(e) Type of Samples
(f) Time Intervals

During sampling, these factors must also be taken care of:

- Choosing of proper sampling container
- Avoiding contamination
- Ensure the personal safety of the collector

(ii) **Reproducible:** The data obtained must be reproducible by others following the same sampling and analytical protocols.

(iii) **Defensible:** Documentation must be available to validate the sampling procedures. The data must have a known degree of accuracy and precision.

(iv) **Useful:** The data can be used to meet the objectives of the monitoring plan.

2.6 Proper Labeling

Proper labeling prevents sample misidentification and ensures the responsibility and accountability of the collector. The sample container should be labeled properly, preferably by attaching an appropriately inscribed tag or label. Alternatively, the bottle can be labeled directly with a water- proof marker. Barcode labels are also available nowadays.

Information on the sample container or the tag should include at least:

(i) Sample code number (identifying location)
(ii) Date and time of sampling
(iii) Source and type of sample
(iv) Pre-treatment or preservation carried out on the sample
(v) Any special notes for the analyst
(vi) Sampler's name

2.7 Preservation

- Usually a delay occurs between the collection and analysis of a sample. The characteristics of the sample can be changed
- during this period. Therefore proper preservation is required in the way to laboratory after collection, and in the laboratory up to when analysis starts.
- Complete and unequivocal preservation of samples, whether domestic wastewater, industrial wastes, or natural waters, is a practical impossibility because complete stability for every constituent never can be achieved. At best, preservation techniques only retard chemical (especially, hydrolysis of constituents) and biological changes that inevitably continue after sample collection.
- No single method of preservation is entirely satisfactory; the preservative is chosen with due regard to the determinations to be made. Preservation methods are limited to pH control, chemical addition, the use of amber and opaque bottles, refrigeration, filtration, and freezing.