B-DASH: Demonstration on the Deterioration Diagnosis of Sewerage Facilities by Vibration Diagnosis and Big Data Analysis

(Research of FY 2015-2019)

1. Purpose

This study aims to demonstrate a technology inspecting and diagnosing facilities' degradation conditions using monitoring with vibration sensors and instrumentation facilities data of wastewater treatment facilities.

The demonstration was selected as B-DASH Project 2015 of MLIT, interim reported in 2016. After the independent study of 2017, the consortium of Water Agency Inc., NEC Corporation, Asahi Kasei Engineering Corporation, Japan Sewage Works Agency, Moriya City, and Hidaka City started the study again as an entrusted research project of NILIM in 2017.

2. Progress of the Past Years

In 2015, the researchers verified each elemental technology, and during 2016 and 2018, the validity of sensing technology and accuracy improvement of big data analysis technology. In 2019, they summarized and reported the past demonstration and analysis to solve problems from the past research.

3. Outcomes of This Year

The study measured rotating equipment installed in many WWTPs online with vibration sensors. This measurement aims to verify element technologies, "Sensing" and "Big data analysis." "Sensing technology" monitors vibration tendency with control standard values to detect appropriate timing of

repairing and retrofitting. "Big data analysis technology" integrates measurement or process signals shown at control panels of central operation rooms into data servers to detect abnormal predictions and predict deteriorations.

Big data analysis has targeted "Invariant analysis," warning unusual behaviors by online monitoring, and "Heterogeneous mixture learning," estimating repair and retrofit timing by deterioration progress prediction (Figure 1.)
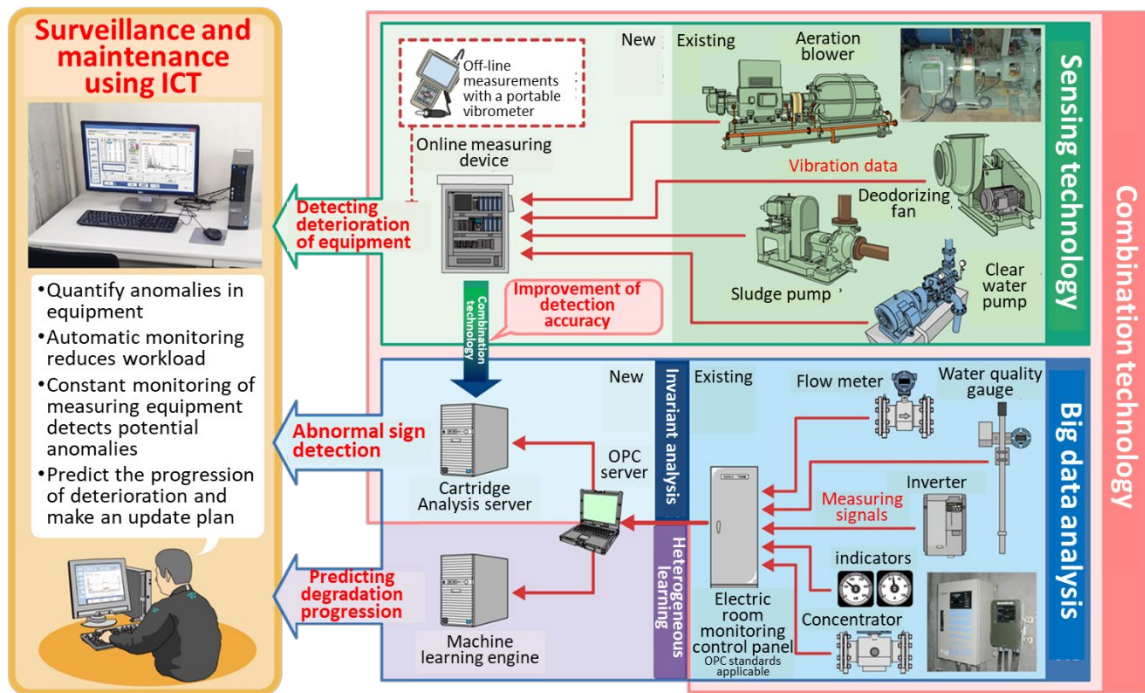

Figure 1. Outline of the study

As figure 2 describes, the sensing technology recognizes aging deterioration by normal continuous operations with no disturbances, and invariant technology recognizes disturbances that are abnormal predictions such as clogging.
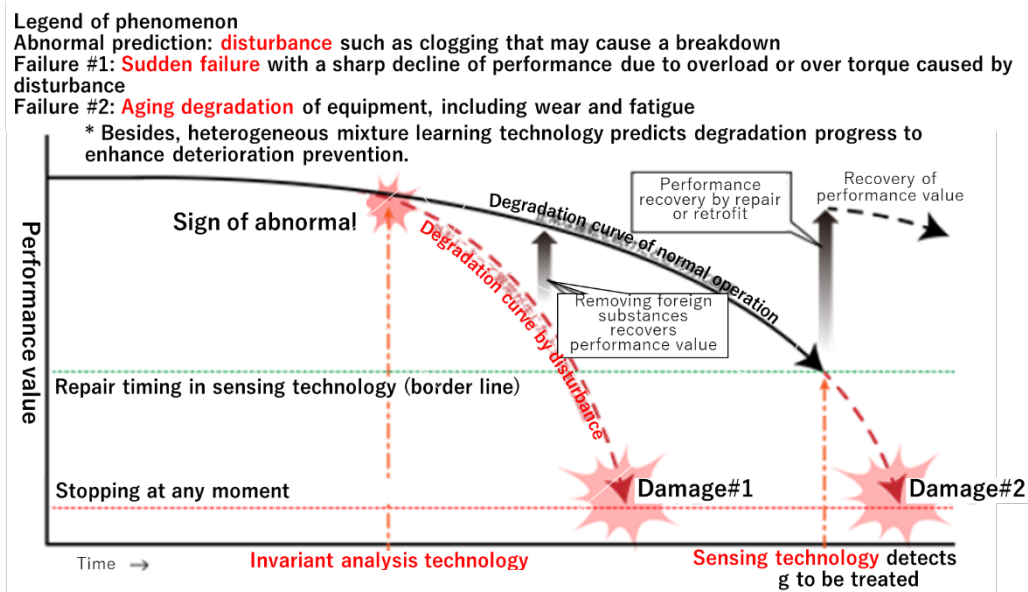
Figure 2. The concept of deterioration prediction

This year, deterioration prediction study at the demonstration facility verified the following items.

- Accuracy improvement manner of abnormal sign detection,
- Accuracy of pumping amount decrease precision of the main wastewater pump (a target relative error of 0.5% or less)
- Validity against degradation and durability under the installed environment.

Besides, a guideline was developed.

4. Conclusion

This study confirmed that sensing technology targets land rotating equipment with 600rpm and over. On the other hand, single screw pumps and screw pumps are available even at less than 600rpm.

It was verified that big data analysis technology requires data collection of a proper cycle and data accumulation over a specific period for its application, and the adoption benefit evaluation allowed the technology the effective deterioration prediction.

Besides, the study discovered that step-by-step adoption was also enabling, such as adopting sensing technology first and combining invariant analysis technology.