Annex 1: List of chemicals of international concern

Persistent Organic Pollutants (POPs):

POPs are a group of compounds that remain intact in the environment for long periods, become widely distributed in nature and accumulate in the fatty tissue of humans and wildlife. Exposure to POPs can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and even diminished intelligence. The first 12 POPs under the Stockholm Convention were aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls (PCBs), DDT, PCDD (dioxins) and PCDF (furans). In May 2009, nine new chemicals were added: alpha, beta and gamma hexachlorocyclohexane, chlordecone, commercial penta- and octa- brominated diphenyl ethers, pentachorobenzene, hexabromobiphenyl and perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride.

DDT

DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane) is a pesticide that was widely used in agriculture and public health. DDT is often used to refer to related compounds DDE (1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene) and DDD (1,1-dichloro-2,2-bis(p-chlorophenyl)ethane). DDE and DDD are present as contaminants in technical grade DDT and are also breakdown products of DDT. The Stockholm Convention allows the use of DDT for use in public health for disease vector control as recommended by and under the guidance of the World Health Organization (WHO). The WHO recommends the use of DDT for indoor residue spraying only to control, in particular, the anopheles mosquito that carries the malaria parasite.

DDT and related compounds are very persistent in the environment. Half of them can be found in the soil 10-15 years after application. They are also transported large distances and have been found in the Arctic and Antarctic environment where they have never been used. DDT accumulates acutely in fish and marine mammals (such as seals and whales), reaching levels many thousands of times higher than in the surrounding water. DDT and its metabolites have been detected in food from all over the world. For most people, food is the greatest source of exposure.

DDT is not very toxic to humans. However, its persistence and accumulation has given rise to concern in relation to possible long-term impacts. While a wide range of effects have been reported in laboratory animals, these have not been confirmed in human studies. There is some evidence that DDT may disrupt reproductive and endocrine functions, and studies in animals have shown that oral exposure to DDT can cause liver cancer. The World Health Organization is currently undertaking an updated human health risk assessment of DDT, to be finalized in 2010. Several harmful effects in wildlife populations have been linked to DDT: these include the thinning of eggshells in birds, feminization and altered sex-ratios, and impacts on the nervous system and on behaviour.[38]

38 Source: An Assessment Report on: DDT, Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Hexachlorobenzene, Mirex, Toxaphene, Polychlorinated Biphenyls, Dioxins and Furans, IPCS; Public Health Statement for DDT, DDE, and DDD, ATSDR, 2002; The Use of DDT in Malaria Vector Control, WHO, 2007.

Dioxins and Furans

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), often referred to simply as dioxins and furans, have never been used or manufactured for other than laboratory purposes.

Because these chemicals exist throughout the environment, almost all living creatures, including humans, have been exposed to them. Exposure arises mainly through fatty foods, including breast milk, but can also arise from accidental releases or in workplaces.

Much of the information on the toxicity of these chemicals is based on extensive studies in experimental animals of the most toxic member of the family – 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). TCDD and related compounds can produce a wide variety of effects in animals and might produce many of the same effects in humans.

The International Agency for Research on Cancer (IARC) identified 2,3,7,8-TCDD as the most toxic of all dioxin compounds, and as carcinogenic to humans, based mainly on studies of cases involving heavy accidental or occupational exposure. Animal studies have also shown an increased risk of cancer from long-term exposure to dioxins and furans as well as a wide variety of reproductive and developmental effects, including reduced viability, structural alterations, growth retardation and functional alterations. There is also evidence of neurobehavioural effects and effects on immune and various endocrine functions, including those of the thyroid. Because of this evidence in animals, particularly at high doses but in some cases at doses close to those with relevance for human beings, scientists are concerned about the potential for humans to show the same effects, especially those on developing children that result from prenatal exposure.[39]

Endosulfan

Endosulfan is an organochlorine compound commonly used as an agricultural insecticide. It comes in two forms, alpha (α) and beta (β). In the environment it transforms into endosulfan sulphate.

Endosulfan and its transformation products have been found at concentrations of potential concern at some distance from where they were applied. Endosulfan is also found in remote areas, including the Arctic and Antarctic, evidence that it has enough persistence and transport potential to move around the planet.

The toxicity and ecotoxicity of endosulfan and its metabolites is well documented. It is highly toxic to aquatic and terrestrial animals, including humans. It shows acute and chronic effects at relatively low levels of exposure to both invertebrate and vertebrate animals. Endosulfan affects the central nervous system and it may cause endocrine disruption and affect the immune system.[40]

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39 Source: Guidelines on BAT and Guidance on BEP December 2006.

40 Source: Endosulfan Draft Risk Profile. POPs Review Committee, Stockholm Convention on Persistent Organic Pollutants, July 2009.

Lindane

Lindane has been used as a broad-spectrum insecticide for seed and soil treatment, leaf applications, in tree and wood treatment and against external parasites such as ticks and flees in both veterinary and human medicine. The manufacture of lindane results in the production of by-products of two related chemicals – alpha- and beta-hexachlorocyclohexane – which are also of concern.

Lindane can be found in all environmental compartments; it has been detected in air, water, soil sediment, aquatic and terrestrial organisms and food worldwide, including in human blood, fatty tissue and breast milk in different countries. Levels of lindane in the environment in colder regions is often higher than in warmer parts of the globe.

Lindane is highly toxic to aquatic organisms and moderately toxic to birds and mammals following acute exposures. There is also evidence of chronic effects to birds and mammals – studies have shown effects on reproduction such as reduction in egg production in birds. Some effects seen in these studies suggest that lindane may disrupt the endocrine system. Laboratory studies have found lindane to have adverse effects on development, the liver, and the nervous and immune systems. The International Agency for Research on Cancer (IARC) has classified lindane as possibly carcinogenic to humans. Exposure of children and pregnant women to lindane is of particular concern from its use to treat scabies and headlice, and its presence in breast milk.[41]

PCBs

Polychlorinated biphenyls (PCBs) have been used as coolants and lubricants in transformers, capacitors and other electrical equipment because they do not burn easily and are good insulators. Among other things, products that may contain PCBs include old fluorescent lighting fixtures and electrical devices with PCB-capacitors. PCBs can also be released as a by-product of combustion and industrial processes.

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions. PCB exposures in the general population are not likely to result in skin and liver effects.

Studies in exposed workers have shown changes in blood and urine that are linked to liver damage. In two incidents, each involving about 2,000 cases, Japanese and Taiwanese people were exposed to high concentrations of PCBs and furans through consumption of contaminated rice oil. When compared to the general population, the people exposed were found to have 2-3 times the expected number of fatal liver disease.

Most of the studies of health effects of PCBs in the general population have looked at children of mothers who were exposed to PCBs. PCBs may be associated with developmental or endocrine effects. Women who were exposed to relatively high levels of PCB in the workplace or ate large amounts of fish contaminated with PCB had babies that weighed slightly less than babies of women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behaviour. Some of these behaviours, such as problems with motor skills and a decrease in short-term memory, lasted for several years.

41 Source: Lindane Risk Profile. Adopted by the POPs Review Committee, Stockholm Convention on Persistent Organic Pollutants, November 2006.

IARC has determined that PCBs are probably carcinogenic to humans. A few studies of exposed workers have indicated that PCBs are associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats fed food containing high levels of PCB for two years developed liver cancer.[42]

PFOS

Perfluorooctane sulfonate (PFOS) is commonly used as a salt in some applications or incorporated into larger polymers. PFOS can be formed by degradation from a large group of substances, referred to as PFOS-related.

PFOS-related chemicals are used in a variety of products, including as surface-treatments of fabric for soil/stain resistance, as part of a sizing agent formulation in coating of paper and in specialised applications such as fire fighting foams. They can be released to the environment during their manufacture, during their use in industrial and consumer applications, and from disposal of the chemicals or of products or articles containing them after their use.

PFOS is persistent in the environment and has been shown to bioconcentrate in fish. The only known condition whereby PFOS is degraded is through high temperature incineration. PFOS also travels large distances in the environment and is found in the Arctic biota far from its sources.

PFOS is toxic to mammalian species. Repeated exposure damages the liver and increases mortality; newborns may be more sensitive to these effects. Studies of exposed workers have shown an association between PFOS and the incidence of bladder cancer; an experimental study in animals has show that exposure to PFOS results in liver and thyroid tumours. PFOS appears to be of low toxicity to fish but more toxic to other aquatic organisms. There is evidence of high acute toxicity to honey bees.[43]

Polybrominated Flame Retardants

Polybrominated diphenyl ethers have had a wide range of uses, including in polyurethane foams and plastics for electronic equipment. They are a class of substances used as flame retardants that are physically combined with the material being treated. This means that they retain their chemical structure in the product. The physical, chemical and toxicological properties of the compounds vary depending on the form and bromination level of the specific substance.

Brominated diphenyl ethers are of concern because they are persistent, bioaccumulate and are transported long distances in the environment. Monitoring data in remote areas shows evidence of the long transport range of these compounds. The degradation of brominated diphenyl ethers in the environment and biota is a key issue as compounds with higher number of bromine atoms are converted to forms with less bromine that are possibly more toxic. Some brominated diphenyl ethers have been measured in wildlife at levels that are similar to those where adverse effects have been noted in experimental animals.

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42 Source: Guidelines on BAT and Guidance on BEP December 2006

43 Source: Perfluorooctane Sulfonate Risk Profile. Adopted by the POPs Review Committee, Stockholm Convention on Persistent Organic Pollutants, November 2006; Hazard Assessment of Perfluorooctane Sulfonate (PFOS) and its Salts, Organisation for Economic Co-operation and Development, Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology, Paris, November 21, 2002.

There is incomplete understanding of the toxicology of brominated diphenyl ethers, either individually or as a mixture. Specific studies have reported hazards such as delayed neurotoxicity, immunotoxicity, reproductive toxicity, neurodevelopmental toxicity and effects on the thyroid hormones. It is also possible that polybrominated diphenyl ethers are endocrine disruptors. Pregnant women, embryos and infants are more vulnerable because of effects on the thyroid hormone balance and the development of the embryo's central nervous system.

The phase-out of polybrominated flame retardants has reduced their release in the environment and levels measured in people in Europe. However, there is still a large stock of materials in use, such as polyurethane foams and plastics in electronic equipment. Polybrominated flame retardants continue to be released during the use of these articles, as well as when they are collected for recycling or disposed of. The main routes for human exposure are food and exposure to dust in indoor air at home and workplaces. Fish and agriculture products are the main food sources of certain brominated flame retardants, as well as mother's milk for the nursing child.[44]

POPs Pesticides (Organochlorine)

Organochlorine pesticides are effective against a variety of insects. Some have also been used as fungicides, antimicrobials and termicides. These chemicals were introduced in the 1940s and vary in their chemical structures and mechanisms of toxicity. They can be classified into four categories: dichlorodiphenylethanes (such as DDT), cyclodienes (such as dieldrin, endosulfan and heptachlor), chlorinated benzenes (such as hexachlorobenzene) and cyclohexanes (such as hexachlorocyclohexane or lindane). The use of most organochlorine pesticides has been banned or severely restricted around the world, although endosulfan, is still widely used in some countries.

Organochlorine pesticides can enter the environment from direct application and runoff, disposal of contaminated wastes into landfills, emissions from waste incinerators and releases from manufacturing plants that produce them. Some organochlorine pesticides are volatile or can adhere to soil or particles in the air. In aquatic systems, organochlorine pesticides are adsorbed into sediments in water that can then bioaccumulate in fish and other marine mammals.

Because these chemicals are soluble in fat, they are found at higher concentrations in fatty foods. The main source of exposure to organochlorine pesticides is through eating fatty foods, such as milk, dairy products, or fish that are contaminated with these pesticides. It is also possible to pass these pesticides through the placenta to the unborn child or by breastfeeding, or to absorb them through the skin.

Organochlorine pesticides affect the nervous system and can harm the liver. Potential adverse effects include reproductive effects, endocrine disruption and cancer. Organochlorine pesticides can build up in a person's body over time, but the health effects associated with low exposure are still uncertain. Organochlorine pesticides have been linked to adverse reproductive effects in wildlife.[45]

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44 Source: Commercial Octabromodiphenyl Ether Risk Profile. Adopted by the POPs Review Committee, Stockholm Convention on Persistent Organic Pollutants, November 2007; Pentabromodiphenyl Ether Risk Profile. Adopted by the POPs Review Committee, Stockholm Convention on Persistent Organic Pollutants, November 2006

45 Source: Third National Report on Human Exposure to Environmental Chemicals, July 2005 (including fact sheet "Spotlight on Organochlorine Pesticides"). U.S. Centers for Disease Control and Prevention; The History of "Organochlorine Pesticides" in Australia. Australian Pesticides and Veterinary Medicines Authority.

Mercury

Mercury has been used in various products and processes for hundreds of years. Industrial processes, coal-fired power plants, mining and waste sites are important sources of mercury into the environment. In recent years, levels of mercury in the environmental mercury have risen. Once released in the environment, mercury can persist and move among air, water, sediments, soil and biota and concentrate up the food chain. Mercury in the air can be transported long distances away from the point of release.

Mercury and mercury-containing compounds are highly toxic and have a variety of significantly adverse effects on human health, wildlife and the environment. In the human body, mercury damages the central nervous system, thyroid, kidneys, lungs, immune system, eyes, gums and skin. Neurological damage to the brain caused by mercury cannot be reversed. There is no known safe exposure level to mercury in humans, and effects can be seen even at very low levels.

The most common way for people to be exposed to mercury is through fish and other marine species contaminated with methylmercury. People who are more vulnerable to exposure to mercury include fetuses, newborn babies and children, as they are more sensitive to its effects. People who have a diet rich in fish and other seafood are at risk of higher exposure as well.[46]

Lead

Lead is a heavy metal that is toxic at very low exposure levels and has acute and chronic effects on human health including neurological, cardiovascular, renal, gastrointestinal, haematological and reproductive effects. Once emitted into air, lead is subject to atmospheric transport and bioaccumulates in most organisms. Lead is released by various natural and anthropogenic sources, including mining and processing activities and the manufacturing, use, disposal and recycling of products containing lead, such as batteries, ammunition and alloy for cable shearing. Lead used in paint is of particular concern as there is a high risk of exposure for vulnerable groups such as children. Recent recalls of millions of children's toys possibly containing lead attracted worldwide attention due to both the health risk to the end user and the economical risk for the producer.

Ozone Depleting Substances

Chlorofluorocarbons (CFCs) and other ozone-depleting substances (ODS) include a range of industrial chemicals first developed in the 1920s. They are stable and nontoxic, cheap to produce, easy to store and highly versatile. As a result, they came to be used in a wide range of applications, including as coolants for refrigeration and air conditioning, for blowing foams, as solvents, sterilants and propellants for spray cans.

When released, they rise into the stratosphere, where they are broken apart by solar radiation to release chlorine or bromine atoms, which in turn destroy ozone molecules in the protective stratospheric ozone layer. They are slow to disappear, which means that past and present emissions will contribute to ozone depletion for years to come.

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46 Source: The Mercury Issue: Introduction. UNEP, 2008.

Highly Hazardous Pesticides

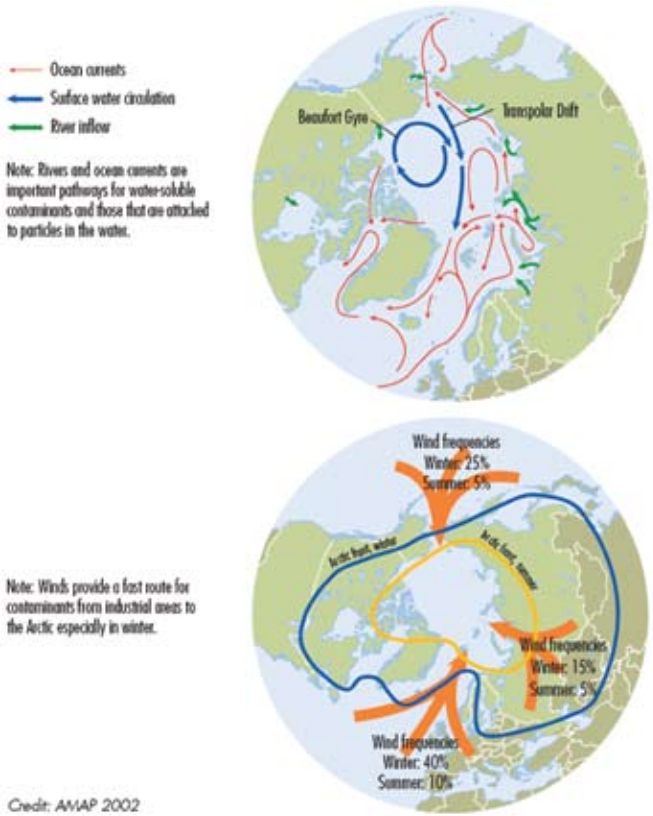
While further regulation in advanced industrialised countries increasingly excludes highly hazardous pesticides, their intensive use remains common in many developing countries. In many areas there is considerable overuse and abuse of such products, resulting in relatively high incidence of farmer poisoning and pesticide residues on food crops, particularly fruit and vegetables, above established Maximum Residue Levels. The Forum VI of the Intergovernmental Forum on Chemical Safety (IFCS) recognised and recommended that promotion of integrated pest management, which reduces reliance on pesticides, should be a key element of risk reduction strategies for pesticides.

Annex 2: Global travelers

The identity and overall well-being of indigenous peoples is closely linked to their relationship to the environment. Persistent organic pollutants (POPs) and heavy metals have been found in all parts of the Arctic ecosystem, including in people. By following their traditional diet, Inuit in the eastern Canadian Arctic and Greenland are exposed to among the highest levels of POPs and mercury in the world.

Contaminants reach the Arctic from all over the world through wind, air and water currents and there it enters the food chain. This endangers a sustainable lifestyle based on harvesting, distribution and consumption of local renewable resources, which has existed for generations. Yet, most of these substances are present in the Arctic ecosystems and in the diets of Arctic peoples as a result of activities carried out elsewhere (such as using the insecticide toxaphene on cotton fields).

Pollutants path to the Arctic



Source: UNEP: Global Environment Outlook 4, 2007

Annex 3: Overview of main international chemicals-related agreements

Basel Convention[47]

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal came into force in 1992. It aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes. The Convention had 172 Parties as of November 2009. It regulates the transboundary movements of hazardous and other wastes applying the Prior Informed Consent (PIC) procedure. The Convention furthermore obliges its Parties to ensure that hazardous and other wastes are managed and disposed of in an environmentally sound manner. Technical assistance, technical guidelines on the Environmentally Sound Management (ESM) of specific hazardous waste streams and further guidance material are provided as a support to developing countries and countries with economies in transition, to manage and dispose of hazardous wastes in an environmentally sound manner.

Rotterdam Convention[48]

The Rotterdam Convention creates legally binding obligations for the implementation of the PIC procedure for pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons by the Parties. The Convention builds on the voluntary PIC procedure, which was initiated by UNEP and FAO in 1989 and came to an end on 24 February 2006. The Rotterdam Convention had 130 Parties as of November 2009. Its objectives are:

- *to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm;*
- *to contribute to the environmentally sound use of those hazardous chemicals by facilitating information exchange and by providing for a national decision-making process on the import and export of those hazardous chemicals.*

Stockholm Convention[49]

The Stockholm Convention is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that are persistent, bioaccumulative, subject to long-range environmental transport and that are toxic to humans and the environment. Governments have to take measures to eliminate or reduce the release of POPs into the environment. At its adoption, the Convention targeted 12 particularly toxic POPs for reduction and eventual elimination. Nine further POPs have been added to the Convention based on a consensus decision by the Parties in May 2009. The Convention also provides support to developing countries and countries with economies in transition to phase out and clean up stockpiles of certain chemicals. The Stockholm Convention entered into force in 2004 and had 168 Parties as of November 2009.

47 Basel Convention website: www.basel.int
48 Rotterdam Convention website: www.pic.int
49 Stockholm Convention website: www.pops.int

Strategic approach to international chemicals management (SAICM)[50]

Adopted by the International Conference on Chemicals Management (ICCM) on 6 February 2006 in Dubai, United Arab Emirates, the Strategic Approach to International Chemicals Management (SAICM) is an international voluntary policy framework to foster the sound management of chemicals. Its aim is to support the achievement of the goal agreed at the 2002 Johannesburg World Summit on Sustainable Development of ensuring that, by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health. A major driving force for the establishment of the Strategic Approach has been the recognition of the growing gaps between the capacities of different countries to manage chemicals safely, the need to improve synergies between existing instruments and processes and the growing sense of urgency regarding the need to assess and manage chemicals more effectively to achieve the 2020 goal articulated in the Johannesburg Plan of Implementation.

Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer

The 1985 Vienna Convention, its 1987 Montreal Protocol and subsequent amendments are aimed at protecting the ozone layer from various human activities. The Convention encourages intergovernmental cooperation on research, systematic observations of the ozone layer, monitoring CFC production and the exchange of relevant information on human activities. The Convention is concerned with the indirect effect of chemical substances on the ozone layer. When CFCs breakdown, they release chlorine atoms which give rise to ozone depletion. Similarly, bromine atoms are released by halon breakdowns that have a similar impact. The Vienna Convention is a framework Convention and does not contain legally binding controls or targets. The Montreal Protocol was designed to reduce the production and consumption of a number of CFCs and several halons following agreed phase-out schedules that are based on scientific and technical assessments. Amendments to the Protocol have adjusted the phase-out schedules, introduced new controlled substances to the list and introduced other types of control measures. A range of alternative chemical substances have been developed and commercialized allowing developed countries to end the use of CFCs faster than originally anticipated. The Montreal Amendment to the Protocol included provision to ban exports of used, recycled and reclaimed substances other than for destruction, to discourage illegal sales of these substances.[51]

International Code of Conduct on the Distribution and Use of Pesticides (Revised version)

The 2002 version of the FAO International Code is a revised version of the 1985 Code of the same name. Provisions for PIC originally drafted in the earlier Code were removed from the revised version, as the Rotterdam Convention specifically addressed this important issue. The Code was developed in response to a growing concern regarding the appropriateness of supplying pesticides to countries that lack the infrastructure to register pesticides and thereby ensure their safe use. The objectives of the

50 SAICM website: www.saicm.org
51 Developing and Sustaining an Integrated National Programme for Sound Chemicals Management; UNITAR, 2004.

Code are to establish voluntary standards of conduct for all public and private entities engaged in, or associated with the trade, distribution and use of pesticides, particularly where there is inadequate or no national legislation to regulate pesticides. The standards set forth in the Code focus on risk reduction, protection of human health and the environment, and support for sustainable agriculture developed by adopting various procedures. The Code details responsibilities of governments to legislate, regulate and enforce such actions as well as establish information exchange networks between regulatory authorities on actions for banned or severely restricted pesticides. Establishment of appropriate educational, advisory, extension and health care services are also included. Under the Code, industry is responsible for adhering to standards of manufacture, distribution and advertising of pesticides especially in countries that lack appropriate legislation or means of implementing regulations. They also have to ensure that pesticides are adequately tested in terms of risk and that pesticides are adequately labelled and packaged. [51]

ILO Chemicals Convention 1990, No. 170

The Convention represents one of the most far-reaching international agreements in the area of chemicals management and specifically addresses the protection of workers from harmful effects of chemicals at the workplace. It applies to all branches of economic activity in which chemicals are used, covers all chemicals and provides specific measures in respect of hazardous chemicals. The Convention requires that classification systems be established and that all chemicals should be marked to indicate their identity. Hazardous chemicals should be labelled to provide essential information on their classification, their hazards and safety precautions to be observed. Because of the tri-partite composition of the ILO under whose jurisdiction the Convention was negotiated, governments, suppliers, employers and workers all have responsibilities for the safe management and handling of chemicals. Governments are required to develop national policies on safety in the use of chemicals at work and that may include measures to prohibit and/or restrict the use of certain chemicals. Suppliers, which may include manufactures, importers and distributors, are required to ensure that chemicals are properly classified and labelled and that safety data sheets are provided to employers.

Employers have an obligation to ensure that workers are not exposed to chemicals exceeding national or international limits, that they are provided with safety data sheets and that they are trained on all aspects of safety in the use of chemicals in the workplace. Employers are also required to assess the risks associated with use the use of chemicals and identify options to protect workers throughout all stages of the life-cycle of the chemical. Workers have an obligation to co-operate with their employers and to take all reasonable steps to minimize or avoid risk. [51]

51 Chemical Leasing is a service-oriented business model that shifts the focus from increasing sales volume of chemicals towards a value-added approach. In such a model, the producer does not just provide the chemical, but also his know-how on how to reduce the consumption of chemicals and how to optimize the conditions of use. While in the traditional model the responsibility of the producer ends with the selling of the chemical, in Chemical Leasing business models the producer remains responsible for the chemical during its whole life cycle, including its use and disposal.

Note

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