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THE NATIONAL ENVIRONMENTAL MONITORING SYSTEM IN BELARUS - STATUS AND PROSPECTS

Submitted by the delegation of Belarus[1]

Introduction

1. The Republic of Belarus has large reserves of a variety of natural resources; in recent decades, making rational use of them, and the closely related issue of environmental protection, have become matters of particular importance.

2. The levels of contamination resulting from economic activity in a number of regions are now so high that additional pollution or human intervention may bring about numerous irreversible disruptions to natural ecosystems.

3. Environmental pollution can have ecological, toxicological, social and economic effects on public health and life-support systems. Warding off the adverse effects of human activity has become an urgent necessity, one that can be attained only on the basis of objective information

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about the sources of pollution, the concentrations and properties of pollutants, the paths they follow through the environment, the objects on which they act and the conditions under which they can be eliminated.

4. Hence efforts to get the National Environmental Monitoring System (NEMS) up and running, initiated by the Council of Ministers and now being pursued under the guidance of the Ministry of Natural Resources and Environmental Protection, assume national importance.

I. REGULATORY AND INSTITUTIONAL UNDERPINNINGS

5. The Belarusian Council of Ministers passed resolution No. 247, on the establishment of a national environmental monitoring system in the Republic, in 1993. The resolution called for the establishment of such a system, defined its overall structure and lead organizations, and laid down a procedure for funding the work involved.

6. Pursuant to the resolution a number of documents - a master plan and a programme - were drawn up to provide the foundations of the regulatory base for the new national environmental monitoring system.

7. The National Environmental Monitoring System Programme was approved by resolution of the Cabinet of Ministers No. 311 dated 25 June 1995. The same resolution assigned the Ministry of Natural Resources and Environmental Protection the function of monitoring the execution of the Programme. The technical design for the System was developed pursuant to the resolution and an order by the Ministry of Natural Resources about tracking progress in the Programme's execution: a network of monitoring stations was defined along with the nature of the indicators to be monitored, the data-collection, -processing and -transmission technology to be used, and technical and economic indicators of the System's performance. The main features of the technical design were published in a book entitled *Organizational Principles underlying the Establishment and Management of the Belarusian National Environmental Monitoring System*.

8. In August 1998 the Council of Ministers passed resolution No. 1344 on the execution of the National Environmental Monitoring System Programme, thereby endorsing the technical design for the System proposed by the Ministry of Natural Resources and Environmental Protection, setting up an interdepartmental coordinating board to supervise Programme execution, and approving annual financing from the State budget for the establishment of and improvements to the System.

9. The passage of Council of Ministers resolution No. 201 of 8 September 1999, "Local monitoring of the environment in the Republic of Belarus", which endorsed a proposal from the Ministry of Natural Resources to introduce local monitoring, led to the formulation of regulations governing local monitoring and the operation of a regional local-monitoring centre, and standard instructions on local environmental monitoring arrangements and practices at individual businesses, organizations and institutions. Regulations governing the NEMS Main Information Analysis Centre, System data and other texts of a methodological or regulatory nature have also been produced.

10. The National Environmental Monitoring System is an amalgam of observation, evaluation and forecasting systems concerned with the state of natural environments and phenomena and with biological responses to changes in the environment under the influence of natural and man-made factors; monitoring data are gathered, processed and made available to governmental and economic bodies for use in tackling national-scale problems with the rational use of natural resources.

11. The System embraces 13 separate kinds of monitoring united by the commonality of the tasks they perform, their purpose, the functions they carry out and their data integrity. The conduct of individual kinds of monitoring happens and is planned with a fair degree of autonomy, depending on the particular features of individual monitoring objectives and assignments and the features being monitored.

12. The System is based on a structured scheme for the collection of information about the status of different constituents of the natural environment from observation stations in the fixed network under long-term programmes. Monitoring data are gathered (obtained) at observation stations on a State register. There are altogether 2,624 such stations.

13. The observation networks are sited so as to ensure that the reported characteristics of natural features are representative and reliable, in accordance with international recommendations and regulatory instruments drawn up by industry-specific institutes and governmental departments, making maximum use of stations with long data sequences.

14. The reliability of the monitoring information is guaranteed by the use of unified, modern methods and by quality control of observation-network data. Data from the System constitute official State information about the state of the environment in Belarus.

15. Individual types and subtypes of monitoring are carried out by the following entities:

Medical, physical phenomena	Ministry of Health, National Health and Epidemiology Centre, Belarusian Hygiene and Epidemiology Research Centre, Belarusian Health and Hygiene Research Institute
Air, surface water, radiation, agriculture-related soil contamination	Radiation Control and Natural Environment Monitoring Centre
Subsurface water	Belarusian Geological Survey Research Institute
Land (soil)	State Committee on Land Resources, Geodesy and Mapping, the Soil Science and Agro-chemistry Institute (a State-owned research establishment), Belgorod State University
General atmospheric ozone content	Department of Hydrometeorology, National Ozone Monitoring Centre
Seismic	Belarusian Academy of Sciences Institute of Geological Science

Complex environmental	Belarusian Ekologia research centre
Plant life	Belgosles State forestation association, Bellesinvest unitary enterprise, Belarusian Academy of Sciences Institute of Experimental Botany, Belgorod State University
Animal life	Belarusian Academy of Sciences Institute of Zoology
Emergencies	Ministry of Emergency Situations, Radiation Control and Environmental Monitoring Centre
Local	Ministry of Natural Resources and Environmental Protection

II. MAIN ACTIVITIES AND RESULTS

A. Medical Monitoring

16. Medical monitoring includes observations of atmospheric pollution, water supplies and public health. Average concentrations of dust, sulphur dioxide, carbon monoxide and nitrogen oxides in 2000, according to Health and Epidemiology Service figures, were within health and hygiene standards in almost all the Republic's cities. On the other hand, concentrations of formaldehyde in most industrial centres were between 50 and 200 per cent over the limit, and between 400 and 600 per cent too high when weather conditions were unfavourable. A number of cities face the real problem of residential areas intermingled with industrial estates, which means that tens of thousands of people are forced to live within districts subject to health restrictions.

17. A total of 3.1 per cent of samples from communal water pipes failed to meet bacteriological standards in 2000; 25.4 per cent failed to meet chemical standards. The discrepancies found in centralized water supply, communal and government-department-managed water pipes were chiefly concerned with iron (33-56 per cent of cases); in decentralized water supplies, with nitrates (43 per cent). Piped water quality below the national average standards was found in Vitebsk, Gomel and Brest oblasts. Some 6.54 per cent of city dwellers and 55.8 per cent of the rural population use well water, but only 78 per cent of wells are properly constructed. In 27.3 per cent of drinking-water samples from wells in 2000, the water failed to meet established bacteriological standards; in 46.8 per cent of the samples it fell short of chemical safety standards. Over the past five to seven years the physical condition of rural drinking water pipes has deteriorated markedly, leading to increased microbial contamination and, in consequence, a higher incidence of acute intestinal infections and viral hepatitis.

18. Increasing mortality is a serious problem for the Republic. A rise in primary and overall morbidity attests to the decline in public health. Between 1991 and the end of 2000, overall morbidity rose by 21.8 per cent. There has been a marked decline in life expectancy, from 71.4 years in 1985-1986 to 68.4 years in 1998 (total population), or 62.7 years for men and 74.4 years for women.

B. Atmospheric monitoring

19. Regular measurements of air quality in Belarus began in 1965. The country's fixed air-quality monitoring stations have equipment for taking air samples, measuring concentrations of carbon monoxide and recording weather conditions. The principle governing the siting of the stations and ancillary monitoring units was the need to obtain a general profile of air quality in the residential, administrative and business districts of the country's industrial centres that are most important from the public health viewpoint. In each city where air quality is monitored, one measurement station is sited in the cleanest area, generally a piece of woodland or parkland on the windward side, and used to provide background readings. Measurements taken at other points sited amidst concentrations of industrial plant and in administrative and residential areas are compared with the background values. Two or three ancillary units are set up in cities with populations of under 500,000, and as many as five or six in cities of over a million inhabitants, depending on the results of research into the spatial distribution of concentrations of pollutants.

20. The air was monitored in 16 Belarusian cities, encompassing the area in which some 65 per cent of the urban population lives, in 2000. The chemical composition of acidic precipitation was regularly studied at 13 stations, and that of the snow cover at 22. Concentrations of the main pollutants (suspended particles, sulphur dioxide, carbon monoxide, nitrogen dioxide) were measured at 50 stations in all 16 cities. The concentrations of many specific, high-priority substances were measured as well: formaldehyde, ammonia, phenol, hydrogen sulphide, carbon bisulphide, lead, cadmium etc. In all, the list of monitored substances covers 32 ingredients.

21. Air quality in Belarusia's cities in 2000 developed against the background of a downward trend in emissions dating back to the early 1990s. Overall volumes of atmospheric emissions had fallen by 60 per cent, and emissions from fixed sources by 40 per cent, making for a marked reduction in levels of atmospheric pollution by most of the contaminants monitored.

C. Water monitoring

22. Up to 60 indicators and substances are identified by the surface-water monitoring system: the basic chemical content, suspended and organic substances, biogenic constituents, petroleum products, phenols, cyanides and so forth. The indicators monitored illustrate the natural state of the hydrosphere and the existence of universally present contaminants together with the degree of water pollution brought about by waste streams from industrial plants, sewage and run-off from farm land.

23. Observations of the hydrochemical composition of surface water were made in 2000 on 83 bodies of water, at 106 measuring stations and 165 hydrographic sections. Associated hydro-biological observations were made on 74 bodies of water, at 95 measuring stations and 138 hydrographic sections.

24. Underground water is monitored at 31 background-grade stations and 47 regional-grade ones. The underground water monitoring system determines the content of principal ions, iron, manganese, nitrogen compounds, dissolved organic substances, heavy metals, pesticides and so forth.

D. Soil (land) monitoring

25. There is no observation network for land monitoring; findings are based on statistical reports on land availability, current quality and use. Soil quality is monitored at separate test sites under special programmes to investigate changes in soil properties under the effects of irrigation, erosion, the addition of mineral and organic fertilizer, plant-growth stimulators and so on. The soil monitoring system also includes regular agrochemical surveys conducted once every five years by oblast-level engineering-research stations tracking the use of chemicals in agriculture.

26. Agriculture-related and man-made soil contamination is monitored within the pollution footprints of large industrial sites, near major highways, and at the reference stations studying overall background soil contamination levels; the soil is also monitored in 29 districts of the Republic for pesticide residues.

27. Throughout the Republic as a whole, farmland diminished by 23,800 ha in 2000 compared with 1999; arable land diminished by 48,500 ha. The areas under forest and other wooded land increased (by 22,300 ha).

E. Radiation monitoring

28. Radioactive contamination of the atmosphere is monitored by means of measurements of gamma-radiation exposure doses at 57 stations, levels of radioactive fall-out in the surface layer of the atmosphere at 30 stations, and radioactive aerosol content at 6 fixed stations. Radioactive contamination of surface water is conducted on six rivers (Dnieper, Sozh, Prypyat, Iput and Besed) to determine their caesium-137, strontium-90 and aggregate beta-activity content. Radiation monitoring of the soil is conducted at 181 reference sites and 19 terrain geochemistry test sites to ascertain what radioactive elements they contain so that their migration (vertical and declination) in various soil types can be studied and trends towards higher soil contamination threatening human life and the environment can be spotted.

29. Gamma-radiation exposure doses at all monitoring stations were significantly lower in 2000 than in 1986, chiefly owing to natural radionuclide decay. A map of radioactive contamination in the Republic reveals several basic patches of caesium-137 contamination in the soil: the 30-km zone around the Chernobyl nuclear power station (contamination in isolated spots exceeds 37,000 kBq/m2); south and south-eastern Gomel oblast, the central areas of Brest, Grodno and Minsk oblasts (contamination levels varying between 170 and 2,400 kBq/m2); and in isolated settlements in Grodno and Minsk oblasts, and four settlements in Vitebsk oblast, caesium-137 content exceeds 37 kBq/m2.

30. Strontium-90 contamination in Belarus is a localized phenomenon. Contamination levels of over 5.5 kBq/m2 have been found over an area of 21,100 km2. About 4,000 km2 are contaminated with isotopes of plutonium: 238Pu, 239Pu and 240Pu. From the results of surface-water monitoring it may be concluded that radiation levels in the country's rivers have stabilized, there having been no recorded incidents of higher levels of caesium-137 or strontium-90 in river water than are permitted.

F. Monitoring of plant life

31. Wooded land throughout the Republic is monitored on a regular 16x16 km, 8x8 km and 4x4 km grid around large industrial centres (Minsk, Gomel, Mogilev, Mozyr, Zhlobin, Novopolotsk etc.), providing extensive coverage so as to determine the effects of transboundary atmospheric pollution on the country's forests. As part of this exercise, environmental monitoring of woodland that is irrigated or drained is carried out to investigate the state of forest and marshy biocoenoses directly or indirectly affected by forest irrigation or drainage works. A survey of the nation's forests was made in 2000, using the national monitoring grid, at 1,432 permanent checkpoints under the level I monitoring programme and at 81 permanent test areas under the level II programme.

32. A comparison of forest monitoring data for 1999 and 2000, across the country as a whole and over a cross-section of oblasts, shows a slight deterioration in the condition of standing trees (defoliation), chiefly in Gomel and Minsk oblasts. Defoliation in Belarusian forests is generally rather worse than in Europe; yet the percentage of dead trees is only 43 per cent of the European level despite the relatively poor state of the country's forests.

33. The network that monitors meadowland growth is sited in accordance with terrain and geographical area. It encompasses the plants growing on meadowland proper, marshy meadowland and water meadows. Monitoring of the higher aquatic flora was conducted in 2000 on seven lakes and six rivers; initial plans had called for 50 lakes and 23 rivers. Primary sites for the developing network include stations with relatively long periods of multi-faceted observations.

G. Monitoring of animal life

34. Monitoring of animal life is at the introductory stage. Its aims and objectives are largely addressed by a system of observations of the state of various populations, notably economically valuable animals (ungulates, aquatic species, fowl and some others) and rare or endangered species, taken in the Berezina and Prypyat reservations, the Belovezhskaya Pushta National Park, and the Polessye radiation-ecology reserve. It covers:

- Fish and related species;
- Terrestrial vertebrates;
- Birds;
- Aquatic animals.

H. Monitoring emergencies

35. Emergencies are monitored when accidents, catastrophes, natural disasters, naturally-occurring emergencies (dangerous weather and agrometeorological conditions), and epidemics affecting man, animals or plants threaten or occur, providing regularly updated information on the situation and how it is progressing for use in reaching decisions on how to

protect people and the environment and contain and deal with the consequences of those emergencies that do occur. Environmentally hazardous economic installations are monitored, as are areas adversely affected by the elements (flooding, forest fires, peat-bog fires etc.) and the sites and districts where disease breaks out.

36. Six different kinds of spontanenous weather phenomena and two kinds of spontaneous agrometeorological condition were recorded in the Republic in 2000. Man-made emergencies caused significant damage to the environment. Numerous accidents on main pipelines - pipes bursting, leaks and other incidents - led to spills of oil and oil-water emulsion, contaminating the land around and accidentally releasing petroleum products into lakes and rivers. As far as life-support systems are concerned, there were breaks in water pipes and damage to the storm-drain system.

37. The Naroch and Pleshchenitsy observatories and the Brest, Soligorsk and Gomel regional seismic stations, which differ in geological formation, type of ground, groundwater levels, seismic background and other criteria, perform seismic monitoring. The observation networks monitor seismic activity around the clock across the country and in the vicinity of particularly important facilities, and study the structure of the lithosphere for practical applications.

I. Local monitoring

38. A local monitoring system is being set up to provide complete, reliable and comparable information about the environmental impact of pollution sources and to verify that the regulations governing technological processes are being complied with. The observations are made by accredited governmental and commercial laboratories under the supervision of Ministry of Natural Resources authorities. Ultimately there are plans to introduce automated, round-the-clock monitoring devices; these will be installed at a limited number of enterprises releasing the largest quantities of the most toxic emissions.

39. A resolution by the Council of Ministers dated 8 February 1999 orders economically active entities, whatever their form of ownership or affiliation, which adversely affect the environment to make arrangements for local monitoring, and assigns governmental departments to draw up and approve the appropriate instructions and other regulatory texts. An order dated 12 May 2000 from the Ministry of Natural Resources approved a list of 33 enterprises for top-priority introduction of local monitoring. A later order, dated 23 February 2001, approved a list of enterprises for subsequent introduction of local environmental monitoring as follows:

- 2001 50 enterprises
- 2002 41 enterprises
- 2003 35 enterprises.

40. An information bulletin was produced and published on the basis of the results from the first series of enterprises where local monitoring was introduced, offering aggregated (monthly average) figures on atmospheric emissions and pollution concentrations in waste water.

41. Most of the first series of enterprises where local monitoring was introduced belong to the Belneftekhim concern, which includes such large plants and conglomerates as Polimir and Naftan (in Novopolotsk), Khimvolokno (Mogilev), Khimvolokno (Svetlogorsk), the Gomel chemical works and GPO Azot, with aggregate emissions ranging from 2,000 to 55,400 tonnes per year. The number of emission sources covered by the local monitoring systems ranges between 1 and 41.

42. Among the enterprises discharging waste water into lakes and rivers which were part of the first wave to introduce local monitoring, mention should be made of the municipal water-treatment works run by the Ministry of Housing and Municipal Services in Minsk, Gomel, Vitebsk and Grodno, with waste flows ranging from 243,000 to 270,430,000 m3 per year, and controlled releases by large enterprises such as Polimir, Naftan and Khimvolokno, the waste-water treatment plant in Mogilev and the Mozyr waste disposal plant with waste flows of up to 76,972,000 m3 per year.

III. PROBLEMS AND PROSPECTS

43. The problems the National Environmental Monitoring System faces are the following:

(a) Ensuring that all types and subtypes of monitoring are fully operational. At present, the air quality, water quality, land, soil, atmospheric ozone content, radiation and woodland monitoring systems are working at full strength. The systems monitoring health, agriculture-related soil contamination, seismic activity, meadowland and animal life, and the local monitoring systems, are at the introductory stage. Development is still in progress on physical phenomena (factors), multifaceted environmental, higher aquatic flora and emergency monitoring systems.

(b) Physical equipment and analytical instruments. Renewing the instruments and analytical equipment currently in use and making use of remote sensing, automatic round-the-clock monitoring and so forth.

(c) Establishing a NEMS information system. This will be a fairly complex and arduous process since different organizations and institutions are studying environmental quality indicators in a variety of ways and the results they obtain are not generally available for widespread use by experts in the field. The introduction of unified standards for the storage and presentation of monitoring data and the development of technology to process the data are also proving difficult. The problems of access to the data bases at governmental departments remain unresolved for now: quite often large bodies of expensive environmental data are left without any systematic organization and untapped. For a wide variety of reasons many constituent elements of the System have no access to international environmental information services.

(d) Operating the NEMS Main Information Analysis Centre and centres for individual types of monitoring. This will require the installation/upgrading of computer hardware and software and the development and adoption of electronic publishing technology for NEMS information.

44. Plans for the very near future include work on the legislative and regulatory underpinnings for the System (drafting legislation on environmental monitoring in the Republic of Belarus, regulations to govern exchanges of information between the constituent elements of the National System and within the local monitoring system, and other texts to do with the conduct of individual types/subtypes of monitoring). The organization of work, including the establishment of the network of observation stations and laboratory designations, will be completed with a view to ensuring that all types of monitoring are in full operation.

45. It is assumed that the National System will be provided with scientific and technical support - the execution of individual assignments (topics) relating directly to work on individual types of monitoring programme, and improvements to (reviews of) the observation networks, the indicators tracked, and the methods and routines followed - through the State's multidisciplinary science and technology and departmental programmes.

46. Departmental and corporate networks responsible for specific geographical areas need to be set up to meet the information needs of the Ministry of Natural Resources and governmental bodies and authorities, and to coordinate work under the NEMS Programme. Given the relative complexity of the NEMS information system and the various degrees of readiness for full operation of its constituent parts, it makes economic sense to construct the information network step by step, concentrating on the primary tasks - gradually linking the information analysis centres associated with individual types of monitoring into the main NEMS information analysis centre for their demarcated areas, and developing special operating software for the corporate network.

47. One of the main tasks of the National System is to prepare and arrange for the publication of the resulting documentation: yearly compendiums of observations by the System, information bulletins, and yearbooks on individual types of monitoring. National centres for forest and ozone monitoring have been set up and are in operation, and a national centre for plant-life monitoring and centres for medical and other kinds of monitoring are being set up as part of the National System, to process, supply and exchange information with international organizations. The NEMS main Information Analysis Centre now exists to interpret and prepare System information.

48. NEMS data are used in international collaborative work on projects to reduce transboundary pollution and bring the environment back to normal in the Dnieper, Western Bug and Western Dvina basins. For closer collaboration and international cooperation in environmental monitoring and protection, promising specialist personnel will need to be given opportunities to attend training and study courses, international seminars, conferences and congresses.
