PROGRESS IN ENVIRONMENTALLY SOUND MANAGEMENT AND DISPOSAL OF PESTICIDE POPS WASTES IN CHINA

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Abstract: China, the largest developing country in the world, had widely used pesticides containing persistent organic pollutants for the pesticides and disease prevention and control in the fields of agriculture, sanitary and epidemic control, termite prevention and antifouling. Such POPs pesticides include DDT, HCB, toxaphene, chlordane and mirex. Pesticide POPs wastes are mainly original production process wastes, pesticide stockpiles and contaminated matters. In China, pesticide POPs wastes are mainly distributed in original manufacture plants and original sales, use and distribution areas; pesticide POPs wastes are mainly concentrated in the area of agricultural area, with the DDT wastes in largest percentage. As Chinese life-cycle management system of hazardous wastes is gradually improved, corresponding environmental management and disposal requirements are established for pesticide POPs wastes. Nowadays, Chinese government is actively disposing of pesticide POPs wastes left over historically, including environmentally sound disposal of nearly 3000t pesticide POPs wastes via cement kilns co-processing, which provides experiences and references for the management and disposal of pesticide POPs wastes in various developing countries.

Keywords: POPs pesticide wastes; status quo; environmentally sound; co-composition in cement kiln;

1. Information of Pesticide POPs Wastes in China

In the past, China produced and used pesticide POPs in large scale. By 2004, the total accumulative output of pesticide POPs had reached about 574,000t [1], mainly including DDT, HCB, chlordane, mirex, toxaphene and heptachlor, and excluding 3 POPs pesticides, i.e., aldrin, dieldrin and endrin, which have never been used in China. On May 17, 2009, the Ministry of Environmental Protection of the People's Republic of China, together with other nine ministries and commissions, had issued Announcement No. 23/2009, banning the production, distribution, use, import and export of DDT, chlordane, mirex and HCB in China (unless DDT is used for acceptable purposes), fulfilling the commitment to Convention implementation of banning the use of POPs pesticides to the world.

Table 1 Output of POPs Pesticides in China [1]

Type	Condition	Accumulative output (t)	Use field
DDT	Out of production in 2009	About 464,000	Agriculture, health, marine antifouling paints
HCB	Out of production in 2004	>79,278	Raw material of sodium pentachlorophenate (Na-PCP)
Toxaphene	Out of production in 1980s	20,660	Agriculture (mainly for grain and cotton production)
Chlordane	Out of production in 2004	>9,000	Termite prevention
Mirex	Out of production in 2004s	160	Termite control
Heptachlor	Out of production in 1980s	<100	Railway crossties

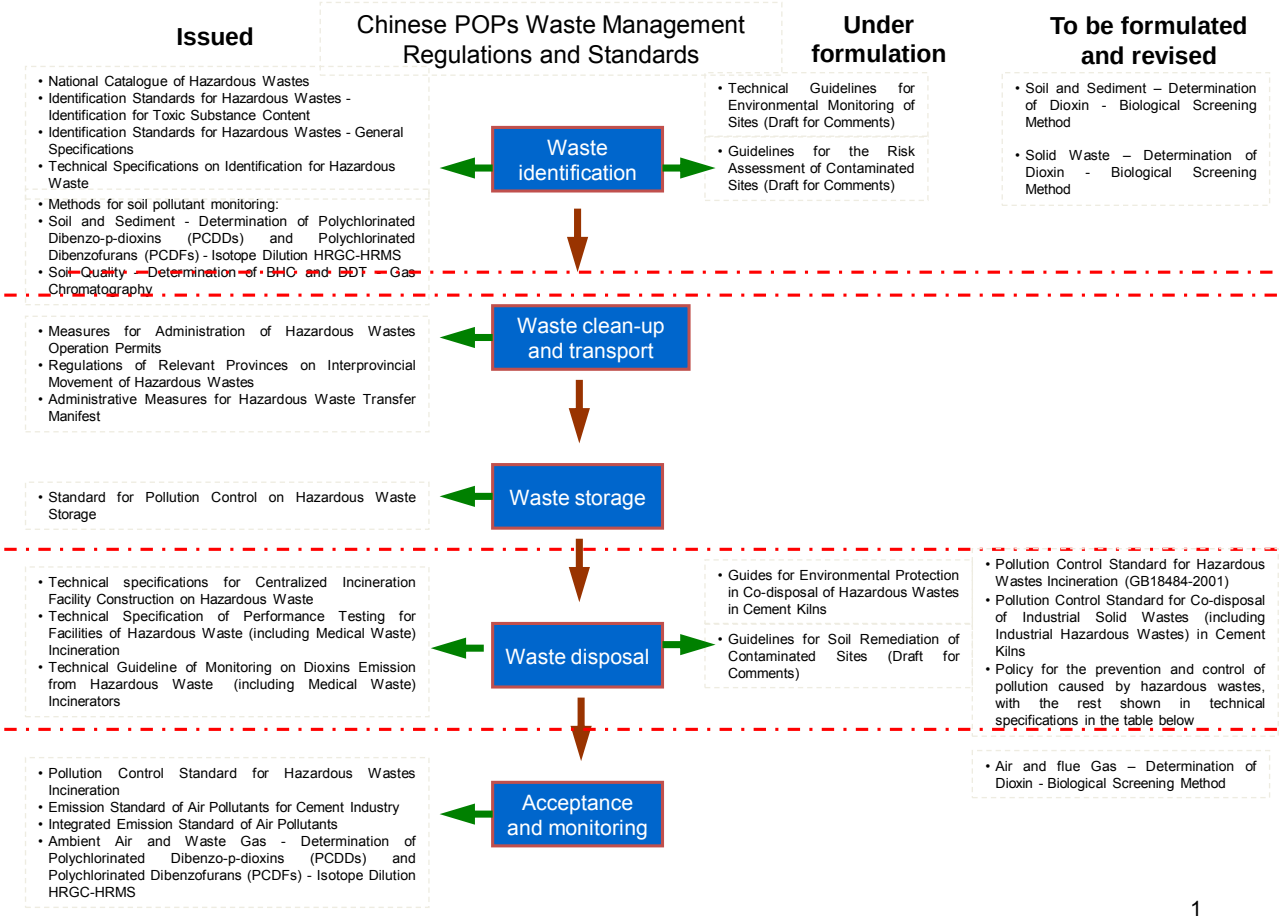
Now, pesticide POPs wastes in China mainly include POPs pesticide stockpiles not used after May 17, 2009, and

intermediate wastes generated during production of POPs pesticides and wastes contaminated by POPs pesticides. They mainly exist in the obsolete stockpiles in the fields of original production, distribution and use and relevant contaminated wastes. In the field of production, the pesticide POPs wastes are mainly the sludge, residues, and intermediate by-products generated during production, in addition to some contaminated residual equipment and construction waste. In China, totally more than 50 enterprises had been produced pesticide POPs, and they are mainly distributed in 18 provinces, cities and autonomous regions, including Tianjin, Jiangsu, Zhejiang and Hebei. In the field of distribution, the pesticide POPs wastes feature as follows: (1) they are mainly concentrated in agricultural sectors and mainly come from agricultural materials companies, pesticide and fertilizer store, plant protection intitutes, as well as pesticide sales points etc., with little wastes in the industries of termite prevention and control, garden, forestry and health; (2) DDT wastes are the largest in the quantity, followed by POPs mixture. According to the investigation during the development of National Implementation Plan for Stockholm Convention and on POPs pollution over China, it is expected that the total quantity of pesticide POPs wastes all over China is about 4,000-6,000t.

2. Environmental Management Concerning Pesticide POPs Wastes in China

Pesticide POPs wastes are hazardous wastes, of which, the environmentally sound management and disposal system initially established in China has involved the identification, reporting, and import and export management, packaging, transportation, storage, treatment and disposal and any other aspects, forming an environmentally sound management system of pesticide POPs wastes [2~4].

Fig.1Chinese POPs Waste Management Regulations and Standards



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(1) In 2007, the Identification Standard for Hazardous Wastes - Identification for leaching Toxicity (GB 5080.3) listed the test methods for DDT, HCH, chlordane, HCB, toxaphene and mirex. The Identification Standards for Hazardous Wastes - Identification for Toxic Substance Content (GB 5085.6) specifies that pesticide POPs shall be disposed of as hazardous wastes in case the toxic substance content is equal to or larger than 50 mg/kg. (2) In 2008, the National Catalogue of Hazardous Wastes included the pesticide POPs, PCB wastes and dioxin wastes. (3) POPs wastes are hazardous wastes. According to the provisions in Article 53 of the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste, the generators producing hazardous wastes are obligated to develop the hazardous wastes management plan in accordance with relevant regulations of the State, and report the type, output, flow, storage, disposal and other relevant information of hazardous wastes to administrative departments in charge of environmental protection under local people's governments above the county level. The declaration and registration system for POPs wastes has been established. (4) The Technology Policy for the Prevention and Control of Pollution Caused by Hazardous Wastes has expressly specified that POPs wastes should not be recovered, recycled, reclaimed or directly reused. The Standard for Pollution Control for Hazardous Waste Incineration and the Standard for Pollution Control on Hazardous Waste Storage is being revised by the Ministry of Environmental Protection of the People's Republic of China, in which the incineration and disposal requirements for pesticide POPs wastes are the same as those for common hazardous wastes before revision, that is, the temperature of the incinerator is equal to or greater than 1100℃, the destruction and removal efficiency is equal to or greater than 99.99% and dioxin concentration in flue gas is less than 0.5 ng-TEQ/Nm^3. The Guides for Co-disposal of Hazardous Wastes in Cement Kilns (for comments) has been drafted in China and puts forward specific disposal and environmental protection requirements for POPs wastes[5,6].

3. Disposal of Pesticide POPs Wastes in China

In 2009, the Chinese government applied for the "Project for Environmentally Sound Management and Disposal of Pesticide POPs Wastes and Other POPs Wastes in China funded by Global Environment Facility", which aims to promote the perfection of management system on pesticide POPs wastes in China, carry out environmentally sound disposal of pesticide POPs wastes, and completely eliminate the environmental risk of pesticide POPs wastes remaining in China. Under the support of the Project, a series of disposal activities were carried out from place to place through the co-processing in new dry-process and rotary cement precalciner kiln, including the disposal of 160t DDT pesticide wastes in Jiangsu Province in 2009 and the disposal of totally about 13t disused DDT stockpile in partial health and anti-epidemic agencies in Hunan Province and Sichuan Province, etc. In 2011, 2,228t pesticide POPs wastes were disposed in Hubei Province, and 637t in Hebei Province. Now, the environmentally sound disposal of nearly 3,000t pesticide POPs wastes has been completed in China.

The detection results of POPs in conventional pollutants and raw meal, clinker and flue gas during disposal show that the emission concentration of dust, NOx, SO_2, HF, HCl, TOC, heavy metal, dioxin/furan and other air pollutants during co-disposal of DDT pesticide meets the emission standards of the wastes incinerated in cement kiln in our existing Emission Standard of Air Pollutants for Cement Industry (GB4915-2004) [7,8], Standard for Pollution Control for Hazardous Waste Incineration (GB 18484-2001) and Directive of EU on Incineration of Wastes (2000/76/EC), with the DRE more than 99.9999%, and the average emission concentration of dioxin at 0.01ng-TEQ/Nm^3. This shows that the co-processing of pesticide POPs wastes causes no adverse effect on flue gas emission under the condition of appropriate feeding rate of pesticide POPs wastes. Meanwhile, the coal consumption, power consumption, clinker output record data, clinker quality analysis data and other data during conventional cement production and co-processing of pesticide POPs wastes indicate that it causes no adverse effect on the production process of clinker, clinker output and clinker quality under a proper feeding rate.

The detection has shown that the DDT concentration in clinker during co-disposal of DDT waste pesticide is lower than the instrument detection limit, and there is minute amount of DDT (49-73ng/m^3) in the released flue gas, with DRE changing within the range of 99.9999984% - 99.9999996%. This indicates that DDT has been effectively decomposed in the cement kiln.

Currently, the hazardous wastes are still disposed of by high-temperature incineration and safe landfill in China, and the co-disposal in cement kiln are carried out for POPs wastes containing pesticide on a large scale, but on

the whole, the treatment and disposal technology is relatively simple and reliable in economic and technical respect. The secondary emission of dioxin exists in the incineration technology, while the landfill technology does not really achieve the destruction of POPs, and large quantity of land resources are occupied, furthermore, there are potential environmental risks.

4. Main Problems in Newly-added POPs Wastes in China

In May 2009, the 4th Conference of the Parties of the Convention was held, formally listing the α-HCH, β-HCH, chlordecone and silvanol into the Convention to be controlled. In April 2011, the 5th Conference of the Parties of the Convention was held, formally listing the endosulfen into the Convention to be controlled. The newly-listed pesticide POPs pollution has become one of the important environmental issues, so the related research and inventory investigation are in urgent need.

(1)There are about 4,000-6,000t pesticide POPs wastes in China, in addition to some contaminated residual equipment and construction waste. The pesticide POPs wastes in the distribution field are mainly concentrated in the agricultural sectors, with the DDT wastes most abundant.(2)In the environmentally sound management system of hazardous wastes, China has initially established and perfected the management requirements for pesticide POPs wastes.(3) Through the support of Project for Environmentally Sound Management and Disposal of Pesticide POPs Wastes and Other POPs Wastes in China supported by Global Environment Facility, the research on co-processing of pesticide POPs wastes in rotary cement kiln shows that it is a cost-effective and environmentally sound disposal method under the condition of controlling the feeding rate of pesticide POPs wastes. By utilizing this disposal method, China has completed the disposal of nearly 3,000t pesticide POPs wastes.(4)China shall carry out the related research and inventory investigation urgently for the Convention implementation of newly-added pesticide POPs.

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