Online effluent waste water quality monitoring in real time

Amod Gujral Managing Director
Encardio-rite Electronics Pvt. Ltd., Lucknow, India
agujral@encardio.com

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V K Rastogi Director-Marketing
Encardio-rite Electronics Pvt. Ltd., Lucknow, India
vkrastogi@encardio.com

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Debkumar Biswas Head R&D
Encardio-rite Electronics Pvt. Ltd., Lucknow, India
dbiswas@encardio.com

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KEYWORDS

Water quality, effluent treatment plant, sewage, Real time online monitoring, Central Pollution Control Board

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ABSTRACT

The subject of monitoring quality of water has today assumed greater importance than ever before. The Government of India is determined to clean major rivers in the Country. The sources that contribute to pollution of river and underground water are industrial effluents and sewage that is discharged from cities into our rivers, lakes and even underground. This requires that the quality of water at the output of effluent treatment plants installed in numerous industrial units and sewerage treatment plants spread throughout the length and breadth of the country must be monitored on line and on a real time 24x7 basis. Automated monitoring eliminates human error in recording data and reduces the chance of intentionally or unintentionally modifying it.

The Central Pollution Control Board has presently identified 21 grossly polluting industries with effluent treatment plants at the outlet of which on line water quality monitoring systems have to be installed in a time bound manner. It is estimated that a total number of around 4,000 online water quality monitoring systems will have to be installed all over the Country to cover these 21 types of Industries.

An effective and extensive quality monitoring plan spread over the length and breadth of the Country requires that the huge amount of collected data is meaningfully analyzed and timely presented to all stake holders who may be located at dispersed locations throughout the Country. A properly designed and executed instrumentation plan will go a long way in reducing total monitoring costs, increase the quality and reliability of collected data, reduce manpower requirement, automatically analyze the collected data and present it in relevant tabular or graphical form. Authorized users located anywhere should be able to access the data simultaneously over the internet with least possible time delay consistent with user requirement.

The paper discusses the modalities and details of the system and the server to be provided to find a practical and feasible solution taking into consideration the technological tools available today.

1. INTRODUCTION

We are today facing the grim reality of ever deteriorating quality of water in ourrivers, lakes and even underground. It has threatened human and animal lives to a very great extent. In many parts of our country, polluted underground and river water causes genetic diseases in human beings which is even more disastrous. Depletion in fresh water resources is going to make life more and more difficult for our future generations and today the time has come when we can no longer ignore the challenge of improving the quality of water.

For devising, implementing, monitoring and reviewing the effectiveness of the plans for improvement of water quality and regeneration of fresh water reserves, it is essential to comprehensively map,

measure and monitor the extent and quality of both sub soil aquifers and surface fresh water reservoirs. It is equally necessary to monitor and effectively control the industrial effluents and sewage that is discharged from cities into our rivers, lakes and even underground. As per Government guidelines, polluting industries have to deploy Effluent Treatment Plants (ETP) to properly treat their effluents before they are discharged into rivers. Municipal bodies in all cities have to install Sewage Treatment Plants (STP) before discharging them in any water body.

An effective and extensive water quality monitoring plan spread over about 4,000 industries covering the length and breadth of this vast country is both an expensive proposition and a logistic nightmare due to the sheer number of sampling sites that will include many remote locations and the large trained manpower required to collect and send the data to designated central locations. It is also essential that the huge amount of collected data is meaningfully analyzed and timely presented to all stake holders who may be located at dispersed locations throughout the country.

A properly designed and executed instrumentation plan can go a long way in reducing total monitoring costs, increase the quality and reliability of collected data, reduce manpower requirement, automatically analyze the collected data and present it in relevant tabular and graphical forms and make it available to authorized agencies located anywhere in the country, simultaneously over the internet with least possible time delay consistent with user requirement.

Automated monitoring from a central location provides a great advantage to monitoring and regulatory bodies and authorities. The data from remote locations can not only be monitored in near real time, but it also eliminates any chance of human error in recording data, and the actual data cannot be intentionally or unintentionally modified by any person.

The discussion in this paper relates to instrumentation and telemetry solutions available that can cater to the need ofCentral and State Pollution Boards CPCB/SPCB) as well as local Pollution Control Centers (PCC). Let us first start with understanding the technology available within our own country to achieve this ambitious objective.

2. ESSENTIAL INSTRUMENTATION USED FOR MONITORING WATER QUALITY

Encardio-rite is an Indian Company that has served the Indian industry for the past 49 years by developing, manufacturing and installing on turn-key basis state of the art instrumentation products. It has now adequately responded to the new challenge of water quality instrumentation. Encardio-rite automatic water quality monitoring system offers a range of sensors that monitor various water quality parameters. Any combination of sensors can be used depending on application, precise monitoring need, measurement location or type of industry.Online monitoring of water quality allows the pollution level of water at remote locations to be monitored continuously in near real time from a central location and requires very little skilled or unskilled manpower.

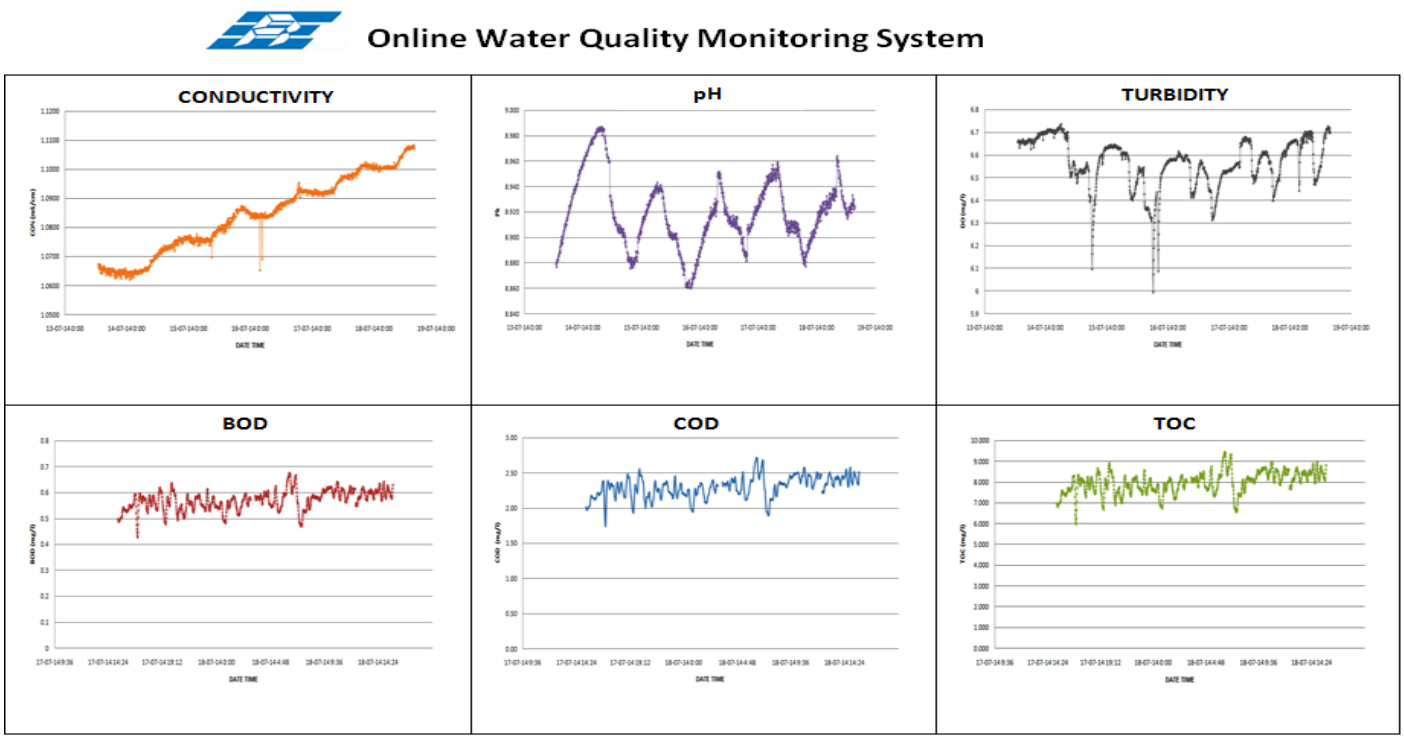
Range of sensors offered includes:

- DISSOLVED OXYGEN
- PH/ORP
- CONDUCTIVITY
- TURBIDITY
- TEMPERATURE
- COLOUR

- SPECTROPHOTOMETER
- OIL IN WATER ANALYZER

Spectrophotometer can monitor following parameters:

- SAC254 – SPECTRAL ABSORPTION COEFFICIENT (at 254 nm wavelength)
- TSS – TOTAL SUSPENDED SOLIDS
- COD – CHEMICAL OXYGEN DEMAND
- TOC – TOTAL ORGANIC CARBON
- DOC – DISSOLVED ORGANIC CARBON
- BOD – BIOCHEMICAL OXYGEN DEMAND
- NO2-N – NITRITE
- NO3-N – NITRATES
- NH_2CL – CHLORAMINE/AMMONIA



Some of the features of the instrumentation are:

- ✓ Easy to install using simple plug and play modules.
- ✓ Quick remote access to data with telemetry option.
- ✓ Large data storage memory allows data to be monitored for longer time between retrievals.
- ✓ Digital signal transmission

- ✓ Built-in log for analysis
- ✓ Easy to handle and maintain.

3. REQUIREMENTS OF POLLUTION CONTROL BOARD

The subject of monitoring quality of water has today assumed greater importance than ever before. The Government of India is determined to clean major rivers in the Country.The Central Pollution Control Board (CPCB) has presently identified grossly polluting industries that must have suitable on line water quality monitoring systems. Under the directive from the Central Pollution Control Board with reference no. B-29016/04/06/PCI/5401dated February 5, 2014, and final guidelines issued on November 07, 2014, all factories coming under the listed 21 categories of grossly polluting industries have to install continuous on line effluent quality monitoring systems at the outlet of their Effluent Treatment Plants for monitoring of industry/sector specific parameters like flow, pH, BOD, COD, TSS etc not later than 31 March 2015.

Evidently, this is a major step towards checking and controlling water pollution created by some of the most polluting industries. However, the task is gigantic as the total number of such industries all over India will not be less than 4,000. The objective of this Paper shall not be complete without a discussion on how best this can be achieved.

We would like to highlight important guidelines provided by the CPCB and share our views on some of them:

3.1 The parameter i.e. Flow, pH, TSS, COD, BOD, and Ammonia will be monitored by installing Real Time Monitoring Systems.

3.2 The vendors/instrument supplier shall install their server in SPCB/PCCs and CPCB for transferring data from the real time system. The vendor/instrument supplier shall make provisions to provide data continuously at least 04 locations in SPCBs/PCCs, RO/DO of CPCB, and industry directly from the analyzers

This provision needs serious reconsideration and revision in light of the following facts:

3.2.1 Technically speaking, it is not necessary for the data from the sensors located at the outlet of the ETP to be fed to more than one computer simultaneously. It needs to be fed to the server computer at only one location (say the local SPCB office). This server would have all the software needed for its processing with modems for sending SMS alarms if the parameter value exceeds a preset level. The data can be viewed by any number of authorized users over the internet using any standard browser without requiring any special software to be installed at each user's computer or mobile device.

3.2.2 India consists of 29 states and 7 Union territories. The directives issued by the CPCB to SPCBs in May 2014 require a manufacturer/supplier who wants to cater to the whole Country to install and maintain 37 servers all over the Country including one at the CPCB at Delhi. With the huge amount of maintenance and duplication of efforts required this is a very cumbersome and expensive proposition and is also not required with modern available technology. Please also appreciate the un-necessary cost and manpower required to maintain 37 servers all over the India by each instrument supplier working at a National level when only one central server will effectively do the job.

3.2.3 The server to be installed by the supplier has to be of very high reliability and has to be maintained with a very high MTBF. These servers are not ordinary computers but are sophisticated systemsconsisting of rugged server quality computers, redundant power supplies, data backup and archival devices, security appliances and reliable broadband internet connection. Such fully configured systems are priced at around Rs. 800,000 each. It

is best therefore to allow the supplier to install the server at the SPCB or CPCB office closest to his preferred location and use this server for monitoring the data from all over the Country including all the states and union territories. For example, we as a manufacturer have a full fledged set-up at Lucknow with a staff of more than 200 personnel. We will therefore like to install and maintain the server at the premises of the SPCB at Lucknow and provide online web based data from this server on a continuous basis. Similarly, a supplier from Chennai will find it easier to operate through the SPCB premises at Chennai to cover industries located in any state anywhere in the Country.

3.2.4 An online video camera with continuous recording facility should be installed in the server rooms of the CPCB/SPCB to ensure that maintenance personnel of any vendor is not able to get access of any form to another vendor's (competitor's) server to cause any unwanted disruption in the competitor's setup or data.

3.2.5 Maintenance of a high reliability server requires a matching infrastructure like 24 hours stable uninterrupted power supply, air-conditioning, reliable internet connection and availability of maintenance personnel round the clock.Though infrequent, different types of fault in the server require personnel with different levels of competence to have physical access to the server to rectify the fault. Most vendors would welcome the provision of being able to keep the server for all India operation at an SPCB office located near their office where their IT support staff is based.

3.3 The industry should take Bank Guaranty (BG) equivalent to 25% of the cost of the Real Time Monitoring Systems from the manufacturer of the system or its authorized Indian counterpart The BG is taken to ensure optimal performance of the system including 85% data captive rates, providing reliable & accurate data.

This provision again needs serious review as such a bank guarantee is not possible to be provided by the Instrument Supplier. Presently there are only three or four credible suppliers of Real Time Effluent Quality Monitoring Systems (RTEQMS) in the country. Out of these, Encardio-rite is the only indigenous manufacturer. There are 4,000 factories and STPs all over India which are classified under the 21 types of grossly polluting industries. Considering the requirement of RTEQMS to be 4,000, each costing nearly Rs 30 Lakhs, the total online instrumentation to be installed is worth around Rs 1,200 crore. If the instrument suppliers have to submit a bank guarantee of 25% of the value of the RTEQMS, the total value of bank guarantee works out to Rs 300 crore!!!!

3.4 In table 3 of the guidelines issued by CPCB dated November 7, 2014, the approximate cost of each instrument is given.

The values given in the above table are not realistic and should not have been included in the guidelines. It is creating confusion as it does not include taxes, cost of bank guarantees (if any), payment terms and spares/manpower required for maintenance to keep the system operational.

4. CONCLUDING REMARKS

On line monitoring of quality of water being discharged from the Effluent Treatment Plants is indispensable to clean our rivers, lakes and aquifers containing underground water. The final guidelines issued on November 11, 2014 are too stringent and not industry friendly. They are almost impossible to follow by Industry, SPTs and the instrument supplier.They are based on mistrust between the CPCB and the Industry. To have an effective system, it should be simple to follow and execute in practice. Non-compliance should of course result in punishment. For example, rather than spending time on installing and maintaining 37 servers all over the Country(un-necessary with

technology available presently), there should be one server close to the location of the instrument supplier and time should be spent on maintaining the installations made at the industry or the STP.

It is not possible to cover around 4,000 industries and STPs with online instrumentation in a period up to March 31, 2015. This needs to be implemented systematically in a time bound manner. Due consideration must be given to the views of manufacturers of water quality instrumentation particularly indigenous manufacturers such that the Real time monitoring may be made a reality in the shortest possible time frame with adequate long term servicing and maintenance. For any such programme to be effective, “MAKE IN INDIA” is the best solution eventually.