

Sources and Emissions of PCDD/PCDFs in China

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Introduction

Chinese government ratified the Stockholm Convention on Persistent Organic Pollutants (POPs) on Jun 25, 2004. As a party of the Convention, China is just preparing its national implementation plan (NIP) that should be finished and submitted to COP before Nov, 2006.

It is shown in Fig.1 that there are mainly 4 parts for the NIP development: inventory and strategy of Pesticide, POPs Stockpiles, PCBs and Unintentionally Produced POPs. The last one is the most difficult and complex part because it covers a lot of industries around the whole country^[1].

This paper analyzed and calculated the major sources of PCDD/PCDFs release in China, which can give a draft view about the dioxin production and emission situation in China.

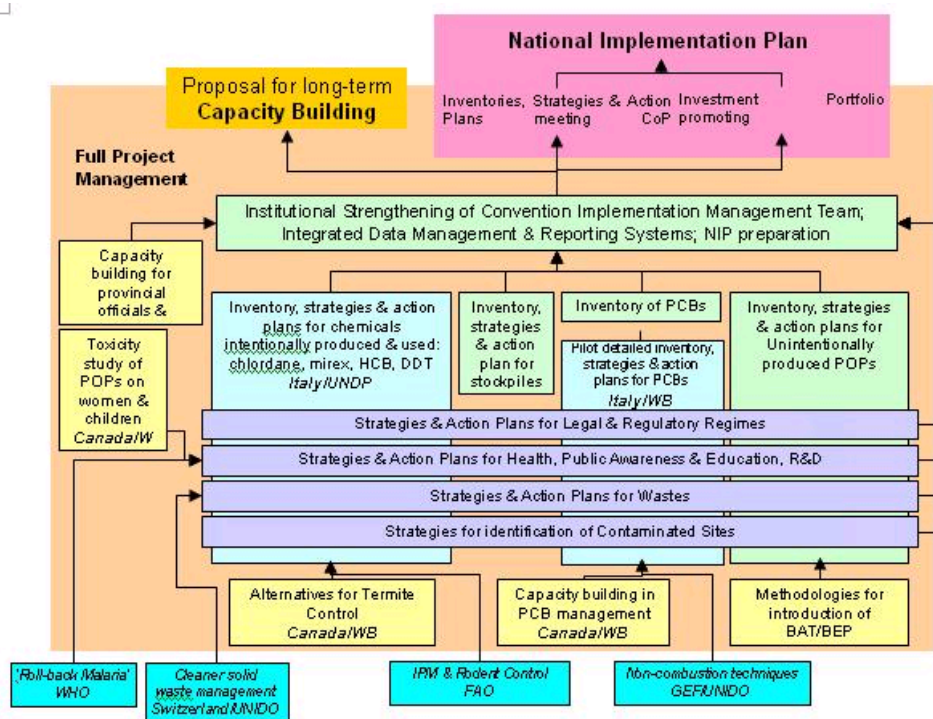


Fig.1 The objective and structure of the NIP project in China

Main Sources of PCDD/PCDFs and Emission levels in China

Incineration

Landfill was the leading MSW disposal method in China. But in recent years, the trend of building incineration plants was increasing in many big and developed cities. To July 2002, the capacity of constructed incineration plants in

China was 13,155 tons wastes per day. An investigation of 40 MSW incineration plants has shown half data exceed national standard for dioxins emission limitation (1.0ng-TEQ/Nm^3) [2].

In “National plan for hazardous wastes and medical wastes disposal facilities construction”, to 2006, Chinese government will invest 15 billion RMB to construct 31 hazardous wastes central disposal plants and 300 medical wastes central treatment plants [3]. Fig. 2 shows the potential MSW incineration ratio and capacity in 8 provinces from 2005 to 2020, respectively.

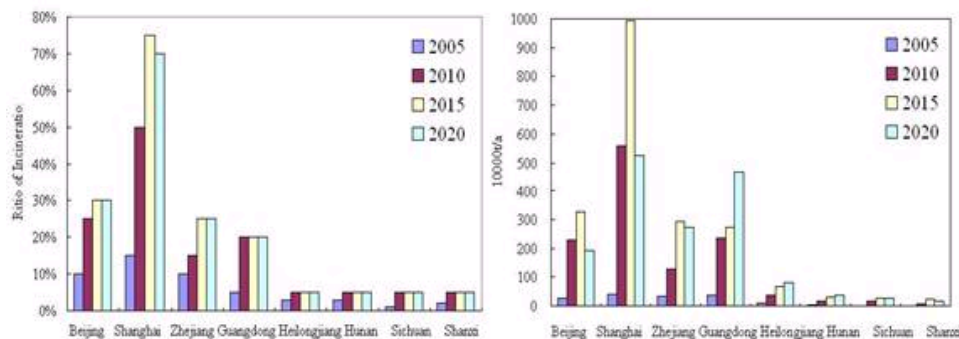


Fig. 2 Ration and Amount of Incineration for MSW of the 8 provinces of China in 2005-2020

On the assumption that all stack gas emitted at the standard value the PCDD/Fs emissions from 2005 to 2020 was calculated and listed in table 1 [4].

Table 1 PCDD/Fs Emission by Flue Gas in MSW Incineration in 2005-2020

Year	2005	2010	2015	2020
g-TEQ/a	19.44~27.78	60.83~86.90	126.58~180.89	100.30~143.33

As for hazardous wastes and medical wastes, incineration technology will have high priority in the plan to treat flammable hazardous and medical wastes. China produced about 65×10^4 t medical wastes in 2002. If the mean lower heating value (LHV) was 3000 kcal/kg, waste combustion could generate flue gas $7500 \text{ Nm}^3/\text{t-waste}$. On the assumption that all the medical wastes were burnt and the emission concentration was 0.5ng-TEQ/m^3 , the total PCDD/PCDFs amount in medical wastes exit gas was 2.44g-TEQ/a .

Production of pulp using elemental chlorine

Bleaching is a necessary process during the paper making, in which chloride bleaching agents will be adopted. As a byproduct with the bleaching agent, it will come into the waste water, even in the paper. Prof. Zheng Minghui had investigated 5 paper making plants in the north of China, which use straw and reed as raw materials. The results showed that the PCDD/PCDFs concentration was 34-44 pgTEQ/g pulp [5,6]. About 20g TEQ PCDD/PCDFs would be emitted to the water system with the waste water every year in China.

Chlorine Alkali industry

China has big chlorine-alkali industry, which has 300 of the 500 chlorine alkali companies all over the world. The PCBs, PCDD/PCDFs, and HCB will be produced during the production process and as the impurities in the final products. An investigation regarding the impact of PCDD/PCDFs in contaminated sediments and soil in the Ya-Er Lake area showed that total concentrations of PCDDs $70\text{-}1.6 \times 10^5 \text{ ng/kg}$ dry weight, and PCDFs $1.8\text{-}1.8 \times 10^4 \text{ ng/kg}$ dry weight [7].

In 1990's, China produced about 5000 tons of pentachlorophenol(PCP) annually for application in the prevention of blood fluke and as wood preservative for making railway sleepers. The results indicated that some of the lake in

south of China were heavily polluted by these chlorinated compounds. One sample showed that the dioxin in the electrolysis salt slurry was as high as 378.85µg/kg (21.65µg/kg TEQ). The emission of dioxin reached 5.41kg TEQ in 1990's^[8], which took a very important part of the total emission.

Ferrous and non-ferrous metals production

China has the biggest Ferrous and non-ferrous metals production industry. According to the production of sintering, coke and steel of China in 2002^[9] potential PCDD/PCDFs emissions are listed in table 2.

Table 2. Potential PCDD/PCDFs release from sintering, coke and steel in China

Subcategories	Production (10 ⁴ t/a)	Annual release(g TEQ/a)			
		Air	Water	Residues	Subtotal
Iron ore sintering	21755.26	65.27~4351.05	-	0.65	65.92~4351.70
Coke production	10072.74	30.22~302.18	6.04	-	36.26~308.23
Metal production and foundries	19734.98	5.92~1973.50	-	39.47~2960.25	45.39~4933.75
Total					147.57~9593.68

It can be found in table 2 that production of ferrous and non-ferrous metals will be a very big dioxin emission source in China. Furthermore, the scale and capacity of ferrous and non-ferrous metals production industry increase largely these years.

Discussions and Conclusions

From the above analysis and calculation, it can be found that the main sources and releases of PCDD/PCDFs are very different from other countries. Waste incinerators (19.44~27.78g-TEQ), production of pulp using elemental chlorine (20g-TEQ), chlorine alkali (5.41kg-TEQ in 1990's) and, non-ferrous and ferrous metals (>147.57g-TEQ) are all-important sources of PCDD/PCDFs.

In the near future, the PCDD/PCDFs releases from waste incinerators and non-ferrous and ferrous metals will increase since the incineration ratio and metal production will increase largely in the near future. And the release from production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching and chlorine alkali will reduce if suitable alternative raw materials and more advanced technology can be adopted.

It must be pointed out that the above estimation and calculation about PCDD/PCDFs were based on few research data. To realize the present situation of PCDD/PCDFs in China and take effective measures to control dioxin pollution, more reliable data investigation project must be fulfilled and in the same time more effective monitoring system should be established. We are trying an environmental modeling study based on the above surveyed information, a part of which will be opened in Toronto.

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