

Development of Decision Support System for Optimization of Water Treatment Process Operation and Maintenance

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Abstract. These days, water treatment operators are facing demand of optimization and cost efficient operation. So, operators and policy decision makers have been developing programs and policies to make best decision for water treatment plants. In this research, we develop a DSS (decision support system) for optimization of water treatment process. The main purpose of DSS software is to provide suitable information and decision support for operators and cost efficient operation of water treatment plant. For this purpose, process operation technology and evaluation of the blending operation process are essential for the premise of safe and sustainable water use. Implementation of this software can provide a much safer and suitable quality and quantity of water with cost and energy saving.

Keywords: Decision Support System; Water Treatment Process; Operation and Management

1 Introduction

Nowadays, South Korea is facing a strict water resources shortage. The use of multiple water resources can be good option to solve this problem. Surely, the efficient water source selection and blending is difficult because of matrix effect and difficulties of management and control of water treatment facilities. Because of these problems, various methods are developed like DSS (decision support system) for water treatment system.

In this research, we develop a DSS software for water treatment plant with multi-water source. The purpose of this DSS is blending of multi-water sources and operation management of water treatment plant to make best decision. This system is made up of multi-water blending module and unit process operation support module. To support operator, this DSS software collect time-series data and optimize multi-water blending process. Based on this software, operator can make best decision and take economic, environmental benefit related with water treatment facilities.

2 Methodology

2.1 Software Development of DSS for Unit Processes Operation Support

The main purpose of DSS software is to provide suitable information for operation support. The DSS software were designed to make the desired treated water quality and quantity for each unit in the three different processes. DSSs are composed of a user interface, analysis module, unit process optimization module, database module. Based on this DSS with operation and management, unit processes for water treatment are cartridge and optimized. By using cartridge unit process, this DSS software take flexibility and generality for various type of plant.

2.2 Fuzzy Algorithm for Blending of Water Resources

This DSS software's main algorithm is well-developed fuzzy algorithms. This fuzzy algorithm can analysis the time-series to provide appropriate result and decision. In this water treatment system, fuzzy algorithm is used to determine blending ratio of various water resources and diagnosis of system operation. For the implementation of this algorithm, TOC, ammonia, nitrate, turbidity, conductivity, and pH are selected as water quality parameters.

Fuzzy algorithm is used to assess particular water quality by developing a water quality index based on fuzzy membership function. Input ranges and parameters for water quality determinants in this DSS software vary based on water quality parameters.

3 Results & Discussion

3.1 Development of Cartridge System Module

In the system operation management, each unit processes and their operation parameters are made as cartridge system to take generality. Depending on the unit processes order, DSS software analysis and diagnosis the total set process.

3.2 Development of System Operation & Management Support Module

In the system operation management, each unit processes and their operation parameters are presented for safe and stable system operation. Depending on the influent water quality and quantities, DSS software can collect and calculate time series dataset to support decision of operators. And then, show the alarm.

3.3 Development of Blending Module

For determination of blending multiple water resources, real-time influent water quality, quantity data are used. This DSS software communicate with pilot plant SCADA system for real-time decision making. By using this system, DSS software present optimum water blending ratios by using a fuzzy algorithm.

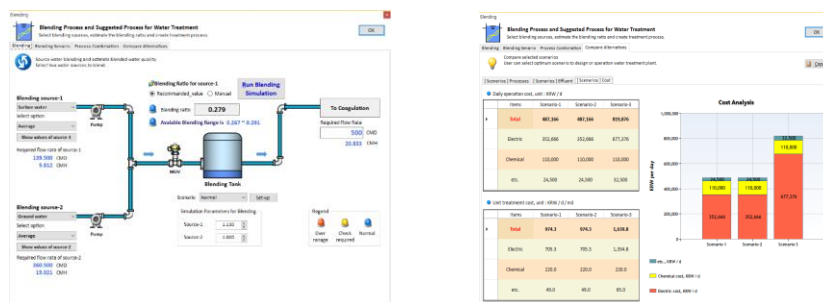


Fig. 1. DSS Software (Blending Module)

4 Conclusion

In this study, we present the DSS software for operation management. This DSS software has three priorities.

- 1st Water resources blending software with water quality parameter prediction system module
- 2nd Operation and management system for each water treatment unit processes
- 3rd Implementation of cartridge system for support unit process operation

According to this DSS software, the operator can operate and management the water treatment facilities. Therefore, long-term operations by DSS software will result in economic and environmental benefits in the water treatment plant in near future. This

DSS software will be implemented in the pilot plant and evaluated for adaptability of this software.

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