

Development of global scenario model for effectiveness evaluation of the Minamata Convention on Mercury

Principal Investigator: Kenichi NAKAJIMA

Institution: National Institute for Environmental Studies

Tsukuba City, Ibaraki, JAPAN

Tel: +81-29-850-2744 / Fax: -

E-mail: nakajima.kenichi@nies.go.jp

Cooperated by: Ritsumeikan University

[Abstract]

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Appropriate implementation of the Minamata Convention on Mercury may reduce global supply and demand for mercury and anthropogenic mercury emissions and releases to the environment. However, there are concerns regarding the significant increase of mercury emissions from major sectors depending future socio-economic conditions.

This study has developed a global scenario model for estimating anthropogenic emissions of mercury into the atmosphere. The findings indicate that significant reductions in mercury emissions can be expected with the implementation of measures compared to the reference scenario without additional measures (4.1×10^9 g, 2050). However, the “Step-wise reduction” scenario by implementing mercury removal measures (2.1×10^9 g, 2050) only offset the increase in emissions from economic growth after 2015. Thus, this study also analyzed the cobenefit and tradeoff effects of reduced or increased mercury emissions brought by deep decarbonization measures towards the global carbon-neutral target. Decarbonization measures toward the carbon-neutral target would have large cobenefit mercury mitigations. But mercury emission reductions reach a ceiling at about 50% compared to the reference scenario in the OECD developing countries for example, even if CO₂ emissions reach the nearly 100% reduction target by 2050. Bioenergy with carbon capture and storage is one of the silver-bullets for achieving carbon neutrality, but triggers the tradeoff effect of higher mercury emissions. Thus, mercury removal measures need to be implemented to further reduce remaining or increasing mercury emissions. In conclusion, measures to reduce mercury emissions need to be strengthened and introduced immediately, and it would be possible to reduce mercury emissions drastically by 2050 with maximum implementation of both decarbonization measures and mercury removal measures.

This study also assessed trade-offs of countermeasures in mercury emission sources (Artisanal and small-scale gold mining (ASGM), Ferrous and non-ferrous metal industries, etc.). The findings indicate that the retort and cyanidation methods can significantly reduce mercury emissions in the ASGM by 2050, although they also reveal potential risks on other health issues associated with such interventions, and highlights the need to review the financial mechanism to achieve waste mercury management.

In addition, data driven approaches to exposing illegal and informal trade and use of mercury were developed. As a result of the analysis, significant inconsistencies were found in reported values related to mercury consumption and use in Central and South America, Africa, and some countries in Asia. We also succeeded in detecting illegal intercountry trade of mercury using discrepancies in mirrored trade data from UN Comtrade.

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