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Assessment of activities that pose a major threat to the environment

Report of the Secretary-General

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INTRODUCTION

1. The General Assembly, in its resolution 50/113 on the special session for the purpose of an overall review and appraisal of the implementation of Agenda 21, requested the Secretary-General to include, in his report on an overall assessment of the implementation of Agenda 21, coverage of the environmental impact of activities that are gravely hazardous to the environment, taking into account the views of member States. The present report has been prepared in response to that request by the United Nations Environment Programme (UNEP), in close cooperation with the International Atomic Energy Agency (IAEA), in accordance with arrangements agreed to by the Inter-Agency Committee on Sustainable Development (IACSD).

2. Although the initial proposal submitted for the Assembly's consideration concerned the environmental impact of nuclear tests, eventually the General Assembly decided to have the report placed in a broader context so as to include other activities that have a potentially negative impact on the environment.

3. The present report limits itself to a selection of human activities that are: (a) not gravely hazardous to the environment if carried out over a limited period of time but are cumulative and hazardous if undertaken on a continued basis; (b) undertaken occasionally and/or involve a potential risk of major contamination within a given geographical area and time-frame.

4. The report, however, does not provide a comprehensive analysis of environmental impacts of activities that are gravely hazardous to the environment. It reviews the sources of hazards that are the best known and researched, and also indicates the attempts of the international community to deal with those hazards and find adequate solutions.

5. The activities identified in the present report are organized under three main subject areas: hazardous wastes, chemicals and nuclear activities. Those topics are also discussed in the reports of the Secretary-General on environmentally sound management of hazardous wastes, including the prevention of illegal international traffic in hazardous wastes (E/CN.17/1997/2/Add.19); environmentally sound management of toxic chemicals, including prevention of illegal international traffic in toxic and dangerous products (E/CN.17/1997/2/Add.18); protection of the atmosphere (E/CN.17/1997/2/Add.8); and safe and environmental sound management of radioactive wastes (E/CN.17/1997/2/Add.21).

I. HAZARDOUS WASTES

6. Hazardous wastes include materials that are toxic, flammable or corrosive, as well as materials with a high water pollution potential. They have a high potential of damaging the environment and posing a threat to human health. Most hazardous wastes originate from industries that are among the most important in the growth and maintenance of a modern industrial society, such as iron and steel, non-ferrous metals, and the primary and secondary chemical industries.

7. Depending upon the state of their economic development, the countries and regions of the world experience different environmental and health problems associated with hazardous wastes. Based on the global wastes survey undertaken by the International Maritime Organization (IMO) in 1995, serious environmental problems can be summarized as follows:

(a) For the countries that are members of the Organisation for Economic Cooperation and Development (OECD), where it has been estimated that 100 kilograms (kg) of hazardous wastes are being generated per person per year (as compared to 6 kg in developing countries with predominantly agricultural economies), their disposal, particularly the contamination of sites, is perceived as the most acute problem. The contamination of sites usually threatens the quality of underground water;

(b) Middle East and North African countries are predominantly facing stockpiling-related problems, such as uncontrolled dumping alongside the factory of origin. In the Asia and the Pacific region, as well as in sub-Saharan Africa, uncontrolled waste disposal poses a serious threat to the quality of surface water as well as to groundwater;

(c) Countries of Latin America and the Caribbean, Eastern European countries and countries with fast growing economies are faced with a mix of serious environmental problems, associated with stockpiling, uncontrolled waste disposal and contamination of sites.

8. In order to mitigate the impacts of hazardous wastes, Agenda 21 stresses the need to act in four priority areas: the prevention and minimization of hazardous wastes; the strengthening of institutional capacities in hazardous wastes management; the strengthening of international cooperation in the management of transboundary movements of hazardous wastes; and the prevention of illegal international traffic in hazardous wastes. Successes and unfulfilled expectations in implementing chapter 20 of Agenda 21 are outlined in the relevant task managers' report for the special session of the General Assembly on the review and appraisal of Agenda 21.

9. Cleaner production and eco-efficiency approaches to reduce hazardous wastes generation are now recognized by an increasing number of Governments, as well as by business and industry, as the means to reconcile the various objectives of environment protection, effective management of natural resources and economic development. The main United Nations bodies involved in that area, such as the United Nations Industrial Development Organization (UNIDO) and UNEP, are promoting the cleaner production approach through the development of cleaner production practices, as well as by supporting the establishment of national cleaner production centres. At least 51 centres involved in cleaner production technologies are operational worldwide. Nonetheless, technology choices do not sufficiently take into account their overall environmental impact, particularly with regard to wastes. Small and medium-sized enterprises are difficult to reach, and still perceive eco-efficiency as an additional cost, not as a potential source of benefits. Transfer of more up-to-date technologies has to be further enhanced. Furthermore, there is now a need to develop approaches to minimize the production of hazardous wastes from other sources than industrial

processes, such as hospitals, agriculture and domestic use. End-of-life equipment needs to be thoroughly addressed.

10. To assist in the environmentally sound management of hazardous wastes, various technical guidelines have been developed, particularly by the secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Many countries have adopted legislation and established the necessary mechanisms to, inter alia, promote the environmentally sound management of hazardous wastes. But even when legislation and regulations do exist, they are often not complied with due to either lack of capacity or resources. Soil and water contamination resulting from past inadequate management of wastes are now issues that are being given higher priority in developing countries and countries in transition, as the consciousness of health impacts increases.

11. Within the framework of the Basel Convention, a ban on the exportation of hazardous wastes for disposal from States parties to the Convention that are members of OECD and the European Community, as well as Liechtenstein, has been adopted. By 31 December 1997, the ban will also cover hazardous wastes for recovery, recycling, reclamation, direct use or alternative uses.

II. CHEMICALS

A. Persistent organic pollutants

12. Persistent organic pollutants (POPs) are chemical substances that are persistent, bio-accumulative and pose a risk to human health and the environment. The concern with POPs arises because such chemicals resist photolytic, chemical and biological degradation. Their persistence has often been considered one of their best features. However, they also have low water and high lipid solubility, resulting in bio-accumulation in the fatty tissue of living organisms. They are semi-volatile and able to be transported over long distances through the atmosphere, and are transported in low concentrations by the movement of fresh and marine waters, resulting in widespread distribution in the environment, including in areas where they have never been used.

13. Incidence of damage due to POPs to natural habitats and populations has been documented over several decades, such as decline of bird populations because of eggshell thinning, poisoning and the accumulation of pesticides in the fatty tissues of marine mammals. Some Governments have banned the use or application of those organic components because of their toxicity, persistence and other adverse effects. The consequences of the use of POPs has had a major impact on the environment and health over the last 40 years.

14. Bio-accumulation, a process that affects aquatic life, bacteria, invertebrates and fish, as well as terrestrial species, is an important fate for some POPs, such as dichlorodiphenyltrichloroethane (DDT), chlordane, toxaphene, aldrin, dieldrin, endrin and hexachlorobenzene. If chemicals that are bio-accumulative settle in aquatic sediments, bio-magnification in the food chain can occur and thus affect man, and can be a major hazard for terrestrial animals. There is evidence that POPs, such as chlordane, polychlorinated

biphenyls (PCBs) and hexachlorobenzene, cause cancer in rats and mice and have a potential carcinogenic effect on humans. Research also shows that POPs, such as chlordane and toxaphene, are mutagenic and interfere with or have adverse effects on reproduction. Secondary effects sometimes arise, such as contamination with chlordane, which suppresses earthworm populations and consequently soil fertility. Immunosuppressive effects, such as the effects of PCB contamination, are among the more subtle chronic effects of concern. There is also strong evidence of the role of PCBs as endocrine disruptors, leading to defective sexual organs, behavioral abnormalities and impaired fertility.

15. The UNEP Governing Council, at its nineteenth session, requested UNEP to prepare for and convene an international negotiating committee with a mandate to prepare an international legally binding instrument for implementing action to reduce or eliminate the release of 12 POPs, and, where appropriate, to eliminate production and subsequently the remaining use of those POPs that are intentionally produced. The 12 POPS are: aldrin, dieldrin, endrin, chlordane, DDT, hexachlorobenzene, mirex, toxaphene, heptachlor, PCBs, dioxins and furans.

B. Unwanted stocks of pesticides and chemicals

16. Unwanted stocks of pesticides and chemicals is another problem that gravely compromises human health and the environment, with unacceptable risks that affect particularly developing countries and countries with economies in transition. The complex problems linked to overstocking, excessive donations, poor storage facilities and management, inadequate disposal or waste management capacity, vulnerability to insect plagues and changes in national policies have resulted in an alarming increase in outdated pesticide and chemicals stocks over the last two decades.

17. Activities undertaken by the Food and Agriculture Organization of the United Nations (FAO) to address unwanted pesticides have illustrated the magnitude of the problem by recording the quantities of material identified for elimination on a subregional basis with reference to Africa. The majority of the following obsolete stocks were acquired under donor arrangements:

(a) Sahel region (Burkina Faso, Cape Verde, the Gambia, Mali, Mauritania, the Niger and Senegal): 808 tons, about half of which are dieldrin stocks;

(b) Horn of Africa (Eritrea, Ethiopia and Sudan): 1,241 tons, old locust control stocks, including large quantities of organochlorine compounds;

(c) South-East Africa (Madagascar, Mozambique and Seychelles): 336 tons, old stocks and potential risk of pollution of the Indian Ocean.

18. To address the problem, FAO, UNEP, the World Health Organization (WHO) and other partner United Nations organizations have undertaken actions to raise awareness and prevent further contamination of the environment by pesticides and chemicals stocks. Some of the steps taken to date include:

(a) Preparation of the publication Technical Guidelines on Disposal of Bulk Quantities of Obsolete Pesticides in Developing Countries (1996);

(b) Mounting by FAO of an inventory programme of obsolete stocks in 37 countries, 33 of which were African countries;

(c) Review of available disposal options;

(d) Pilot disposal operations initiated by FAO, in cooperation with other agencies;

(e) Development of the UNEP Global Programme of Action for the Protection of the Marine Environment from Land-based Activities.

C. Transportation of chemicals, particularly at sea

19. In recent years, the transport and storage of hazardous substances that may present a danger to both the public and the environment have increased greatly. Hazardous substances may be carried at sea either in bulk or in packaged form. Carriage in bulk may be either in chemical tankers, for substances that are liquids, or in gas carriers, for substances that are gaseous. The less volatile chemicals that do not evaporate to the atmosphere but float on the sea surface, such as crude oil or fuel oil, pose a major threat to the marine environment, particularly in the case of accidental spills. The environmental impacts of such spills are probably the best researched. Of the estimated total of 1.5 million tons of oil that enter the sea each year as a result of marine transportation losses, almost two thirds comes from vessel operational discharges.

20. Understanding of the effects of oil spills has increased dramatically over the last decade, but the results of research continue to be limited by uncertainties over total ocean ecosystems. The effects of the particular spill situation will depend on many factors, including the volume of the oil spilled and its physical, chemical and toxicological characteristics, as well as the physical conditions in which the spill occurred. Ecological effects resulting from a spill may include physical and chemical changes in habitats; changes in growth, physiology and behaviour of individual organisms and species; toxicity and increased mortality in individual organisms and species; and destruction and modification of entire communities of organisms through the combined effects of toxicity and smothering.

21. Floating oil may contaminate mammals and birds that swim or dive through the surface of the water. In the open sea, many birds and animals may be able to avoid contact with an oil slick, but in coastal areas the organisms may be trapped between the shore and the approaching spill and become contaminated. Organisms that survive the initial lethal effects of a spill take up petroleum compounds, both from the surrounding water and sediments and from contaminated food, and deposit them in their tissues. The accumulated concentrations may be high enough to affect behaviour, growth and reproduction, and may lead to disease and early death. It is believed, however, that fish stocks are not seriously affected by individual oil spills. Marine mammals, including seals, otters, whales and porpoises, which probably do not actively avoid oil, are affected in a much more serious manner, but aquatic birds are the most visibly vulnerable to oil spills.

22. The International Convention for the Prevention of Pollution from Ships, (MARPOL 73/78), which was elaborated under the auspices of IMO, aims to achieve the complete elimination of intentional pollution of the marine environment by oil and other harmful substances and the minimization of accidental discharge of such substances. Annex II to the Convention on noxious liquid and annex III on harmful substances in packaged forms entered into force, respectively, on 2 October 1983 and 1 July 1992.

D. Chemicals associated with energy production

23. Energy production based on hydrocarbons generates various by-products that have a significant impact on the environment, particularly oxides of carbon and sulphur.

24. Carbon dioxide (CO_2) is by far the most important greenhouse gas contributing to global warming. Assuming the best estimate of climate sensitivity made by the Intergovernmental Panel on Climate Change, the temperature increase by the year 2100 will be on the order of 2°C. Such a temperature rise would lead to a global sea level rise of 50 centimetres between the present and the year 2100. Sea level rise and possibly changes in the frequency of extreme events represent potential additional stresses on systems that are already under intense and growing pressure. Adverse impacts may include coastal erosion, degradation of freshwater supply and quality, and threats to human settlements and human health.

25. Global warming would also induce changes in continental temperature and precipitation patterns, with impacts on soil moisture and the potential for more severe droughts and floods in some places and less severe ones in other places. A general warming would tend to lead to an increase in high-temperature events and a decrease in the occurrence of extremely low temperatures. Ocean circulation could change. In the North Atlantic, weakening of the overturning process might lead to a reduction of the strength of the warming in that ocean, with implications for the regional climate.

26. Despite the agreements reached at the United Nations Conference on Environment and Development and the adoption of the United Nations Framework Convention on Climate Change, CO_2 emissions continue to rise. The transport sector, which was responsible for 22 per cent of CO_2 emissions in 1990, is one of the most rapidly growing sectors. Nevertheless, some progress towards emissions control is being made within the framework of the Convention. Parties to the Convention have agreed to negotiate a protocol or other legal agreement to limit greenhouse gas emissions in industrialized countries (annex I parties) after the year 2000. They have also agreed to launch a pilot phase of activities implemented jointly until the year 2000, involving emission control projects in one country with the financial and technical support of an investing country. The countries involved in the pilot phase actively contribute to a reduction in CO_2 emissions.

27. Annual global emissions of sulphur dioxide (SO_2) were assessed at about 294 million tons in 1991, of which 160 million tons were anthropogenic. Man-made emissions have been rising at a rate of about 4 per cent annually. Most

anthropogenic sulphur dioxide is formed when fossil fuels containing sulphur are burned. About 10 per cent is formed through metal-smelting and sulphuric acid production; that sulphur may return to Earth as dust. When sulphur reacts with moisture, it form particulate sulphates and droplets of sulphuric acid, the major constituent of acid rain. Although acid rain is a major problem in the north-eastern United States of America and Europe, SO_2 pollution is also becoming particularly evident in such countries as China, Mexico and India. The adverse impacts of SO_2 on the environment include acidification of soils, lakes and rivers, and damage to plants and crops.

28. Acidic deposition may release the aluminium in soils or reduce the availability of other chemicals, such as calcium. Aluminium released by acidification can enter rivers and lakes, where it poisons marine life and can ultimately be ingested by humans through drinking water.

29. In the north-eastern United States and Scandinavia, acidification of water bodies is causing the decline and loss of fisheries. Atmospheric deposition was the dominant source of acid anions for 75 per cent of the 1,180 lakes surveyed in the United States in 1991. When the pH changed from 6.8 to 5.0, there were dramatic changes in the lakes' food web, particularly changes in phytoplankton species and fish reproduction, the disappearance of benthic crustaceans and the appearance of filamentous algae. In southern Norway, it was found that the number of barren lakes had doubled between 1974-1975 and 1986 due to acidification.

30. Acid rain has an impact on vegetation, particularly forests, through defoliation and discoloration. In a survey carried out in 1994 in Europe, 26.4 per cent of the sampled trees were damaged. It should be noted, however, that defoliation and discoloration are two non-specific symptoms: the degree to which individual factors (such as acid rain, adverse weather conditions, pests and forest fires) have contributed to such damage cannot be quantified.

31. Much of the world's population lives in cities in which pollution levels exceed those considered as safe under WHO guidelines, thereby exposing their inhabitants to substantial health threats. In particular, more than 1,200 million people may be exposed to excessive levels of sulphur dioxide. SO_2 has a number of adverse health effects and is linked to bronchitis, tracheitis and respiratory problems. Sulphurous smogs pose a hazard to human health, such as the sulphurous smogs in London in 1952, which caused the death of more than 4,000 people.

32. Under the auspices of the Economic Commission for Europe, a convention on long-range transboundary air pollution was adopted in 1979. To address specifically the emission of SO_2, a protocol to that convention on the reduction of sulphur emissions or their transboundary fluxes by at least 30 per cent was adopted at Helsinki on 8 July 1985.

E. Chemicals depleting the ozone layer

33. The thin layer of ozone in the stratosphere, 10 to 50 kilometres (km) above the surface of the earth, absorbs all but a small fraction of the harmful ultraviolet radiation (UV-B) emanating from the sun. It therefore shields plant and animal life from UV-B, which in high doses can be particularly damaging to natural life.

34. However, ozone can be destroyed by the chlorine released from certain chemical compounds reaching the stratosphere. Due to their stable, non-toxic, non-corrosive and non-flammable properties, the consumption of chlorofluorocarbons grew rapidly in developed countries. The damage to the ozone layer caused by the release of those chemicals became known in the 1970s. As scientific knowledge developed, other families of chemicals, including halons, carbon tetrachloride, methyl chloroform and methyl bromide, were identified as ozone destroyers.

35. Observations of stratospheric ozone concentrations since the 1970s have confirmed the evidence of gradual ozone depletion, with seasonal variations. Since 1979, ozone concentrations have fallen by about 4 per cent per decade at mid-latitudes (30°-60°) in both the northern and southern hemispheres. In the northern spring of 1995, stratospheric ozone concentrations were 12 per cent lower than in the mid-1970s; over North America they were 5 to 10 per cent lower overall but as much as 20 per cent lower in some places. In the southern spring, catastrophic ozone losses of up to 90 per cent at some altitudes occur over the South Polar region.

36. Any rise in the amount of UV-B reaching the Earth's surface has potentially harmful effects on human health, animals, plants, micro-organisms, material and air quality. In humans long-term exposure to UV-B is associated with the risk of eye damage: a 1 per cent increase in stratospheric ozone depletion is estimated to result in a 0.6 to 0.8 per cent rise in the incidence of cataracts. UV-B radiation can also cause suppression of the immune system. In light-skinned populations, high exposure to UV-B is the key risk factor in the development of skin cancers. Experiments suggest that cases increase by 2 per cent for every 1 per cent reduction in stratospheric ozone.

37. Marine life is particularly vulnerable to UV-B, which damages the early developmental stages of fish, shrimp, crab and other water life, and reduces the productivity of phytoplankton, the foundation of the aquatic food chain. In the polar regions, phytoplankton losses can reach 5 per cent as a result of a 16 per cent level of ozone depletion. Plant growth may also be directly reduced by UV-B radiation, harming crop yields and quality and damaging forests. Synthetic materials are also affected by UV-B: the damage caused ranges from discoloration to loss of mechanical strength.

38. In order to halt the destruction of the ozone layer, the international community adopted the Vienna Convention for the Protection of the Ozone Layer in 1985, as well as the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987. Under the latter instrument, phase-out schedules for the various categories of ozone depleting substances have been set. Those schedules were revised in 1990, 1992 and 1995. Full compliance with those treaties will result

in recovery of the ozone layer to approximately its pre-industrial levels by the mid-twenty-first century.

III. NUCLEAR ACTIVITIES

39. Over the last few decades, man has artificially produced several hundred radionuclides. Radionuclides are widely used in medicine, hydrology, agriculture and industry. Nuclear materials fuel electric power stations, and special fissionable materials are used for nuclear weapons. Individual doses from man-made sources of radiation vary greatly, and most of the people and most ecosystems receive a relatively small amount of artificial radiation, but a few get much more important doses. At present, medicine is by far the greatest source of human exposure from man-made radiation, but that source has little effect on the natural environment. Environmental concerns focus on fall-out from nuclear weapon tests, risks of contamination resulting from accidents and long-term problems associated with radioactive wastes.

A. Nuclear explosions

40. For the last 40 years, the whole earth has been exposed to radiation from fall-out from nuclear weapons, most of which is the result of atmospheric nuclear explosions carried out to test nuclear weapons. That testing reached two peaks: the first occurred between 1954 and 1958, when the United States of America, the former USSR and the United Kingdom of Great Britain and Northern Ireland were all exploding devices; the second and greater peak occurred in 1961 and 1962 when the United States and the former USSR were the main contributors. In 1963, the three countries signed the Partial Test-Ban Treaty committing themselves not to test nuclear weapons in the atmosphere, oceans and outer space. Over the next two decades, France and China conducted a series of much smaller atmospheric tests, with declining frequency. They also stopped testing after 1980, and there have been no atmospheric tests since then. With the conclusion of the Comprehensive Test-Ban Treaty in September 1996, all five declared nuclear-weapon States have ceased nuclear weapons testing.

41. Some of the radioactive debris from atmospheric tests land relatively close by. Some stays in the troposphere (the lowest layer of the atmosphere), and is carried by the wind around the world at much the same latitude. As it travels, it gradually falls to earth. Most is pushed into the stratosphere (the next layer of the atmosphere) where it stays for many months, and then it slowly descends all over the earth.

42. As far as the research concerning the effects on the environment of the underground (underwater) nuclear tests is concerned, a comprehensive study has been launched in response to a request from the French Minister for Foreign Affairs to the Director-General of IAEA in August 1995. In January 1996, an informal technical consultation meeting was convened by IAEA with the participation of WHO, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and a number of international experts, which, inter alia, drafted the terms of reference for the study, and concluded that the proposed international review of the radiological situation at the atolls of

Mururoa and Fangataufa should proceed. The study's findings, conclusions and recommendations will be contained in the report of the International Advisory Committee, which IAEA expects to publish in early 1998.

B. Radioactive wastes

43. The production of nuclear power is much the most controversial of all the man-made sources of radiation, yet it makes a very small contribution to human exposure. In normal operations, most discharges from nuclear facilities emit very little radiation to the environment. By the end of 1995, according to data in the Power Reactor Information System (PRIS) maintained by IAEA, there were 437 nuclear power plants for electricity generation. The projected expansion of nuclear power is slowing under the impact of energy conservation trends and public opinion. The power stations, however, are only part of the nuclear fuel cycle. The cycle starts with the mining and milling of uranium ore and proceeds to the making of nuclear fuel. After use in the power stations, the irradiated fuel is sometimes reprocessed to recover uranium and plutonium. Eventually, the cycle ends with the disposal of nuclear wastes. It is at the back end of the fuel cycle, i.e., reprocessing and waste management, that environmental protection measures are most important. As many nuclear power reactors reach the end of their lifetimes, problems of decommissioning also have to be confronted.

44. In that context, the Commission on Sustainable Development has urged Governments to apply the precautionary principle by, for example, including preparatory measures for final disposal in decisions concerning new or extended activities that generate radioactive waste. In most countries with nuclear programmes, the preferred method for the disposal of long-lived radioactive waste is its long-term isolation in a system of multiple barriers located in deep and stable geological formations.

45. As stated in the task managers report for the special session of the General Assembly on review and appraisal of Agenda 21, the large amount of accumulated radioactive waste from both civilian and military programmes, particularly in Russia and other Commonwealth of Independent States countries, is a cause for concern. On the other hand, the relaxation of tensions between the East and the West have allowed much previously classified information on matters related to radioactive releases and their environmental impacts to become available.

46. At the April 1996 nuclear safety summit in Moscow, the Russian Federation proposed the establishment of regional radioactive waste storage sites, financed and supervised by countries advanced in nuclear technology. The availability of such sites would enable the Russian Federation to accede to the 1993 amendment to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention of 1972) banning the dumping of all types of radioactive waste at sea. Other steps to improve safety of nuclear waste disposal are also being undertaken. For instance, Japan is helping to build a liquid waste processing plant in the Far East. A plant for treating liquid low-level wastes in the Arctic is being built as a joint effort between Norway, the Russian Federation and the United States. The same countries also signed an

agreement in September 1996 for dealing jointly with nuclear and other waste stored or dumped in the Arctic. A draft convention on the safety of radioactive waste management is being developed under the auspices of IAEA and with the participation of UNEP, the European Commission and the OECD Nuclear Energy Agency.

C. Nuclear power plants

47. Accidents inevitably happen in the handling of nuclear materials. Prior to Chernobyl, two serious accidents happened in 1957 in military plants in the southern Urals, where some 74 quadrillion becquerel of radioactive materials were scattered over the former USSR provinces of Chelyabinsk, Sverdlovsk and Tyumensk, and in Cumbria, United Kingdom, where a release of radioactive materials led to an estimated collective dose commitment of 1,300 man-sievert. The 1979 accident at the Three Mile Island nuclear power plant in the United States, although serious, did not have off-site consequences.

48. The 1986 Chernobyl power station disaster caused extensive local contamination and spread radioactive materials over the western former USSR (Ukraine, Belarus and the western Russian Federation) and other parts of Europe, and to a lesser extent throughout the rest of the Northern hemisphere. UNSCEAR has calculated that about 70 quadrillion becquerel of radionuclides were emitted from Chernobyl. However, the International Chernobyl Conference, held in April 1996 at Vienna, has concluded that no dramatically obvious long-term impacts on populations or ecosystems have been observed. In general, no food produced by the collective farm system has exceeded established international radiation levels, although some food produced by private farmers has done so, as have mushrooms, game and other wild foods. As for long-term radiation health effects, apart from an increase in the incidence of thyroid cancer (especially among young children and particularly in Belarus, where 400 cases have been observed, as well as in Ukraine and some parts of the Russian Federation) there has been no statistically significant deviation to date in the incidence rates of other cancers, nor any hereditary effects that can be attributed to radiation exposure due to the accident. The transboundary consequences of the Chernobyl accident spurred the international community to adopt three international conventions, on notification and emergency assistance in a case of a nuclear accident or radiological emergency in 1986, and on nuclear safety in 1994.
