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Russian Federal Program "Dioxin": present state, problems and solutions

Anna E. Danilina, Russian State Committee of Environmental Protection, B. Gruzinskaya str., 4/6, 123826, Moscow, Russia
Elena I. Grosheva, Institute of Ecological Toxicology, P.O. Box 48, Baikalsk, Irkutsk region, 665914, Russia

Abstract

To protect population and environment from exposure to supertoxicants (PCDD and PCDF) Ministry of Environmental Protection and State Committee of Sanitary and Epidemic Control of Russia with assistance from other Ministries and Departments announced Federal Program "Protection of population and environment from dioxins and dioxin-like toxicants" (subsequently referred to as Program "Dioxin"). The Program was confirmed in late 1995 by the Government of Russian Federation. The main goal of the program is to collect and process data on dioxin pollution on the territory of Russia, to determine primary sources of pollution and to estimate potential threat to population's health and environment. The most important part of the Program is generalization of Russian and international experience in the problem and evaluation of dioxin pollution influence on boreal ecosystems which comprise the significant part of Russia.

Introduction

Pollution by dioxins and similar xenobiotics has several specific features in Russia. On the one hand, high concentration of industrial production in many regions of Russia results in serious ecological and hygienic problems. On the other hand, the problem of reduction of industrial pollution by dioxins, PCBs and other toxicants is being solved very slowly. This constitutes a potential threat of degradation of unique boreal ecosystems of northern Russia and Siberia, loss of natural resources, decline in biodiversity, etc. This report is focused on the goals and problems of the Program "Dioxin". Our aim is to summarize international experience and to attract attention of

research teams to the study of the problem of dioxin pollution in Russia. Diversity of natural ecosystems of Russia and sources of environmental pollution by dioxins and similar substances (both industrial and catastrophic) can serve as a model to tackle this problem on the global scale.

Experimental Methods

4 research centers which are intercalibrated and accredited for analysis of PCDD and PCDF in environmental objects, biota, food, and human bioliquids currently exist in Russia. These laboratories mainly use American equipment produced by Hewlett Packard and also equipment from Germany and France. Hence the problem of dioxin pollution and danger assessment is complicated by the lack of modern homemade analytical facilities and high costs of analyses.

Results and Discussion

Systematic measurements of dioxin pollution levels have never been carried out in Russia. Data on quantitative and qualitative composition of dioxin-containing industrial waste are lacking. All this renders estimation of influence of dioxins on death-rate and morbidity among population of Russian Federation impossible. Without such data it is also impossible for supervising organizations to charge factories which discard toxic waste into environment.

The importance of the dioxin problem in Russian Federation is due to introduction of significant number of home and foreign "dioxin-unsafe" technologies in recent years. At the same time formation and environmental distribution of dioxins was not controlled on the governmental level.

Furthermore, the country lacks legislative, administrative, informational basis and also ecological and sanitation standards which are essential for solution of dioxin problem.

All mentioned above reasons are responsible for dioxin pollution of large territories, basins, air, food and drinkingwater. Master data on this pollution is presented in the report.

Analysis of density of dioxin-contaminating industry showed that the most heavily polluted by dioxins are Central, Ural and North-Western regions of Russia.

According to the data of the Russian State Committee of Environmental Protection about 200 industrial plants which are sources of severe environmental pollution by dioxins exist in Russia. However this list does not

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include a significant number of smaller manufactures, contribution of automobile-exhaust and drainage pollution, fires, accidents etc.

Selected inspection of several Russian towns (Ufa, Schelkovo, Noginsk, Chapaevsk, Dzerzhinsk) with chemical plants using chlorophenols as raw material showed high contamination by dioxins (in 2,3,7,8-PCDD equivalents) of manufactured end products (10-140 $\mu\text{g}/\text{kg}$ compared to foreign standard 1-5 $\mu\text{g}/\text{kg}$), of the soil on the territory of these plants (0,9-40 $\mu\text{g}/\text{kg}$ with foreign standard 1 $\mu\text{g}/\text{kg}$), of mud (150 $\mu\text{g}/\text{kg}$), drinking water (10-20 $\mu\text{g}/\text{l}$) and air (up to 0,06 pg/m^3). High levels of pollution by dioxins of air, soil, water, vegetation and women's milk are reported in Russian Federation around industrial plants producing PCB or using them as raw material (metallurgical, condenser and dye factories). For instance, at the distance of 0,5-1,0 km from such industrial plants in Chelyabinsk region soil contamination by PCB exceeds 5-17 times the hygienic standard (0,06 $\mu\text{g}/\text{kg}$). In Serpukhov town this value exceeds standard 33 times 0,5 km far from a condenser factory.

High concentrations of PCDD/PCDF and PCB were also detected in waste from garbage destructors in Moscow and Murmansk. It is significant that garbage destructors are located in residential areas and the technology of waste utilization or disposal is lacking.

Amount of dioxins produced during garbage destruction varies from 0,1 to 1,0 mg per ton of garbage and thoroughly depends on the chemical composition of processed garbage and also on the type of destructor. Seven garbage utilization plants currently exist in Moscow, Vladivostok, Sochi, Pyatigorsk and Murmansk.

Extremely high concentrations of dioxins were measured in spent gases from industrial toxic waste crematories. For example, spent gases of SAO "Caustic" (town Sterlitamak) contain 2,4 ng/m^3 dioxins which exceeds 24 times international standards.

Preliminary estimation (using small number of probes) of PCDD and PCDF levels in food consumed by residents in several cities of Russia (Moscow, Baikalsk, Novosibirsk, Irkutsk) showed higher content of these substances compared to samples from Germany. Analyzed food products contained isomers of PCDD and PCDF with high degree of chlorinating. The highest concentrations of PCDD/PCDF (per lipid mass) were detected in cream (45,2 ng/kg) and beef (39,2 ng/kg) from Irkutsk; in "Swiss" cheese (34,6 ng/kg) from Moscow; in butter (27,0 ng/kg) and pork (20,3 ng/kg) from Baikalsk. Similar values measured in Germany are given below (in ng/kg) to make a comparison: beef-24.9, pork-8.9, cheese-22.2, butter-17.5.

Environmental and industrial pollution resulting in food contamination by dioxins has strong negative influence on health of different population groups

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in the cities with major chemical plants. 55 cases of professional dermatitis "chloracne" were reported in the town of Chapaevsk. 30 people with this diagnosis currently live in the town.

Contamination of women's milk by dioxins in Chapaevsk varies in dioxin equivalent from 160 to 500 ng/l depending on the neighborhood. When such milk enters organism of a 1-2 years old child the daily acceptance limit of dioxins is exceeded 380 times.

It was found that Archangels region is polluted by dioxins at a level comparable with industrial areas of central Europe.

High levels of pollution of air, soil, water, vegetation and women's milk are reported near condenser plants in Chelyabinsk region.

Women's milk in Penza, Moscow, Baikalsk and Rostov was found by selective analysis (4-20 samples) to exceed US standards in daily acceptance limit of dioxins for children.

According to the data collected during inspection of household waste dump in Tula concentration of dioxins in arable land at the distance of 100m from the dump reached the value of 2100-800 pg per kg of soil.

Significant contamination by dioxins was detected in ground sediments (5 ng/kg) and water (5-9 pg/l) of Tom river and also in drinking water (5-7 pg/l) in Kemerovo and other towns of Kemerovo region.

The problem of dioxin pollution does not only exist in several towns of Russia where it recently resulted in escalation of social tension but also in many regions with developed industry and intensive agricultural production.

To protect population and environment from exposure to dioxins Goscomecologia together with Goscomsanepidnadzor and other ministries and organizations launched the Federal Program "Protection of population and environment from dioxins and dioxin-like toxicants". The program was confirmed in late 1995 by the Government of Russian Federation.

The Federal Program "Protection of population and environment from dioxins and dioxin-like toxicants" (subsequently referred to as Program "Dioxin") deals with objective estimation of dioxin threat to population genofond, animal and plant worlds. The Program is based on analysis of data on people's health and results of selective inspections of environment and food for contamination by dioxins and dioxin-like toxicants in Russian Federation.

The main goal of the Program "Dioxin" is to reduce environmental pollution by dioxins and similar supertoxicants and to minimize their negative influence on health of people in Russian Federation.

Taking into account the extreme complication of the problem, current state of domestic economy and financial difficulties it was decided to carry out implementation of the Program in two stages:

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-first stage : development of legal norms, formation of analytical network monitoring levels of dioxin and dioxin-like toxicants, development of scientifically-proved recommendations how to localize and minimize entry of these supertoxicants from known sources, rehabilitation of people in "dioxin-unsafe" regions;

-second stage (1997-2000): organization of constant monitoring of environment, accomplishment of a series of measures to localize and decrease pollution by dioxins and furans, reorganization of dioxin-producing industries, implementation of dioxin-safe technologies, rehabilitation of people.

The Program implementation will result in decrease of levels of environmental pollution from industrial plants by dioxins and furans to the physiologically-acceptable norms.

One of the high-priority tasks is neutralization of dioxins and limitation of their spread in environment. First of all it is necessary to neutralize abandoned dioxin-containing waste dumps. Recently significant progress was made abroad in development of technologies for utilization of such waste. Analysis of these technologies and implementation of some of them in Russian Federation will help to preserve environment.

Implementation of the guidelines of the Program "Dioxin" (1 stage: 1995-1996) will allow to establish legal and economic regulations, organize constant monitoring and accomplish series of scientifically-proved measures aimed at reorganization of industrial production in Russia. These measures will exclude possibility of dioxin contamination during all stages of production and in end products.

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