

Dioxin pollution in Japan: History and future

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1. Introduction

We studied the cause and trend of dioxin pollution in Japan. Contrary to the commonly speculated combustion source as a major pollution source, the study revealed that agrochemicals were the major sources of dioxin in the 1960s and 1970s and still contributing about half of the pollution in the current surface sediment from the Tokyo Bay. Here, I will introduce the major findings of our study.

2. Tokyo Bay study ⁽¹⁾

Based on the detailed analysis of a dated sediment core, surface sediment, and soil samples, the sources and mass balance of dioxins in Tokyo Bay basin, Japan, were estimated. The dioxins in the sediment core showed that their deposition in the bay increased rapidly during the 1960s, peaked in the early 1970s and then decreased gradually. Principal component analysis of the congener-specific data showed that three major sources existed: combustion, pentachlorophenol (PCP), and chloronitrophen (CNP). PCP and CNP are paddy field herbicides used extensively in Japan in the past. The time trends of source contributions were estimated by multiple regression analysis using the source congener profiles. The results revealed that dioxin emission from PCP and CNP herbicides was high in the 1960s and the early 1970s, respectively. The total contribution in terms of TEQ from the two herbicides was at their maximum of 70% in the 1970s and decreased thereafter. Their contribution, however, was as high as 50% in recent sediment, indicating that dioxins sprayed as herbicide impurity were still remaining in the terrestrial soil of the basin and running off gradually.

3. Agrochemical study ⁽²⁾

The profile and amount of dioxin impurity in agrochemicals were studied. The chemicals analyzed include PCP, CNP, 2,4-dichlorophenyl-4'-nitrophenyl ether (nitrofen, NIP), tetrachloro-iso-phthalonitrile (chlorothalonil, TPN), 2-methyl-4-chloro-phenoxyacetic acid (MCP), and 2,4-

dichlorophenoxyacetic acid (2,4-D). Among the six, two herbicides, PCP and CNP, produced during the 1960s and 1970s, contained very high concentrations of PCDD/DFs and TEQ. Others contained relatively low concentrations of PCDD/DFs. The total dioxin emissions from the use of agrochemicals in Japan during the past 40 years (1955-1995) were estimated to be about a few hundred thousand kg of PCDD/DFs and 250 kg of WHO-TEQ from PCP and 190×10^3 kg of PCDD/DFs and 440 kg of WHO-TEQ from CNP.

4. Future trend ⁽³⁾

Exposure model was constructed to estimate average dioxin exposure by a Japanese in the past as well as in the future. The estimated trend of body burden agreed well with the reported dioxin concentration in preserved milk samples. Even without any emission control, the exposure was estimated to decrease in the future. Reduction of emission from incineration sources by 90% will contribute to speed up the decrease. The margin of exposure (MOE) for the risk of reproductive alteration in female offspring exposed prenatally was calculated based on the estimated body burden. The MOE may not have been large enough to guarantee the safety of female offspring of mother born in the 1950s.

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