

## PART III

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# PROJECT GUIDELINES

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PRINCIPLES OF INDUSTRIAL POLLUTION  
MANAGEMENT  
MONITORING  
SUMMARY OF AIR EMISSION AND EFFLUENT  
DISCHARGE REQUIREMENTS  
POLLUTANTS  
POLLUTANT CONTROL TECHNOLOGIES  
INDUSTRY SECTOR GUIDELINES

# Principles of Industrial Pollution Management

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## A New Approach

In the 10 years since the World Bank Group produced its first set of *Environmental Guidelines*, there has been an important shift in the way in which environmental agencies and the Bank Group approach the problem of minimizing the environmental damage caused by industrial development. In the past, guidelines and legislation tended to focus on achieving acceptable pollution concentrations in different media, and it was logical to rely on end-of-pipe controls and “external” treatment of pollution. Moreover, since environmental concerns were seen as distinct from industrial (“productive”) processes, environmental legislation steered well clear of interfering in industrial production decisions.

This approach has achieved significant reductions in pollution, but the costs have sometimes been high, and performance has not always been consistent. Thus, it has become clear that another approach is required, especially in countries experiencing rapid economic and industrial growth, if progress in preventing industrial pollution is to continue. The new approach that is emerging incorporates the concepts of sustainable development and cleaner production, together with an emphasis on good management practices.

## Sustainable Development

The World Bank Group recognizes and promotes the concept of sustainable development, in which growth and environmental protection are compatible. Within this framework, it is important to avoid or reduce the discharge of pollutants and to minimize their impact on human health and the environment. The *precautionary principle* is a fundamental guiding principle of this *Handbook*: whenever possible, projects should seek ap-

proaches that avoid additional burdens on the environment, especially where the outcome is uncertain and potentially irreversible. One way of applying the precautionary principle is by implementing cleaner production.

### *Cleaner Production and Pollution Prevention*

Pollution prevention is preferable to reliance on end-of-pipe pollution controls. The Bank Group encourages the adoption of cleaner production approaches, which go beyond pollution prevention. Cleaner production encompasses production processes and management procedures that entail less use of resources than conventional technologies and also generate less waste and smaller amounts of toxic or other harmful substances. It emphasizes the human and organizational dimensions of environmental management, including good plant operation to avoid deliberate or accidental discharges.

Industries striving toward environmental excellence now also consider how environmentally friendly the final product is. Thus, a petroleum refinery would not only address the emissions caused by the refining process itself but would also change its processes to discontinue the use of lead as an additive to boost octane in gasoline, because of the well-known serious health effects of lead. Today, cleaner production aims to include everything from the drawing board to final disposal or reuse of the product.

### *Treatment and Disposal*

Cleaner production and pollution prevention can reduce the quantities of waste and eliminate some pollutants, but treatment and disposal of remaining wastes are required. Appropriate treatment systems must be designed and installed to

achieve acceptable emissions levels. The systems must then be operated and maintained to attain the required reductions in pollutants. The transfer of pollutants from one medium to another (e.g., from effluent to sludges) may simplify but does not solve the disposal problems of an industry. An integrated approach should be adopted toward management of pollutants to ensure that the overall treatment and disposal solution is the most appropriate.

Monitoring of control devices, treatment plant performance, and emissions is an integral part of the operation of the system. The information gathered from monitoring should be utilized to achieve and maintain system performance.

### *Good Management*

The Bank Group promotes good management and operating practices such as maintaining and operating production processes and pollution control devices according to design specifications. It encourages the continual improvement of processes, the installation of controls, and the monitoring of performance.

In support of this emphasis on pollution prevention, the new approach also stresses the human and organizational dimensions of environmental management that are required to develop sound plant management and operational practices and the need for a regulatory and resource pricing framework that provides incentives for continuous improvements in environmental performance. In its economic and sector work, the Bank Group assesses the role of prices, taxes, and other instruments to ensure that there are incentives to apply such measures.

### *Environmental Regulations*

The World Bank encourages its country borrowers to develop (a) appropriate permitting procedures to encourage pollution prevention and to decide on applicable emissions limits and (b) sound and enforceable ambient environmental standards. It supports the strengthening of appropriate institutions and the training of staff to identify pollution prevention and cleaner production options and to monitor and enforce compliance with permit conditions and environmental

standards. Some of these responsibilities might be carried out by the private sector as a way of ensuring the long-term sustainability of its investments.

## **Guidelines**

### *Purpose*

The *Pollution Prevention and Abatement Handbook* has been prepared to assist Bank Group staff and consultants, other financial institutions, and borrowers in ensuring that industrial projects achieve adequate environmental performance. To protect human health and the environment, Bank Group-financed industrial projects must comply with pollution prevention and abatement measures acceptable to the Bank Group. The *Handbook* describes measures that the Bank Group would consider acceptable for the purposes of deciding on Bank Group financing. It must be applied in conjunction with other Bank Group requirements, in particular those on environmental assessment, EA (see "Using the Guidelines," below).

### *Scope*

The principal focus of Part III of this *Handbook* is on industrial pollution. However, from the point of view of environmental impacts, the sources of pollution are often very hard to distinguish, particularly in urban areas. Indeed, in many cases, the key issue is to understand the relative contributions of point and nonpoint sources, urban and industrial sources, large polluters and small and medium-size enterprises.

### *Underlying Principles*

The *Handbook* is based on good industrial practices. The cleaner production and waste minimization guidelines cannot cover all possible processes and products, but they do indicate typical levels of performance that are achievable in a well-designed and well-managed plant. The Bank Group supports continuing improvement in industrial efficiency and encourages enterprises to achieve better performance than the *Handbook* recommends.

Minimizing waste reduces not only the demand for resources but also the scale of final treatment required. However, in most cases there will also be a need for pollution control measures to supplement cleaner production efforts. The relevant treatment requirements and the emissions levels given in the *Handbook* are based on good practice; they are intended to be maintained in the long term using the skills and resources normally available in industry in the countries in which the Bank Group operates.

The *Handbook* also stresses the need for good management and for adequate operating and monitoring resources to ensure that a plant's proper environmental performance is maintained, documented, and reviewed as a matter of course. Good pollution management habits should be developed so that good performance becomes routine. Each plant should also put in place measures to minimize accidental releases (such as spills) and emergency response procedures to manage such events.

Design and implementation of industrial projects to minimize the use of resources must include energy conservation measures. Energy efficiency is frequently indistinguishable from environmental efficiency. Whenever possible, both issues should be addressed together.

### *Process of Preparation*

The preparation of the *Handbook* has been a long and cooperative process, drawing on a wide range of expertise and experience both inside and outside the World Bank Group.

The sections in Part III were circulated for comment, initially to a small number of specialists and later to a wider audience of interested parties. The guidelines related to thermal power plants were discussed at a two-day meeting of an international panel of experts at the World Health Organization in Geneva. The review and comment process had to balance breadth of review with the time and resources required for the preparation of each document.

The documents in Part III are intentionally short. Their aim is to emphasize the key points that should be addressed in the preparation of a project involving the particular sector. They are

not intended to be comprehensive guides to the technologies of the sector.

### **Using the Guidelines**

Normal Bank Group procedures for analysis of industrial projects include (a) an appropriate EA that takes into account relevant national legislation and (b) an economic analysis that includes an assessment of the costs and benefits of the alternative environmental measures available for new or existing plant, evaluating reductions in exposure and improvements in ambient conditions compared with the situation without such environmental measures. On the basis of these analyses, site-specific requirements related to the local conditions and resources available are established (e.g., emissions limits and special operating procedures) to ensure that human health is protected and environmental benefits are optimized. Depending on the circumstances, these site-specific requirements will be as strict as, or stricter than, those set out in the *Handbook*. In rare instances, the EA may show that less-strict site-specific requirements would be acceptable. If these are adopted, the project documentation would be expected to provide detailed justification for the measures chosen.

The site-specific requirements determine the level and type of pollution abatement measures required for a particular project. These depend on (a) the impact of the pollutants from that plant on the overall ambient pollution level; (b) the environmental and health damage caused by pollutants relative to the costs of reducing emissions levels; and (c) the most cost-effective options for reducing the ambient level of pollution, for example, through an approach that takes into account systemwide technical and institutional solutions within a river basin, an airshed, or a power grid.

### *Projects Involving New Plant*

An EA for a new industrial project should not only determine the environmental impact of the project but should also identify alternative options for achieving the project objectives at equal or lower cost, taking into account environmental cost. Among the options to be considered are

policy and institutional measures and comprehensive approaches to airshed and watershed management, including use of alternative sources of energy. Some of these alternatives will apply only to projects initiated by governments, but many will also apply to private sector investors who will find it in their best interest to conduct EAs that consider the broadest reasonable range of alternatives. Early investments in a sound EA often pay off in smoother project implementation.

When a project involves adding new plant in an area where there are already plants in operation, the EA should examine a range of alternative ways of reducing the exposure of people and the environment to harmful pollution by taking into account the contribution of other pollution sources. If the EA indicates that there will be no significant deterioration in ambient conditions, the plant should comply, at a minimum, with the measures set out in the *Handbook*.

If the EA indicates that there may be a significant deterioration in ambient conditions, several possibilities should be examined: (a) the new project simply complies with the measures recommended in the *Handbook*; (b) the Bank Group may require the application to the plant of additional measures on the basis of site-specific conditions; or (c) the Bank Group may require, as a condition for providing financing, that further measures be taken to address other sources within the project area of influence, where this is a more cost-effective approach to reducing the overall impacts. This option may call for the assistance of the World Bank Group in facilitating negotiations between various government institutions or between the government and the private sector.

### *Projects Involving Existing Plant*

For any Bank Group-financed industrial project involving significant modifications to an existing facility, the Bank Group requires that the facility undergo an environmental audit as the basis for appropriate project design. The report should (a) assess past and current releases to land, air, surface water, and groundwater; (b) identify good housekeeping and good maintenance practices, process modifications, and end-of-pipe measures that can improve the environmental

performance of the facility; and (c) recommend site-specific targets and a timetable for achieving them.

The economic prospects of an existing industrial plant should define the type of expenditure to be made to reduce pollution. Plants with a longer expected economic life are required to focus to a greater extent on process improvements to reduce their pollution emissions and should be held to standards that approach those of a new plant. Plants with a shorter economic life should make management improvements and should reduce emissions of the most damaging pollutants by implementing other cost-effective measures for which the benefits achieved within the anticipated economic life of the plant exceed the costs involved. With technical justification and government approval, such plants may be held to less strict standards if there is a clear commitment to close the plant within an agreed time period and to avoid or clean up any hazardous materials and soil or groundwater contamination that pose an immediate threat or a persistent risk to human health and the environment.

The Bank Group encourages governments to undertake a process of negotiation between plant owners and management, on the one hand, and local regulators, on the other. The success of cleaner production or industrial pollution abatement measures depends crucially on an agreement with plant managers regarding the management and process modifications that are required, after considering the different options available to achieve environmental objectives.

For each plant, a detailed public schedule should be worked out that refers to the industry's specific pollution performance over time and includes agreements on (a) *initial compliance*, involving management improvements and installation of certain equipment, and (b) *continuing compliance* based on the results of environmental monitoring, which is normally carried out by the enterprises themselves and verified independently.

### *Industry-Specific Guidelines*

The industry-specific sections provide information on pollution prevention measures and emissions requirements. The *pollution reduction targets*

and pollution emissions levels provided cannot be applied rigidly to every project, but they should be achieved wherever possible. Where they cannot be achieved, the reasons for nonperformance should be explained in detail.

Specific *emissions guidelines* are intended to be measurable with the expertise and equipment normally available within the industry or to the relevant regulatory and enforcement body. The intention of the *Handbook* is to present realistic performance levels to which industry will be held rather than nominal targets that enterprises do not take seriously. Where appropriate, the Bank Group may assist in developing local capabilities for monitoring and interpreting results.

New projects should meet the *maximum emissions levels* contained in the sector-specific guidelines unless the site-specific environmental analysis recommends stricter controls or provides a justification for a variance from the guidelines contained in the *Handbook*. The Bank Group requires a site-specific environmental analysis for all projects that may affect the environment. The analysis should take into account local conditions and national legislation.

The *Handbook* is intended to apply to both the design and monitoring of projects. The emissions guidelines are typically stated as concentrations, which are normally more easily measured than loads. However, the objective is to reduce the overall loads discharged to the environment. Any process or operating procedure that uses dilution or similar approaches to circumvent the objective of reducing pollutant loads is unacceptable.

Project design should include consideration of the equipment and personnel requirements for the operation and monitoring of pollution prevention and abatement measures. Basic sampling and laboratory facilities should be included as project components, if necessary.

Avoidance of damage to human health is a principal objective of the guidelines. However, the guidelines focus on industrial sources and do not necessarily reflect all the potential exposures

to pollutants. For example, in dealing with pesticides and fertilizers, there are potentially serious exposures that are not addressed here and that could be far more important than those related to manufacturing and waste disposal. These include exposures of children playing in recently sprayed fields or with large containers (drums), repackaging of wholesale quantities for individual consumption, contamination of the food chain, and so on. Similarly, for lead, the individual industry guideline does not address factors such as removal of existing environmental lead (which can circulate for up to 30 years), nor does it deal with various nonfuel sources of lead that may be more important locally but are often not monitored. Thus, compliance with emissions standards at individual sources can give a false sense of security by creating the impression that the overall problem has been addressed. The appropriate watchword is, "Environmental management, not just pollution control."

### Application of the Guidelines

Technical and managerial circumstances and constraints will continue to change, and further experience will be gained as regulatory and pollution management systems are implemented. This *Handbook* can be used as a basic point of reference, but users must constantly be aware of new developments and change and must apply the advice provided here in the light of conditions that pertain at a given time and place.

The next document in Part III is a discussion on monitoring of pollutants, followed by a summary table of requirements for air emissions and effluent discharges as presented in the *Handbook*. The remainder of Part III presents material on specific pollutants, brief descriptions of control technologies for pollutants of special importance, guidelines for specific industries, and a document on general environmental guidelines. A glossary of terms follows Part III.