RISK REDUCTION STRATEGIES FOR WASTES MANAGEMENT IN JAPAN

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Abstract

There are three types of risk associated with waste or waste management, namely risk to daily living environment, risk to our community environment and risk to the global environment. There are 1893 incinerators for municipal solid waste in Japan. General approach to reduce risks are waste reduction, pollution control, heat recovery and recycling. The five years dioxin study to control type 2 risk was summarized.

Introduction

First of all, three kinds of risk associated with waste or waste management are defined. Type 1 risk is generation of waste itself. Human beings produce and consume a variety of things in order to live. As a result, they also generate large quantities of wastes. Wastes are generated as by-products of our living. If you choose more comfortable and more convenient life, you may generate more wastes. More benefit you prefer, more wastes you will generate. We will face risk type 1 in response to our benefit we obtain by consuming material and consumer products. Let's face that risk 1 is not avoidable as long as we do not give up our comfortable and convenient life which is benefit.

Type 1 risk is considered to be generation of pollution like bad odor, unpleasant gas, or damage to environmental scenery. The type 1 risk is attached to waste itself. This risk may be considered to be risk to daily living environment. Waste has minus value. However majority of citizen are involved for production and trading of positive valued material, another word consumer product.

Now type 2 risk is the risk associated with "waste management". For example, risk of air pollution caused by flue gas from an incinerator, or risk of ground water pollution caused by landfilling of solid waste is considered to be type 2 risk or risk to our community environment. Risk of dioxin in flue gas is considered to be the type 2 risk.

Now people worry about type 3 risk which is risk to the global environment. NOX, SOX and HCl may contribute to the formation of acid rain. Methane gas generated from landfill sites, carbon dioxide and other pollutants generated from incinerators may contribute to the green house effect.

In order to control the type 1 risk, we have to have a waste management system which may includes collection, transportation, incineration and/or landfilling. Now we have to be careful to manage these three risks associated with waste and/or waste management with balanced senses.

Waste Management in Japan

The wastes under the "Waste Disposal Law" are classified into two types,

namely general wastes from living activities and wastes from business activities, or general waste and industrial waste in Japan. In 1987, 310 million tons of industrial waste and 43 million tons of general waste were generated. This classification is important as it is related with disposal responsibility and burden of expense. In the case of general waste, the local authority (city, town and village) is responsible for its plan, construction of disposal facility and its management.

The industrial waste must be disposed of by the waste generating business operator by himself. Concerning the disposal expense, the cost for general waste from living activities is paid by the ordinary account of local authority. This means citizen is responsible for the cost to manage their own waste.

In contrast, the cost for wastes from business activities is usually paid by the waste generating business operator. Here PPP is applied.

The degree of risk to daily living environment is classified into three categories. Accordingly different structure for landfill are required. The most risky waste is called as "hazardous industrial waste" and must be landfilled at the isolated landfill site. The hazardous industrial waste contains heavy metals and other hazardous chemicals which may hurt people's health and those leaching potential from hazardous industrial waste is high. Domestic waste is disposed of by the 2nd category of landfill.

There are 639 continuous combustion type incinerators and 1254 batch type incinerators for municipal solid waste in Japan based on 1987 survey. These incinerators were built from the view point of risk reduction. Incinerators are built with combination of swimming pool, park, museum, sport centers and so on. You could reduce type 2 risk, but citizen never welcome a waste management facility without some other benefit like these wanted facilities.

Risk Reduction Strategies

The General approach to reduce the risk of type 1, 2, and 3 is shown as follows,

Risk Type 1: Waste Reduction. Product Life Cycle Assess ment or Product Assessment is requested for producers for minimization of waste generation. Recycling, reuse and conservation of traditional deposit charge system are promoted.

Risk Type 2: Pollution Control. Waste volume reduction to be disposed of by landfill and source separation for combustible waste, noncombustible, and reusable waste are actually practiced.

Incinerators; Air Pollution control(dust, NOX, SOX, HCL: required; dioxin and heavy metals; under the discussion)

Landfill; Leachate Control, Monitoring of leachate --- regional landfill operation (Phenix plan)

Risk Type 3: Waste Reduction, Recycling and Heat Recovery. Reduction of Type 1 and 2 risk will contribute for reduction of Type3 risk.

So our strategies for proper waste management are the following 4 steps:

Step 1. Minimization of waste generation. Risk communication, campaign for waste minimization to ask---voluntary recycling activities is established.

Step 2. Volume reduction. Incineration and material recovery should be studied and implemented.

Step 3. Reduce Risk 1 as much as possible;

Incineration is the best for reduction of Risk type 1.

Requirement for risk type 2 reduction are different for 1) total continuous incinerator, 2) semi-continuous incinerator and 3) batch type incinerator.

Step 4. Proper management of residues. Sanitary landfill, or controlled type landfill is required for disposal of general waste and incineration residue of general wastes. Monitoring system is of course required.

Results of Five Years Dioxin Study

In 1983, the Japanese report on detection of dioxins in fly ash and bottom ash from municipal solid waste (MSW) incinerators made citizens worry about environmental pollution type 2 risk and made difficult to site waste disposal facilities. The Ministry of Health and Welfare set up the expert committee to manage the risk of dioxin emitted from MSW incinerators in Japan in December 1983. One of the recommendations made by the committee in May 1984, was to start a study on "formation and decomposition of dioxins and related compounds" for proper management of MSW. After then, five years study financed by Japanese Government was conducted during FY 1985-1989.

The objective of this research project is to study the effects of operating conditions of incinerators on generation of dioxins and related compounds and to develop the control techniques for dioxins.

Extended investigations were conducted for two stoker-type incinerators and two fluidized bed incinerators for MSW.

The followings are some of the findings.

A. Formation of Dioxins
(1) PCDDs concentration tends to increase in later parts of incinerators.
(2) Dioxin in flue gas tends to increase as carbon monoxide increase in flue gas. Dioxin is formed from insufficient combustion gas and carbon dioxide which is considered to be an index of insufficient combustion is one of the important parameters.
(3) There is positive relation between the concentration of dioxin and temperature of flue gas surrounding ESP which remove dust in flue gas. As many researchers pointed out, 300 centigrade may be the best temperature for the formation of Dioxin.
(4) We could not find any clear relationship among the content of plastics in wastes and concentration of Dioxins.
(5) The ratio of homologue chlorinated at the positions of at least 2,3,7,8th of dioxin molecule to the homologue is very close to the ratio calculated theoretically.

B. Control of Dioxins
The best way to control dioxin is to achieve the complete combustion. So the following two conditions are preferable in order to minimize the dioxin emission.

(1) Higher temperature combustion.
(2) Better mixture of unburned gas and air.

By achieving these conditions, carbon monoxide in flue gas will be decreased. Control of oxygen concentration at a low level, can maintain the concentrations of carbon monoxide and carbon hydroxide at a low level which may be good for control of NOX and achieving high energy recovery .

C. Control of Dioxins with Flue Gas Cleaning System.
In order to control Dioxins in flue gas with gas cleaning system, we have to

maintain lower temperature which is not good for formation of Dioxins. The system should get high removal efficiency not only for Dioxins but also NOX and heavy metals.
These may be achieved by
(1) lower temperature of flue gas surrounding the ESP.
(2) applying fabric bag filter, or
(3) applying wet scrubbing system

An investigation was conducted to see the effect of bag filter and ESP for the stoker-type incinerator equipped with bag filter and ESP. The higher removal efficiency on dioxins was observed for bag filter than ESP.

D. Disposal of Residue of Incineration.
Most of fly ash and bottom ash containing dioxins and related compounds are disposed of by control-type landfill in Japan. The investigation was conducted to find the most suitable leaching test for fly ash. PCDDs and PCDFs were not detected in leachate from fly ash generated from MSW incinerators using Japanese Environment Agency Leaching Test Procedure. The detection level was 0.4 ng/l.

After cross checking study for gas sampling and chemical analysis conducted by the four institutes, the most suitable measurement method of PCDDs and PCDFs concerning MSW incineration has been proposed as a standard method.

Concluding Remarks

Generally speaking, extremely small risk is reported sensational. Because well-known risk like traffic accidents is not worthwhile to report.

Risk caused by dioxins is not clearly assessed quantitatively. Detection of dioxins is not equal to be a problem. We have to answer to the questions "How bad it is? Is the risk reduction worthwhile to apply ? In order to answer those questions, we have to know the cost of alternative risk reduction methods and real meaning of risks. The smaller risk is better for us? It may be true if extra cost is not required for risk reduction.

We can not answer to many questions regarding dioxin issues. Therefore we have to continue to conduct research on wastes management and dioxins to gain information so that we could conduct quantitative risk assessment on dioxins and choose the best waste management system based on scientific analysis. We have to manage properly risk type 1 that is waste itself with considerations of benefits we enjoy by consuming materials, risks caused by waste management, that is type 2 risk and cost for waste management.