China chemical safety case study: PCBs pollution in Ziyang, Sichuan Province

In the frame of the EU-funded project: Strengthening the capacity of pollution victims and civil society organizations to increase chemical safety in China (China Chemical Safety Project)

IPEN and Green Beagle
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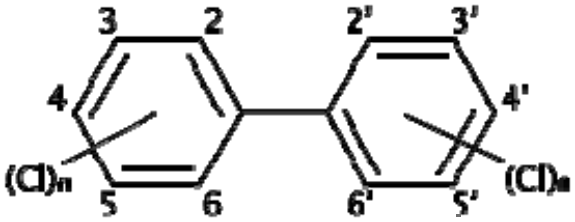
Introduction

PCBs are a global problem due to their toxic properties and wide use in electrical equipment. In 2001, the world's governments finalized the Stockholm Convention and agreed to globally eliminate PCBs by 2028. China is a Party to the Convention and is legally bound by a series of obligations including development of inventories of PCBs and their environmentally sound disposal. However, it can be very difficult to identify where PCBs are in use. This case study focuses on the discovery of significant PCBs use and contamination in a factory that was never identified on any official inventory. The case illustrates the potential widespread threat of PCBs to workers and communities as well as the importance of information transparency and engagement with civil society in Convention implementation as contributors to treaty compliance in China.



Structure of PCBs; image by wikimedia[1]

A quick history of PCBs

PCBs are synthetic organochlorine chemicals with properties ideally suited to use as insulators in electrical equipment: they do not conduct electricity and are very resistant to heat and other chemicals making them very stable.[2] For these reasons, PCBs have been widely used in transformers and capacitors, along with other uses such as flame retardants, ink solvents, and plasticizers. Unfortunately the same characteristics that make PCBs an ideal component of electrical equipment also cause serious problems. PCBs are persistent, soluble in fat, accumulate in living organisms, and travel long distances far from the point of production or use. Toxic effects of PCBs include damage to the immune and reproductive systems, liver, gastrointestinal tract, skin, and thyroid.[3] Unfortunately the human health threats posed by PCBs became apparent in several poisoning incidents including the Yusho poisoning in Japan in 1968 and the Yucheng incident in Taiwan in 1976. In both incidents, many people were unintentionally poisoned by

PCBs-contaminated rice oil and had serious health problems afterward including chloracne and liver cancer.[4]

Commercial production of PCBs began in the US state of Alabama in 1929 by the Swann Chemical Company. Six years later, Monsanto purchased Swann and began large-scale PCBs production.[5] Production rapidly expanded to companies in France, Germany, Japan, Russia, and other countries, but Monsanto remained the world leader at more than 640,000 tonnes.[6] In the 60 years between 1929 and 1989 approximately 1.7 million tonnes of PCBs were produced.[7] Currently, the Stockholm Convention Secretariat estimates that about 3 million tonnes of PCBs and PCBs-contaminated equipment still exist globally.[8] Annex 1 describes Stockholm Convention obligations for PCBs.

PCBs in China

From 1965 to 1974, around 10,000 tonnes of PCBs products were produced in China by four companies and incorporated into approximately 470,000 capacitors, each containing 10 – 15 kg PCBs.[9] [10] Before 1980, eleven companies produced PCBs-related products – three producing capacitors with PCBs and eight producing PCB-containing paints.[11] Production cities included Dalian, Guangzhou, Shanghai, Suzhou, Tianjin, Xi'an, and others. Like in other countries, PCBs were used in a wide range of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment. The import of equipment containing PCBs was banned in 1979. In 1991, the State Environmental Protection Agency banned production and use of PCBs. Currently, at least 15,000 – 25,000 pieces of equipment in use are believed to contain PCBs.[12] In 2007, the Ministry of Environmental Protection estimated that there are 50,000 tonnes of wastes with >500 ppm PCBs and 500,000 tonnes of wastes with PCBs levels between 50 ppm – 500 ppm. [13]

Guo Ruzhong's 21 years of struggle

Even though PCBs have been widely used in China, there is very little publically available information on inventories or poisoning incidents such as the Yusho case in Japan and Yucheng case in Taiwan. Information about PCBs production, use, replacement and disposal is completely lacking in the public sphere. However, Guo Ruzhong changed that.

Guo worked as an electrician at the Foundry Branch of the State-owned Ziyang Locomotive Plant in Sichuan Province. The company produced locomotives in the 1960s and used at least 500 power capacitors containing PCBs that often leaked, resulting in human exposure. Workers repaired damaged capacitors and also cleaned the leaking ones by hand without any protective measures.

In 1990, after 20 years of work, Guo found himself diagnosed with nasopharyngeal carcinoma at age 44. While struggling to deal with his own health problems, Guo was shocked to find an abnormally high percentage of cancers and other serious illnesses among his colleagues at the locomotive plant. Some of them even died at young ages in their thirties or forties. Guo suspected links to occupational exposures and electrical capacitors containing PCBs became the prime suspect. This led to an investigation into the use and disposal of these capacitors as well as his colleagues' exposure to PCBs.

PCBs capacitors found in the 1990s at the Ziyang plant; photo by Guo Ruzhong

The brands of the PCB-containing capacitors; photo by Guo Ruzhong

In 2003, the factory admitted that more than 200 PCB-containing capacitors were still in use at the factory. In 2009, the factory delivered them to Tianjin Hejia Veolia Environmental Services, for disposal. However, Guo reminded the company and public that due to their persistence, the leaked PCBs would continue to pose a threat.

By 2011 Guo's diligence and activities resulted in the following:

- Documenting the PCBs pollution history in his plant since the early 1970s
- Identifying at least 300 capacitors containing PCBs within his plant; many of which were illegally removed and disposed of
- Reporting the danger of the toxic capacitors to the local government and plant administration
- Pushing the local government and the plant administration to remove the capacitors containing PCBs
- Conducting a comprehensive health survey in his plant and identifying more than 20 suspected PCBs poisoning cases
- Mobilizing scientists to sample and test the contaminated sites, which proved the leaching of PCBs-containing oil from capacitors

Guo Ruzhong makes notes on the contents of a factory waste pile; photo courtesy of Southern Weekend[14]

Despite this impressive track record, Guo could not get the exposed and sick workers recognized as pollution victims by the company or the government. This prevented any compensation for

their damage. In addition, despite great effort, Guo could not mobilize the company or the government to conduct comprehensive research on the PCBs contamination issue at the plant.

Getting Guo's story out

In October 2011, Green Beagle staff visited Ziyang and met Guo Ruzhong for the first time. The resulting investigation report caught the attention of the influential newspaper *Southern Weekend*. The paper sent a journalist to Ziyang and reported the story, "Ziyang Patient" on March 19, 2012. This was the first time that Guo's story was formally publicized by the media – two decades after he first characterized the PCBs problem at the plant.

In the summer of 2012, Green Beagle staff and three volunteers went to Ziyang again and interviewed more PCBs pollution victims there. This information, along with Guo Ruzhong's diary and photos, resulted in a 9000-word article on the topic that will be published soon. Green Beagle also organized a public seminar in Chengdu (Sichuan Province) with Guo Ruzhong as the main speaker.

PCBs contamination continues in Ziyang

In March 2014, Guo Ruzhong discovered 47 insulating paper coils sitting in a waste pile at the factory that he recognized formed part of the electrical capacitors containing PCBs. Other industrial waste was also found at the site. Green Beagle personnel requested photos and samples for testing and tests were commissioned at the SGS-CTSC laboratory in Shanghai. The results showed PCB levels as high as 8.11 mg/L – 4000 times higher than permitted under Chinese law.[15] Laboratory personnel noted that this sample had the highest PCB concentration they had ever measured. Project personnel released the data publically and called for government actions.

Industrial batteries found at the same hotspot site;
photo taken in March 2014 by Guo Ruzhong

An additional study by researchers at the State Key Laboratory of Marine Environmental Science in Xiamen University confirmed results of serious PCBs contamination at the factory. Results showed high levels of PCBs in soil from the front gate of the capacitor storage tunnel (~227 ppm) and in dust from the window sill of the iron foundry (>10 ppm).[16] The authors noted that

toxicity equivalents of dioxin-like congeners varied from 75 – 24,027 pg/g – levels that are much higher than those in soils of notoriously contaminated ewaste recycling sites.

Capacitor waste removed, but PCBs oil contaminated the soil;
photo taken in March 2014 by GuoRuzhong

Guo Ruzhong also sent Green Beagle some photos showing PCBs oil from the wastes mentioned above that contaminated the surrounding soil. However, still to date there has been no government action to clean up the site. On the contrary, the contaminated land has been sold to a big real estate company, for development.

The information that Guo collected about this single site in Ziyang reveals some important points about Stockholm Convention compliance with obligations related to PCBs. Guo's survey found at least 300 capacitors containing PCBs at this single site, which was formally confirmed by the plant management. In contrast, the government inventory results from the Ministry of Environmental Protection (MEP) show far fewer capacitors containing PCBs – a discrepancy that raises concerns about further contamination and subsequent health and environmental impacts. The difference also raises concerns about compliance with the country's Stockholm Convention obligations to fully identify PCBs-containing equipment and dispose it according to rigorous treaty requirements.

Information transparency

In early 2012, based on the investigation in Ziyang and the information provided by Guo Ruzhong, Green Beagle applied to the Ministry of Environmental Protection (MEP) for information about a survey of PCBs-containing devices in non-electricity sectors of eight key provinces. MEP declined the request and so Green Beagle launched an administrative litigation against the ministry to obtain the information. Soon after MEP received the notification from the court of the lawsuit, its officials invited Green Beagle to their office and provided the information. Green Beagle subsequently withdrew the litigation.

In April 2012, the Project turned to obligatory Stockholm Convention reporting for information about China's inventory of PCBs. However, we were surprised to find that there was no Chinese national report listed on the Convention website. The Secretariat confirmed that the Chinese

government did submit a national report on time, but that it was a printed hard copy and not an electronic version, and therefore not posted. It was obvious that the Secretariat simply needed to scan and upload the report to the Convention website. After requesting this action in line with treaty requirements, the Secretariat made the report publically available.

Implementation of PCBs obligations under the Stockholm Convention in China

Parties to the Stockholm Convention are required to periodically report on their progress in Convention implementation through their National Implementation Plan. Public participation is supposed to be an integral part of country implementation. The Stockholm Convention obliges Parties to promote and facilitate public participation in national efforts to address POPs, including opportunities for providing input to national Convention implementation.[17] Public participation is also highly relevant to the updating of the National Implementation Plan and how the plan will be implemented. Governments must also report their progress in PCBs elimination every five years. However, the most recent publically available report from China is from 2007.[18]

One of China's stated priorities for treaty implementation is to, "*Investigate and update inventories of POPs releases from unintentional production and inventories of electrical equipment containing PCBs and POPs wastes."* China promised to, *"Establish a system for the declaration, registration and environmentally sound management of equipment in use containing PCBs by 2010."* In addition, the plan was to, *"Complete the environmentally sound management and disposal of PCBs wastes in demonstration areas by 2010."*

Unfortunately, the results of the inventory investigation have never been released to the public and there are doubts over the completion of the 2010 PCBs waste disposal goal. For example, one demonstration area is Zhejiang Province and the PCBs clean-up there has not been finalized. In 2013, MEP hosted a training workshop on the statistics and reporting system of PCBs waste, which indicates that the overall system for PCBs management has not been finalized.

China's objectives for PCBs by 2015 include:

- Elimination of the use of PCBs in currently used equipment containing PCBs; achieve the environmentally sound management and disposal of currently used equipment containing PCBs, with identified high risk, across the country by 2015.
- Achieve the environmentally sound management and disposal of high-risk PCBs-containing wastes indicated in the inventory for the first phase.
- Establish an inventory of pesticide POPs contaminated sites and begin to form an inventory of sites contaminated by PCBs and Dioxin by 2015.

The Ziyang case study provides a warning that without a thorough review of the current reporting and management system for PCBs pollution, these goals for 2015 may not be truly achieved, because the current system does not incorporate public participation and hence many PCBs wastes cannot be identified. As Southern Weekly reported, Chinese POPs experts admitted that many inventory investigations can hardly be completed. One important reason is that relevant documents have not been well maintained. The Ziyang PCBs-contaminated site is now being developed into a commercial area. Obviously, the local government did not conduct any

PCBs monitoring. If this pattern continues, POPs pollution sites will continue to exist well after 2015 and far into the future.

China plans to, *"Complete the identification of currently used equipment containing PCBs and eliminate uses of PCBs by 2025."*

The gaps in implementing Convention requirements on PCBs identified by the Ministry of Environmental Protection in their written report are consistent with many of the elements identified in this case study:

- The inventory of equipment containing PCBs is incomplete and systems related to declaration, registration and environmental management, as well as relevant mechanisms, are not well established.

This case study illustrates this gap quite well, as Guo Ruzhong, an electrician working at a factory, uncovered a major gap in the PCBs inventory. The only "relevant mechanism" was Guo's personal interest in identifying PCBs-containing equipment and wastes.

- The supervision and management capacity of the management institutions concerned is insufficient.

As Southern Weekly reported, in the early 1990s Guo Ruzhong started to report the problem to different levels of government departments responsible for environmental protection, but the local government and plant did not admit the problem until 2003 and not fix the problem until 2009. This means that the supervising system is insufficient and not functional.

- The standards' system has not yet been established for the environmentally sound management of the identification, labeling, operating maintenance, transport, storage, abandonment and monitoring of currently used equipment containing PCBs.

MEP actually has distributed some guidelines for identifying, moving and storing PCBs equipment and waste, but they seem to be not seriously regarded by local governments. We were not able to evaluate how these guidelines were implemented in areas other than the two demonstration provinces, namely, Zhejiang and Liaoning.

- Most of the owners of PCBs-containing equipment lack understanding of the environmental and health risks caused by PCBs.

The Ziyang case illustrates this problem quite well. The managers of the plant disregarded the harmfulness of PCBs.

- Strategies for identifying PCBs-containing wastes are not yet complete and basic data are relatively weak.

The primary PCBs identification strategy at the company in this case study appears to have been the concerns of a sick electrician and his determined manner to uncover the harms to himself and other workers. While effective in this example, this is not an effective policy for treaty compliance.

Conclusion

The Ziyang case study provides opportunities for improvements in several areas:

Expedited attention to PCBs obligations under the Stockholm Convention
According to China's national report of Convention implementation, PCBs-containing waste and devices has only been partly identified. Guo Ruzhong and Green Beagle's discovery of new PCBs waste showed that toxic pollutants indeed still exist in some unknown places. This requires government and other interested social groups to conduct comprehensive surveys nation-wide.

Due to a large amount of PCBs capacitors used historically in Guo Ruzhong's plant, the land of the site might have been contaminated. However, it was not evaluated before being sold to a real estate developer. Developing PCBs-contaminated land without clean-up under Treaty guidelines is not consistent with Stockholm Convention obligations and this demands urgent attention from the government and the public.

Civil society participation in Stockholm Convention implementation
The Stockholm Convention obliges Parties to promote and facilitate public participation in national efforts to address PCBs and other POPs. However, this aspect of Convention implementation is lagging in China. As seen from this case, we found that without public participation, the Stockholm Convention cannot be well implemented in China.

One good reason to include the wider public in implementing PCBs obligations is illustrated in this study. Identifying PCBs-containing devices or waste is not easy, even for many government officials or experts. This is because PCBs-containing devices were produced and deployed very early and stopped being used some time ago. Only experienced technical persons like Guo Ruzhong can effectively guide environmental protection officers or ordinary people to do such work. In addition, for better public participation, MEP and local environmental bureaus should publicize more information, for example the details of the PCBs storage locations. More information, on the one hand, can help people prevent themselves from dangers, and on the other hand, can include professional NGOs or persons to help monitor the hotspots.

Occupational health and safety
Guo Ruzhong reveals that when they worked in the workshop near PCBs, there were no sufficient occupational measures to protect workers from pollution risks. In addition, there is no mechanism for workers to claim themselves as occupational disease victims. On April 28, 2003, Guo knew there was an official document titled "Notice on Organizing the Second Identification of the Damage Extent of the Workers with Permanent Disability". He felt that might be an opportunity to raise the issue of PCBs victims. On April 30, he completed the application form of "occupational disease identification" and brought it to his boss for a signature. At the beginning his boss refused to sign, but after some argument with Guo, he reluctantly signed. Thereafter, several departments, including the human resources department, safety production department and factory hospital, all did not want to accept his application, but in the end received his documents.[1]

On July 7th, Guo suddenly received a notice from the human resource department of the Foundry Branch that informed him to submit identification photos and identification card for furthering

[1] Guo Ruzhong Diary, April, 2003.

the occupational disease identification procedure. Following the instruction, he filled out four copies of a form for the identification. However, he still needed a confirmation of the safety production department. Guo then went to the safety production department and was refused by the officers there. They said such an issue was the factory hospital's responsibility.

On July 11th, Guo Ruzhong met Guo Luqiong (who was in charge of the occupational disease identification issue) and asked her to accept his case. Guo Luqiong showed him an ordinance issued by the Health Ministry on the list of government-recognized occupational diseases, in which PCBs were not included, nor any diseases related to this toxicant. Guo felt angry with this rejection and conducted some research on the policy. Later he re-approached Guo Luqiong and showed her the counter evidence on the Health Ministry's stance on the scope of occupational diseases. His evidence was an official reply letter from the Health Ministry to Shanghai Health Bureau that explained that for those toxicants or occupational diseases that were not on the aforementioned list, the local government should make an assessment based on the actual situation. Unfortunately, the health officer of the Factory continued to ignore what Guo raised. Many years later, Guo commented on such ignorance: "this only chance of being identified as occupational disease patient died in its infancy". Southern Weekly also reported that this is one of the most extreme cases of occupational POPs exposure case in history.

Enforcement of waste management laws

The identification of new PCBs wastes in the Ziyang case demonstrates poor compliance with waste management laws, particularly laws related to hazardous waste management. In order to manage PCBs wastes, Zhejiang Province promulgated a specified ordinance in 2009, which provides a good basis for strictly controlling PCBs pollution. Other provinces in which PCBs equipment was heavily used in history should follow Zhejiang's experience.

Information disclosure

Public right to know is a key principle of chemical safety. However, this case demonstrates that there are many blind areas for PCBs pollution control in China. The government and industries alone cannot solve the problem. Without public participation, the commitment that the Chinese government made to implement the Stockholm Convention cannot be met. The key step to encourage and mobilize public participation is to release all existing information to the public and clearly admit what information may be missing, so that the ordinary people can be cautious to potential harm and concerned communities or environmental group can take action to help fill the gaps. In addition, to let people know all information about POPs- including PCBs- is an obligation of implementing the Stockholm Convention. As Southern Weekly reported, MEP and local governments still possess a lot of data, but refuse to let the public know where the identified PCBs equipment is stored. This must be corrected.

Polluter pays

Treatment costs for PCBs destruction run from USD$2000 - $5000 per tonne, including packaging and transport. Considering the amounts of PCBs currently existing in capacitors and transformers globally, it could cost between USD$8 - $35 billion for environmentally sound waste management – an amount far greater than the total budget allocated for implementation of the entire Stockholm Convention. According to Rio Principle 16, the polluter should pay this cost, but it appears that this will not happen. The true cost of the private sector decision to

produce PCBs and incorporate them into electrical equipment around the world is enormous. As noted in the Stockholm Convention PCBs Elimination Network Magazine, "This provides a powerful argument in favor of a precautionary approach to chemicals management, extended producer responsibility and makes a compelling economic case for green chemistry."[19] In this case, the polluter is a state-owned company. This implies the need for a harmonized approach to government obligations under the Convention and policies of state-owned companies.

Liability and compensation

Liability and compensation is another key principle of chemical safety.[20] In 2010, the Governing Council of the United Nations Environment Programme (UNEP) developed guidelines for national legislation on liability and compensation.[21] China participated in the meeting and its consensus decision to endorse the guidelines. The decision acknowledges Rio Principle 13 and seeks to operationalize Rio Principle 16, the polluter pays principle. Company responsibilities include strict liability for damages either by commission or negligence. The Guidelines grant both individuals and public authorities the right to claim compensation including for damage to property and economic loss. According to Chinese Civil Law, for environmental pollution cases if the plaintiff can prove the existence of polluting activities and damage to property and health, then the defendant should take the responsibility to disapprove the causal relationship between the pollution and damage. In this case, victims are afraid to launch a lawsuit against the polluter for liability and compensation, because these suits have not historically been well developed and thus the victims feel hopeless about proving responsibility, giving them a negative expectation about any legal action.

Media reports

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Annex 1. Stockholm Convention obligations for PCBs

PCBs are listed in Annex A of the Stockholm Convention for elimination. All Parties to the Convention are prohibited from intentionally producing PCBs but the continued use of PCBs contained in equipment such as transformers or capacitors is allowed through the year 2025.[22] Governments are obliged to finally dispose of and destroy all PCB-containing waste by 2028.[23] Parties are prohibited from exporting or importing PCB-containing equipment other than for purposes of their environmentally sound disposal.[24] Parties are also prohibited from allowing PCBs contained in a piece of equipment to be recovered and used in other equipment.[25]

The Convention encourages Parties not to wait until 2025 to eliminate PCB-containing equipment, but to act more quickly. Parties are requested to make a determined effort to identify, label and remove from use equipment containing PCBs starting with those that contains five liters or more of PCB-containing liquids. The highest priority should go to such equipment whose liquid contains 10% or more of PCBs; the next priority to those whose liquid contains .05% PCBs or more.[26] Parties are also requested to promote measures to remove leaking equipment from use and to ensure that no PCB-containing equipment will be used in areas where food or feed is produced or processed. Parties are also encouraged to promote measures to prevent fires in PCB-containing equipment and to promote inspection of equipment for leaks.[27] Parties must report every five years on their progress in eliminating PCBs.

About the China Chemical Safety Project

This is an EU-funded project of IPEN with partner Green Beagle that aims to strengthen the capacity of civil society organizations and communities impacted by pollution to increase chemical safety in China. The Project (also known as the China Chemical Safety Project) is being implemented in China over two years with total EU funding of €344,580 and EU contribution of 77.84% of the total cost.

The Project includes:

- Improving capacities of impacted communities and civil society organizations for involvement in policy making
- Training on public participation in environmental impact assessment
- Generating new publicly available data about pollution and impacted communities that contribute to increased implementation of local and national chemical safety policies
- Raising awareness on emissions-related pollution

European Union

Strengthening the capacity of pollution victims and civil society organizations to increase chemical safety in China (China Chemical Safety Project) is funded by the European Union. The contents of this report are the sole responsibility of the IPEN and Green Beagle and can in no way be taken to reflect the views of the European Union.

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