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[Sources, behavior and risks of micro-pollutants in waters]

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Water Environment Engineering, Environmental risk assessment

Cancer risks from foods and drinking water

After the 2011 accident, many people concerned the health effects caused by radionuclides in dietary. I am one of the people. I therefore estimated the cancer risks of radionuclides from dietary after the 2011 accident based on the radionuclide concentrations in individual areas and food trades within areas. The cancer risk represents life-time one, which was calculated from the exposure within the 1st year and estimated exposure of following years. The cancer risks of other pollutants are also shown to compare (Table 1). Note that cancer risk does not represent a possibility of cancer incidence. This is a potential maximum value and used for judgment or an indicator for a safety control.

Cancer risks of artificial radionuclides from dietary after the 2011 accident depend on the ages, sexes, and habitats, and were in the ranges of 0.1-1 persons per 100000 persons for Tokyo, and 0.2-4 persons per 100000 persons for Fukushima City. The dietary includes various carcinogens such as inorganic arsenic, acrylamide, and natural radionuclides (although this may not be known), and the cancer risks of artificial radionuclides after the 2011 accident were much lower than their ubiquitous cancer risks.

However, this does not mean that it is not necessary to control pollutants. It is because countermeasures are effective if risk reductions can be achieved with low costs. Table 2 compares costs for reduction of one-year life-saving among environmental and other fields. The cost effectiveness of controls of radionuclide in vegetables after the 2011 accident are better than other countermeasures in environmental fields; however, the cost effectiveness in environmental fields are generally worse than that in other fields such as safety control, medical treatment, and lower than citizens' willingness to pay. I have heard that some say an extreme argument that "we should not do countermeasures for environment because of low effectiveness". However, there are limitations for evaluating risks and benefits in the environmental field. No doubt that what we expect is not the society with low risks. I guess that we want to advance and live in the society, which enable us cultural and hatefully-rich, proud, and sustainable. How we control the risky substances is the problem of a sense of value - such as what society we want to live in. How do we reflect the sense of value for risk management? This is the question to face after the 2011 accident.

Table 1. Cancer risks in Japan.

Pollutants	Lifetime cancer risk (persons/100000 persons)
Radionuclides from dietary after the 2011 accident	
Fukushima City	0.2~4
Tokyo	0.1~1
Osaka	0.01~0.1
Natural radionuclides	810 (dietary ⁴⁰ K: 9% ²¹⁰ Po: 35%)
Inorganic arsenic from dietary	31 (rice: 60% hijiki: 28%)
Acrylamide from dietary	140 (potatoes and processed foods: 54%)
Tap water	2.2

Table 2 Cost effectiveness in environmental and other fields.

Cases	Cost per a life year (10000 Yen/year)
Regulation of chlordane (white ant control agent)	4500
Regulation of mercury at sodium hydroxide production	57000
Mercury-free of battery	2200
Regulation of benzene in gasoline	23000
Regulation of dioxin at waste incineration plant	790 (emergency) 15000 (long term)
Control of trihalomethane at waterworks	1200-220000
Regulation of radionuclides in dietary (within 1 year after the accident)	Vegetables, 1100-16000 Beef, 37000-230000 Rice, 30000-100000
Safety control (traffic accident etc)	2700
Medical prevention	330
Medical treatment	97
Willingness to pay	250~2500