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Feature Article

TCSB's 2nd Anniversary: Building a Safe Chemical Environment

The EPA's Toxic and Chemical Substances Bureau (TCSB) has facilitated the implementation of many important measures since its establishment nearly two years ago. First, in response to food safety concerns, the *Toxic Chemical Substances Control Act*（毒性化學物質管理法）was amended to promote better source management. The TCSB also expanded the capacity of ChemiCloud and inspection and audit functions, coordinated controls for buildings containing asbestos, and improved toxic chemical incident prevention and response measures. In the future, the EPA will continue to work toward realizing its vision of safety management for chemical substances via effective controls to build a healthy and sustainable environment.

Amendment of the *Toxic Chemical Substances Control Act*

The public has long been concerned about the use of chemical substances in food products. In order to further control them at the source, the EPA proposed a draft revision that the *Toxic Chemical Substances Control Act* be changed to the *Toxic and Concerned Chemical Substances Control Act*（毒性及關注化學物質管理法）.

In the revision, existing controls for Class 1~4 toxic chemical substances remain while the "concerned chemical substances" will be newly added with chapters for their own control regulations. After evaluation, harmful chemical substances will be put on the control list along with toxic ones, thus expanding the Act's scope and tiered management: Competent authorities will have more inspection powers; a foundation is to be set up for risk prevention and control to raise money; and consulting mechanisms will be strengthened to respond to environmental accidents. Also, the revision reviews the existing responsibilities of central and regional competent authorities, and brings in clauses for whistleblowers, witness protection, public reporting, civil litigation, and the confiscation of

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illegal gains. After being reviewed by a committee of the Legislative Yuan, the draft passed the third reading at the Legislative Yuan on 21 December this year.

Strengthening chemical substance source control and expanding utilization and functions of ChemiCloud

(1) Gradual chemical substance control and cooperation with local governments on assistance and inspections

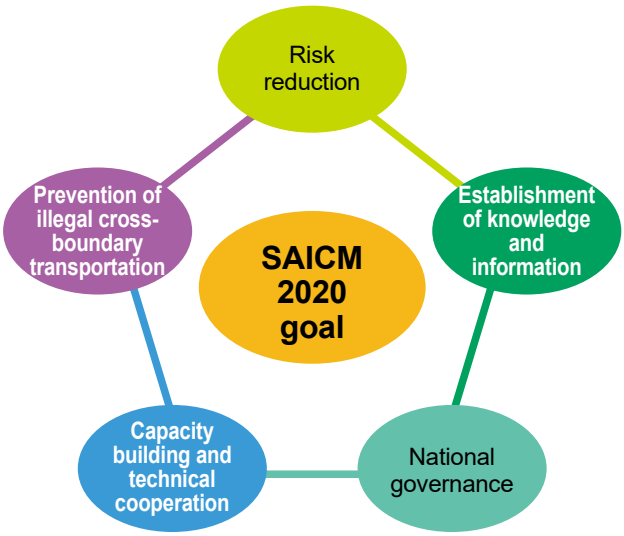
At source management is implemented to expand controls in stages and groups. Announcements have been made incrementally, based on different features of chemical substances.

Fifty-seven chemical substances with potential food safety risks were split into two batches in 2017 and 2018, while 27 of them have been announced as Class 4 substances. The users are required to report flows and mention the chemicals on warning labels: "Banned for food" and "Prohibited for food and feed." They must obtain permits for usage before operation, and are not allowed to transfer the goods without authorization in order to be prevented from entering the food chains.

Working with regional environmental bureaus for preventive consultations and visits, the EPA completed 3,102 cases as of 15 December 2018. They included 2,550 consultations and visits to suppliers of chemical raw materials, 268 joint inspections on chemical raw material suppliers selling food additives and 284 consultations during Dragon Boat Festival. In addition, 12 users were counseled as model sites, and 113 consultations and visits were conducted in the feed industry.

Under the guidance of the Food Safety Office, Executive Yuan, the *Action Plan for Joint Inspection on Chemical Raw Material Suppliers Selling Food Additives*, carried out by the EPA and the Ministry of Health and Welfare (MOHW), has screened 268 enterprises since 1 July 2018. They were inspected for different aspects of toxic chemical substances control: Four self-management points for chemical substances; food product enterprise registration; labeling for products containing food additives; and three guidelines for food additive management. All inspections were completely done as of 31 October 2018, and no violations of toxic chemical laws were found. Other violations against the *Act Governing Food Sanitation* have been found by the health authorities and were given limited time for improvement.

(2) Continual updating of the



1. Collecting chemical substances data
2. Reducing risks of chemical substances
3. Enhancing accident prevention and emergency response
4. Promoting clean production
5. Increasing awareness of harmful chemicals
6. Strengthening national chemical substances control policy
7. Enhancing international cooperation
8. Formulating cross-border control strategies
9. Establishing a national inspection and testing unit

Taiwan's chemical substances management and performance is reviewed with nine indicators that align with the UN Strategic Approach to International Chemicals Management

chemical substances database and additional inquiries and scheduled inspections

Between 11 December 2014 and 16 December 2018, the TCSB was in charge of 2,772 registrations of new chemical substances and 15,005 registrations of first-stage existing substances (more than 27,000 existing chemical substances registered). Since 1 October 2018, all the chemical substance registrations and reviews were changed from entrusting other organizations to self-administered by the TCSB.

Considering inter-ministerial management needs and trends in international chemical substances registration systems, the EPA preannounced the revision of the *New Chemical Substances and Existing Substances Data Registration Regulations*（新化學物質及既有物質資料登錄辦法） in March 2018. The revision focuses on coordinating Taiwan's chemical substances registration system. Also, 106 widely used existing substances with high potential of harm for which data were lacking would be listed in the first stage to complete the standard registrations and announcement of the registered chemical substances for annual reports.

Since its establishment in June 2015, ChemiCloud has been coordinating and transferring data from 9 ministries and 44 systemic databases. Four main functions, including basic information inquiry, diverse screening for suspected enterprises, cross-area comparison and analysis, and warning, have been set up for the data. It strengthens interdepartmental management and exchange on chemical substances information as each department is able to access relevant information for its operations.

Promotion of asbestos measures and interdepartmental discussions on management of structures containing asbestos

(1) Promotion of asbestos use

Manufacturing, import, sale, and use of crocidolite and amosite have been banned since 26 February 1997. Besides research, testing, and education, all uses of asbestos have been banned as of 1 January 2018.

In 2016, the EPA established the Asbestos Risk Information Platform jointly with the Ministry of Labor, MOHW, Ministry of Economic Affaris, and Ministry of the Interior. A booklet on asbestos risk and prevention promotion was published in 2017 as a result of interdepartmental efforts. Then in 2018, the EPA, the Construction and Planning Agency (CPA) of MOI, and Occupational Safety and Health Administration (OSHA) of MOL, produced a short video, "About Asbestos". They also held three seminars promoting asbestos risk and management of asbestos-containing construction materials in northern, central, and southern Taiwan. The aim was to strengthen education and training of asbestos prevention and protection as well as risk communication with the public.

(2) Interdepartmental coordination on asbestos removal and disposal management

The MOI's Construction and Planning Agency (CPA) assured that all new building materials sold in Taiwan are now free of asbestos. For demolishing, clearing, and disposal of asbestos-containing building materials, the EPA has discussed with the CPA and the Occupational Safety and Health Administration (OSHA), Ministry of Labor (MOL), on systems, regulations, data sharing, and division of responsibilities. The aim is to lower the risk of exposure to asbestos.

Enhancing toxic substances and chemical substances disaster prevention and rescue capacity

(1) Lowering harm and risk of toxic chemical substance disasters

From January 2018 to the end of November, a total of 408 on-site consultations and 205 trials without prior warnings were carried out with help from regional governments to tighten toxic chemical substance risk management and disaster prevention. It was done to supervise and help enterprises improve their substance management. The EPA also assisted enterprises to form joint national chemical substance incident prevention organizations. So far, 102 joint organizations have been formed, with over 4,500 enterprises participating.

Handling cross-regional joint preventions, two briefings, 76 joint prevention organization consultations and inspections, and 41 at-site operation trials and trainings for joint prevention organizations; eight trainings for "Northern, Central, and

Southern District Joint Prevention and Rescue Teams for Toxic Chemical Disasters". And a total of six sessions were held in the "Northern, Central and Southern District Toxic Chemical Disaster Prevention and Mobilization Seminar."

(2) Incorporating disaster response capacity

Between January and the end of November 2018, the EPA investigated 451 accidents in Taiwan, deployed personnel for disaster response support 44 times, and offered professional emergency consultation and suggestions 195 times. The purpose is to help relevant authorities become familiar with the joint response mechanism and incorporate the response capacity of enterprises in different regions.

Remediation technology enhancement and promotion of international exchanges

In the future, the EPA will continue to promote various measures in stages. These measures include keeping up with farmland pollution, strengthening pollution prevention and control, pursuing liable parties, establishing a soil quality database, holding an inter-ministerial discussion on homeland planning management strategies, and formulating a sustainable protection mechanism for quality soil.

The EPA stays updated on international developments in pollution investigation and remediation technology and introduces new technology suited to the characteristics of Taiwan's pollution sites and remediation needs. Other efforts are directed toward local technology development, improving existing technology, and technological assistance. The EPA has also expanded international exchanges and cooperation, established the Asia-Pacific Regional Soil and Groundwater Pollution Remediation Task Team, and enhanced remediation technology capacity.

Promotion of international exchanges

The EPA promotes chemical substance control with a vision of building a healthy and sustainable environment via effective controls, and hopes to strengthen chemical substance safety management using government policies and resources. Hopefully, chemical substances can be properly used to give a competitive edge in safe international trade while achieving sustainable development.

Environmental Management

Greenhouse Gas Emission Control Action Programs Promulgated

On 3 October 2018, the EPA launched the *Greenhouse Gas Emission Control Action Programs*（溫室氣體排放管制行動方案）which target six major sectors, namely: energy, manufacturing, transportation, residence and commerce, agriculture, and environment. The Action Programs were formulated in accordance with the *Greenhouse Gas Reduction and Management Act*（溫室氣體減量及管理法）and mainly focus on carbon reduction measures from 2018 to 2020. In addition, the Action Programs are also supported by the *Phase 1 Goals for Greenhouse Gas Emission Controls*, which aim to reduce carbon emissions by 2% compared to the baseline year (2005) before 2020.

The *Special Report on Global Warming of 1.5°C* was recently released by the Intergovernmental Panel on Climate Change (IPCC) on 8 October 2018. The report urges the world to speed up the progress on climate change countermeasures before the damage to the ecosystem becomes irreversible. To better adapt to climate change, the report also suggests rapid and far-reaching transitions in land, energy, industry, buildings, transport, and cities.

The *Greenhouse Gas Reduction Promotion Program* divides the phased emission reduction goals and action plans into six categories, namely: energy, manufacturing, commerce and residence, transportation, agriculture, and environment. All related central government agencies, including the Ministry of Economic Affairs (MOEA), Ministry of Transportation and Communications (MOTC), Ministry of the Interior (MOI), Council of Agriculture (COA), and the EPA, are required to take responsibilities in drafting control measures based

on the Promotion Program.

The main focus of the Programs are:

1. Promoting energy transition:
   Increase the electricity generation rate by renewable energy to 20% by 2025, and reduce carbon emissions from energy production by 11.2% (from 0.554 kg CO_2 per kWh in 2017 to 0.492 kg CO_2 per kWh in 2020.)

2. Transitioning into a low-carbon industrial structure:
   Prior to 2020, reduce the carbon intensity of the manufacturing sector by 43% of what it was in 2005.

3. Promoting the use and development of green transportation:
   Increase the use of public transportation from 2015 to 2020 by at least 7%. Achieve information transparency on the energy consumption of buildings by 2020. Increase the energy efficiency standards of buildings by 10% from 2016 to 2020.

4. Promoting electricity generation from methane gas:
   Reach the goal of having at least 50% of farm animal waste used in power generation by 2020. Strengthen the use of methane emissions from landfills and industrial wastewater. Increase the national wastewater treatment rate to 60.8%.

After the *Greenhouse Gas Emission Control Action Programs* have been launched, all related central competent authorities have to submit their annual implementation report on their emission reduction measures. The EPA has already been preparing for the performance report on the phased control goals from 2016 to 2017, and will submit it to the Executive Yuan by the end of this year. Evaluations on emission data and statistics will be conducted, and parties failing to achieve the control goals will have to formulate improvement plans. Control targets will be reviewed and modified every five years on a rolling basis to reach Taiwan's carbon reduction goals.

As a consequence of the increasingly frequent occurrence of heat waves, droughts, and floods, many government departments have not attained significant results from their emission reduction measures. Therefore, the Executive Yuan has requested each department to look for the root of the problems and to come up with innovative methods for improvement, which will be disclosed to the public.

The EPA has been discussing the *Greenhouse Gas Control Implementation Plan* with local governments and encouraging them to formulate their own GHG control plans based on regional characteristics. More than ten cities/counties are expected to finish their draft plans by the end of the year. In addition, the EPA and related ministries have reached a consensus to set the Phase 2 GHG emission control goals in 2025 to be 10% lower than the baseline year, and to enhance capacity building.

Air

Air Pollutant Emission Standards for Boilers Announced

On 19 September 2018, the EPA announced the *Boiler Air Pollutant Emission Standards*（鍋爐空氣污染物排放標準）that tighten emission standards for particulate pollutants, sulfur oxides, and nitrogen oxides produced by boilers. With growing demand for better air quality, the EPA has included boiler improvement as a key part of the *Air Pollution Control Action Plan*（空氣污染防制行動方案）and focused on control and subsidization at the same time. The new standards are expected to effectively accelerate boiler replacement and strengthen reduction of pollutant emissions.

The EPA stated that it has tightened emission standards for large-scale combustion emission sources of specified industries. However, boiler-generated emissions from general industries, taking up 10~20% of Taiwan's total emissions, fall only under the *Stationary Pollution Source Air Pollutant Emission Standards*（固定污染源空氣污染物排放標準）. Moreover, emission standards for sulfur oxides and nitrogen oxides had not been evaluated and revised for a period of time, so it was necessary to formulate a specific set of standards for boiler equipment.

In order to enhance measures to improve air quality, the Standards were formulated by referencing international boiler-related emission standards, evaluating Taiwan's current emissions, and analyzing available control technology as well as costs and benefits. With no distinctions made for scales and fuel types, emission standards for particulate pollutants, sulfur oxides, and nitrogen oxides are set at 30 mg/Nm3, 50 ppm, and 100 ppm, respectively. Enterprises will also have time to make improvements before all boilers are required to be in compliance with the Standards by 1 July 2020. Emissions for sulfur oxides, nitrogen oxides, and particulate pollutants are expected to lower by 8,567 tons/year, 4,246 tons/year, and 2,598 tons/year, respectively.

The EPA encourages enterprises to begin improvements as early as possible and take advantage of subsidy plans offered by the EPA and the Industrial Development Bureau (IDB) of the Ministry of Economic Affairs (MOEA). The EPA and IDB are also available for consultations, should there be any problems concerning subsidization.

Sustainable Development

Taiwan Hosts APEC Roundtable Meeting for Sustainable Marine Environment

On 3~4 October 2018, the EPA hosted the 19th APEC Roundtable Meeting on Participation of the Business/Private Sector in Sustainability of the Marine Environment. It was attended by delegates from nine APEC members: Indonesia, Malaysia, the Philippines, Singapore, South Korea, Thailand, the US, Vietnam, and Taiwan. Over 60 participants representing governments, NGOs, private enterprises, experts, and scholars discussed two major topics, climate change and the marine ecosystem as well as reducing marine pollution. The focus was to enhance participation of corporations and the private sector to safeguard marine environments and pursue sustainable utilization of marine resources.

Sixteen speakers gave presentations on issues such as climate change, public and private sector responses to climate change and disaster mitigation, coastal environment monitoring systems, ocean waste control, marine pollution monitoring and response, and public awareness. Suggestions were proposed during discussions at the end of the meeting, which will be used as references for the APEC Ocean and Fisheries Work Group (OFWG) Meeting in 2019.

Dr. Huichen Chien, Executive Director of the EPA's Office of Sustainable Development, speaks in a discussion session during the meeting.

The EPA stated that Taiwan is surrounded by oceans, so the issues of climate change mitigation, marine pollution prevention and control, fisheries, marine ecosystem preservation, and marine protection zones all closely affect its well-being. To align with the UN's 14th Sustainable Development Goal (SDG), "conserve and sustainably use the oceans, seas and marine resources", the EPA also listed plastic-free oceans and ocean waste reduction among its main policies. The *Taiwan Ocean Waste Control Action Plan*（臺灣海洋廢棄

物治理行動方案）was brought up in 2018 in order to gradually achieve the vision of plastic-free oceans.

Ocean waste has become an issue of international concern. Malaysia, Singapore, South Korea, and Taiwan shared experiences in ocean waste control and plastic reduction in the roundtable meeting. The aim was to accelerate exchanges and cooperation among APEC members and discuss controls on and removal of ocean waste. The Ocean Observation Administration (OOA), which was established in April 2018, was invited to the meeting to share Taiwan's marine pollution response mechanisms.

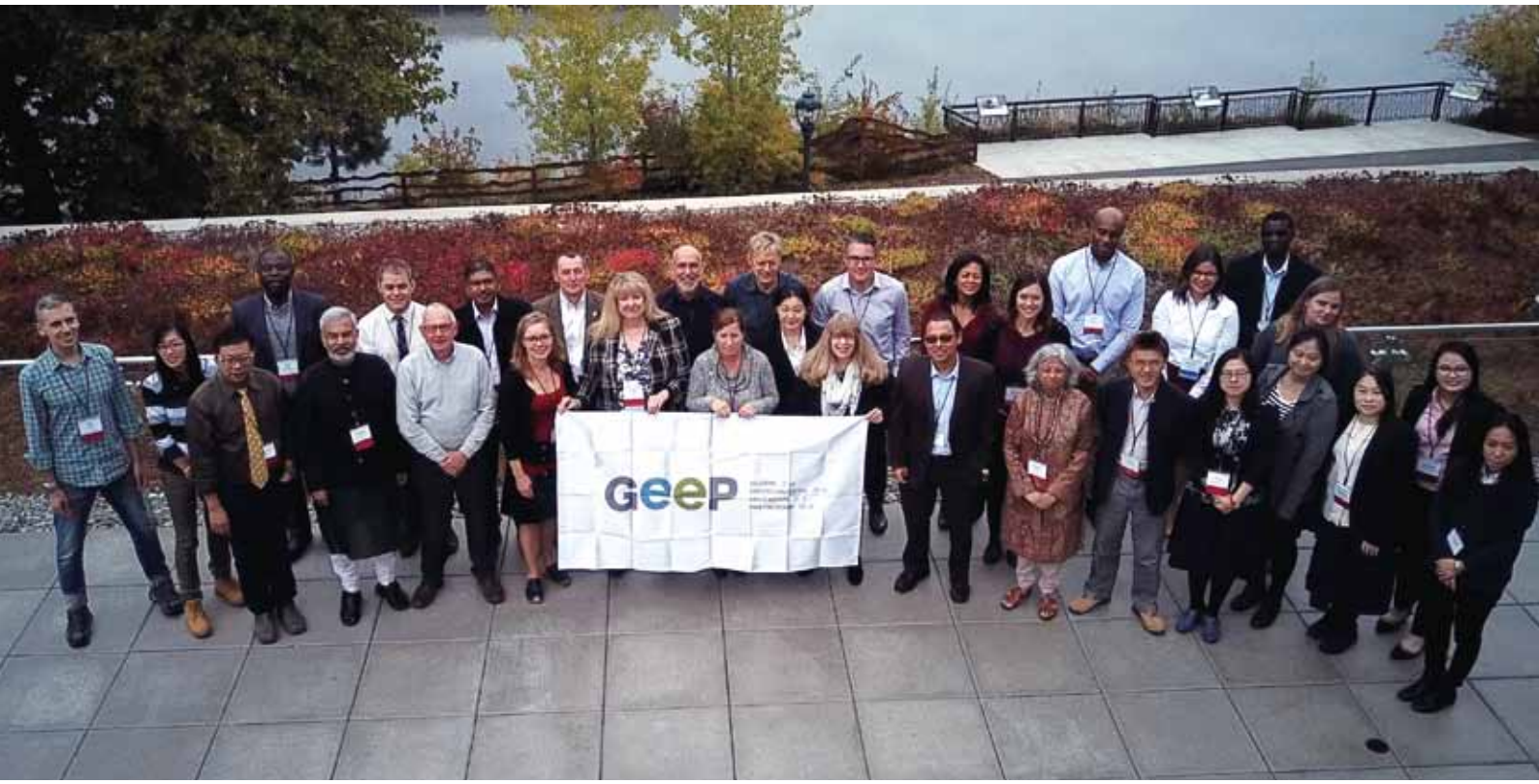
As marine resources supply vital food and other economic sources in the Asia-Pacific region, meeting participants all stressed the pressure and challenges posed to marine resources by climate change, pollution, and overfishing. APEC members can cut marine pollution, face climate change challenges, and protect marine environments together only through sustainable marine resource management, and through digital and internet collaboration utilizing innovative technology and satellite monitoring. The EPA expressed hope that with the joint efforts of countries in the Asia-Pacific region, a harmonious relationship between humans and oceans could be reached, and that all would be able to enjoy a sustainable environment with all marine species protected.

Environmental Education

2018 GEEP Delegation Meeting Held in US

On 12 July, USEPA Principal Deputy Assistant Administrator Jane Nishida visited Taiwan and met with EPA Minister Ying-Yuan Lee to promote the Taiwan-US joint International Environmental Partnership (IEP) program. In the second half of 2018, Taiwan and the US will jointly organize events such as the 7th Annual Asia Pacific Mercury Monitoring Training Workshop, the Global Circular Economy Symposium, the International E-Waste Management Network (IEMN) Meeting, and the Global Environmental Education Partnership (GEEP).

2018 GEEP Delegation Meeting (outside of Spokane Convention Center)



On 8-9 October 2018, the EPA and the USEPA jointly held a Global Environmental Education Partnership (GEEP) Conference in Spokane Washington. Participants of the conference included 32 environmental education specialists and scholars representing governments and NGOs from 15 different nations. A variety of topics were covered in the conference and would also be further discussed in the annual conference of the North American Association for Environmental Education (NAAEE), including: incorporating global environmental education in the UN's Sustainable Development Goals (SDGs); arranging an Asia-Pacific environmental education meeting; and connecting regional environmental education networks to ensure the sustainability of global environmental education.

This conference was cohosted by the EPA and the USEPA with participants of government officials, experts and scholars from 15 nations: Australia, Botswana, Canada, Denmark, Finland, Ghana, Japan, India, Malaysia, the Netherlands, New Zealand, Russia, the UK, the US, and Taiwan. Representatives from Taiwan included two experts in the field of environmental education and were led by Pei-Yu Wu, Deputy Director of the EPA's Department of Comprehensive Planning.

At the opening ceremony, Deputy Director Wu pointed out that the world has now entered the age of extreme climate change and natural disasters. While facing all the problems such as melting ice caps, droughts and heat waves, the world should concentrate on the promotion of the SDGs to expand the influence and awareness of environmental education and protection for better environmental literacy and public participation.

International Cooperation

USEPA Principal Deputy Assistant Administrator Jane Nishida Shares Results of the IEP

Jane Nishida, USEPA Principal Deputy Assistant Administrator, was invited to attend the Yushan Forum to give a keynote speech on 11 October 2018 on the results of the Taiwan-US joint International Environmental Partnership (IEP) program. Her speech outlined the long-term accomplishments of Taiwan-US environmental cooperation. Ms. Nishida also acknowledged the results in environmental quality preservation, environmental policy, technological exchanges, and global construction of sustainable environments, all achieved by the central and local governments in Taiwan as well as the USEPA.

The EPA pointed out that it has been 25 years since Taiwan signed the first bilateral environmental cooperation agreements with the US in 1993, and that both jointly launched the IEP in 2014. The IEP is a global program particularly focused on the Asia-Pacific region, where economic development activities have grown the fastest in the world. There have been a total of 80 events with more than 40 countries participating since its launch.

Environmental education, e-waste management, air quality, mercury monitoring, and soil and groundwater pollution remediation and restoration are among the common environmental priorities the IEP has been working to solve. The first Asia-Pacific Children's Health Symposium was held in 2017 to raise public awareness of environmental health issues concerning children. Through the IEP, the EPA and USEPA have worked with dozens of organizations across Asia and the world to help Taiwan and other countries promote bilateral and regional collaborations.

In 2018, the IEP organized several events, including the preparation meeting for the Global Environmental Education Partnership (GEEP) Consultant Group Meeting, the Asia-Pacific Environmental Education Preparation Meeting, and the Air Quality Control Strategy Exchange Symposium, all held in Taipei in June. The 8th International E-Waste Management Network (IEMN), and the 7th Annual Asia Pacific Mercury Monitoring Training Workshop were also held in Manila, the Philippines in September. Current work includes preparation for the second Asia-Pacific Children's Health Symposium in 2019.

Waste

International Conference on Sustainable Materials Management and Workshop Held to Display Circular Economy Results

The EPA held the 5th International Conference on Sustainable Materials Management (SMM) and SMM Workshop. The conference focused on the plastic issue. Officials, experts, and guests from various countries discussed the latest trends in circular economy and declared the goal of total control of plastic disposables by 2030. At the same time, the workshop investigated cooperation between private and public sectors, and between nations under international partnership mechanism so as to achieve a circular economy via SMM.

Experts from different countries discussed a Circular Economy of Plastic

Under the International Environmental Partnership (IEP) Program's framework, the EPA held the 5th International Conference of SMM in the GIS Convention Center of the Ministry of Transportation and Communications on 19 November 2018. The topic this year was "From Waste to Valuables: Redefining Plastics for A Circular Economy". Government representatives and scholars in various industries from Taiwan, the EU, the Netherlands, New Zealand, Japan, Germany, and the US, all attended and discussed the issues of plastics and circular economy.

Taiwan has always been a strong advocate of a circular economy. To respond to the strong emphasis placed on a plastic circular economy by the UN, EU, OECD, and various global organizations, the EPA began from improving the production concept, creating an eco-consumption model, and strengthening recycling systems. It also announced that a total ban on plastic disposables will be implemented in 2030 and that measures to reduce the use of plastic products will be expanded in 2018. A total ban on plastic microbead-containing products came into effect in July 2018 to build a well-rounded plastic circular economy and recycling industry to maintain the environment and ecosystems.

Professor Shin-Cheng Yeh, a former EPA Deputy Minister as well as Director of the Graduate Institute of Environmental Education of National Taiwan Normal University, was invited as the keynote speaker to share the core methods to promote a circular economy. In addition, strategies of plastic management and innovative technology were discussed among the attending local and foreign

Opening of International Conference of SMM

experts. Anestic Filopoulos, Policy Official of Grow at the European Commission, talked about Europe's plastic control strategies. Herman Huisman, senior advisor for international projects of the Ministry of Infrastructure and Environment in the Netherlands, shared his country's plan on a plastic circular economy. Akira Sakano, Director of Zero Waste Academy in Manikatsu, Takushima, told attendees about the zero waste movement in Japan. Jay Hadfield, Investment Manager of the New Zealand Ministry for the Environment, discussed New Zealand's journey on developing a circular economy for plastic resources. Moreover, plastic industry representatives from Remondis, Dupont, Carrefour, and Horng En Group were present to discuss the issue of expanding manufacturers' responsibilities and building a plastic value chain to generate business opportunities for plastic materials.

Cooperation between private and public sectors and among nations to create a partnership mechanism

On 20 November 2018, the SMM Workshop was held by the EPA with representatives and guests from various countries. The event focused on promoting cooperation between private and public sectors, as well as among nations under the IEP mechanism.

On cooperation between the private and public sectors, the discussion was on how governments and enterprises can work together to cut down plastic waste and relevant costs. Attendees also looked into how to promote SMM and a circular economy with smart technology via international cooperation among nations, as well as intensify bilateral and multilateral cooperation.

After the workshop, attendees headed to 2018 Taichung World Flora Exposition to visit venues featuring ideas related to a circular economy. The Humanitarian Eco-Tech Pavilion exhibited manufacturing, recycling and remanufacturing of plastic bottles by the recycling industry, and how they went from scraps of recycled bottles at the beginning, to granules, yarn, and fabric, to eco-products at the end.

The Netherlands Pavilion displayed various energy-conserving and green energy technologies like a pneumatic vacuum elevator, aquaponic farms, edible landscapes, sun-blocking vine walls. In addition, all equipment in the venue is mostly rented, instead of bought, to demonstrate the new business model and a circular economy that emphasize service. Nearly all building materials could be used repeatedly and would be used in the Taiwan Circular Design Zone in Taisugar's factory in Yuemei, Taichung, after the pavilion is demolished once the exposition ends.

General Policy

Leading Publication Features Taiwan's Experience in Waste Reduction

Seeing the increasingly serious problems of global waste, *The Economist* news magazine analyzed waste problems faced by countries in Europe, North America, and emerging and developing countries, along with possible solutions in its latest special features section. The report began with an introduction of the Taiwanese company Miniwiz and an interview with EPA Minister Ying-Yuan Lee, who talked about half of the teams in the 2018 World Cup wearing Taiwan-produced jerseys made of recycled PET bottles. This example serves as a cornerstone for a future circular economy. The report concluded with the statement, "Most (countries) have a long way to go before they emulate Taiwan".

The 29 September 2018 issue of *The Economist* did an extensive analysis, spreading across 12 pages, on global waste issues and mentioned certain countries' methods in tackling them. Journalist Jan Piotrowski first focused on Miniwiz to illustrate recycling and reuse in Taiwan. The feature then elaborated on how the recycling rate of household waste has reached 52% and that of industrial waste 77%, not only as good as the rates in Germany and South Korea, but also well above those in the US, which stand at 26% and 44%, respectively.

In the interview, Minister Lee talked about 16 of 32 teams participating in the 2018 World Cup in Russia

wearing made-in-Taiwan jerseys produced with thread made from recycled material. Taiwan's past problems with garbage disposal were mentioned, as well as its reduction of daily waste per capita from 1.15 kg 20 years ago to the current 0.85 kg. This was done by implementing measures including the establishment of 24 incinerators, promotion of extended producer responsibility (EPR), waste sorting, and severe penalties for illegal dumping and for profiting from illegal operations. Taiwan's efforts in at-source waste reduction and circular economy can be used as references for other countries.

The Economist stated that the world cannot escape from growing waste levels that tend to come with growing economies. Based on a World Bank report, a total of 2 billion tons of household garbage was produced in the world in 2016, 200 million tons over that of 2013, and nearly 3.4 billion tons are expected to be produced by the middle of the century. The feature then said that "emerging economies have led to rapid increase of global waste with waste treatment becoming an imminent problem". As a result, it is time to turn from the thinking of "raw material exploitation, manufacturing, and waste treatment" to that of "reduction, reuse, and reutilization".

Environmental Monitoring

Central and Regional Governments Monitor Pollution with Internet of Things and Smart Inspection

In 2018, 3,200 sensors were installed as part of the Internet of Things (IoT) for environmental monitoring. The public can check for real-time air quality by visiting the EPA's iEnv website. The EPA stated that it finished building the air pollution sensing IoT by working with 13 regional environmental bureaus and can now monitor over 30,000 factories that are under control. The effort is to aid environmental law enforcement with big data analysis and AI technology. It has also led the Environmental Police Unit (EPU) to discover 12 violations.

The EPA has been constructing its sensing IoT to provide the public with information on local air quality. By October 2018, sensors were installed in 2,500 locations in four municipalities (New Taipei, Taoyuan, Tainan, and Kaohsiung) and nine counties (Yilan, Keelong, Hsinchu, Miaoli, Yunlin, Chiayi, and Pingtung). In addition to the 700 sensors set up in 2017, the total monitored area covers over 30,000 factories under control across 120 towns, 44 major industrial zones and science parks.

To effectively investigate pollution sources, the EPU utilizes data from environmental management systems and various technologies based on pollution types, and conducts inspections and investigations by monitoring data from sensing IoT. Violations of 12 enterprises were discovered in 2018, leading to issuing of penalties. Also, the EPA will form the *In-Depth Inspection Plan for Stationary Pollution Sources* to target enterprises that have installed automatic continuous emission monitoring systems (CEMS) according to the regulations. Enterprises with large emissions are screened out and have their regularly reported air pollutant emission data compared. The plan will also analyze big data such as regional air quality changes and petitions in order to conduct inspections on possible pollution sources, punish violating enterprises, and improve air quality.

The EPA noted that it has cracked down on multiple violation incidents by combining environmental sensing IoT and smart detection functions. It proves that the

The EPA's iEnv website (https://ienv.epa.gov.tw/)

sensing IoT can aid environmental law enforcement and produce tangible results. People can now go to the EPA's iEnv website (https://ienv.epa.gov.tw/) to find the latest $PM_{2.5}$ data, which is updated at the sensor's spots every three minutes. The public can find air pollution sources with changing data and trends to take part in air quality improvement efforts.

Environmental Management

Online Map for Drinking Water Launched to Create a Low-carbon, Plastic-free Xiaoliuqiu

The EPA and the Pingtung County Government have worked in cooperation to promote the "Low-carbon, Plastic-free Xiaoliuqiu Model Project" aimed at reducing pollution caused by plastic waste. Currently there are nine areas with ten water machines installed at the tourist harbor, scenic areas, ferry waiting areas and the inspection office of Xiaoliuqiu, an island south of Kaohsiung. In addition, a map for drinking water on Xiaoliuqiu is made available by scanning a QR code, allowing people to know the location of water machines on the island.

The EPA stated that, in addition to locations of water machines, people can also access information about entities in charge of machine maintenance as well as data regarding E. coli., inspection organizations, inspection dates, and water quality. People who refill their bottles will gain a better understanding of the environmental benefits of using water machines. Each time they fill a bottle, the machine will indicate how many PET bottles have been reduced. It also serves as a reminder that drinking water is not only good for the body but can also be a way to show one's appreciation for the environment by reducing carbon. After less than one month's use, the water machines on Xiaoliuqiu have already reduced PET bottle usage by 10,000, given that the average bottle volume is 600ml. Refilling one bottle reduces the carbon footprint by 150 grams, with a total of 1,500 kilograms of carbon reduced since the machines were installed.

Through Online Map for Drinking Water, people can access information about entities in charge of machine maintenance as well as data regarding E. coli., inspection organizations, inspection dates, and water quality.

Xiaoliuqiu is the only coral reef island among Taiwan's outlying islands. With its beautiful landscape, rich biodiversity and the world's densest habitat for green sea turtles, Xiaoliuqiu is a precious gift for the Taiwanese people.

The plan to make Xiaoliuqiu a plastic-free and low-carbon area, with its small area yet high density of tourists, will help maintain the island's environment and protect the green sea turtle, an invaluable asset for tourism. The plan also allows Xiaoliuqiu's tourism industry to develop a mode of sustainable operations.

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