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ENVIRONMENTAL MONITORING AND REPORTING BY ENTERPRISES

EASTERN EUROPE, CAUCASUS
AND CENTRAL ASIA

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NOTE

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

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This publication results from a series of meetings organized by the UNECE Working Group on Environmental Monitoring and Assessment during the period from June 2005 to November 2006.

Aare Sirendi (Estonia), consultant to the UNECE secretariat prepared first draft guidelines on strengthening environmental monitoring and reporting by enterprises. He, Angela Bularga (secretariat of the Environmental Action Programme Task Force) and Alexey Kostine (Russian Federation) led the discussions on this document at a Workshop in September 2006. Many members of the UNECE Working Group on Environmental Monitoring and Assessment provided valuable comments that helped to finalize the guidelines. Mikhail Kokine from the UNECE secretariat served as both editor and overall project manager.

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Preface

The "Environment for Europe" process, under the aegis of the United Nations Economic Commission for Europe, has worked since 1991 to strengthen international cooperation to protect and improve the environment across Europe.

At the fifth "Environment for Europe" Conference, in Kiev, Ukraine, in 2003, environment ministers stressed the importance of environmental information and data for policy making and public awareness. For them improving environmental assessments, including reporting, especially in countries of Eastern Europe, Caucasus and Central Asia, were top priorities. The ministers agreed to do this with the involvement of business and industry by encouraging the latter to improve environmental management systems and reporting on environmental issues.

To meet this goal, the UNECE Committee on Environmental Policy, through its Working Group on Environment Monitoring and Assessment, undertook the preparation of practical recommendations to countries of Eastern Europe, Caucasus and Central Asia to strengthen environmental monitoring and reporting by enterprises. The Working Group organized a series of international meetings that involved experts from environment ministries, statistical agencies, business and industry and their associations, and civil society organizations.

The present publication results from this collaborative endeavour. It contains the Guidelines for Strengthening Environmental Monitoring and Reporting by Enterprises in Eastern Europe, Caucasus and Central Asia that were approved by the UNECE Committee on Environmental Policy in May 2007

and will be transmitted to the sixth "Environment for Europe" Conference, (Belgrade, Serbia, October 2007).

The publication is aimed at officials and experts working for government bodies at the national and subnational levels responsible for environmental policy, environmental monitoring and compliance monitoring, and statistical agencies in countries of Eastern Europe, Caucasus and Central Asia and other countries, as well as for enterprise management and environmental citizens' organizations. It is my sincere hope that it will prove very valuable to them.

Marek Belka
Executive Secretary
Economic Commission for Europe

GUIDELINES FOR STRENGTHENING ENVIRONMENTAL MONITORING AND REPORTING BY ENTERPRISES IN EASTERN EUROPE, CAUCASUS AND CENTRAL ASIA

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Introduction

The preparation of pan-European environmental assessments, data collection for country environmental performance reviews and reporting under multilateral environmental agreements reconfirmed that substantial improvements in environmental monitoring and data collection are needed in Eastern Europe, Caucasus and Central Asia, especially in such areas as air emissions, water discharges and waste management. Such improvements are difficult to achieve without the commitment and cooperation of enterprises.

The main problems with the existing enterprise environmental monitoring and reporting systems are the following:

(a) Shortcomings or contradictions in basic requirements for enterprise environmental monitoring and reporting in legislation;

(b) Weak coordination and communication between various environmental, health and statistics authorities at different levels in handling and exchanging environmental data that are collected and reported by enterprises;

(c) Lack of trust between public authorities and enterprises;

(d) Lack of a commitment by the general management of industries to environmental issues and a tendency to delegate these to an environmental department or an individual in the company.

To help countries of Eastern Europe, Caucasus and Central Asia resolve these problems, the UNECE Working Group on

Environmental Monitoring and Assessment, in cooperation with other international entities, including the Secretariat of the Task Force for the Implementation of the Environmental Action Programme for Central and Eastern Europe, Caucasus and Central Asia, launched the preparation of the Guidelines for Strengthening Environmental Monitoring and Reporting by Enterprises.

A workshop held in Debe (Poland) in September 2006 provided a forum for the discussion of key issues to be included in the Guidelines by major stakeholders, including government bodies at the national and subnational levels responsible for environmental policy, environmental monitoring and compliance monitoring, as well as statistical agencies, business and industry and their associations, and civil society organizations. Based on the workshop results, the Working Group prepared the present version of the Guidelines in November 2006.

I. OBJECTIVES AND SCOPE OF THE GUIDELINES

The Guidelines aim to promote better enterprise environmental monitoring and reporting in countries of in Eastern Europe, Caucasus and Central Asia and other interested countries on the basis of good practices developed in various parts of the UNECE region and taking into account the requirements of relevant multilateral environmental agreements and decisions of Ministerial Conferences “Environment for Europe”, including the Environmental Strategy for Eastern Europe, Caucasus and Central Asia adopted at the Kiev Ministerial Conference of 2003.

Increasing the quantity of environmental information produced by enterprises, improving the quality of this information and enhancing access to it by the general public will help

decision-making at various levels concerning the prevention and reduction of adverse environmental impacts by enterprises.

Public authorities can use the Guidelines to improve the legal and regulatory framework for enterprise environmental monitoring and to streamline the requirements for environmental reporting (including statistical reporting) by enterprises. The application of the Guidelines will strengthen monitoring of enterprise compliance with environmental regulations. It will also help to improve data collection in order to produce national environment assessment reports and other assessments for decision-making. In addition, it will help public authorities in reporting data under multilateral environmental agreements and programmes.

The Guidelines respond to the increasing need for socially responsible behaviour by industry, especially in the environmental field. With the help of the Guidelines industrial operators will be able to develop and implement effective enterprise environmental monitoring programmes that have value added for them as well. Better enterprise environmental data collection will help the management to understand the effects of the company's environmental performance on profitability, market value and investment decisions. The Guidelines may also help to establish similar or compatible conditions for business and industry throughout the region in their environmental monitoring and reporting, thus avoiding impediments to investment and trade.

The Guidelines reflect the general need to make environmental protection a shared responsibility of different stakeholders and the goal of authorities to establish strategic partnerships with stakeholders.

II. GENERAL RULES FOR ENTERPRISE ENVIRONMENTAL MONITORING AND REPORTING

A. Definition and purpose

Enterprise environmental monitoring and reporting is the system of measures implemented and paid for by operators, who are the natural or legal person exercising actual power over the technical functioning of the facility (i.e. one or more installations on the same site, or on adjoining sites). Such a system includes continuous and periodic observations; the recording, storage and treatment of data relating to environmental protection; and the reporting of the results to the management and all employees of enterprises, the public authorities and the general public as sets of primary, calculated or aggregated data and general information.

As a priority, mandatory enterprise monitoring systems (defined as production environmental control in the legislation of some EECCA countries) should ensure that operators accurately report releases of pollutants to air, water (to surface water, to sewers without a final wastewater treatment plant and to off-site wastewater treatment plants) and land (including by underground injection) as well as off-site transfers of waste or wastewater fed into a (public) sewer system. Reporting of an enterprise's impact on environmental media outside its sanitary protection zone, of waste avoidance or minimization, and of the effectiveness of enterprises' environmental protection measures may be a longer-term objective.

By requiring better enterprise environmental monitoring on the basis of the existing legislation or by improving the latter, public authorities should aim at obtaining benefits for society as a whole (reaching an appropriate balance between environmental, economic and social objectives) through:

(a) Improved control over sources of impacts on the environment and an earlier proactive response to irregular situations, based on the operator's knowledge of and experience with the process;

(b) Increased management environmental awareness and responsibility for regulatory compliance and the prevention and reduction of process releases into the environment;

(c) Increased efficiency in energy and resource use and overall cost-effectiveness of the process, since good enterprise environmental monitoring provides useful information relating to energy use and materials flow;

(d) Increased public access to information and public assessment of enterprise environmental performance, which may lead stakeholders to influence the operator to improve performance (e.g. through industry rating systems);

(e) The use of enterprise environmental monitoring data by the public authorities as an addition to state monitoring programmes for environmental policy purposes.

B. Legal basis

National legislation should at least set basic requirements for mandatory enterprise environmental monitoring and reporting (e.g. basic principles, scope and methods of monitoring, and responsibilities of parties). This may relate, first of all, to enterprises with a certain threshold capacity in the main polluting sectors of economic activity in the country. Legal requirements should be supplemented by regulations such as guidelines for individual environmental media (e.g. air-quality requirements for enterprise zones) and individual industrial branches.

In this respect, it is advisable to apply, among others, the Guidance to Implementation of the Protocol on Pollutant Release and Transfer Registers (PRTRs) to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (www.unece.org/env/pp/prtr.docs.htm) that provide guidance regarding the range of industries that should be subject to mandatory environmental monitoring and the parameters to be monitored. The reference documents concerning the implementation of EU Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC) (eippcb.jrc.es), the Guidance Document for the Implementation of the European PRTR (www.eper.cec.eu.int/) and guidance documents prepared under the North American PRTR (www.epa.gov/tri/programs/prtrs.htm) can also be helpful in determining the list of components to be monitored in different sectors.

The legislation should also ensure that the public authorities have such (well-delineated and not mutually conflicting) powers as:

(a) Requiring operators to perform monitoring according to an endorsed programme;

(b) Gathering additional information, sampling and analysing samples;

(c) Having access to data (including viewing/copying entries into registries of primary monitoring data; ordering the operator to copy documentation and send it to the public authority);

(d) Having access to the site for verification.

The legislation should also include, where appropriate, detailed monitoring requirements regarding measurement programmes and frequency, sets of basic measurement

parameters, reference standards and validation of results. This may help to prevent disputes between the public authorities and individual operators and to avoid corruption, as the costs of implementing monitoring programmes may vary widely.

The operator should generally be required to develop a draft enterprise environmental monitoring programme and to include a proposal for such a programme in the permit application. Depending on the quality of the programme, the public authorities may either accept it or reject it and demand modifications. Once approved, the mandatory environmental monitoring programme should become part of the permit conditions and be legally binding. A clear link should be established between parameters regulated by permits and mandatory measurement parameters.

The obligation to conduct enterprise environmental monitoring should apply regardless of ownership. A minimal and distinct set of reporting obligations may be set for small and medium-sized enterprises (SMEs). This may be better done within the permitting process. SMEs that are under reporting thresholds may be obliged to report information on their emissions and discharges (although not necessarily on a facility-specific basis), if these are significant at the local level. For other SMEs, monitoring requirements could be set on a voluntary or pilot basis.

Operators should be allowed to perform the measurements themselves or engage an external organization to do it. The same requirements for quality assurance should be applied in both cases. These include standardized methods of measurement, certified instruments and personnel, and accreditation or verification of laboratories.

The operator should be obliged to submit enterprise environmental monitoring data to the public authority:

(a) Periodically, according to a predefined schedule;

(b) Immediately, when violations are discovered, or in the case of any incident or accident or adverse meteorological event that is causing or may cause significant pollution; and/or

(c) Upon the request of the public authority.

Besides analysis and reporting, the operator should be obliged to take actions for improvement when enterprise environmental monitoring data show non-compliance with regulatory requirements. The legislation should foresee, where appropriate, penalties, including criminal sanctions in case of infringement of the enterprise environmental monitoring programmes and for false reporting, inexcusable failure to report, distortion of a monitoring device or falsifying or failing to keep records.

The national legal framework should define the obligations of public authorities which should collect, validate and manage environmental monitoring data from enterprises, as well as deal with accessibility to the data and confidentiality issues. A "single-window" approach should be introduced, step by step, to facilitate enterprise environmental reporting to the public authorities. If necessary, a new legal instrument should be developed to ensure a comprehensive and workable system leading to the establishment of a national PRTR.

C. Monitoring approaches

Enterprises should use *(a)* direct monitoring based on measurements; *(b)* indirect monitoring based on estimates (obtained through, e.g., use of surrogate parameters, mass balance calculations or emission factors); or *(c)* a combination of these

two approaches. The choice of monitoring approach will be based on the following criteria:

(a) Fitness for purpose (i.e. is the method suited to the original reason for monitoring?)

(b) Compliance with legal requirements (i.e. is the method in line with international and national legislation?)

(c) Adequacy of facilities and expertise (i.e. are the available technical equipment and the professional expertise of the staff adequate for the proposed method?)

Surrogate parameters are measurable indices which can be directly or indirectly related to standard direct measurements of pollutants and which may be monitored and used instead of direct release indices. They can give early warning of possible increases in emissions and can sometimes be even more accurate than direct measurement results. The use of surrogates may not always be possible, however, and it may be valid only for a certain range of process conditions. Other disadvantages of surrogates include the lack of public confidence in them compared to direct measurements and their unsuitability for legal procedures.

Mass balance monitoring is a method that accounts for inputs, accumulations, outputs and the generation or destruction of the substances in question. The releases to the environment are then calculated based on the difference in balance. Mass balances can be used to estimate the emissions from a facility, process or technological unit. Mass balances can be used only when the exact input, output and quantities can be determined. Discrepancies connected with the tracking of individual materials or with other activities at each stage of material handling can result in large deviations for total facility releases, however. A slight error at any one step of the operation can significantly affect release estimates.

Emission factors are values that can be used to estimate releases by multiplying these factors by the capacity of the installation or by its throughput data (e.g. production output or water consumption). Emission factors are in general expressed as the amount of a pollutant released divided by the unit of throughput (weight, volume etc.) of the facility emitting the substance – for instance, kilograms of pollutant emitted per cubic metre of combustion gas. Empirical relationships or emission factors do not always exist for all sources. In these cases direct measurement of releases is the only way to obtain an estimate of the amounts of pollutants.

The approach to be adopted in a monitoring programme may be chosen, proposed or specified for use by the public authority or the operator. (In the latter case, approval from the authority is needed.) In each situation, the public authorities should weigh the need for, and the added value of, direct measurements against the possibility of simpler verification using indirect methods. Whenever direct measurements are not used, the relationship between the method used and the parameter of interest should be demonstrated and well documented.

D. Types of monitoring

Enterprise environmental monitoring generally includes operation monitoring, emission monitoring and monitoring of environmental quality.

Operation monitoring is the measurement of the physical and chemical parameters of the technological process in order to confirm that the plant is functioning within the required limits. Examples of the parameters to be measured are the pressure or temperature in the reactor, the oxygen content in the biological treatment process of wastewater, and the flow rate of raw

materials. Operation monitoring also includes supervision of the operation of pollution control devices to make sure they are functioning properly. It should guarantee the prevention of process malfunctions and the minimization of environmental impacts.

Emissions monitoring is the supervision and measurement of emissions and releases from the plant at source. It includes the continuous or routine measurement of production losses, air emissions, wastewater discharges, amounts of hazardous and non-hazardous wastes and nuisances (heat, noise, vibration, etc.).

Monitoring of environmental quality is the monitoring of pollution levels in the environment surrounding the facilities and, in the future, of the effects of the operation on human health and ecosystems. The purpose of environmental-quality monitoring is to provide information for decision-making to make sure that environment quality and human health objectives are realized. Even if operators do not perform environmental-quality monitoring themselves, they should cover its costs. Environmental-quality monitoring may be contracted out to specialized organizations which have the required competence.

The public authorities should decide on the specific parameters of emissions and environmental-quality monitoring. The operation parameters to be monitored will be defined by the operator on the basis of regulatory and technical documentation. Exceptions may apply for the monitoring of parameters that are crucial for calculating emissions indirectly or describing the conditions relevant for emissions and environmental-quality monitoring. The public authorities may also impose special terms for operation monitoring of purification or abatement equipment.

E. Timing considerations

Various timing considerations should be taken into account when setting monitoring requirements for enterprises. It is important to establish the exact time when samples or measurements should be taken. Other relevant factors are the averaging time of the measurement result and the frequency of sampling.

The basis for the monitoring timing requirements is the description of the emission limit value (ELV) in the permit. ELV requirements and corresponding compliance monitoring should be clearly defined and indicated in the permit so as to avoid misunderstandings. ELVs can be set with various averaging times (hour, day, month, year, etc.), or maximum peak values can be established, and the monitoring programme should make it possible to check compliance with ELVs based on different averaging times. In establishing timing requirements, the type and size of the facility as well as its hazardousness should also be taken into account, and these conditions should preferably be regulated directly by legal act.

The total duration of an enterprise environmental monitoring programme is linked to the operating life of a process. In case of environmental-quality monitoring, the public authorities should require, where necessary, an assessment before a process has begun operating in order to establish the baseline ambient status.

The pre-operation monitoring programme depends on the risk level of the facility and the specificity of the area surrounding the site. Enterprise environmental monitoring will sometimes be required to continue under the responsibility of the operator after a process has ceased to operate, if its harmful effects are more

durable. For example, groundwater can be monitored after the closure of fuel depots or landfill sites. The post-operation enterprise environmental monitoring should be determined for individual facilities based on the likelihood of remote effects of their processes.

F. Costs of enterprise environmental monitoring

The "polluter pays" principle is the basis for enterprise environmental monitoring, and therefore the polluter should generally cover the costs of monitoring. Assessment of the costs of enterprise environmental monitoring could be undertaken to reach an optimal balance between the scope and accuracy of enterprise environmental monitoring and the associated costs. A general rule in designing enterprise environmental monitoring programmes is that a streamlined monitoring system that works well will always be better than a more complicated system that does not work properly. Optimization of costs should be performed when possible, but always without losing sight of the overall objectives of enterprise environmental monitoring.

G. Access to information

It is advisable to give members of the public access to reviewing draft monitoring programmes within the permitting process. Information obtained through mandatory self-reporting should be made available to the general public through databases kept by the public authorities and through annual corporate reports and corporate databases open to the public. Information should be made available in the form requested unless it is reasonable to make it available in another form or the information is already publicly available in another form. It should be made available free of charge or at such a minimum charge as to cover the cost of

reproducing the information. Information should be specified geographically, where applicable.

Members of the public should be granted access, to the extent possible, to the enterprise environmental monitoring information without having to state the reason for their interest. This can be done by ensuring, for instance, direct electronic access via the Internet. Under normal operating conditions, this should allow the information to be continuously and immediately available, as appropriate, and its design should take into account the possibility of its future expansion and should include all data reported for previous reporting years.

III. ELEMENTS OF AN ENTERPRISE ENVIRONMENTAL MONITORING PROGRAMME

The parameters to be monitored, the frequency of monitoring, and the types, methods and organizational forms of monitoring may vary according to the risk that different categories of facilities pose for the environment and human health, individually or due to the high cumulative effect of multiple sources.

A. Parameters measured

Enterprise environmental monitoring programmes should generally focus on main groups of parameters, as follows:

(a) Use of raw materials and energy;

(b) Operating conditions of the plant that affect releases;

(c) Channelled emissions of waste gases and particulate matter to ambient air from stationary sources;

(d) Controlled discharges of wastewater via sewers to and from wastewater treatment plants, and directly to the environment;

(e) Controlled disposals of solid waste to landfill sites, as well as controlled disposals of solid and liquid wastes to incinerators;

(f) Diffuse (fugitive) releases to air, water and land;

(g) Releases that are accidental (including spilling, emitting, discharging, injecting, disposing or dumping) or through sewer systems without final wastewater treatment;

(h) Levels of noise, vibration, and other nuisances;

(i) Quality of atmospheric air, water in water bodies (including groundwater) and soil in the vicinity of the facilities.

B. Main steps and elements

The following steps are involved in developing a monitoring programme for implementation by the operator:

(a) **Specify programme goals**. The goals should be documented at the start and kept under systematic review. In addition to the understanding of data uses, the actual and potential users of the monitoring data should be identified. The objectives of the monitoring need to be made clear to and discussed with the data's users and any third parties involved. The monitoring data should be regularly compared with the programme goals to ensure that these are being met.

(b) **Establish responsibilities**. The mandatory environmental monitoring responsibilities of the operator should be clearly stated. The permit should include the statement that the principal responsibility for the monitoring and its quality remains with the operator even if the operator has used external contractors to undertake the actual monitoring work.

(c) **Identify the programme's scope**. The programme should specify clearly and unambiguously the pollutants or parameters being monitored. As enterprise environmental monitoring should provide authorities with adequate information on emissions and their variations in time, in certain cases the number of parameters to be monitored may exceed the number of parameters for which ELVs are established. In that case the monitoring of additional parameters will have mostly an information function. The public authorities should avoid unjustified additional load to the operators.

(d) **Decide on the approach and monitoring methods**. The enterprise environmental monitoring programme should first identify and describe whether direct or indirect monitoring is required. After that the technical details of particular methods should be given. Different approaches can be chosen to monitor a parameter, including direct measurements, surrogate parameters, mass balances, emission factors and other calculations. In choosing one of these monitoring approaches, there should be a balance between the availability of the method, its reliability, its level of confidence, the costs and the environmental benefits.

(e) **Specify the technical details of a particular standard or other measurement method and the units of measurement**. The operator should use only validated measuring methods whose performance criteria are known and formally documented. Usage of standard methods required by the International Organization for Standardization (ISO) or other international standards, such as those of the European Committee for Standardization (CEN) or the American National Standards Institute (ANSI), is recommended. When necessary, internationally approved calculation methods such as the Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel for Climate Change (www.ipcc-nggip.iges.or.jp/public/gl/invs4.htm) and the EMEP/CORINAIR

Atmospheric Emission Inventory Guidebook (www.unece.org/env/lrtap/welcome.html) should be used. If these are not available or not applicable, national standards or alternative methods may also be used with the prior approval of the public authority. The monitoring programme should specify performance criteria for the method, including uncertainty, limit of detection and specificity.

(f) **Specify the timing requirements of sampling and measurements**. Several timing considerations are relevant for setting monitoring requirements in permits. The most important of them are the time when samples or measurements are taken, the averaging time and the frequency. The frequency with which the parameter is monitored may vary depending on the needs, the risk to the environment and the monitoring approach taken.

(g) **Specify unambiguously the location where sampling and measurements should be performed**. The sampling or measurement points should match the positions where the emission limit values are applied and should be based on requirements of sampling and measurement standards. The operator should provide for sampling or measurement sites according to enterprise reference documentation. Relevant requirements for technical facilities such as measurement platforms and sampling ports should also be established.

(h) **Define the operational conditions, including production loads**, under which the monitoring is to be performed. If average or nominal production or capacity at the facility is required, this should be numerically set.

(i) **Establish appropriate quality assurance and control requirements** so that the measurements or estimates are reliable, comparable, consistent and auditable. This includes calibration and maintenance of the monitoring system when

necessary, the use of recognized quality management systems, periodic checks by an external accredited laboratory and certification of instruments and personnel under recognized certification schemes.

(j) **Define the recording and reporting requirements**, specifying what results and other information are to be kept and reported, and when and how this should be done.

(k) **Make arrangements for the assessment and reporting of exceptional and accidental releases**. Foreseeable exceptional releases occur during start-ups and shut-downs of the process and maintenance of the equipment.

(l) **Establish an internal framework to ensure compliance**, including allocation of environmental responsibilities to the facility's personnel at all levels, a system of internal audits, corrective actions and staff training. Company management will need to carefully consider and use incentives for inducing environmentally responsible behaviour among staff, regardless of their position in the hierarchy.

(m) **Provide a clear statement of the compliance control procedures and the response in case of non-compliance**.

The public authorities, in cooperation with accreditation organizations, should be responsible for assessing, endorsing and checking the correct implementation of the mandatory monitoring programme. Enterprise environmental monitoring does not change the duty of the public authorities to assess compliance through inspections and by using monitoring data from accredited laboratories that are not linked with the enterprise being checked.

IV. QUALITY ASSURANCE AND QUALITY CONTROL

A. Quality assurance and control

The public authorities should require operators to conduct data quality assurance activities in order to ensure the reliability of enterprise environmental monitoring data. Several types of such activities exist, and the public authorities should determine which ones guarantee the obtaining of data of the highest quality. The main activity types are:

(a) Sampling and analysis according to the required techniques and laboratory practices;

(b) Performing analysis at certified or accredited laboratories;

(c) Calibration of equipment according to designated techniques;

(d) Self-certification of monitoring data; and

(e) Participation in laboratory inter-calibrations and other evaluations.

Quality control activities should be used to ensure that measurement uncertainty is maintained within acceptance criteria for the attainment of the data quality objectives of the enterprise environmental monitoring programme. Quality control includes preparing protocols for site operation, equipment maintenance and record keeping. It is also necessary to prepare protocols for equipment calibration and site visit schedules, as well as for data inspection, review, validation and use.

B. Quality management systems

Environmental monitoring activities should be included in an overall quality management system for an installation. Quality management systems (e.g. BS EN ISO 9000) are useful for ensuring that the equipment and methods used in the measurements as well as the various monitoring tasks are carried out according to the requirements. Quality assurance includes maintenance and calibration procedures. Environmental management systems assist in the systematic management of monitoring data, for instance, in relevant documentation and in the practical organization of the tasks.

Standards should be adopted setting competence requirements for the personnel carrying out the monitoring tasks and the laboratories participating in the work. The IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (www.ipcc-nggip.iges.or.jp/public/gp/english/gpgaum_en.htm) may be used for this purpose. Good practices for accessibility and quality in release data reporting are described, in particular, in the Reference Document on General Principles of Monitoring published by the EU IPPC Bureau (http://eippcb.jrc.es/). The Resource Centre for PRTR Release Estimation Techniques of the Organisation for Economic Co-operation and Development (http://206.191.48.253/) provides access to guidance manuals on issues like emission factors, mass balance methods, engineering calculations and monitoring information.

C. Certification, accreditation and calibration

Certification involves systematically comparing different aspects of monitoring, such as equipment, quality management systems and personnel with documented criteria and procedures. It

should be done by an organization which is formally accredited as competent to do it and which is independent of the operator and authority. Self-certification may also be desirable for all reports submitted by the operator and is used in some countries. The report must be signed by an authorized person or that person's authorized designee and must include a certification stating that the information submitted is true, accurate and complete. The law should foresee sanctions in cases of falsification of reported data.

The use of accredited organizations and methods should be required for monitoring work. Accreditation is used formally to show that an organization is competent to do a specific task, or that a method is fit for a particular purpose. An analytical laboratory is accredited to do one or more specific analyses. To ensure quality control, the accreditation should follow the ISO 17025 standard.

To ensure metrological support of analytical control activities, calibration should be done. Calibration is used to test the performance of monitoring equipment against standard samples. Calibration is done under controlled conditions, and its aim is to check that the equipment is giving results which are precise within the required limits. Calibrations should be repeated at regular intervals to ensure that the required performance is maintained. They may be done at an installation or in an off-site laboratory.

V. RECORD KEEPING AND REPORTING

A. Record keeping

The operator should record all sampling, analyses, measurements, examinations, calibrations and maintenance

carried out in accordance with its environmental monitoring programme. Records should be kept a sufficient amount of time. In establishing the retention period it is necessary to follow the requirements of international agreements and national legislation.

The retention period for records will depend upon the type of enterprise environmental monitoring, the parameter monitored, the category of facility and the demands for further analysis and verification of data. For instance, data on persistent pollutants should be kept for a period equal to the time required for their biodegradation in the environment. Data on toxic substances, especially carcinogens, should be kept for a period equivalent to the duration required for the manifestation of intoxication symptoms under chronic exposure, whether directly or through biomagnification.

The operators should ensure efficient data management, including the creation of automatic systems for information collection, recording, search and processing. Environmental data management systems should be entirely associated with systems of technological and financial management at the facility. The structure of databases and software supply of information systems should enable their future development.

B. Mandatory reporting

The operator should be required to present the results of mandatory environmental monitoring in summarized form to the public authorities. Besides helping to assess regulatory compliance and determine regulatory charges and environmental taxes, enterprise environmental monitoring provides data for emission inventories. These and other uses should determine the character of reporting requirements.

From the large amount of data generated when a parameter is monitored, a summary of the results over a certain period of time should be presented to relevant stakeholders. Standardization of reporting formats facilitates the electronic transfer and subsequent use of data and reports. Depending on the medium and the monitoring method, the report may include averages (e.g. hourly, calendar day, monthly or annual averages) and/or peaks or values at a specific time or at times when the ELVs are exceeded. In addition to emission data and uncertainty assessment, adequate documentation of the data production chain and reference measurements should be presented.

Enterprise environmental monitoring data should be reported in line with agreed schedules and criteria, or in response to requests. The enterprise environmental monitoring programme should contain specific reporting conditions and schedules which will state how, when, by whom and to whom the data are to be reported, and what types of data are acceptable (e.g. calculated, measured, estimated). The schedules should specify the type of reporting, the frequency of recurring reporting and report submission dates. The schedule might cover the timescales and locations of interest and the format of the data. It might also give details of relevant limits, the units to be used and any normalization required (e.g. to standard temperature and pressure conditions).

A data transfer system should allow a smooth and possibly automated data flow from individual operators to the public authorities and to a publicly accessible website. The operators should use standardized reporting formats developed at the national level. The public authorities should make electronic reporting forms available on their websites. Each operator should be assigned a user name and a password so as to be able to download and submit these forms.

VI. DATA MANAGEMENT BY THE PUBLIC AUTHORITIES

Validation of data may be more easily achievable if responsibility is delegated to competent local or regional (subnational) authorities or to competent regional (subnational) or local offices of national authorities, since they will be closer to the operators and are more likely to have an overview of the latter's activities. It may be particularly useful to link the validation of the data to other controls of facilities – for example, via regular or extraordinary environmental inspections or by state monitoring of pollution sources.

Once the authorities receive monitoring reports from enterprises, the responsible person should check these without delay and take necessary actions (e.g. request additional information, require that some data be verified, or conduct an inspection to validate data). After the responsible person validates enterprise environmental monitoring data, these should be uploaded to the relevant database.

The legal and institutional structures for the collection of data may vary according to the environmental medium. Although legal competence may be divided between various public authorities, one institution at the national level should be responsible for compiling the complete data set for the whole country. The same data should be used for all reporting purposes to afford conformity between the different databases. For instance, consistency of reported emission data should be ensured, as these data are used in preparing national emission inventories and in reporting to the governing bodies of multilateral environmental agreements.

VII. PROMOTION OF ENTERPRISE ENVIRONMENTAL MONITORING AND REPORTING

A. Establishing dialogue and optimizing costs and benefits

There is a need to establish constructive dialogue between the public authorities, members of the public and the operators in order to strengthen the motivation of industry to perform enterprise environmental monitoring and reporting adequately. There is a need to regulate the principles for the involvement of members of the public in defining the open parameters of enterprise environmental monitoring.

The public authorities should consider the costs of monitoring, data production, analysis and reporting when imposing monitoring requirements. Adequate scope and frequency of enterprise environmental monitoring should be established on the basis of dynamic, simple and transparent prioritization rules. The public authorities should encourage operators and staff implementing enterprise environmental monitoring programmes to take account of opportunities to improve the cost-effectiveness of monitoring technologies.

B. Developing guidance and training personnel

The public authorities should develop or revise appropriate reporting forms and improve existing reporting methods (e.g. by establishing online reporting) and should develop guidance documents related to pollution measurement, calculation and estimation (or translate available international guidelines and disseminate them to operators). The public authorities of interested EECCA countries should undertake, in particular, the development, at the international level and in close cooperation with business and industry, of detailed manuals on model

environmental monitoring programmes for enterprises in major polluting sectors (chemical, oil and gas, and still-making industries and others).

They should also aim at integrating open media-specific reports and reducing the frequency of mandatory environmental reporting. Introducing annual reporting could be a tool for meeting the latter objectives. This should be decided in cooperation with the statistics departments.

The public authorities should provide methodological support to enterprise analytical laboratories through the creation of national reference laboratories, involvement of enterprise laboratories in the international inter-calibration and training of personnel. Operators should involve organizations specialized in environmental reporting and reporting in the field of sustainable development in training their personnel.

C. Promoting environmental management systems

The public authorities should encourage operators to establish and enhance enterprise environmental monitoring programmes that go beyond regulatory requirements. Specific legal approaches, policy considerations and inducements should be considered to promote voluntary auditing and environmental management systems (EMS), which frequently include additional (voluntary) enterprise environmental monitoring. The results of such enterprise environmental monitoring cannot be used to penalize operators, since they aim to reduce the risks to the environment. On the contrary, they are likely to reduce the chance of penalties being imposed for violations of legal requirements set by permit conditions or directly by legislation. Operators can use the results of monitoring to demonstrate their company’s positive performance to customers and other stakeholders.

EMS focuses on the actual and potential environmental impacts of a company's production activities and services, including the wider impacts on society and the municipality in which the company operates. The company should first develop an overall corporate environmental and sustainable development strategy. Specific targets, goals and objectives should be integrated into a strategy based on the concept of continual improvement in environmental performance. To measure improvement in a company's environmental performance, accurate and reliable statistical data are collected, along with other specific information about environmental impacts.

The public authorities should encourage operators to establish EMS based on ISO 14001 or the EU Eco-Management and Audit Scheme (EMAS) and publication of open environmental and sustainability reports by which stakeholders, clients and members of the public get information about the operator's environmental performance.

The public authorities should launch information campaigns and training programmes to demonstrate to operators that better environmental data collection and reporting using EMS can help them to, *inter alia:*

(a) Establish environmental priorities and improve environmental performance;

(b) Identify areas of wasteful and inefficient use of natural resources, materials and energy to improve processes and reduce costs;

(c) Improve regulatory compliance with the possibility of less frequent inspections; and

(d) Establish better relations and improved communication with the public authorities, employees, shareholders and the general public.

D. Corporate reporting and environmental performance rating

Mandatory, regulatory environmental reporting and voluntary additional environmental and sustainability reporting do not contradict each other and are mutually complementary, providing complete information for public needs and the most important exposure data for communities and other stakeholders.

In order to simplify complicated systems and to transmit meaningful information about the performance of an operator, company or geographic region, or to compare the performance of different industries, environmental indicators are used. These indicators may be used to report on environmental performance to the public, including the investment, insurance and banking communities, and to set the framework for a methodical assessment of progress. The public authorities should encourage operators to use relevant indicators developed in accordance with international standards when reporting on their environmental performance, including relevant indicators from the Guidelines for the Application of Environmental Indicators in Eastern Europe, Caucasus and Central Asia.

The public authorities should encourage operators to disclose information through corporate reporting and to use relevant guidance developed in accordance with international standards to prepare corporate environmental and sustainable development reports. They should also consider harmonizing, as much as possible, regulatory reporting with international standards and benchmarks for corporate reporting.

Operators may consider applying international principles and guidelines such as universal social and environmental principles of responsible business approved by the United Nations Global Compact (http://www.un.org/Depts/ptd/global.htm), the guidelines for reporting sustainability promulgated by the Global Reporting Initiative (www.globalreporting.org), *Measuring Eco-Efficiency – A Guide to Reporting Company Performance* by the World Business Council for Sustainable Development (www.wbcsd.org) and the recommendations of the organization CSR-Europe (www.csreurope.org).

The public authorities should promote the creation of independent socio-environmental performance industry rating schemes based on enterprise environmental monitoring data and support the use of such ratings by industry associations, insurers, banks and the like for business self-regulation and to help simplify enterprise information so as to make it more acceptable and meaningful for the general public.
