ECOREA

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06

Environmental Health

E C O R E A

is a compound of the prefix "ECO", which suggests an ecologically sound and comfortable environment, and the name the of the nation, "KOREA"

Main Policy Framework

(1) Protecting People's Health from Environmental Risks
(2) Chemical Control System
(3) Chemical Emissions Survey and Emission Reduction
(4) Improving Living Environments

Current Policy Focus

(1) Reinforced Management of Chemical Safety
(2) Chemicals Subject to International Control
(3) Asbestos Safety Management and Asbestos Injury Relief

Key Facts and Trends

(1) Number of Environmental Disease Patients
(2) Chemical Distribution and Emissions



Main Policy Framework

(1) Protecting People's Health from Environmental Risks

National Environmental Health Survey and Health Impact Surveys

The Ministry of Environment has been carrying out the Korean National Environmental Health Survey to systematically and continuously investigate the distribution and influencing factors of people's level of exposure to hazardous pollutants and use the data as basic information for environmental health policies. The survey, implemented since 2005, has been systematically organized by specifying legal grounds in the Environment Conservation Act as of 2009 and formulating and executing three-year plans.

The Stage 1 survey took place for three years from 2009 to 2011, and samples were designed by considering national representativeness and factors associated with exposure to environmental pollution based on the enumeration districts of the Population and Housing Census of Statistics Korea. A total of 350 enumeration districts were extracted, including standard areas, areas equipped with an air monitoring network, and coastal regions, with 6,000 adults completing a questionnaire together with the analysis of blood and urine levels of 16 environmentally harmful substances. The Stage 2 survey has been taking place from 2012 to 2014. It involves a 142-item questionnaire, 19 clinical tests, and biomonitoring of 21 types of environmentally harmful substances.

Separate health impact surveys are carried out for pregnant women, children, older adults, and other sensitive populations. The main examples are the "Maternal and Infant Health Impact Survey," "Children and Young Adults' Health Impact Survey," and "Senior Population Health Impact Survey" regarding exposure to environmentally harmful substances. Implemented since 2006, the Maternal and Infant Health Impact Survey has traced and monitored pregnant women's (fetal) and infants' exposure levels to heavy metals, endocrine disruptors, volatile organic compounds, and other environmentally harmful substances and infant health impacts (growth/

cognitive development disorders, atopic dermatitis, asthma, etc.) according to the stage of infant growth. The results confirmed that bodily concentrations of hazardous substances according to the pregnant women's living environments and breastfeeding decisions can affect children's weight and neural and cognitive development.

Recent efforts have focused on formulating systematic policies to reduce exposure to environmental pollution during growth to protect infants and children, populations that are particularly sensitive to environmental pollution. To obtain the basic data, a large birth cohort on infants and children has been in development since 2013 through a planned study titled "Design and Infrastructure Construction for Children's Environmental Health Research."

Health impact surveys have also been carried out on vulnerable populations in the surroundings of abandoned mines and industrial complexes. Detailed resident health impact surveys were conducted regarding 17 abandoned metal mines from 2005 to 2007, and detailed investigations and follow-up measures have been implemented since 2008 for residents who have exceeded heavy metal limits. A preliminary health impact survey was also conducted in 2007 on 401 abandoned metal mines that have exceeded soil contamination limits and therefore cause concerns over health impacts. The results of the preliminary survey identified 39 areas that required closer examination, and health impact surveys were completed in these areas in 2011. A long-term (20 year) health impact survey (cohort study) is being conducted for residents of industrial complexes with concerns regarding environmental diseases or high pollutant emissions. It began with the Ulsan Industrial Complex in 2003 and has currently been expanded to five industrial complexes.

Health Impact Assessment System

The Ministry of Environment has improved the previous environmental impact assessment system to operate a health impact assessment (HIA) system, which assesses impacts on human health in addition to environmental impacts prior to the implementation of a development project.

A basic database necessary for the development and evaluation of assessment techniques for each project type, including industrial complex construction and waste treatment facility

installation, was established in 2006. A pilot project to create an assessment form was carried out from 2007 to 2009, and the HIA system was fully implemented in 2010 in accordance with the Environment Conservation Act. The HIA currently focuses on the air quality, water quality, and noise and vibration impacts from industrial complex development and factory construction projects of a certain scale or larger, thermal power plant installation, and installation of waste treatment facilities, excreta treatment facilities, and public livestock wastewater treatment facilities. The HIA system will be further developed by increasing the scope of target projects and evaluation items based on the results of system operation so far.

Protecting the Health of Children and Other Sensitive Populations

The Ministry of Environment focuses on reinforcing environmental services for children, older adults, low-income earners, and other populations that are vulnerable to health damage caused by environmental pollution. Children are particularly vulnerable to exposure to environmental pollution or chemical substances because they have a high metabolic rate per unit mass, their respiratory and reproductive organs are not fully developed, and they tend to put anything they can reach in their mouths. Accordingly, environment health policies are being implemented with a priority on protecting children's health.

▶ Children's Activity Spaces

Analyses of pollutant sources and risk assessments were carried out through environment monitoring during a two-year period, with investigations giving priority to children's activity spaces with major hazard concerns, and control measures are being prepared based on the information obtained. The project began with children's playgrounds in 2006 and has been expanded to include childcare facilities, schools, and school zones. Investigations and risk assessments have been completed for children's playgrounds and control measures have been formulated accordingly.

In 2009, the Environment Health Act was amended to prepare environmental safety control

standards regarding matters such as indoor air pollutants, heavy metals, and parasites in children's activity spaces, making the facility owner or administrator responsible for controlling the hazards. Accordingly, since 2009 the government has been conducting an environmental safety diagnosis project on elementary schools, parks, daycare centers, and indoor and outdoor playgrounds that are subject to the environmental safety control standards. Any facility that is diagnosed with a problem or is inadequate is provided with eco-friendly paint and wallpaper, air handling units, air purifying plants, and CO_2 sensors as part of an environmental improvement project.

▶ Children's Products

Efforts are being made to identify environmental hazards contained in baby bottles, toys, and other objects that children frequently come into contact with and to minimize children's exposure to hazards through children's products. In order to achieve this, exposure and risk assessments are carried out regarding environmental hazards contained in children's products and the sale of any product whose results reveal hazards may be restricted or suspended.

Since 2007, risk assessment techniques for children's products have been established, and risk assessments are carried out on key substances and products. An announcement was made in 2009 specifying 135 types of environmental hazards contained in children's products, regarding which risk assessments are carried out according to the subsequently formulated implementation plans. Transfer or content limits for children's products are prescribed regarding substances whose risks are confirmed through the risk assessment, and limits were set for four substances in 2012. The "Project on Environmental Safety Diagnosis of Children's Products" was also implemented, which involves collecting and examining children's products that are available on the market.

Efforts are also being made to encourage manufacturers of children's products and other associated business operators to engage in self-management to voluntarily reduce environmental hazards. The Environment Health Act was amended in 2011 to prepare legal grounds regarding the formulation and implementation of self-management plans by business operators, and the government became able to provide financial assistance to business operators engaging in self-management. A self-management guideline was distributed in 2012 and financial assistance has

been provided since the end of 2012 to cover consultation and analysis costs for formulating self-management plans.

(2) Chemical Control System

Chemical safety has been managed in accordance with the Toxic Chemicals Control Act enacted in 1990. This system will be significantly reorganized by the Chemicals Control Act to be enforced as of January 1, 2015. This section gives a brief introduction to the current system; the provisions of the new Chemicals Control Act will be described in "**Current Policy Focus**. (1) Reinforced Management of Chemical Safety."

The Toxic Chemicals Control Act focuses on the toxicity management of chemicals, safety management of poisonous and toxic chemicals, investigating chemical emissions and distribution, and responding to chemical accidents.

Dangerous chemicals are currently classified into 900 types of poisonous substances and substances requiring preparation for accidents, 6,000 types of single dangerous substances, and energy and high-pressure gases. Target substances and control methods vary among government ministries. In the case of the Ministry of Environment, chemicals that have a high likelihood of accidents or are likely to cause major damage are designated as substances requiring preparation for accidents(69 types). Any facility that handles[1)] a certain amount or more is required to formulate and submit a self-prevention plan containing information on the toxicity of the substance concerned, status of control facilities and equipment owned, safety control organizations, staff and organization charts, and emergency measures to address any accidents.

Toxic chemicals are classified into poisonous substances and substances under observation according to the degree of toxicity identified in toxicity examination and safety tests. In order to import any poisonous substance, the type and purpose thereof must be declared to the Korea

1) Manufacture, use, retention, or storage.

Chemicals Management Association. The operation[2] of any such substance requires a poisonous substance business registration at the local government. According to a 2013 performance report, 45,046 thousand tons of poisonous chemicals were distributed, with 37,675 thousand tons manufactured and 7,371 thousand tons imported. There are 7,200 businesses selling poisonous substances. Substances that are deemed likely to be carcinogenic are designated as substances under observation. The manufacture or import of any substance under observation must be declared to the Korea Chemicals Management Association, but unlike poisonous substances, there are no special regulations regarding business operation.

Substances that are identified as being particularly harmful according to the results of risk assessments and those that are restricted or prohibited by international organizations and international agreements are specifically provided for. Restricted substances are significantly harmful when used for certain purposes and therefore distribution and use is prohibited for these specific purposes, while prohibited substances are prohibited under all circumstances. Currently 12 types of restricted substances and 60 types of prohibited substances have been designated.

(3) Chemical Emissions Survey and Emission Reduction

The "Chemical Emissions Survey System" identifies and notifies the government of the volume of chemicals that have been discharged or have moved into the environment (air, rivers, soil, wastes, etc.) from businesses that manufacture or use the chemicals. The government gathers the reported data and discloses it to the public.

The Ministry of Environment has been progressively increasing the scope of target chemicals and industries with the aim of identifying the total emissions of key chemicals in Korea. Starting with 80 chemicals in the two industries of oil refining and chemicals in 1999, the survey was carried out for 415 chemicals in 39 industries in 2011. The survey previously targeted establishments with 30 employees or more, but as of 2014 it targets establishments with one or

2) Manufacture, retention, storage, transportation, sale, or use.

more workers.

Emission surveys have also been conducted at nonpoint sources every four years since 2003. In 2011, the third survey was carried out for 15 nonpoint sources after adding two-wheeled vehicles, watercraft, and construction equipment to existing survey targets, including agriculture, homes, and railways.

Voluntary agreements are being used to reduce chemical emissions. The 30/50 program, a voluntary agreement to reduce chemical emissions, has been entered into by major emitters since 2004. The main aim of the agreement is to reduce emissions by 30% in the next three years and by 50% in the next five years, with participating companies being able to make their own decisions on which substances to reduce. From 2004 to 2009 the agreement had been signed by a total of 200 establishments, investing a total of 803.4 billion won to achieve an emission reduction of 80% compared to the baseline year.

The "Chemical Emission Reduction SMART (Stewardship-based Management for Area-specific Risk reduction Target) Program" has been implemented since 2011 to reduce emissions of chemicals of regional interest based on the achievements of the 30/50 program. The SMART program sets reduction goals for industrial complexes that emit large amounts of specific substances by gathering opinions from a variety of stakeholders, including local residents, environmental groups, associated businesses, and local governments. The pilot project began in 2011, and four industrial complexes had signed the agreement by the end of 2013. The aim is to reduce benzene by 100 tons, 1, 3-butadiene by 29 tons, and dichloromethane by 950 tons by 2019.

(4) Improving Living Environments

While intensifying urbanization has resulted in poorer conditions for controlling noise damage and indoor air, there is greater public demand for quality of life, and it is becoming increasingly necessary to improve people's everyday living environments. Accordingly, the Ministry of Environment has formulated various measures to address everyday matters such as indoor air quality, indoor radon, and noise levels while also carrying out basic research regarding electronic waves, light pollution, and other areas that lack adequate controls.

Indoor Air Quality

Korea manages the indoor air quality of 21 facility groups (public-use facilities) including subway stations, underground road shopping districts, medical institutions, steam rooms, large shops, and movie theaters in accordance with the "Indoor Air Quality Control in Public-use Facilities, etc. Act."

Maintenance limits are set for fine particles (PM_{10}), carbon dioxide (CO_2), formaldehyde (HCHO), total airborne bacteria, and carbon monoxide (CO), and any violation is addressed by administrative action such as fines or correction orders. For nitrogen dioxide (NO_2), radon (Rn), total volatile organic compounds (TVOC), asbestos, and ozone (O_3), which are relatively less dangerous or whose sources are located externally, recommended limits are set for self-regulated compliance.

Constructors of newly built multi-unit dwellings consisting of 100 or more homes, for which the "sick house syndrome" is of particular concern, are required to determine and announce the indoor air quality before the residents move in.

The Ministry of Environment also works together with associated government ministries to determine and announce construction materials that produce large amounts of pollutants such as formaldehyde and TVOC. Construction materials announced by the Minister of Environment are prohibited from indoor use in public-use facilities and multi-unit dwellings.

The "Public Transportation Indoor Air Quality Control Guideline" was prepared in December 2013 and has been enforced since March 2014 to improve the indoor air quality of urban railways (subway), railways, express and direct intercity buses, and other public transportation vehicles.

In addition, for small facilities that are not subject to legal controls, an indoor air quality analysis and improvement project management manual has been developed and distributed since 2007 to encourage the facility managers themselves to manage the indoor air quality.

Radon

Radon is a colorless, odorless, natural radioactive gas produced via the decay of uranium naturally present in soil and rocks. Exposure to radon that has been produced from the ground and has built up indoors can lead to lung cancer, making it necessary to control the radon concentration of indoor air. According to the World Health Organization, 3% to 14% of lung cancer worldwide is caused by radon, which has been named the second major cause of lung cancer after smoking.

In Korea, radon is controlled by setting a recommended limit (148 becquerels (Bq/m^3) = 4 picocuries (pCi/L)) for indoor air quality in public-use facilities.

Investigations were conducted in public buildings (661 schools, 439 government offices, 2008-2009), public-use facilities (330 locations, 2009-2010), 1,000 households (2010-2011), and 20,000 households (2011-2014) nationwide to examine indoor radon levels. Residential radon investigations will be further expanded and the results will be used to create a national radon map.

In addition, a free radon determination and reduction consultation service has been provided since 2012 for underground and ground floor residences, which are vulnerable to radon exposure. Any residence that has exceeded the limit and has a high radon concentration is provided with a radon alarm.

Noise and Vibration

Factory-generated noise is managed by the emission facility reporting and permit system under the Noise and Vibration Control Act. The noise-emitting facilities of factories are fixed noise sources; once installed, the noise source cannot be removed and may cause continuous damage to nearby areas. Installation of any noise-emitting facility near a school, general hospital, public library, multi-unit dwelling, residential area, childcare facility, or other places where quietness is required must be permitted by the local government. The reporting system is operated in other areas. There were 37,299 noise-emitting businesses subject to permits or reporting in 2013, and among these, 950 obtained a permit in a quiet area.

Traffic noise generated by sources such as motor vehicles and trains not only has very high noise levels, but also affects vast areas. In Korea, areas where damage caused by traffic noise is of concern are designated as traffic noise and vibration control areas, and measures can be taken such as speed restrictions and detour orders. In the case of motor vehicles, permissible limits are specified for the acceleration, exhaust, and horn noise of manufactured vehicles and the exhaust and horn noise of vehicles in operation. A noise map has been under construction in eight cities since 2013 to formulate reduction measures by identifying the noise distribution and exposed populations of each city.

There is a wide variety of everyday noise sources including megaphones, construction sites, work noise from small factories, and entertainment venues. While recent urbanization has led to an increase in everyday noise sources, there is growing demand for quiet living environments following enhanced living standards, which has resulted in a sharp increase in civil complaints regarding everyday noise and calls for measures to address the situation. In 2013, noise complaints accounted for 39.6% of all environmental complaints. The Noise and Vibration Control Act prescribes regulatory limits regarding noise generated by megaphones, small factories, and construction sites, and noise levels exceeding these limits are required to be addressed by reduction measures such as the installation of noise prevention facilities and work time adjustment. Recently there have been frequent incidents of noise between floors in multi-unit dwellings (apartments), resulting in conflicts between neighbors and creating a social problem. Accordingly, the Ministry

of Environment jointly enacted the "Control Standards on Noise between Floors in Multi-unit Dwellings" with the Ministry of Land, Infrastructure and Transport. In 2012, a professional agency was also established to provide consultation and mediation regarding noise between floors.

Fig. 6-1 Monitoring and Consultation for Noise between Floors



Aircraft noise generated by airports also affects surrounding areas. Accordingly, aircraft noise limits have been prescribed in the Noise and Vibration Control Act since 1994. The "Airport Noise Prevention and Areas Assistance Act" was enacted in 2010 to lay the groundwork for the successful execution of noise measures projects to address aircraft noise damage.

Vibration refers to strong shaking movements caused by the use of machinery and equipment. It usually spreads to buildings through the ground and generates secondary noise inside the buildings. The Noise and Vibration Control Act mandates the installation of anti-vibration facilities and prescribes permissible vibration limits. Factories in residential areas that have been the subject of civil complaints are required to install anti-vibration facilities prior to facility operation.

Light Pollution

Korea enforced the Act on the Prevention of Light Pollution by Artificial Lighting as of February 2013. According to this Act, regions of si and do areas that are affected by or are likely to be affected by light pollution can be classified into and designated as one of four types of lighting environment control areas. Installation of any lighting equipment in a lighting environment control area must comply with permissible light emission levels. The Ministry of Environment also prepared standards on public lighting in 2013. It plans to announce lighting equipment installation and control standards for advertisement lighting in 2014 and decorative lighting in 2015.

Current Policy Focus

(1) Reinforced Management of Chemical Safety

The Ministry of Environment is wholly amending the current chemical safety management system according to the Chemicals Control Act (CCA). It is also in the process of enacting the "Act on the Registration and Evaluation, etc. of Chemicals" (AREC). Both the CCA (June 4, 2013) and AREC (May 22, 2013) were promulgated in the first half of 2013 and will be enacted as of January 1, 2015. As of 2014, the Ministry of Environment is working towards the enactment of subordinate laws that contain specific details on the new system.

Reinforced control of chemicals and chemical accidents was initiated when hydrofluoric acid leaked from a chemical plant in Gumi-si in 2012, resulting in five employee deaths. Crops withered and the health of residents and livestock was affected in the surrounding area, which was declared a special disaster zone. This incident gave rise to greater social demand for a system to prevent and respond to chemical accidents. Chemical accident prevention and response policies are being implemented as part of the current policy focus of the Park Geun-hye administration.

Reinforced Management of Chemicals and Chemical Accidents

A toxic chemicals business permit system will be introduced by the newly enacted CCA. To obtain a toxic chemicals business permit, an off-site consequence analysis report, test report, and risk management plan must be submitted in addition to being equipped with facilities, equipment, and staff of a certain standard. The off-site consequence analysis system aims to prevent chemical accidents at the source. It involves quantitatively assessing the potential off-site impact of chemical accidents and applying the findings from the installation stage of chemical handling facilities.

Furthermore, fines have been significantly increased to reinforce the responsibility of toxic chemicals businesses. When the safety management of toxic chemicals is outsourced, the ordering party is responsible for managing the contractor, and it must not insist on unreasonable operation. Any legal violation by the contractor also affects the ordering party.

Every five years, handlers of substances requiring preparation for accidents must formulate a risk management plan that includes chemical accident leakage scenarios, emergency action plans, and damage restoration. This measure is stronger than previous regulations, which required handlers of substances requiring preparation for accidents of a certain size or larger to formulate self-prevention plans.

The reporting system for accidents was strengthened, requiring chemical handlers to address any chemical accident by taking emergency action according to the risk management plan and immediately reporting to the associated institution. Previous regulations required accidents to be reported only when there were concerns regarding human health or environmental risks, resulting in many reports being delayed or omitted.

Areas that are highly likely to be affected by accidents are designated as special control zones, where a specialized institution can be established to provide constant supervision regarding chemical control and respond to any accidents.

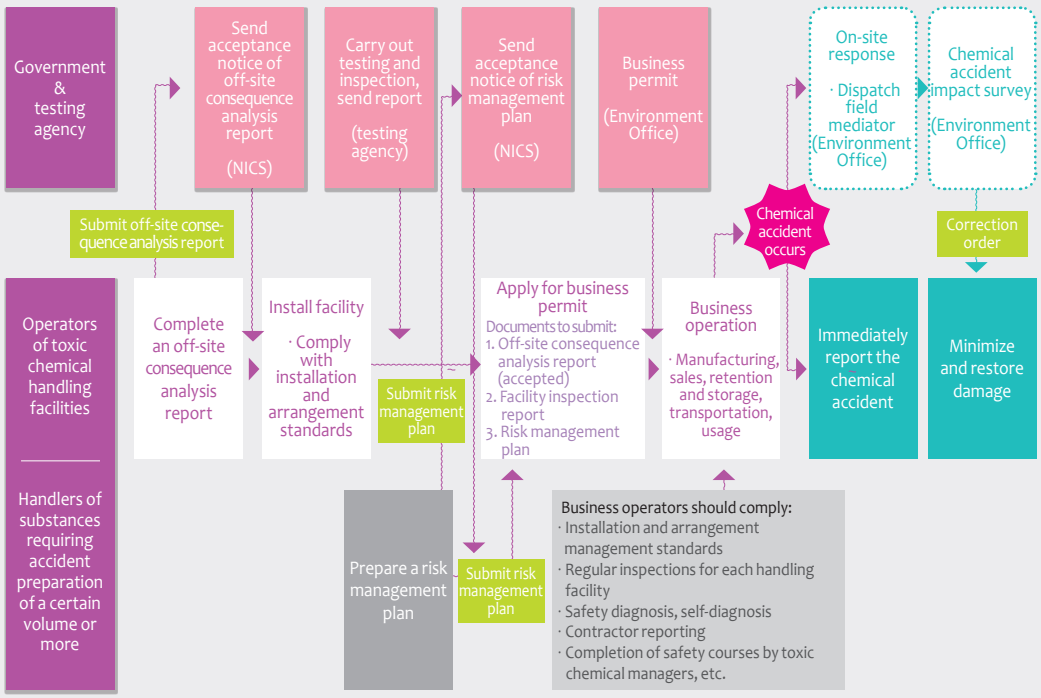
The chemical accident response system was reorganized so that the Ministry of Environment is in sole charge of all chemical accidents and field mediators can be assigned to accident sites to provide accident recovery and other assistance based on scientific decisions. The standard manual on chemical accidents is also being revised.

The National Institute of Chemical Safety (NICS) was newly established in 2013 as a specialized institution to be in charge of chemical accident prevention and responses. The NICS maintains an accident response information system, revises accident response manuals, provides assistance for accident site response and recovery, and offers professional training for chemical handling and response staff. It acts as a control tower for risk management and responses. It plans to run a chemical accident and anti-terrorism training course for the Ministry of Environment, local governments, firefighters, and other persons in charge of accident response. It will develop new training programs for field mediators and disaster prevention centers.

To share and integrate chemical accident-related staff and systems dispersed among government ministries, associated government ministries will work together to establish "chemical disaster prevention centers" in major industrial complexes to provide joint guidance and inspections for chemicals businesses and share information on chemicals.

Improvements will be made to the Chemical Accident Response Information System (CARIS) previously operated by the National Institute of Environmental Research to implement measures such as integration with information from other government ministries and establishment of a control system and enhanced driver training regarding vehicles transporting dangerous substances.

Fig. 6-2 "Chemicals Control Act" (CCA) Flow Chart



Introduction of a Chemical Registration and Evaluation System

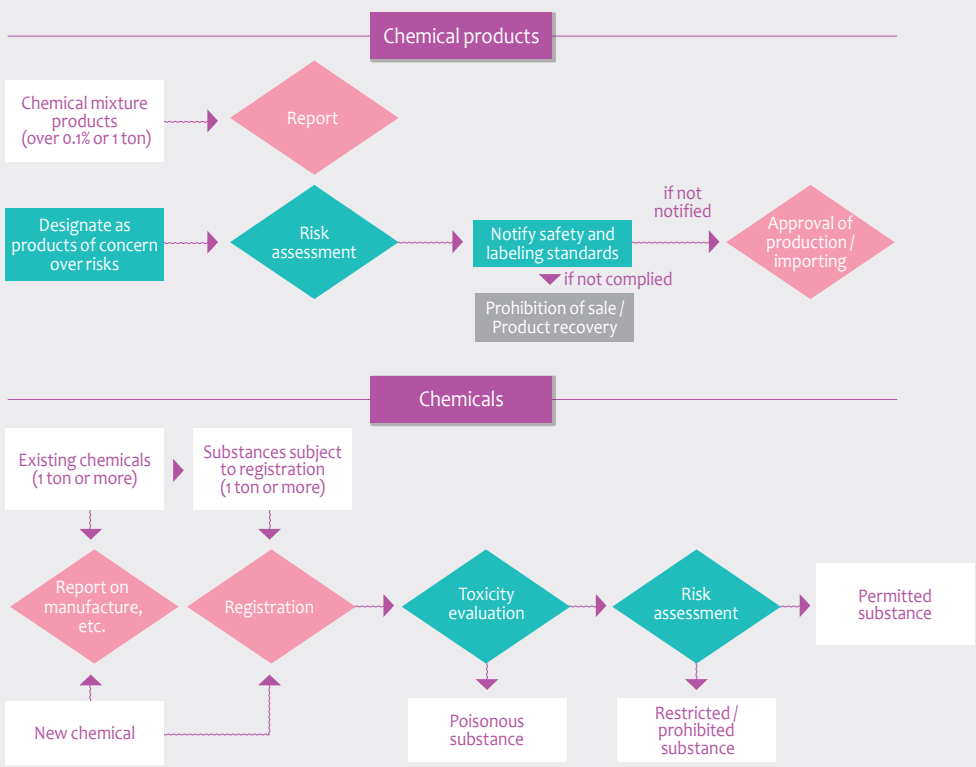
The Ministry of Environment, while protecting people's health and the environment from the harmfulness of chemicals through preventive measures, worked towards enacting the Act on the Registration and Evaluation, etc. of Chemicals (hereinafter "AREC") starting from late 2010 to promote the increased competitiveness of the Korean chemical industry. It was promulgated in May 2013 and will be enforced as of January 1, 2015. Enactment of AREC gained momentum due to accidents involving damage caused by humidifier disinfectants that occurred around 2011. It was necessary to identify accurate information on chemicals distributed in Korea.

The key provisions of AREC provide that: (1) Manufacturers, importers, and sellers of any new chemicals or not less than 1 ton of any existing chemical are to report on matters such as output and purpose on a yearly basis; (2) Any individual who wishes to manufacture or import any

new chemical or not less than 1 ton of any existing chemical subject to registration must submit information and be registered under the competent authorities; and (3) Registered chemicals must undergo toxicity evaluations and risk assessments and be classified into poisonous substances, permitted substances, and restricted and prohibited substances. A control system for chemicals was also introduced. It requires any product containing toxic chemicals to be reported, and any product that may cause harm must be produced and imported according to safety and labeling requirements.

The newly introduced AREC creates information on the toxicity and harmfulness of chemicals and allows the information to be shared between industries and the government. Businesses will be able to use the information for safety management and the government will also be able to formulate more-effective policies.

Fig. 6-3 "Act on the Registration and Evaluation, etc. of Chemicals" (AREC) Flow Chart



(2) Chemicals Subject to International Control

Mercury and the Minamata Convention on Mercury

Mercury (Hg) exists on Earth in three forms: as a metal element, inorganic mercury, and organic compounds. Inorganic mercury causes disorders upon inhalation, but this is mainly an issue upon occupational, high-concentration exposure. Organic mercury is consumed through food and can have serious effects on the central nervous system, kidneys, and liver. In Korea, a national survey conducted from 2005 to 2008 regarding heavy metal concentrations in the body found that the blood mercury concentration was 3.0~4.34μg/l, which is approximately five times greater than that of countries such as the United States and Germany. The limit of 5.8μg/l recommended by the U.S. EPA was exceeded by 30% of participants.

The Ministry of Environment has been implementing national measures for mercury control (Mercury Control Plan 2006-2010) since 2006. It is currently working on the 2nd Comprehensive Plan on Mercury Control (2011-2015), the vision of which is to "minimize health risks caused by mercury pollution." The aim of the 2nd Comprehensive Plan is to significantly reduce the proportion of the population displaying high blood mercury levels and to prepare for an international agreement on mercury, and involves projects across the following five sectors. First is the integrated management of the mercury life cycle from raw materials to mercury-containing products and waste products. Second is stricter mercury control in air, water, and waste emission facilities by reinforcing emission limits. Third is reinforced environment monitoring by strengthening the national mercury monitoring network and building a long-distance mercury monitoring system. Fourth is prevention of mercury damage in vulnerable and sensitive populations by preparing exposure reduction measures based on measures such as a basic survey on national health and human exposure monitoring of sensitive and vulnerable populations and high-exposure groups in specific areas, and by preparing a recommended seafood consumption guide. Fifth is strengthening the basis of mercury control by preparing for an international mercury agreement while also establishing an associated database.

Internationally, there are definite movements to create a UN-centered international agreement on mercury control. Since the decision was made in 2009 to pursue an agreement, there have been a total of five intergovernmental negotiating committee meetings, and this resulted in the adoption of the Minamata Convention on Mercury in Kumamoto, Japan in October 2013.

Korea has been actively participating in the intergovernmental negotiating committee to present ideas based on national opinions gathered through industrial groups. In preparation for the effectuation of the international mercury agreement, Korea will actively participate in the intergovernmental negotiating committee and get ready to join the agreement by communicating with industries and other stakeholders.

Persistent Organic Pollutants

Persistent organic pollutants (POPs) refer to substances such as DDT, PCBs, and dioxins that are highly toxic and are not easily broken down in natural environments, remaining for long periods of time and building up to high concentrations in organisms to pose major risks to humans and ecosystems. The Stockholm Convention on prohibiting the production and use of these substances was adopted by the UNEP in 2001 and took effect as of 2004. Korea ratified the Convention in January 2007.

▶ Dioxins

An emission source and emission volume survey project on dioxins has been carried out since 2001, and "national dioxin emissions (emissions inventory)" have been announced every two years since 2005. The survey includes steel, nonferrous metal, and other industries that emit dioxins in addition to waste incineration facilities, where dioxin controls have been in place since 1997.

According to the results of the national dioxin emissions (emissions inventory) survey, 120.9g I-TEQ/year of dioxins were emitted into the air in 2011, a reduction of 88% compared to 2001 (1,004g I-TEQ/year). Waste incineration facilities accounted for 42.8g I-TEQ/year of dioxins, a

reduction of 95.1% compared to 2001. This rapid decrease in dioxin emissions from incineration facilities appears to be the result of a variety of policies, such as expanding the application scope of dioxin regulations from medium to large incineration facilities to small incineration facilities of less than 0.2 tons starting from 2003, significantly tightening permissible emission levels, measuring dioxin emissions from emission facilities and encouraging establishments that exceed the limits to improve their facilities, and providing technical support for smaller establishments.

▶ PCBs

Discussions on eco-friendly methods to treat PCBs began in 2006, and technologies such as high-temperature incineration and chemical treatment are being developed to treat wastes containing PCBs in accordance with local circumstances. Because PCB reduction requires the status of contaminated equipment to be identified in advance, a PCB source inventory is being created by requiring the owners of oil-immersed transformers and other equipment subject to controls to declare the equipment, in addition to enforcing the Persistent Organic Pollutants Control Act.

There are an estimated 2.2 million transformers in Korea, 90% of which are owned by the Korea Electric Power Corporation (KEPCO). Approximately 20-25% of the transformers is designated waste containing 2ppm or more of PCBs and must be treated in accordance with legally prescribed standards. KEPCO has addressed approximately 150,000 waste transformers that had accumulated over the years until the end of 2010. From 2011, it has been creating a monthly handling system for treating wastes generated each month.

▶ New POPs

After 2009, perfluorooctane sulphonate (PFOS) and other new substances were added to the list of substances regulated under the Stockholm Convention. While the previous 12 substances were mostly agricultural chemicals, the newly listed substances were mostly industrial substances.

Korea amended laws in 2011 to prepare a domestic regulatory basis for the new POPs and is formulating control measures by investigating residues of new POPs in environmental media.

Ensuring the Safety of Nanomaterials

Nanomaterials are chemical substances measuring 1 to 100 nanometers in size, manufactured using nanotechnology. Substances such as silver, carbon, titanium dioxide, and gold exhibit different properties when produced in nanosize form. Nanomaterials are not only used by industries as new materials but can also be frequently encountered in everyday settings through sunscreens, cosmetics, purification filters, and other commercial products. The potential risks of nanomaterials, however, have not been thoroughly examined.

Accordingly, the OECD set up the Working Party on Manufactured Nanomaterials (WPMN) in September 2006 to review the impact of nanomaterials on human health and environmental safety. A nanomaterial safety test sponsorship program has been implemented for 14 types of manufactured nanomaterials. Korea is actively cooperating by participating in toxicity tests and supervising the sponsorship program.

To ensure the systematic implementation of nano safety-related projects, which were previously carried out by each government ministry, the Mid-term Plan on Nanomaterial Safety Management (2010-2014) was formulated by the Ministry of Environment in 2010. The pan-governmental "1st Comprehensive Plan on Nano Safety Management (2012-2016)" was formulated and has been implemented since 2011. A survey on the distribution and specific status of nanomaterials (2011-2015) is also in progress, through which a national nano inventory is being created.

(3) Asbestos Safety Management and Asbestos Injury Relief

Asbestos, when inhaled into the human body, is known to cause diseases such as malignant mesothelioma and lung cancer after an incubation period of 10-40 years. It was intensively used in Korea in the 1970s to 1990s, mainly for construction materials (82%), automotive parts such as brake linings (11%), and textiles (5%).

Due to concerns that asbestos will cause a rapid increase in occupational and environmental health damage, the Korean government announced 2007 as the first year of asbestos safety management, and the "Comprehensive Plan on Asbestos Control" was formulated jointly by associated government ministries. The 1st Asbestos Control Master Plan (2013-2017) has been implemented jointly by associated government ministries since 2013.

Asbestos use in Korea was wholly prohibited as of 2009, and as a result, the asbestos safety management became particularly important in terms of environmental health rather than industrial health. The Ministry of Environment is focusing on developing and implementing asbestos control policies in the environmental health sector such as the safe management and demolition of buildings in which asbestos has been used, appropriate treatment of waste asbestos, managing and restoring asbestos mines and areas with naturally occurring asbestos, and preparing a relief system for people whose health has been negatively affected by asbestos.

In order to achieve this, the Asbestos Injury Relief Act was enacted and a relief system was implemented from 2011 for people affected by asbestos injury. The Asbestos Safety Management Act was enacted and enforced as of April 2012 to manage the entire asbestos life cycle. The Ministry of Environment provides building asbestos control, support for slate roof removal, and asbestos injury relief. It has also prescribed an asbestos content limit (1%) for asbestos-containing minerals (substances that may contain asbestos) in accordance with the Asbestos Safety Management Act. It is creating a geological map showing the distribution of naturally occurring asbestos and training supervisors by designating training institutions for supervisors who will oversee asbestos dismantling businesses.

Asbestos Safety Management in Buildings

With the enforcement of the Asbestos Safety Management Act as of April 2012, government agencies, public institutions, schools, public-use facilities, cultural and convention facilities, medical facilities, and older adults' and children's facilities throughout the country must carry out an asbestos survey within two to three years. Buildings in which large amounts of asbestos have been used must prepare a building asbestos map that indicates the location, area, and condition of the asbestos materials used, and must designate an asbestos building safety manager to ensure building users do not suffer health damage due to scattering asbestos. If it is deemed that health risks caused by asbestos are of concern, the head of the local government may give orders to dismantle or remove the asbestos from the building.

Removal of Asbestos Slate Roofing in Agricultural and Fishing Villages

Slate is a construction material that typically has a high asbestos content (10-15%). It was widely used in Korea around the 1970s, especially in rural areas. According to a study by the Ministry of Environment in 2010, among the 6.83 million buildings nationwide approximately 1.23 million, or 18%, are slate buildings, of which 55% was built before the 1970s.

The deterioration of such a large number of asbestos slate roofs is raising concern over damage to residents' health. It appears highly likely that their removal will be delayed or handled inadequately due to cost burdens, as they are mainly concentrated in agricultural villages. To address this, the government worked together with associated government ministries to formulate the Comprehensive Plan on Slate Control (2011-2021) in 2010 and is working towards the timely removal of slate roofs by providing budget support. A total of 28 billion won was injected from the National Treasury from 2011 to 2013 to finance the removal of slate roofing from more than 30,000 buildings. In 2014, removal from 20,000 buildings will be supported with a subsidy of 28.8 billion won.

Asbestos Injury Relief System

The Asbestos Injury Relief Act has been enforced since 2011 to ensure timely and fair relief for people whose health has been damaged by asbestos and bereaved family members. The Asbestos Injury Relief Act is Korea's first damage relief act for an environmental disease. It is the sixth in the world after France (2002), Japan (2006), Belgium and the Netherlands (2007), and the United Kingdom (2008).

People whose health has been damaged by environmental asbestos exposure and those who have been affected by asbestos bereavement are eligible for asbestos injury relief. Upon applying for asbestos injury recognition, they may be able to receive a relief allowance (convalescence allowance, medical fees, funeral expenses, etc.) after a decision-making process by the Asbestos Injury Decision Committee. A person who is suspected to have suffered asbestos-related health damage is provided with health services such as regular health examinations.

Asbestos injury recognition applications and decisions are being actively made since the system was enforced on January 2011. As of the end of 2013, there were 1,730 cases of deliberations, and 1,035 of these were acknowledged as asbestos injuries.

Efforts are also being made for early identification of potential asbestos injury patients in high-risk groups. Health impact surveys are carried out on residents of areas near abandoned asbestos mines and asbestos factories and the alumni and teaching staff of schools in the surrounding areas.

It is likely that a considerable number of asbestos victims are unable to make full use of the injury relief system due to old age or restricted movement, creating difficulties in accessing information. Since 2011, the government has been increasing policy promotions and provision of relevant information while also providing injury relief by actively seeking asbestos victims instead of simply waiting for applications from victims. The addresses of potential asbestos victims are identified using information on asbestos patients registered with the National Health Insurance Service. These potential victims are provided with information on the system by mail, telephone, and home visits, and when requested, application forms can be completed on their behalf. Service information was provided to 1,795 people until early 2014, and of these, 457 were acknowledged as

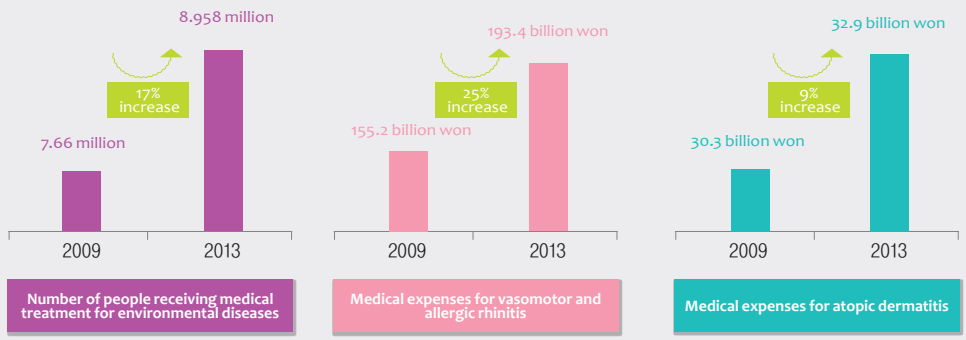
asbestos victims or bereaved family members and received 13.7 billion won in asbestos injury relief payments.

Key Facts and Trends

(1) Number of Environmental Disease Patients

An environmental disease is one that has been deemed to be associated with environmental hazards through epidemiological studies. The main examples are atopic dermatitis, asthma, and allergic rhinitis. According to statistics from the Health Insurance Review and Assessment Service, there were 8,958,000 patients with environmental diseases in 2013, a 17% increase from 2009. Medical costs for vasomotor and allergic rhinitis were 193.4 billion won in total, a substantial increase of 25% compared to four years ago. Atopic dermatitis also increased by 9%.

Fig. 6-4 Trends in Environmental Diseases



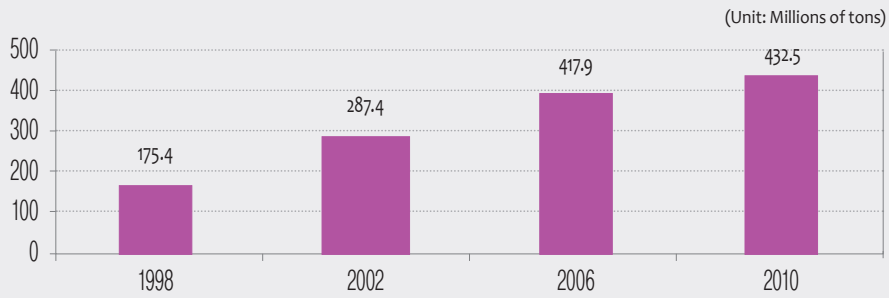
Source: Health Insurance Review and Assessment Service, Statistical Indices on Medical Expenses, 2013

(2) Chemical Distribution and Emissions

The production, import, usage, and export volume and purpose of use of each type of chemical substance distributed in Korea are identified through a chemical distribution survey, and the information obtained is used as basic data for chemical control policies. Originating from a pilot project on chemical distribution surveys in 1996, a total inspection is carried out every four years.

Chemical distribution in 2010 amounted to 432.5 million tons, a 3.5% (14.6 million ton) increase compared to 2006. A comparison of oil imports, manufacturing factory operation rates, and other national statistics on industrial production revealed similar trends.

Fig. 6-5 Chemical Distribution Trend



Pollutant Release and Transfer Registers (PRTR) is a system in which the amount of pollutants that are released into the air, rivers, soil, and other environments from an establishment during the course of handling chemical substances or the amount that moves outside the establishment for purposes of recycling or processing is identified by the emitters themselves and reported to the government, which then collates the information and discloses it to the public. PRTR began in 1999, and results have been announced every year since 2001 when the first results were announced.

Emission rates (emission volume/amount handled) have steadily decreased since PRTR was implemented. In the case of 10 types of Group 1 carcinogens such as benzene and 1,3-butadiene,

the amount handled is steadily increasing while emissions are decreasing, clearly highlighting the diminishing trend in emission rates.

Fig. 6-6 Chemical Emissions Trend

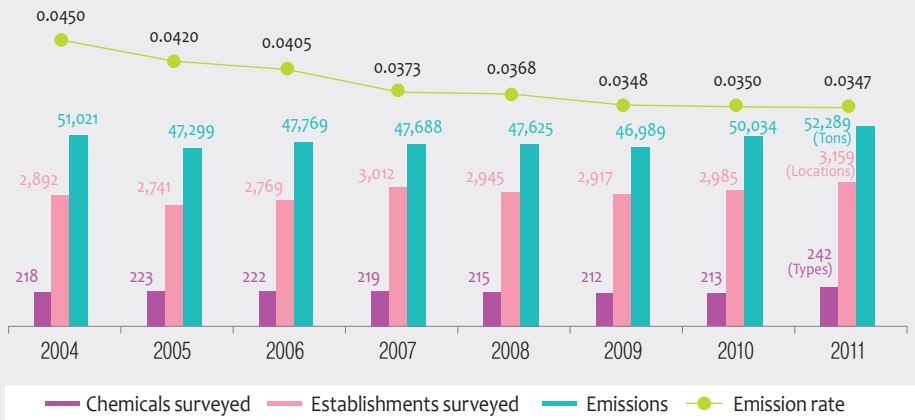
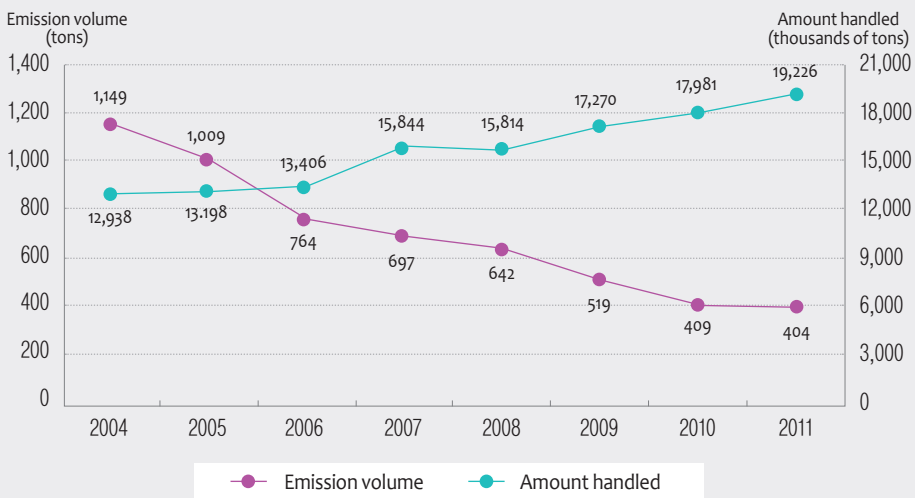


Fig. 6-7 Emissions Trend of Group 1 Carcinogens







07

Waste

E C O R E A

is a compound of the prefix "ECO", which suggests an ecologically sound and comfortable environment, and the name the of the nation, "KOREA"

Main Policy Framework

(1) Policy Direction of Resource Circulation

(2) Waste Management and Reduction

(3) Waste Recycling

(4) Hazardous Waste Management

Current Policy Focus

(1) Disposable Products and Over-packaged Products

(2) Volume-based Food Waste Fee System

(3) Waste Electrical & Electronic Product Recycling Target Management System

(4) Free Collection for Large-scale Household Appliances Waste

(5) Waste-to-Energy

Key facts and trends

(1) Waste Generation

(2) Waste Treatment



Main Policy Framework

(1) Policy Direction of Resource Circulation

The waste policy of the Ministry of Environment of Korea, based on the principle of resource circulation, is aimed at minimizing untreated wastes in landfill and maximizing recycling by refraining from the single use and disposal of energy and resources to create a resource circulation society in which natural resources and energy are recirculated within the economic activity areas for as long as possible.

Under this policy, the first fundamental plan of resource circulation (2011-2015) was established in 2011 with the goal of realizing a zero-waste society by going beyond the quantitative level of resource circulation and shifting towards "upcycling" that upgrades the value of waste resources.

In addition, the ministry announced measures to promote the transition to a resource circulation society in September 2013, which include free pickup services for large-scale waste home appliances, securement of the collection, transportation and classification of recycling resources, expansion of waste to energy facilities, creation of a recycling market, etc. To that end, it plans to establish the "Act on Promotion of Transition toward a Resource Circulation Society."

<Table 7-1> Paradigm Shift of Waste Management Policy

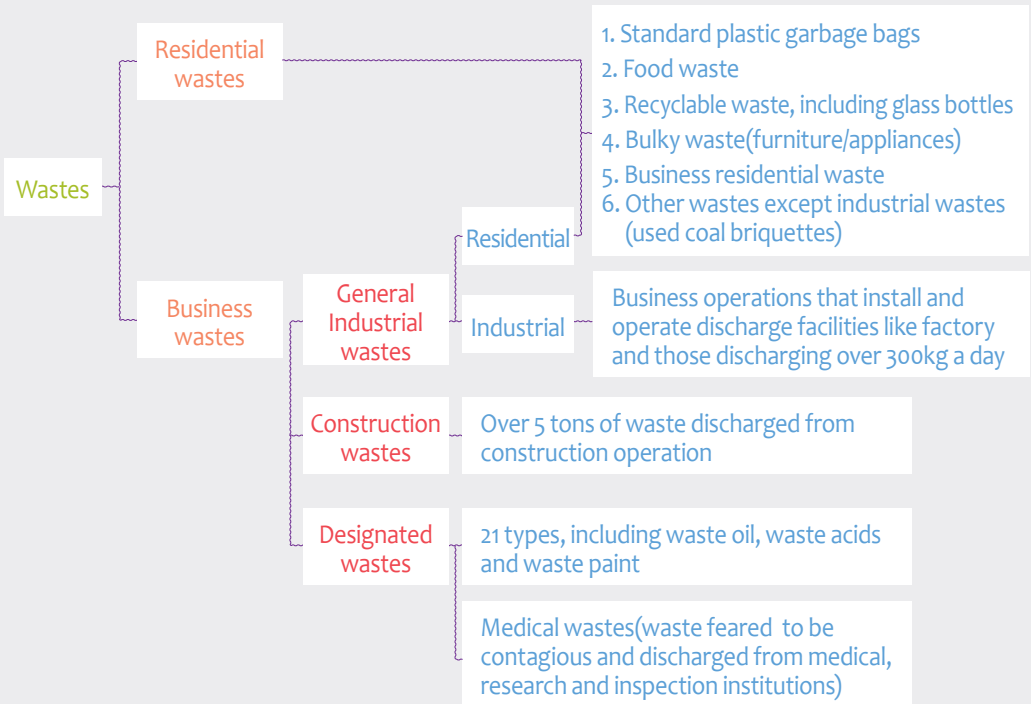
Category	Previous Policy Direction		New Policy Direction
Motivation	Worsened environmental pollution due to waste		Climate change, Raw material and energy exhaustion
Objective	Create clean living conditions	➡	Construct a resource circulation society
Implementation strategy	Reduction → Recycling → Treatment		Efficient Production/Consumption → Material recycling → Energy harvesting → Advancing treatment
Main Tasks	Volume-based waste fee system, EPR, and building the treatment facilities	➡	Resource recyclability evaluation, Recycled product quality certification, Waste-to-Energy, Merger of treatment district
Core concept	'Waste'		'Resource (Circulation/Natural)'

(2) Waste Management and Reduction

Legal Classification of Wastes

The Wastes Control Act largely classifies wastes into "residential wastes" and "business wastes" depending on the source of generation. Business wastes are divided into "general industrial waste", "construction waste", and "designated waste" according to hazardousness. Examples of designated wastes include 21 wastes with potential hazards to the human body, including waste oil, waste acids and medical waste, and construction waste takes up a considerable portion of industrial wastes.

Fig. 7-1 Legal Classfication of Wastes



Volume-based Waste Fee System

The Volume-based Waste Disposal System is a policy, in accordance with the polluter pays principle, to fundamentally reduce waste generation and facilitate separation and discharge of recyclable materials by imposing waste fees in proportion to the amount of residential wastes one generates (except recyclable wastes). Under this program, wastes are required to be discharged by using designated standard plastic garbage bags or putting on labels marking wastes as bulky waste, and the charges are collected by selling volume-rate garbage bags and labels marking wastes. In the case of discharging recyclable materials, they are collected free of charge regardless of the amount.

The Volume-based Waste Disposal System applies to residential waste discharged from households and business operations, and was recently expanded to cover food waste.[3] This program, launched in January 1995, is considered to have significantly decreased the amount of residential waste. With this, the daily generated amount of residential waste per person decreased from 1.3kg in 1994 to 1.0kg since 1995 after the implementation of the program.

Waste Charging System

The Waste Charging System is designed to control the generation of wastes and prevent waste of resources by charging the manufacturers or importers, under the polluter pays principle, the cost for disposing of products, materials and containers that include poison or harmful substances, or are difficult to reuse and have the potential to create problems in waste management.

The collected waste charges revert to the Environmental Improvement Special Account and are used to fund studies on waste reduction and reuse, as well as the development of related technology, supporting projects for installing waste disposal facilities and reusing waste, funding local governments for retrieving and reusing waste, and purchasing and stocking up on reusable resources.

The items charged as of 2013 are pesticide and poisonous substance containers, anti-freeze,

3) For more information, see **Current Policy Focus** (2) Volume-based Food Waste Fee System

chewing gum, disposable diapers, cigarettes, and plastics. As for plastics, the disposal cost will be levied on the end product rather than the raw material itself, considering the varying reuse rates.

Business Waste Reduction Program

The Reduction of Industrial Waste program is concerned with reducing environmental hazards by minimizing the amount of waste disposed of through the control of their generation and expansion of recycling in order to encourage the voluntary efforts of businesses to reduce harmful waste.

This program was introduced in December 1996, and four types of business operations were added to target businesses subject to mandatory waste reduction in 2014. Currently, 2,312 businesses from 18 types of business operations that are considered to generate large amounts of waste are designated for the reduction program and encouraged to voluntarily make improvements on waste reduction. An analysis and evaluation of waste reduction records in 2012 shows that production output increased by 6.9% compared to the previous year, while the amount of waste generated increased by 5.4% compared to the previous year. This result indicates that the voluntary efforts of businesses, including eco-friendly process improvement (1.7 million tons) and eco-friendly material use led to the prevention of waste generation.

<Table 7-2 > Business Waste Reduction Results

Classification		2012 Performance
◦ Number of Target Businesses		1,538
◦ Production Output (kton)		780,938
◦ Prevented Amount of Waste Generation (kton)		340
◦ Waste Generation (kton)		39,703
- Generated Amount per ton of output (kg/ton)*		50.8
Treatment Method	- Recycling (kton, %)	36,582 (92.1%)
	- Incineration, Landfill, etc. (kton, %)	3,120 (7.9%)

* Generated Amount per ton of output : The amount of waste (kg) generated from the production of 1 ton of waste-generating products

In 2005, an online waste reduction information system (www.allbaro.or.kr) was created to provide information on waste reduction policy direction, model cases and reduction methods, and a reward program for businesses with outstanding performance in reducing waste generation, as well as a presentation program for model businesses with outstanding performance in reducing waste generation, have been in place.

(3) Waste Recycling

Extended Producer Responsibility (EPR)

Extended Producer Responsibility was introduced to promote the reduction, reuse and recycling of waste by encouraging manufacturers to consider the environment through the whole process of product design, manufacturing, distribution, consumption and disposal.

Prior to introducing the EPR, the Wastes Deposit Program had been implemented since 1992 as a way to strengthen the role of manufacturers regarding recycling. The Wastes Deposit Program allowed manufacturers to deposit a cost in proportion to their production output and retrieve it in the amount in proportion to their records in reuse. It was designed to encourage businesses to make effort to recycle by offering financial incentives, but the system faced criticism because companies simply paid the charge and did not make actual reuse efforts.

Under these circumstances, the Waste Deposit Program was abolished and EPR was introduced to ensure the practical efforts of businesses. After a preparatory period that began with seven items, including electronic products, between 2000 and 2002 with a voluntary agreement between the government and industry, the full-fledged Extended Producer Responsibility system was introduced in 2003. The total amount of recycling has grown from 938,000 tons in 2002 to 1,519,000 tons in 2012, an increase of about 62%, which implies quantitative growth in the recycling sector.

At the time of the initial operation of EPR in 2003, the target items were limited to products and packaging containers such as paper packs, glass bottles, metal cans, synthetic resin packaging,

batteries, tires, lubricants and electronic products, but the list of applicable items has been consistently increased to include the items shown in <Table 7-3> [4].

<Table 7-3> EPR Target Items

Products	Tires, Lubricants, Batteries (six types, including mercury batteries), Fluorescent lamps, Electronics and Electric Products (27 types, including TVs and computers), Aquaculture Styrofoam buoys
Packaging containers	Metal cans, Glass bottles, Paper packs, Synthetic resin packaging used for Food and Beverages, Agricultural, Fisheries, and Livestock products, Detergents, Medicines and Cosmetics

If manufacturers subject to mandatory recycling fail to meet their targets, they should pay fees. The fees are imposed on less than 130% of the actual recycling cost per item, and vary depending on the recycling performance rate. If manufacturers exceed their targets, the amounts that surpassed the targets can be used for 2 years.

Since 2008, the long-term recycling targets for 5 years have been announced to help manufacturers establish recycling plans from a long-term perspective.

In addition, electric and electronic products such as TVs, refrigerators, washing machines, computers and mobile phones are designated as items subject to mandatory recovery through retail stores. In other words, the retailers of electronic and electrical products should collect waste electric and electrical products and the packaging of new products free of charge when purchasers ask them to do so after they purchase new products.

Program for Ensuring Environmentality in Electrical & Electronic Products and Automobiles

Eco-Assurance System (ECOAS) for Electrical & Electronic Products and Automobiles is concerned with creating a resource circulation system encompassing the whole process from

4) According to the Eco-Assurance System (ECOAS), which began after the Act on Resource Circulation of Electrical and Electronic Equipment and Vehicles was implemented, not only recycling of electrical and electronic goods, but also their use of harmful substances are controlled. For more information, see the Program for Ensuring Environmentality in Electrical & Electronic Products and Automobiles in the following chapter.

design and production to disuse in order to control the use of harmful substances and thus facilitate recycling.

To support this program, Korea implemented the Act on the Resource Circulation of Electrical and Electronic Products and Vehicles in April 2007. Prior to the enactment of the law, the government implemented a guideline on examination of preliminary recycling of electrical and electronic products and vehicles and restriction of their use of harmful substances. However, their feasibility was not satisfactory, and the follow-up management at the disposal stage was conducted through EPR, but was limited to electrical and electronic products.

The main contents of the Act on the Resource Circulation of Electrical and Electronic Products and Vehicles are as follows. First, businesses are encouraged to use eco-friendly and easy-to-recycle raw materials in the production stage and are made to assess and evaluate their compliance with standards on the inclusion of harmful substances.

Second, every manufacturer or importer of electrical and electronic products and every manufacturer or importer of vehicles must provide people who are engaged in the recycling business with information about recycling, including the composition of materials, contents of harmful substances and dismantling methods, to help those persons pursue their recycling businesses.

Third, the law clarifies the roles of interest groups related to the recycling of end-of-life vehicles. Manufacturers or importers of vehicles should make efforts to develop and distribute recycling technology and provide financial and technical assistance. Persons who run a business of dismantling vehicles and persons who run a business of recycling residual scrap should recycle resources from end-of-life vehicles as much as possible, and recycling methods and standards for end-of-life vehicles were established to promote proper recycling.

Fourth, every automotive dismantler should separately collect and store substances that affect the climate and ecosystem such as freon gas. Every vehicle scrap recycler must separately discharge residual scrap generated from end-of-life vehicles after collecting metals, and the expenses needed for treatment and recycling is deducted from the price of end-of-life vehicles.

Food Waste Recycling

Although the Ministry of Environment put a priority on reducing the generation of food waste as its basic direction of food waste management policy, it is also actively promoting recycling of food waste inevitably generated as organic resources despite the reduction efforts. Food waste can be turned into valuable resources such as feed and fertilizer since they contain organic substances and nutritive components.

<Table 7-4> Food Waste Generation and Treatment

(Unit: Ton/day)

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Generation	11,464	12,977	13,372	14,452	15,142	14,118	13,671	13,537	13,209
Generation per person (kg/person/day)	0.24	0.27	0.28	0.29	0.30	0.28	0.27	0.26	0.26
Landfill	1,607 (14.0)	356 (2.7%)	261 (2.0%)	451 (3.1%)	565 (3.7%)	281 (2.0%)	194 (1.4%)	167 (1.2)	153 (1.1)
Incineration	541 (4.7%)	516 (4.0%)	507 (3.8%)	674 (4.7%)	867 (5.7%)	459 (3.3%)	422 (3.1%)	465 (3.4)	381 (2.9)
Recycling	9,316 (81.3%)	12,104 (93.3%)	12,603 (94.2%)	13,327 (92.2%)	13,710 (90.5%)	13,378 (94.7%)	13,055 (95.5%)	12,905 (95.3)	12,675 (96.0)

To that end, the developer of a housing and tourist complex was made to mandatorily install a facility to convert food wastes into resources in December 1997. According to the "Fundamental Plan on Food Waste Recycling" established in 1998, the reduction target and implementation measures are to reduce the total amount of generated food waste by more than 10% and recycle the total amount of food waste by more than 60% by 2002. In 2004, Comprehensive Measure for Reducing Food Wastes was established. As a result, 96% of the total amount of generated food waste (13,209 tons/day) is used as recycling materials, such as feed and compost, as of 2012.

As of the end of 2013, a total of 185.1 billion won has been used to fund the installation of public facilities to convert food wastes into resources, and vehicle purchases for 130 businesses and 926 billion won was loaned to a total of 2,227 private businesses from the Recycling Industry

Promotion Fund to assist related technology development and facility installation in the private sector.

Construction Waste Recycling Promotion

Construction waste has increased consistently, from around 53 million tons in 2003 to around 68 million tons in 2012, due to the requirements of the domestic construction industry, and it makes up more than half of the total amount of business waste.

The recycling rate of construction waste has increased continuously, to 97.3% in 2012, thanks to the government's recycling policy, and thus the landfill rate has been gradually decreasing. However, most of the construction waste is recycled at a low level, such as mounding and backfill, and the real recycling rate of high-value-added waste resources such as aggregates and asphalt remains at 32.3% due to negative perception and reluctance to use them. Under these circumstances, the government has been implementing various policies with an aim to increase the rate of recycling of resources with high added value to 45% by 2016.

<Table 7-5> Construction Waste Treatment Status (as of 2012)

Classification	Total	Landfill	Incineration	Recycling
Treated amount (ton/day)	186,627	4,118	1,016	181,493
Percentage	100.0%	2.2%	0.5%	97.2%

As for the proper treatment and recycling of construction waste, Ministry of Environment and Ministry of Land, Infrastructure and Transport has divided their roles and implemented them. The Ministry of Environment established the Construction Waste Recycling Promotion Act, which was put into effect in January 2005, to provide the legal ground to treat construction waste in an eco-friendly manner and recycle waste to create high-value resources.

According to the law, recycled aggregates should be mandatorily used for the construction of roads, industrial complexes and environmental infrastructure. In 2013, the revision of the

enforcement ordinance and regulations specified the treatment methods for construction waste. Based on the revision, the asphalt concrete waste used for simple mounding and backfill should be separately discharged and stored away from other construction waste, and the recycling of asphalt concrete waste was restricted to road construction.

To guarantee the quality of recycled aggregates, the government introduced a quality certification system for recycled aggregates in January 2007 and implemented quality standards for recycled aggregate products by use in 2012.

Moreover, information related to the transfer of construction waste through the process of discharge, collection and transportation, and treatment should be inserted into an electronic information treatment program to manage construction waste in a transparent and effective way. Also, a construction waste information management system has been in place that provides information related to the production status, quality, demand and supply of recycled aggregates to directly link manufacturers and consumers.

Exchange of Resources used by the Circulation

The Exchange of Resources used by the Circulation is an online marketplace between waste suppliers and waste consumers. This system allows waste suppliers to register information about types, properties, quantity and quality of wastes with the online exchange, and then waste consumers can use this information on the nearest business operations, prices, regions and quality to find and purchase optimal products. Starting from the second half of 2014, a distribution assistance service intermediating between businesses engaging in waste discharge and waste treatment, a GIS-based search function, and an electronic bidding system were additionally introduced to the system to dramatically activate the trade of high-value-added waste resources.

Fig. 7-2 Mission of the Exchange of Resources used by the Circulation



This program was initiated in 2012 as a pilot program using synthetic resin wastes, secondhand home appliances, furniture and baby products. It produced tangible results, with a total of 690,000 trades accomplished by the end of July 2014.

The government plans to strengthen support for this program, including expanding source of demand and creating new markets for waste resources, by activating the functions of the Exchange in preparation for strengthening various recycling-related policies in the future, including landfill and incineration charges and prohibition of direct disposal in landfills.

Fostering the Recycling Industry and Expanding Related Infrastructure

In an effort to foster the fledging domestic recycling industry, the government provides long-term, low-interest rate loan support for facility installation, commercialization of development technology, technology development, management stability and distribution and sales of recycling businesses. An analysis of loan support for small-scale waste recycling businesses shows a total of 1,064 billion won was loaned to 2,614 businesses from 1994 to 2013.

Meanwhile, as the recovery of recyclable resources significantly increased due to the positive results of the recycling policy, there is a growing need to expand infrastructure, including facilities for gathering and selecting recycling resources. To meet this requirement, the government has been implementing a project to substitute and convert the public recycling infrastructure of local

governments to modern facilities since 2000. As of 2013, a total of 147.4 billion won was used to fund 394 business operations for the installation and improvement of collection facilities (local governments shared 30% of the total expenses).

(4) Hazardous Waste Management

Allbaro System (Waste Management System)

The Waste Disposal Certification System, which was introduced in 1999 to track the transportation of hazardous wastes, was a system in which recording and transferring of document and reporting to relevant authorities was performed manually. Thus, it was difficult to achieve its intended goal since the program required excessive amounts of manpower, time and costs to figure out the moving routes of wastes by checking documents.

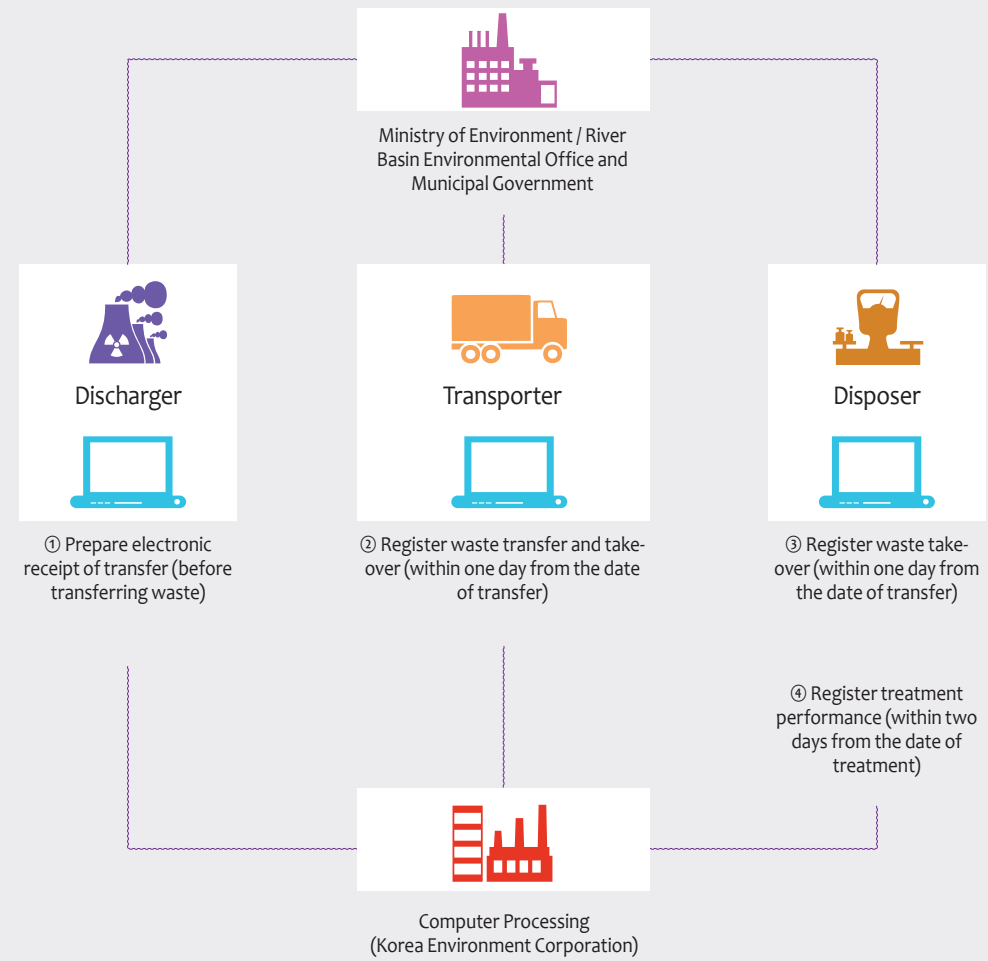
To resolve this problem, the Allbaro system (Waste Management System), which enables the reporting, confirming and record management on the Internet of the entire process of waste from discharge to final treatment, was introduced in September 2001. Following its trial operation, the system was put into operation in September 2002, serving businesses that discharge large amounts of designated waste and their contracted businesses related to the collection, transportation and treatment of waste.

The Allbaro system digitizes and processes the waste transfer certificates that circulate between waste producers, transport agents, processing agents, and administration, and enables a user to compare and analyze previously compiled agent license information and waste transfer data. A user can trace waste transfers, check waste processing stages and processing results at any time. Government administrators can oversee the entire process of waste management in real time, and ensure that waste is transferred in a legal and transparent manner to prevent illegal disposal.

Since the full-fledged operation of the system in September 2002, it has gradually expanded to cover industrial waste other than designated waste. As of the end of 2013, 340,000 businesses have

used this system, and more than 10 million electronic take-over documents are issued annually, which means that about 128 million tons of wastes, accounting for most of the waste generated from nationwide business operations, have been managed by the electronic information system.

Fig. 7-3 Scheme of the Allbaro System



Abandoned Waste Treatment

A lot of waste was left abandoned after failing to be properly treated by waste-related businesses that went bankrupt during the financial crisis in 1998. As of the end of 2011, 3,057,000 tons of abandoned waste was generated from a total of 970 businesses. Among this, about 96%, or 2,937,000 tons of waste, were treated through the polluter pays principle or administrative measures as of the end of 2011, and about 90,000 tons of abandoned waste from 16 businesses across the country remain untreated.

Against this background, on February 8, 1999, the government introduced the Abandoned Waste Performance Bond Guarantee System, which ensures the guarantee of disposal of abandoned waste by allowing waste treating businesses to choose either to join a mutual aide association or to take up a performance bond insurance policy. In the case of joining a mutual aid association, the association takes the responsibility to dispose of abandoned waste through mutual aid projects for its members, while in the case of purchasing the insurance the supervisory authority receives the insurance money to treat abandoned waste.

Since then, the government has made various efforts to improve the effectiveness of the system, including expanding the scope of businesses to be subject to the performance bond system. Recently, the costs for disposal of abandoned waste, which serve as a standard price to calculate the performance bond deposit for abandoned waste, were raised to ensure the efficient implementation of abandoned waste disposal, and the unit prices of for the disposal of different types of abandoned waste, which were revised in October, 2013.

Medical Waste Management

Medical waste requires strict management and safe treatment, as it contains disease-spreading viruses and bacteria that are highly infectious and have a high risk of secondary infections that are difficult to treat. Currently, 148,000 tons of medical wastes are generated yearly (as of 2012), and the amount is expected to continue to grow with the increasing elderly population, which buttresses the need to steadily push for a policy for an efficient safety management related to medical waste.

While the infectious characteristics of medical waste require strict management, their efficient management within a scope that reassures safety must not be disregarded. Thus, it has been necessary to create an efficient management system and alleviate the burden of the discharging party (e.g., hospitals), while reinforcing safety management from discharge to the treatment of medical waste.

To make improvements in such problematic aspects, the government has come to work to upgrade efficiency in the use of containers dedicated to medical waste within a scope that assures safety management, while moving to establish Radio Frequency Identification (RFID) that would ensure real-time computerized monitoring of the discharge, collection, transport, and disposal of medical waste. The RFID-applied tracking of waste became mandatory for the transfer of medical waste in August 2008.

In 2008, an improvement allowed a mixed storage reflecting the properties, source, and charateristics of medical waste so that treatment was facilitated to meet the demand from discharging parties and treatment businesses. In 2010, standards were liberalized to create dedicated containers in various sizes, while legal action was ensured against any person who produced, distributed, or used dedicated containers in an illegal manner. Furthermore, in 2013, the safety management of medical waste was intensified when specific disinfection standards and disinfection equipment for vehicles transferring medical waste were established.

Current Policy Focus

(1) Disposable Products and Over-packaged Products

Along with the rapid growth of the national economy and increased living standards, the use of disposables and ostentatiously over-packaged products has become common, causing a waste of resources, generating unnecessary waste and bringing about a negative impact on the environment.

Accordingly, the Ministry of Environment started to act in 1994 to control the use of disposables and over-packaged products in accordance with the Act on the Promotion of Saving and Recycling of Resources, and currently focuses on legal regulations and voluntary agreements as it main policies to handle these issues.

Legal Regulations

The current legal regulations against disposable products require businesses that use large amounts of such products to restrict their use or prohibit giving them out to customers for free. As seen in <Table 7-6>, regulation measures and targets are differentiated in consideration of the characteristics of the business type.

<Table 7-6> Regulations of Disposable Products

Business type	Requirement	Subject items
Restaurant, Food service	Restriction of use	- Disposable cups (synthetic resin, aluminum foil) - Disposable plates (paper, synthetic resin, aluminum foil) - Disposable bowls (paper, synthetic resin, aluminum foil) - Disposable chopsticks, toothpicks, forks, spoons, knives, tablecloths
Bathhouse	Prohibition on giving away	- Disposable razors, tooth brushes, toothpaste, shampoo and conditioner
Large retail stores, wholesale & retail	Prohibition on giving away	- Disposable plastic bags and shopping bags (except paper bags)
Food manufacturing & processing, on-the-spot food manufacturing & processing (limited to large-scale stores)	Restriction of use	- Disposable synthetic resin containers
Banking, Insurance & Securities	Restriction of use (Restriction of production & distribution)	- Disposable promotional materials

As for the legal regulations for product packaging, the government puts restrictions on packaging methods (a space ratio in product packaging of 10-35%, or less than two times of

packaging) to reduce unnecessary packaging materials, as well as on packaging materials by prohibiting the use of materials that are difficult to recycle, including PVC.

The ministry has reflected the social and cultural changes and development of technology related to recycling and packaging to adjust regulation targets and measures. In 2008, it exempted biodegradable resin products from the regulation on disposable products, abolished the disposable cup deposit program and report reward system on disposable products on account of an insufficient legal basis, and permitted the use of disposable paper cups and free paper bags for shoppers.

The ministry established the Guideline on the Restrictions of Use of Disposable Products in order to ensure that local governments could conduct systematic checks and inspections of target businesses, and implemented crackdowns on over-packaged products during traditional Korean holidays like Lunar New Year's Day and Chuseok, and school admission and graduation seasons.

Voluntary Agreement

Coffee shops and fast-food franchises are representative businesses that use large amounts of disposable products, including disposable cups. In October 2002, Ministry of Environment reached a voluntary agreement with 13 major coffee shops and fast-food chains in an effort to reduce the use of disposable products. The major contents of the agreement include a reduction of the use of disposable products, intensified collection and reuse of inevitably used disposable cups, and offering incentives to people with reusable cups. In 2013, the agreement was renewed by adding some clauses that included the setting up of quantitative reduction targets, press releases on inspection results, and offering instant cash discounts to people with reusable cups.

In 2011, the Ministry concluded a voluntary agreement with five megastores to reduce the use of disposable plastic bags and promote the use of shopping baskets, encouraging them to use alternative materials such as shopping baskets and volume-based garbage bags and packing containers instead of disposable plastic bags. Moreover, by entering a voluntary agreement in 2012 with two bakery franchises that were using a lot of disposable plastic bags, the ministry has been making efforts to eliminate the practice of providing products in plastic bags unnecessarily, and to use paper bags instead of disposable plastic bags.

As for product packaging, the Ministry reached an agreement in 2011 with large-scale distributors and civic groups based on the Farm Produce Green Packaging Safety Regulations to reduce the use of accessory packaging materials such as paper bands and ribbons. In accordance with this agreement, about 40% of the paper bands were removed from fruit gift baskets for the Chuseok holiday in 2012. Following this move, in September 2013, the ministry expanded the scope of the targets of the agreement to include livestock and marine products, as well as agricultural products, increased the number of participating businesses and concluded the "Primary Food Eco-friendly Packaging Voluntary Agreement," which strengthened the contents of the existing agreement, including the use of reusable packaging materials. Also, the ministry concluded an agreement with the cosmetics industry and is implementing a pilot project to reduce the packaging of cosmetics containers.

(2) Volume-based Food Waste Fee System

Recently, Ministry of Environment has been shifting its policy direction to restrict the generation of food waste and has implemented a volume-based food waste fee system that imposes fees in proportion to the amount of food waste generated. This program has been implemented nationwide by expanding targets to include multi-unit housing starting in 2013.

A volume-based fee system has been implemented for residential waste with an aim to reduce the amount of waste generated and promote recycling since 1994, but recycling products separately discharged and food waste have been excluded from imposing the fees charged in the proportion of the amount of waste generated. However, as the amount of food waste generated has been increasing since the direct landfill of food waste was banned in 2005, people's living standards have improved, and the number of one- or two-person households now accounts for 48% of the total households, there is an increasing need to reduce the amount of food waste generated. In 2012, the daily generated amount of food waste was about 13,209 tons, which makes up about 27% of the total amount of generated residential waste (48,990 tons/day).

Subsequently, the relevant ministries jointly adopted the "Comprehensive Measures for Food

Waste Reduction" in 2010 and are promoting various measures fit for the characteristics of food waste by the stage and source of generation. As part of the implementation measures, the volume-based food waste fee system was implemented.

The volume-based food waste fee system can be implemented by choosing one of three billing systems, such as a designated standard bag system, RFID system, and a chip or sticker system. The standard bag system is one in which a discharger buys a standard plastic bag to dispose of food waste. The fees are collected in proportion to the amount of food waste through the cost of purchasing the bags. The chip or sticker system requires a discharger to buy a payment chip or sticker and attach it to a collection container to be picked up. The RFID system allows the information on a discharge to be checked through an electronic tag, and fees are charged according to the waste volume. Since the RFID system is the most suitable option for the objective of a volume-based fee system, the Ministry of Environment recommends this system.

As of June 2014, 142 out of 145 local governments are participating in the Volume-based Wastes Disposal System. In particular, the system was improved by correcting inconvenient details that appeared from conducting a trial project using an RFID system between 2010 and 2011. Based on these results, the RFID system has been expanding in earnest since 2012.

Fig. 7-4 Implementation Types of Volume-based Food Waste Fee System

Payment Chip	RFID	Standard Bag
		
- Suncheon in Jeollanam-do -	- Guri in Gyeonggi-do -	- Jongno in Seoul -

※ RFID-based Food Waste Fee System : Information on food waste(discharger and amount) is collected via an RFID chip and fees are charged in accordance with waste weights.

(3) Waste Electrical & Electronic Product Recycling Target Management System

The Waste Electrical & Electronic Product Recycling Target Management System is intended to require manufacturers to meet certain recycling amounts by setting a per capita recycling target rate. As it has become difficult to set clear classification standards for each item in the electrical and electronic product markets and to make remarkable improvements in recycling through the current item-based recycling measure, this system was introduced in January 2014.

The recycling target is a concept similar to the mandatory amount of recycling imposed on manufacturers in the existing EPR system, but it was changed from a method to set a mandatory recycling rate by item to a method to set a per capita target rate (kg/person) by product group. Under the EPR system, the mandatory recycling rates of individual manufacturers are calculated by applying market share rates to mandatory recycling rates by item, while under the Recycling Target Management System, the per capita recycling target rate is converted to the total amount in consideration of the population number, and the mandatory recycling target rate is set according to the market share of each manufacturer.

The Per Capita Waste Electrical & Electronic Product Recycling Target Rate announced in January 2014 was set at 3.9kg/capita in 2014 and 6.0kg/capita in 2018. Meanwhile, the number of target items increased from the existing 10 to 27, and these items are classified into five groups: large-scale equipment, telecommunication devices, medium-size equipment, small-size equipment and cellular phones. The government plans to establish a small- and medium-sized home appliance collection system in consideration of the discharging characteristics, weights and collection conditions of small- and medium-sized home appliances.

(4) Free Collection for Large-scale Household Appliances Waste

The Free Collection Service for Large-scale Household Appliances Waste is a system in which a person can reserve to dispose of a bulky home appliance such as a TV, refrigerator, washing machine, etc., using the Internet or via a call center, and then a task force team visits the household to collect the item free of charge.

In the previous system, residents were required to purchase a discharge sticker (between 3,000 won and 15,000 won) from the municipal government, attach the stick to the waste home appliance and put it outside their house to be collected. Moreover, as the collected items failed to be delivered to recycling centers, and some core parts containing rare metals were illegally collected to be sold or exported, such problems caused severe environmental pollution and resource outflows. A survey showed that less than 5% of the collected waste home appliances were transferred to recycling centers in their original state with the previous system.

Under such circumstances, the Ministry of Environment initiated a free pick-up service for waste home appliances in Seoul as a pilot project in June 2012, and five metropolitan cities and Gyeonggi Province participated in the program in May 2013. A total of 162,000 units of waste home appliances were collected through the program in 2013. Compared to the collection performance results in 2012 under the previous system, collections in 2013 increased significantly, 1.5 to 6 times by each local government. If the program succeeds, it is expected to greatly contribute to achieving the national recycling target for electrical and electronic products. In addition, as the recovery rate of appliances in their original forms improved remarkably, from below 5% to over 95%, the program is expected to contribute to the circulation of rare metals. The ministry plans to gradually expand the free pick-up service for waste electrical and electronic products nationwide starting in 2014.

(5) Waste-to-Energy

Korea depends on imports for 97% of its energy needs. Therefore, it is imperative that the country comes up with methods for extending the production and distribution of new and renewable energy. As of 2012, the ratio of total domestic primary energy to new and renewable energy was a mere 3.18%, but the government plans to increase the portion of new and renewable energy to 20% by 2050. The remarkable fact is that currently, over 67% of new and renewable energy is produced from waste, and its production cost is cheaper at 10% of solar power and 66% of wind power. Thus, energy production using waste has emerged as the method that can realize new and renewable energy in the most effective way at an early stage.

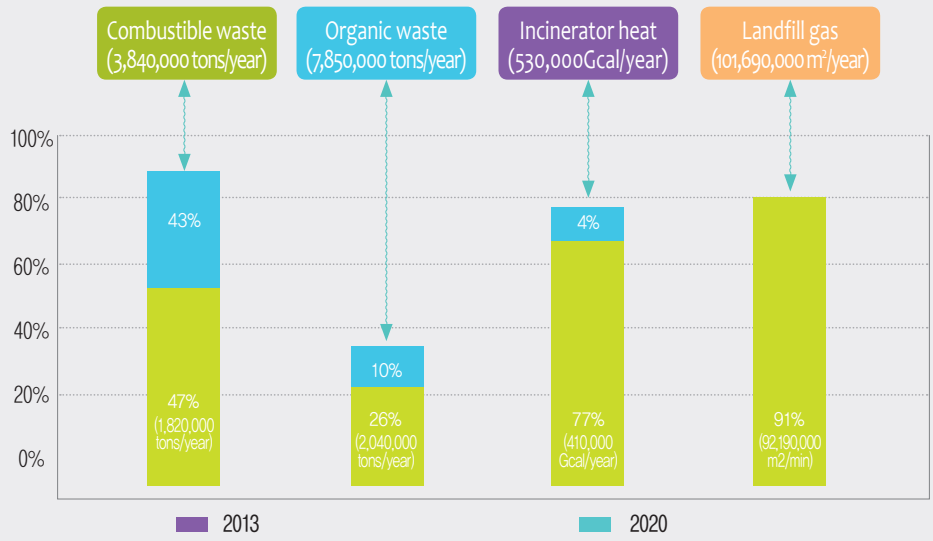
The total production of Korea's new and renewable energy in 2012 was 8,850,000 TOE[5]. Among this, the production of renewable energy converted from waste[6] was 3,220,000 TOE, which accounts for 1.2% of primary energy and 36.4% of new and renewable energy. The largest amount of energy was collected from residual heat from waste incineration facilities or landfill gas. Thus, the government needs to promote a more active waste-to-energy policy to expand its programs to include the production of Solid Refuse Fuel (SRF) using combustible waste and establishment of SRF power plants, and electricity production and upgrading facilities using biogas from organic waste.

The Ministry of Environment disclosed its Measures for Waste Resource and Biomass Energy in October 2008 and an implementation plan for the same measures in July 2009. According to the measures, the amounts of combustible waste and organic waste are 3,840,000 tons/year and 7,850,000 tons/year, respectively. Only 1.5% (58,000 tons/year) of combustible waste and 2% (160,000 tons/year) of organic waste are used as sources of energy. Against this background, the ministry is pushing ahead with relevant measures to increase the percentages of recycled inflammable and organic waste to 90% (3,450,000 tons/year) and 36% (2,830,000 tons/year), respectively, by 2020.

5) TOE (Tonnage of Oil Equivalent)

6) Waste gas excluded, biogas and landfill gas included.

Fig. 7-5 Waste-to-Energy Goals



Expansion of Waste-to-Energy Facilities

Since 2007, the government has gradually increased the budget to offer subsidies to waste-to-energy facilities, and is currently providing about 105.3 billion won in financial aid to such facilities in local governments across the country in 2014.

As a result, there are currently nine SRF facilities and boilers in operation, and 12 such facilities are being built as of June 2014. Also, a total of 10 facilities for converting organic waste to biogas are in operation across the country, including the Seoul Metropolitan Landfill Site and in the Dongdaemun District of Seoul, and seven facilities of the same kind are being designed or are under construction in major cities, including Daejeon and Jeonju.

Institutions for Waste-to-Energy

To facilitate the waste-to-energy measures, institutional improvement and statute revision are underway. First, as the ocean dumping of organic wastes was banned in 2012, a legal amendment

was made to ensure sewage sludge that was usually dumped into the sea could be used as fuel at coal-fired power plant. Also, the raw materials and manufacturing methods for solid refuse fuels became diversified through the revision of relevant laws to facilitate measures to convert combustible waste to solid fuel. Moreover, the SRF Product Information Management System (www.SRF-info.or.kr) has been operating since the end of 2010 to promote information exchanges between SRF manufacturers and consumers.

Eco-friendly Energy Town

Starting in 2014, the Ministry is actively pursuing a project to create Eco-friendly Energy Towns, which are designed to return profits to the residents by combining the production of new and renewable energy such as waste energy and solar photovoltaic energy. The ministry developed a project model aimed at improving the welfare and income of local residents by using waste resources such as food waste, and livestock manure and biomass to produce energy, including heat and electricity, or by providing or selling the gas and heat generated from landfills or incineration facilities to the surrounding areas, and is conducting a pilot project in Hongcheon-gun, Gangwon-do. Also, it plans to establish three Eco-friendly Energy Towns each year in the future.

Key facts and trends

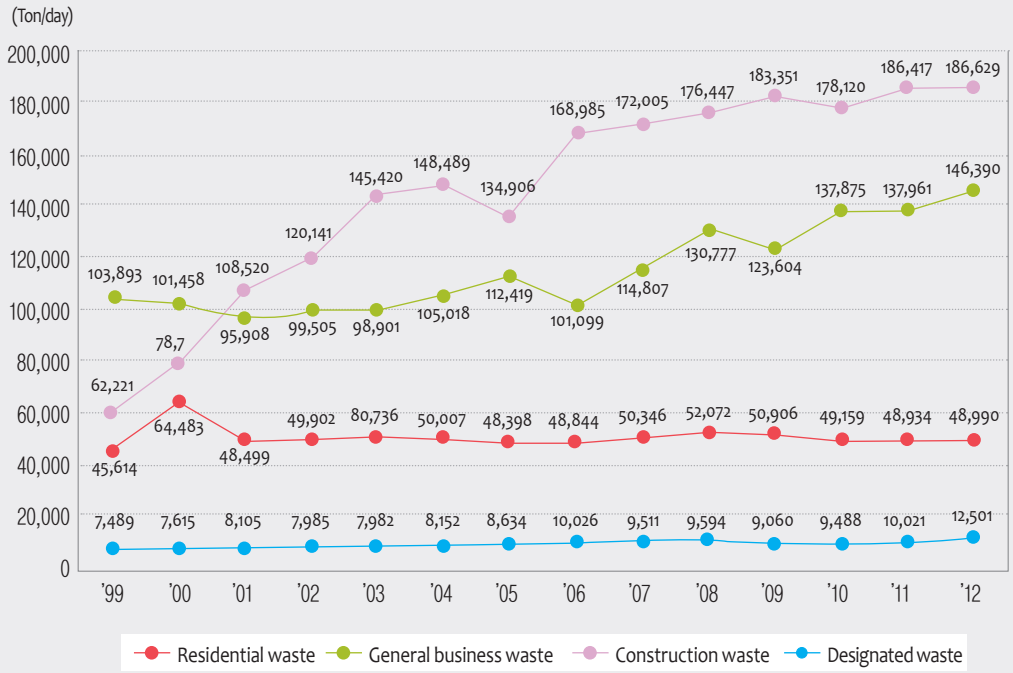
(1) Waste Generation

The ministry has been conducting surveys on waste generation status by source and type, and waste treatment status by subject and method annually, and is conducting a National Waste Statistics Survey every 5 years.

As for residential waste, the amount of waste generated per person has decreased from 1.3kg per day in 1994 to 1.0kg per day since the implementation the Volume-Based Waste Fee System. In 2012, the per capita amount of residential waste generation was 0.95kg per day. The reduction of the amount of residential waste generation can be attributable to the implementation of the volume-based waste fee system and the separate discharge policy for recycling materials and food waste.

On the other hand, the amount of industrial waste is on the rise. In particular, the amount of construction waste generated increased significantly between the late 1990s and the late 2000s on the back of the booming construction industry, but the trend is slowing due to the downturn of the industry since 2011. In addition, the amounts of general industrial waste and designated waste are consistently increasing due to the increase in industrial production.

Fig. 7-6 Residential and Business Waste Generation Trend



(2) Waste Treatment

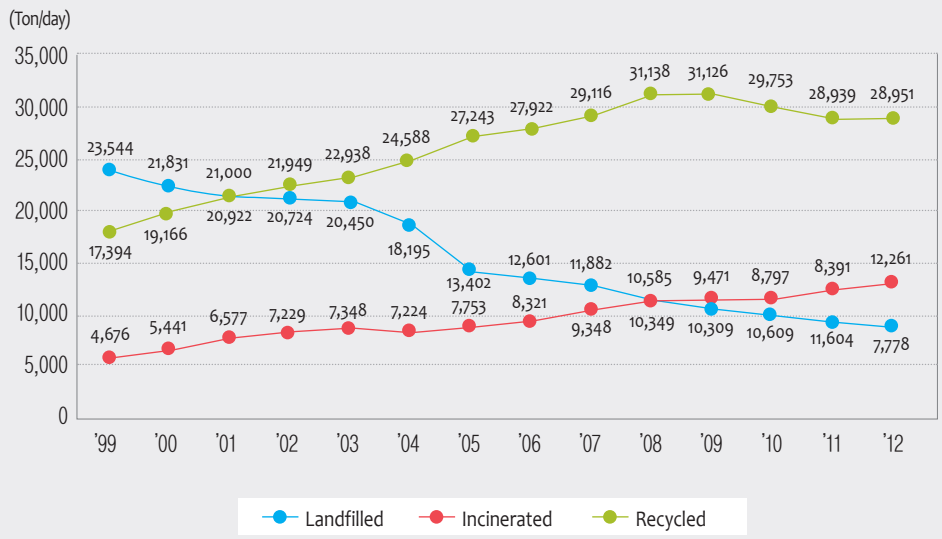
With regard to treatment methods for waste, including residential and business wastes, 10.3% of waste was buried, 6.3% incinerated, 82.4% recycled and 1.0% discharged into the sea. Although the percentages of waste treated by incineration or recycled have been increasing annually, the rates of waste treated by landfill and ocean dumping have been decreasing. In particular, the reduction of waste discharged into the sea indicates that the ocean dumping of sewage sludge, food waste leachates, and livestock wastewater was banned in 2012-2013 as the 1996 protocol to the London Convention[7] took effect, and the treatment methods for these types of waste are being changed to incineration or recycling.

When considering the trend of residential waste treatment between 1999 and 2012, seen in <Figure 7-7>, the percentage of waste that is landfilled has steadily decreased, whereas the percentages of waste incinerated or recycled have increased. These results show that waste treatment measures are shifting from a simple landfill-based treatment to a resource circulation type, creating a virtuous circle of waste resources on the back of the volume-based waste fee system, promoting recycling and waste-to-energy efforts, etc. Meanwhile, the percentage of recycled waste has been decreasing since 2010, which implies waste that was simply recycled in the past is being converted into energy in accordance with the waste-to-energy policy.



7) London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972)

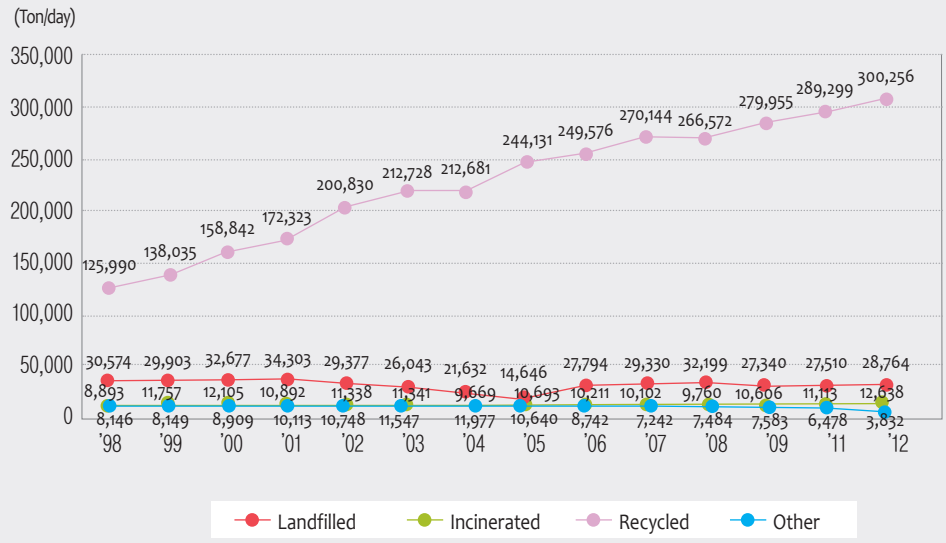
Fig. 7-7 Residential Waste Treatment



Likewise, the percentage of landfilled business waste is generally decreasing, whereas the percentage of recycled business waste is significantly increasing. The percentage of recycling of business waste is very high, at 82.4%. This is because construction waste, which has been almost entirely recycled, makes up a high percentage of the total amount of business waste generated, but the percentages of recycling of general business waste and designated waste are generally increasing.

By type of treatment, as of 2012, 97.3% of construction waste and 76.5% of business waste were recycled, 14.9% of them were landfilled, 6.5% incinerated, and 2.1% discharged into the sea, while 54.4% of designated waste was recycled, 16.4% incinerated, 23.0% landfilled and 6.2% treated by other measures (storage).

Fig. 7-8 Business Waste Treatment





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Abbreviation

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AREC	Act on Registration and Evaluation, etc. of Chemicals
CARIS	Chemical Accident Response Information System
CCA	Chemicals Control Act
CO	carbon monoxide
CO_2	carbon dioxide
DDT	dichlorodiphenyltrichloroethane
ECOAS	Eco-Assurance System
EPA	Environmental Protection Agency (US)
EPR	Extended Producer Responsibility
HCHO	formaldehyde
HIA	health impact assessment
I-TEQ	International Toxic Equivalent
KEPCO	Korea Electric Power Corporation
NICS	National Institute of Chemical Safety
NO_2	nitrogen dioxide
O_3	ozone
OECD	Organization for Economic Co-operation and Development
PCB	polychlorinated biphenyl
PFOS	perfluorooctane sulphonate
PM_{10}	particulate matter up to 10 micrometers in size
POP	persistent organic pollutant
PRTR	Pollutant Release and Transfer Resisters
PVC	polyvinyl chloride
RFID	Radio Frequency Identification
SMART	Stewardship-based Management for Area-specific Risk reduction Target
SRF	Solid Refuse Fuel
TOE	Tonnage of Oil Equivalent
TVOC	total volatile organic compounds
U.S.	the United States
UN	United Nations
UNEP	United Nations Environment Programme
WPMN	Working Party on Manufactured Nanomaterials