WATER ANALYSIS

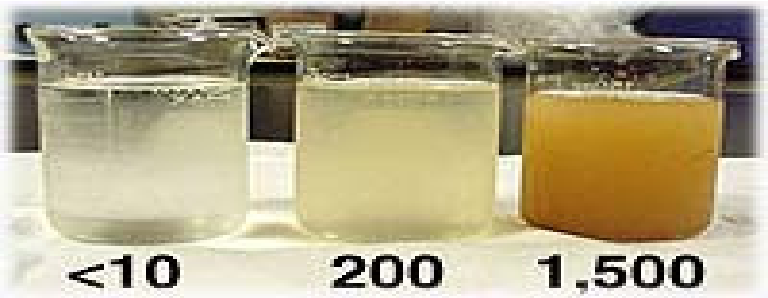
Water system should be monitored at frequency that is sufficient to ensure that the system is under control & continues to produce water of an acceptable quality. Hence samples are taken from representative locations within the processing & distribution system. To analyze water we have well equipped laboratory at Parvati W.W. Laboratory at P.W.W. is a central laboratory & water purified at Parvati W.W., Holkar W.W., Warje village W.W., Chikhali W.W., New Warje W.W. is tested at this laboratory. Water supplied to the additional villages under PMC is also tested at P.W.W. Laboratory. At Parvati W.W. samples from Raw water, filter water & treated water are taken for analysis. Daily about 90 samples are collected from all over the city, which includes overhead & service reservoirs, intermediate connections in distribution network & maximum tail end points.
Water testing is divided into three sections viz.
Physical analysis of the water
Chemical analysis of water
Microbiological examination of water.
The testing & distribution of Drinking water at P.M.C is based on the Specifications of Indian Standards for Drinking water i.e. as per I.S. :10500.

PHYSICAL ANALYSIS OF WATER

Color, taste, odor, turbidity, Conductivity these are the some of the physical parameters of water.

Color of the water is measured in Hazen units, we have a filter photometer to measure the color of the water. As per IS the color of water should be less than 5Hz units here the relaxation is upto 10 Hz. Units.

Turbidity



Turbidity is the amount of particulate matter that is suspended in water. Turbidity measures the scattering effect that suspended solids have on light: the higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid include: clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton, microscopic organisms.

Turbidity makes the water cloudy or opaque. Turbidity is measured by shining a light through the water and is reported in Nephelometric turbidity units (NTU). During periods of low flow (base flow), many rivers are a clear green color, and turbidities are low, usually less than 10 NTU. During a rainstorm, particles from the surrounding land are washed into the river making the water a muddy brown color, indicating water that has higher turbidity values. Also, during high flows, water velocities are faster and water volumes are higher, which can more easily stir up and suspend material from the stream bed, causing higher turbidities.

Turbidity can be measured in the laboratory and also on-site in the river. A handheld turbidity meter (picture) measures turbidity of a water sample. The meter is calibrated using standard samples laboratory. The picture with the three glass vials shows turbidity standards of 10, 100, and 500 NTUs. Once the meter is calibrated to correctly read these standards, the turbidity of a water sample can be taken.

As per IS the turbidity of the drinking water should be less than 5 NTU again the relaxation is upto 10 NTU.

Specific conductance

Specific conductance is a measure of the ability of water to conduct an electrical current. It is highly dependent on the amount of dissolved solids

(such as salt) in the water. Pure water, such as distilled water, will have a

Meter to measure specific conductance in the field and lab

very low specific conductance, and sea water will have a high specific conductance. Specific conductance is an important water-quality measurement because it gives a good idea of the amount of dissolved material in the water.

CHEMICAL ANALYSIS OF THE WATER

There are numerous chemical parameters for water. At PMC water is analyzed for all parameters which are described under essential parameters in IS:10500. Besides that numerous parameters are tested in PMC P.W.W. laboratory.

Dissloved oxygen

Although water molecules contain an oxygen atom, this oxygen is not what is needed by aquatic organisms living in our natural waters. A small amount of oxygen, up to about ten molecules of oxygen per million of water, is actually dissolved in water. This dissolved oxygen is breathed by fish and zooplankton and is needed by them to survive.

Rapidly moving water, such as in a mountain stream or large river, tends to contain a lot of dissolved oxygen, while stagnant water contains little. Bacteria in water can consume oxygen as organic matter decays. Thus, excess organic material in our lakes and rivers can cause an oxygen-deficient situation to occur. Aquatic life can have a hard time in stagnant water that has a lot of rotting, organic material in it, especially in summer, when dissolved-oxygen levels are at a seasonal low.

At P.W.W we have a digital D.O. meter to measure Dissolved oxygen in the water. Ideally there should be more than 4ppm of D.O. in Drinking water.

Hardness

Scale buildup in a a pipe, caused by hard water.

The amount of dissolved calcium and magnesium in water determines its "hardness." Where the water is relatively hard, you may notice that it is difficult to get a lather up when washing your hands or clothes. And, industries might have to spend money to soften their water, as hard water can damage equipment. Hard water can even shorten the life of fabrics and clothes. As per IS the Hardness of drinking water should be less than 300ppm.

pH

P^H is an important measurement of water. Not only does the pH of a stream affect organisms living in the water, a changing pH in a stream can be an indicator of increasing pollution or some other environmental factor.

pH ranges from 0 to 14, with 7 being neutral. pHs less than 7 are acidic while pHs greater than 7 are alkaline (basic).

P^H is measured by using P^H meter. As per IS P^H of drinking water should be between 6.5 to 8.5. Here you do not have any relaxation. If the P^H of water goes below 6.5 then you may have irritation of mucous membrane, & if it goes above 8.5 then you may have gastric troubles.

Other parameters which are analyzed at P.W.W. are as following, Nitrates, Nitrites, Sulphide, Chlorides, Fluorides, Calcium, Magnesium, Sodium, Potassium, Lead, Cyanide, Aluminum, Iron, Phosphates, TDS, and Alkalinity.

Microbiological Examination of water

Microbiological examination of drinking water is an attempt to determine the relation of the possible transmission of water borne didease. It is usally not practicle to examine watersupplies for various pathogens that may be present. Therefore, the routine monitering of water is based on the testing of indicator organisms. Samples for microbiological analysis are tested immediately.

Residual chlorine test

Though this is chemical test we include it under microbiological section. As residual chlorine has great significance in presence or absence of microorganisms. Chlorine gas solution is used as a disinfectant at P.W.W., residual chlorine can be defined as the amount of excess or residue of chlorine that remains in the water after disinfection. This residual chlorine must present in water throughout distribution system, as it will take care of any recontamination of water. As per IS there should minimum 0.2 ppm of residual chlorine must be present at user end. Hence PMC`S any running tap must contain minimum of 0.2ppm residual chlorine.

All samples collected by Parvati laboratory or send by any other office are preliminary tested for their residual chlorine content. For that take 0.1 ml O-toludine reagent in a test tube to this add app. 10ml of sample water, if the sample water turns yellow then we can say residual chlorine is present & if no color change is observed the result is interpreted as absence of residual chlorine. The yellow color developed in res. Chl. Test is then compared with std. disc of yellow color using a chlorine comparator. This gives direct ppm of residual chlorine present in sample water.

Total Coliform Count

Total Coliform Count is used as indicator of the general sanitary quality of treated drinking water supplies. The term coliform bacteria represents a vaguly defined group of organisms which have a long history in water quality assessment.

Coliform bacteria ferment lactose & produce gas within 24 to 48 hours at $35^{O}C$. Coliform bacteria occur in the bowel of humans & warm blooded animals, but also in soil & fresh surface water. Although many of these bacteria are faecal origin, some are heterotropic & are able to multiply in

various water environments. The presence of coliform bacteria is not always proof of faecal contamination. The presence in drinking water is usually a result of a problem with the treatment system or water pipes & indicates that water may be contaminated with microorganisms that can cause disease.

Coliform bacteria are detected by incubation of Mac-conkey broth at 35 – 37^{O}C. To the five tubes containing 10ml sterile mac-conkey browth, 10ml of sample water is added. This set of five tubes is then incubated at 37^{O}C for 48 hrs. & after incubation are observed for acid, gas formation. Formation of acid & gas indicates presence of Coliform bacteria.

Faecal coliform or thermotolerent coliform bacteria & E-coli

Faecal coliform bacteria are bacteria that are associated with human or animal wastes as they usually live in human or animal intestinal tracts. Their presence in drinking water is strong indication of recent sewage or animal waste contamination,

Faecal coliforms bacteria are predominantly E-Coli. The group of Faecal coliform E-coli bacteria are more closly related with faecal pollution. Presence of faecal coliform & E-coli bacteria is not acceptable.

For determination of E-coli two broths are used; Brilliant green lactose browth (BGLB) & Pepton water browth. Apositive test tube in total coliform test is taken for determination of E-Coli. A sterile platinum wire is dipped in the positive test tube in coliform test & loopful is taken out & transferred to BGLB. Then again sterlising the platinum wire again loopful is taken out from same test tube & is transferred to peptone water. This is called as inoculation. These inoculated test tubes are then incubated at 44.5^{O}C for 24 hrs. After completion of incubation BGLB is observed for gas formation & to peptone water Kovac`S reagent is added.

If there is gas formation in BGLB & simultaneously pale yellow colored Kovac`S reagent added to peptone water turns red (This test is called as indole test) then E-coli bacteria are said to be present.