

Technical Advice on Water Treatment Plant Operational Problems

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- *Objective:* Optimizing the existing WTP's operation and maintenance by incorporating local design criteria.
- *Target Sites:* The Metro Roxas WD – Surface water treatment plant; San Narciso WD, Zambales and Mambusao WD, Capiz – Groundwater Treatment Plant and Numancia WD in Aklan – Grant-Aid for Grassroots Project.
- *Output:* Efficient and simple operation, minimize maintenance cost and training of operators.

Background:

The Philippines is an archipelago comprising 7,100 islands. Most water supply are from the countryside comes from groundwater, while Metropolitan Manila derived its water needs through surface water from impounding dams. The quality of water supply from groundwater is good bacteriologically, that it only needs marginal chlorination as a way of treatment prior to its usage. Although the content of most deep wells exhibited high mineral and dissolved gases, these are nevertheless being used due to the inadequacy of water supply in some areas. In the case of surface water, conventional water treatment plants were being constructed based on western design criteria. The adoption of such design may be brought about by the technology of foreign consultants, since the Philippines has no previous experience in the design and construction of appropriate water treatment plant of this magnitude during those times.

In the case of the independent water supply systems in the countryside ranging from Level I to Level III, the increasing water demand of the virtually 600 duly formed water districts throughout the country is seen as one potential problem in the coming years. Hence, new



water sources utilizing river water is now being considered to augment existing groundwater which is seen to be rapidly depleting, as monitored in Bicol region and in the province of Cebu. With the increasing population and water demand, surface water treatment is the possible alternative to bring about potable drinking needs of the Filipino people.

The Initiative:

The request of the LWUA for a technical cooperation from the government of Japan through JICA was realized in 1996 when JICA dispatched the first JICA expert which was soon followed by more long-term and short-term experts. Since LWUA is mandated to cater the development of water supply systems in the countryside, LWUA and JICA initially assessed the water supply systems of water districts in terms of their operational needs. It was found out that existing water treatment plants require refurbishment with regards to better operation and maintenance, personnel training and facilities improvement. Hence, Metro Roxas Water District in Panay Island was chosen as a pilot water treatment plant for the specific study of establishing that objective of optimizing the operation and maintenance and at the same time incorporating local design criteria.

In order to further enhance this objective, another project was established involving the putting up two pilot aeration facilities in San Narciso Water District in Zambales and Mambusao Water District in Capiz. These facilities main purpose is to determine the behavior of harnessing the efficiency of aeration, temperature, hydrogen ion concentration, sunlight, chemicals and biological growth in the ultimate treatment of groundwater supply from deep well. The result of such pilot facilities were then incorporated in the actual construction of aeration facilities in Numancia Water District in Aklan as funded through Grant-aid for grassroots level project of the Japan Embassy in the Philippines.



The Local Design Concept:

It was on the onset that foreign design concept in water treatment plant construction was accepted by the Philippines. However, the Philippines is so blessed that it is located in the tropical region that temperature is considered stable throughout the year. The abundance of sunlight as a source of plant energy, the behavior of hydrogen ion concentration (pH) and the reaction of various chemical coagulants to a variety of raw water qualities are the key element. It is for this reason, that by harnessing this tropical climate, we can modify the western design by incorporating this local potential in order to reduce operation and maintenance cost, more efficient system and better water services.

In the Philippines, the presence of persistent minerals like iron and manganese in groundwater together with the existence of dissolved gases like ammonia are major water constituents that we would like to eliminate in order that it will be drinkable.



For the removal of iron, plain aeration is best considering that ions are more active in tropical climate making allowing them to precipitate faster. In the case of manganese removal, the use of chlorine as oxidizing agent at a controlled dosage of 0.8mg/L with its action on the manganese content at the filter media leads to the removal of such mineral. Likewise, based on our study, ammonia could be removed from groundwater through biological treatment due to the relative high temperature for bacterial metabolism. We strongly believe that utilizing the cascading-type aeration tower will provide the necessary condition for biological growth. Hence we allowed water to cascade into several ladders that would eventually provide the habitat of microbial growth using the ammonia content of water as food for those functional bacteria. This process requires a long period of time to understand the dynamics of the treatment process. However, at this point in time we have not yet fully established the extent and mechanism of the biological treatment process that would warrant adoption for the local design of water treatment plant facilities. Consequently, with the limited number of technical people for LWUA to cover this long-term study, we have trained the water district to assist LWUA in the monitoring activities. Unfortunately, the needed work activities like dislodging of sludge in the aeration tower, continuous operation of the facilities and collection of data are not done properly making the evaluation on the efficiency of biological treatment very difficult.



Aspect of Study: (Surface Water Treatment Plant in Metro Roxas WD)

The subject of study has the following components:

- Quantification of raw water supply and finished water by installing flow meters.
- Optimum establishment of chemical dosage via jar testing experiments.
- Actual Plant simulation for both chemical dosage and flow adjustments.
- Observation of flock sizes, formation and rate of settling.
- Evaluation of horizontal flow sedimentation process.
- Evaluation of filter run and backwashing efficiencies.
- Disinfection methods (pre, intermediate and post applications).
- Water Quality Monitoring and Evaluation of raw and finished water.
- On-the-job training of treatment plant operators.
- Enhancing the laboratory facilities and skills.
- Implementation of WTP studies by the WD and monitoring by JOCV.

Aspect of Study: (Groundwater Treatment Plant in Mumbusao WD and San Narciso WD)

The subject of study has the following components:

- Quantification of raw water supply and finished water.
- Optimum establishment of chemical dosage via Jar Test experiments.
- Chemical dosage and flow adjustments.
- Observation of aeration tower functionality.
- Evaluation of horizontal flow sedimentation process.
- Evaluation of filter run and backwashing efficiencies.
- Manganese removal by the action of chlorine.
- Formation of biological growth for the removal of dissolved gases particularly the presence of ammonia
- Water Quality Monitoring and Evaluation of raw, aerated and finished water.
- On-the-job training of treatment plant operators.
- Production of Operation and Maintenance Manual

Conclusion:

It has been shown in related literatures the beneficial action of biological treatment of drinking water and it is for this fact that we would like to harness this appropriate technology by incorporating the local environmental conditions. The main objective is to develop simple technology, easy operation and maintenance and virtually low cost, since the beneficiaries are mainly small category water districts that could hardly manage themselves in order to provide potable water to the consuming public. Therefore, it is our intension that we shall continue this study until such time that we can demonstrate the beneficial effect of biological treatment using local conditions, a key to success of identifying vital parameters through the action of tropical climate.