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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".

The Southeast Asia Training Course on Environmental Toxicology: Pollution Control and Management

The Southeast Asia Training Course on Environmental Toxicology: Pollution Control and Management organized by the Chulabhorn Research Institute's International Center for Environmental and Industrial Toxicology (ICEIT) was held in Bangkok from 13-30 August 1996. The course was supported by the United Nations Development Programme and the Royal Thai Government through the Department of Technical and Economic Cooperation. Twenty five delegates from nine Southeast Asian countries participated in the three week course which was part of CRI's Southeast Asia Capacity Building Program, an initiative started in 1995 to assist countries in the region in the development of human resources needed in the government, academic and private sectors to cope with rapid economic development and industrialization. The aim of this regional program is to increase capacity for the management of toxic chemicals and hazardous wastes as a necessary stage in promoting sustainable development in Southeast Asia.

The content of training courses organized as part of the Southeast Asia Capacity Development Program is based on an analysis of the training needs, current manpower, and main environmental problems of countries in the region. In a survey conducted to assess the training needs of nine countries in the region, the main priority was seen as the need to develop manpower properly

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The Southeast Asia Training Course on Environmental Toxicology: Pollution Control and Management

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trained in environmental toxicology. There exists in all countries a manifest and urgent need to improve technical capabilities of personnel in pollution management and control.

Chemical toxicity has emerged as an area of prime concern since pollutants are mostly chemical in nature. With the rapid increase in industrialization in the region, together with the accelerating pace of modernisation in agriculture, urbanization and transportation, there is a danger of increased accidents involving toxicity of chemicals used in these activities. Within this context, environmental toxicology has become an area of growing interest to the scientific community and the general public, since environmental factors are now recognized as the major determinants of human health and the quality of life of urban and rural communities.

The present training course attracted senior level delegates from Cambodia, Lao People's Democratic Republic, Malaysia, Pakistan, Union of Myanmar, Vietnam and Thailand, who had been identified as future trainers. The course was designed not only to meet training requirements and provide new knowledge in the specific subject areas but also to serve as an evaluation of the appropriateness of the capacity development program for the government and private sectors.

At the end of the training course, the Editor interviewed two of the distinguished faculty members in the high level team of experts who presented the lectures and practical sessions on the course, Professor Joseph F. Borzelleca, Professor of Toxicology of the Medical College of Virginia and President, Toxicology and Pharmacology, Inc., U.S.A., and Professor H. Autrup, Professor of the Department of Environmental and Occupational Medicine, Aarhus University, Denmark.

Both Professor Borzelleca and Professor Autrup have taught on previous ICEIT training courses organized by CRI and are members of the Institutes' International Advisory Board.

I firstly asked Professor Borzelleca for his views on the advantages of a regional training course and how he saw CRI's regional role.

Professor Borzelleca:

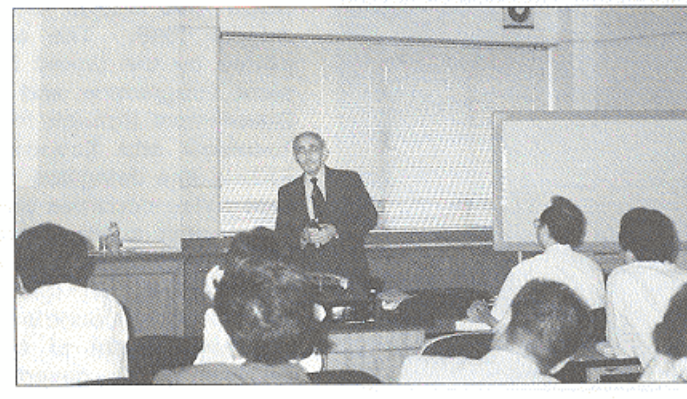
I think that what CRI is doing in regional training is commendable. Someone has to take the initiative to heighten awareness of problems and train people to address them. Many problems can only be identified at a regional level, and it is not necessary for Westerners to come in to identify such problems. This can be done locally. For example, one question that came up in class yesterday was that safety in the workplace is considered very differently here than in the West and the kinds of controls that Western experts might recommend would not be an appropriate way to solve existing problems.

Also, chemical substances react differently in a tropical climate than in a cool climate, particularly in the presence of high levels of humidity. It is problems of this nature that must be studied locally, and the solutions that are found will frequently be different from recommended practice in the West. By all means bring Westerners in to assist with expertise, but the actual identification of problems and the search for appropriate solutions is, I firmly believe, best carried out by local people. And it is in this area that CRI has done a fantastic job in bringing together people from countries in the SE Asia region so that a local pool of expertise can be developed. By starting early in its training programs there is a good chance that CRI will be able to harmonize controls in the workplace; the next step will be controls in air and water quality; and then controls in food ingredients and safety requirements for drugs. CRI has taken a significant first step in making such harmonization possible. The Institute has shown great vision and this important work needs to be continued.

We next turned to a specifically local problem, but one which affects all major cities in the region. Since Professor Borzelleca and Professor Autrup have made a number of visits to Thailand in recent years, I asked for their views on the main health hazards facing the inhabitants of a city like Bangkok.

Professor Borzelleca:

With regard to environmental problems in Bangkok, the ones that are most apparent to me are air and



water pollution. The traffic in the city and the related air pollution are major problems. The fact that the traffic police now have to wear masks over their nose and mouth, and increasingly other workers constantly exposed to traffic fumes are doing likewise, is indicative of the seriousness of the problem. With regard to water pollution, I understand that Bangkok was once referred to as the Venice of the Orient, but walking along the streets now and seeing so much stagnant water in the waterways, allowing the growth of all kinds of organisms, is very worrying. Something really needs to be done. I don't know the details of the drinking water here in Bangkok, or how it is treated, but certainly stagnant water in the canals is a serious health hazard. The amount of solid waste that one sees piled up also needs to be addressed. Bangkok is clearly a city that has grown quickly, with what you might describe as an uncontrolled cancerous type growth, and so you would expect to find some problems of pollution; but the magnitude of the problem here is overwhelming. Looking also at some of the housing which is certainly substandard, with people living by the side of stagnant waterways, there is a great risk of infection from microorganisms and bacteria. To me this is very distressing because these are human beings who have a right to something better than the conditions they are being exposed to.

You asked me what the individual citizen can do to reduce these risks: one basic measure is care over consumption of street food, because with the level of contaminants in the air and water, food sold by the roadside could be hazardous. There must be stricter controls on the sale of food. People must be made aware that there could be a health problem, and the question is, how do you educate people to realize that there is a problem. The only way to get the message across to people is, I believe, by means of television because this medium is the most effective communicator. There needs to be a campaign of short clips on television, not with a doctor in a white coat giving a lecture, but using a familiar type setting, with a family group so that the presentation is not threatening, but takes the form of a discussion among friends. Of course the government is the only body that could afford to run such a campaign initially, but once you heighten awareness of the problems, people will begin to do something themselves. Individuals might not be able to do anything about the level of air pollution, but they can do something about the food they eat, solid waste, their garbage, and this in an area in which a public health campaign can have an important impact on individual behavior. If you use the right terminology you can get through to people. If you are dealing with people whose formal education is limited, it is particularly necessary to express the danger, not just in rational terms, but in a way that strikes the imagination and communicates the reality of the danger of typhoid and other diseases. A degree of shock treatment may be necessary to get people's attention.

Too often one hears the criticism that academics don't understand the real world. We do understand the real world, but our problem is how best to get our message across to the general public, in other words, how best to educate and motivate.

There is no instant solution to pollution problems in a city like Bangkok. Change has to come at the ground level and it must begin immediately.

Professor Autrup:

The focus of exposure assessment is important in Thailand. If you look at the main cause of pollution in Bangkok, it is of course traffic generated air pollution; and from statistics gathered in other countries, it has been shown that there is a direct link not only between exposure to such pollution and risk of cancer but also to other diseases such as asthma, particularly among people who are very sensitive. It may also be associated with other chronic diseases, although the relationship is still not clearly established. Air pollution is extremely complex in chemical terms. It consists of particles and also of gases. The particles mainly come from the exhaust of motorcycles and diesel engines, and most carcinogenic material is associated with these particles. Also very small particles irritate the airways thus inducing asthmatic conditions; not the heavy particles from construction sites, because these settle on the ground.

There is much concern at the moment on the effect of air pollution on Thai children. One must remember that any capital city, any large urban area, has problems of air pollution and this is particularly bad in zones when there is no regular shift in wind. In Bangkok, where there is little replacement of air by wind change, asthma is more of a problem. One positive sign, however, is that the level of lead in the air has been decreasing. At the time of my first visit to Bangkok three years ago, unleaded gasoline had just been introduced, and since then lead levels have dropped dramatically. There are still some old cars using leaded gasoline however, and one at the cheapest ways of reducing air pollution is by replacing old cars with new cars with catalytic converters.

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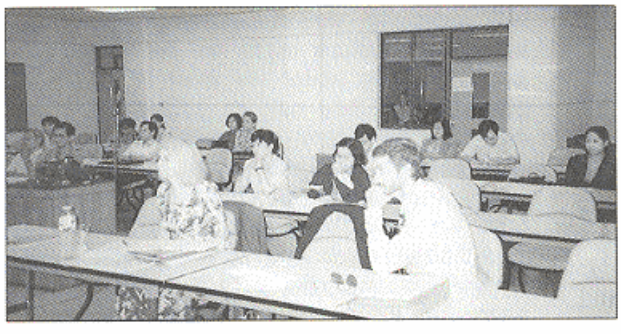
Regional Workshop on Risk Assessment and Risk Management in Biotechnology

The Chulabhorn Research Institute's International Center for Environmental and Industrial Toxicology with the support of the Thai government and the United Nations Development Programme organized a regional workshop on risk assessment and risk management in biotechnology from 30 September to 4 October, 1996.



The workshop was organized in recognition of the urgent need for policies and biosafety regulations when international transfers of GMOs take place, particularly to countries where scientific and legal infrastructures are inadequate to assess the potential health and environmental risks. Thus, the goal of the regional workshop was to provide an insight into and an overview of risk assessment and management procedures in biotechnology for professionals and academics actively engaged in research and development in this area, as well as those involved in regulatory agencies.

The workshop covered fundamental principles of risk assessment and risk management for GMOs as well as providing a general background on biosafety issues such as development, commercialization and trade issues. The workshop program included lectures on the principles and methods of risk assessment and risk management using a wide range of case studies from developed and industrialized countries. These case studies, highlighting key issues in risk assessment and risk management, covered areas of agriculture and commodities, pharmaceuticals, vaccines, transgenic animals and microbes in field trials. Discussion was a major feature of the workshop and participants had the opportunity to discuss and exchange ideas on all issues with a distinguished group of resource persons from U.S.A., U.K. and the Asia Pacific region.

Biotechnology is considered by many developing countries as technology that will accelerate economic development through commercialization of products. Thus, in many countries, there has been a major investment of financial and human resources as well as infrastructure in research and education to promote development in biotechnology. The contribution of the present workshop was to stress that such activity should proceed along with appropriate mechanisms to assess, monitor, regulate or control the technology and its application.

Health Impacts of Chernobyl

The 10 years that have elapsed since the catastrophic accident involving a nuclear reactor at Chernobyl have, to date, produced only uncoordinated attempts in data collection to answer some of the most difficult questions in radiation biology. In the Chernobyl disaster, it is estimated that some 800,000 people from all over the former Soviet Union received substantial radiation doses.

Attempts to measure the impact of the disaster on the health of local populations were initially hampered by the secrecy that surrounded the event and the suspicions of outside interference on the part of Soviet researchers. More recently there has been friction between national and international agencies that have initiated major research programs on radiation effects caused by Chernobyl.

A further problem has been that incomplete national cancer data make it extremely difficult to reconstruct radiation dose rates and monitor relatively small changes in cancer incidence in a large population over a wide geographical area. After the initial crisis and the encasement of the damaged reactor, there was increasing distrust and resentment among the population directed at researchers and physicians.

Monitoring in the three republics contaminated by Chernobyl did not begin until ten days after the accident, and it was not until 1989, three years after the disaster, that the Soviet government invited the first international team of experts, coordinated by the International Atomic Energy Agency (IAEA), to assess the consequences of radiation on the most affected populations. Again, however, there was opposition and hostility from the local population since IAEA was seen as a promoter of nuclear power; early reports issued by the agency's experts were criticised for downplaying the accident.

In 1991 the World Health Organisation (WHO) launched a $20 million program on the health effects of the Chernobyl accident. The program, which was funded mainly by a grant from Japan, comprised pilot projects in five priority areas: thyroid, hematology, brain damage in fetuses, epidemiological registers, and oral health.

One of the main contributors to Chernobyl research has been the European Commission (EC) which allocated over $27 million between 1991 and 1995 to fund sixteen pilot projects on health effects, environmental impact, and emergency management issues.

Learning from the mistakes of the past, greater importance was given to collaborative effort; thus, part of the EC funding went to boost scientific infrastructure in the republics by raising local researchers' salaries and purchasing essential equipment such as computers and scientific instruments.

More recently, the US National Cancer Institute (NCI), Nuclear Regulatory Commission and Department of Energy have all signed bilateral collaborative agreements with the three most highly contaminated republics, Belarus, Russia, and Ukraine.

Thyroid Cancer

One of the main areas of current research activity and involvement is in epidemiological studies of thyroid cancer, with major programs being funded by WHO and EC.

When a dramatic increase in thyroid cancer among children was reported by researchers from the Radiation Medicine Unit in Minsk, Belarus, in 1991, the findings were initially treated with a degree of scepticism since earlier predications made by IAEA after a 1990 visit to the contaminated area were that any effects of the Chernobyl fallout were not expected to show up for at least 6 to 8 years. However, the Belarus cases had begun to appear only four years after the accident, and local scientists were claiming that the incidence of childhood thyroid cancer had reached thirty times preaccident rates,with 59 cases diagnosed nationwide compared to only two in 1986.

To date, more than 700 cases have been diagnosed in regions of Belarus, Russia, and Ukraine, that bore the brunt of contamination. This escalation in the incidence of thyroid cancer is the most pronounced health effect of the accident determined so far. Radiation scientists are eager to find out why the number of cases is so much higher than formerly anticipated. This research may ultimately lead to new knowledge about how radiation damages a cell's molecular machinery, as well as resulting in a better understanding of the interaction between radiation exposure and other possible risk factors for thyroid cancer, including iodine deficiency, genetic predisposition to developing tumours, and the special risks that radiation poses to young children.

Leukemia

Studies of the Japanese atomic bomb survivors at Hiroshima and Nagasaki, and studies of other radiation accidents have identified leukemia as the key early indicator of the health effects of radiation. Paradoxically, however, three major international studies of the Chernobyl disaster have failed to detect any measurable increase in leukemia or any other cancers in the general population. The important question remains: why, ten years after an accident that released hundreds of times the amount of radiation as the bombings of Hiroshima and Nagasaki, is there a marked increase in thyroid cancer but little increase in leukemia?

One reason given is the different ways radioactive iodine and cesium, the two biggest threats to the general population from the Chernobyl accident, produce health effects. Iodine has a half-life measured in days and is taken up into the body into the thyroid, resulting in a short intense dose of radiation to that organ. Longer lived radioactive cesium irradiates the entire body through the environment and food chain over an extended time period, providing low whole-body radiation doses. Reconstructing individual dose rates at such low radiation levels is, however, extremely difficult. Internal doses can be calculated from measurements of ingested cesium, which accumulates in tissues, particularly muscle. However, any attempt to assess the total radiation dose from both internal and external sources involves major monitoring programs, and until this monitoring has run its full course, no firm conclusions can be drawn. Radiation experts caution that, with the long latency period for many cancers, it may be years or even decades before significant results are available.

Source: Science, Vol. 272, 19 April 1996.

List of Important International Agreements on Use of Chemicals

In recent years United Nations and national government agencies in a number of countries have drawn up recommendations and guidelines on the use of chemicals that pose a threat to the environment and to human health. Some of these guidelines have been formulated as international agreements, the most important of which are:–

❒ United Nations Recommendation on the Transport of Dangerous Goods

United Nations Recommendation on the Transport of Dangerous Goods (UN RTDG) can be considered as the "father" of most if not all the existing classification systems. It includes about 3000 dangerous materials which have been classified as to hazard labelling and packaging requirements. The first published text of the Recommendations was prepared in 1956.

❒ WHO Recommended Classification of Pesticides by Hazard

The WHO Recommended Classification of Pesticides by Hazard was first approved in 1975 and updated on a regular basis by the International Programme on Chemical Safety with input from the Food and Agriculture Organization of the United Nations (FAO).

❒ FAO code of Conduct

The International Code of Conduct on the Distribution and Use of Pesticides was adopted in 1985 by the Food and Agriculture Organization of the United Nations (FAO).

❒ London Guidelines

The London Guidelines for the Exchange of Information on Chemicals in International Trade were originally adopted in 1987. They request states to notify the International Registry of Potentially Toxic Chemicals of the United Nations Environment Programme (IRPTC, UNEP) of control actions to ban or severely restrict chemicals so that the information can be transmitted to Designated National Authorities of other countries.

❒ Prior Informed Consent

The procedure known as Prior Informed Consent (PIC procedure) was adopted in 1989 to help control imports of unwanted chemicals that have been banned or severely restricted. The PIC procedure is implemented jointly by the FAO and the UNEP through the FAO/UNEP Joint Programme for the Operation of PIC. The Plant Production and Protection Division of FAO is the lead agency for pesticides and UNEP, through the International Register of Potentially Toxic Chemicals (IRPTC), is the lead agency for the chemicals.

The procedure is complimentary to the International Code of Conduct

Phytoremediation-key to a cleaner environment

The term "phytoremediation" was coined by Professor Ilya Raskin, a professor of plant biology at Rutgers University in New Jersey, to describe the removal of organics and metals from contaminated soils and water by the use of plants.

The concept is not new; however interest in it has grown in recent years as a result of the daunting task faced by many countries of cleaning up a wide range of sites contaminated with radioactive metals such as cesium and strontium and toxic heavy metals such as selenium and cadmium, as well as organic compounds including pesticides, explosives, and solvents.

Scientists have found that many plants naturally absorb metals from the ground and store them in their tissues. Plants such as *Streptanthus polygaloides* and *Thlaspi* are called hyperaccumulators since their tissues can contain from 1,000 to 10,000 ppm of certain heavy metals.

One reason phytoremediation is becoming an increasing focus of interest is because it is potentially cheaper than incineration and chemically based soil washing, the two main conventional treatments. Phytoremediation is also being explored because it may increase the slow pace of hazardous waste clean up. For example, American and Ukranian scientists are field testing the ability of Indian mustard plants to decontaminate the soil made radioactive by the Chernobyl nuclear accident by absorbing metals such as cesium and strontium.

An advantage of this technology is that it may leave topsoil in a usable condition. Moreover, phytoremediation may also have direct health benefits since the technique seems particularly effective for the cleanup of lead in soils. In a phytoremediation demonstration project in the state of New Jersey, plants are being used to remove lead from lagoon sediments near a facility where lead tetraethyl was made for use in leaded gasoline.

However, despite many apparent advantages, scientists acknowledge that phytoremediation also has certain drawbacks. It is a time consuming process that can take a number of growing seasons to clear up a site. Vegetation that absorbs heavy toxic metals may also pose a risk to wildlife that eats the plants, allowing these harmful metals to work their way up the food chain. Thus, although there are grounds for optimism, scientists accept that phytoremediation is still in its early stages of experimentation and development.

Source: Environmental Health Perspectives, Vol. 103, No. 12 December 1995.

on the Distribution and Use of Pesticides (1985, FAO) and the London Guidelines for the Exchange of Information on Chemicals in International Trade (1987, UNEP). The aim is to promote a shared responsibility between exporting and importing countries in protecting human health and the environment from the harmful effects of certain hazardous chemicals being traded internationally.

❒ Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal was adopted in 1989. The Basel Convention defines different categories of wastes including their hazard classification.

❒ Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer was agreed upon at the Headquarters of the International Civil Aviation Organization in Montreal. The Protocol came into force, on time, on January 1st, 1989. 155 countries are now parties to the Protocol, of which over 100 are developing countries.

❒ International Labour Standards

International labour standards have been the principal means of action of the International Labour Organization (ILO). The contents of the labour standards are discussed and adopted in the International Labour Conference by the representatives of governments, employers' and workers' organizations of the ILO member states.

The labour standards related to chemical safety besides the ILO Chemicals Convention itself include the following conventions and recommendations: White Lead (Painting) 1921, Benzene 1971, Occupational Health Services 1985, Asbestos 1986. Prevention of Major Industrial Accidents 1993.

ILO Chemicals Convention, 1990, (No. 170), states the responsibilities of chemical suppliers, and employers as well as rights and duties of workers in order to prevent or reduce the incidence of chemically induced illnesses and injuries at work. The ILO Chemicals Convention is supplemented by its accompanying ILO Chemicals Recommendation 1990 (No. 177).

❒ Agenda 21, Chapter 19

An international agreement on Environmentally Sound Management of Chemicals, Including Prevention of Illegal International Traffic in Dangerous Products. The agreement was adopted at the United Nations Conference on Environment and Development in Rio de Janeiro, June 1992. The Agenda 21, Chapter 19 comprises six major programme areas to be implemented globally:

A) Expanding and Accelerating International Assessment of Chemical Risks

B) Harmonization of Classification and Labelling of Chemicals

C) Information Exchange on Chemicals and Chemical Risks

D) Establishment of Risk Reduction Programmes

E) Strengthening of National Capabilities for Management of Chemicals

F) Prevention of Illegal International Traffic in Dangerous Products.

❒ Chemical Weapons

The Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (CWC) was signed in January 1993 in Paris. It is the first disarmament agreement negotiated within a multilateral framework that provides for the elimination of an entire category of weapons of mass destruction under universally applied international control. As of 24 June 1996, 160 States had signed it.

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A good sign that I have noticed is that a lot of the old buses that were causing air pollution three years ago have now been replaced, so that in this respect air quality is probably better now than in the past. The last time that my wife and I came to Thailand from Denmark, we had a blood test before we left home and again on our return, and there was no appreciable difference, which is in itself an encouraging sign. We have an ongoing project between CRI and our Department of Environmental & Occupational Medicine, University of Aarhus in Denmark on blood levels of traffic police. The results of this joint research are not yet available, but when they are, they should form the basis for future decision making. For example, one question that we are now asking in Denmark is should we ban cars from the centre of the city, or should a special tax be levied on private cars in the city. This measure has already proved successful in Norway and is also being intoduced in Sweden. Awareness of the health problem of air pollution caused by vehicle exhaust has been raised in Denmark by research we did on bus drivers. We found that bus drivers in Copenhagen have three times the level of exposure to cancer causing agents than bus drivers outside the city. This has made people realize that we do have a problem in Denmark, so one measure is to eliminate diesel cars, or at least the old diesel cars, which can be done at two different levels. You can produce a better engine, but it would take between 10 and 15 years before this can be developed; or you can develop a new diesel fuel, and that is the attempt that is currently being made. Another solution of course would be to use a different source of energy, which could be electricity or liquid gas.

These are problems that are also going to have be resolved here in Thailand.

Through CRI's Southeast Asia Capacity Building Program personnel are being trained in the necessary steps and measures to resolve these

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and other environment problems that have an adverse effect on sustainability of industrial and economic development in the region and on the quality of life of the individual.

Two of the delegates at the August training course spoke to the Editor about their work and the relevance of the course to the environmental problems in their own countries.

Mrs. Do Hong Lan Chi

I work in the Centre of Environmental Technology, which is part of Ho Chi Minh City, University of Technology. My job is as lecturer and researcher in the field of Environmental Engineering, specially biological treatment for domestic and industrial waste water, environmental impact assessment, etc. The subject I teach is the use of microorganisms in environmental engineering since my academic background is in biology. In the near future we will plan to extend our courses and also offer environmental toxicology. This is why I had a particular interest in attending the CRI training course. What I am learning here will be most useful in preparing for our new courses.

Research is also a major part of my work in the Centre of Environmental Technology and I am currently engaged in a project to develop the use of biological methods for waste water treatment. Like Bangkok, Ho Chi Minh City has high levels of water pollution, mainly due to domestic waste being discharged into the waterways – although industrial waste is also becoming a major problem – and the research we are doing is aimed at finding solutions to these problems, by developing more effective approaches to waste water treatment. For this work we receive financial support from our Ministry of the Environment and also from Ho Chi Minh Metropolitan Authority. The Metropolitan Authority is of course very concerned with prevention of environmental degradation and one of the main priorities is rehabilitation of communities living in slum areas along the river. In this we have learned a great deal from the Thai experience and also from Singapore. For both domestic and industrial waste, long term solutions to our current problems lie in both water treatment and prevention of pollution at source, and we are addressing both these aspects of the problem.

Dr. Benny L. Priatna

Dr. Priatna, a delegate from Indonesia, explained the nature of his work as Head of the Regional Institute of Occupational Health and Safety in the Department of Manpower, Jakarta, Indonesia.

The Institute has both a national and 14 regional centres. The National Institute is primarily responsible for safety standards and control whereas the regional institutes focus on the specific needs of the geographical regions. For example, in Bali, the emphasis is on health and safety of workers in the tourism industry. In this area, the application of water treatment and waste disposal technologies is of paramount importance both for sustainable development of the industry and for promoting the goals of ecotourism. In other geographical regions, the main emphasis of the work of the Institutes relates to the occupational hazards for workers associated with agricultural and marine industries.

Dr. Priatna's own background is in medicine, specialising in occupational respiratory health care, and since he is based in Jakarta his main professional concern is in industrial health and toxicology. The CRI training course has thus been very relevant to his work on the control of industrial toxicology and he praised the high technical standard of the lectures and dissemination of information on research findings and studies in the area of environmental pollution from industrial sources.

The interrelationship of industry and the environment is an important concept for Dr. Priatna. He believes that occupational health should not be studied only in the context of the workplace but also in the wider context of the environment. Clean industry will create a clean environment.

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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