Advanced Applications with PRTR Data for Sound Life-cycle Managements of Chemicals

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[Abstract]

Key Words: Pollutant Release and Transfer Register (PRTR), Chemical substance, Reliability, Waste treatment, Sewage treatment, Release estimation, Self-management, Support tool, Risk assessment, Environmental monitoring

This study aimed to provide knowledge for more practical use of Pollutant Release and Transfer Register (PRTR) data in chemical management at the national, regional, and site levels. For this purpose, we presented how we can use the PRTR data to understand the substance flows and emission inventories of chemical substances and developed simplified tools and databases for supporting the risk assessment by business establishments and local governments.

We evaluated the reliability and coverage of the PRTR data from several aspects. The evaluation of PRTR-reported data showed that the employed estimation technique is not necessarily appropriate in some cases, suggesting that a part of the reported PRTR data may deviate from the actual situation. The evaluation of the reliability of the estimated "releases from listed industries below the threshold" suggested that the estimated values based only on the questionnaire to facilities were considered underestimated by several orders of magnitude. The coverage of actual release by the PRTR data was also evaluated based on the consistency between environmental monitoring data, PRTR release data, and predicted environmental concentrations by models. Based on these results, we presented measures to improve the reliability and the coverage of the PRTR data.

We also proposed a method for estimating the chemical substance flows through waste treatment by connecting the PRTR-reported transfer data to the administrative reporting data on waste treatment. The proposed method estimates the flows to each destination through the waste treatment by multiplying the amount of transfer to each treatment pattern by connecting those data and the assumed distribution rate of substanecs in each waste treatment pattern. Consistencies between the PRTR-reported data and the administrative reporting data were also clarified, which presented the need to ensure consistency between those data.

The inflows and distribution rates of PRTR target substances in sewage treatment facilities were verified by the comparative investigation between PRTR published data and the surveyed data of the monitoring of 108 PRTR compounds at actual facilities. Based on the results, the estimated releases were refined for 19 substances and the estimated releases were newly acquired for three substances. In addition, the behavior of perfluorooctane sulfonic acid (PFOS), which is one of the PRTR compounds, during sewage treatment was investigated by lab-scale experiments. It was shown that PFOS increases during biological treatment due to the formation from the precursors. The findings were utilized for suggesting a new estimation of PFOS from sewage treatment.

We developed simple and practical tools for business operators to easily assess the environmental

risk around their facilities by utilizing PRTR data. One is a simple assessment sheet which enables them to easily assess the environmental risk of chemicals in ambient air around their facilities by only selecting the rank of five parameters. Another is a simple tool to easily estimate and visualize the environmental concentration of released chemicals around the emission source using Microsoft Excel. The Developed tools are useful for business operators to understand the environmental risk around their facility using PRTR data without any advanced analytical skills.

We also provided tools to support the national and local government to comprehensively understand how release reduction measures have improved the local environment. We developed a database for automated identification and quantification of GC-MS spectrum for about four hundreds PRTR target chemicals. We also developed a one-week continuous sampling method for atmospheric analysis. These analytical techniques enable efficient and effective environmental monitoring. A number of monitoring data was obtained and the accuracy of the PRTR was assessed by comparing with those data. Those data were stored in the developed database, which is also connected to a GIS application.