Environmental Risk Management

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For UEE

Epidemiology

- Cohort study

	With Prevalence	No Prevalence
With Exposure	*a*	*b*
No Exposure	*c*	*d*

- Odds ratio: *ad*/*bc*

Water quality standards and Air quality standards

- We determine water quality standard, air quality standard, and so on.
- We determine effluent standard, vehicle exhaust gas standard, and so on in order to keep the environmental quality standard with proper assumption of dilution or diffusion.

What kind of concept can be used for determining environmental quality standard.

- Zero risk standards or risk based standard.
- Japanese government had long been announced to the public people that environmental quality standard is based on zero risk concept.

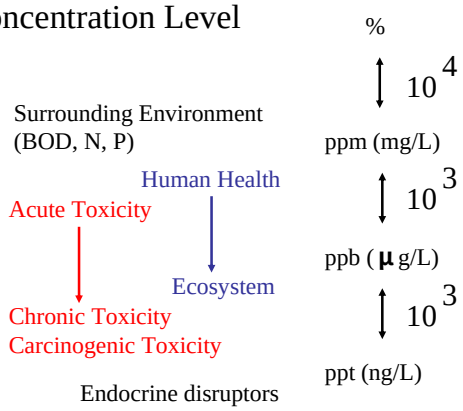
Cancer risk

- Cancer is caused by injury of gene by something (incl. Chemical compounds). If we want to regulate carcinogenic substances, zero risk concept leads to zero concentration in the standard because lower concentration means only lower possibility of becoming cancer.
- No threshold assumption

Progress in analytical procedures

- When the chemical analysis of the pollutants was poor and was low sensitivity, the government can set the environmental quality standards at “not detectable level”.
- However, nowadays, we can analyze very low concentrations such as mg/L (ppm), μg/L (ppb), ng/L (ppt), ….
- Zero risk concept is becoming hard for the government to maintain.

Concentration Level



Zero risk standards to risk based standards

- Zero concentration is a very difficult goal to achieve in the case of certain compounds.
- Zero concentration target means that we cannot use several compounds even if the compounds gives large benefit to us.
- It is necessary to introduce other concept than the zero risk when we consider regulations or standards.

What is Risk ?

- Risk is events
  - which are not favorable
  - which can be expressed by probabilities.

Chemical compounds which pose risks to human

- Dioxins -- Cancer
- Plastic additives -- Endocrine disruption

Lifetime risks

• Hit by thunder	10^{-6}
• Typhoons and Flooding	10^{-5}
• Killed by others	10^{-4}
• Traffic accidents	10^{-2}
• Suicide	10^{-2}
• Environmental risk (Water, Air, Food,…)	
- Exposure to one substance	$10^{-5 \text{ to } -6}$
- All	10^{-4}

Regulated risks and overlooked risks

- Voluntary risks and forced risks
  - 10^{-4} level occupational risks tends to be overlooked, because the target persons have “chosen” the occupation voluntarily.
    Coal miners, Policeman, Divers
    Mountain climbers, …..

Nuclear power plant workers have higher risks than the surrounding people.

The final target of the risk control is quite different

Do you accept your occupational risks ?

- As long as you want to be an engineer, your occupational risk may be higher than your friends in faculty of literature.
- As long as you choose the laboratory works in your study, your risk derived from your research works may be higher than your friends doing computer simulation works.
- Do you accept your risk?

Risks imposed over large population

- Though 10^{-4} level occupational risks are overlooked, 10^{-6} level risks imposed over large population cannot be overlooked in usual cases.

Risk – benefit analysis

- Risk is not controlled based only on the probability such as 10^{-5} or 10^{-6}.
- Please remember that the risk caused by traffic accidents is 10^{-2}. If risk should be controlled by its probability, driving a car should be prohibited.
- Why is it overlooked?

Driving a car provides not only risks but benefits.

Cost – benefit analysis

- Cost – benefit analysis (CBA) has not been applied in the field of policy making because it is too dry and lacks ethics. However, according to a survey in US, if the cost required for saving one person is less than 2 million US$, a suitable action has been taken for reducing the risk. In other words, if the cost for reducing the risk is more than that, it is difficult to take an action.

A brief history of introduction of risk concept in environmental regulations in Japan (1)

- 1992 Drinking water quality standard was revised. In this occasion, Japanese government followed WHO guideline in which 10^{-5} risk concept was considered.
- 1994 The word “Environmental risk” appeared at the first time in the policy paper and it includes both human health risk and ecology risk.

A brief history of introduction of risk concept in environmental regulations in Japan (2)

- 1996-1997 TDI (Tolerable dairy intake) was determined for dioxins.
- 1997 Air quality standard for benzene, which is a carcinogenic compound was determined. 10^{-5}
- 1999 TDI for dioxins was revised.
- 2002 A new concept was introduced for the risk evaluation of DEP (Diesel Emission Particulate matters) in the air quality standard.

Dioxins

TDI(Tolerable Dairy Intale)
In 1996, 10pgTEQ/kg/day (PCDDs + PCDFs)
In 1999, 4pgTEQ/kg/day (PCDDs + PCDFs + Co PCB)

1% of TDI was assigned to water
(50kg person who drink 2 liter/day)

1 pgTEQ/L Environmental quality standard

10 times dilution in environment is expected

10 pgTEQ/L Effluent discharge standard