DOWNLOAD PDF PERSISTENT ORGANIC POLLUTANTS

Chapter 1 : The 12 Initial POPs

Persistent organic pollutants (POPs) are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes. Because of their persistence, POPs bioaccumulate with potential adverse impacts on human health and the environment.

For this reason, they bioaccumulate in fatty tissues. Halogenated compounds also exhibit great stability reflecting the nonreactivity of C-Cl bonds toward hydrolysis and photolytic degradation. The stability and lipophilicity of organic compounds often correlates with their halogen content, thus polyhalogenated organic compounds are of particular concern. They exert their negative effects on the environment through two processes, long range transport, which allows them to travel far from their source, and bioaccumulation, which reconcentrates these chemical compounds to potentially dangerous levels. Long-range transport[edit] POPs enter the gas phase under certain environmental temperatures and volatize from soils , vegetation , and bodies of water into the atmosphere , resisting breakdown reactions in the air, to travel long distances before being re-deposited. POPs have low solubility in water but are easily captured by solid particles, and are soluble in organic fluids oils , fats , and liquid fuels. POPs are not easily degraded in the environment due to their stability and low decomposition rates. Due to this capacity for long-range transport, POP environmental contamination is extensive, even in areas where POPs have never been used, and will remain in these environments years after restrictions implemented due to their resistance to degradation. Dietary accumulation or bioaccumulation is another hallmark characteristic of POPs, as POPs move up the food chain, they increase in concentration as they are processed and metabolized in certain tissues of organisms. The natural capacity for animals gastrointestinal tract concentrate ingested chemicals, along with poorly metabolized and hydrophobic nature of POPs makes such compounds highly susceptible to bioaccumulation. The purpose statement of the agreement is "to protect human health and the environment from persistent organic pollutants. The convention and its participants have recognized the potential human and environmental toxicity of POPs. They recognize that POPs have the potential for long range transport and bioaccumulation and biomagnification. The convention seeks to study and then judge whether or not a number of chemicals that have been developed with advances in technology and science can be categorized as POPs or not. The initial meeting in made a preliminary list, termed the "dirty dozen," of chemicals that are classified as POPs. As of , the United States of America has signed the Stockholm Convention but has not ratified it. There are a handful of other countries that have not ratified the convention but most countries in the world have ratified the convention. Humans are primarily exposed to aldrin through dairy products and animal meats. Chlordane , an insecticide used to control termites and on a range of agricultural crops, is known to be lethal in various species of birds, including mallard ducks, bobwhite quail, and pink shrimp; it is a chemical that remains in the soil with a reported half-life of one year. Chlordane has been postulated to affect the human immune system and is classified as a possible human carcinogen. Chlordane air pollution is believed the primary route of humane exposure. Dieldrin , a pesticide used to control termites, textile pests, insect-borne diseases and insects living in agricultural soils. In soil and insects, aldrin can be oxidized, resulting in rapid conversion to dieldrin. Dieldrin is highly toxic to fish and other aquatic animals, particularly frogs, whose embryos can develop spinal deformities after exposure to low levels. Dieldrin residues have been found in air, water, soil, fish, birds, and mammals. Human exposure to dieldrin primarily derives from food. Endrin , an insecticide sprayed on the leaves of crops, and used to control rodents. Animals can metabolize endrin, so fatty tissue accumulation is not an issue, however the chemical has a long half-life in soil for up to 12 years. Endrin is highly toxic to aquatic animals and humans as a neurotoxin. Human exposure results primarily through food. Heptachlor , a pesticide primarily used to kill soil insects and termites, along with cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes. Heptachlor, even at every low doses has been associated with the decline of several wild bird populations â€” Canada geese and American kestrels. In laboratory tests have shown high-dose heptachlor as lethal, with adverse behavioral changes and reduced reproductive success at low-doses, and is classified as a possible human carcinogen. Human exposure primarily results from food.

Hexachlorobenzene HCB , was first introduced in â€"59 to treat seeds because it can kill fungi on food crops. HCB-treated seed grain consumption is associated with photosensitive skin lesions, colic , debilitation, and a metabolic disorder called porphyria turcica, which can be lethal. Mothers who pass HCB to their infants through the placenta and breast milk had limited reproductive success including infant death. Human exposure is primarily from food. Mirex , an insecticide used against ants and termites or as a flame retardant in plastics, rubber, and electrical goods. Mirex is one of the most stable and persistent pesticides, with a half-life of up to 10 years. Mirex is toxic to several plant, fish and crustacean species, with suggested carcinogenic capacity in humans. Humans are exposed primarily through animal meat, fish, and wild game. Toxaphene , an insecticide used on cotton, cereal, grain, fruits, nuts, and vegetables, as well as for tick and mite control in livestock. Widespread toxaphene use in the US and chemical persistence, with a half-life of up to 12 years in soil, results in residual toxaphene in the environment. Toxaphene is highly toxic to fish, inducing dramatic weight loss and reduced egg viability. While human toxicity to direct toxaphene exposure is low, the compound is classified as a possible human carcinogen. Polychlorinated biphenyls PCBs , used as heat exchange fluids , in electrical transformers , and capacitors , and as additives in paint, carbonless copy paper, and plastics. Persistence varies with degree of halogenation , an estimated half-life of 10 years. PCBs are toxic to fish at high doses, and associated with spawning failure at low doses. Human exposure occurs through food, and is associated with reproductive failure and immune suppression. Immediate effects of PCB exposure include pigmentation of nails and mucous membranes and swelling of the eyelids, along with fatigue, nausea, and vomiting. Food contamination has led to large scale PCB exposure. It was widely used as insecticide during WWII to protect against malaria and typhus. After the war, DDT was used as an agricultural insecticide. DDT is toxic to many organisms including birds where it is detrimental to reproduction due to eggshell thinning. DDT can be detected in foods from all over the world and food-borne DDT remains the greatest source of human exposure. Short-term acute effects of DDT on humans are limited, however long-term exposure has been associated with chronic health effects including increased risk of cancer and diabetes, reduced reproductive success, and neurological disease. Dioxins are unintentional by-products of high-temperature processes, such as incomplete combustion and pesticide production. Dioxins are typically emitted from the burning of hospital waste, municipal waste, and hazardous waste , along with automobile emissions, peat, coal, and wood. Dioxins have been associated with several adverse effects in humans, including immune and enzyme disorders, chloracne , and are classified as a possible human carcinogen. In laboratory studies of dioxin effects an increase in birth defects and stillbirths, and lethal exposure have been associated with the substances. Food, particularly from animals, is the principal source of human exposure to dioxins. Polychlorinated dibenzofurans are by-products of high-temperature processes, such as incomplete combustion after waste incineration or in automobiles, pesticide production, and polychlorinated biphenyl production. Structurally similar to dioxins, the two compounds share toxic effects. Furans persist in the environment and classified as possible human carcinogens. Human exposure to furans primarily results from food, particularly animal products. New POPs on the Stockholm Convention list[edit] Since , this list has been expanded to include some polycyclic aromatic hydrocarbons PAHs , brominated flame retardants , and other compounds. Chlordecone is toxic to aquatic organisms, and classified as a possible human carcinogen. Many countries have banned chlordecone sale and use, or intend to phase out stockpiles and wastes. Large stockpiles of HCH isomers exist in the environment. Commercial octaBDE is highly persistent in the environment, whose only degradation pathway is through debromination and the production of bromodiphenyl ethers , which can increase toxicity. It is immunotoxic , neurotoxic , carcinogenic , linked to liver and kidney damage as well as adverse reproductive and developmental effects in laboratory animals and aquatic organisms. PeCB has also been used in PCB products, dyestuff carriers, as a fungicide, a flame retardant, and a chemical intermediate. PeCB is moderately toxic to humane, while highly toxic to aquatic organisms. Tetrabromodiphenyl ether tetraBDE and pentabromodiphenyl ether pentaBDE are industrial chemicals and the main components of commercial pentabromodiphenyl ether pentaBDE. PentaBDE has been detected in humans in all regions of the world. Perfluorooctanesulfonic acid PFOS and its salts are used in the production of fluoropolymers. PFOS and related compounds are extremely persistent, bioaccumulating and biomagnifying. The negative effects of trace

levels of PFOS have not been established. Endosulfans are insecticides to control pests on crops such coffee, cotton, rice and sorghum and soybeans, tsetse flies, ectoparasites of cattle. They are used as a wood preservative. Global use and manufacturing of endosulfan has been banned under the Stockholm convention in , although many countries had previously banned or introduced phase-outs of the chemical when the ban was announced. Toxic to humans and aquatic and terrestrial organisms, linked to congenital physical disorders, mental retardation, and death. Hexabromocyclododecane HBCD is a brominated flame retardant primarily used in thermal insulation in the building industry. HBCD is persistent, toxic and ecotoxic , with bioaccumulative and long-range transport properties. Additive and synergistic effects[edit] Evaluation of the effects of POPs on health is very challenging in the laboratory setting. For example, for organisms exposed to a mixture of POPs, the effects are assumed to be additive. With synergistic effects, the toxicity of each compound is enhanced or depressed by the presence of other compounds in the mixture. When put together, the effects can far exceed the approximated additive effects of the POP compound mixture. Some are carcinogens per IARC , possibly including breast cancer. People and animals are exposed to POPs mostly through their diet, occupationally, or while growing in the womb. In general, POP serum levels increase with age and tend to be higher in females than males. Low level exposure to POPs during critical developmental periods of fetus, newborn and child can have a lasting effect throughout its lifespan. The study aimed to answer the question whether or not chronic, low level exposure to POPs can have a health impact on the endocrine system and development of organisms from different species. The study found that exposure of POPs during a critical developmental time frame can produce a permanent changes in the organisms path of development. Exposure of POPs during non-critical developmental time frames may not lead to detectable diseases and health complications later in their life. In wildlife, the critical development time frames are in utero , in ovo , and during reproductive periods. In humans, the critical development timeframe is during fetal development. The study stated that POP exposure can lead to negative health effects especially in the male reproductive system , such as decreased sperm quality and quantity, altered sex ratio and early puberty onset.

Chapter 2 : Persistent Organic Pollutants - Eurofins USA

The Stockholm Convention on Persistent Organic Pollutants, which was adopted in and entered into force in , is a global treaty whose purpose is to safeguard human health and the environment from highly harmful chemicals that persist in the environment and affect the well-being of humans as well as wildlife.

Damage to the central and peripheral nervous systems Disruption of the endocrine, reproductive, and immune systems A study published in suggests that an increased level of POP. According to the U. The negative effects of pesticides in the marine and coastal environments include changes in reef community structure, such as decreases in live coral cover and increases in algae and sponges and damage to seagrass beds and other aquatic vegetation from herbicides. For many regions, including Central America and the Caribbean, monitoring of POPs is mainly ad hoc and relies on analysis from research, accidents or evaluation of specific hot spots. This is particularly so for pesticides such as DDT, heptachlor and chlordane. DDT continues to potentially affect the health of millions of people around the world. Persistent pesticides are still a problem in areas highly dependent on agricultural goods, such as in the Central and South American Regions. The same is true for the countries that produce these chemicals such as in the East Asian region. In the Arctic, there has been an increase in some levels of persistent pesticides. The environmental condition in this region favors a higher persistence and therefore a higher chance of entering into aquatic food webs. Data available from Europe, North America, East Asia and Mediterranean Regions show that dioxins and furans levels, two of the non-pesticide POPs, are higher in urban and industrialized areas. A major source of these two chemicals is from poor waste management practices and improper burning UNEP The potential impacts of some new chemicals are also a global concern. There is evidence of ecotoxicological effects for brominated flame retardants and alkylphenols, two groups of these newer chemicals UNEP This is further confirmed by Fernandez et al , who confirmed the limited availability of data in the Wider Caribbean Region. Additionally, there are no facilities in the Wider Caribbean region for the routine monitoring of dioxins and furans and a number of emerging PTSs of concern, such as flame retardants. According to Singh , poor land management practices and the lost of agricultural lands to other economic activities have led to increased pesticide usage. The steep topography of most of the islands and cultivation on steep slopes encourages soil erosion and the movement of pesticides to coastal areas. According to UNEP massive coral mortalities and egg shell thinning cases have been reported. Fish mass mortality has occurred in areas of agricultural runoff where pesticides have been illegally used. For example, in Jamaica an increase in fish mortality in coastal areas coincides with the period of the year when pesticides are applied on coffee plantations Chin Sue The PCBs have been detected in atmospheric, marine, freshwater, groundwater, sediment, soil, food and biota samples, including human blood and milk. DDT residues have been reported in agricultural areas of all the 23 countries of the Wider Caribbean Region. According to Fernandez et al DDT and its metabolites is one of the organic pollutants most frequently reported in the Wider Caribbean Region. The presence of these compounds suggests the existence of long-range transport within the Wider Caribbean Region Fernandez et al Endosulfan is used to control pests on various crops in a number of countries in the region. The major source of polycyclic aromatic hydrocarbons PAHs , dioxins and furans in the region is from the burning of domestic, industrial and agricultural waste and burning of vegetation for clearing land. According to UNEP Barbados was the only country reporting that open burning of garbage disposal was illegal and Jamaica was the only country having a legal control of dioxin and furan emission. This is also supported by Adolfo Fernandez et al who further suggests that organic pollutants can be found in most parts of the region including locations that are far from the pollution sources which indicates long-range transport of these contaminants. The countries of North Africa in the Sahel region apply large amounts of pesticides, including those banned in the Caribbean and the United States. One of the newer persistent substances in the Wider Caribbean region is tributyl tin. Antifouling paints used on vessel hulls is the primary source of tributyl tin UNEP Some findings presented in this study include; in most countries land clearance practices, inefficient irrigation, and use of agrochemicals damage surface and groundwaters; the use of low lying wetlands for rice cultivation requires heavy pesticide use; in St

Kitts and Nevis water resources are susceptible to agricultural pollution due to its low lying position; industrial pollution sugar, rum, petrochemical, paint, agroprocessing and metal is particularly a problem in Trinidad and Tobago. Some findings from Colombia and Venezuela include: For Central America and Mexico it was reported that: With specific reference to the management of pesticides, regional Governments have promulgated a number of laws, decrees, regulations and standards. These have focused primarily on regulations relating to importation, licensing and conditions of usage but very little on education and awareness. The Convention entered into force in and is a legally binding, regional multilateral environmental agreement for the protection and development of the Wider Caribbean Region. In this LBS Protocol, Annex I lists Primary Pollutants of Concern, which include, but are not limited to, organotin compounds, polycyclic aromatic hydrocarbons, biocides and their derivatives and compounds with hormone-like effects. Regarding pesticides, Annex IV of the LBS Protocol refers to Agricultural Non-point Sources of Pollution and states that the Parties shall develop plans for the prevention, reduction and control of agricultural non-point sources of pollution. These plans should include: An evaluation and assessment of agricultural non-point sources of pollution that may affect the Convention Area, which may include: Education, training and awareness programmes, which may include: Aims to reduce releases of POPs chemicals on a global basis. The convention entered into force on May 17th, Read more at http: Aim to promote shared responsibilities in relation to importation of hazardous chemicals and contribute safe use. The Convention entered into force on 24 February 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. It has Parties and came into force in The aim of the Convention is that Parties shall endeavor to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. The aim of the protocol on POPs is to control, reduce, or eliminate discharges, emissions, and losses of persistent organic pollutants. The protocol entered into force on 23 October Is a Globally Harmonized System GHS of Classification and Labelling of Chemicals promoting standard criteria for classifying chemicals according to their health, physical and environmental hazards. Aim to prohibit the use of harmful organotins in anti-fouling paints. Will enter into force on 17 September Aims protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. Entered into force on January 1, Examples of on-going activities relating to the management of the use and disposal of POPs and pesticides include: This project provides the opportunity for the collaborating countries to implement comprehensive management practices and specific measures to control the use and application of pesticides in the agricultural sector thereby reducing pesticides run-off to the Caribbean Sea. The project is a cooperative effort of national, regional and local stakeholders. At the national level, the executing agencies are the Ministries of Environment in Nicaragua, Costa Rica and Colombia. The main stakeholders for this project are the farmers, agrochemical distributors, health, agricultural and environmental ministries and agencies, environmental NGOs and other community-based organizations, relevant international organizations and academic institutions. The project contains a significant number of activities. As approved by the GEF Council, the project contains six main elements that will be implemented through three project components and various subcomponents. The six 6 elements are:

Chapter 3 : Organic pollutants Â« World Ocean Review

Persistent organic pollutants (POPs) About POPs. Persistent organic pollutants (POPs) are chemicals of global concern due to their potential for long-range transport, persistence in the environment, ability to bio-magnify and bio-accumulate in ecosystems, as well as their significant negative effects on human health and the environment.

Chemicals proposed for listing under the Convention The 12 initial POPs under the Stockholm Convention Initially, twelve POPs have been recognized as causing adverse effects on humans and the ecosystem and these can be placed in 3 categories: Aldrin Listed under Annex A A pesticide applied to soils to kill termites, grasshoppers, corn rootworm, and other insect pests, aldrin can also kill birds, fish, and humans. In one incident, aldrin-treated rice is believed to have killed hundreds of shorebirds, waterfowl, and passerines along the Texas Gulf Coast when these birds either ate animals that had eaten the rice or ate the rice themselves. In humans, the fatal dose for an adult male is estimated to be about five grams. Humans are mostly exposed to aldrin through dairy products and animal meats. Studies in India indicate that the average daily intake of aldrin and its byproduct dieldrin is about 19 micrograms per person. Chlordane Listed under Annex A Used extensively to control termites and as a broad-spectrum insecticide on a range of agricultural crops, chlordane remains in the soil for a long time and has a reported half-life of one year. The lethal effects of chlordane on fish and birds vary according to the species, but tests have shown that it can kill mallard ducks, bobwhite quail, and pink shrimp. Chlordane may affect the human immune system and is classified as a possible human carcinogen. It is believed that human exposure occurs mainly through the air, and chlordane has been detected in the indoor air of residences in the US and Japan. After the war, DDT continued to be used to control disease, and it was sprayed on a variety of agricultural crops, especially cotton. DDT continues to be applied against mosquitoes in several countries to control malaria. Perhaps the best known toxic effect of DDT is egg-shell thinning among birds, especially birds of prey. Its impact on bird populations led to bans in many countries during the s. Although its use had been banned in many countries, it has been detected in food from all over the world. Although residues in domestic animals have declined steadily over the last two decades, food-borne DDT remains the greatest source of exposure for the general population. The short-term acute effects of DDT on humans are limited, but long-term exposures have been associated with chronic health effects. DDT has been detected in breast milk, raising serious concerns about infant health. Dieldrin Listed under Annex A Used principally to control termites and textile pests, dieldrin has also been used to control insect-borne diseases and insects living in agricultural soils. Its half-life in soil is approximately five years. The pesticide aldrin rapidly converts to dieldrin, so concentrations of dieldrin in the environment are higher than dieldrin use alone would indicate. Dieldrin is highly toxic to fish and other aquatic animals, particularly frogs, whose embryos can develop spinal deformities after exposure to low levels. Dieldrin residues have been found in air, water, soil, fish, birds, and mammals, including humans. Food represents the primary source of exposure to the general population. For example, dieldrin was the second most common pesticide detected in a US survey of pasteurized milk. Endrin Listed under Annex A This insecticide is sprayed on the leaves of crops such as cotton and grains. It is also used to control rodents such as mice and voles. Animals can metabolize endrin, so it does not accumulate in their fatty tissue to the extent that structurally similar chemicals do. It has a long half-life, however, persisting in the soil for up to 12 years. In addition, endrin is highly toxic to fish. When exposed to high levels of endrin in the water, sheepshead minnows hatched early and died by the ninth day of their exposure. The primary route of exposure for the general human population is through food, although current dietary intake estimates are below the limits deemed safe by world health authorities. Heptachlor Listed under Annex A Primarily used to kill soil insects and termites, heptachlor has also been used more widely to kill cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes. It is believed to be responsible for the decline of several wild bird populations, including Canadian Geese and American Kestrels in the Columbia River basin in the US. The geese died after eating seeds treated with levels of heptachlor lower than the usage levels recommended by the manufacturer, indicating that even responsible use of heptachlor may kill wildlife. Laboratory tests have also shown high doses of heptachlor to be fatal to

mink, rats, and rabbits, with lower doses causing adverse behavioral changes and reduced reproductive success. Heptachlor is classified as a possible human carcinogen. Food is the major source of exposure for humans, and residues have been detected in the blood of cattle from the US and from Australia. It was widely used to control wheat bunt. It is also a byproduct of the manufacture of certain industrial chemicals and exists as an impurity in several pesticide formulations. Mothers also passed HCB to their infants through the placenta and through breast milk. In high doses, HCB is lethal to some animals and, at lower levels, adversely affects their reproductive success. HCB has been found in food of all types. A study of Spanish meat found HCB present in all samples. In India, the estimated average daily intake of HCB is 0. Mirex Listed under Annex A This insecticide is used mainly to combat fire ants, and it has been used against other types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods. Direct exposure to mirex does not appear to cause injury to humans, but studies on laboratory animals have caused it to be classified as a possible human carcinogen. In studies mirex proved toxic to several plant species and to fish and crustaceans. It is considered to be one of the most stable and persistent pesticides, with a half life of up to 10 years. The main route of human exposure to mirex is through food, particularly meat, fish, and wild game. Toxaphene Listed under Annex A This insecticide is used on cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock. Toxaphene was the most widely used pesticide in the US in For humans, the most likely source of toxaphene exposure is food. While the toxicity to humans of direct exposure is not high, toxaphene has been listed as a possible human carcinogen due to its effects on laboratory animals. Polychlorinated biphenyls PCB Listed under Annex A with specific exemptions and under Annex C These compounds are used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, and plastics. Of the different types of PCBs, 13 exhibit a dioxin-like toxicity. Their persistence in the environment corresponds to the degree of chlorination, and half-lives can vary from 10 days to one-and-a-half years. PCBs are toxic to fish, killing them at higher doses and causing spawning failures at lower doses. Research also links PCBs to reproductive failure and suppression of the immune system in various wild animals, such as seals and mink. Large numbers of people have been exposed to PCBs through food contamination. Consumption of PCB-contaminated rice oil in Japan in and in Taiwan in caused pigmentation of nails and mucous membranes and swelling of the eyelids, along with fatigue, nausea, and vomiting. Similarly, children of mothers who ate large amounts of contaminated fish from Lake Michigan showed poorer short-term memory function. PCBs also suppress the human immune system and are listed as probable human carcinogens. Polychlorinated dibenzo-p-dioxins PCDD Listed under Annex C These chemicals are produced unintentionally due to incomplete combustion, as well during the manufacture of pesticides and other chlorinated substances. They are emitted mostly from the burning of hospital waste, municipal waste, and hazardous waste, and also from automobile emissions, peat, coal, and wood. There are 75 different dioxins, of which seven are considered to be of concern. One type of dioxin was found to be present in the soil 10 - 12 years after the first exposure. Dioxins have been associated with a number of adverse effects in humans, including immune and enzyme disorders and chloracne, and they are classified as possible human carcinogens. Laboratory animals given dioxins suffered a variety of effects, including an increase in birth defects and stillbirths. Fish exposed to these substances died shortly after the exposure ended. Food particularly from animals is the major source of exposure for humans. They have been detected in emissions from waste incinerators and automobiles. Furans are structurally similar to dioxins and share many of their toxic effects. There are different types, and their toxicity varies. Furans persist in the environment for long periods, and are classified as possible human carcinogens. Food, particularly animal products, is the major source of exposure for humans. Furans have also been detected in breast-fed infants.

Chapter 4 : International Cooperation | US EPA

Persistent Organic Pollutants (POPs) are organic chemical substances, that is, they are carbon-based. They possess a particular combination of physical and chemical properties such that, once released into the environment, they.

WhatsApp The production and release of vast quantities of novel synthetic chemicals over the past 75 years has proved to be a great global experimentâ€”one that now involves all life. Even before the Chemical Revolution moved into high gear at the end of World War II, the first warning sign appeared that some man-made chemicals might spell serious trouble. In , scientists found residues of a man-made pesticide, DDT, in human fat. Seven years later, another study brought disturbing news of DDT contamination in the milk of nursing mothers. In the early s, naturalists saw thinning eggshells and crashing populations of bald eagles and other birds. By , Rachel Carson documented the growing burden of contamination in Silent Spring, which detailed the devastating impact of persistent pesticides on wildlife and warned about hazards to human health. Ironically, chemicals that were developed to control disease, increase food production, and improve our standard of living are, in fact, a threat to biodiversity and human health. Because the risk from these originally well-intentioned chemicals outweighs their benefits, their continued use is no longer warranted. Today, the contamination from persistent man-made chemicals is a pervasive global problem that urgently demands a global solution. Responding to the gravity of this threat, the international community has begun important steps toward stopping this unintended experiment. In June , nearly a hundred nations embarked on negotiations with the goal of concluding a binding, global treaty on persistent organic pollutants POPs before the end of The outcome is critical since this process will determine the scope and pace of global action against persistent chemicals. Trash burning releases cancer-causing dioxins into the atmosphere, along with arsenic, mercury, formaldehyde, and carbon monoxide. EPA estimates that 20 million burn barrels across the U. These contaminants are of concern locally and globally. Locally, fish and wildlife are an essential part of the Alaskan Native diet and culture. Globally, this unanticipated concentration of pollutants may be sending an important message about how contaminants travel and accumulate far from the original source. The presence of environmental pollutants in the Arctic is particularly troubling because the Arctic ecosystem is fragile and slow to recover from impacts. The contaminants of greatest concern are persistent organic pollutants, or POPs. POPs have a broad range of negative effects. They are transported to the Arctic by large-scale air and water currents and some migratory species. The levels of persistent organic pollutants found in the Alaskan Arctic are surprising because POPs were not manufactured in the Arctic. Although this paper focuses on the long-range transport of contaminants, some POPs were used at military installations during World War II and the Cold War, and these sites also concern local residents. However, these contaminants can travel long distances from areas in Russia, Asia, and other countries where they are still used. In the Aleutian Islands for example, bald eagles, sea otters, and Steller sea lions all have elevated levels of the pesticide DDT and some other contaminants. Concentrations of the pesticide hexachlorohexane HCH in male polar bears from Alaska are among the highest in the Arctic. Some killer whales in the North Pacific are now considered among the most contaminated marine mammals on earth. People also are exposed to these pollutants. Canadian studies have shown that the concentration of PCBs in the blood of adult Inuit is approximately seven times higher than in other North American adult populations that have been tested. In Alaska, they have been found in water, air, wildlife, and humans. There is good reason to suspect that harmful effects are likely in some instances, but conclusive evidence is lacking. An organized, systematic approach is needed to properly evaluate the real risks posed by these chemicals and to identify actions needed to reduce unacceptable risks. Persistent Organic Pollutants in the Arctic. Human Health in the Arctic. The State of the European Arctic Environment. A white paper published by the Department of the Interior and the State of Alaska.

Chapter 5 : Persistent Organic Pollutants (POPs) in the Environment â€“ theinnatdunvilla.com

Persistent organic pollutants (POPs) are organic compounds that resist environmental breakdown via biological, chemical, and photolythic processes, some taking as long as a century to degrade. POPs exposed to the environment are proven to travel long distances from their origin via wind and ocean currents.

For more information about the dirty dozen, see table below. These are the chemicals initially addressed by the Stockholm Convention when negotiated. Since that time, other chemicals have been added to the Convention. Although most developed nations have taken strong action to control POPs, a great number of developing nations have only fairly recently begun to restrict their production, use, and release. The Stockholm Convention adds an important global dimension to our national and regional efforts to control POPs. Though the United States is not yet a Party to the Stockholm Convention, the Convention has played a prominent role in the control of harmful chemicals on both a national and global level. For example, EPA and the states have significantly reduced the release of dioxins and furans to land, air, and water from U. In addition to the POPs-related agreements the United States has taken part in signing, the United States has also provided ample financial and technical support to countries across the globe supporting POPs reduction. A few of these initiatives include dioxin and furan release inventories in Asia and Russia, and the reduction of PCB sources in Russia. Many POPs were widely used during the boom in industrial production after World War II, when thousands of synthetic chemicals were introduced into commercial use. Many of these chemicals proved beneficial in pest and disease control, crop production, and industry. These same chemicals, however, have had unforeseen effects on human health and the environment. POPs include a range of substances that include: Intentionally produced chemicals currently or once used in agriculture, disease control, manufacturing, or industrial processes. Examples include PCBs, which have been useful in a variety of industrial applications e. Unintentionally produced chemicals, such as dioxins, that result from some industrial processes and from combustion for example, municipal and medical waste incineration and backyard burning of trash. An estimated 4 billion pounds of this inexpensive and historically effective chemical have been produced and applied worldwide since In the United States, DDT was used extensively on agricultural crops, particularly cotton, from to DDT was also used to protect soldiers from insect-borne diseases such as malaria and typhus during World War II, and it remains a valuable public health tool in parts of the tropics. The heavy use of this highly persistent chemical, however, led to widespread environmental contamination and the accumulation of DDT in humans and wildlife - a phenomenon brought to public attention by Rachel Carson in her book, Silent Spring. A wealth of scientific laboratory and field data have now confirmed research from the s that suggested, among other effects, that high levels of DDE a metabolite of DDT in certain birds of prey caused their eggshells to thin so dramatically they could not produce live offspring. One bird species especially sensitive to DDE was the bald eagle. The bald eagle has since experienced one of the most dramatic species recoveries in our history. Transboundary Travelers Global Dust: This figure shows a satellite image of the passage of a cloud of dust across the Pacific Ocean to North America. This dust cloud was raised by a storm in Asia in April Also shown is a dust cloud from northern Africa traveling west over the Atlantic Ocean. A major impetus for the Stockholm Convention was the finding of POPs contamination in relatively pristine Arctic regions - thousands of miles from any known source. Much of the evidence for long-range transport of airborne gaseous and particulate substances to the United States focuses on dust or smoke because they are visible in satellite images. Tracing the movement of most POPs in the environment is complex because these compounds can exist in different phases e. For example, some POPs can be carried for many miles when they evaporate from water or land surfaces into the air, or when they adsorb to airborne particles. Then, they can return to Earth on particles or in snow, rain, or mist. POPs also travel through oceans, rivers, lakes, and, to a lesser extent, with the help of animal carriers, such as migratory species. For example, none of the original POPs pesticides listed in the Stockholm Convention is registered for sale and distribution in the United States today and in , Congress prohibited the manufacture of PCBs and severely restricted the use of remaining PCB stocks. In addition, since , EPA and the states have effectively reduced environmental releases of dioxins and

furans to land, air, and water from U. These regulatory actions, along with voluntary efforts by U. To better understand the risks associated with dioxin releases, EPA has been conducting a comprehensive reassessment of dioxin science and will be evaluating additional actions that might further protect human health and the environment. After studying the persistence of DDT residues in the environment, the U. The remaining exempted uses public health use for controlling vector-borne diseases, military use for quarantine, and prescription drug use for controlling body lice are voluntarily stopped. There is no U. Controlling Dioxins EPA has pursued regulatory control and management of dioxins and furans releases to air, water, and soil. The Clean Air Act requires the application of maximum achievable control technology for hazardous air pollutants, including dioxins and furans. Major sources regulated under this authority include municipal, medical, and hazardous waste incineration; pulp and paper manufacturing; and certain metals production and refining processes. Dioxin releases to water are managed through a combination of risk-based and technology-based tools established under the Clean Water Act. Studies have linked POPs exposures to declines, diseases, or abnormalities in a number of wildlife species, including certain kinds of fish, birds, and mammals. Wildlife also can act as sentinels for human health: Behavioral abnormalities and birth defects in fish, birds, and mammals in and around the Great Lakes, for example, led scientists to investigate POPs exposures in human populations see below for more information on the Great Lakes. In people, reproductive, developmental, behavioral, neurologic, endocrine, and immunologic adverse health effects have been linked to POPs. People are mainly exposed to POPs through contaminated foods. Less common exposure routes include drinking contaminated water and direct contact with the chemicals. In people and other mammals alike, POPs can be transferred through the placenta and breast milk to developing offspring. It should be noted, however, that despite this potential exposure, the known benefits of breast-feeding far outweigh the suspected risks. A number of populations are at particular risk of POPs exposure, including people whose diets include large amounts of fish, shellfish, or wild foods that are high in fat and locally obtained. For example, indigenous peoples may be particularly at risk because they observe cultural and spiritual traditions related to their diet. To them, fishing and hunting are not sport or recreation, but are part of a traditional, subsistence way of life, in which no useful part of the catch is wasted. In remote areas of Alaska and elsewhere, locally obtained subsistence food may be the only readily available option for nutrition see below for more information on the Arctic. In addition, sensitive populations, such as children, the elderly, and those with suppressed immune systems, are typically more susceptible to many kinds of pollutants, including POPs. Because POPs have been linked to reproductive impairments, men and women of child-bearing age may also be at risk. POPS and the Food Chain POPs work their way through the food chain by accumulating in the body fat of living organisms and becoming more concentrated as they move from one creature to another. This process is known as "biomagnification. This means that even small releases of POPs can have significant impacts. For example, laboratory studies have shown that low doses of certain POPs adversely affect some organ systems and aspects of development. Studies also have shown that chronic exposure to low doses of certain POPs can result in reproductive and immune system deficits. Exposure to high levels of certain POPs chemicals - higher than normally encountered by humans and wildlife - can cause serious damage or death. Epidemiological studies of exposed human populations and studies of wildlife might provide more information on health impacts. However, because such studies are less controlled than laboratory studies, other stresses cannot be ruled out as the cause of adverse effects. As we continue to study POPs, we will learn more about the risk of POPs exposure to the general public, how much certain species including people are exposed, and what effects POPs have on these species and their ecosystems. Reservoirs of POPs POPs can be deposited in marine and freshwater ecosystems through effluent releases, atmospheric deposition, runoff, and other means. Because POPs have low water solubility, they bond strongly to particulate matter in aquatic sediments. As a result, sediments can serve as reservoirs or "sinks" for POPs. When sequestered in these sediments, POPs can be taken out of circulation for long periods of time. If disturbed, however, they can be reintroduced into the ecosystem and food chain, potentially becoming a source of local, and even global, contamination. Top of page The Great Lakes: A vital resource for the United States and Canada, the Great Lakes are used for fishing, swimming, boating, agriculture, industry, and tourism; they are also a source of drinking water and energy.

Despite their size, however, the Great Lakes are vulnerable to pollution. Until the s, a variety of POPs, heavy metals, and other agricultural and industrial pollutants were routinely discharged into the Great Lakes. Toxic substances also entered the Great Lakes Basin through other avenues, including waste sites, river runoff, and atmospheric deposition. These pollutants existed in large enough quantities to warrant concern regarding the effects on human health and wildlife, including several species of fish and shellfish, bald eagles and other birds of prey, and fish-eating mammals such as mink. Extensive cleanup and pollution control efforts were subsequently launched, and many contaminant levels have declined dramatically in the Great Lakes as a result, illustrating the positive outcomes that can be achieved when communities, government, and industry work together to reduce pollution. Still, some POPs exist at significant concentrations, indicating their persistence and the possibility of continued contamination from other sources, particularly long-range atmospheric transport of POPs from other areas. In , the United States and Canada signed the first Great Lakes Water Quality Agreement , calling for the two countries to clean up and control pollution of these waters. In , they signed a new agreement, which added a commitment to work together to rid the Great Lakes of persistent toxic chemicals, some of which are POPs. As part of this agreement, both countries have been monitoring atmospheric loadings of these chemicals to the Great Lakes since The strategy provided a guide for governments and stakeholders toward the virtual elimination of 12 identified substances through cost-efficient and expedient pollution prevention and other incentive-based actions. Over the course of the ten-year period, working closely with state, provincial, tribal, and local governments and stakeholders from industry, academia, environmental and community groups, both governments made significant progress in meeting that goal of virtually eliminating persistent toxic substances such as mercury, PCBs, and dioxin from discharging into the Great Lakes environment. The two governments agreed to continue to extend the agreement in order to work together to identify new challenges that are presented by emerging substance of concern, such as flame retardants. Great Lakes Research Through these efforts, we will steadily continue to reduce levels of toxics in fish. Someday we will answer the question. We have learned, for example, that a major route of exposure is through contaminated food, particularly fish. Studies conducted in the s showed a correlation between fish consumption and elevated POPs levels in blood, leading researchers to conclude that people can be exposed to POPs by eating contaminated fish. As a result, extensive fish contaminant monitoring programs have been established in the Great Lakes states, and fish consumption advisories are regularly released to help inform people which fish are safe to eat and how much is safe to eat see Resources below. Top of page Alaska: But even here, POPs have been found in the air, water, soil, plants, fish, and other wildlife. Some POPs have been used or released in Alaska and other northern regions by military sites, smelters, pulp and paper mills, power stations, mines, and other sources. Others have rarely or never been used locally. POPs can enter Alaska and the Arctic in several ways, too. The first indication that Arctic pollution could originate elsewhere came during the s, when pilots noticed a haze in the North American Arctic that was eventually traced to sources in the lower latitudes. Since then, scientists have discovered that POPs can reach Arctic regions via air, water, and, to a lesser extent, migratory species. POPs can also travel in rivers from southeast and central Asia into the Pacific Ocean, where water currents flow into the Arctic Ocean.

Chapter 6 : Persistent organic pollutant - Wikipedia

Persistent organic pollutants (POPs) are chemical substances that persist in the environment, bioaccumulate through the food web, and pose a risk of causing adverse effects to human health and the environment. This group of priority pollutants consists of pesticides (such as DDT), industrial.

Toxic effects in water and soil are unlikely, except near a point source or as the result of an accident, although there is little direct information available. It is likely that the concentration of PAHs in some lake sediments is high enough that sediment-dwelling organisms midge larvae, oligochaetes, crustacea may be affected Sanders et al. The tendency of POPs to bioaccumulate means that it is top predators that are affected, in particular, birds raptors, piscivors and marine and marine mammals seals and whales. Well-known examples of the effects of bioaccumulation are egg shell thinning by OCs in birds of prey Pearse et al. More recently, organochlorines OCs and PCBs are now though to be responsible for endocrine disruption in freshwater fish. Some PAHs are known or suspected carcinogens, although the ecological consequences have not been established, as most organisms will be predated before they develop carcinomas. However tumours in fish can present a problem for the human food chain. The Convention entered into force on 17 May This is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health or on the environment. Exposure to Persistent Organic Pollutants POPs can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and damages to the central and peripheral nervous systems. Given their long range transport, no one government acting alone can protect its citizens or its environment from POPs. In response to this global problem, the Stockholm Convention, which was adopted in and entered into force in , requires its parties to take measures to eliminate or reduce the release of POPs into the environment. As set out in Article 1, the objective of the Stockholm Convention is to protect human health and the environment from persistent organic pollutants. Among others, the provisions of the Convention require each party to: Annex A allows for the registration of specific exemptions for the production or use of listed POPs, in accordance with that Annex and Article 4, bearing in mind that special rules apply to PCBs. The import and export of chemicals listed in Annex A can take place under specific restrictive conditions, as set out in paragraph 2 of Article 3. Annex B allows for the registration of acceptable purposes for the production and use of the listed POPs, in accordance with that Annex, and for the registration of specific exemptions for the production and use of the listed POPs, in accordance with that Annex and Article 4. The import and export of chemicals listed in Annex B can take place under specific restrictive conditions, as set out in paragraph 2 of Article 3. The Convention promotes the use of best available techniques and best environmental practices for preventing releases of POPs into the environment. The Convention requires that such stockpiles and wastes be identified and managed to reduce or eliminate POPs releases from these sources. The Convention also requires that wastes containing POPs are transported across international boundaries taking into account relevant international rules, standards and guidelines. A Committee composed of experts in chemical assessment or management - the Persistent Organic Pollutants review Committee, is established to examine proposals for the listing of chemicals, in accordance with the process set out in Article 8 and the information requirements specified in Annexes D, E and F of the Convention.

Chapter 7 : Persistent Organic Pollutants (POPs) | Air Pollution Information System

These persistent organic pollutants (POPs) include some of the most well known, and most toxic, environmental contaminants, such as PCBs and theinnatdunvilla.com accumulate in the fatty tissue of animals and humans, and biomagnify in the food chain, so that the higher up an animal is on the food chain, the higher the contaminant levels are (Tanabe).

As a result, the use of many of these chemicals is now prohibited. However, new toxic substances that were not initially recognized as a threat are frequently detected in the environment. Polyfluorinated compounds PFCs are one current example. There is still no solution to this problem Page: In consequence, a very wide range of chemicals is used in industry today. According to the Organisation for Economic Co-operation and Development OECD , approximately , different chemical substances are currently on the market worldwide. In Europe alone, approximately 10, chemicals are produced and marketed annually in amounts of greater than 10 tonnes. It is estimated that between 1 and 3 per cent of these chemicals are problematical. These environmentally relevant pollutants include heavy metals such as lead and mercury, which are released into the environment by the burning of oil, mining activities, and industrial emissions and effluents. Persistent organic pollutants, known as POPs, are another problematical substance category. They include pesticides such as DDT and lindane, industrial chemicals such as polychlorinated biphenyls PCBs , and substances such as dioxins, which are the unwanted by-products of manufacturing and combustion processes. As these substances are highly stable and therefore non-degradable to a large extent, they can be transported over long distances and accumulate in the environment. POPs cause problems because they are stored in the fatty tissue or organs of animals, where they can have toxic effects. For example, they can disrupt the endocrine system, cause cancer or genetic defects, and weaken the immune system. Various effects of POPs on marine mammals have been investigated. Studies of Baltic ringed seals Phoca hispida and grey seals Halichoerus grypus found uterine occlusions, stenoses and tumours, resulting in reduced reproductive ability. Other observed effects included colonic ulcers, as well as reduced bone density, which led to changes in the skeletal system. In seals and porpoises, researchers found indications that POPs depress the immune and endocrine systems. A further topic of discussion in this context is whether these pollutants and the weakening of the immune system affect the spread of epidemics, such as the disease that killed thousands of seals in the North Sea in and again in â€” probably an epidemic of the phocine distemper virus. Humans mainly ingest POPs from food and drinking water, but also from the air mainly by breathing in dust particles and through the skin through direct contact with the chemicals. The highest concentrations of POPs are generally found in marine mammals and humans, both of which are at the top of the food chain. The process illustrated here relates to polychlorinated biphenyls PCBs , a typical environ-mental toxin. These include polyfluorinated compounds PFCs , which have been used in a wide variety of every-day applications for more than 50 years. PFCs are mainly used as fluoropolymers in the textile industry, for example, in the manufacture of breathable membranes for outdoor clothing, and in the paper industry in the production of water-, stain- and grease-proof paper e. They are also used for surface treatment of furniture, carpets and clothing textiles and in non-stick coatings for cookware such as Teflon frying pans. It is believed that a total of six manufacturers have produced around tonnes of PFCs every year over the past decade: This group of substances is significant nonetheless, due to its environmentally relevant properties, as some PFCs are highly bio-accumulative in organisms. At present, more than different PFCs are known to exist. The best-known is perfluorooctanesulfonic acid, more commonly known as PFOS. Based on animal experiments with PFOS, researchers conclude that repeated exposure can have an extremely adverse effect on human health; among other possible effects, it may cause damage to the liver. PFOS may also be carcinogenic, and it is also thought to impair the development of progeny. PFOS therefore recently became the first PFC to be listed as a persistent organic compound POP under the Stockholm Convention, which means that it is now on the list of particularly hazardous chemicals for which a worldwide ban is to be imposed.

Chapter 8 : Persistent organic pollutants (POPs) | UN Environment

Persistent organic pollutants (POPs) are persistent, mainly lipid-soluble chemicals which bioaccumulate in fatty tissues and are biomagnified up the food web, and pose a risk to human health and the environment.

It is noted that while the use of the synthetic organic POPs such as pesticides and industrial chemicals was banned in the United States several decades ago, they continue to volatilize from historically-contaminated soils and cycle in the environment. Global Sources of Local Pollution: The National Academies Press. The United States was a signatory party to the protocol in but has not ratified it http: Although persistent organic pesticides are banned or restricted in most developed countries throughout the world, they continue to cycle in the global environment due to revolatilization from historically contaminated soils, vegetation, and water bodies. As a result, some persistent organic pesticides continue to undergo long-range atmospheric transport, deposition, and bioaccumulation in remote U. Over long periods of time years to decades these compounds eventually degrade or become sequestered in deep soils and sediments. As a result, atmospheric concentrations of persistent organic pesticides are generally decreasing in remote U. Because of these properties, POPs are environmentally persistent and tend to bioaccumulate in adipose tissue, putting breast-feeding infants at higher risk of adverse health effects. The individual compounds have different toxicological properties that can result in adverse biological effects in fish, wildlife, and humans. Potential human health effects include impairment of the immune system, nervous system, hormonal system, and reproductive functions. Concerns over the risks of POPs have led to the establishment of worldwide monitoring programs to determine concentrations of POPs in adipose tissue and associated adverse consequences Jorgenson, ; Li et al. The risks associated with the following groups of substances were reviewed: The task force also performed a short hazard assessment for polychlorinated terphenyls, polybrominated diphenylethers, polybrominated dibenzo-p-dioxins and dibenzofurans, and short-chain chlorinated paraffins to identify the main gaps in information necessary for risk assessment. As a result, POPs are subject to both gas-phase and aerosol-phase removal mechanisms in the atmosphere, including wet and dry deposition, gas exchange, and direct and indirect photolysis. Precipitation, particularly snow, is an efficient scavenger of POPs from the atmosphere Wania et al. When this snow melts, it releases a pulse of POPs to the surrounding ecosystem Daly and Wania, ; Lafreniere et al. Gas-phase POPs react with photochemically generated OH radical in the atmosphere, and has been shown to be the most significant environmental transformation reaction for some POPs Anderson and Hites, ; Mandalakis et al. In general, the photochemical degradation rate decreases and atmospheric half-life increases for aerosol-phase POPs, increasing the potential for long-range atmospheric transport of POPs sorbed to fine particles. Because POPs are emitted primarily from anthropogenic combustion, industrial, and agricultural sources, their atmospheric concentrations tend to Page Share Cite Suggested Citation: The concentrations of some POPs have been shown to increase in remote areas due to episodic transport events from source regions Hageman et al. Historically, many POPs have been deposited or applied to soils and continue be released as secondary emissions similar to mercury. These secondary emissions are difficult to estimate, given that the magnitude and distribution of the original deposition and resulting emissions are largely unknown. Thus, global emission inventories for POPs have high degrees of uncertainty. Global emission estimates have been developed only for PCBs Breivik et al. In many cases POP emissions from developing countries are largely unknown. Although strong transpacific transport events are episodic, occurring primarily in the late winter and spring, the inflow of POPs from Eurasia to the western United States likely occurs at a low level throughout the year. Bachelor in Oregon, along with several other indicators of Asian anthropogenic sources Primbs et al. In a recent study conducted to identify POP source regions and emissions from recent use vs. S air masses Genualdi, Our current understanding of the magnitude of the inflow of POPs to the United States through transpacific transport of Eurasian emissions is limited but growing. They estimated that percent of the POP concentrations measured in Alaskan parks were due to long-range transport, while 30 to 70 percent of the concentrations of these POPs measured in the most westerly continental U. Rainier National Park were due to long-range transport including transpacific transport. At progressively more interior parks Glacier and Rocky

Mountain National Parks the contribution from long-range transport decreased to 10 to 30 percent. In elevated POP concentrations were measured at a remote mountain site in the western United States and linked to emissions from forest fires in western Canada Primbs et al. The outflow of POPs from the United States to the Great Lakes region, and the resulting bioaccumulation in this ecosystem, has long been recognized and modeled Hafner and Hites, , ; Ma et al. Page Share Cite Suggested Citation: These data suggest that the atmospheric concentrations of these POPs are decreasing in the Great Lakes region. In comparison, there is much more limited data on atmospheric POP concentrations and source regions to the U. Arctic only Point Barrow, Alaska, from to Su et al. Because of the low temporal resolution of the Point Barrow dataset samples collected over the period of a week , a thorough investigation into the geographic location of POP source regions to the U. Arctic has not been conducted. Although the outflow of POPs from the United States to Mexico and Europe likely occurs to some degree, this outflow has not been directly measured in discrete air masses and its magnitude is unknown. Because each POP has unique chemical properties and sources, global modeling has been conducted for a limited number of POPs. For example, findings from Ma et al. In their analysis European, North American, and Asian emissions of PCB are 65, 14, and 8 percent of the global total, respectively. A 20 percent reduction in PCB emissions from Europe results in a 7, 3. While these modeling exercises are an important step forward, to date there has been relatively little interaction between the modeling and observational communities. As a result, these global model predictions are largely unverified. These results demonstrate that long-range transport of POPs is an important process to consider, but we are not yet able to make accurate quantitative predictions for most compounds. It is important to be able to model the episodic nature of long-range transport of POPs. Existing satellite images for particulate matter and gas-phase combustion products may not be appropriate surrogates for pesticides because of differences in source regions, atmospheric chemistry, and deposition. These compounds can undergo atmospheric long-range transport Shoeib et al. Their precursors can also be found throughout the globe, including in remote locations such as Alaska and the Arctic and high-elevation ecosystems Smithwick et al. PBDEs are also distributed globally, including remote U. Although there have been regulations and voluntary efforts to move from the persistent, bioaccumulative, and toxic tetra- and penta-brominated PBDEs to safer alternatives, these alternatives have been shown to undergo photodegradation Hua et al. For example, increased surface temperatures could result in the volatilization of POPs from current temperate and tropical source regions and their deposition in colder regions, such as high-elevation and high-latitude ecosystems Simonich and Hites, ; Wania and Mackay, ; Blais et al. On the other hand, if temperature increases more at higher latitudes compared with lower latitudes, fewer POPs will be stored at high latitudes. The melting of glaciers may result in the release of POPs stored decades ago into global circulation Donald et al. Decreases in sea ice cover and increases in ocean temperature also have the potential to result in the redistribution of the more volatile POPs stored in ocean water Macdonald et al. Although increased surface temperatures would theoretically increase the degradation rate of POPs in the environment, this benefit may be offset if POPs are redistributed to colder environments with more limited sunlight. Because rain and snow are efficient scavengers of airborne POPs, changes in precipitation patterns can affect where and how efficiently POPs are removed from the atmosphere. Because of their affinity for terrestrial surfaces, the global distribution of POPs will change along with vegetation patterns. The tremendous uncertainty in predicting how POPs will be distributed globally in the future adds to the motivation for maintaining long-term atmospheric monitoring programs. What do we know about the current import and export of POPs? There is substantial observational evidence that POPs can be transported over intracontinental scales, but only a few transport pathways have been documented. For instance, transpacific atmospheric transport of POPs to the contiguous United States is relatively well characterized, whereas inflow to Alaska is not. There is evidence of inflow from Canada to the United States, while inflow from Mexico is not well characterized. Some chemicals currently in use that have the potential to be considered POPs due to their persistence, bioaccumulation potential, and toxicity such as PBDEs and FOCs are known to undergo long-range transport and have exhibited increasing concentrations in the food web and humans in recent years. What are the potential implications of long-range transport of POPs on humans and ecosystems and environmental management goals? It is difficult to characterize the significance of this

influence, both because of the scientific uncertainties described above and because there are currently no clear national goals for POPs deposition. How might the factors influencing these issues change in the future? There is potential for the U. This potentially increasing exposure may be more pronounced in the western United States because of the patterns of transpacific transport from Asian countries. There is potential for the enhanced re-release of legacy POPs from melting glaciers, forest fires, and warming soils and oceans due to climate change influences. There is likewise potential for remote high-elevation and high-latitude U. The impacts of these future changes cannot currently be predicted quantitatively.

Chapter 9 : Persistent Organic Pollutants (POPs) and Pesticides â€" Caribbean Environment Programme

It is considered to be one of the most stable and persistent pesticides, with a half life of up to 10 years. The main route of human exposure to mirex is through food, particularly meat, fish, and wild game.

POPs exposed to the environment are proven to travel long distances from their origin via wind and ocean currents. Precipitation has been found to carry PCBs polychlorinated biphenyls POPs therefore can be found globally, even in areas such as the Arctic and Antarctica, far from their source. Human exposures in certain Arctic areas are among the highest worldwide. POPs bio-concentrate as they move up through the marine food chain and accumulate in the fatty tissues of living organisms at higher trophic levels. Marine mammals around the world carry high burdens of POPs. Although many countries have banned these chemicals, they remain stockpiled, are produced or used illegally, or, because of lengthy half-lives, they continue to exist in soil, or other environmental media. The United Nations is currently considering the elimination or reduction of twelve of some of the most damaging POPs through the formulation of an international treaty. Nine of the POPs chemicals under consideration are pesticides that have been extensively used in both developed and developing countries. The developing brain and nervous system may be most vulnerable. POPs are capable of causing behavioral problems, cancer, diabetes and thyroid problems. According to a landmark longitudinal study, babies whose mothers ate large amounts of highly contaminated fish PCBs were measured from Lake Michigan had lower birth weights, smaller head circumferences and shorter attention spans than babies whose mothers did not eat fish. Followed over 11 years, the exposed children have continued to do poorly in a range of skills and development tests, including deficits in general intellectual functioning, short- and long-term memory, and attention span. The health of marine mammals has deteriorated significantly over the past two decades. Many of the newly emerging and resurgent diseases are associated with immune system dysfunction and suggest a broad environmental distress syndrome. Marine mammals present a metabolic imbalance, so they are considered one of the most vulnerable organisms with respect to long-term toxicity of man-made chemicals such as organochlorines. Cetaceans whales and dolphins are known to have a poor ability to detoxify organic pollutants because they lack isozymes that are required to detoxify DDT and PCBs. Aldrin â€" an organochlorine insecticide; A pesticide used to control soil insects. It has been widely used to protect crops such as corn and potatoes, to protect wooden structures from termites. It is oxidized in the insect to form dieldrin, a neurotoxin. It is a carcinogen as well as a mutagen. It binds strongly to soil particles, is resistant to leaching into ground water. It is released from soil by volatilization. Due to its persistent nature, aldrin is known to bio-concentrate. Aldrin is toxic to humans causing headache, dizziness, nausea, general malaise, and vomiting, followed by muscle twitchings, myoclonic jerks, and convulsions. Occupational exposure to aldrin, in conjunction with dieldrin and endrin, has been associated with a significant increase in liver and biliary cancer. Many countries, including the US have ended its usage and manufacture It is a carcinogen as well as a mutagen. Chlordane â€" a manufactured pesticide; Chlordane is a broad spectrum contact insecticide that has been used on agricultural crops as well as being used extensively in the control of termites Banned in US in by the EPA; Chlordane sticks strongly to soil particles at the surface and is not likely to enter groundwater. As a result it can stay in the soil for over 20 years and breaks down very slowly. Bio-concentrates in fish, mammals, and birds; In both humans and animals, it can damage nervous and digestive systems, and liver - Has caused convolutions and death; Recent human studies have linked chlordane exposure with prostate and breast cancers. DDT â€" a synthetic pesticide DDT is a toxicant; It has a half life of years, and is immobile in most soils Breakdown products in the soil environment are DDE and DDD, which are also highly persistent and have similar chemical and physical properties. Banned in the US for most uses in At the chronic level, individuals who consumed contaminated fish increased diabetes occurrences; The EPA, in , classified DDT as a probable human carcinogen. Dieldrin â€" an insecticide; Closely related to aldrin which itself breaks down to form dieldrin It accumulates as it is passed along the food chain. An insecticide used on cotton, maize, and rice; a rodenticide used to control mice and voles It can bio-concentrate in the fatty tissues, of organisms living in water. It is very toxic to aquatic organisms, namely fish, aquatic invertebrates, and phytoplankton.

Food contaminated with endrin has caused several clusters of poisonings worldwide, especially affecting children. Heptachlor â€" an insecticide; Similar to the insecticide chlordane The U. A fungicide formerly used as a seed treatment, especially on wheat. Known animal carcinogen liver, kidney, thyroid ; Probable human carcinogen; After its introduction as a fungicide in , for crop seeds, this toxic chemical was found in all food types. Banned in the U. S in ; In humans it can cause liver disease, skin lesions, ulceration, hair loss, thyroid damage; Human and animal studies have demonstrated that HCB crosses the placenta to accumulate in fetal tissues and is transferred in breast milk. Extremely toxic to aquatic creatures. Risk of bioaccumulation in an aquatic species is high Mirex â€" an insecticide, flame retardant; Listed as a persistent, accumulative, and toxic pollutant by EPA in the U. It was used to control fire ants and as a flame retardant in plastic, rubber, paint, paper and electronics. Mirex is transported across the placenta and can be passed from mother to child through breast milk; Most effected in animals is the liver; Proven to cause cancer in mice and rats and is a carcinogenic risk to humans; Toxic for a range of aquatic organisms, with crustacea being particularly sensitive. Mirex induces pervasive long-term physiological and biological disorders in vertebrates. There is evidence of accumulation of mirex in aquatic and terrestrial food chains to harmful levels Mirex is one of the most stable of the organochlorine insecticides and is it is widespread in the environment. All uses of mirex as a pesticide were banned in the U. Mirex is still used in the USA mainly as a flame-retardant in plastics, rubber, paint, paper and electronics. PCBs are very stable compounds and do not degrade readily. Despite being banned in the s due to their high toxicity, PCBs still persist in the environment Prior to the ban estimates have put the total global production of PCBs on the order of 1. Bio-concentrates in animals; PCBs can be transmitted to children via breast milk as well as through the placenta. In humans, PCBs can cause liver disease, ocular lesions, lessened immune response Babies born to women exposed to PCBs have been shown to weigh less, have problems with motor skills, a decrease in short-term memory, and compromised immune systems. PCBs alter estrogen levels in the body and contribute to reproduction problems. Biological magnification of PCBs has led to polar bears and whales that have both male and female sex organs and males that cannot reproduce. Effects on animals are liver, stomach, thyroid damage, plus immune system changes, changes in behavior, impaired reproduction Some studies indicate that PCBs are associated with cancer in humans, such as cancer of the liver and biliary tract. PCBs are known to induce Vitamin A deficiency in mammals, an affect that may be associated with impairment of the immune system, reproduction and growth. This means that even small amounts in contaminated water can bio-concentrate up the food chain to dangerous levels. In animals and fish, studies have shown dioxin exposure to cause cancer birth defects, liver damage, endocrine damage, and immune system suppression. Studies have shown that exposure to dioxin increases the ratio of female births to male births among a population. Concentrations of dioxins are found in all humans today, with higher levels found in persons living in more industrialized countries. The estimated elimination half-life for dioxins in humans ranges from 7. Dioxin enters the general population almost exclusively from ingestion of food, specifically through the consumption of fish, meat, and dairy products since dioxins are fat-soluble and readily climb the food chain Because Dioxins are lipophilic, breast fed children usually have substantially higher dioxin body burdens than non-breast fed children until they are about 8 to 10 years old. Dioxins are also generated in bleaching fibers for paper and textiles. Polychlorinated dibenzofurans Properties and chemical structure similar to dioxins; Toxaphene â€" an insecticide; Banned in US in , outlawed in by the Stockholm Convention Exposure can cause damage to lungs, nervous system, kidneys and can be fatal Additional Persistent Organic Pollutants POPs PBDEs â€" Polybrominated diphenyl ethers flame retardants PBDEs are used in plastic, foam and textiles in clothing, computers, televisions, furniture and cars. PBDEs have been found at high levels in indoor dust Research has linked some chemicals in the flame retardants to effects on thyroid function on brain function, reduced male fertility and damaged ovarian development and the development of the embryonic nervous system, impacting motor skills and behavior. In August , California became the first state to ban two forms of the fire retardants chemicals known to accumulate in the blood of mothers and nursing babies. Levels of concentration in humans and marine mammals continue to increase, particularly in the United States. Studies have found that PBDEs accumulate in human blood, fat tissue and breast milk. It has been found that a woman can pass these chemicals to her unborn child through the placenta.

In the United States levels in human breast milk are 40 times higher than in Europe and are steadily rising. Marine mammals like bottlenose dolphins, harbor porpoises, pilot and beluga whales have been found to be contaminated with PBDEs. Birds including cormorants and glaucous gulls, and popular food fish including salmon and tuna have also been found to carry high concentrations of PBDEs PFCs â€" perflorinated compounds; PFCs are used as industrial and commercial surfactants - wetting agents that lower the surface tension of liquid. In contrast to the majority of organic pollutants that are deposited in fatty tissue, perflorinated contaminants circulate in the blood and accumulate primarily in the liver. PFCs are synthetic molecules that are thought to bioaccumulate and are believed to be extremely resistant to physical degradation, biodegradation, and biotransformation. Science has begun to demonstrate clear links between chemicals such as phthalates, bisphenol A, and perflorinated compounds found in consumer products including baby bottles, toys, and cosmetics to reproductive disorders. All contents, including the BlueVoice. Website design by Troika Studio.