

## Environmental Risk Management

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For UEE

### 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.

### 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  $10^{-5}$  to  $10^{-6}$
  - 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) is not 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 the carcinogenic compound was determined.
- 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.