

For a Green and Clean World, Promise of the Future, Responsible Care

KRCC is an organization established for Responsible Care (RC), by institutions involved in petrochemicals, fine chemicals, fertilizers, and chlor-alkali, as well as the American Chamber of Commerce in Korea, the European Union Chamber of Commerce in Korea, and other chemical institutions. RC incorporates activities to improve the environment, safety, and health in the chemical industry.

Environment



Active and preemptive responses

Safety



Sustainable development

Health



Affluent and abundant human life

Responsible Care

Commitment of the
Chemical Industry to
Sustainable Development

51
Issue No



CONTENTS

04

SPECIAL REPORT 1

Domestic Petrochemical Companies Make All-out Efforts for Pyrolysis Technology to Use Waste Plastic

08

SPECIAL REPORT 2

EU and US Perfluorochemicals (PFCs) Regulatory Trends and Industry Response Measures

14

ISSUE

Results of the 2023 RCLQ Second-Half Year Leadership Conference

20

RC NEWSROOM

Main Activities of the RC Newsroom Secretariat

22

MEMBERS' NEWS

Main Members' Trending News

26

LIST OF KRCC MEMBER COMPANIES

27

CALENDAR

To pass on abundance
for humankind
A better world for
future generations

The KRCC will strengthen
its activities and roles for
sustainable development with
one mind and one heart

Responsible Care
means international
voluntary activities
for the chemical industry

promote improvement
of the environment
and the safety and health
of the people

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Responsible Care® is a voluntary program in the chemical industry that continuously promotes the protection of the environment through safety and health improvement activities by pledging participants' commitment. It implements the program through management policies to protect the environment, safety, and human health throughout the entire lifecycle of chemicals, from the development of chemical products to their manufacture, sale, distribution, use, and disposal.

**Responsible
Care**
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Domestic Petrochemical Companies Make All-out Efforts for Pyrolysis Technology to Use Waste Plastic

Throughout its long history, humankind has improved people's convenience of life by using and applying various materials. Among them, the leading one is probably plastic, which plays a crucial role in current civilization.

However, the COVID-19 pandemic that broke out in 2020 quickly raised concerns about plastic use and its effect on the environment, and the circular economy. Amid these concerns, domestic petrochemical companies have been actively moving into the waste-plastic recycling business. This issue examines their current trends based on "The Use of Pyrolysis Technology and Policy Tasks for Carbon-neutral Industrial Transition" published by the Korea Environmental Research Institute in November last year.



● Recently, chemical recycling using pyrolysis has drawn attention as the most efficient, resource-conserving, and ecofriendly technology.

Thermal Decomposition, Key to Tackling Waste Plastics.

As food delivery and online shopping have become much more common since the COVID-19 outbreak, the amount of plastics used as packaging materials for foods has increased. With plastic waste emerging as an environmental threat to the international community, a circular economy strategy has been called for — in order to fundamentally reduce the generation of waste plastics. At the same time, countermeasures have been introduced due to the severe problem of greenhouse gas emissions caused by plastics production, and its use, and disposal. In other words, this method separates and processes recyclable plastics so that they can be reused in new products (enhanced recycling); develops plastic substitutes using eco-friendly materials; or introduces eco-friendly plastic manufacturing technology (introducing alternative materials and technologies). Another method is to develop plastic products with enhanced biodegradability so that they can decompose naturally (using bioplastics).

Recently, chemical recycling using pyrolysis has been in the spotlight as the most efficient, resource-conserving, and eco-friendly technology. Thermal decomposition of waste-plastics refers to a chemical reaction that reduces, decomposes, and converts plastics into low-molecular-weight compounds under medium-temperature and oxygen-free conditions between approximately 400°C and 600°C. This technology produces liquid oil and converts plastic into a petroleum-like substance. In other words, it decomposes into a mixture of small molecules called pyrolysis oil at high temperatures, converting the mixed plastics into chemically uncontaminated feedstock and creating new plastic.

Government Measures for Waste-Plastics Pyrolysis Business

In June 2021, the Korean government announced that it would expand the current waste-plastics pyrolysis treatment scale from 10,000 tons per year to 310,000 tons in 2025, and 900,000 tons in 2030 — by leading investment and participation by the petrochemical industry and local governments. At the time, the Ministry of Environment announced plans to realize a circular economy and carbon neutrality by the year 2050, by increasing the proportion of waste plastics pyrolysis treatment from the current 0.1% to 3.6% in 2025, and 10% by 2030. If implemented as planned, the pyrolysis of waste plastics is expected to increase to 3.6% by 2025 and 10% by 2030. Also, in October of the same year (2021), the need grew for mid- to long-term business transformation in the petrochemicals industry as South Korea embarked on a carbon-neutral journey with the '2030 Nationally Determined Contribution (NDC) Increase.' Subsequently, the "Korean Type (K)-Circular Economy Implementation Plan" for carbon neutrality was established in December 2021, focusing on domestic waste-plastics pyrolysis projects.

According to the Korean (K)-Circular Economy Implementation Plan, Korea plans to increase the proportion of waste-plastics pyrolysis treatment to 10% by 2030. To this end, the main source of fuel pyrolysis oil will be improved and used as a raw material for petroleum and chemical processes, during which the petroleum and chemical companies will seek ways to recycle pyrolysis oil to reuse it as an alternative raw material for petroleum products such as naphtha and diesel oil. Companies such as Hyundai Oil Bank, SK Geocentric, and GS Caltex have been verifying special cases using regulatory sandboxes, carrying out institutional improvements to expand the pyrolysis facility installation in industrial complexes. They have also made efforts to revise related guidelines— so that when waste plastic pyrolysis oil is used as a raw material for petroleum products, their carbon- emissions rights can be recognized considering the greenhouse-gas reduction effects. The amendment to the enforcement ordinance of the Act on Promotion of Installation of Waste Treatment Facilities and Assistance to Adjacent Areas (Waste Facilities Promotion Act) announced by the Ministry of Environment in February 2022 mainly states that “facilities that recycle or incinerate waste plastic pyrolysis can be installed instead of landfill facilities.” Previously, a landfill facility had to be installed to develop an industrial complex with an annual waste generation of more than 20,000 tons and an area of more than 500,000m2. Accordingly, 34 of the 52 industrial complexes required to install waste treatment facilities secured land for waste treatment facilities but were unable to install landfill facilities due to a lack of business feasibility and civil complaints. However, the amendment was expected to help achieve the goal of the pyrolysis share of the Korean (K)-Circular Economy Implementation Plan announced in December 2021.

Ignition of Carbon Neutrality by Domestic Companies’ Technological Expansion

As one of the key tasks to achieve carbon neutrality in 2050, the government has been actively promoting waste plastic conversion into fuel and raw materials through chemical recycling such as pyrolysis. As the plastics circular economy has emerged to not only increase resource efficiency but also reduce waste-generation, domestic petrochemical companies are also actively engaging in the waste plastics recycling business. Recently, the domestic chemical industry has expanded its investment in pyrolysis technology, accelerating its steps toward carbon neutrality. Pyrolysis, a chemical decomposition reaction that occurs by heating to a high temperature, is used to treat various types of waste, of which the chemical industry is interested in recycling waste plastics by thermally decomposing them. In 2021, Hyundai Oilbank became the first domestic oil refinery to acquire ISCC PLUS¹⁾(International

The Korean government is actively promoting waste plastics conversion into fuel and raw materials through chemical recycling such as pyrolysis as a key task to achieve carbon neutrality in 2050.

<Reference Materials>

Cho Ji-hye et al. (2022), “Conditions to Promote Waste Plastic Pyrolysis and Policy Tasks”, Korea Environment Institute.
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 LG Chem (2022), “We Will Begin Plastic Chemical Recycling”, LG Chem press release (January 28)
 SK Geocentric (2023), “SK Geocentric, First Step into the World’s First ‘Plastic Recycling Cluster’”, SK Geocentric press release (dated November 15).

Sustainability & Carbon Certification PLUS), an international eco-friendly product certification system. The following year, in 2022, Hyundai Oilbank conducted an empirical study to produce eco-friendly petroleum products by injecting waste-plastics pyrolysis oil into the existing refining process. This certification is granted for the process of producing waste-plastics pyrolysis oil into eco-friendly naphtha. Starting with the ISCC PLUS certification, Hyundai Oilbank has announced plans to begin the eco-friendly plastic business using waste plastics in earnest. In addition, LG Chem began building a large-scale waste plastic pyrolysis oil production facility in Dangjin, South Chungcheong Province, last March. It plans to complete construction at the end of 2024 and begin full-scale production of pyrolysis oil the following year to implement a circular economy. According to LG Chem, the plant will apply supercritical pyrolysis technology, which is chemical-recycling technology that decomposes waste plastics at high-temperature and with high-pressure water vapor. This technology effectively removes impurities during the pyrolysis oil production process, recycling snack bags and plastic lids for instant rice, which are not easy to separate and collect. When 10 tons of vinyl and plastic are inputted, more than eight tons of pyrolysis oil and two tons of by-product gas are obtainable.

In November of this year, SK Geocentric held a groundbreaking ceremony to create a plastics recycling cluster ‘Ulsan ARC’ on a 215,000m2 site within the SK Innovation Ulsan Complex (CLX). During the ceremony held under the theme of “Opening the Future of Korea’s Circular Economy,” SK Geocentric said, “Once Ulsan ARC is completed, about 320,000 tons of waste plastics will be processed annually, allowing the Korean chemical industry to see new future growth, and advancing based on recycled plastic as our driving force.” They also emphasized, “Ulsan ARC is a very symbolic project for SK Innovation, which is pursuing innovation as a business that contributes to the environment and sustainability, which is the core value of SK Group.” Through Ulsan ARC, SK Geocentric expects to have an economic ripple effect throughout the country, including the Ulsan region, and that this construction will employ approximately 2,600 people regularly, create indirect employment for about 38,000 people, and bring indirect production effects to the Ulsan region worth KRW 1.3 trillion per year. The expected annual export amount upon completion is also expected to reach KRW 700 million per year. As such, the option of choosing only between ‘incineration’ or ‘landfill’ — even though plastic can be chemically recycled — is expected to be greatly improved by the domestic chemical industry’s recent active movement toward the waste-plastics pyrolysis business. 🌱

1) The Korean government is actively promoting waste plastics conversion into fuel and raw materials through chemical recycling such as pyrolysis as a key task to achieve carbon neutrality in 2050.

Perfluorinated Compounds (PFAS) in the EU and the US, Regulatory Trends and Industry Response Measures

Eunho Son, Senior Researcher | Korea Research Institute of Chemical Technology

On May 11, 2023, Korea's Ministry of Trade, Industry, and Energy published a press release titled 'Response to the Review of Restrictions on the Use of Perfluorinated Compounds in the European Union (EU).' Through this, the author was able to briefly understand the report contents on the regulation and status of using PFAS released in Europe while also predicting the serious future impact it will have on the industry. The dangers of PFAS were introduced in a 2020 movie titled *Dark Waters*, depicting the anecdote of a lawyer from a large law firm who oversaw a lawsuit over PFOA leaks from DuPont, the world's largest chemical company. The movie, which defined PFOA as an 'eternal chemical that accumulates in the body without being decomposed,' showed that PFOA permeates various places in our daily lives from frying pans, to contact lenses, and baby mats. Recent studies have revealed that it can cause metabolic diseases and hormonal imbalance diseases and affect the mother and fetus if accumulated in the body and exposed to it for a long time. However, since not all fluorine compounds regulated by the OECD contain such risks, it is necessary to increase understanding by examining the classification and characteristics of PFAS, which are used as essential materials in various industrial fields and the PFAS regulations in Europe and the United States. This paper will look at PFAS regulations in these aforementioned regions in more detail and consider the industry's future response plans.

The core of the proposed PFAS compound regulation is based on the premise that they can act as toxic substances to the environment or living organisms.

PFAS Regulatory Trends in Europe

Starting with regulating the production and commercialization of PFOA in 2004 following the Stockholm Agreement, Europe has included PFAS-related substances that can dissolve in water in its regulations. However, according to the restriction report released in March 2023, almost all PFAS of more than 10,000 types are within the scope of regulation, including even fluoropolymers far from water-soluble PFAS. As a result, many companies in Europe, the United States, Japan, Korea, etc. argued that fluoropolymers should be excluded from regulation - or that the grace period should be extended according to the relevant field, submitting stakeholders' opinions on rational arguments and supporting data on technological, economic, and social impacts. PFAS compounds excluded from Europe's extensive regulations are 'PFAS (or fluorine compounds) with functional groups highly likely to decompose, such as complete biodegradation or photodecomposition in the environment.' The core purpose of the regulation proposal is to "focus on long-term sustainability in nature, fundamentally assuming that PFAS can act as a toxic substance to the environment or living organisms."

However, in materials that make contact with blood, such as medical devices, PFAS do not harm life or prolong life by avoiding blood coagulation, etc., countering the opinion that there is no substitute material for PFAS explained above. This is because the concept of PFAS was confused by including non-toxic and highly biocompatible fluoropolymers in the regulatory group within the extensive regulations. Nevertheless, it appears that toxic PFAS that may be used or generated during the manufacturing of fluoropolymers and the use of raw materials cannot escape the validity of European PFAS regulations.

Accordingly, global fluorochemical manufacturers such as Solvay, Alkema, Daikin, DuPont, and Chemours have established goals such as developing processes that replace or do not use PFAS substances used in fluoropolymer production. Moreover, they are researching ways to limit the release of PFAS substances to the outside using technologies such as adsorption and decomposition of generated PFAS substances. Stakeholder opinions submitted until September 25 of this year included many opinions that were exceptions to fluoropolymer application, including the efforts of these companies, along with supporting data.

Regarding the future PFAS regulations in Europe, the author cautiously predicts that it will be difficult to avoid the rapid process within the proposed regulatory scope in the case of toxic PFAS used for convenience in daily life. However, it is expected that the need for an exception will be fully recognized in the industrial use of fluoropolymers that require high durability and high performance. Nevertheless, given the direction of PFAS regulations, efforts are urgently needed for domestic firms to discover PFAS substitutes and develop new materials. On the one hand, the market



for high-value-added fluorine products may be secured in irreplaceable areas, by upgrading the processing facilities for PFAS generated during manufacturing, and establishing specialized industrial facilities. In other words, a clear two-track strategy seems necessary for the national industry.

PFAS Regulatory Trends in the United States

The difference between the United States and Europe in PFAS regulations stems from the risks posed by PFOA- and PFOS-based substances, which have been detected as residual substances in drinking water for a long time. According to a survey by the U.S. Environmental Protection Agency (EPA), PFAS was detected in the blood of 97% of the U.S. population. Accordingly, the current U.S. PFAS regulations clearly aim at limiting the concentration of PFAS in drinking water. The reduction and elimination of PFOA through voluntary participation and agreement by eight PFAS production companies under the EPA's Stewardship Program in 2006 served as an opportunity to further clarify the future direction. As seen above, if Europe has announced regulations that include almost all PFAS substances in 2023, the United States has announced enhanced concentrations of PFAS substances in drinking water, PFOA (perfluorooctanoic acid), PFBS (perfluorobutane sulfonate), and PFNA (perfluorononanoic acid), PFOS (perfluorooctane sulfonic acid), PFHxS (perfluoro-hexane sulfonic acid), and HFPO-DA (hexafluoropropylene oxide dimer acid).

The United States is characterized by enacting and enforcing laws on a state-by-state basis following EPA's recommendations. As of 2020, PFAS drinking water restrictions are implemented in 142 related laws in 28 U.S. states, and 38 laws are in effect in 15 states such as California, Connecticut, Maine, Michigan, New Jersey, Pennsylvania, Washington, Vermont, Maryland, and Minnesota have implied strong regulations on products containing PFAS. The eastern state of Maine has shown the strongest movement to enforce PFAS sanctions. Movements to regulate PFAS products by the state are limited to food packaging, textiles, carpets, rugs, youth products, ski wax, food bags, overholser furniture, and outdoor clothing. The state-specific regulatory roadmap proposed until 2028 is briefly summarized below:

- Consumer packaged goods manufacturers, importers, and retailers of products containing PFAS would have had to comply with new regulations in four states - California, Maine, Vermont, and Washington - in 2023.
- Six other states (Colorado, Maryland, Connecticut, Minnesota, Hawaii, and New York) have enacted PFAS regulations that will take effect in 2024 and 2025.
- More states including Massachusetts, New Jersey, and Minnesota plan to enact new state laws and regulations in 2024.

The difference between the United States and Europe in PFAS regulations stems from the risks posed by PFOA and PFOS-based substances, which have been detected as residual substances in drinking water for a long time.



- Sectors most frequently targeted by state regulators include children's products, textiles, clothing, footwear, cosmetics, upholstery, furniture, rugs, carpets, cookware and food packaging, ski wax, and waterproofing.

Based on such strengthened drinking water regulations, the USA is developing technology to remove or decompose PFAS contained in drinking water, while also working to expand large-capacity facilities. For example, Orange County in southern California has built a testing and data infrastructure for more than a year, including testing 14 types of granular-activated carbon and ion exchange products and new adsorbents, which is considered the largest PFAS abatement project in the United States. Additionally, the city of Stuart, Florida, has also developed and is about to operate the state's first ion exchange (IX) water-treatment system, and the nation's largest PFAS decontamination system. As such, in the United States, various technologies - such as pyrolysis; plasma exposure, supercritical treatment; steam-energy generation; and microwave-assisted hydrothermal methods - are proposed to decompose PFAS, with various studies currently underway in academia.

Conclusions

PFAS regulations in Europe and the United States have different purposes and scopes but are heading in the same direction in terms of considering the severity of environmental impacts. To minimize the impact of environmental regulations on the domestic industry and secure the supply chain of PFAS used as essential materials, Korea also needs to strengthen the government-led industry-academia-research cluster cooperation system. Within this system, government ministries need to closely investigate the possibility of substitution by industry/item and create a database, and companies, research institutes, and universities need to actively communicate and conduct collaborative research to develop and evaluate alternative materials and apply them to industrial sites. In addition, for developed materials, they should secure evidence for using materials by thoroughly testing their effects on the human body and the environment. On the other hand, if it is judged to be an irreplaceable material, they should secure leadership as a PFAS-producing country by developing zero PFAS - emission process technology. As a researcher working on PFAS, I would like to conclude this paper with the sincere hope that the protection of domestic industries while contributing to human welfare will be realized by mobilizing capabilities at the national level. 🌱



More Than **35** Years of Responsible Care®

Responsible Care® Global Charter

CEOs from leading chemical suppliers and manufacturers around the world have signed the Responsible Care Global Charter, which outlines our unified commitment to:

- Enable a corporate leadership culture that supports safe chemicals management;
- Safeguard people and the environment through continuous process improvement;
- Strengthen chemical management systems around the world;
- Influence business partners to transparently report progress;
- Engage stakeholders to promote chemical safety; and
- Contribute to sustainability.

While Responsible Care requirements can vary from region to region, a set of ICCA implementation milestones enables national associations to track progress to build and grow Responsible Care. A fundamental component of Responsible Care is adoption of codes, guidance, policies or procedures around a set of core values and objectives. By implementing a common management approach, national associations can connect the Responsible Care principles to national and international practices, standards, and sustainability principles.

Enabling Continual Progress

ICCA's Key Performance Indicators (KPIs) reporting tool enables national associations to work with companies in their regions to collect and report data on industry performance metrics related to:

- Workplace Safety;
- Energy and Water Consumption;
- CO₂ Emissions; and
- Process Safety Incidents.

Building on a model first used in Europe, ICCA is also developing a Self-Assessment Tool for global use to connect Responsible Care with broader international standards in the fields of sustainability, corporate social responsibility, health, safety and environment, and efficiency.

It also introduces four "maturity" levels, describing four different levels of Responsible Care implementation. This can help attract more small and medium-sized enterprises that are interested in joining Responsible Care and are looking for a starting point.

[Access the full 2021 ICCA Responsible Care Status Report by scanning the following QR Code.](#)



Expanding Responsible Care® Around the Globe

Global Capacity Building Activities

With a focus on China, India and Africa, ICCA provides financial and technical resources to support capacity building to advance Responsible Care adoption and implementation.

These efforts focus on:

- Promoting awareness of and knowledge about chemical hazards;
- Managing risks associated with manufacture and use of chemicals; and
- Developing the necessary national infrastructure and capacities for regulatory and voluntary approaches to chemical management.

Since 2019, ICCA has contributed approximately € 860,000 to support 79 capacity building projects promoting Responsible Care:

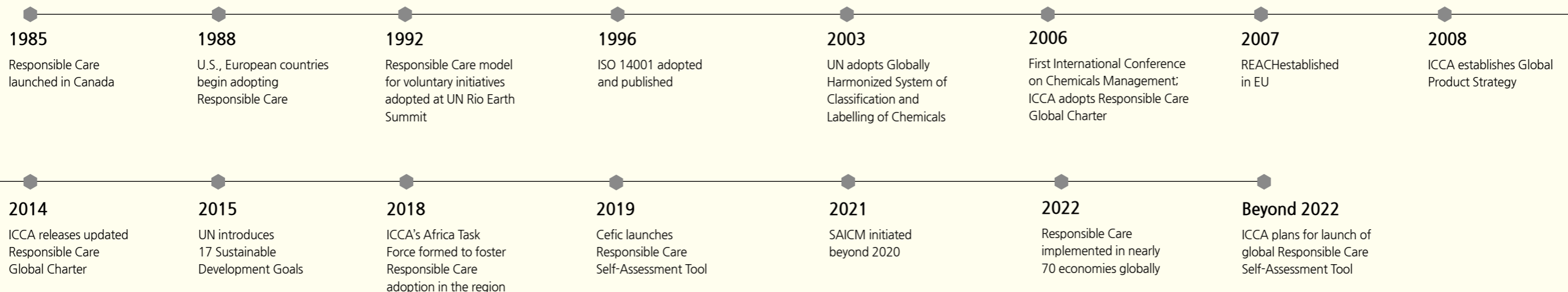
- 2019**
26 workshops and events 19 countries
- 2020**
14 workshops and events 11 countries
- 2021**
20 workshops and events 16 countries
- 2022**
17 workshops and events 15 countries



Peer Mentoring Network

ICCA member associations and companies have access to a global network of experienced practitioners to help enhance safety, health and environmental protection.

Experienced practitioners lend expertise to online workshops and specialist topics, including GHS implementation and UN Recommendations on the Transport of Dangerous Goods legislation.



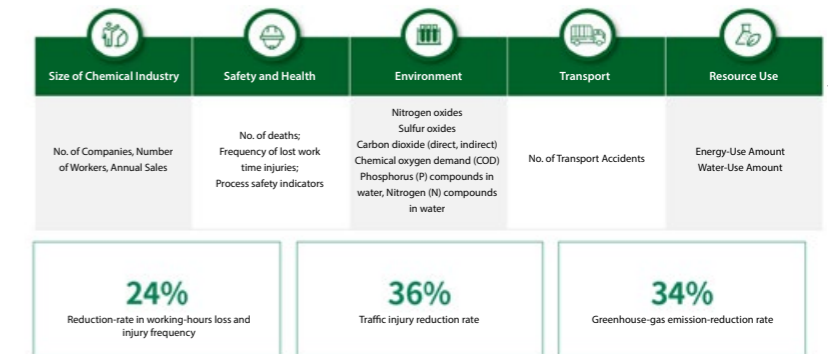
Results of the 2023 RCLQ Second-Half Year Leadership Conference

The International Council of Chemical Associations (ICCA) RC Leadership Group meeting in the second half of 2023 was held in a hybrid of both online and offline in Mumbai, India, from October 17 to 18, 2023. About 45 representatives from 30 member countries attended the meeting. Under ICCA, five leadership groups are in operation: Energy & Climate Change; Chemical Policy, Health; Responsible Care; Communication; and Plastics. Each leadership group holds meetings twice a year to discuss major issues and response plans by area. At this RC Leadership Group meeting, the representatives discussed the improvement of chemical companies' KPI, the development of RC self-assessment tools, and the status of RC by country. The following are the main agenda items and future plans discussed at the meeting:



1 Improvement of RC Key Performance Indicators (KPIs)

- (Background) Established a process and platform to demonstrate the results of international RC activities in the chemical industry to external stakeholders.
- (Status) Promoted KPI (Key Performance Indicator) survey to analyze performance through RC implementation in the chemical industry.



○ (Improvements)

- Existing: Each association collects data from member companies from the previous year and enters it into ICCA's KPI website.
- Change: Blind codes are given to member companies subject to data submission by country.

- Blind codes are designated and granted to companies by the national association, and once assigned, the company code cannot be changed to another company.
- A total of six digits are assigned, with the first-three digits being the country identification code and the last-three digits being the company identification code.
Example) 001003: 001 is a specific country code / 003 is the code of a specific company in country 001

○ (Promotion plan)

- Blind codes are assigned to companies subject to data submission by country and entered into the KPI website (scheduled to open in January 2024)

2 Improvements to the ICCA Self-Assessment Tool (SAT)

- (Purpose) To clearly measure corporate performance, build accountability and commitment, and identify actions for improvement through recommendations.
- (Composition) 101 questions in 6 chapters to evaluate the degree of RC implementation, and each company's performance in RC and SDGs participation can be checked with scores and graphs.
 - *Corporate leadership culture, human and environmental protection, strengthening chemical management system, business partner influence, stakeholder participation, contribution to sustainability
- (Status) Completed developing an ICCA self-assessment tool based on the model of the European Chemical Industry Council (Cefic)
- (Progress)
 - Reviewed existing self-assessment tools by forming an SAT Working group (~ March 2022)
 - Recruited and tested beta version candidates (~ June 2023)
 - Final version of web tool released (~ Sept. 2023)
 - 1st campaign targeting chemical companies around the world (Jan. 2024 - Nov. 2025, English version)
- (Expected effects)
 - Provide practical methods to evaluate the level of RC implementation and promote continuous improvement
 - Can be used in corporate activities such as linking with international standards (ISO 9001, 14401, etc.), improving ESG evaluation indicators, and establishing internal goals.
 - Applicable to companies of all sizes, including small and medium-sized businesses

- (Future plan) After translating the final version of the guidebook, the Korean version will be applied to global web tools.

3 E&CC (Climate Change) Leadership Group Progress

- (Purpose) Maintain the competitiveness and growth of the chemical industry and promote a comprehensive chemical industry energy and climate change strategy.
- (International Trends)
 - Many countries and companies declared Net Zero at COP26 (2021)
 - Aims to reduce GHG by 60% by 2035 through energy and fuel transition (IPCC 6th report)
 - Shift from pledge- to implementation-centered from 2022 to 2023 (COP27, 28)
 - Efforts needed to maintain the tenor of the Paris Agreement and the Net Zero goal.
 - Increased burden to show GHG reduction path and actual implementation status
- (Carbon Neutral TF)
 - Evaluate greenhouse-gas emissions and set a reduction path considering future technology availability and costs
 - Identify greenhouse-gas emissions related to product production and prepare carbon-neutral measures
 - Will present the preliminary results of the report at COP28, considering future technology availability and costs.
- (Future issues)
 - Discovered excellent solutions* in the global chemical industry to transition to a low-carbon society
 - * Carbon footprint calculation, LCA utilization method, policy development, etc.

4 RC Promotion Trends in Asia

o (Status) Operates APRO consisting of 16 associations in the Asia-Pacific region

* Asia Pacific Responsible Care Organization

- Japan: Creates a safety culture at the workplace through a safety recognition system and by publishing a collection of best practices.
- India: Identified requirements for the chemical industry at the government's request, collaborated with the country through sustainability reports, etc., and established a management system comprised of more than 30 CEOs.
- China: The comprehensive evaluation guidelines for chemical industrial complexes announced by the government in 2020 use RC as an evaluation indicator for the industrial complex management system.

o (Improvements)

- Need to improve RC implementation capabilities through collaboration with government agencies in each country.

5 Announcement of the 2024 APRCC (Asia Pacific Responsible Care Conference)

o (Purpose) Pursue long-term joint development, including promoting RC activities in the Asia-Pacific region, share best practices, and improve the image of the chemical industry.

o (Date) March 27 (Wed) ~ 28 (Thurs), 2024

o (Location) Kaohsiung, Taiwan

o (Topic) Responsible Care, Safeguarding our Future (detailed agenda TBD)



Day 1

6 Entire Schedules

| Time | Agenda | Note |
|---------|---|---|
| 9:00am | Opening of the meeting Chairman's Opening Remarks Welcome by Host/Welcome new members Vice-Chair's Opening Remarks Welcome from Host Participant Introductions | RCLG Chair: Jeff Kovacs, ExxonMobil RCLG Vice Chair: Hidehiko Yashima, Mitsubishi Host: Tara Henriksen, ACC |
| 9:20am | Review Agenda, Previous Meeting Minutes and Key Documents | Jeff Kovacs, ExxonMobil Cherie Weible, ACC |
| 9:30am | Sustainability and Circularity in Tata Chemicals Globally | R. Mukundan, Tata Chemicals Limited |
| 9:45am | KPI Enhancement Project | Steven de Regter, BASF Phil Scott, CIA Tara Henriksen, ACC Cherie Weible, ACC |
| 11:00am | Indian Chemical Council Report | Pranav Tripathi, ICC |
| 11:30am | Communications / Responsible Care International Marketing Strategy | Kelly Montes de Oca, ACC |
| 13:15pm | Self-Assessment Tool | Steven De Regter, BASF Phil Scott, CIA Cherie Weible, ACC |
| 14:15pm | Review Outcomes of Day 1 | Jeff Kovacs, ExxonMobil |
| 14:30pm | Adjourn | |

Day 2

| Time | Agenda | Note |
|---------|--|--|
| 9:05am | Energy & Climate Change Leadership Group | Noriyuki Mita, Mitsubishi Chemicals Ignacio Hernandez-Bonnet, Shell |
| 9:30am | Responsible Care and ESG | Ahmed Al Khaldi, Sipchem Yun-Zi Huang, CPCIF |
| 10:30am | Workshop: Warehousing · ICC RC Warehousing Manual · AICM Warehousing Project | Pranav Tripathi, ICC Xiao Li, AICM |
| 11:45am | Colombia Pilot Project | Ana Ocampo, RIC |
| 13:15pm | RCLG Regional Focus: Asia | Kozo Tachibana, JClA |
| 14:15pm | RCLG Budget Overview | Cherie Weible, ACC |
| 15:30pm | Operation Clean Sweep (OCS) Blue | Ali Chertack, ACC |
| 16:30pm | Review meeting outcomes/summary of action items | J. Kovacs, ExxonMobil |
| 16:45pm | Adjourn | |

Held the First Steering Committee of 2023

The Korea RC Council held the '2023 1st Steering Committee' simultaneously online and offline on Friday, June 9. The main agenda was ① 2023 Outreach Promotion Project 'Open! Item to review 'Happy World of Chemistry' ② The item on the use of reserve funds of the Korea RC Council in 2023 (renewal of RC logo trademark rights) was reviewed and resolved as per the original plan.



Hosted the 2023 Open! Happy Chemistry World

2023 Open! Happy Chemistry World is a community social contribution activity held since 2003 by the Korea RC Council and member companies. It was held virtually from 2021 due to COVID-19, but with the relaxation of COVID-19 regulations, it has reverted to an offline event this year. This year's Open! Happy Chemistry World was held twice on August 19 in Yeosu and September 2 in Seosan, participated by around 200 students from 4th to 6th grades. Open! Happy Chemistry World aims to provide experience in chemical experiments and vitalize the development of science and engineering.



Participated in the 2023 RCLQ Second-Half Year Conference

The International Council of Chemical Association (ICCA) RC Leadership Group meeting in the second half of 2023 was held in a hybrid of both online and offline in Mumbai, India from October 17 to 18, 2023. In this meeting participated by 30 representatives from 30 member companies, ① KPI strengthening project, ② RC self-assessment tool, ③ E&CC (Climate Change) Leadership Group progress, and ④ Asia RCLG trends were shared.



Safety Culture Improvement Seminar Held for Executives in 2023

The Korea RC Council held the 2023 Safety Culture Improvement Seminar on Wednesday, October 25 to improve environmental safety leadership in the chemical industry. Around 20 persons including executives from member companies attended and shared ① Water & Protection Safety Solutions Sharing, ② Organizational structure of the global EHS organization and the role of each detailed organization, and ③ the Composition and role of a dedicated organization for DuPont Korea's Serious Accident Punishment Act.



1st RC Executive Committee held in 2023

The Korea RC Council held the 2023 1st Executive Committee meeting on November 14. At this meeting, about 14 persons including executive committee members from member companies attended and discussed agenda items such as ① Reporting on the improvement of RC KPI and ICCA self-evaluation tool, ② Results of this year's RC promotion project, and ③ Holding APRCC in 2024.



Holding of the 2023 KRCC Annual Workshop

The Korea RC Council held the 2023 KRCC Annual Workshop at the Ramada Plaza Jeju Hotel from November 14 to 15. The KRCC Annual Workshop has been held since 2002 to promote information exchange and networks in the chemical industry. This year's workshop was attended by about 50 executives and employees of member companies, including Korea RC Council Chairman Chae Jong-kyung. Through this workshop, attendees learned about ① Understanding and using ChatGPT for sustainable development, ② Air Liquide's safety culture, ③ Climate change response strategy and product information disclosure, ④ Air quality regulation trends, and ⑤ Merck Korea's RC implementation cases, etc. were shared.



LG Chem

LG Chem and GS Caltex
Join Forces in Joint
Biodegradable Plastic
Business

1

LG Chem and GS Caltex are accelerating their bio raw material business. Last October, the two companies signed a memorandum of understanding (MOU) to cooperate in joint projects with 3HP (3-hydroxypropionic acid), a key eco-friendly raw material for biodegradable plastics. This follows the signing of a joint development agreement (JDA) to develop 3HP mass-production technology by both companies in 2021 and the commencement of construction of a 3HP demonstration plant at the GS Caltex Yeosu plant last July. This recently completed factory aims to produce full-scale prototypes in the first quarter of next year. 3HP is an eco-friendly material produced through a microbial fermentation process of plant-derived raw materials. Plastic made from 3HP is a polymer with excellent biodegradability and high flexibility and can replace various disposable materials, drawing the spotlight as a next-generation platform chemical that can be converted to bio-acrylic acid and become a raw material for super absorbent polymer (SAP) applied to diapers, paints, adhesives and adhesives, coatings, and carbon fiber. In the future, the two companies plan to comprehensively discuss various cooperation including reviewing the establishment of a joint venture to expand joint business, considering the market conditions for biodegradable materials and bioplastics.



S-Oil

S-Oil Imports Ammonia
from Aramco...
Hydrogen Business Begins in
Earnest

3

S-Oil signed a letter of intent (LOI) to purchase low-carbon ammonia from Aramco, a global energy and chemical company, last October. This letter of intent contains a cooperation plan to supply and use low-carbon ammonia produced in Saudi Arabia to Korea. Aramco will produce low-carbon ammonia using carbon capture and storage technology (CCS), and S-Oil will import it, convert it into hydrogen, and use it to reduce its own greenhouse-gas emissions, and develop linked projects. Last year, in addition to ammonia, S-Oil signed four business agreements with Aramco to strengthen cooperation in alternative energy, including new petrochemical technology (TC2C), research and development (R&D) related to low-carbon future energy production, and venture investment. Through this, S-Oil plans to import, store, and supply clean hydrogen, blue hydrogen, and blue ammonia, into the country and build infrastructure to use them. The two companies will also engage in research and development together. S-Oil CEO Ryu Yeol said, "By introducing low-carbon ammonia into the domestic market, we will be able to help S-Oil's efforts to reduce greenhouse gases and build a domestic hydrogen industry."



DL Chemicals

DL Chemicals Established
In-House Venture Notak...
Dedicated to New
Material Development

2

DL Chemicals, a petrochemical subsidiary of DL Group, approved the establishment of the in-house venture 'NOTARK' at the board of directors meeting held last October. Its predecessor was BTT (Break Through Team), the advanced technology division of its subsidiary Kraton, and has been developing new materials completely different from the existing business areas of DL Chemical and Kraton. DL Chemicals plans to spur the promotion of new businesses by making the division an independent corporation. Notark has already invented Notark resin, a highly insulating PCB material used in ultra-high-speed communications and next-generation semiconductor packaging, and is now commercializing it. A PCB is a circuit board that forms a circuit on a wide insulating plate and electrically connects the components mounted on it. It is a key component used in electronic products, mobile phones, automobiles, etc. According to DL Chemicals, the signal-loss rate of Notark resin is more than 10 times higher than that of existing epoxy resin. Kim Jong-hyun, Vice Chairman of DL Chemicals, said, "Starting with the establishment of Notark, we will become a true technology-centered specialty company."



Kumho
Petrochemical

Kumho Petrochemical
Puts All Its Efforts into
Environment and Safety...
Materializing its ESG Plan

4

As Kumho Petrochemical Group establishes a sustainable management system, it will strengthen its capabilities in the environment and various safety areas. Kumho Petrochemical with its vision of "Let's Act, Advance, and Accelerate for ESG!" is focusing on advancing the environmental and safety management system, while making every effort to implement related key tasks. In response to climate change, it prepared a carbon-neutral growth plan in March of last year and established a greenhouse-gas reduction implementation roadmap. It also plans to start carbon-neutral growth in 2035 and reduce Scope-1 and -2 carbon emissions by 100% compared to BAU by 2050. Kumho P&B Chemicals, which has established a vision for ESG management in the first half of 2023 as 'a company that increases value through sustainable chemical products,' is strengthening monitoring of air pollutants and odor-causing substances within its business sites. Kumho Polychem is seeking to reduce air pollutants by installing additional air pollution prevention facilities. Kumho Petrochemical Group affiliates have decided to gradually reduce pollution-sources generated from vehicles operated by the company. Accordingly, they plan to operate about 60 zero-emission vehicles at all business sites by 2030.



SK Geocentric

SK Geocentric signed a Supply Agreement for Recycled Plastic Raw Materials with Global Company 'Amco'

5

SK Geocentric and Amco, a global packaging materials company, signed an agreement to supply plastic raw materials using waste-plastic pyrolysis oil. As a result, SK Geocentric will supply recycled plastic raw materials scheduled to be produced starting in 2025 to global packaging materials companies. Currently building Ulsan ARC, the world's first waste-plastic recycling complex, SK Geocentric plans to begin selling recycled raw materials produced there. Pyrolysis oil refers to oil extracted by melting waste-plastic waste, such as waste vinyl, that was mainly landfilled and incinerated. After a series of post-treatment processes, it becomes possible to produce products of the same quality as chemical products extracted from crude oil. SK Geocentric will supply polyethylene (PE) and polypropylene (PP) made from Ulsan ARC pyrolysis oil, which will be produced, from 2025, to Amco. Amco plans to use this raw material to produce packaging materials for cosmetics, pharmaceuticals, and food products and sell them to global consumer goods companies. Regarding this agreement, CEO of SK Geocentric Na Kyung-soo remarked, "We will continue to contribute to building a circular economy by expanding the supply chain, and applying pyrolysis oil produced from plastic wastes to packaging materials for final consumer products."



Taekwang Industrial

Taekwang Industrial Completes Solar Power Facility for Self-consumption... "Practice Low-carbon ESG Management"

7

Taekwang Industrial, a textile and petrochemical affiliate of Taekwang Group, completed the construction of a 1MW solar power facility for self-consumption using idle land in the Ulsan plant last October, participating in RE100 and practicing ESG management focusing on low carbon. It is the first company in the textile and chemical industry located in Ulsan to install a 1MW solar power facility for self-consumption to implement RE100. Unlike power generation businesses that sell electricity, solar power for self-consumption consumes the generated electricity within the business itself and is used as one of the means of implementing RE100. The power-generation facility installed this time utilizes the employee parking lot and is expected to not only reduce greenhouse gases and achieve carbon neutrality goals but also serve as a sunshade to block sunlight and rain. Taekwang Industrial, using the completion of this solar power facility as a stepping stone, plans to accelerate ESG management. Recently, Taekwang Group launched the Future Committee to establish an ESG-centered management system, and Taekwang Industrial, its main affiliate, also established an ESG Committee within the board of directors on the 16th of last month.



SKC

SKC Acquired ESG Management Evaluation Integrated 'A+' by KCGS

6

SKC obtained an integrated 'A+ (plus)' rating, one level higher than the previous year, in the '2023 ESG Management Evaluation' announced by the Korea ESG Standards Service (KCGS). KCGS comprehensively evaluates the environmental, social, and governance-related management of domestic listed companies every year and presents a total of seven grades, including S, A+, A, B+, B, C, and D. This year, it evaluated 1,049 listed companies, and only 19 companies, including SKC, received an A+ rating, placing them in the top 1.8%. The detailed grade was A+ in the environmental field, up two levels from the previous year, and maintained the previous year's grade of A+ and A in the social and governance fields, respectively. Choi Gap-ryong, head of the ESG Promotion Division at SKC, commented, "That we received A+ from KCGS is the result of recognition of our sustainable management that we have consistently promoted." He added, "We will continue to grow with the trust of stakeholders through transparent ESG management activities and ESG-based business model innovation."

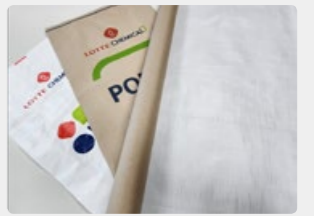


Lotte Chemical

Polypropylene for Extrusion Coating Selected as World-class Product

8

Lotte Chemical's 'polypropylene for extrusion coating (LAMI PP)' was selected as a World-Class Product of 2023. 'World-Class Product' is an official certification system hosted by the Ministry of Trade, Industry and Energy and operated by the Korea Trade-Investment Promotion Agency (KOTRA) to diversify export products and expand future export engines. They are divided into 'Current top-tier products' that are in the top-5 in global market share and have a global market size of more than \$50 million per year or export volume of more than \$5 million per year, and 'Next-generation top-class products' that are likely to be in the top-5 within the next five years. Lotte Chemical currently has a total of 15 world-class products, including the products selected this time. A Lotte Chemical official remarked, "LAMI PP, the No. 1 product in domestic production, is exported to various countries such as Vietnam, Indonesia, Bangladesh, and Turkey. We plan to actively target the global market by expanding customized products based on excellent technology and market understanding."





Regular Members

- | | |
|--|------------------------------------|
| Aekyung Petrochemical Co., Ltd. | Korea Ineos Styrolution Co., Ltd. |
| Air Liquid Korea Co., Ltd. | Korea Trinseo, LLC. |
| Akema Co., Ltd. | KPX Chemical Co., Ltd. |
| BASF Korea Co., Ltd. | Kumho P&B Chemical Co., Ltd. |
| Daehan Oil & Chemical Co., Ltd. | Kumho Petrochemical Co., Ltd. |
| DIG Airgas Co., Ltd. | Lances Korea, LLC. |
| DL Chemical | LG Chem Co., Ltd. |
| Dongseo Petrochemical Co., Ltd. | Lotte Chemical Co., Ltd. |
| Dongwoo Fine Chem Co., Ltd. | Lotte EOS Chemical Co., Ltd. |
| DuPont Korea Co., Ltd. | Lotte MC Co., Ltd. |
| Eastman Fiber Korea Co., Ltd. | Lotte Precision Chemical Co., Ltd. |
| Evonik Korea Co., Ltd. | LX MMA |
| GS Caltex Co., Ltd. | Merck Co., Ltd. |
| Hanwha Solutions Co., Ltd. | OCI Co., Ltd. |
| Hanwha TotalEnergies Petrochemical Co., Ltd. | Poly Mirae Co., Ltd. |
| Hyosung Chemical Co., Ltd. | Samnam Petrochemical Co., Ltd. |
| Infinium Korea | Seoheung Co., Ltd. |
| Isu Chemical Co., Ltd. | SH Energy Chemical Co., Ltd. |
| KCI Co., Ltd. | SK Geocentric Co., Ltd. |
| KOBESTRO KOREA Co., Ltd. | SK Materials Co., Ltd. |
| Kolon Industries Co., Ltd. | SKC Co., Ltd. |
| Korea Alcohol Industry Co., Ltd. | Taekwang Industrial Co., Ltd. |
| Korea ASK Chemicals Co., Ltd. | Yeocheon NCC Co., Ltd. |
| Korea Dow Chemical Co., Ltd. | Yongsan Chemicals Co., Ltd. |

Associate Members

- Korea Chemicals Management Association
- Korea Chlor-Alkali Industry Association
- Korea Fertilizer Association
- Korea Petrochemical Association
- Korea Petroleum Association
- Korea Precision Chemical Industry Promotion Association
- Korea Research Institute of Chemical Convergence

CALENDAR

2024

KRCC's major events of 2024

KRCC's Major Events in 2024

| Dates. | Major Events | Note |
|--|---|-------------------------|
| February. 23. | 1 st Board of Directors and 25th Annual General Meeting | |
| March. 14. | 1 st Executive Committee | |
| March. 25. - 26. | RCLG Meeting | Kaohsiung, Taiwan |
| March. 27. - 28. | 2024 APRCC | Kaohsiung, Taiwan |
| April. 27 | 2 nd Board of Directors (exercise meeting) | |
| May. 9. | 1 st Steering Committee | |
| June. 20. | 2 nd Executive Committee | |
| August. 31. September. 7. September. 28. | Outreach Program (Open! Happy Chemistry World) | Yeosu, Ulsan, Daesan |
| September. 12. | 3 rd Executive Committee | |
| November. 14. - 15 | KRCC Annual Workshop 3rd Board of Directors Meeting (Sports Meeting) | |
| December. 17. | 2 nd Steering Committee | |



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RESERVATION



How to join to KRCC Membership

Please scan the QR code to see the application process for membership of the Korea Responsible Care Council.