5. Environmental Quality Targets and Environmental Monitoring

Definition and objectives

Environmental quality targets are science-based indicators of environmental quality approved by public authorities. They serve as instruments for the quantitative performance measurement in the implementation of the concept of sustainable development. In this context environmental quality monitoring is the regular and systematic analysis and assessment of the state of the environment and its trends based on carefully constructed metrics for pollution control and natural resource management1.

The aim of environmental quality targets is to define an accepted state of the environment both in terms of quantity and quality. For example, a quantitative target can be established to govern water extraction from rivers to ensure minimum water flows needed to protect fish whereas quality targets might be based on physio-chemical, biological and morphological parameters. Air quality standards in cities are also a good example for environmental quality targets.

Environmental monitoring systems shall contribute to achieving targeted, resource-efficient and economic solutions to environmental problems. They serve the following objectives:

1) Assessment of environmental quality in a given region to identify risks to human health as well as risks to nature and the environment.
2) Baseline information to contribute to the establishment of local or national environmental quality targets.
3) Identification of long-term environmental pollution trends starting from baseline assessments.
4) Information for concerned individuals in the public and establishment of information channels to warn the public of increased health risks caused by environmental pollution.
5) Development of policies, regulations, action plans and/or management strategies to achieve environmental targets.
6) Assessment of impacts and evaluation of policies, regulations, action plans and/or environmental quality management strategies.

Environmental quality monitoring systems are established according to environmental quality legislation and specified technical rules set by government and devolved specialised agencies for collecting, evaluating and documenting environmental quality information. These main implementation actors can cooperate with the relevant government administration at local, regional and national levels. The technical management of environmental quality monitoring initiatives may be entrusted to public agencies, private companies, scientific units or industrial and infrastructural facility managers (e.g. airports, harbours, industrial estates), however, the collected data need to be directed to a central archive. In many countries, specialised agencies are entrusted with environmental monitoring. Examples include the German Federal Environment Agency (UBA), the United States Environmental Protection Agency (US EPA) and US Council on Environmental Quality. The target groups for providing environmental quality information include the public, political leaders, environmental quality analysts and policy specialists, and emission control technical experts.

Mode of operation

Environmental quality is to be ensured by a targeted combination of both emission and immission (transfer of pollutants to receiving media) monitoring and reduction of emissions at source. Public involvement is a major factor in environmental quality management and public opinion has proved to be a major force in developing

[1] Esty, D. C., T. Srebotnjak, C. H. Kim, M. A. Levy, A. de Sherbinin, B. Anderson Pilot 2006 Environmental Performance Index, Yale Centre for Environmental Law & Policy, New Haven 2006 http://www.yale.edu/esi/

advanced environmental quality standards. The availability of reliable emission and immission data to the public has contributed to reaching a consensus on policy and other measures needed to reduce emissions. This is valid both for the enforcement of emission reduction measures in industry as well as the reduction of non-point sources related to transport, households or agriculture.

The following steps outline how an environmental monitoring system can be developed, how environmental quality targets can be established and how action plans can be developed:

Step	Issues to consider
Establishment of environmental monitoring systems	The public sector initiates the establishment of environmental monitoring systems and environmental targets. Priorities for environmental monitoring should be established in consideration of national and international requirements. Policy makers should establish a continuous dialogue with those who implement monitoring systems. Monitoring results should be widely published in consultation with interested stakeholders. The resources devoted to establishing and operating environmental monitoring systems should be reviewed and monitored with respect to the benefits it provides and the costs it imposes.
Develop the institutional framework	A workable institutional structure including (a) designated institution(s) for environmental monitoring needs to be established. For this, it might be necessary to further develop legal frameworks, and/or to develop adequate financing systems (see below).
Development of environmental quality targets and action plans	At the political level the general targets, norms and standards for environmental quality management should ideally be established by politically accountable decision makers. They should consult experts and relevant stakeholders including the private sector and the general public. Where required standards are not met, environmental management or action plans should be developed and implemented. Action plans need to be set up in a participatory manner, to ensure that interested actors have an opportunity to be involved in the development and implementation of policy.
Implementation of action plans	Action plans should be developed in consultation with consultation with concerned stakeholders in order to improve environmental quality where environmental quality targets are not met to assure acceptable long-term environmental pollution levels.

Table 1: Steps and issues to consider when implementing environmental monitoring measures

The above steps should be seen as cyclic, continuous processes because changes in emissions and/or immissions can result in new risks for health and the environment. Those risks may require an adaptation of strategic planning and the implementation of activities with regard to national environmental policy and/or regional and local quality planning.

It is established practice in Europe and North America as well as in a number of Asian countries to require an assessment of local and regional environmental quality (especially for water and air quality) to provide baseline information before plans to reduce environmental pollution are developed. This ensures that policy makers have the capacity to measure the relative success or failure of measures that may be implemented under the plans. The European Directives on Air Quality and on Water Quality Management in particular define a set of instruments and procedures which link environmental quality with regulatory activities and provide guidance for the improvement of environmental quality in the case of non-compliance.

Financing environmental monitoring systems

Generally environmental monitoring should be considered a public task, however environmental permits and/or discharge fees paid by firms are one means to finance monitoring activities of public agencies as well as representing a manifestation of the "polluter pays principle". To achieve sound environmental monitoring structures concepts have been developed in many countries to invite or even force the generators of environmental pollution to participate in establishing and financing environmental monitoring networks.

Strengths and Weaknesses

The strengths and weaknesses of environmental monitoring and environmental targets are:

Strengths	Weaknesses
■ The impact of emission sources on the state of the environment (immissions) and the resulting risks to human health, nature and cultural heritage can be demonstrated. ■ Environmental quality targets can set a benchmark that is to be striven for through environmental action plans. ■ The assessment of risks caused by pollutants can be based on objective, traceable and reliable information which also enables policy makers to rationally respond to individual complaints of unacceptable environmental conditions (e.g. odour, noise, health effects). ■ A solid quantitative foundation is created for identifying priorities for policy intervention, for establishing environmental targets and for developing environmental policy measures and action plans. Quantitative information collected over time can enable an evaluation of environmental regulations from a financial perspective (e.g. cost per unit of pollution reduced). ■ Environmental monitoring offers information to the public and is the basis for public support for more advanced resource efficiency policies.	■ Immission and emission monitoring requires human and financial resources. In the context of a developing country those resources can often be limited. In such cases, innovative financing schemes involving both the public and private sector need to be further developed. ■ There is a necessity to monitor long-term trends with high time resolution to avoid coincidental or misleading assessments/findings. This in turn can make monitoring programmes costly. ■ Environmental impact chains are often quite complex. Meteorological circumstances or other natural phenomena can influence environmental data which significantly complicates interpretation of data. Communicating monitoring results can be particularly problematic in the instance of non-experts such as the public or political leaders.

Table 2: Strengths and weaknesses of environmental monitoring

Success factors

The following table provides an overview of a number of factors that will support the successful implementation of environmental quality targets and an effective environmental monitoring system:

Success factor	Issues to consider
Engaging stakeholders from civil society	Public interest in environmental quality and environmental pollution reduction should be supported by continuous public communication about the state of the environment and its impact on human well-being, productivity and nature conservation. Engaged citizens and civil society may play a central role in stimulating a public debate on environmental standards and demanding action.
Availability of technical and organisational infrastructure	Availability of technical infrastructure and trained staff/ personnel for immission and emission monitoring equipment including sampling, laboratory and analytical infrastructure, statistical analysis & interpretation and evaluation with respect to control measures greatly influences the quality of data and therefore information obtained.
Existence or set-up of central monitoring institution	All activities such as filing/archiving, evaluation and publication of monitoring results should be coordinated by one national centre or central administration[2]. Environmental Quality Indices (or Environmental Performance Indices/EPI) which integrate a number of indicators into a single index number can be very useful for publication and communication as complex data are reduced to an understandable index. Despite a strong interest in developing globally applicable and comparable indices, there can be good reasons to develop national or regional indices in addition to the global initiatives, which may reflect specific regional and local circumstances.

[2] As the Air Quality Monitoring Group for example is for the US Environment Agency as a whole, see: http://en.wikipedia.org/wiki/_note-4; Another example is the US Council on Environmental Quality: http://www.whitehouse.gov/ceq/aboutceq.html

Sufficient knowledge and implementation capacity	The implementation of findings or pollution reduction measures requires on the one hand a clear national strategy, legal framework and enforcement instruments. On the other hand technical competence and capacity is required at the local level, specifically an environmental authority dedicated to promoting environmental management and enforcing environmental legislation.
Involvement of the private sector	The private sector should be prepared to cooperate with government agencies and civil society organisations and also be prepared to direct resources toward innovation and implementation of cleaner technologies.
Linking targets and monitoring to eco- and energy-efficiency	Better pollution reduction results can usually be achieved if enforcement of pollution reduction measures are combined with eco- and energy-efficiency initiatives supporting resource-efficient economies in, for instance, industry, households and the transport sector.

Table 3: Success factors

Key Literature and Case Studies

Burden, F.; I. McKelvie; U. Forstner; A. Guenther (2002): Environmental Monitoring Handbook. McGraw Hill

Esty, D. C., T. Srebotnjak, C. H. Kim, M. A. Levy, A. de Sherbinin, B. Anderson (2006): Pilot 2006 Environmental Performance Index, Yale Centre for Environmental Law & Policy, New Haven http://www.yale.edu/esi/

Gilbert, R. O. (1987): Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold: New York

Case Studies / Examples	Link
Co-operative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe	http://www.emep.int
The US Council on Environmental Quality	http://www.whitehouse.gov/ceq/
La Fédération des Associations Agréées de Surveillance de la Qualité de l'Air (Good example for financing environmental monitoring systems)	http://www.atmo-france.org/fede_pres.php (French)