

JAPANESE SOURCE INVENTORY, FOCUSING ON THE EMISSION REDUCTION MEASURES IN THE MANUFACTURING INDUSTRIES SECTOR

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Introduction

The authors would focus on the importance of clarifying the source inventory in the manufacturing industries sector, or the economical activities related area other than the waste incineration, as the further step than the reduction of emission of PCDD/Fs from the waste incineration sector. The process between the investigation (forming the inventory) and the application of reduction measure taken in Japan is to be introduced and then the effective manner of this process is to be examined.

In the manufacturing industries sector, the choice of measures reducing dioxins to be taken substantially depends on the area of the industries and on the nature of the operating process. Sometimes, even manufacturing process itself as well as up or down stream of the sector or related areas get substantial impacts by the reduction measures. So, the reduction strategies of dioxins need to be built up in consideration of the whole industrial activities. By introducing the policies taken in Japan, the authors would hope that the activities in this area would be more encouraged.

Material and Methods

19 industries, see Fig.1. (*), have been chosen to be investigated.¹⁾²⁾ These areas have been picked up by the conditions; (1) to contain processes which are regarded to have higher probability to generate dioxins (temperature range 300—800 deg.C, and the processes easily be exposed to the source of chlorine supply), or (2) to have been indicated area as to have higher potential to generate dioxins by the former investigation or research.

Since the data collection process was required to be carried out rapidly and widely covering the industry area under the limitation of time and other resources, primary data gathering work have been carried out under voluntary support by the industries which belong to the 19-industry areas. 4 industry areas (Electric Furnace Steel Manufacturing, Iron and Steel Sintering Process, Zinc Recovery, Aluminum Alloy Manufacturing), which showed relatively high density or amount of emission, have been cross checked by the Ministry of International Trade and Industry. Trough the procedure above, the number of data gathered amounted as much as 357 in the 19 industry areas.

Thus the total amount of 19 industries can be regarded to cover most of the manufacturing industries sector by

the current scientific knowledge.

Data gathered above have been processed and have been investigated, not only by the 'average' or 'data range', but also 'number of data gathered' and 'standard deviation'. Further, the emission of dioxins rates per goods produced in the manufacturing process, have been calculated and was used to extended-estimation for total amount of emission in the concerned industry sector in the cases when the data gathered didn't fully cover all plants.

The process above has been carried out with the advisement given by 'the Dioxin Examination Committee', that is consisted of the researchers and the experts in dioxin or the manufacturing industries' field. The data above have been released to the public for reference.

Results and Discussion

Through the process above, the inventory of emission of PCDD/Fs in Japan in 1998 have been obtained as Fig.1. According to the table, the amount of emission from the manufacturing industries is 381.8g—TEQ/yr or 7.1—7.3% of the total. Taking the result into account, the Electric Furnace Steel Manufacturing Industry has been arranged to be under control by the Air Pollution Control Act. Then, 3 industries, the Iron and Steel Sintering Process, Zinc Recovery and Aluminum Alloy Manufacturing, which are relatively high in the density or the amount of emission, made the voluntary reduction guidelines of dioxins. The guidelines, reflecting respective industries' technological situation, include the emission densities to be achieved, portion to be reduced in the amount by the target years. According to the plans made by those industries, total amount of emission out of the manufacturing industries (19 industries) is expected to be reduced by 30% by the year 2002.

The investigation on the 19 industries has been carried out not in a parallel manner but in a priority basis. The Electric Furnace Steel Manufacturing Industry and the Paper/Pulp Industry have been picked up for the first, since those industries were or had been assumed to have higher potentials as sources of dioxins. The result of the evaluation of the two was followed by the policy to chose former to be under control by the law. Then the examination stepped forward to the rest, or the 17 industries, lead the 3 industries to make respective voluntary reduction guidelines. This stepwise approach can be regarded as contributive to the smooth and quick grasp of what's happening and of introduction of the reduction measures under the limitation of time and resources.

After the detailed inventory of the manufacturing industry is made, then, it is expected to contribute to form the policy plans in both the public industrial and environmental policy planning sector and private industry firms. From the results obtained by the step above, the international status of the emission of dioxins from manufacturing industries can be estimated as Fig.2. for example. Since the amount of emission of dioxins out of manufacturing industries sector reflects the activities of the manufacturing industries in the country, the emission amount versus GDP (see (A) on the table) may give one with general view on the status of each country's industrial sector. Then the index might have chance to be taken into account in considering the policy for reduction of dioxins from manufacturing industries area. More precise analysis would also be possible if more detailed data in each industry shared internationally.

In anyway, availability of the precise and detailed emission profile is prerequisite for effective deployment of reduction measures in emission of PCDD/Fs. The techniques to deal with the emission from the waste incineration sector have relatively been well clarified and have been well introduced since there rather common

reduction methods apply as well as the sector often be put higher priority in reduction effort since it has larger potential as the source. So, the detailed grasp in larger coverage of area of the emission data in the

Fig.1. The Inventory of Emission of PCDD/Fs in Japan (1998)

Source of Production		g TEQ/yr*****	(% of total)	N*****
Municipal Waste Incineration	**	4,300	(79.8-2.3)	
Hazardous Waste Incineration	***	460	(8.5-8.8)	
Medical Waste Incineration	***	80-240	(1.5-4.5)	
Sewage Sludge Incineration	***	5	(0.1)	
Wood-Combustion Plants	***	0.2	(0.0)	
Automobile Exhaust Gas	***	0.07	(0.0)	
Agricultural Production	****	0.06	(0.0)	
Electric Furnace Steel Manufacturing		187	(3.5-3.6)	70
Kraft Black Liquor Boilers	*	1.7	(0.0)	6
Paper/Pulp Sludge Boilers	*	2.8	(0.1)	5
Paper/Pulp, to water or sludge	*	0.4	(0.0)	40
Vinyl Chloride Manufacturing	*	0.62	(0.0)	19
Vinyl Chloride Mfg., to water or solid		0.374	(0.0)	21
Cement Manufacturing	*	1.86	(0.0)	44
Iron and Steel Sintering Process	*	118.8	(2.2-2.3)	18
Cast and Forged Iron Manufacturing		1.4	(0.0)	9
Copper Primary Smelting	*	4.0	(0.1)	9
Lead Primary Smelting	*	0.05	(0.0)	2
Zinc Primary Smelting	*	0.3	(0.0)	8
Copper Recovery	*	0.05	(0.0)	1
Lead Recovery	*	1.0	(0.0)	3
Zinc Recovery	*	34.0	(0.6-0.7)	11
Precious Metals Recovery	*	0.02	(0.0)	3
Elongated Copper Manufacturing	*	5.316	(0.1)	10
Aluminum Alloy Manufacturing	*	15.7	(0.3)	21
Aluminum Rolling	*	1.65	(0.0)	19
Aluminum Rolling, to air	*	0.3	(0.0)	5
Electric Wires/Cables Manufacturing	*	1.89	(0.0)	6
Aluminum Cast /Die Cast	*	0.21	(0.0)	5
Utility by Coal, Oil or LNG	*	2.4	(0.0)	14
Utility, to water	*	0.0	(0.0)	8
TOTAL		5,227-5,387	(100.0)	357

(Notes)* 19 manufacturing industries (Paper/Pulp, Vinyl Chloride, Al Rolling, Utility industries have more than one sources in the table), by Ministry of International Trade and Industry, Japan^{1,2)}

** by Ministry of Health and Welfare, Japan (MHW issued revised data in April '99; Municipal Waste I.=1320g-TEQ/yr, Industrial Waste I.=960 g-TEQ/yr, Small Incinerators for the industry use under legal control 15 g-TEQ/yr)

*** by Professor Masakatsu Hiraoka, **** : by Environmental Agency, Japan

***** The numbers on the table principally show the amounts of PCDD/Fs emitted to the air, unless anything is written.

***** number of data gathered

manufacturing industries sector remains to be more stimulated. Authors would hope Japan's experiment would be of reference in encouraging international share of data, and of information on technological or political reduction measures.

Fig.2. Emission of PCDD/Fs to the air per GDP/Population/Surface Area, from manufacturing industries sector

Country	(year)	Emission* g-TEQ/yr	Emission per GDP** (A)	Emission per Popltn.***(B) (for reference)
Luxembourg	(94) ³⁾	29.2	2637.8	72.82
Belgium	(95) ³⁾	229.8	1047.4	22.80
Norway	(95) ³⁾	42.1	384.1	9.73
France	(95) ³⁾	457.5	322.0	7.92
E-13 ****		1350.8-1468.8	244.1-265.4	4.49-4.88
Spain	(90) ³⁾	85.5	177.1	2.18
Finland	(88-92) ³⁾	16.2	167.3	3.18
Germany	(90-96) ³⁾	336.5	164.4	4.13
Netherlands	(91-93) ³⁾	37.0	111.6	2.41
United States	(95) ⁴⁾	692	104.1	2.65
Sweden	(94) ³⁾	17.9	91.0	2.04
Japan	(98) ²⁾	381	83.0	3.05
UK	(97) ⁵⁾	65-183	63.8-179.6	1.12-3.15
Denmark	(95) ³⁾	9.0	61.6	1.73
Austria	(95) ³⁾	11.8	60.1	1.47
(Japan2002)*****		267	58.2	2.14
Switzerland	(95) ³⁾	13.3	51.7	1.90
Average***** *		161.6-169.5	136.4-143.0	3.53-3.70

(Notes)* emission to the air, ** GDP (in trillion US dollars, 1994), *** Population (in million, 1994)

**** average of 13 European countries,

***** estimated by the targets from the voluntary reduction guidelines of dioxins by 4 industries

***** weighted average in 15 countries

Acknowledgment

The argument in this paper does not represent the Ministry of International Trade and Industry's official view but the authors' own opinions.

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