



CRI/ICEIT NEWSLETTER

VOL. 27 NO. 2 – April 2017
ISSN 0858-2793
BANGKOK, THAILAND



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".

CRI's WHO Collaborating Centre on Capacity Building & Research in Environmental Health Science & Toxicology

Official Visit of Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol to the World Health Organization's Regional Office for South-East Asia



On February 21st, 2017, Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol, President of the Chulabhorn Research Institute (CRI), paid an official visit to the World Health Organization's Regional Office for South-East Asia (WHO SEARO) in New Delhi, India, for the annual review of progress on collaborative activities previously agreed upon between WHO SEARO and CRI, carried out under CRI's International Centre for Environmental Health and Toxicology (ICEHT), a WHO Collaborating Centre for Capacity Building and Research in Environmental Health Science and Toxicology since 2005.

Discussions that took place, including in the technical discussions attended by a team of senior researchers from CRI on February 20th, covered the following areas:

- (1) CRI's capacity building/training programmes in Chemical Safety and Occupational and Environmental Health/Medicine, including in-country training that was conducted in Bhutan in 2016 and that has been tentatively scheduled for November 2017 in Sri Lanka;
- (2) further development of training modules/courseware for both face-to-face and web-based training in chemical safety, including the use of the developed electronic distance learning tool (eDLT) on risk assessment and risk management of chemicals for train-the-trainers courses, and development of a new module on the WHO Global Environmental Monitoring System/Food Database;
- (3) enhancing and widening information dissemination networks, e.g. for raising awareness and disseminating

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Official Visit of Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol to the World Health Organization's Regional Office for South-East Asia

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information related to chemical safety and risk assessment; and (4) possible research collaborations in the area of children's environmental health.

CRI organized 4 international training courses in 2016, and 5 have been tentatively planned for 2017. These courses are open to participants, primarily from the Asia Pacific region, and are taught by international experts from world-renowned academic and research institutions with a wealth of teaching experience in the region.

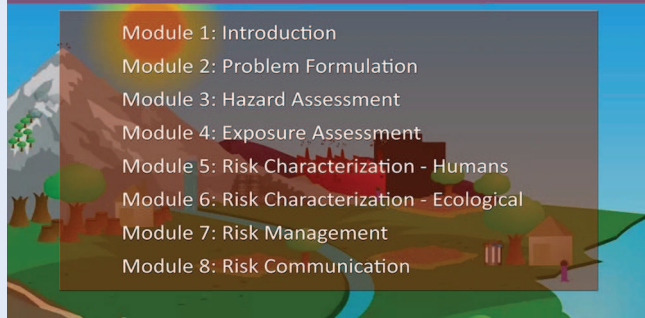
Courses tentatively scheduled for 2017 include:

	Training Course	Time
1	Principles of Toxicology, Toxicity Testing and Safety Evaluation	February 7 - 22, 2017
2	Environmental Toxicology	April 24 - May 2, 2017
3	Advanced Occupational and Environmental Health	July 17 - 21, 2017
4	Risk Assessment and Risk Management of Chemicals (train-the-trainers)	November 23 - 28, 2017 (in Sri Lanka)
5	Environmental and Health Risk Assessment and Management of Toxic Chemicals (train-the-trainers)	November/December 2017

Those who are interested in applying for a fellowship to attend such training courses can check the calendar of events on CRI's website at http://www.cri.or.th/en/ac_actcalendar.php.

The Electronic Distance Learning Tool (eDLT) on Risk Assessment and Risk Management of Chemicals

The Electronic Distance Learning Tool on Risk Assessment and Risk Management of Chemicals:



The eDLT is an interactive web-based self-learning tool that makes use of narration, animation, and exercises to explain the fundamentals of chemical risk assessment and risk management through 8 modules.

The collaborating institutions/organizations on the project are the Chulabhorn Research Institute (CRI), as the implementing institution, the World Health Organization's International Programme on Chemical Safety (Geneva, Switzerland), University of Ottawa (Canada), and Utrecht University (the Netherlands). The eDLT was officially launched on February 14th, 2013 at the WHO South-East Asia Regional Office (WHO SEARO) in New Delhi, India, by Her Royal Highness Princess Chulabhorn Mahidol, President of CRI.

CRI received an **award for the Most Outstanding Quick Start Programme (QSP) Project in the Asia-Pacific Region in 2014**, as the implementing institution and on behalf of all collaborating institutions on the project entitled, "Development of course materials and a distance learning tool for the assessment of risk from the use of chemicals to support SAICM's capacity building efforts in developing countries".

Interested individuals and institutions should send an e-mail to envtox@cri.or.th to request registration, and include in that e-mail the full names and affiliations of all individuals who will be using the eDLT. A nominal fee of \$100 USD per person covers the costs of maintaining the eDLT and Learning Management System, and a username and password will be generated and sent for each individual user for access to the eDLT through the website.

For more information on the eDLT, please visit <http://www.chemDLT.com>.



Pesticide Exposures and Respiratory Health in General Populations

Human exposures to pesticides can occur in the workplace, in the household and through the ambient environment.

While the associations between occupational pesticide exposures and respiratory health have been well documented, more studies on pesticide exposures and respiratory health in the general population are needed. This is an important gap in the literature given that low-dose environmental pesticide exposures are more prevalent than higher-dose occupational exposures.

According to the United States Environment Protection Agency (US EPA) Pesticide Program, approximately two billion pounds of pesticides are used every year in North America (US EPA, 2011), only 1% of which actually reaches its target, suggesting that pesticides mostly enter the environment without producing the intended benefit.

The run-off of pesticide from farm land into lakes, rivers, ground water etc. further increases contamination in the environment, thereby increasing the likelihood that non-target organisms and the general public will be exposed.

Consumption of food containing residues of this excess is a recognized source of pesticide exposures in the general population. It has been estimated that up to 50% of fruits, vegetables, and cereals grown in the European Union (EU) contain pesticide residues, and that one out of every 20 food items on the shelves in EU markets exceed EU legal limits for such contamination (EU EC, 2005).

This review critiques recent evidence which addresses the associations between non-occupational pesticide exposures and respiratory health in general populations.

A summary of adverse health impacts of environmental chemicals, including pesticides, indicates that pesticide exposures from the environment or in the diet may cause respiratory diseases and symptoms in the general populations.

The effect of environmental pesticide exposures on respiratory health among general populations was understudied.

Most epidemiological evidence concerning the association between pesticide use and asthma has been collected in the occupational settings. In the general populations, children are probably among the most vulnerable groups which face the non-occupational or environmental exposures to pesticides that have been associated with asthma.

In addition to asthma, COPD, sinusitis and bronchitis have also been linked to environmental pesticide exposures in the general population. In children, respiratory symptoms include wheezing, coughing, airway irritation, and airway infection.

This article highlighted questions arising from these studies, including recent analyses using data from the Canadian Health Measures Survey (CHMS).

Studies of CHMS data have provided new population-based evidence regarding the effect(s) of environmental pesticide exposures on respiratory health in the general population in Canada.

The analyses of CHMS data from the Canadian general populations, have suggested adverse effects of pesticide exposure on respiratory health, especially on lung function.

Exposures to organophosphate insecticides, pyrethroid insecticides, and the organochlorine pesticide DDT were associated with impaired lung function, but no significant associations were observed for the herbicide 2,4-D.

Future research should focus on potential age-specific and pesticide-specific effect on respiratory health in the general population, and repeated longitudinal study designs are critical for assessing temporal variations in pesticide exposures.

Research findings from current studies of non-occupational pesticide exposures and their health impact in general populations will help improve the role of regulatory policies in mitigating pesticide-related public health problems, hopefully providing greater benefit to the general population in the long run.

Source: Journal of Environmental Sciences, Vol. 51, Pages 361–370, January 2017.

Prenatal Mercury Exposure and Birth Outcomes

Although exposure to mercury in any of its forms – elemental, inorganic, or organic – negatively affects human health, the predominant organic form, methylmercury (MeHg), is of greatest concern due to its neurotoxicity.

Fetuses and children are especially vulnerable to mercury exposure. The fetus in the womb receives nutrients through the placenta, which can also transfer contaminants such as MeHg to the developing child.

Studies have indicated the detrimental effects of mercury exposure on newborn anthropometry or on the

length of gestation. However, the reports have been inconclusive among populations with moderate chronic exposure.

In addition to birth weight, placental development (weight and shape) have been shown to predict health outcomes at later stages of life. However, the association between mercury exposure in humans and placental weight is still not clear.

Exposure to MeHg in the general population occurs primarily through the

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Exposure to Pesticides and the Associated Human Health Effects

Pesticides are used widely to control weeds and insect infestation in agricultural fields for around 85% of world production. These chemical substances also target various pests and disease carriers such as mosquitoes, ticks, rats, and mice, in houses, offices, malls, and streets, etc.

Unfortunately, many pesticides are also harmful to people who are exposed them at work or at home, in food or drink containing pesticide residue, or via inhalation of pesticide-contaminated air.

This systematic review of published studies (since 1999 to 2016) describes the general aspect of pesticides with respect to classification, status of pollution, transfer routes, and impacts on human health.

Because the modes of action for pesticides are not species-specific, concerns have been raised about environmental risks associated with the unintended exposures which can occur through various routes such as residues in food or drinking water.

Pesticides can be found distributed throughout the human body via the bloodstream. They can also be excreted through urine, the skin, or exhaled air.

The toxicity of pesticides varies, depending on the type of exposure, such as dermal, oral, through the eyes or the respiratory system (via inhalation).

Pesticide exposure has been linked to various diseases including cancer, hormone disruption, asthma, allergies, and hypersensitivity. Even very low levels of exposure may have adverse health effects in early development, leading to birth defects, reduced birth weight, fetal death, etc.

Although such hazards range from short-term (e.g., skin and eye irritation, headaches, dizziness, and nausea) to chronic impacts (e.g., cancer, asthma, and diabetes), their risks are difficult to elucidate due to the involvement of various factors (e.g., period and level of exposure, type of pesticide (regarding toxicity and persistence), and the environmental characteristics of the affected areas.

There are many inherent problems in conducting large-scale experiments to directly assess the cause of human health problems associated with the use of pesticides.

Even so, the statistical associations between exposure to certain pesticides and the incidence of some diseases are compelling and cannot be ignored.

There are no groups in the human population that are completely free of exposure to pesticides. At the same time, most diseases are multi-causal, which complicates considerably any public health assessments.

Moreover, some members of the population have an inherent genetic

susceptibility to pesticide associated diseases and are thus likely to be more at risk than others.

Evidence suggests that much of this exposure is presented in the form of multiple mixtures of chemicals. The toxic effects of such exposures are unknown, particularly over longer time periods of time.

Precision and accuracy are very important in the quantitation of pesticides, as are improved safety profiles to reduce possibly adverse effects on human health and the environment.

Furthermore, there should be a focus on determining what types of chemicals or formula are the most appropriate tools for environmental and ecological management of pests. Natural bio-control agents, such as beneficial bacteria, viruses, insects, and nematodes, should be used for agricultural purposes. Integrated Pest Management (IPM) techniques are desirable to reduce the impacts of pesticides.

Finally, both the public and private sectors – e.g. government agencies, NGOs, and manufacturers -- should invest more seriously in research, product development, product testing and registration, and implementation of pesticide use strategies, while advocating for public education concerning pesticides.

Source: Science of the Total Environment, Vol. 575, Pages 525–535, January 2017.

Arsenic Accumulation in Rice and Management Practices to Reduce Human Health Risk

Arsenic (As) is one of the most challenging environmental problems affecting millions of people worldwide in drinking water and in food crops, especially in rice.

Rice consumption represents a major route for inorganic As exposure in many countries, especially among people for whom rice is 60% of their daily diet.

As content in rice varies widely, with most concentrations reported to be in the range 0.02 to 0.90 mg/kg.

Rice is more efficient in assimilating As into its grains than other cereal crops. Accumulated As may adversely affect its quality and nutritional value.

Recent studies indicate that rice genotypes have wide variations in total grain-As concentrations and As speciation around the world.

Accumulation of As in paddy soil and irrigation water, especially inorganic As, poses a potential health risk to humans.

Inorganic As is classified as a human carcinogen (IARC, 2004b). Several epidemiological studies confirm the relationship between As exposure via drinking water and various health impacts in humans including skin and kidney disease, heart disease, diabetes mellitus, neurological, respiratory complications and gall bladder and lung cancers.

It will be important to go beyond studies that assess the presence of As

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Prenatal Mercury Exposure and Birth Outcomes

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consumption of fish and other seafood. Discrepancies in findings concerning the net effect of fish intake on fetal growth and the length of gestation could be related to differences in frequency of consumption or the origins and species of the fish most commonly consumed.

In the past fish intake has been recommended because it provides beneficial nutrients such as selenium, iron, and iodine.

Fish intake has also been recommended as a way to achieve a balanced diet. Fish is a good source of protein, low in saturated fats, and is the main source of n-3 fatty acids which are critical to the prevention of deficiencies in brain development and cardiovascular disorders.

However, intake of seafood also risks exposure, not only to environmental pollutants such as mercury or polychlorinated biphenyls (PCBs), but also to other known contaminants such as hexachlorobenzene, dioxins and dibenzofurans, brominated diphenyl ethers, cadmium, or lead.

Differences in fish choices may affect the balance between possible

benefits and risks, and are therefore a key factor in confounding assessment. It becomes difficult to determine if the potentially adverse effects linked to mercury exposure may be outweighed by the beneficial effects of fish intake.

The Spanish multicenter mother-and-child cohort study reported high cord blood total mercury (T-Hg) concentrations, with a geometric mean of 8.2 µg/L, and strongly associated with fish intake. They also found that T-Hg was associated with birth weight and that the intake of different fish groups was confounding this association.

The objective of the present study was to assess the association between cord blood T-Hg levels and anthropometric measures at birth in the 4 INMA sub-cohorts with available T-Hg determination in cord blood from newborns, including head circumference, placental weight, and gestational length. The researchers also assessed possible heterogeneity among geographical areas and the confounding role of fish intake.

The results show that a doubling of T-Hg from geometric mean T-Hg, 8.2 µg/L (from a previous study) was associated with decreased placental

weight and marginally with head circumference. T-Hg was also found to be inversely related to infant weight and length, although with weaker estimates.

Mercury exposure was not associated with length of gestation. The inverse relation between T-Hg and growth was enhanced when an adjustment was made in the models to account for the intake of different seafood groups.

In the population of newborns with relatively high prenatal exposure to mercury, T-Hg was inversely associated with placental growth. Mercury exposure may also be inversely related to anthropometry at birth; regional differences in estimates for birth weight were observed.

Results underscore the need to control for confounding by fish intake variables in similar studies. While acknowledging the benefits of eating seafood, human mercury emissions should be reduced and preventive actions maintained to limit mercury exposure in vulnerable groups.

Source: Environmental Research, Vol. 151, Pages 11–20, November 2016.

Arsenic Accumulation in Rice and Management Practices to Reduce Human Health Risk

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in rice. In order to understand the extent of exposure and risk, the bioavailability of As from rice must also be made clear.

The main focus of this review is As and rice genotypes, how rice genotypes control As uptake and their speciation, and growth and yield of rice crops vs As contamination in irrigation and soil. Major management practices that minimize As uptake by rice plants are also considered. Additionally, the discussion touches upon rice consumption and the risk to human health of As exposure in the context of bioavailability and incremental lifetime cancer risk.

There is a substantial genetic variation among rice genotypes in grain-As accumulation as well as speciation. Identifying the extent of genetic variation in grain-As concentration and speciation of As compounds is crucial to determining which rice varieties accumulate low inorganic As.

Arsenic speciation draws major attention because toxicity totally depends on the speciation pattern, which differs from variety to variety and location to location. In fact, environmental variation is more prominent than genotypic variation.

In view of the significant variations in As bioaccumulation, speciation and bioavailability revealed by research, management strategies and practices (including cooking) will have to be adapted to minimize As exposure from water, soil and food. Varietal selection, and the use of fertilizer nutrients, and irrigation water will be affected.

There is an urgent need to develop a mitigation strategy to minimize As accumulation in rice grains. It is crucial that As transfer from soil to rice grains be reduced to protect humans from exposure risks.

Arsenic intake from rice represents an important channel of exposure, especially for peoples consuming large amounts of rice in their diet. Mitigation measures to reduce As accumulation in rice are therefore urgently needed. Using more effective water management strategies, developing new genetic variations or identifying rice varieties which accumulate low As are some possible partial solutions.

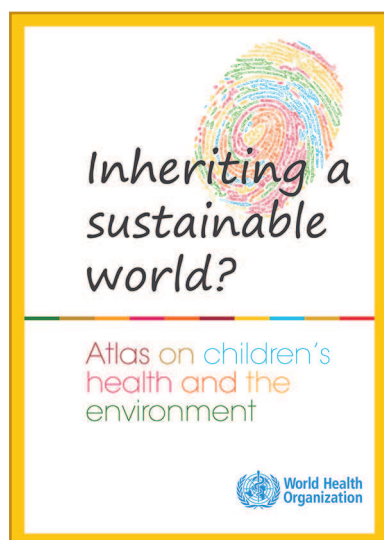
Current knowledge of As contamination, including bioavailability and bio-accessibility, should be used to minimize As exposure.

In the meantime, assessing the bioavailability of As from rice is crucial to understanding human health exposure and to reducing the risk.

Source: Environment International, Vol. 96, Pages 139–155, November 2016.

WHO REPORTS: POLLUTED ENVIRONMENTS KILL 1.7 MILLION CHILDREN EACH YEAR

Exposure to polluted environments is associated with more than one in four deaths among children under 5 years, according to two World Health Organization reports. Worldwide, 1.7 million children's deaths are attributable to environmental risks, such as indoor and outdoor air pollution, second-hand smoke, unsafe water, lack of sanitation, and inadequate hygiene.



The first report, *Inheriting a Sustainable World: Atlas on Children's Health and the Environment* reveals that a large portion of the most common causes of death among children aged 1 month to 5 years – diarrhoea, malaria and pneumonia – are preventable by interventions such as access to safe water and clean cooking fuels which are known to reduce environmental risks.

Harmful exposures can start in the mother's womb, increasing the risk of premature birth. Additionally, when infants and pre-schoolers are exposed to indoor and outdoor air pollution and second-hand smoke, the risk of pneumonia in childhood increases, along with a lifelong increased risk of chronic respiratory diseases such as asthma. Exposure to air pollution may also increase their lifelong risk of heart disease, stroke and cancer.

The second report is a comprehensive overview, *Don't pollute my future! The impact of the environment on children's health*.

In this report, the top 5 causes of death in children are linked to the environment:

- **Respiratory infections** (e.g., pneumonia): The deaths of 570,000 children under the age of 5 years are attributable to indoor and outdoor air pollution, and to second-hand smoke.
- **Diarrhoea**: 361,000 children under the age of 5 years die annually as a result of poor access to clean water, sanitation, and proper hygiene.
- **Death in the first month of life**: 270,000 children die each year from conditions, including prematurity, which could be prevented through access to clean water, sanitation, and good hygiene in health facilities, and by reducing air pollution.
- **Malaria**: 200,000 deaths annually of children under 5 years of age could be prevented through environmental actions, such as reducing breeding sites of mosquitoes or covering drinking-water storage containers.
- **Unintentional injuries**: 200,000 children under 5 years of age die due to causes attributable to the environment, such as poisoning, falls, and drowning.

WHO reports detail the long-term effects that environmental pollution can have on children's health. Children exposed to air pollution and second-hand smoke have an elevated risk of developing pneumonia and chronic respiratory problems, such as asthma.

Increasing volumes of electronic waste from disposed smartphones and similar devices can expose children to toxicants linked to reduced intelligence, lung damage, and cancer. The volume of so-called e-waste is expected to reach 50 million metric tonnes by 2018, a 19 percent increase from 2014.



The rising temperatures and carbon dioxide levels that come with climate change boost pollen growth and pose a threat to sibly asthma sufferers. An estimated 44% of asthma cases among children worldwide are thought to be related to environmental exposures.

In addition to highlight the burdens borne by young children, the new WHO reports suggest ways in which risk factors, and therefore death rates, can be reduced.

Reducing air pollution inside and outside households, providing safe water, improving sanitation and hygiene (including in health facilities where women give birth), protecting pregnant women from second-hand tobacco smoke, and building safer environments can prevent many childhood diseases and deaths. Other potential solutions mentioned in the reports are removing mold and pests from housing, removing lead paint, ensuring sanitation and good nutrition at schools and implementing better urban planning to create more green spaces in cities. Safe management of industrial waste by industries is also highlighted, along with ending the use of hazardous pesticides and child labor in agriculture.

Under Sustainable Development Goals (SDGs), many countries have acceded to a set of targets to guide interventions for children's environmental health, and to end the preventable deaths of newborns and of children under the age of five by 2030.

Source: Environmental Research, Vol. 136, Pages 234-245, January 2015.



Announcing Three Summer Courses in Occupational and Environmental Health: Brescia, Bangkok and Munich

Three international Courses on Occupational Health and Safety and Environmental Health are planned for summer 2017:

1. **"Global Occupational and Environmental Determinants of Diseases: A multidisciplinary approach for prevention"**, July 10-14, at the University of Brescia, Italy [Website: <http://summerunibs2017.neurotoxmet.org/>];
2. **"Advanced International Training Course in Occupational and Environmental Health"**, July 17-21, at the Chulabhorn Research Institute in Bangkok, Thailand [Information on [Page 8](#)];
3. **"Teaching Interventions Crossing Borders"**, August 21 - September 1, at the Ludwig Maximilian University of Munich, Germany [Website: http://www.en.uni-muenchen.de/misu/summer_academies/02_master/teaching_interventions/index.html].

In addition to high-quality, hands-on training in occupational health and safety, these courses provide unique opportunities for networking among OEH professionals from both high-income countries and low- and middle-income countries and for developing multi-national approaches to continuing education that extend beyond the courses. Students and faculty attending the three courses are encouraged to provide information about occupational and environmental health in their countries including such aspects as OHS services coverage and organization; workers' benefits and compensation; ratification and implementation of ILO and WHO policies; preventive interventions in environmental health; and remediation of hazardous waste sites.

To provide an opportunity for young OEH professionals to publish their work in a peer-reviewed journal, students and faculty participating in the courses are invited to submit publications in a special issue of the *Annals of Global Health* that will be specifically dedicated to Occupational and Environmental Global Health and guest edited by the Directors of the three courses.

Professionals in Occupational Environmental Health in countries around the world are invited to apply for one of more of these courses.

Contact information:

1. Summer School of Brescia:
 - Roberto Lucchini (Mount Sinai School of Medicine, USA, University of Brescia, Italy)
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 - Mitchel Rosen (Rutgers University, USA)
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2. Summer School of Bangkok:
 - Philip Landrigan (Mount Sinai School of Medicine, USA)
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 - Mathuros Ruchirawat (Chulaborn Research Institute, Thailand)
E-mail: mathuros@cri.or.th
3. Summer School of Munich:
 - Katja Radon (Ludwig Maximilian Universität, München, Germany)
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CALENDAR OF EVENTS

Advanced International Training Course in Occupational & Environmental Health July 17 - 21, 2017 at Chulabhorn Research Institute, Bangkok, Thailand

Course Description:

The course is intended to be an advanced course in occupational and environmental health. It is designed for physicians, medical students, nurses, industrial hygienists, environmental health scientists and other health care workers. Previous participation in the Introduction to Occupational & Environmental Medicine course, which was organized in 2011 and 2013 is advisable, but not a requirement.

The theme of the course is occupational and environmental causes of disease, and approaches to prevention. The course will present information on major current occupational and environmental hazards and the diseases they cause, with particular emphasis on hazards, including emerging hazards, in South and South East Asia. It will describe the scientific methodologies used in occupational and environmental health to assess toxic hazards and to establish linkages between hazards and disease. It will discuss the multidisciplinary nature of research and practice in occupational and environmental health. It will provide information on the on-line literature resources available in occupational and environmental health, and on new advances in e-learning and communication technology. It will also discuss approaches for prevention and control of occupational and environmental diseases, with particular focus on strategies for translating scientific findings into public policy.

The course will combine lectures with supervised case studies in which participants will have the opportunity to work in small groups and to discuss topics directly with faculty of renowned institutes from the USA and Thailand. These include:

1. **Roberto Lucchini**, M.D. (Icahn School of Medicine at Mount Sinai, New York, U.S.A. and University of Brescia, Italy)
2. **Melissa A. McDiarmid**, M.D., M.P.H. (University of Maryland School of Medicine, Maryland, U.S.A.)
3. **William A. Suk**, Ph.D., M.P.H. (National Institutes of Health, NC, U.S.A.)
4. **Khunying Mathuros Ruchirawat**, Ph.D. (Chulabhorn Research Institute, Bangkok, Thailand)

Requirement:

Participants should be part of a network of health sciences professionals involving physicians, medical students, nurses, industrial hygienists, environmental health scientists and other health care workers.

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

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