# INVENTORY METHODOLOGY AND OCCURRENCE OF PCBS WASTES IN ZHEJIANG PROVINCE OF CHINA

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## Introduction

The Stockholm Convention on Persistent Organic Pollutants (POPs) listed PCBs as the first 12 particular toxic POPs for reduction and eventual elimination[1]. The convention requires that each party make determined effort to identify stockpiles and products and articles containing PCBs, which, once identified, need to be managed in a safe, efficient and environmentally sound manner[2]. Not only is it the direct requirement of the convention that PCB inventory be carried out by each party, but also the prerequisite for further activities because inventory would serve as the major source of baseline information of the status quo of PCB in one country, based on which further PCB management could be conducted.

In the last 20 years, national PCB inventory was carried out in many countries[3-5]. China has also initiated its identification of PCB problem as one of the activities for implementing the Stockholm Convention as well as an important approach to acquire baseline information for PCB management. With the experience in PCB inventory from several countries and the characteristics of China's PCB problem, this study develops a method to conduct the PCB inventory investigation in China. And this methodology was adopted as a guideline in the PCB investigation activity in Zhejiang province. With the successful practice of inventory investigation in Zhejiang province, the inventory methodology will be revised and applied for the rest of the country.

## Materials and Methods

(1) Establishment of the PCB inventory methodology in China

The PCB inventory methodology in China was drafted based on UNEP's guideline on the identification of PCB[6, 7]. International experience in PCB inventory[3-5] and the status quo as well as history of PCB management in China[8] are also used for reference. The draft guideline was revised several times after the reviews by some national and international experts.

(2) PCB inventory investigation in Zhejiang province

Zhejiang province lies in the east part of China. It covers an area of more than 100,000 $km^2$ and has a population of 46,670,000. The inventory process in Zhejiang province includes following activities in 3 stages. (a) Preparatory stage: An inception workshop attended by officials and technicians from environmental protection and electric power sectors of Zhejiang province was held in Jan 2004. An administrative order to conduct the provincial inventory was issued in April 2004 and the investigation team was established in the mean while. A train workshop for the investigation team was held in early May 2004. (b) Implementation stage: Background information had been collected in late May 2004 and then potential units with PCB containing capacitors were identified. Questionnaires were subsequently delivered to these sites for detailed information and were then collected in late June. Afterward from July till the end of year 2004 followed a three round site investigation. During the investigation, potential sites were visited and sampling and analysis was carried out. (c) Summing-up stage: Based on the information from questionnaire and site investigation, a preliminary inventory result has been achieved in the province.

## Results and Discussion

(1) PCB inventory methodology in China

According to the inventory guideline presented by UNEP and inventory experience of Canada, Ukraine and Morocco, several inventory approaches were used for PCB inventory, including questionnaire, site investigation, voluntary report from PCB owners and the public[3-5]. For the PCB inventory in China, questionnaire will be selected as the major approaches. It is found in previous inventory that many storage sites of PCB containing capacitors have been contaminated. Therefore PCB contaminated wastes (mainly soil) with a PCB concentration of above 50 ppm, the control level stipulated by "PCBs Containing Wastes Pollution Control Standard" [9], will also be targeted by the inventory. And information on these wastes will be acquired by site investigation, sampling and analysis.

The inventory process is divided into three stages, namely, the preparatory stage, the implementation stage and the summary stage, as explicated in details by figure 1.

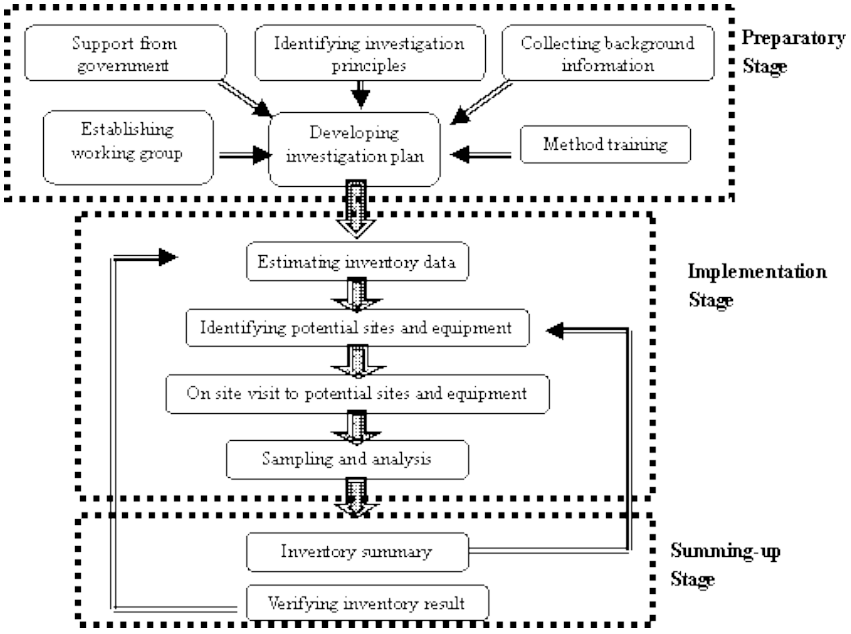


Figure 1 Flow chart of the major activities in PCB inventory methodology in China

(2) Estimation of PCB capacitors in Zhejiang province

In history, the Zhejiang province experienced pollution accidents with PCBs containing capacitors and therefore much attention has been paid to PCB pollution ever since. According to the background investigation, a total transforming capacity of 5.12 KVa was identified for year 1965 to 1980, when PCBs capacitors are extensively used. Correspondingly an amount of 20,500 PCB containing capacitors was estimated for the province with the estimation approach. In addition, it is recorded that about 2,000 PCB containing capacitors were transported from other provinces to Zhejiang, adding to a total of 22,500 PCB containing capacitors.

(3) Preliminary inventory of PCB wastes in Zhejiang province

After one year's effort, following result has been achieved during the inventory of PCB containing capacitors in Zhejiang province. (a) Most PCB containing capacitors have retired from service and are now in storage or have been sealed up for keeping. Correspondingly, most of the units identified in the investigation have already had their capacitors stored, sealed in caves or buried underground. (b) A total of 42 PCB storage sites have been identified by now and information on the location, capacitor number, as well as detailed description of most sites is now available. Figure 2 presents a brief summarization of these results. One of these contains about 1,000 capacitors and most of others contain an average of 200 to 300 capacitors. It is estimated that some 20 storage sites have not been identified yet. (c) According to data acquired by site investigation, sampling and analysis of several sites, it could be estimated that Zhejiang would have about 2,000 tons of highly contaminated waste (with a PCB content over 500 ppm) and 20,000 tons of slightly contaminated waste (with a PCB content between 50 and 499 ppm).

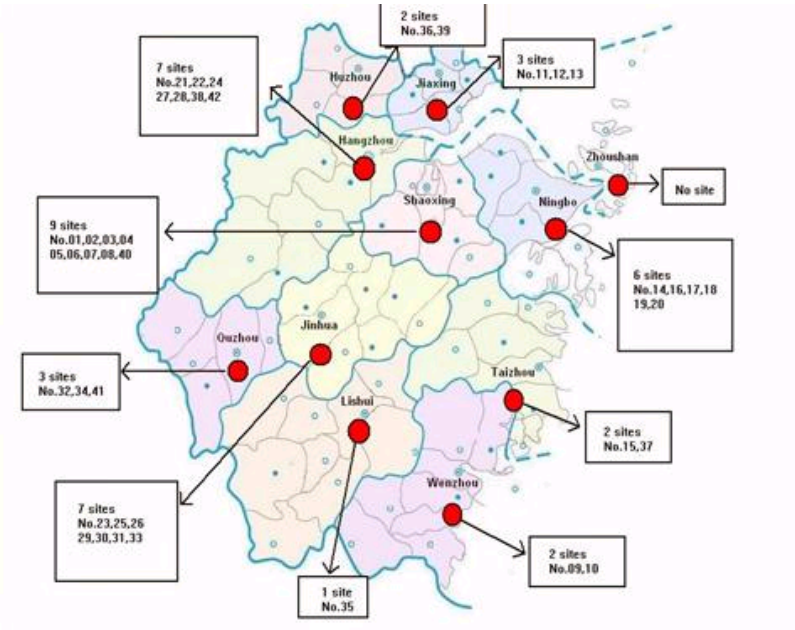


Figure 2 Identified PCB storage sites in Zhejiang province

(4) Suggestions for the national inventory of PCB in China

For the development of national inventory plan and its smooth application, following measures are recommended from the experience and lessons of the provincial inventory. (A) Identify the major investigation objectives: according to the experience of 1995 inventory and Zhejiang inventory, major sectors with potential PCB containing capacitors are power electric departments and large enterprises. Therefore these sectors should be the target of national inventory. (B) Apply various investigation approaches: several kinds of investigation methods, including questionnaires, site investigation and self-report should be combined to supplement each other so as to achieve the maximum integrity of inventory data. (C) Establish the legal or administrative framework: very often would PCB owners be reluctant to report their exact volume of possessed PCB if they are not well informed of the purpose of the inventory and subsequent responsibility. Thus it is necessary to issue legal or administrative documents beforehand, which are both imperative and explanatory, to illuminate the purpose of the inventory and regulate the detailed

responsibilities of PCB owners, as well as the corresponding penalties if they are not properly assumed. This framework should be stable and constantly improved so as to warrant the integrity and continuity of the inventory.

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