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Chulabhorn Research Institute

INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND INDUSTRIAL TOXICOLOGY (ICEIT)

CRI's ICEIT has been designated as a
"UNEP Centre of Excellence for Environmental and Industrial Toxicology".

Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol receives the 2013 IUTOX Merit Award for her distinguished career in toxicology

On June 30th, 2013, Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol, President of the Chulabhorn Research Institute (CRI), was presented with the 2013 International Union of Toxicology (IUTOX) Merit Award, the highest honor IUTOX bestows on a scientist, at a special ceremony held in Seoul, Korea during the 13th IUTOX International Congress of Toxicology.

This award is presented in recognition of her long and distinguished career in toxicology at the international level, including achievements in the fields of academia, public service and industry, and reflects the mission of IUTOX, which is to improve human health through the science and practice of toxicology worldwide.

Thus the award was made in recognition of Her Royal Highness' significant contributions to science in developing countries, including research in the areas of toxicology, environmental health,and cancer, as well as the development of toxicology and risk assessment training programs in the Asia Pacific region. Her Royal Highness' dedicated work in the development of human resources in toxicology through organizing a number of training courses, including a cutting edge electronic distance-learning tool on risk assessment and risk management of chemicals, is a key factor in the availability of risk assessment training in developing countries. In addition, IUTOX recognized Her Royal Highness' important role in the establishment of CRI and the critical work in the area of environmental toxicology, specifically which focuses on problems faced by scientists in developing countries working to improve the living conditions of the people.

WHO SEARO DESIGNATED CRI TO BE THE REGIONAL TRAINING CENTER FOR CHEMICAL SAFETY IN THE SOUTH-EAST ASIA REGION

at the WHO Regional Workshop on Chemical Safety, Bangkok, Thailand from June 24-26, 2013

On Monday June 24, 2013, Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol presided over the opening of the WHO Regional Workshop on Chemical Safety at the CRI Convention Center.

The regional workshop, co-hosted by the Chulabhorn Research Institute (CRI) and WHO SEARO, had the main objective of developing a regional implementation plan for the health-related aspects of chemical safety, by providing an opportunity for representatives from the health and environmental sectors of WHO Member States in the South-East Asia region to review and assess the overall status of chemical safety and to explore and elaborate actions for strengthening chemical safety. This would help guiding and strengthening collaboration at the national and regional levels to better define work programmes and activities.

Dr. Samlee Plianbangchang, Regional Director of WHO SEARO, stated at the Opening Ceremony that WHO SEARO had designated CRI to be the Regional Training Center for Chemical Safety in the South-East Asia Region.

Through its WHO Collaborating Centre for Capacity Building and Research in Environmental Health Science and Toxicology, CRI has many on-going activities related to chemical safety, including (a) short-term and long-term capacity building programmes that include courses in Principles of Toxicology, Environmental Toxicology, Detection of Environmental Pollutants and Monitoring of Health Effects, Occupational and Environmental Medicine, and Environmental and Health Risk Assessment and Management of Toxic Chemicals; (b) research in the area of Environmental Toxicology that includes the health effects of benzene, arsenic and electronic waste; (c) the regional chemical helpdesk, or Chem HelpDesk, which provides a free, web-based question and answer service for registered users on the issues of chemical safety and chemicals management (detailed information on page 7); and (d) development and maintenance of an electronic distance learning tool (eDLT) on risk assessment and risk management of chemicals.

This regional workshop on chemical safety brought together 60 participants from the International Health Regulations (IHR) and the Strategic Approach to International Chemicals Management (SAICM) focal points in 10 countries, as well as representatives from national poison centers, non-governmental organizations and academic and research institutions, as well as from WHO, UNEP/SAICM, UNITAR, FAO and ILO.

The workshop was divided into 5 sessions: (1) assessing the current status of chemical safety in countries of WHO South-East Asia Region, (2) enhancing the role of the health sector in the sound management of chemicals, (3) implementation of regional and international chemicals priorities, (4) implementation of the chemical aspects of the IHR, and (5) strengthening and building regional networks for chemicals safety and capacity-building. Participants shared information regarding status of chemical safety and chemicals management in their countries, were informed about regional and sub-regional initiatives, provided their input on IHR implementation and how the health sector could play a key role in chemical safety, and heard about tools and training available for building capacity in the region. The input received from participants would be used towards development of a regional implementation plan for the health-related aspects of chemical safety.

NEW PARTNERSHIP BETWEEN CRI AND IARC TO PROMOTE CANCER RESEARCH IN THAILAND AND SOUTH-EAST ASIA

A new cooperative agreement was signed on April 19, 2013 in Lyon, France, by Prof. Dr. Her Royal Highness Princess Chulabhorn, President, Chulabhorn Research Institute (CRI) and the International Agency for Research on Cancer (IARC), Director, Dr. Christopher Wild.

This new agreement marks an important step in the continuing collaboration between CRI and IARC to better understand and address the increasing incidence of cancer in Thailand and the South-East Asia region.

Cancer is one of the leading causes of morbidity and mortality in South-East Asia, with an estimated 725 000 new cases and 500 000 cancer-related deaths in 2008 in the member countries of the Association of South-East Asian Nations (ASEAN) alone. According to IARC forecasts, cancer incidence in this region is set to increase by more than 70% in the next 20 years, simply because of population growth and ageing.

The objectives of the partnership between CRI and IARC are to enhance the scientific and technical capacity to design and implement joint research projects and to facilitate fellowship exchanges and state-of-the-art training in both epidemiology and molecular epidemiology. An innovative research topic of high priority to both organizations is the role of early-life exposures (dietary factors, chemical pollutants, or air pollution) on cancer and other health risks later in life.

Other current topics include the role of human papillomavirus in cervical cancer as well as evaluations of the effectiveness of screening for colorectal and cervical cancer and early detection of breast cancer. In north-eastern Thailand, where infection with liver flukes is highly endemic, a research study is under way to look at genetic alterations in bile duct cancer (cholangiocarcinoma).

Under this agreement, the two institutions will expand their collaboration in two domains: Effects of early life exposures (including dietary factors, chemical pollutants, air pollution, naturally occurring toxins, etc.) and the development of cancer research in the region.

Air Pollution and Lung Cancer Incidence in 17 European Cohorts

Lung cancer is one of the most common cancers and has a poor prognosis. Active smoking is the main cause, but occupational exposures, residential radon, and environmental tobacco smoke are also established risk factors.

Ambient air pollution, specifically particulate matter with absorbed polycyclic aromatic hydrocarbons and other genotoxic chemicals, is suspected to increase the risk for lung cancer. Results of several epidemiological studies have shown higher risks for lung cancer in association with various measures of air pollution and suggested an association mainly in non-smokers and never-smokers and in individuals with low fruit consumption. In developed countries, overall lung cancer incidence rates have stabilized during the past few decades, but major shifts have been recorded in the frequencies of different histological types of lung cancer, with substantial relative increases in adenocarcinomas and decreases in squamous-cell carcinomas. Changes in tobacco blends and ambient air pollution might have contributed to these shifts.

Within the European Study of Cohorts for Air Pollution Effects (ESCAPE), the aim of the present study was to analyze data from 17 European cohort studies with a wide range of exposure levels to investigate the following

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THE LINK BETWEEN AMBIENT AIR POLLUTION AND HYPERTENSIVE DISORDERS OF PREGNANCY

Hypertensive Disorders of Pregnancy represent major obstetric complications that affect 5–7% of pregnancies and are a leading cause of maternal and neonatal morbidity and mortality. In Hypertensive Disorder of Pregnancy cases, maternal inflammatory processes are exaggerated compared to the low level of inflammation in a normal pregnancy. Therefore, factors that aggravate maternal systemic and/or placental inflammation have the potential to increase Hypertensive Disorder of Pregnancy risk.

The 1st trimester likely represents a critical window of susceptibility for developing Hypertensive Disorder of Pregnancy, as it is during this period that trophoblast invasion into the maternal decidua occurs, establishing the fetal blood supply. The potential effects of air pollution in subsequent trimesters are unknown, but could be involved via pro-inflammatory processes. In addition to air pollution, obesity is associated with systemic inflammation, and air pollution may exaggerate systemic inflammation in obese individuals. Whether pre-pregnancy body mass index (BMI) influences the relationship between air pollution and Hypertensive Disorder of Pregnancy risk is unknown, but given that BMI is an established risk factor for preeclampsia, but not for Hemolysis Elevated Liver Enzyme Low Platelet (HELLP) count syndrome, it could be an important modifier of disease risk.

In this study, researchers explored the potential influence of BMI on the relationship between ambient pollutants and Hypertensive Disorder of Pregnancy beyond its role as an independent risk factor for Hypertensive Disorder of Pregnancy.

The aim of the present study was to investigate the role of trimester-specific ambient air pollution (particulate matter less than 2.5 μm and 10 μm in diameter [$PM_{2.5}$, PM_{10}, respectively], nitrogen dioxide [NO_2], carbon monoxide [CO], and ozone [O_3]) on Hypertensive Disorder of Pregnancy risk. Specifically, the researchers hypothesized that (1) the 1st trimester-specific ambient air pollution exposures are associated with Hypertensive Disorder of Pregnancy and (2) maternal pre-pregnancy BMI modifies the associations between ambient air pollution and Hypertensive Disorder of Pregnancy occurrence. These hypotheses were tested in a study that was conducted in 298 predominantly Hispanic women. Among 136 clinically confirmed cases, 67 met the criteria for mild preeclampsia, 27 had severe preeclampsia, and 42 had gestational hypertension.

Controls on average delivered two weeks later than the cases, indicating that, as a group, they had ample opportunity to develop preeclampsia and be classified as cases. As expected, cases were more likely to be nulliparous than controls, have a higher BMI, and have infants with lower birth weights. Cases and controls did not differ on preexisting or comorbid conditions. However, women with preeclampsia were more likely to have chronic hypertension, have a history of previous Hypertensive Disorder of Pregnancy, and have small for gestational age babies. Moreover, as expected, the maximum systolic and diastolic blood pressures were significantly higher among cases than controls. Cases and controls did not differ in their smoking status; however, a higher proportion of cases were exposed to secondhand smoke than controls.

Similar patterns of correlations among the pollutants were seen across three trimesters. Carbon monoxide, PM_{10}, $PM_{2.5}$, and NO_2 were positively correlated with each other. Ozone was negatively correlated with CO, $PM_{2.5}$, and NO_2, and was uncorrelated with PM_{10}.

Interestingly, the observed associations between 1st trimester CO and $PM_{2.5}$ on Hypertensive Disorders of Pregnancy occurrence were stronger and statistically significant only among non-obese women (BMI < 30). One possible explanation is that the preexisting state of inflammation in obese women may have masked any additional influence of air pollution on Hypertensive Disorders of Pregnancy. In contrast, exposure to air pollution in non-obese subjects may have initiated inflammatory processes, which would trigger the subsequent pathophysiologic events leading to the development of Hypertensive Disorders of Pregnancy. Other alternatives include the possibility that biochemical pathways by which CO and $PM_{2.5}$ are processed may vary between obese and non-obese women and the prospect that Hypertensive Disorders of Pregnancy heterogeneity – that the condition itself is different between obese and non-obese women – could explain observed differences.

The study concluded that $PM_{2.5}$ and CO exhibited significant associations with Hypertensive Disorders of Pregnancy during the 1st pregnancy trimester, and the associations were stronger in non-obese women. The results may have important public health implications in promoting maternal and child health and advocating for public policy changes regarding pollutant levels. Since Hypertensive Disorders of Pregnancy is itself a risk factor for future maternal cardiovascular disease as well as a number of diseases among children born to mothers with preeclampsia, further reductions in ambient air pollution are likely to provide a wide array of health benefits.

Source: Environmental Research, Vol. 123, Pages 9-16, May 2013.

Air Pollution and Lung Cancer Incidence in 17 European Cohorts

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hypotheses: that ambient air pollution at the residence (specifically particulate matter) is associated with risk for lung cancer; that the association between air pollution and risk for lung cancer is stronger for non-smokers and people with low fruit intake; and that the association with air pollution is stronger for adenocarcinomas and squamous-cell carcinomas than for all lung cancers combined.

The results showed a statistically significant association between risk for lung cancer and PM_{10} and for $PM_{2.5}$. There was no association between lung cancer and nitrogen oxides concentration or traffic intensity on the nearest street.

The cohort-specific analyses consistently identified smoking-related variables as the most important confounders, in accordance with the fact that smoking is the most important risk factor for lung cancer. Radon in the residence is an additional potential confounder, but information about radon was not available for any cohort. Radon is probably inversely associated with air pollution concentrations, because radon concentrations are generally low in apartments, which are common in city areas with higher air pollution concentrations. Thus, if confounding by residential radon occurred, we would expect it to lower the hazard ratios (HRs) for lung cancer in association with air pollution. The association was, however, mainly with adenocarcinoma. If residual confounding had occurred, squamous-cell carcinomas should also have been associated with air pollution.

Data for previous lung disease were not obtained, which is a potential weakness of this study because previous lung disease might be associated with both air pollution concentrations and the risk for lung cancer. The HRs for lung cancer were similar with and without restriction to participants below most of the predefined threshold values, suggesting that exposure of populations to particulate matter air pollution even at concentrations below the existing European Union air quality limit values for PM10 (40 $\mu g/m^3$) and $PM_{2.5}$ (25 $\mu g/m^3$) might increase the risk for lung cancer. How widely the overall risk estimates from this meta-analysis can be generalized to all European populations is uncertain, but the absence of significant heterogeneity among the HRs obtained for the single cohorts suggests that the overall estimate can be generalized.

However, this very large multicenter study shows an association between exposure to particulate matter air pollution and the incidence of lung cancer, in particular adenocarcinoma, in Europe, adding substantially to the weight of the epidemiological evidence.

Source: The Lancet Oncology, Vol. 14, Issue 9, Pages 813-822, August 2013.

Exposure to Pesticides or Solvents and Risk of Parkinson Disease

Parkinson disease (PD) is regarded mainly as a sporadic disorder of multifactorial origin. Besides age and family history, a number of potential contributing factors, such as comorbidities (e.g., diabetes, hypertension) and lifestyle habits (e.g., dietary pattern, smoking), have been identified. Also, the role of living and working environments has been considered to be of great significance.

The first demonstration that the active metabolite of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine can cause a subacute form of parkinsonism aroused considerable interest in the role of some organic pollutants, such as pesticides. The same applied to solvents, compounds that seem also to be responsible for earlier onset and more severe symptoms. *In vitro* and *in vivo* studies have demonstrated their toxic effects on dopaminergic pathways, and recent evidence supports gene-based susceptibility.

Preliminary meta-analyses published more than 10 years ago suggested that exposure to pesticides or related proxies (e.g., rural living or farming) may be a risk factor for developing PD. Similar findings on pesticides and related subcategories (herbicides and insecticides) have been confirmed recently.

Since information on the etiology of PD may improve health prevention policies, the aim of this study was to investigate the epidemiologic relationship between PD and exposure to pesticides and solvents by means of a meta-analysis.

A total of 104 studies/3,087 citations fulfilled inclusion criteria for meta-analysis. In prospective studies, study quality was not a source of heterogeneity. PD was associated with farming and the association with pesticides was highly significant in the studies in which PD diagnosis was self-reported. In case-control studies, study quality appeared to be a source of heterogeneity in risk estimates (exposure assessment, occupational exposure, multiple adjustment, source of controls, geography) for some exposures. Higher study quality was frequently associated with a reduction in heterogeneity. In high-quality case-control studies, PD risk was increased by exposure to any-type pesticides, herbicides, and solvents. Exposure to paraquat or maneb/mancozeb was associated with about a 2-fold increase in risk. In high-quality case-control studies including an appreciable number of cases (>200), heterogeneity remained significantly high (>40%) only for insecticides, organochlorines, organophosphates, and farming; also, the risk associated with rural living was found to be significant.

The literature supports the hypothesis that exposure to pesticides or solvents is a risk factor for PD. Further prospective and high-quality case-control studies are required to substantiate a cause-effect relationship. The studies should also focus on specific chemical agents.

Source: Neurology, Vol. 80, No. 22, Pages 2035-2041, May, 2013.

EVALUATION OF TRACE ELEMENTS IN SELECTED FOODS AND DIETARY INTAKE BY YOUNG CHILDREN IN THAILAND

Currently, increasing demand for food safety has stimulated research regarding the risk associated with consumption of food contaminated with toxic elements and pesticides. Intensive food production to supply a rapidly increasing population also requires additional nutrients applied to plants and animals. Some are necessary nutrients for growth and function of plants including iron (Fe), zinc (Zn), copper (Cu), chromium (Cr), manganese (Mn) and selenium (Se). On the other hand, some elements such as arsenic (As), cadmium (Cd), lead (Pb) and mercury (Hg) are toxic and can contaminate the human food chain.

Application of commercial fertilizers, manures and sewage sludge containing toxic elements, pollution from mining and industry can also contaminate foodstuffs. These toxic elements are not biodegradable, some having long biological half-life and they can accumulate in organs and may lead to undesirable side effects in the future.

Food and drinking water are the major sources of exposure to toxic chemicals. Therefore, exposure and risk of element(s) toxicity are modulated by the diet and nutritional status. Special concern should be given to infants and young children. When growing, breast milk alone is not sufficient to meet the child's nutritional needs. Therefore, complementary foods such as rice, meat, vegetable and infant formula are needed to fill the gap between nutritional requirement and milk supply.

Cd exposure and accumulation start at a young age. Its accumulation in kidney is responsible for nephrotoxicity and osteoporosis, which are observed at the adult age. In school-age children, high urinary Cd levels were associated with immune suppressive effects. For 4–9-year-old children, cereals like bread, pasta and rice showed the highest contribution to Cd, Hg and Pb intake.

Exposure to As from drinking water was associated with reduced intellectual function in 6-year-old children in Bangladesh. Recently, children in India aged 13–18 years were found to have a relative higher potential risk of skin lesions caused by As-contaminated cooked rice than 1–6-year-old children. In Bangladesh, 10-year-old children consuming tube-well water with an average concentration of 793 µg Mn/L may be at risk from Mn-induced neurotoxicity.

Intake of a wide variety of foods will help children to meet their nutrient requirements for growth. World Health Organization (2005) suggests different kinds of foods such as egg, meat (or liver), poultry, fish, rice, wheat, potato, spinach, pumpkin and guava for feeding non-breastfed children of 6–24 months of age in South Asia. Several studies in different countries have evaluated both macro elements (Ca, Mg, Na, K, P) and trace elements (Fe, Zn, Cu, Se) including some toxic elements (Pb and Cd) in various foods such as cereals, vegetables, fruit, milk and dairy products, meat and meat products and fish.

A recent study has evaluated trace elements including some toxic elements (As, Cd and Pb) in selected foods and dietary intake by Thai children.

The study found that As and Cd levels in most foods were below the maximum levels as set by international organizations. Filtered and bottled drinking water, rice, vegetables and banana contained low concentrations of As, Cd and Pb. Non-polished rice had higher Mg, Ca, Mn, Fe and Se concentrations than polished rice. Banana was a major source for Mg and Se. Pig kidney and liver contained high levels of As and Cd. Mg, Cd, Pb and Al concentrations in soybean milk could also be of concern. With respect to food safety for children, the amounts of As and Cd ingested with poultry, pig liver or rice corresponded to high weekly or monthly intake.

Source: Food Additives & Contaminants: Part B, Vol. 6, No. 1, Pages 55-67, January 2013.

THE CHEM HELPDESK

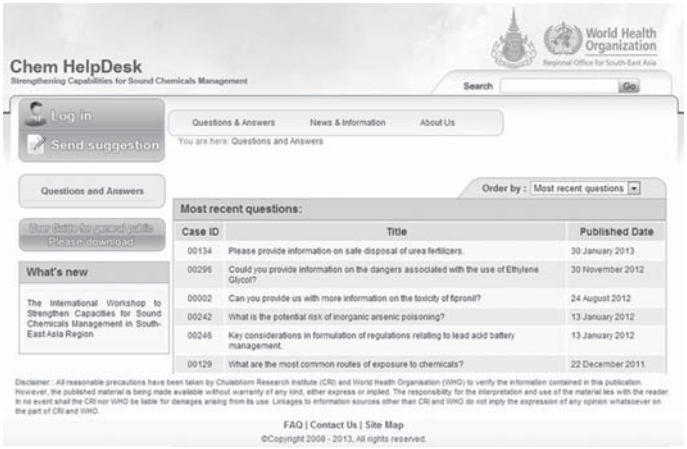
A joint initiative of the Chulabhorn Research Institute (CRI) and the World Health Organization's Regional Office for South-East Asia (WHO SEARO)

The Regional HelpDesk for Chemical Safety, or Chem HelpDesk, was established as a joint-initiative between WHO SEARO and CRI, through the WHO Collaborating Center for Capacity Building and Research in Environmental Health Science and Toxicology. The aims of the Chem HelpDesk are to address the issue of the widening gap in the fields of chemical safety and chemicals management between developed and developing countries, and to empower countries in the South-East Asia Region to manage the import, manufacture and processing, storage, distribution, transport, use, recycling and disposal of chemicals, in ways that minimize significant adverse impacts on health and the environment.

The Chem HelpDesk is not-for-profit, and through its website provides cost-free answers to questions submitted by registered users. These answers are provided by experts in the respective fields, who supply technical and scientific advice as part of a Community of Practice (CoP). It is the aim of the Chem HelpDesk to benefit users and to help countries in areas of most need to protect human health and the environment through the safe use and management of chemicals. In addition, the Chem HelpDesk weblog provides information related to the safe use and management of chemicals for all visitors, including news, related websites, and activities.

The following topics are covered:

- International cooperation: IFCS, SAICM, ICCM, and IOMC
- Multilateral Environmental Agreements (MEAs): Basel Convention, Rotterdam Convention, Stockholm Convention, Vienna Convention, Montreal Protocol, and Kyoto Protocol
- Chemical Safety Towards Sustainable Development: Rio Declaration on Environment and Development, Agenda 21
- International Law and Regulations: REACH



"Strengthening Capabilities for Sound Chemicals Management"

According to the Chem HelpDesk workplan, under the Memorandum of Understanding (MOU) signed between WHO SEARO and CRI in February 2012, WHO SEARO and CRI will work together to expand the scope of the Chem HelpDesk, identify and link to country-level agencies (e.g. WHO Collaborating Centres) that could work as "National Chem HelpDesks", and continue to develop the weblog, e.g. through adding research findings related to chemical safety to help disseminate information and increase awareness and understanding. In February 2013, Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol, President of CRI, visited WHO SEARO in New Delhi for an annual meeting to review progress on the activities of the WHO Collaborating Centre. The main item for discussion on the Chem HelpDesk was widening of its scope, particularly through increasing the base of registered users, i.e. through including national SAICM focal points from the Asian region, as well as to coordinate with national poison centers in the SEA region in development of national chemical help desks that could be tailored to a country's specific needs, e.g. in their national languages.

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For more information, please visit:
http://www.chemhelpdesk.org

CALENDAR OF EVENTS

International Training Courses in Environmental Toxicology at Chulabhorn Research Institute, scheduled for 2013 - 2014

	Training Course	Date	Final Date for Application
1.	Environmental and Health Risk Assessment and Management of Toxic Chemicals	December 2 – 13, 2013	September 27, 2013
2.	Detection of Environmental Pollutants, Testing and Screening of Toxicity	February 24 – March 7, 2014	November 25, 2013
3.	Environmental Toxicology	May 2014	February 25, 2014

Course Coordinator: *Khunying* Mathuros Ruchirawat, Ph.D.

Course Description:

1. **Environmental and Health Risk Assessment and Management of Toxic Chemicals (December 2 – 13, 2013)**

The course is an integration of science and policy, covering the fundamental basis of environmental and health risk assessment and management from exposure assessment and risk characterization; mode of action and human relevance framework; the relationship between risk assessment and risk management; and the need for open, transparent and participatory acceptance procedures and credible communication methods. Emphasis will be placed on human health risk assessment, although the principles of ecological risk assessment will also be covered. Importantly, the course teaches the practical application of risk assessment methods to various problems, e.g. hazardous waste site release, through the use of case studies relevant to problems faced in developing countries, and describes the policy context in which decisions to manage environmental health risks are made.Teaching and learning aids such as electronic distance learning tools and IPCS risk assessment toolkit will be introduced.

Requirement: Participants should have jobs/responsibilities related to assessment of risk from the use of chemicals.

2. **Detection of Environmental Pollutants, Testing and Screening of Toxicity (February 24 – March 7, 2014)**

This course covers both theoretical and practical aspects in toxicology relating to detection of different types of toxicants and toxicity. This course presents the different analytical methods in environmental toxicology; toxic compounds in the environment, mechanisms of actions and their effects on humans; how to monitor human exposure through the use of biomarkers; and modern techniques in instrument analysis. Trainees will have an opportunity to conduct hands on experiments and testing.

Requirement: Participants should have responsibilities /jobs related to detection of toxicity from toxic compounds in the environment and the effects on humans.

3. **Environmental Toxicology (May 2014)**

The course provides students and participants with a background of the major groups of toxic substances encountered by humans and animals through food and the environment, and also through exposure at the workplace. These toxicants include mycotoxins, naturally occurring plant and animal toxins, toxic substances in air, water and soil, N-nitroso compounds, solvents, plastics, pesticides, pollutants and radiation (UV, electromagnetic, ionizing). The course focuses on the chemistry, fate and distribution in the environment, mechanisms of their action, toxic manifestation in living organisms, as well as toxic syndrome in human beings.

Requirement: Participants should have some basic knowledge in chemistry, biological sciences and medicine.

Fellowships:

A limited number of fellowships are available that will cover roundtrip airfare, accommodation (on site) and meals, training materials, and health insurance.

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More Information and Application:
please visit - http://www.cri.or.th/en/ac_actcalendar.php

The ICEIT NEWSLETTER is published quarterly by the International Centre for Environmental and Industrial Toxicology of the Chulabhorn Research Institute. It is intended to be a source of information to create awareness of the problems caused by chemicals. However, the contents and views expressed in this newsletter do not necessarily represent the policies of ICEIT.

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