



Empowered lives.  
Resilient nations.

# SOUND CHEMICALS AND WASTE MANAGEMENT FOR SUSTAINABLE DEVELOPMENT

Results, lessons, and human impact from selected GEF-funded projects to implement the Stockholm Convention on Persistent Organic Pollutants



## HEALTHCARE WASTE

- Africa Regional
- Kazakhstan
- Kyrgyzstan



## UNINTENTIONAL POPs

- China e-waste
- Indonesia



## PCBs

- Colombia
- Ecuador



## INDUSTRIAL

- China copper

# Table of Contents

<b>Introduction</b>	1
<b>HEALTHCARE WASTE</b>	
Africa Regional (Ghana, Madagascar, Tanzania, Zambia) Reducing UPOPs and Mercury Releases from the Health Sector in Africa	2
<b>KAZAKHSTAN</b> NIP Update, Integration of POPs into National Planning and Promoting Sound Healthcare Waste Management	4
<b>KYRGYZSTAN</b> Protect Human Health and the Environment from UPOPs and Mercury from the Unsound Disposal of Healthcare Waste	6
<b>UNINTENTIONAL POPs</b>	
<b>CHINA</b> Reduction of POPs and PTS releases by environmentally sound life cycle management of electrical and electronic equipment and associated wastes	8
<b>INDONESIA</b> Reducing Releases of PBDEs and UPOPs from Unsound Waste Management and Recycling Practices and Manufacturing of Plastics	10
<b>PCBs</b>	
<b>COLOMBIA</b> Development of National Capacity for the Environmentally Sound Management and Disposal of PCBs	12
<b>ECUADOR</b> Integrated and Environmental Sound Management of PCBs in Ecuador	14
<b>INDUSTRIAL</b>	
<b>CHINA</b> Reduction of UPOPs in the Secondary Copper Production Sector	16



# Introduction

At the Seventh Meeting of the Conference of the Parties to the Stockholm Convention (SC COP-7) in Geneva in May 2015, UNDP highlighted the results of its work to protect human health and the environment from POPs through 11 Case Studies from around the world, funded by the GEF.

With an additional 4 years of project experience gained since then, I am very pleased to share with you at this Stockholm Convention COP-9 Meeting in Geneva (29 April to 10 May 2019), some of the latest results of UNDP's work with this publication which highlights the results, lessons learned, and human impact from 8 selected GEF-funded projects to implement the Stockholm Convention on POPs and the Minamata Convention on Mercury. These 8 Case studies are grouped under four categories:

- (a) **Healthcare Waste Management** (Africa Regional, Kazakhstan, and Kyrgyzstan)
- (b) **Unintentional POPs** (China, Indonesia)
- (c) **PCB Management** (Colombia, Ecuador)
- (d) **Industrial POPs** (China).

These projects are linked to SDG #3: good health and well-being; SDG #5: gender equality; SDG #8: decent work and economic growth; SDG #9: industry, innovation and infrastructure; and SDG #12: responsible consumption and production. It is also directly linked to UNDP Strategic Plan Output 1.3. "Solutions developed at national and sub-national levels for sustainable management of natural resources, ecosystem services, chemicals and wastes." We have highlighted in this publication some of the human interest/impact stories to draw out why the recipient communities feel that the projects are helping their livelihoods and protecting their health. A particular focus of this publication is on gender issues and equality as women strive to play a critical role in protecting the environment.

Since 2004, UNDP has been assisting 84 developing countries and countries with economies in transition in their efforts to sustainably manage the use, disposal, and destruction of POPs, working with private sector partners and NGOs. Through the introduction of life cycle management of POPs and affordable alternative approaches and technologies, 18,203 tonnes of POPs were safely disposed of, reducing the risk of direct exposure to POPs for 2.5 million people.

Without collective efforts by all stakeholders, sound chemical and waste management would not be achieved. We are looking forward to foster and build multi-agency and multi-stakeholder partnerships to deliver our collective support to countries and communities for protecting people and ecosystems from the threats of hazardous chemicals and wastes.



**Xiaofang Zhou**  
Director,  
Montreal Protocol/Chemicals Unit  
Bureau for Policy and  
Programme Support  
UNDP





# AFRICA REGIONAL

(Ghana, Madagascar, Tanzania, Zambia)

## Reducing UPOPs and Mercury Releases from the Health Sector in Africa

### Background

This project is directly linked to UNDP's priorities on chemicals and waste and indirectly to climate action and poverty reduction, through improved healthcare waste management to mitigate infections. The project helps Sub-Saharan African countries turn SDGs into action by reducing releases of dioxins, furans and mercury, which are harmful to our planet.

### Project Achievements and Impacts

- Healthcare workers in 24 pilot facilities in 4 countries (Ghana, Madagascar, Tanzania and Zambia) have been trained and equipped to correctly and efficiently sort waste at its source, safely store and transport it. Kenya, Uganda, and Jordan have also benefited from HCWM training through this project.
- Ghana, Madagascar and Tanzania completed national policy and regulatory improvements, adopting technical guidelines and a handbook for sustainable HCWM systems.
- 14 facilities have received a total of 18 autoclaves to sterilise their collected infectious waste.
- With the current setup, the amount of dioxins (UPOPs) releases avoided is estimated at 42.1 g-TEQ per year, above the project target of 31.8 g-TEQ per year.

- Non-mercury medical devices have been distributed in all 24 pilot facilities and exchanged with mercury-containing equipment. Based on the supplied items, mercury releases were reduced by 101.26 kg/year, also well above the project target of 25.3 kg/year.
- In Madagascar, the Ministry of Health issued an official memo to all healthcare facilities in the country to stop procurement of mercury-containing medical devices.

### Tackling Zambia's Medical Waste Problem

As the furnace heated up, Friday Chola, an operator at Kabwe Central Hospital (KCH), used to sort through the medical waste and flipped open the lid of the chamber to monitor the incineration process. Noticing that the last batch of waste was almost burnt to ashes, Chola would rush for a yellow bag containing an assortment of used syringes, rubber gloves and polythene waste, pour in some of the waste, mix it with a forked rod and then replace the lid to allow the incineration process to continue. Now dressed in protective clothing, Chola recently became an autoclave operator – one of 20 former incinerator operators trained to operate a new healthcare technology that disinfects, neutralizes or contains infectious medical wastes.



DEMONSTRATION OF THE USAGE OF AUTOCLAVES FOR WASTE TREATMENT IN GHANA. PHOTO BY JAN-GERD KÜHLING



GEF GRANT (USD):  
\$6,453,195



CO-FINANCING (USD):  
\$28,936,164



PARTNER INSTITUTIONS  
• WORLD HEALTH ORGANIZATION (WHO)  
• NGO: HEALTH CARE WITHOUT HARM (HCWH)



EXECUTING AGENCIES

- GHANA: MINISTRY OF HEALTH
- MADAGASCAR: MINISTRY OF ENVIRONMENT, ECOLOGY AND FORESTS
- TANZANIA: MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN
- ZAMBIA: MINISTRY OF HEALTH

“I knew that my job was risky, but I had no choice. I have to work to feed my family” said Chola, a 30-year old father of two. Three months ago, the health of medical waste handlers was endangered by improper medical waste treatment - they had to regularly deal with cuts and needlestick injuries and were highly exposed to toxic ash and smoke from burning chemicals.

KCH is the largest referral hospital in central Zambia and one of the country’s oldest healthcare facilities with a 470-bed capacity. Waste generated at the hospital was previously poorly managed with minimal segregation due to lack of awareness and training for staff on health and environmental effects of infectious waste. Poor handling and disposal of waste through the municipal waste system meant scavenging by waste-pickers for resale and re-use was also a serious health risk. The hospital also used to burn their medical wastes in low-temperature burning chambers or traditional incinerators which produce Unintended Persistent Organic Pollutants (UPOPs), negatively affecting the health of individuals staying or working at the facilities, and those living nearby.

Autoclaves, a game-changer

KCH and two other key health facilities including the country’s largest hospital, the University Teaching Hospital, now have a solution to their problems, and a way of cutting emissions of UPOPs - a healthcare waste treatment facility equipped with a highly-effective non-incineration technology known as autoclave. This was achieved with GEF funding with technical support of UNDP, WHO and the NGO “Health Care Without Harm” and implemented by the Ministry of Health.



“With this medical waste treatment plant, our hospital will now be able to effectively and safely handle its healthcare waste. This is a great step forward for both the people and the environment of Kabwe,” says Dr. Victor Kusweje, the Medical

Superintendent of KCH. “The burning and incineration of all types of wastes not only inhibit people’s right to a healthy environment, but also puts public health at risk,” says Winnie Musonda, UNDP’s Environmental Advisor in Zambia. The steam-based autoclaves can handle 2,000 kilograms of waste per day and are expected to decontaminate medical waste produced by the beneficiary hospitals and other health centres in surrounding communities.

Key lessons learned from the project

- A comprehensive, integrated approach should be implemented in parallel (policy and guidelines, review of HCWM practices including sorting, training, support to installation and maintenance of equipment and economic feasibility, including through recycling) to increase the chance of success.
- Training provided to local procurement teams in Health Ministries is critical to future expansion of mercury-free and non-incineration technologies.
- The availability of new mercury-free and non-burn treatment technologies in teaching hospitals will also facilitate on-the-ground practical education in the related fields.
- The training of healthcare professionals, especially Environmental Health Officers and Nurses, should be strengthened through higher education institutions to improve the necessary skills to support expansion of such HCWM systems.



AUTOCLAVE OPERATION TRAINING. PHOTO BY UNDP TANZANIA

# KAZAKHSTAN

## NIP Update, Integration of POPs into National Planning and Promoting Sound Healthcare Waste Management

### Background

The project helps the country promote best environmental practices and introduce non-incineration healthcare waste treatment technologies and mercury-free medical devices. Strengthening the capacity of state bodies, industrial enterprises and local authorities in the management and handling of chemicals and hazardous wastes is a key objective. This project is directly related to SDGs #3 and #12 and to UNDP's Strategic Plan. Previously most medical waste was destroyed by incineration. A system for the disposal of infected medical waste in specialized autoclaves with saturated steam under high pressure was proposed. Premises for the centers, and necessary conditions for the operation of the equipment, were provided by the recipients of the equipment.

### Project Achievements and Impacts

- Six centers for the disposal of medical waste with two autoclaves in each center with a capacity of 100 kg/hour were created in three pilot regions (Astana, Ust-Kamenogorsk, and Kostanay). The centers in rural areas had autoclaves with a capacity of 20 kg/hr. In total the centers processed 2.5 tonnes of infected healthcare waste annually

reducing POPs emissions by 0.1 g/TE/year. 20 people (including 5 women) received training and certificates to work on autoclaves for the disposal of medical waste.

- A system for the safe transportation of medical waste has been created that complies with the requirements of ADR (shredders, specialized containers and vehicles, necessary permits).
- To introduce a uniform system of medical waste management and address issues of waste segregation, a Standard Operating Procedures (SOP) system was developed and tested in the pilot regions.
- In the pilot areas, 18,000 mercury-containing thermometers were replaced with electronic ones with 36 kg of mercury disposed safely. MOUs were signed with local executive bodies in pilot areas to reduce the use of mercury in medicine, and prevent future purchase and use of mercury-containing clinical thermometers.
- 1,400 people (440 males and 960 females) participated in seminars and training courses. Participants came from state bodies, local authorities, industrial enterprises, hospitals and NGOs from all regions. An online course on POPs and



TRAINING ON IDENTIFICATION OF POPs. PHOTO BY ZULFIYA BAISAGATOVA



GEF GRANT (USD):  
\$3,400,000



CO-FINANCING (USD):  
\$35,012,758



PARTNER INSTITUTIONS  
• Ministry of Ecology  
• Ministry of Energy

Mercury issues prepared by the project helps raise awareness on these issues ([www.zhasyldamu.kz/ru/proekt-proon-programa-po-problemam-rtuti.html](http://www.zhasyldamu.kz/ru/proekt-proon-programa-po-problemam-rtuti.html)).

- To increase awareness of project activities, a training seminar was held for countries in the Asian region.
- Amendments made to the Environmental Code of Kazakhstan on the regulation of emissions of dioxins and furans in the flue gases from POPs destruction facilities; introduction of BAT; and Amendments to the Law of Kazakhstan on stricter requirements for public procurement.
- Order of the Minister of Ecology “On approval of the National Plan for the fulfillment of the obligations of the Republic of Kazakhstan under the Stockholm Convention on POPs for 2015-2028”.
- Order of the Minister of Energy “On approval of the list of pollutants and types of waste for which emission standards are established”.
- Six national standards were approved on the definition of polychlorinated dibenzodioxins and dibenzofurans in the environment.

### Anecdote



Bizara Dosmakova, Deputy Director of Waste Department of Ministry of Energy of Republic of Kazakhstan, National Project Director said the following:

“The work on new database inventories of new POPs and UPOPs helped us update our Stockholm Convention compliance plan. They cover potential sources of new POPs in the production of goods, as well as enterprises whose emissions may contain POPs. The methodology for conducting these inventories will serve as a basis for continuing this work. Establishment of non-incineration centers for processing healthcare wastes in pilot regions will be a good basis for further expansion, which will reduce UPOPs emissions and involve healthcare wastes in secondary raw materials. This will positively impact the environment and the quality of life. Recycling plastic waste will contribute to business development and the economy.

One of the important results is the work on amending legislation to permit non-incineration technologies to dispose of healthcare waste helped the establishment of the Centers and the new healthcare waste management system. The approach to inform and train stakeholders visiting pilot regions by using

project-prepared training programmes on capacity building by trained trainers is very effective since we covered a large number of people.”

### Key lessons learned from the project

- Due to the high cost of laboratory equipment, the state agency responsible for conducting national POPs emission monitoring is currently unable to obtain funding from the state budget. The Project, with the participation of Kazhydromet RSE, did passive sampling of atmospheric air and soil and analyses for POPs content, including UPOPs in five regions. The analysis showed the presence of POPs increasing over time. Monitoring data have been submitted to the Ministry of Energy to use as justification for obtaining funds from the government budget to increase the analytical capacity of the laboratories of Kazhydromet RSE.
- Analysis of the healthcare waste management system in medical institutions showed that waste segregation is carried out according to the class of hazard without separation by type of waste. Also most medical waste is mainly plastic waste. With proper organization of the collection and neutralization system, these wastes can be used as secondary raw materials.
- Model patterns for standard operating procedures in the field of medical waste management have been sent to the Ministry of Health for application at work sites.
- Amendments to the legislation allowing for the use of high-temperature methods as an alternative to combustion has expanded the market for the provision of these services.



TRAINING ON POPs MONITORING. RECETOX CENTRE, MASARYK UNIVERSITY.  
PHOTO BY ZULFIYA BAISAGATOVA



# KYRGYZSTAN

## Protect Human Health and the Environment from UPOPs and Mercury from the Unsound Disposal of Healthcare Waste

### Background

This UNDP/GEF project is directly linked to UNDP's priorities on chemicals and waste and indirectly to climate action and poverty reduction, through improved healthcare waste management (HCWM) to mitigate infections. It implements Best Environmental Practices (BEP) and Best Available Technologies (BAT) in healthcare facilities in the capital Bishkek and supports 100 rural health posts in Chui and Issyk-Kul Oblast. Mercury releases (generally due to breakage of mercury thermometers) are reduced by supporting the phaseout of mercury-containing medical equipment and introducing mercury-free alternatives. This project is directly related to SDGs #3 and #12 and to UNDP's Strategic Plan.

Minimizing waste, segregating at source, avoiding incineration, and recycling all conserve resources and energy. Research conducted by the NGO Health Care Without Harm (HCWH) proved that autoclaving has waste CO<sub>2</sub> emissions at least 15 times lower than waste incineration. Improved management of healthcare wastes in and outside of hospitals leads to a reduction in occupational exposure of healthcare staff to pathogens, reduces the occurrence of hospital acquired

infections, and reduces exposure of waste handlers, recyclers, and waste-pickers who face hazardous working conditions when in contact with infectious and toxic healthcare waste. Communities living close to waste disposal sites (municipal waste dumps and landfills) or incinerators also benefit.

### Project Achievements and Impacts

- National HCWM Strategy and Budget, and National Action Plan approved in July 2017
- A Regulatory and Institutional Analysis (RIA) led to the approval (order of the Ministry of Health in March 2018) of standard operating procedures (SOP) for HCWM and guidelines for monitoring and evaluation of HCWM system in health care organizations. Four documents were approved: (a) *Guidance for monitoring and evaluation of the waste management system in health organizations*; (b) *SOP for the organization of medical waste management system in health organizations*; (c) *SOP for autoclaving of medical waste at the decontamination (autoclaving) site*; and (d) *SOP for actions of personnel of health organizations for treatment of medical waste during emergencies*.



AUTOCLAVING ROOM AT A MATERNITY HOSPITAL IN BISHKEK. PHOTO BY ZHANNA KHUSAINOVA





GEF GRANT (USD):  
\$1,425,000



CO-FINANCING (USD):  
\$7,032,109



PARTNER INSTITUTIONS  
• Ministry of Health  
• State Agency on Environmental Protection and Forestry

- The Feb. 2018 Decree “Instruction on the Management of Healthcare Waste in the Territory of the Kyrgyz Republic”, covers all medical institutions and focuses on application of strict requirements for HCW collection, temporary storage, storage, transportation and disposal.
- The Ministry of Health approved Order No. 715 on 20 Sept. 2016 on the withdrawal of clinical mercury thermometers and their replacement by electronic thermometers in health organizations in Bishkek.”
- Rules for working with mercury-containing medical products were adopted by the Decree of the Government of the Kyrgyz Republic No. 94 dated 15 Feb. 2018.
- Reduction of UPOPs releases from municipal waste burning is estimated at 4.5 g TEQ/Year
- Autoclaves were provided for 13 hospitals in Bishkek and 100 First Midwife Stations (FMS) in the Chui and Issyk-Kul regions. Training (in Russian and Kyrgyz) was provided to staff on management of HCW and safe handling and disposal of Mercury.
- 4 roundtables with experts, key decision makers and staff from Ministries and Committees on the impact of UPOPs and mercury emissions on public health, with TV and media coverage, preparation and printing of booklets and other infographics.
- Training on emergency situations with mercury spills conducted for 25 government officials and 100 specialists (89 men, 11 women). Also 400 medical workers (12 men, 388 women) from 68 health organizations in Bishkek trained on cleanup, storage and transportation of mercury-containing waste.
- 3,000 electronic thermometers purchased for 11 medical institutions, as well as materials for the collection, transportation and temporary storage of 1,300 mercury-containing thermometers that were later disposed of at the Khaidarkan mercury combine.
- The animation “Do you know what to do if a mercury thermometer breaks?” was watched by 1 million people on Facebook. Posters were distributed to all health organizations in the country. KTRK broadcasted a special report and a programme for children on the dangers of mercury thermometers.

## Anecdote



Dr. Aleksey Kravcov, Head, Center on Infection Control, Ministry of Health, was the main government counterpart for the project. He said “My view changed on the HCWM problem. Before I only considered the infectious and hazardous side, but now I look at it from the environmental point of view also. We are considering working with the World Bank for nationwide replication of those results that we piloted in 100 First Midwife Stations (FMS) during project implementation”.

## Key lessons learned from the project

- To facilitate cooperation with national counterparts, the global environmental objective of the project was linked to the quality and effectiveness of delivery of health services in the country.
- By improving segregation of healthcare waste and demonstrating use of non-incineration technologies for treatment of HCW, UPOPs emissions were reduced and the project facilitated the rapid introduction of HCWM regulations to ensure the implementation of environmentally safe waste management at hospital facilities and the disposal by means of BAT/BEP compliant technologies.
- Training and capacity building were critical elements for project success. Curricula in HCWM have been established in educational institutes, so the training will continue after the project ends.



TRAINING ON USING THE PORTABLE TABLE AUTOCLAVE. PHOTO BY THE MINISTRY OF HEALTH OF KYRGYZ REPUBLIC

# CHINA

## Reduction of POPs and PTS releases by environmentally sound life cycle management of electrical and electronic equipment and associated wastes

### Background

This project is directly related to SDGs #3, #9, #11 and #12 and to UNDP's Strategic Plan. The project will help China fulfill Stockholm Convention requirements by addressing the POPs/PTS release sensitive e-waste stream in the recycling, dismantling, treatment and final disposal processes of Waste Electrical and Electronic Equipment (WEEE).

### Project Achievements and Impacts

- Environmental upgrading in e-waste collection modes, environmentally sound dismantling and materials recovered in 3 demonstration provinces, 5 demonstration enterprises and BAT/BEP (Best Available Technologies/Best Environmental Practices) promoted in 20 e-waste dismantling enterprises.
- 2 provincial level e-waste regulations formulated, and 3 national level policy research reports produced with in-depth analyses on standards and auditing of regulated dismantling of 9 new e-waste types, registration of e-waste dismantling enterprises and development of a national WEEE information management system.
- 38.05 million units of e-waste collected and treated in an environmentally sound manner, which included safe treatment of 403.4 kg PBDE containing plastic and reduction of 57.97g/-TEQ PCDD/F.
- 3 major types of e-waste collection, including reverse logistics, online to offline solutions and community based collection implemented, which led to the successful treatment of 38.05 million units of e-waste.
- Over 15,000 tonnes of CRT have been treated contributing to the reduction of 2,550 tonnes of lead released into the environment.
- Research reports produced on eco-design of electrical and electronic equipment (EEE) in China and more industrialized countries.
- Assessment report of POPs application in computers prepared – based on this report Lenovo E50 series was chosen to pilot eco-design to reduce at least 20% of POPs in laptop design and manufacturing.
- Synergies with the Basel Convention - formulating a guidance manual to differentiate WEEE from used EEE, and organizing training courses for customs officers to counter solid waste trafficking including e-waste.
- Promoted international technical exchange and knowledge sharing under which visits to 8 countries took place and 3 international meetings organized to share and promote project achievements and experience.



UNLOADING E-WASTE COLLECTED FROM NEARBY TOWNS. PHOTO BY WU JUNLIAN, SOLID WASTE MANAGEMENT CENTER, JIANGSU PROVINCE



GEF GRANT (USD):  
\$11,650,000



CO-FINANCING (USD):  
\$47,000,000



PARTNER INSTITUTIONS  
• FECCO, MINISTRY OF ECOLOGY AND ENVIRONMENT (MEE)

- A variety of POPs communication activities and campaigns implemented to engage the public and disseminate e-waste and POPs knowledge, including POPs knowledge dissemination through parents and children interaction activities, live streaming of e-waste factories being dismantled, road show for primary schools, university debate competition on e-waste recycling, etc.
- 6,807 people trained to enhance their managerial and technical capacity in e-waste management. It is estimated that more than 750,000 persons benefited through enhanced awareness and reduced health risk.

## An E-waste Story

Yang Jianrun and Yao Junkai are among 244,000 people with disabilities living in Changzhou city of Jiangsu Province, accounting for 5.92% of its population. Many have limited access to fairly paid economic activities and proper occupational training. One of the e-waste project's key activities was to upgrade the informal collection sector by channeling e-waste into the formal sector by developing a range of collection modes to maximize participation of producers, collectors, dismantling companies, community groups and the public.

Jiangsu Project Management Office (PMO) and Xiangyu, the demonstration dismantling enterprise in Changzhou, have partnered with the Changzhou Disabled People's Federation (CDPF) since 2014 to set up e-waste collection shops across the city and to reach counties and towns in rural areas. The owners and staff of those shops are all people with disabilities and the idea was to transform them into qualified entrepreneurs and collectors equipped with sufficient knowledge and skills on e-waste. In addition to regular technical and business training (provided by Xiangyu, the PMO and experts), funding for renovations, rent allowance, purchasing computers and office supplies and public communication was provided to certified shops. Those collection shops enjoy a transportation fee exemption with Xiangyu transporting their collected e-waste to its dismantling factories. Those shops also participate in e-waste awareness raising campaigns organized by the PMO, which helps increase the visibility of those shops to potential clients.

Yang Jianrun applied through CDPF for opening his own collection shop and with project support, his shop has been operating for 5 years and his monthly income increased to 5,000 yuan (\$735). "I am very content with my current work because my income was raised and my life is better. This work, thanks to the help of your project, freed me from previously physically demanding casual labor and helped me find a position in a meaningful area. Others respect me because I am now working to protect our living environment from e-waste pollution".

For Yao Junkai, since opening his e-waste collection shop in 2015, his business has grown a lot and both his wife and son help run the shop. Every month his shop brings in more than 10,000 yuan (\$1,470). "You cannot imagine how grateful I am for your project's help. I had money and survival worries years ago, but this shop, opened with e-waste project financial and technical support, raised my confidence and dignity. My family is so proud of our business and we work hard to improve our skills and attract clients. As we are trained by Xiangyu, we know how to handle e-waste properly and we guarantee our clients their recycled e-waste will end up in an environmentally regulated dismantling factory. Because of the great performance, Xiangyu and CDPF rewarded my shop with a 10,000 yuan sales bonus and 12,000 yuan rent allowance in 2018."

The project aims to scale-up this partnership to benefit more people in need. More than 15 collection shops have been jointly supported by the project and CDPF covering 13 counties and towns in Changzhou. 48 new jobs have been created and the shops have collected around 95,800 units of e-waste, and all of them are processed in an environmentally friendly manner to reduce chemical pollution.

## Key lessons learned from the project

- Although the project addresses the full lifecycle of EEE with emphasis on e-waste, more lessons learned and experiences aimed at minimizing chemical substances at their source in EEE should also be provided.
- To efficiently close the loop of WEEE management, the project could engage more original producers in the process of reducing WEEE and associated chemical pollutants.
- Attaching equal importance to the social gains of this POPs project will multiply the environmental benefits. The good practice and experience of partnering with the Changzhou Disabled People's Federation will be promoted in the national replication plan that follows.



YAO JUNKAI (MIDDLE) IS DISCUSSING WITH THE PROJECT'S CHIEF TECHNICAL CONSULTANT AND MARKETING MANAGER FROM XIANGYU. PHOTO BY JIANGSU PMO.

# INDONESIA

## Reducing Releases of PBDEs and UPOPs from Unsound Waste Management and Recycling Practices and Manufacturing of Plastics

### Background

This project is directly related to SDGs #3, #5, #8, #9 and #12 and to UNDP's Strategic Plan, especially on reducing gender inequality and promoting women's empowerment.

UNDP is assisting the Indonesian Ministry of Industry follow recommended actions under the Stockholm POPs Convention to reduce releases of toxic flame retardants (polybrominated diphenyl ethers, PBDEs) and unintentional POPs by-products resulting from unsound waste management and recycling practices and in plastics manufacturing, as well as building national capacity on these issues.

The project supports Indonesia's industry and recyclers ensure that no banned POPs are used or recycled into new manufactured articles, and helps municipal and community waste operations reduce environmentally harmful releases. The additional socio-economic benefits include increased recycling and material efficiency, and better waste management.

The project has so far been able to:

- Reduce 190 metric tonnes of PBDEs and UPOPs from manufacturing process, recycling and disposal activities.
- Adopt 8 (eight) regulatory frameworks.
- Train 1,561 people (835 men and 726 women) on managing PBDEs-UPOPs related substances in their manufacturing, recycling and disposal activities.
- 41,000 men, women and children safeguarded from the danger posed by PBDEs-UPOPs in plastics.

### The Recycling Story

According to Pak Syafei, a Kejagan Village leader, at least 700 people work on recycling. The village in East Java has one of the largest non-organic waste management centres that processes waste from various regions in the country. According to Pak Ali Mustofa, 150 tonnes/day of plastics and waste are collected daily. It started very small in the 1970s with very few recyclers and collectors, since most villagers concentrated on farming.



TWO FEMALE WORKERS IN MOJOKERTO AREA ARE DISMANTLING E-WASTE FOR FURTHER PROCESSING. PHOTO BY INDONESIA PBDES-UPOPS PROJECT





GEF GRANT (USD):  
\$3,990,000



CO-FINANCING (USD):  
\$18,731,594



PARTNER INSTITUTIONS  
• MINISTRY OF INDUSTRY

This changed when villagers saw the progress made by recycling units. Pak Syafei said farmers told him "... from waste recycling we can earn money every day while from farming we can earn nothing during the planting season and we have to wait for harvest time to earn money." While many men continued to farm, their wives used trucks to transport waste and recyclables from cities to the village. In the 1980s, male workers started participating in recycling activities, using motorbikes or bicycles with large baskets on both sides to take village fruits (e.g. pineapple, cassava) to the closest cities (e.g. Mojokerto, Surabaya) to sell and returned with waste and recyclables they collected house-to-house. The waste recycling industry in Kejagan has been expanding and villagers now collect waste and recyclables from other regions of Java. Now 70% of Kejagan's population work on waste and recycling and only 30% work in agriculture.

The project is working with plastics recycling industries and associations to train workers on key health, safety and environmental aspects in the workplace. Training has covered the importance of personal protective equipment, establishment of gender-sensitive standard operating procedures (SOP) in the workplace, national standards for several products, technical guidance, etc.

### A Champion on Gender Equality



Ms. Nurul Latifah started her plastic waste separation business in 2005, competing with 8 male recyclers and 1 other female recycler to gain a soft loan (0.5% p.a.) from "Bank Perkreditan Rakyat" (People's Credit Bank).

After going through a process of training and social-networking activities hosted by the District Agency on Industry and Trade, the bank selected her and one male recycler to receive the loan. She said "it was very difficult when she started collecting plastic waste and recyclables in trucks from the nearby cities". She felt bullied since very few women collected plastic waste alone. But she carried on and prospered, hiring 7 male and 15 female workers to collect and separate the waste and crush it into raw material to be sold in the market.

Following her training under the UNDP-GEF project, Nurul gained confidence, skills and became more aware of the danger of PBDEs and other potential POPs in wastes, and how to address the issues. She has been involved in project preparation, gender equality and livelihood assessment, and completed the gender equality training module, finance literacy module, and HSE module development.

She is motivated to share her knowledge and experience with other plastic recyclers. She works with a programme implemented by local government agencies to promote sound management of e-waste and products that contain POPs. She informed more than 30 business owners and workers of the danger of PBDEs in e-waste (such as computer monitors, mobile phones, etc.) in the last year. Some of her colleagues felt she was trying to win the waste recycling business competition by spreading the news on the danger of PBDEs in plastic waste.

Nurul carries on, saying it is time for communities to better manage plastic waste recycling thereby safeguarding communities from POPs and UPOPs. She also expects this small-scale recycling will provide better socio-economic returns for workers, business owners, and communities in the area.

### Key lessons learned from the project

- Processing of waste and recycling can become profitable socio-economic approaches for villagers.
- Female workers are playing a very significant role in this business alongside male workers. Women are proud of their achievements and this helps promote gender equality.
- Standard operating procedures (SOP) and other policies on health and safety applied in the workplace must consider the needs of both male and female workers. Business owners are encouraged to promote equal payment (wages) based on capacity and not on sex-based justification.



A MALE WORKER DISMANTLING E-WASTE IN MOJOKERTO AREA.  
PHOTO BY INDONESIA PBDES-UPOPS PROJECT

# COLOMBIA

## Development of National Capacity for the Environmentally Sound Management and Disposal of PCBs

### Background

This project is directly related to SDGs #9 and #12 and to UNDP's Strategic Plan. The Project's environmental objective is to protect human health and the environment by the phase-out of 600 tonnes of contaminated material. The long term development objective of the project is to establish a sound PCB management system in Colombia through strengthening of institutions for analyzing, quantifying and controlling of PCB, the implementation of an inventory at national scale, and the promotion and development of technologies for PCB treatment and disposal.

### The project so far has:

- Prepared the Technical Manual for the Environmentally Sound Management of PCBs in Colombia.
- Eliminated 1,600 tonnes of PCBs, including pure PCBs, contaminated oils, contaminated equipment and other wastes.
- Developed and implemented 3 pilot projects to test viable approaches for the decontamination and elimination of equipment contaminated with PCBs. This work was carried out in close cooperation with the electricity sector. As a result, Colombia now has 4 treatment plants for environmentally safe management, decontamination, and disposal of PCBs.
- Labelled and Identified the PCB content in 3,500 pieces of electrical equipment.
- Assisted in establishing 14 accredited laboratories for the provision of laboratory services for the analytical determination of PCB content.



PCB PROJECT IMPLEMENTATION. SANDRA PUERTAS, ENGINEER OF THE EPM COMPANY TOGETHER WITH THE WORK TEAM OF THE PCB DECHLORINATION PLANT IN MEDELLIN - COLOMBIA. PHOTO BY EPM (EMPRESAS PÚBLICAS DE MEDELLÍN)



GEF GRANT (USD):  
\$3,400,000



CO-FINANCING (USD):  
\$16,205,093



PARTNER INSTITUTIONS  
• Ministry of Environment and Sustainable Development

- Updated national regulations associated with the integral management of PCBs, these regulations have been adopted by the national government.

### Anecdote



Sandra Puertas, an engineer at Empresas Públicas de Medellín (a Public Utility Company).

“The project allowed us to understand the importance of properly managing PCBs through awareness raising and information sharing. However, the project’s impact was ensured because it also helped us to develop skills to undertake environmentally sound management of PCBs thus allowing all the electric utility companies to adapt in order to meet those demands. The PCB project advised our company in the installation of a dechlorinating technology with sodium to treat PCB oils from the company’s equipment. The project also trained our company personnel on the proper management of PCBs, including the areas of electric power distribution and the PCB treatment plant”.

### Key lessons learned from the project

- Various stakeholders participated in all stages of project development, which allowed everyone to feel part of the project and thus contribute to its success.
- It is important to engage in constructive discussion with various stakeholders; this allows for the proper identification of all relevant actors.
- The relationship of trust among governmental, scientific and private actors facilitated the development of guidelines and relevant instruments for effective regulations of PCB management taking into account the situation of the country.
- The participation of the private sector, such as companies in the electricity sector and entities engaged in research, was one of the main factors leading to the success of the project.
- The pilot and demonstration projects represent a very effective mechanism to “learn-by-doing”, thereby facilitating knowledge transfer and appropriate technological adaptation.



PCB PROJECT IMPLEMENTATION. PHOTO BY THE MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT OF COLOMBIA.



PCB PROJECT IMPLEMENTATION. PHOTO BY THE MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT OF COLOMBIA.



# ECUADOR

## Integrated and Environmental Sound Management of PCBs in Ecuador

### Background

This project is directly related to SDGs #3, #6, #8, #9, #12, #14 and #15 and to UNDP's Strategic Plan on solutions developed at national and sub-national levels for sustainable management of natural resources, ecosystem services, chemicals and waste.

### The project has been able to:

- Eliminate 1,127 metric tonnes of PCBs from which 137 tonnes were contaminated with more than 50 ppm and 990 were below 50 ppm concentration of PCBs.
- Inventory, collect, replace and eliminate all PCB equipment from the Galapagos Islands, thereby making the Galapagos a PCB-free island.
- Strengthen national capacities through the development of national policies to properly manage PCBs.
- Train 2,430 people (40% women and 60% men) to manage PCBs.
- Characterize 16 sites suspected of being contaminated and clean 7 of these contaminated sites.
- Increase PCB analytical capacity fourfold and support the accreditation of two laboratories.
- Ensure sustainability through the involvement of all key stakeholders during project implementation and to promote replicability by strengthening the capacity of utility companies for sound PCB management.



REPLACEMENT OF PCB CONTAMINATED TRANSFORMER (ISABELA, GALAPAGOS). PHOTO BY ECUADOR PCB PROJECT





GEF GRANT (USD):  
\$2,000,000



CO-FINANCING (USD):  
\$9,393,949



PARTNER INSTITUTIONS  
• Ministry of Environment

## The Galapagos Islands

PCBs have been used for decades in many industrial applications, especially in the electrical sector due to their characteristics of low volatility and high fire resistance, making them an excellent additive for dielectric oils from electric transformers and capacitors. Through the Project led by the Ministry of the Environment in coordination with UNDP and the Galápagos Electricity Company (Elecgalapagos), all transformers in the province were analyzed, and all contaminated equipment identified, labeled, packaged and transported to the Netherlands for proper elimination, making the Galápagos the first province in Ecuador to be PCB-free.

“Although these transformers were in good working condition and the national regulation to handle these substances allows their use until 2023, the project prioritized their removal from the Galapagos Islands, considering the global interest for the fragility and uniqueness of its ecosystems. Today, Galapagos is an icon for the implementation of a measure that is progressively expected to be adopted throughout the country” said Mario Rodas, PCB Project Coordinator, Ecuador.

## Cheli's story

I am a beautiful old Galapagos Turtle named “Cheli” from the species *Chelonoidis*. I will soon be celebrating my 100th birthday and over the decades have had so many offspring. We live in the highest parts of the Islands (volcanos). My ancestors were in the thousands and they were hunted for food until almost all were extinct. I am so happy that I am a protected endangered species – now my babies and I can survive into old age. I remember 70-80 years ago there was much less development on the island, now there are a lot of people but luckily for me many are tourists who come to see me and not to eat me!

I was interested to see the nice humans remove those old contaminated transformers lying around the island – they looked ugly but I did not know how dangerous they were. They told me the PCBs may affect turtle eggshells making them softer and unable to last the necessary time until hatching. Maybe that is why baby turtles are not born in the same numbers as before and why I keep on having fewer and fewer babies over the decades. I am so happy the caring humans made my home PCB-free. It is good for me and my babies and also good for them. Galapagos has been called the Enchanted Islands and now that we are PCB-free perhaps I can live another 100 years!

## Key lessons learned from the project

- The proper management of hazardous chemical substances is directly related to the protection of the environment and conservation of biodiversity.
- For Ecuador, protection of the Galapagos is critically important to maintain the unique biodiversity of the Islands, protect the health of humans and land/marine life, as well as show the world how to cost-effectively protect earth's unique biodiversity treasures.
- Working with the private sector (here the hotel sector) is highly effective; with the proper motivation, it can encourage the owners of electrical equipment (or chemical substances) to manage them properly.
- The efforts to maintain the Islands as “PCB Free” is continuous, as it is necessary to control the entrance to the Archipelago of equipment and oil (for replacement or refilling).
- Although the Galapagos is now PCB-free, equipment containing dielectric oil without PCBs is considered dangerous as well, and represents a risk to the environment and health. After carrying out a cost-benefit study, the three alternatives found were: 1) substitution of mineral oil by vegetable oil in all equipment; 2) replace the old electrical equipment with modern, eco-friendly devices and; 3) the status quo. Due to the importance of the ecosystem and in spite of the greater cost, the best option was the second one – “to replace the old electrical equipment with modern eco-friendly devices.



“CHELI” TORTUGA GALÁPAGO. PHOTO BY VICTOR UTRERAS

# CHINA

## Reduction of UPOPs in the Secondary Copper Production Sector

### Background

This UNDP/GEF project titled “UPOPs Reduction through BAT/BEP and PPP-based Industry Chain Management in Secondary Copper Production Sector in China” is directly related to SDGs #9 and #12 and to UNDP’s Strategic Plan. By minimizing industrial pollutants, the project has reduced pollution related health impacts and developed a set of BAT/BEP (Best Available Technologies/Best Environmental Practices) to increase China’s capacity to meet its obligations under the Stockholm Convention.

### Project Achievements and Impacts

- *The Technical Regulation on Applying and Issuing Pollutant Discharge Permits for Secondary Non-ferrous Metal Industry* was formulated and issued by MEE. The regulation is the primary technical document guiding local governments on pollutant discharge permits. More than 800 staff from local environmental protection agencies and enterprises have been trained and over 400 permits will be issued covering all secondary non-ferrous metal enterprises in China.
- *The Evaluation Indicator System of Clean Production in Secondary Copper Industry* was jointly issued by National Development and Reform Committee, MEE, and the Ministry of Industry and Information Technologies. It provides technical support and assessment standards for mandatory clean production in the secondary copper industry.

- Two policy research documents on *Technical Policies on Pollutants Control in Secondary Copper Sector* and *Economic Policies on Pollutants Control in Secondary Copper Sector* were submitted to regulatory governmental agencies, and the project will advocate for their adoption as national standards.
- In the two factories that will demonstrate PCDD/F reduction, the upgrading and installation of environmental facilities for pollution controls are underway and will be completed in 2019.
- The project organized 10 site visits and investigations in the Jiangxi demonstration province, 9 investigations in secondary copper parks, and also visited 10 secondary copper smelting enterprises to collect data and monitor progress.
- 33 training sessions were conducted and participants included 810 governmental officials, 875 technical workers, 181 managers from 10 enterprises and 2,300 other trainees.

### Anecdote

Jiangxi province has one-third of all the copper deposits in China. Copper factories spreading across Jiangxi have created thousands of jobs for locals. For example, in Zeng Chunmei’s hometown Fuzhou, Jiangxi Zili Environmental Technologies Co. Ltd. which employs 1,740 workers is the leading copper smelting company and also the project’s BAT/BEP demonstration factory.



EXAMINING THE QUALITIES OF ANODE PLATES AT JIANGXI ZILI ENVIRONMENTAL PROTECTION TECHNOLOGY CO. LTD. PHOTO BY LE LAN



GEF GRANT (USD):

\$12,600,000



CO-FINANCING (USD):

\$52,450,000



PARTNER INSTITUTIONS

• FECO, Ministry of Ecology and Environment (MEE)

Growing-up in this heavy industry city, Zeng Chunmei was interested in machines and hoped to find a job in a local copper factory. But there was a saying in Jiangxi that women cannot work around smelting furnaces as they will bring bad luck and extinguish the furnace fire! It is also dusty, smoggy and smelly work and so many women prefer to work in administration or general operations. While Zeng Chunmei wanted to be a furnace technician, she also worried about the unpredictable health impact since the furnace workshop had not upgraded its environmental standards. In 2011, she started work in the operations team of Zili.

In 2015, she heard Zili had applied for the UNDP/GEF project and then saw the environmental changes taking place including new covered storage sections in the workshops to categorize raw materials. Dust collectors were installed together with water spray systems. Extensive upgrading was underway to reduce POPs and heavy metals, through bag filters, a second combustion room, quenching and activated carbon. In Nov. 2016 she came to Beijing to attend the inception meeting of this project. *"This experience was mind-blowing. It was the first time in my life I found out there was a profession called gender expert. And the expert taught us how to analyze gender-based needs and also create equal and diverse opportunities for female workers in smelting factories".* After the inception meeting, Zeng Chunmei switched to managing the desulfurizing and dedusting of the anode furnace. *"I was thrilled that I was now able to work directly in managing the furnace. See, I didn't extinguish the furnace, instead I extinguished the rumor that females cannot work around furnaces"* she said smiling.

Since 2015, the project team and experts have visited Zili more than 10 times for baseline studies, monitoring and evaluations. Training always covered upgrading environmental facilities and performance and promoting gender mainstreaming. Of the 33 training courses, almost half included gender-related materials. Zeng Chunmei was promoted to chief of the anode furnace section and is one of the few female management team members in the factory. She has become an unofficial gender champion and has recruited and trained more female workers – at present, 20 out of 56 staff in her section are female, which is unprecedented in the factory history. *"I feel so proud and empowered that I am now able to work in the most important section of our factory. Without the GEF project's emphasis on gender equality, I cannot imagine that a copper factory would take actions to empower women and assign us in key posts. But I have to say the improved working conditions are also very important to convincing females to work directly with furnaces".*

## Key lessons learned from the project

- The project helped develop regulations and standards, and most have been issued by relevant ministries as national standards or guidance. Projects need to keep in close contact with regulatory governmental agencies and also keep abreast with the latest environmental trends to ensure the policy and technical work of the project is fully relevant to national needs.
- The two BAT/BEP demonstration enterprises have undergone extensive facilities upgrading and modifications to meet the requirements for POPs reduction. However, retrofitting work is complicated and also requires heavy co-financing from the enterprises. Future facilities upgrading work in GEF projects should allow sufficient time for feasibility studies to be completed.
- The project provided many rounds of tailor-made training sessions for issuing agencies and enterprises to study *the Technical Regulation on Applying and Issuing Pollutant Discharge Permits for Secondary Non-ferrous Metal Industry*. Those training sessions played a key role in applying for and issuing permits. The success reveals that training can only succeed when it is closely tied to stakeholder needs.
- The secondary copper sector shares many similarities and synergies with other secondary non-ferrous metal sectors, such as lead, zinc, and aluminum. The project should summarize and disseminate its experiences and lessons learned to these related sectors.



ZENG CHUNMEI TOOK A PICTURE IN THE FACTORY AFTER WINNING BEST STAFF AWARD. PHOTO BY LE LAN OF ZILI ENVIRONMENTAL TECHNOLOGIES CO. LTD

## ACKNOWLEDGEMENTS

The views expressed in this publication do not necessarily represent those of the United Nations Development Programme, its Executive Board, the United Nations Member States, or Global Environment Facility.

This is an independent publication by the UNDP Montreal Protocol and Chemicals Unit.

The boundaries and names shown and the designations used on maps in this document do not imply official endorsement or acceptance by the United Nations.

All rights reserved. This publication or parts of it may not be reproduced, stored by means of any system or transmitted, in any form or by any medium, whether electronic, mechanical, photocopied, recorded or of any other type, without the prior permission of the United Nations Development Programme.

**OVERALL COORDINATOR:** Ms. Xiaofang Zhou, Director, Montreal Protocol/Chemicals Unit

**TECHNICAL EDITORS:** Frank Pinto and Ajiniyaz Reimov

**CONTRIBUTORS:** Selimcan Azizoglu, Jose Alvaro Rodriguez Castañeda, Etienne Gonin, Nina Gor, Fitsum Habtemariam, Carlos Andres Hernandez, Monica Gaba Kapadia, Kasper Koefoed-Hansen, Christine Wellington Moore, Anton Sri Probiyantono, Mario Rodas, Maksim Surkov, Zhyldyz Uzakbaeva, Hilda Van der Veen, Han Yang, Moses Zangar Jr.

**ADDITIONAL INPUT/SUPPORT PROVIDED BY:** Rodolfo Alonday, Nejat Ncube, Loise Nganga

**DESIGNER:** Camilo J. Salomon @ [www.cjsalomon.com](http://www.cjsalomon.com)

**PRINTER:** GSB Digital



*Empowered lives.  
Resilient nations.*

Montreal Protocol/Chemicals Unit  
Sustainable Development Cluster  
Bureau for Policy and Programme Support  
United Nations Development Programme  
304 East 45<sup>th</sup> Street, 9<sup>th</sup> Floor  
New York, NY 10017

[www.undp.org/chemicals](http://www.undp.org/chemicals)  
[www.undp.org](http://www.undp.org)

Copyright © UNDP April 2019