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Responsible Care

The Commitment of the Chemical Industry to Sustainable Development

Issue No + 37

Intro

An-Pyo Hong, CEO of Tongsoh Petrochemical Corp., LTD.

Special

Measures to prevent workers with Multiple Chemical Sensitivity (MCS) from suffering health obstacle

Issue

Chemicals-containing products aimed to protect consumers' health
Direction of safety management

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Issue No + 37 Responsible Care



Responsible Care® is a voluntary program operated by the chemical industry with aims to realize environmental protection, safety and human health in the entire process ranging from development of chemical products to their manufacture, sale, distribution, use and removal, internalize and implement them in managerial principles and conduct activities to improve environmental safety and healthcare conditions on a continual basis.

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Attainment of sustainable development through voluntary RC activities and safety, environment and health management


An-Pyo Hong, CEO
Tongsuh Petrochemical Corp., LTD.

Tongsuh Petrochemical Corp., LTD. that was established as a limited partnership between Chungju Fertilizer in Korea and Skelly Oil in the U.S. in 1969. Since then, it has consistently conducted activities to manage safety, health and environment through Process Safety Management (PSM) and its own programs. The company name 'Tongsuh' refers to an encounter with a western company in Korea in the East.


This special company name remains as a place name around a company house. Tongsuh Petrochemical Corp., LTD. is a fully invested company by Asahi Kasei, a global company in Japan, and has emerged as a successful foreign-invested company through close cooperation with the shareholder company. We met with An-Pyo Hong, CEO of Tongsuh Petrochemical Corp., LTD. and listened to what he had to say about corporate growth, environment and safety.




 **Please introduce Tongsuh Petrochemical Corp., LTD. and explain about its characteristics.**

 It is nice to meet you. I am An-Pyo Hong, CEO of Tongsuh Petrochemical Corp., LTD. Since 1972 when the company produced Acrylonitrile (AN), the main raw material of ABS resin and acrylic fiber, for the first time in Korea, Tongsuh Petrochemical Corp., LTD. has been equipped with a capacity to produce 560,000 tons based on ceaseless innovation and investment.

In addition, it has added value to such products generated in the course of manufacturing AN as Sodium Cyanide used in extracting precious metals including gold and silver and EDTA used in cleaning, sterilizing and treating metals. The company is also endeavoring to diversify the industry by advancing into the precision chemical sector through development of such microscopic organism catalysts as Acetonitrile and Acrylamide and related manufacture technologies.


 **Would you please tell us managerial ideology and philosophy of Tongsuh Petrochemical Corp., LTD.?**


 Tongsuh is sharing the value of the shareholder company Asahi Kasei Group whose managerial ideology is based on the motto, 'It pursues to contribute to advancing human lives.'

Toward this end, the company is manufacturing products through the use of such environmentally friendly technologies as use of clean fuels and advancement of waste water treatment system. Besides, the company is consistently operating RC (Responsible Care) system and conducting voluntary activities to manage safety, health and environment, which can induce sustainable development.

I make it a rule to emphasize the importance of safety, health and environment of individuals and the company to employees by letting them know that they are the source of corporate competitiveness. Toward this end, the company

is expanding investments in safety, health and environment every year while endeavoring to enable employees to work in the pleasant work environment.

 **What is the present RC activities and what have you achieved through them?**


 Tongsuh Petrochemical Corp., LTD. had consistently conducted activities to manage safety, health and environment through PSM and related programs prior to introduction of the RC activities.


Since 2000, demand for RC, a corporate autonomous program for activities on safety, health and environment in the domestic petrochemical industry, has been increased. Against this backdrop, the company has proactively introduced RC activities to the safety, health, environment and product safety sectors since July 2002 when an RC launching ceremony was held. In particular, it is pursuing to facilitate and systemize RC activities based on coordination and cooperation with Asahi Kasei, the shareholder company in Japan. Since its earlier stage of introduction of RC activities, the company has proactively taken part in various events and sponsorship activities by serving as the president of Korea RC Council.

It introduced such safety environment management system as CIRS (Continuous Improvement Rating System), the result of reorganization of





ISRS (International Safety Rating System), a global safety environment management system, to befit the current situation while integrating safety environment management activities with RC activities. Since 2002 when RC was introduced in earnest, problems related to safety accidents and processes have consistently decreased to record zero in accidents and disasters in the entire RC sectors. (As of 2016, it achieved 15 times the zero accident goal/about 14 years)


 **Recently, a growing number of companies have emphasized corporate social responsibilities. If you are presently conducting any social contribution activities, please let us know.**


 Since 2008, Tongsoh Petrochemical Corp., LTD. has conducted social contribution activities under the slogan, 'Voluntary service is not to hand out favors to others but to take part with them'. A company aims to make profits, but the output should be returned to the society in any form, and it is important to fulfill responsibilities for the local community and the society. Specifically speaking, employees of the company are directly taking part in Free Meal Voluntary Activity (once a month) for senior citizens and Voluntary Service Bath for the Handicapped (twice a month). In particular, 'Love Gimjang Volunteer Service' annually offered in the yard of a company house has positioned itself as a social contribution

activity in which all employees take part. The company supports social welfare facilities and people from lower income bracket by combining the community chest by all employees with corporate support fund. In addition, as a foreign investment enterprise, it is in full activity to provide overseas volunteer service focused on supporting multicultural families and affiliated overseas children who need help and establishing libraries and kindergartens in developing countries.

 **What is the ideal employee of Tongsoh Petrochemical Corp., LTD.?**


 Tongsoh Petrochemical Corp., LTD. desires employees who can comply with such three behavioral rules as sincerity, challenge and creativity. Toward this end, the company spares no pain to support and invest in nurturing multi-functional employees and experts by sector. Human resources development is a core element that leads to enhanced corporate competitiveness, and the company introduced a language study program to develop global talents in 2010. The company annually selects 3 to 4 employees who are allowed to participate in a language study program enabling them to receive three-month one-on-one private tutoring in Japan in addition to diversified cultural experiences. It also endeavors to nurture specialized technicians by holding regular exchange meetings in cooperation with specialized experts with the shareholder company. It is offering education aimed to nurture customized industry-university technicians among chemical and engineering majors along with local universities.


 **Please introduce your safety management system and safety education programs for employees.**

 Tongsoh Petrochemical Corp., LTD. has maintained an accident-free workplace for the past 15 years by operating various advanced safety management systems. Field-oriented tailored education played an





essential role in achieving it. The company will do whatever it can to figure out potential risks in the field and provide practical help at a time of preventing accidents and managing the field by offering safety education programs befitting the domestic chemical industry. The company explored 7 Action Items aimed to prevent accidents by analyzing accidents that occurred for the past 10 years and deducing fundamental causes while naming it as TSPC-7Habit. The 7 Action Items include ①Check out risks surrounding yourself ②Make an appropriate plan ③Recognize your ability ④Wear an appropriate protector ⑤Clearly communicate to others ⑥Follow procedures ⑦Report all. Through them, the company will settle and advance culture concentrated on detecting and preventing potential risks for itself in an effort to achieve 20 times the zero accident goal by 2022.

 **What do you think is the direction that Tongsoh Petrochemical Corp. needs to take in the future? What is the target of Tongsoh Petrochemical Corp. in the future?**

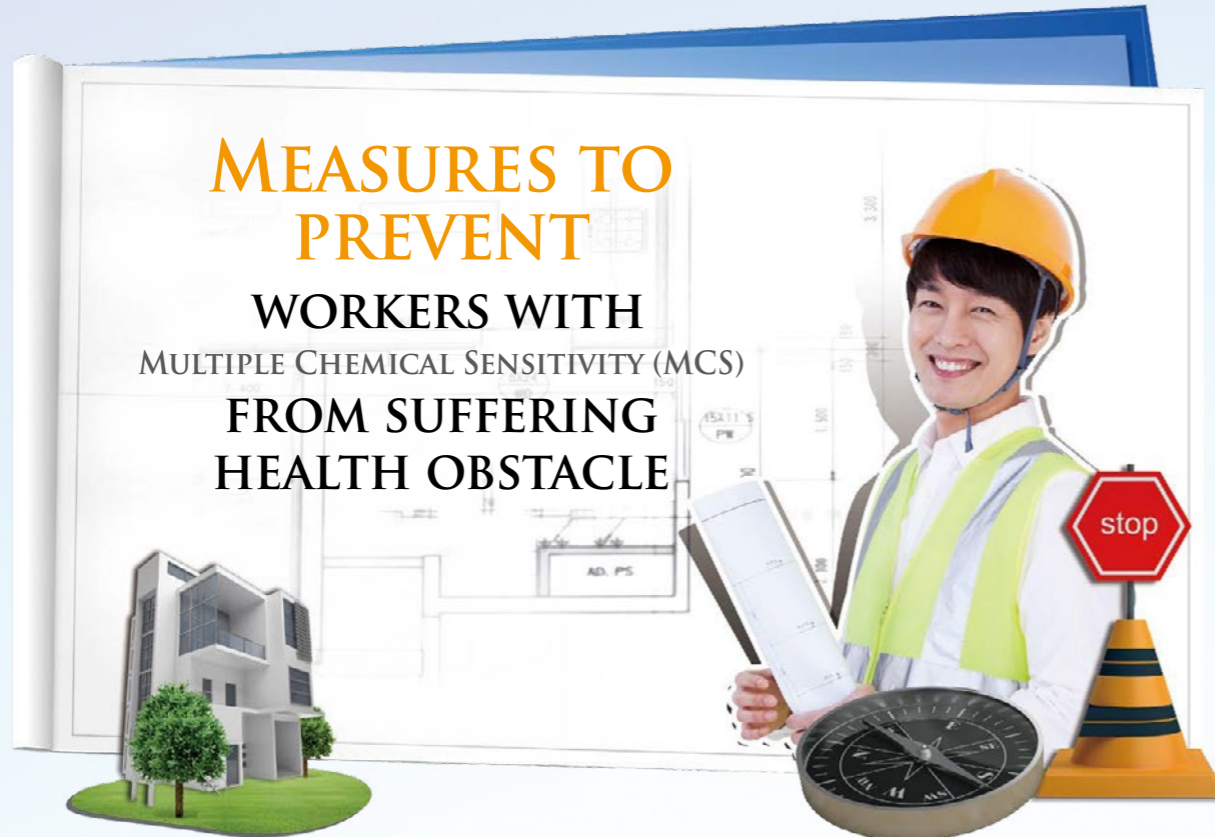
 Recently, the chemical industry has experienced difficult market situation and competition. As seen in the shipbuilding sector and the shipping sector, the petrochemical industry also cannot help but go through heavy seas of business restructuring and structural reorganization. Against this backdrop, Tongsoh Petrochemical Corp. is full of activities to improve the existing business structure. Refusing to be content with the existing system, the company is throwing energy into strengthening overall competitiveness in terms of personnel, facilities and institutions. Its mid-to-long-term goal is business diversification. The company believes that the domestic petrochemical industry needs to conduct restructuring to realize competitive business through selection and concentration. The industry needs to secure a new growth engine for the future by developing high value-added

products and new technologies.

 **If you have anything that you would like officials in the industry, academia, research centers and government agencies to do for the purpose of sustainable development, please let us know.**

 The government has recently endeavored to take measures to regain vitality through reorganization of business pertaining to excessively supplied items and restructuring of the petrochemical industry and resolve problems caused by excessive facilities through mergers based on transfer of business. Since the petrochemical industry tends to go through drastic variability in business according to products and economic cycles and has uniqueness as a process industry, thorough analyses and prediction for the future need to be conducted prior to restructuring. In order to secure global competitiveness in the chemical industry, government support and measures need to be provided through expanded infrastructure, advanced complex and improve legal institutions. Universities and research centers need to channel their entire energy into conducting research and development on technologies and products in an effort to secure a new growth engine for the future, and the government needs to provide appropriate support policy including R&D subsidies.

In addition, it is desperately needed to systematically nurture talents that can contribute to securing global competitiveness. It is regrettable that the negativities of the chemical industry have been brought to the fore instead of its positivities through such safety environment accidents as toxic gas leaks in a chemical plant. If the industry makes more efforts to offer safe and pleasant jobs and if universities, research centers and the government provide more support to enable excellent talents to join the chemical industry, it would be able to achieve further development into a safe and environmentally friendly industry. 🌱



Researcher Gyeong-taek Im
Chemical Toxicity Laboratory of KOSHA

Multiple Chemical Sensitivity (MCS) generally known as an environmental illness is a chronic disease that generates various symptoms correlated with exposure to low concentration chemicals. Those with MCS caused by consistent exposure to new materials go through serious restriction and suffering at work and in living environment, but general social consensus has yet to be generated with regard to definition, cases and diagnosis of the disease.

Work related problems with MCS vary depending not only on occupational exposure but also on relations between the illness and job obligations, and more work-related cases need to be found out to enable workers to go through diagnosis and treatment more rapidly so that MCS can be effectively prevented and managed for workers. Let's find out how to diagnose the illness, what symptoms it shows and how to prevent exposure to low concentration chemicals by explaining causal relationships between MCS situations at home and abroad and related job obligations as well as introducing pertinent cases and countermeasures taken in Japan.

What is MCS, a modernization disease?

Multiple Chemical Sensitivity (MCS) refers to discomfort or non-specific syndrome caused by exposure to low concentration chemicals frequently used in everyday life. It is also known as multiple chemical sensitivity, complex chemical sensitivity or idiopathic environmental intolerance. Idiopathic environmental intolerance is considered to be the same as MCS, and WHO defines it as an acquired disease showing multiple and repetitive symptoms caused by diversified environmental exposure to foods or electromagnetic waves in addition to chemicals. If it pertains to the following symptoms, it can be suspected to be MCS.

- ① Symptoms are reenacted through repeated exposure to chemicals
- ② It is chronic suffering
- ③ It is lower concentration than existing exposure or reenacted due to low concentration exposure that can be generally endured
- ④ If the source of stimulation disappears, symptoms are improved or eased
- ⑤ Reaction appears due to unrelated diversified chemicals
- ⑥ Symptoms need to include various internal organs.

As seen in Sick House Syndrome (Indoor Air Pollution), MCS has been classified as a disease in the U.S. and Japan, respectively, since 1980s and 1990s. In particular, these symptoms are not manifested due to one stimulation, but they cause bodily reaction through continuous and repetitive stimulations. Contemporary people have recently suffered these symptoms due to increase in sealed buildings caused by modernization and continuous and repetitive exposure to contaminated air.

Although MCS symptoms are still mild and unusual, if they are neglected without treatment, the number of MCS patients might be soared in Korea. Currently, those with MCS experience constraints in activities at work and in living environment and go through serious distress. However, general social consensus has yet to be generated with regard to definition, cases and diagnosis of the disease. Work related problems with MCS vary depending not only on occupational exposure but also on relations between the illness and job obligations, and more work-related cases need to be found out to enable workers to go through diagnosis and treatment more rapidly so that MCS can be effectively prevented and managed for workers.



MCS symptoms and statistics

The most frequent symptoms include migraine, sore eyes, asthma, vomit/gastroenteric trouble, dizziness, and they appear in the order of central nervous system, muscular/skeletal system, digestive organs and skin. Table 1 indicates symptoms by internal organ complained by MCS patients.

[Table 1] Symptoms of MCS by internal organ

Distinction	Symptoms by internal organ
Perceptive function	Reduced concentration, decreased power of memory, obscurity, difficult in decision-making and confusion at a time of choosing words
Head	Headache or pressure on the head or the face
Emotional function	Tension, nervous temperament, anxiety, depression & demotivation
Nervous system	Focal dysregulation, numb limbs, dizziness and balance disorder
Respiratory organs/ mucous membrane	Sore eyes, cough, laboring breath, stridor, nasal congestion, nose drippings, postnasal drip, sore throat & hoarse voice
Influenza	Hot flash
Musculoskeletal system	Muscular pain, arthralgia, lumbago, convulsions & stiffness
Cardiovascular system	Heart acceleration, irregular heartbeats & oppressive sensation on the breast
Skin	Rash, urticarial & dry skin
Stomach and intestines	Vomit, abdominal pain, constipation, diarrhea & gas in the bowels
Urinary system	Pelvic pain, frequent urination & urgent urination

Once symptoms appear, many attempt to avoid MCS in various ways. Life style also changes due to avoidance of exposure to chemicals, application of masks, use of vitamins, nutrients or counteragents, move to a new house or a new location, decreased participation in social activities, change of occupation and retirement. As for natural progress of MCS, 40% of patients experienced improvement, and 24% of them went through repeated improvement and deterioration. Most patients complained about difficulties in leading a daily life, and 14% of the patients showed complete inability to lead an everyday life.

[Table 2] Conditions of Exposure and Classification of Demographics by Ashford and Miller

Group	Conditions of exposure	Demographics
Factory workers	Acute or chronic exposure by industrial chemicals	Men aged 20 to 26
Office workers (Sealed buildings)	Inappropriate ventilation, construction, repair & maintenance materials. Or an absence of air exhausters in office equipment	More women than men Office workers aged 20 to 65 & students
Contamination diagnosis	Harmful waste area, contamination around plant areas Crop-dusting, subterranean water contamination and other community exposures	Those from middle class or lower, men and women of all ages, children or infants are influenced the most, and pregnant women can be affected as well.
Individuals	Indoor air, insecticides, home appliances and medical supplies	Office workers from middle class or higher and women aged 30 to 50

As an occupational disease, MCS is expected to cause a lot of damage to workers, but few apply for compensation for industrial disasters. It is due to the fact that few medical doctors have interest in occupational diseases and that relocation of offices or retirement make it difficult to be recognized to be victims of industrial disasters as they often left the pertinent environment.

[Table 3] Chemicals Related to MCS

Chemicals related to MCS
Organic solvent, paint, finishing lacquer Xylene, Methylene Chloride, Distilled petroleum material, Trichloro
Insecticide (Diazinon, azinphos-methyl (guthion) and other organophosphate)
Welding smoke and fume
Metal (Nickel & lead)
Other chemicals (Formaldehyde, Freon, Ethanol, Nitric Acid, Hydrochloric Acid, Toluene)
Powder & dust (Wood & sugarcane)
Food
Specific diseases (Scabies & herpes zoster)
Perfume & air cleaner (Shampoo, nail brightener, remover, after-shaving lotion, various cosmetics, deodorant and etc.)
Furniture
Paper
New buildings

Japanese cases

According to dispensatory published by Industrial Disaster Department of Japan's Ministry of Health, Labor and Welfare, if industrial disasters caused by such chemicals as MCS are found to have stemmed from job obligations as a result of examination on the quantity of exposure to chemicals with regard to specific symptoms or detection of disorder, the time of outbreak and detection of symptoms and the degree of seriousness, they shall be recognized to be related to job obligations. As it can occur due to a very small amount of chemicals or the symptom can be reenacted due to other chemicals than pertinent ones, peculiarity of MCS is highly likely to be excluded. A study meeting on health impact of indoor air held in Life Sanitation Department of Health Bureau of Japan's Ministry of Health, Labor and Welfare in February 2004 gave presentations on 'Medical Opinions on Sick House Syndrome'.

The presentation included "The possibility of existence of patients showing physical and mental conditions according to manifestation of non-allergic hypersensitivity in reaction to various low concentration chemicals cannot be denied." It indicates that methods of naming diseases are frequently inappropriate and that further studies need to be conducted to develop appropriate test methods and diagnosis standards that can exclude other diseases.

The followings pertain to three industrial disaster cases related to Sick House Syndrome and MCS in establishments.

The first case pertains to a reconstructed establishment in Osaka.

H residing in Osaka joined a home merchandise wholesaler in March 1999, and the company was relocated to a reconstructed building in May 2000. Working in a new place, he suffered a headache and a sense of incongruity in the nose or the throat before visiting E.N.T. and the department of dermatology, but the symptoms were not improved at all. In November 2000, he met an industrial health doctor in Workers' Health Service Center and was introduced to E.N.T. familiar with Sick House Syndrome. Convinced that his workplace was the main cause of the symptom, H applied for an industrial disaster, and it was finally recognized in a year. In the meantime, the company fired H for a reason of expiry of a contract period.

For your information, Labor Standard Instruction that recognized the case as an industrial accident due to occupation confirmed that the concentration of formaldehyde in H's workplace was more than 0.08 ppm, the standard limit.

Second case pertains to a day nursery in Osaka. A day nursery in Sakai City in Osaka moved to a temporary building due to reconstruction in May 2001. In 10 days, 11 employees and 15 children started complaining about pain and inflammation in the eyes, nose and throat. 4 part-time childcare workers were recognized to be the victims of industrial disasters in May 2002, and full-time childcare workers, public officials, were also recognized to be the victims of industrial disasters later on. The concentration of formaldehyde of the workplace turned out to be quite high.

The third case pertains to Ehime Iron Foundry.

A, a worker with Ehime Iron Foundry, was recognized to be the victim of an industrial disaster in April 2003. It seems to be the only case where a worker was recognized as the victim of MCS caused by a poor working environment that failed to meet the standard limit.

When A worked as a technical clerk, he usually worked in an office before visiting the factory floor in order to conduct inspection. He suffered such symptoms as intense heat, a headache and hives caused by inhalation of organic solvents in the factory floor in May 2002 before being hospitalized in an industrial disaster hospital.

Organic solvents included Toluene and Xylene whose concentration turned out not to be that high as a result of evaluation on working environment.

More than anything else, the symptoms couldn't be explained as addiction of organic solvents, so he was suspected to suffer psychological problems, which gave him a great deal of difficulties. With the help of his medical doctor, he applied for an industrial disaster in November 2002 and received support from Ehime Labor Safety & Sanitation Center. Labor Standard Instruction announced that he was not addicted to Toluene or Xylene that he was the victim of an industrial disaster by suffering 'an illness caused by exposure to other chemicals'.

Since it is hard to recognize the concentration or period of addition with Toluene or Xylene he was confirmed to suffer MCS.

Labor Standard Bureau of the Ministry of Health, Labor and Welfare in Japan conducted a commissioned study on 'Relations between MCS and Other Similar Diseases' in 2000.

Experts' meetings were held to discuss measures against Sick House Syndrome with regard to occupations, and guidelines for reduction in concentration of formaldehyde that was designated as one of cause substances were developed in 2002. Food and Drug Safety Bureau of the Ministry of Health, Labor and Welfare in Japan held a meeting to review Sick House Syndrome and selected chemicals suspected to be harmful to define regulatory value.

As Construction Sanitation Act was revised in 2003, it became obligated to measure the concentration of chemicals of newly constructed and remodeled buildings. Not only the administrative authority but also builders and the architectural circles show a lot of interest in chemicals of buildings, but they are passive about how to make compensation. In reality, accurate diagnoses are necessary in order for victims to be compensated, and only a small number of medical institutions make a diagnosis, and a method of treatment has yet to be established.

The name of the disease MCS was officially recognized in health insurance by March 2004.

[Table 4] Comparison of Sick House Syndrome and MCS

Sick House Syndrome	MCS
A general term of various health impairments caused by residence instead of a medically established single disease	Psychological and physical symptoms caused by manifestation of non-allergic hypersensitivity in reaction to microchemicals
Main symptoms: Mucocutaneous stimulation in the skin, the eyes, the neck and the head and such unspecified symptoms as fatigue, a headache and a dull feeling in the head	Unexplained conditions and onsets
Onset-related factors: Such chemicals as formaldehyde, fungus, ticks and etc.	Diagnosed cases include patients suffering from such existing diseases as addition or allergy
Since the indoor concentration value is not a threshold (Minimum physical quantity applied to a meter in order to cause reaction or other phenomena) that directly causes Sick House Syndrome, comprehensive review is required at a time of conducting diagnoses.	Conditions of a disease need to be explained, and a method of clinical examination and diagnosis standards excellent at sensitivity or particularly need to be developed.



Cases in Korea

A university hospital in Korea announced that it planned to treat and prevent Sick House Syndrome by conducting collaborative consultation with related departments including pediatrics, dermatology, E.N.T., otorhinolaryngology and pulmonary medicine and sharing facilities and equipment. The hospital established significance by saying that it opened Sick House Syndrome Clinic for the first time in Korea in an effort to take measures in the entire process ranging from prevention and treatment to management of related symptoms centering around occupational and environmental medicine. Patients visiting the clinic receive primary care before going through precise care in pulmonary medicine, pediatrics, dermatology and E.N.T.

In the meantime, the clinic measures and analyzes cause substances that might induce symptoms in living and working environments and evaluates relations between patients' symptoms and cause substances. The clinic also said that it plans to improve overall living environment by pushing for evaluation on indoor environment, indoor epidemiological survey, joint medical support in cooperation with environmental organizations, environmental improvement projects, joint research projects conducted in cooperation with constructors and standard for IAQ.

It also suggested that it would ultimately embrace all diseases caused by working environment with regard to relations between workplace contamination and health.

Suggestions for treatment and prevention of MCS

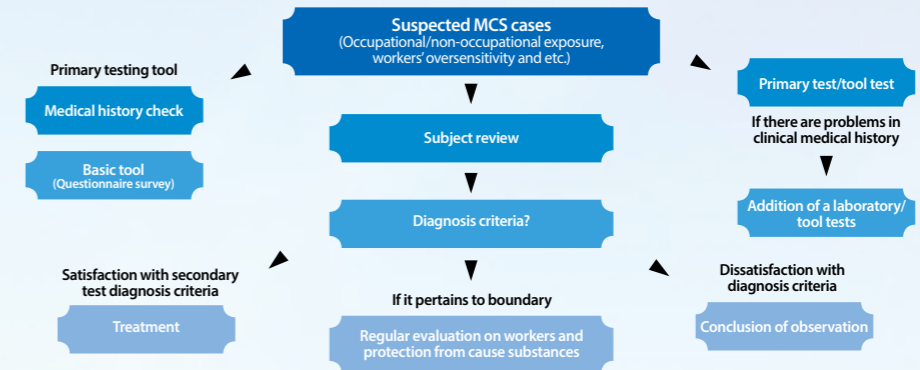
Since MCS has similar diagnostic criteria to sick building syndrome, chronic fatigue syndrome and fibromyalgia and can show the symptoms at the same time, it is very difficult to make a differential diagnosis from sick building syndrome, chronic fatigue syndrome or fibromyalgia.

Diseases indicating similar symptoms to MCS are integrated to be classified as 'medically inexplicable bodily symptoms,' and they are subject to a differential diagnosis from such diseases as allergies, multiple sclerosis, porphyria, anxiety disorder and depression.

In this regard, <Figure 1> suggested MCS diagnostic system and a flow chart related to working environment. It started with suspicion on MCS in consideration of work ability, exposure and hypersensitivity, and a detailed questionnaire survey was conducted with an aim to acquire information on exposure to chemicals in working environment with regard to examination on work ability. Data on working environment record not only exposed chemicals and time of exposure, but they also contain side effects of foods or drugs through the use of such questionnaires as QEEI, UTHS and IESI.

In addition to work ability, various tests and overall lung capacity measurement can be used in occupation environment medicine, and workers who satisfy diagnostic criteria need to go through treatment based on confirmation on diagnoses through additional tests.

If there are any problems in chronic disease history despite the fact that all criteria are satisfied, additional examination needs to be conducted, and workers need to be advised to avoid pertinent pathogenic chemicals.



[Figure 1] MCS Diagnosis System and Flow Chart

There are cases where patients with MCS were completely recovered through administration of antidepressant. However, as medication based on antidepressant, anti-anxiety drugs, sleep inducers and antioxidant is highly likely to deteriorate conditions, precautions need to be used, and education needs to be provided to prevent unnecessary neutralization of poison.

Various methods are being used to treat MCS, but it is known to be the most effective method of treatment to improve environment at home or workplaces so that chemicals can be avoided or exposure to them can be reduced within the limits of the possible. The purpose of treatment is to 'adjust symptoms,' and management needs to be conducted to enable patients to ease symptoms and lead a work life and a family life at the same time. From now on, the government, industries, researchers and the general public need to make efforts to resolve safety problems related to chemicals by taking diversified measures to strengthen air management criteria, introduce work environment certification system and promote guidelines for work environment. 🌱



DIRECTION OF SAFETY MANAGEMENT OF PRODUCTS CONTAINING CHEMICALS FOR PROTECTION OF CONSUMERS' HEALTH

Professor Young-wook Im
Yonsei University College of Medicine



Recently, safety management on chemicals has emerged as one of the most important pending issues. Chemicals are being used in diversified industries including semiconductor, electronics and medicine. If safety is guaranteed and well managed with regard to use of chemicals, they would be very helpful in everyday life, but if an accident occurs, it might cause various problems due to leaks.



Controversy about safety of chemicals

Some companies do not make sufficient efforts to improve chemical products containing harmful ingredients. They sometimes include such a phrase as 'Environmentally Friendly' or use product names at a time of promoting products. There were some cases where controversy occurred.

Many are well aware that paint contains a significant amount of heavy metals and volatile organic chemicals. However, some products were advertised and sold under the name of 'environmentally friendly paints' although those exceeded the certification criteria. Some exceeded certification criteria. Collagen Paint that acquired Environment Mark, Dunn Edward Suprema, an environmentally friendly import,



and Mineral Paint exceeded the Environment Mark Standard of 1.0mg/m³h as suggested by KEITI. Controversy about cleansing agents and coating materials occurred.

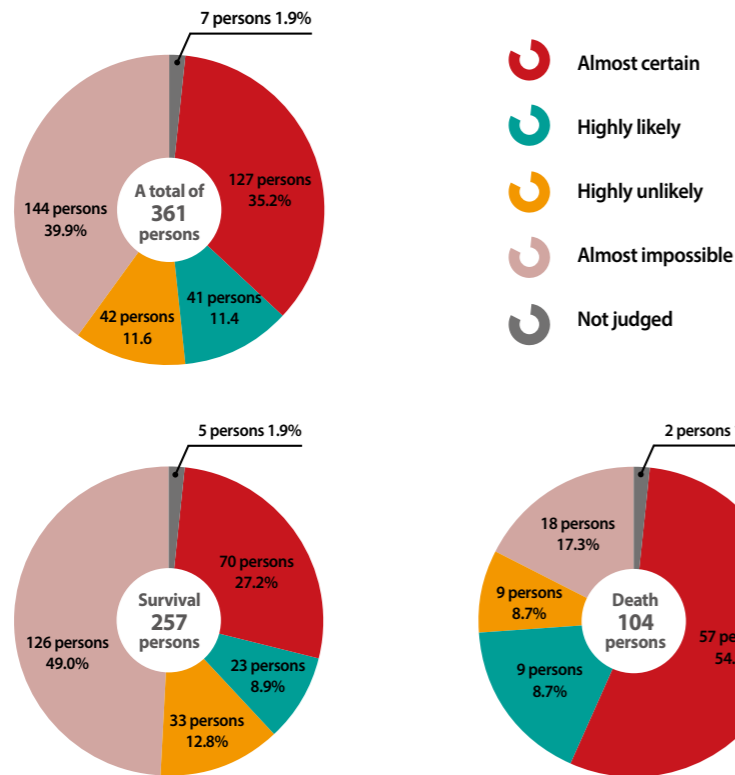
Products manufactured by Ketosi International contained eight times more formaldehyde, a carcinogen causing pressure on the lungs and stimulation of the eyes and the respiratory organs.

In addition, in some cases, dyestuff for tattoos, auto washer solution, deodorant, aromatic, insecticide, car air-conditioning system and antimicrobial filters for air cleaners contained harmful materials that might have a great effect on the human body. The latest greatest issue related to controversy about safety of chemicals is a disinfectant for a humidifier. Oxy released a humidifier disinfectant in 1996, and its material was Preventol R80 whose inhalation toxicity test was completed. Consumers filed a complaint about floating matters of Preventol R80, and Oxy changed the disinfectant ingredient into PHMG in 2001. However, PHMG did not go through an inhalation toxicity test. Since 2005, demand for a humidifier disinfectant has been increased, and 30 cases of pediatric pneumonia whose causes are still unknown were reported to the academia in 2008. In August 2011, Center for Disease Control & Prevention announced that the humidifier disinfectant is assumed to have caused damage to the lungs.

In the end, Oxy went through search and seizure in October 2015, and a statement that the company expected harmfulness but failed to conduct a safety test was secured. Although



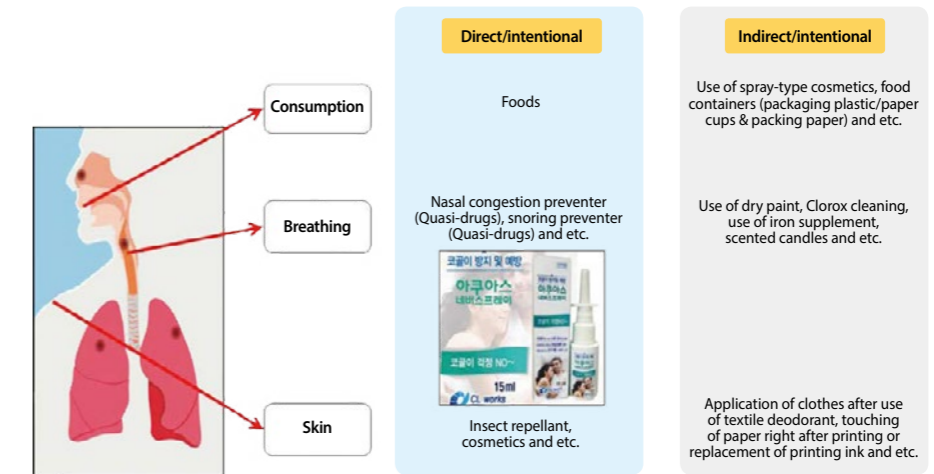
Oxy knew the harmfulness of the disinfectant, it did not stop producing products, and it even promoted safety of their products. As a society becomes more advanced, it should be requested to be more ethical and afraid of consumers' voice.



[Figure 1] Result of Examination on Cases of Suspected Damage to the Lungs

In case of chemicals, it is very important to take the route of exposure into account. At a time of introducing policy, the government should set the accurate direction of designating the route of exposure, and the company should develop products in consideration of possibility of intentional or unintentional exposure according to each and every route of exposure. The humidity disinfectant problems occurred due to insufficient evaluation on the route of exposure. In this regard, consumers need to make it a rule to minimize exposure.

What needs to be more considered is products used by babies and children. Babies and children tend to unintentionally consume products. Products used only by babies and children need to be differentiated from those mostly used by adults.



[Figure 2] Route of Exposure of Chemicals within Products

A method of wise consumption

Daily products include such chemicals as deodorant and adhesive used by consumers in everyday life and such biocides as insecticide and disinfectant aimed to kill, disrupt or obstruct harmful organisms that exclude human beings and animals as well as surfactants contained in all products used in cleaning and washing.

- Aromatic:** Products aimed to weaken odor by spreading scent ingredients in the air
- Deodorant:** Products aimed to turn odor-causing ingredients into odorless ingredients through chemical reaction
- Biocide:** Material that kills such harmful organisms as bacteria, molds and insects
- Surfactant:** Ingredients contained in all products used in washing or cleaning

At a time of using these products, consumers need to comply with a method of use (frequency, period, precautions and etc.) indicated on the products instead of being preoccupied



with convenience. At a time of using daily chemicals, consumers need to comply with the followings. ①Make sure to ventilate the indoor air on a regular basis. ②Make sure not to directly spray chemicals around the respiratory organs. ③Make sure to spray chemicals in a well-ventilated place with the wind. ④Make sure not to use chemicals in a sealed area. ⑤Make sure to keep chemicals outdoors.

It is recommended that consumers are restrained from using biocides, but if it is necessary to use it, make sure to comply with the following procedures.

①Make sure to refrain from using a large amount of biocide spray in sealed space ②Make sure not to directly spray chemicals to a person ③Make sure to use biocide when there is no one in living environment for babies and children ④Make sure to ventilate air and clean the surface after use of products ⑤Make sure not to use biocide sprayed to clothes like underwear where the skin is not directly touched and make sure to wear them after washing. Make sure to fully wash out surfactant after use and check out the content of natural surfactant.

Domestic chemical management system

Act on the Registration and Evaluation of Chemicals was established to prevent damage caused by humidifier disinfectants and similar accidents from recurring.

Act on the Registration and Evaluation of Chemicals aims to conduct management based on risks in consideration of harmfulness, toxicity and exposure with regard to existing chemicals and new chemicals.

It is expected to become the basis for designation of safety standards and indication standards of daily chemicals. According to the Article 2-16 of Act on the Registration and Evaluation



of Chemicals, products of risk concerns refer to chemicals notified by the Environment Minister through consultations with central administration organizations due to concerns about risks posed on public health or environment.

The government plans to complete a total inspection on the actual conditions of use of distributed biocide by 2017 and conduct risk assessment based on the results. It also plans to establish a list of biocides by product group in connection to biocides and biocide-containing products and restrict use of toxic biocides that are highly likely to be exposed to consumers on a preferential basis before designation of safety criteria.

Chemicals Control Act	Act on the Registration and Evaluation, etc, of Chemical Substances
<ul style="list-style-type: none"> - Prevention of risks posed to public health and environmental risks - Chemical management - Rapid response to accidents caused by chemicals ▶Protection of life and property of the general public and preservation of the environment 	<ul style="list-style-type: none"> - Registration of chemicals - Inspection and assessment on harmfulness and risks of chemicals and hazardous chemical-containing chemicals - Designation of matters on designation of hazardous chemicals - Production and use of information on chemicals ▶Protection of public health and environment

Conclusion

The government, companies and consumers make concerted efforts to conduct safety management on chemical-containing products. The government needs to set the clear direction for management of products of risk concerns by setting a reasonable standard based on risk assessment in order to prevent another humidifier disinfectant accident from occurring. It is necessary to conduct review on the level of exposure to the human body according to usage and a method of use of products for the purpose of safety management on daily chemicals. In addition, thorough bodily exposure evaluation and risk assessment need to be conducted to make it possible to review safety of exposure of ingredients of products to the human body.

More than anything else, the company needs to be equipped with morality and provide information on products to satisfy consumers' rights to know. Compared to foreign countries, Product Safety Data Sheet (PSDS) for domestic products is filled with phrases related to promotion on products instead of information on products.

As for cosmetics products, Full Ingredient Labelling System is applied, but the content of each ingredient has yet to be indicated, so more information needs to be provided. Companies using chemicals and those developing products also need to make more efforts to use substances with less harmful ingredients or no hazardous ingredients instead of putting too much emphasis on design and promotion. 🌱





Six companies including Hanwha, Daelim, Lotte and GS make new investment worth 2.6 trillion won in Yeosu Industrial Complex

As Yeosu National Industrial Complex resolved problems caused by a chronic shortage of factory sites, six companies newly invest 2.6 trillion won in expanding their plants.

With Minister Ho-In Gang, Jeonnam-do Vice-Governor Gap-Seop Kim and Yeosu Mayor Cheol-Hyeon Ju on hand, the Ministry of Land, Infrastructure and Transport held a ground-breaking ceremony to expand a factory site in Yeosu Industrial Complex on July 22. According to the Ministry of Land, Infrastructure and Transport, Yeosu Industrial Complex houses about 282 companies in an area covering 35.63 millionm², and they have 20,000 employees. It is the Korea's largest petrochemical industrial complex that accounts for 47% of the domestic production in the petrol chemical sector by recording 8.6 trillion won in annual production. As the petrochemical industrial complex is saturated with plants, tenant companies desiring to expand their plants have suffered a chronic lack of factory sites.

The government decided to support expansion of factory sites by cancelling some unused greens within the industrial complex while pushing for permit and approval for development of the industrial complex.

As development of the industrial complex and revision of an implementation plan for expansion of a factory site were completed in June, a ground-breaking ceremony was held to enter full-fledged development. First of all, six companies are expected to make new investments worth 2.655 trillion won through expansion of factory sites. As for investment by company, Hanwha Chemical invested 450 billion won, KPX Life 30 billion won, Yecheon NCC 910 billion won, Daelim Industry 195 billion won, Lotte Chemical 520 billion won, and GS Caltex 550 billion won. The area of expansion by the six companies is a total of 661,630m².

Minister Gang said, "The industrial complex needs to be changed into a new creative area so

that it can contribute to strengthening long-term competitiveness. Regulation on usage and business type applied to the industrial complex that obstruct business activities conducted by companies needs to be drastically relaxed to facilitate industrial convergence and nurture customized industries through support."

Distinction	Company name	Area (m ²)	Factory expansion	Investment scale (100 million won)
1	Lotte Chemical	157,467	Ethylene Vinyl Acetate (EVA) Plant	5,200
2	Yecheon NCC	135,050	Naphtha Cracking Center	9,100
3	GS Caltex	132,683	Propylene Oxide Plant	5,500
4	Daelim Industry	122,950	Poly Alpha Olefin Plant	1,950
5	Hanwha Chemical	60,435	Chlor-Alkali Plant	4,500
6	KPX Life	53,045	Active Pharmaceutical Ingredient Plant	300
Total		661,630	-	26,550

* Companies are listed in a descending series in terms of area.

| The Dow Chemical Company | Yellow Carpet' for safety of children along

Dow Chemical Korea (CEO Woo-Jong Yu) announced that it would conduct a project to install 'Yellow Carpet' for safety of children along with Childfund Korea (President Je-Hun Lee) and International Child Rights Center (InCRC) (Representative Yang-Hee Lee). The 'Yellow Carpet' project sponsored by Dow Chemical Korea under the slogan, 'A Safe Town Created by Children,' aims to distinguish the access of a crosswalk from walls through the use of yellow color so that children can wait for a signal in a safe spot and drivers can avoid a traffic accident by helping secure a clear view. Durable aluminum stickers applied to indicate a road surface are used as yellow carpets, and since a solar photovoltaic power lamp attached to the upper part gives a charge of electricity in the daytime, and it is automatically turned on by detecting movement when a person approaches at night time, it enables children to cross a road safely.

Dow Chemical Korea installed 'Yellow Carpet' in three spots in Cheonan and three spots in Seoul, respectively, on September 30 and October 7, and its employees proactively participated in removing dusts and attaching lamps in an effort to realize safe crossings along with InCRC and Childfund Korea. Woo-Jong Yu, CEO Of Dow Chemical Korea, said, "We started the project to install 'Yellow Carpet' along with InCRC and Childfund Korea so that we can protect children from car accidents, the leading cause of child death, and realize safer local communities. Dow Chemical Korea will make more efforts to provide support to development of local community by continuously contributing to the society with a sense of social responsibility."



In addition, Dow Chemical Korea is conducting social contribution activities to help advance local communities in various sectors including such environmental protection programs as 'Park Friends', 'Habitat,' 'Community of Hope' and environmental education programs for children.

| DuPont Korea |

Efforts to spread safety culture

KOSHA and DuPont Korea are making efforts to prevent disasters and spread safety culture.



KOSHA Ulsan Branch (Branch Head Tong-Won Shin) and DuPont Korea (CEO Heung-Sik Park) conducted safety check and campaign in DuPont Korea Ulsan Factory in Nam-gu, Ulsan on August 26. The safety check conducted on the day was concentrated on prevention of choking accidents in sealed space in chemical plants and protection from fires and explosions. A campaign was also

conducted to provide technical support and spread safety culture for the purpose of prevention of disasters in workplaces.

| Lotte Chemical |

Yeosu NC Plant holds a ceremony to celebrate continuous operation for 4000 days in a row

Lotte Chemical (CEO Su-Young Heo) held a ceremony to celebrate continuous, stable and safe operation for 4,000 days in a row in NC (Naphtha Cracking) Plant, Lotte Chemical Plant No. 1 in Jungheung-dong in Yeosu City in Jeollanam-do. The ceremony was graced by Myeong-Jin Jeon, Director General of Production, and employees of Lotte Chemical Yeosu Factory. Construction of Lotte Chemical NC Plant was initiated in April 1990 to be completed in April 1992 through a pilot operation. Currently, it is producing 1 million tons of ethylene per annum.



The continuous 4,000-day operation was achieved from June 26, 2005 to September 11, 2016, and during the period, the plant was continuously operated without any irregular stoppage. An official with Lotte Chemical said, "The continuous, stable and safe 4,000-day operation is an inspiring achievement based on operational safety and management technology of the plant. The company will use the occasion to realize continuous accident-

free operation, effective production of products, optimized process operation and thorough field-oriented safety environment management for all employees so that it can emerge as a global petrochemical leader."

| Kolon Industry |

Our colorless Polyimide is 3 to 4 years ahead in terms of technological advancement...will lead the global market"

Announcing its plan on investment in mass production of colorless polyimide for the first time in the world, Kolon Industry, a synthetic fiber company, unveiled its aspiration to widen a technology gap with new competitors and lead the global market through aggressive facility investment. In a briefing session on the world's first colorless polyimide films held in Korea Institute of Financial Investment in Yeoui-do, Seoul on August 2, Kolon Industry said, "Our colorless polyimide is 3 to 4 years ahead in terms of technological advancement compared to competitors at home and abroad. The company will proceed with investment in mass production facilities in order to prevent the competitors from outrunning us at a rapid speed." As core material of a next-generation display, Colorless Polyimide is transparent and strong like glass and thin and unbreakable. In particular, if the film is folded, it is easily bent (1m radius) and leaves no fold marks or scratches after hundreds of thousands of times of folds. Chung-Seok Gang, Executive Director of CPI Business, said, "Companies without experiences in mass-production of polyimide films would have much more difficulties in catching up with us by accumulating mass production technology. Mitsubishi Chemical Corporation and Sumitomo in Japan are cited as representative competitors, and the Japanese government is spending a huge amount of budget on it."

Kolon Industry plans to establish colorless polyimide film mass-production facilities in Gumi Plant in Gumi City in Gyeongbuk in the third quarter and complete them in January 2018. The company will invest in Line 1 first before expanding investment to Lines 2 and 3 in consideration of changes in market trends. The production lines can produce 1 million m² of polyimides per annum. It pertains to 100 soccer fields in terms of size.

Kolon Industry invested a total of 90 billion won in order to record 200 billion won in sales on average for three years by 2020. The investment decision well reflects the management's firm determination to preoccupy the next-generation display market at an earlier possible date and lead the display market in the future. If commercial production of colorless polyimide film is initiated, the date of release of foldable smartphones that smart phone producers are preparing to disclose as a next-generation phone is expected to be moved up. As explained earlier, the colorless polyimide films are not broken and leave no traces even after repeated tests on 200 times of folds. If it goes through hard coating, surface hardness is similar to ion tempered glass.

Young-Seo Yun, CIP Business Team Leader, said, "A test is conducted to fold colorless polyimide more than 200,000 times when it goes through hard coating."

Kolon Industry puts efforts into coating material for hard coating aimed to enhance surface hardness of colorless polyimide film. Executive Director Gang said, "The company will make efforts to apply it to flexible display products and secure momentum to widen a technology gap with Japan and achieve continuous growth in competition with China experiencing growth on the strength of huge investment resources." 🌱

NEWS

RC Activity

ISSUE NO. 37



The 3rd Executive Committee Workshop in 2016

Korea RC Council held the 3rd Executive Committee Meeting with 20 persons including In Park, Chair of Executive Committee (Managing Director of LG Chemical), from 12 member companies on hand in The Ocean Resort in Yeosu from August 30 to August 31.

The workshop was focused on analyzing the cause of accidents by presenting various cases including Analysis on Case of Overseas Accidents Caused by Hydrogen Embrittlement (Geon-Ung Yun, Team Leader of Hanwha Total), Analysis on RC Process Safety Code (Young-Sam Gong, Lotte Chemical) and Risk Factors of Forklifts and a Method of Risk Reduction (In-Nyeong Lee, Managing Director of Basf Korea) before sharing information on the latest issues.

It was followed by review on safety healthcare RC checklist for workers. The 4th Executive Committee Meeting will be held in Executive Office of Korea RC Council at 4 p.m. on December 14 (Wednesday).



2016 Come! Fun World of Chemistry

'2016 Come! Fun World of Chemistry' was held for 4th and 5th graders in Seosan (August 27), Ulsan (September 3) and Yeosu (September 24).

Since 2003, Come! Fun World of Chemistry has been conducted to enable students to participate in easy and interesting chemical experiments through chemical 'experience activity' and 'play court' programs and establish a network where local community cooperates with the chemical industry.

This year, it was successfully held amid a lot of interest and cooperation as 852 students from 134 elementary schools in Seosan, Ulsan and Yeosu took part in the theme, 'Chemical Story in Everyday Life.'

In particular, a magic show aimed to promote the chemical industry

was given as an opening performance to draw a lot of attention from many students.

After the event, many students expressed satisfaction with various new experiences that they have never had as well as marvelous chemical experiments.

In the meantime, 63 officials with 22 related companies took part as volunteer workers to guide students and explain chemistry closely related to our daily life while helping them develop interest in chemistry.



Industries (24 KRCC member companies)

Platinum: Tongsoh Petrochemical Corp. LTD., Lotte Chemical, SK Global Chemical Co., Ltd., Yecheon NCC, Hanwha Total

Gold: Kumho Petrochemical, Daelim Industry, Korea Petrochemical Ind. Co., Ltd., DuPont Korea, Dongwoo Fine-Chem, Lotte Advanced Materials, Dow Chemical Korea, Basf Korea, INEOS-Styrolution Korea

Silver: Lotte MRC, Samnam Petrochemical, Evonik Korea, Air Liquide Korea, LG MMA, Kolon Industry, Trinseo Korea

Government/Institutions

Ministry of Trade, Industry and Energy / Ministry of Environment / Yeosu City Hall in Jeonnam / Seosan City Hall in Chungnam / Ulsan City Education Office / Jeollanam-do Education Office / Chungnam Seosan Education Support Office / Korea Petrochemical Industry Association

Academia (Teachers' Associations in 3 provinces)

Chungnam (Seosan Science Information Education Support Group)
Ulsan (Ulsan Science Education Research Group)
Jeonnam (We Love Chemistry)



NEWS



2016 Petrochemistry Safety Seminar

Korea RC Council held 2016 Petrochemistry Safety Seminar with 50 employees in charge of environment on hand in Severance Building in Yonsei Foundation on October 11.

The seminar held with aims to introduce the latest trends of safety policy for prevention of disasters in the petrochemical industry and share advanced safety management system in establishments in petrochemical complex presented ①Control of unsafe behavior for improved safety culture in companies ②Risk assessment methods and application ③The current state of chemical accidents in the petrochemical industry and a method of improvement of PSM system and ④Safety management system for partners.



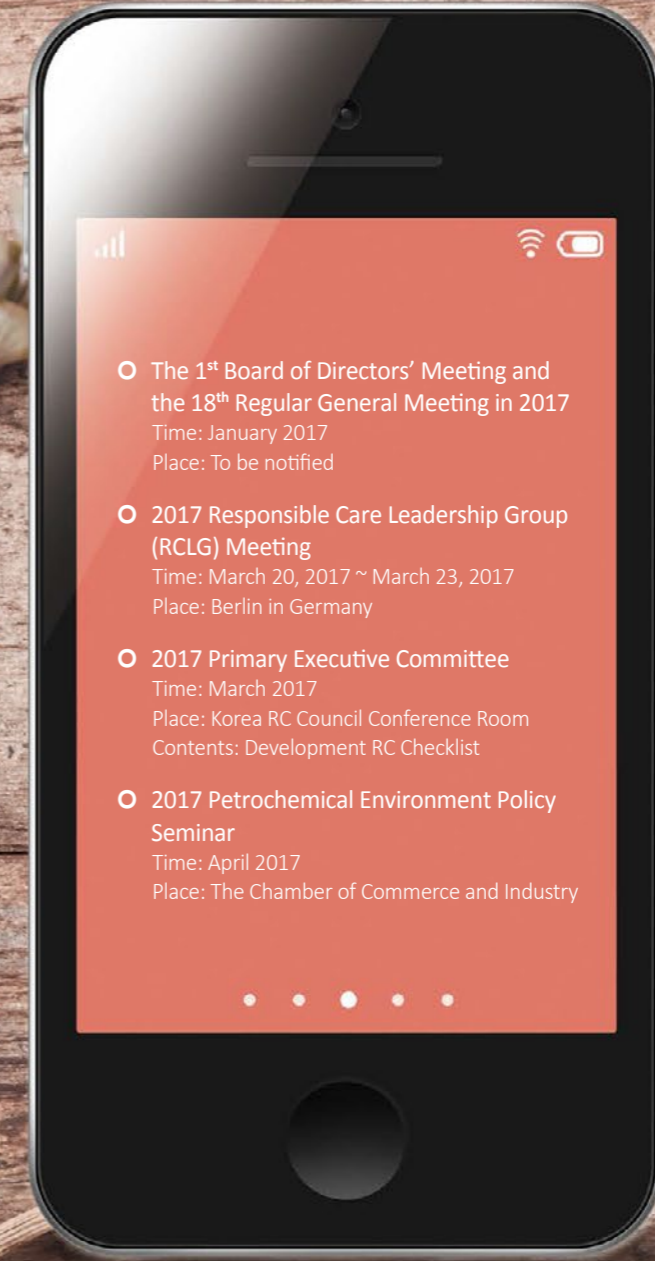
2016 RC Annual Workshop

Korea RC Council held 2016 Annual RC Workshop in Hilton Namhae Resort from November 24, 2016 to November 25, 2016.

The annual workshop was attended by 60 persons including Jong-Hu Lee, President of KRCC, and Jong-Pil Heo, Honorary President of KRCC, from 29 member companies. Sang-Hun Shin, a talking speech professor, gave a presentation about communication through humor that changes people, family and workplaces under the theme, 'The Power of Humor that Makes It Possible to Communicate to Others without Hurling Words and Pain.'

It was followed by safety management cases in member companies. (①Tongsuh Petrochemical Corp. – Safety diagnosis by the top management of Japanese petrochemical companies ②Dow Chemical Korea – Safety culture improvement programs ③Samnam Petrochemical – Safety & health management through loss & safety management ④SK Innovation – SHE management cases by affiliated companies) 🌱

Information on Major Events Conducted by Korea Responsible Care Council in the First Half of 2017



- The 1st Board of Directors' Meeting and the 18th Regular General Meeting in 2017
Time: January 2017
Place: To be notified
- 2017 Responsible Care Leadership Group (RCLG) Meeting
Time: March 20, 2017 ~ March 23, 2017
Place: Berlin in Germany
- 2017 Primary Executive Committee
Time: March 2017
Place: Korea RC Council Conference Room
Contents: Development RC Checklist
- 2017 Petrochemical Environment Policy Seminar
Time: April 2017
Place: The Chamber of Commerce and Industry



Members

Regular Members

- Aekyung Petrochemical
- Air Liquide Korea
- Arkema
- Axalta Coating Systems Korea
- Bayer Korea
- Capro
- Connell Bros.
- Daesung Industrial
- Daesung Industrial Gasses
- Dongwoo Fine-Chem
- Dow Chemical Korea
- DuPont Korea
- Eastman Fibers Korea
- Evonik Korea
- GS Caltex
- Hanhwa Chemical
- Hanhwa Total
- Hanju
- Hansu
- Hyosung
- Ineos-Styrolution Korea
- Isu Chemical
- Kemira Chemical Korea
- Kolon Industry
- Korea Alcohol Industrial
- Korea ASK Chemicals

- Korea Basf
- Korea DowCorning
- Korea Petrochemical IND.
- Tongsuh Petrochemical Corp.
- KPX Chemical
- KR Copolymer
- Kumho P&B Chemicals
- Kumho Petrochemical
- LANXESS Korea
- LG Chem
- LG MMA
- Lotte Advanced Materials
- Lotte BP Chemical
- Lotte Chemical
- Lotte Fine Chemical
- Lotte MRC
- Merck
- OCI
- PolyMirae
- Samnam Petrochemical
- SH Energy & Chemical
- SK Global Chemical
- SKC
- Taekwang

- Trinseo Korea
- Yeocheon NCC
- Yongsan Chemicals

Associate Members

- Korea Chemicals Management Association
- Korea Chlor Alkali Industry Association
- Korea Fertilizer Industry Association
- Korea Petroleum Association
- Korea Petroleum Industry Association
- Korea Specialty Chemical Industry Association
- Korea Testing & Research Institute
- Metropolitan Area Process Safety Management Association

Information on the 1st Board of Directors' Meeting and the 18th Regular General Meeting in 2017

The first board of directors' meeting and the 18th regular general meeting for 2017 will be held to present and discuss record of performance, business plans for 2017 and budget (draft). We hope that you will make sure to attend the meetings to offer valuable advice enabling Responsible Care to fulfill its responsibilities for the chemical industry.

Time: 11:00~13:00, January 2017
 Invitees: CEOs, executives, employees & coordinators of the members

