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REFERENCE HANDBOOK ON ENVIRONMENTAL COMPLIANCE AND ENFORCEMENT IN THE MEDITERRANEAN REGION

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Mr Yasser Sherif has prepared Part I, Mr Rani Amir has prepared Part II, Mr Allan Duncan has prepared Part III, and Mr Robert Kramers has prepared Part IV of the first draft of the document, which was reviewed by the MED POL staff members. The revised draft document was sent to the countries for comments and it was reviewed by a governmental designated experts meeting. The revised document was adopted by the meeting of MED POL National co-ordinators, San Gemini (Italy) 27-30 May 2003.

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- Curbing Pollution
- Safeguarding Natural and Cultural Resources
- Managing Coastal Areas
- Integrating the Environment and Development

FOREWORD

The riparian States of the Mediterranean Sea, aware of their responsibility to preserve and develop the region in a sustainable way, and recognizing the threat posed by pollution to the marine environment, agreed in 1975 to launch an Action Plan for the Protection and Development of the Mediterranean Basin (MAP) under the auspices of the United Nations Environment Programme (UNEP) and, in 1976, to sign a Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention). The Convention entered into force in 1978 and was amended in 1995.

Recognizing that pollution from land-based activities and sources has the highest impact on the marine environment, the Contracting Parties to the Barcelona Convention signed in 1980 a Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (LBS Protocol). The Protocol entered into force in 1983 and was revised in 1996 to better cover industrial pollution sources and activities and to enlarge the coverage to include the hydrologic basin.

A Strategic Action Programme (SAP MED) to address pollution from land-based activities, which represents the regional adaptation of the principles of the UNEP Global Programme of Action (GPA) to address land-based pollution activities, was adopted by the Contracting Parties to the Barcelona Convention in 1997 as a follow up to the provisions of the revised LBS Protocol. The SAP MED identifies the major pollution problems of the region, indicates the possible control measures, shows the cost of such measures and establishes a work plan and timetable for their implementation.

In order to assist the Mediterranean countries in the long-term implementation of the SAP MED, particularly in the formulation, adoption and implementation of National Actions Plans (NAPs), a three-year GEF Project “Determination of priority actions for the further elaboration and implementation of the Strategic Action Programme for the Mediterranean Sea” was implemented by MAP, and in particular by the MED POL Programme, the MAP Regional Activity Centers and WHO/EURO. The project consists of numerous activities which include, among others, the preparation of regional guidelines and regional plans, whose main aim is to guide and assist countries to achieve the pollution reduction targets specified in SAP MED.

The present document is part of a series of publications of the MAP Technical Reports that include all the regional plans and guidelines prepared as part of the GEF Project for the implementation of the SAP MED.

REFERENCE HANDBOOK ON ENVIRONMENTAL COMPLIANCE AND ENFORCEMENT IN THE MEDITERRANEAN REGION

TABLE OF CONTENTS

PREFACE

Within the framework of the MED POL Programme Phase III for the Assessment and Control of Marine Pollution in the Mediterranean adopted in 1996, special reference is made on the pollution control component to assist countries to fulfil the provisions of the Protocol for the Prevention of Pollution from Land-based Sources and Activities (LBS Protocol). In fact, Article 6 of the Protocol, which was signed in 1980 and revised in 1996, calls for the strengthening and/or establishment of systems of inspection related to land-based pollution.

Among the activities for the promotion of the environmental inspections, a workshop of experts on Compliance and Enforcement of Legislation in the Mediterranean for Control of Pollution resulting from Land-based Sources and Activities, was convened in Sorrento, Italy in 2001, to review progress in that field and discuss future activities. As a result, it was recommended that guidelines on compliance and enforcement be developed, indicating the general lines to be followed rather than going into detailed recommendations.

These guidelines have been prepared, reviewed and commented upon by the National MED POL Coordinators and the final text provides the framework for the enhancement and strengthening of the environmental inspection systems in the Mediterranean. The countries may use them to specify their own code of conduct and practices to be followed by their Inspectorates.

Following the preparation of the said guidelines, it was felt that more information was needed on a number of technical issues, so that reference information developed adequately could better assist the implementation of the guidelines. As a result, the Handbook containing more detailed information was produced, under the technical supervision of WHO/MED POL and with the assistance of a team of five experts.

The purpose of the Handbook is to raise the level of performance of the environmental inspectors and support the above mentioned guidelines by providing details on assessing, developing, implementing and sustaining a viable inspection programme.

All aspects of an inspection programme are covered, including planning and designing enforcement programmes, international cooperation, non-point sources of pollution and compliance strategies, enforceability of permits, self-compliance, environmental negotiations, public participation, voluntary agreements, profiles of inspectors, inspection policies and planning, sampling, inspection techniques and training. To address those elements of comprehensive inspection programmes, the Reference Handbook includes the following:

- Organization issues;
- General procedural issues;
- Human infrastructure;
- Sampling.

The above structure appears in the four parts, each one presenting a specific subject related to environmental inspections. The experts team is composed by professionals with long-standing experience on inspectorates in their countries. The texts reflect the authors experience from different angles and different philosophies that enrich the contents. It may happen that some issues are mentioned in more volumes. This is due to the fact that repeated issues provided another perspective and/or are needed for the complete understanding of the specific volume. The experts team is composed by the following scientists:

Mr Yasser Sherif is a former Head of the Environmental Inspection Unit in the Egyptian Environmental Affairs Agency (EEAA). He was responsible for preparing Part I related to "Organizational issues".

Mr Rani Amir is the Director of Marine and Coastal Environment Division in the Israeli Ministry of Environment. He was responsible for preparing Part II related to "General procedural issues".

Mr Allan Duncan is former Chief Inspector of Her Majesty's Inspectorate for Pollution (HMIP) in the UK. He was responsible for preparing Part III related to "Human infrastructure".

Mr Robert Kramers is a specialist in the Dutch Information Centre for Environmental Licensing and Enforcement. He was responsible for preparing Part IV related to "Sampling".

Mr Robert Glazer is former Head of a regional inspectorate for the Ministry of the Environment in the Netherlands and coordinator of the European Network for the Implementation and Enforcement of Environmental Law (IMPEL). He was responsible for preparing the Guidelines on compliance and enforcement and acted as a coordinator and reviewer for all four parts of the Reference Handbook.

Part I

ORGANIZATIONAL ISSUES

TABLE OF CONTENTS

Page

1. DEFINING INSPECTORATE CORE BUSINESS

Differences between the tasks and responsibilities of inspectorates of the different Mediterranean countries depend not only on the development phase of the environmental legislation in each country and the existing of capacity needed to implement and enforce this legislation, but also on policy decisions taken in each country to address the challenges it meets. However, these differences revolve around the relative focus and level of involvement in the inspectorates' basic tasks, which remain the same.

1.1 The Inspection System

In order to be able to identify the inspectorate's core business, it is important to examine the inspection system and its different activities (Figure 1.1). The inspection system includes two types of activities; the first is the normal (standard) activities of compliance checking and non-compliance response activities (checking-response cycle), which forms the core of such system. The second type is the occasional activities resulting from feedback to the elements composing the context of normal activities. The implementation of the normal activities requires the development and implementation of three tools:

- Regulatory requirements;
- Permits;
- Non-compliance response policy.

Feedback from the checking-response cycle affects such requirements through the assessment of progress towards compliance and related barriers, and accordingly forming different cycles, closely related to the main checking-response cycle. Accordingly, the inspection system should not be addressed independently of its context since its inputs, outputs and performance are highly related to such components.

1.1.1 Normal activities: Checking-response cycle

Compliance is achieved when regulatory and permitting requirements are met through the implementation of desired modifications in processes, raw materials or work practices, among others. The nature of the activities of checking compliance is, therefore, related to the scope of these requirements. Achieving compliance is a shared output of both the establishments on one side and the inspectorate and competent authorities on the other side. While the responsibility for compliance to laws limits and conditions is solely to that of the formers, compliance checking and non-compliance response, including enforcement, undertaken by the inspectorate and environmental authorities play a necessary role to provide incentives to comply.

Compliance checking activities result in the identification of cases of non-compliances with regulatory requirements and permits. The non-compliance response could vary according to the type of violation from the implementation of enforcement measures to compliance promotion.

<u>Compliance Promotion</u>

This approach contributes to the enhancement of environmental performance of industrial establishments through guiding them in utilizing the technical and financial support mechanisms, which address waste management and treatment, applying self-monitoring systems and at source pollution control programs. All aiming at only one goal, namely compliance to the set conditions of the law/permit.

- ***Enforcement of legislation***

Enforcement is the application of statuary means of coercion and sanctions to ensure compliance. However, in practice, enforcement is related to many issues, among which:

- The budget and human resources allocated to the inspectorate.
- Regulators requirements.
- Affordability of compliance measures.

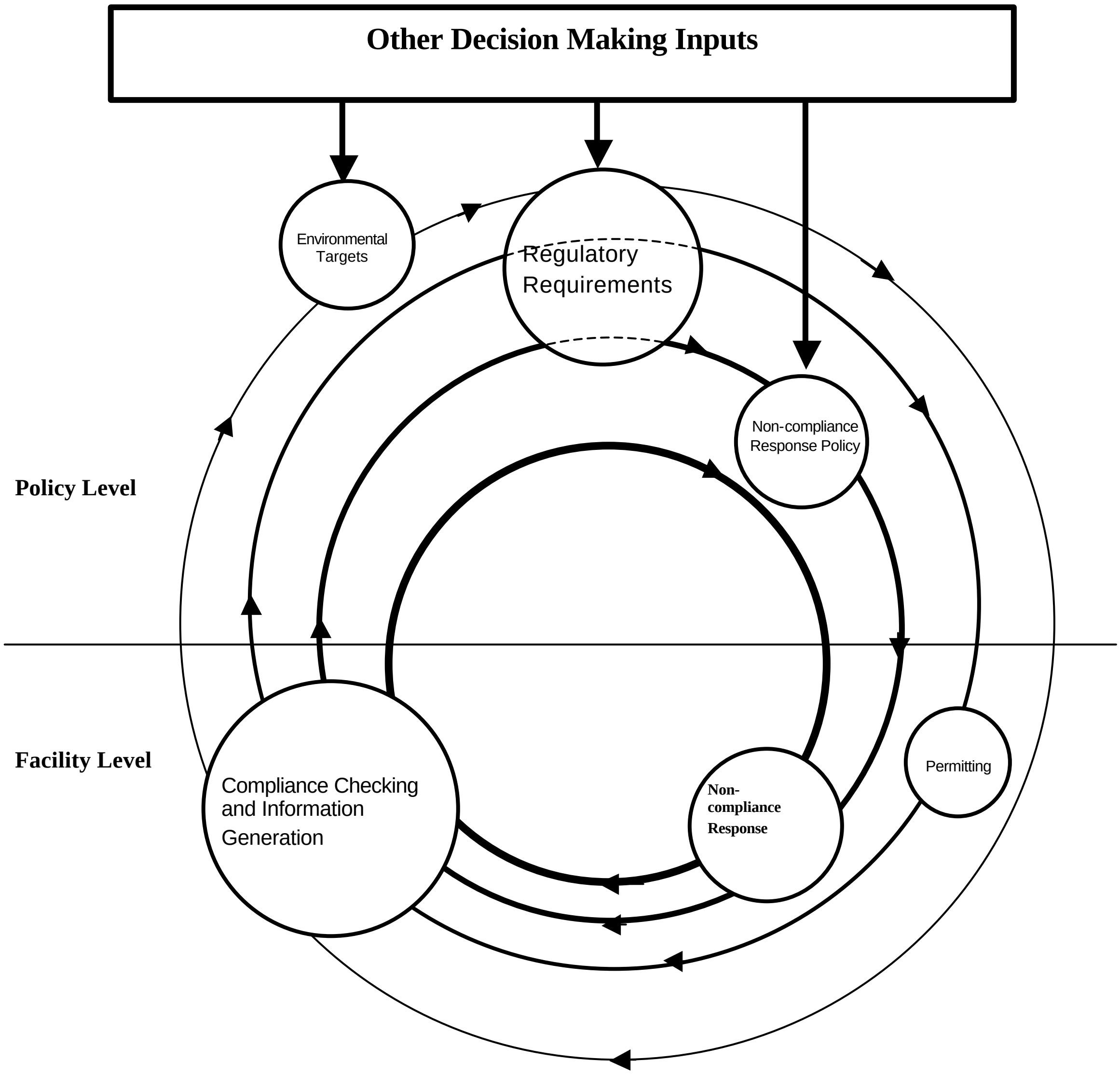

Figure 1.1 The Inspection Context

1.1.2 Adjustment activities: Feedback cycles

- ***Feedback to non-compliance response policy***

In order to insure the compliance of the establishments, non-compliance response is implemented according to a clear policy. The non-compliance response policy is developed based on the national policy of the country and the regulatory requirements.

The non-compliance response policy receives feedback from the compliance checking activity regarding the suitability of the different response actions and the needs for policy adjustments. Such modifications are undertaken based on the regulatory framework and whether it allows such modifications.

In Egypt, the formulation of a clear enforcement policy was identified as an important tool to provide inspectorates with specific decision rules to apply to the cases they encounter. Clear definitions should be given for different cases of non-compliances in order to undertake appropriate enforcement measures. The policy should account for elements that should be continuously updated based on strategic principles and according to the changing conditions such as economic conditions, the general state of industrial compliance, environmental priorities, etc. Moreover, the policy should address fixed definitions and principles that are less likely to change with time. The policy should clearly address the facilities rights[1].

- ***The second cycle: feedback to the permitting process***

The permitting[2] process is undertaken within the regulatory requirements. Permitting should be followed by compliance checking to check the compliance with the permit conditions. The feedback received from the compliance checking process could be used to adjust the requirements of the permitting system, if the environmental regulations pertaining to permitting allow such adjustment. For example, in the Egyptian environmental law, the permit for hazardous substances and waste handling could be revoked in case inspection activities prove that the facility violated the conditions of the permit and it could be modified if it was proved that the permit had not taken into consideration severe negative environmental impacts.

- ***The third cycle: feedback to environmental regulations***

Regulatory requirements are developed based on the national decision making inputs and according to the environmental targets identified based on these inputs. The regulatory, and permitting, requirements are the main issues addressed in the compliance checking activities.

On the other hand, compliance checking feeds back, through the assessment of progress towards compliance and related barriers, to the regulatory requirements in at least three ways:

- The implementability of requirements is an important result of the assessment of progress towards compliance. This should obviously have been taken into account at their design stage. However, a perfect design is known not to exist and experience based on implementation is critical for design improvement.
- In conjunction with an assessment of ambient environmental improvements (which should represent the ultimate objective of the environmental management scheme), compliance checking generates important information about the compatibility of the requirements to environmental objectives. For example, in Egypt, allowable limits are given for both stack and ambient emissions. However, in some cases, complying with the ambient conditions require the implementation of pollution control equipment for stacks such that the stack emissions are much less than the allowable limits.

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1 A proposed outline of such policy is found in the paper: Sherif, Y., Abou Elailah, D., *Closing the Enforcement Loop: The Need to Formalize Enforcement Policy,* presented in Environment 2001, Cairo, Egypt

2 Permitting is used here generically. Not all countries have a developed environmental permitting system, but each has a licensing process that takes to an extent into consideration environmental requirements.

- The feedback process is an essential element in assessing the enforceability of regulations based on the compliance and enforcement experience.

Changes to the regulatory requirements could be suggested if practical experience in compliance and enforcement has detected flaws in the regulations prohibiting proper implementation and compliance, thus assisting in a process of continuous improvement of the laws and regulations for the protection of the environment.

1.2 The Inspectorate's Core Business

The elements of the inspection system, described above, should exist in any country, yet the inspectorate's scope of coverage of these elements may differ from one country to another. However, compliance checking is the activity definitely undertaken by the inspectorate since it is the main node of the inspection system.

Besides compliance checking, the inspectorate might do all or some of the activities required for:

- Permitting;
- Compliance promotion; and
- Enforcement.

- ***Permitting***

In some countries, the inspectorate plays a pivotal role in permitting, while in other cases, other separate organizations undertake this responsibility. Arguments could be made to support both arrangements. For the former, it is argued that the best party to inspect is the one that knows the permit best. For the latter, it is argued that the separation of responsibilities infuses more independent and unbiased checks in the system.

- ***Compliance promotion and enforcement***

Compliance promotion is also sometimes undertaken by inspectors in the form of information and/or generic advice, but in general, promoting compliance includes a wide range of possibilities some of which could be handled in the field by inspectors and other require the involvement of the inspectorate and other environmental authorities and organizations. Depending upon the general level of compliance, the inspectorate may take a stronger or more lenient approach to enforcement as a response to non-compliance. Moreover, there is a high likelihood, as a result of the incremental development of environmental legislations, that enforcement authority would lie, for a number of issues, with several organizations. In fact, in many cases, the inspectorate does not only do inspection but also coordinate the inspection activities of other organizations. The effectiveness of the whole scheme depends on the distribution of roles and responsibilities as well as the level of coordination between different organizations within the framework of an inclusive strategy (see chapter 2). Compliance promotion is definitely a softer approach to achieve compliance. However, it should not be confused with the lack of enforcement, or condoning, which projects the lack of will or capability to take strong positions concerning violations. Such image is, obviously, not conductive for a stable culture of compliance.

The inspectorates' core activity of compliance checking is information intensive, both in terms of generation and provision to different levels of decision-making regarding the development of national directives, environmental policies and strategies, usually undertaken by organizations other than the inspectorate. Quality management of information generation and flows is a necessary, although not a sufficient, condition for effective decision-making. Non-compliance response and feedback loops will enable the inspectorate to monitor the system performance and detect any problem and take the necessary decisions accordingly.

1.3 Quality Management for Implementation and Enforcement

In order to operate successfully, inspection bodies should maintain a continuous high quality performance. This can be achieved by providing a body of well-defined instructions, working methods, control mechanisms and performance indicators, which result in pre-defined outputs and quality levels.

Performance indicators should evaluate:

- The quality of the field inspection: feed-back on performance of inspectors, accuracy of inspection, time needed for inspection.
- The consistency and quality of the inspection report: completeness, consistency and correctness.
- The performance of the inspection/enforcement body: tracking correction of violations, comparison with targets.

Continuous feedback to the inspection systems and elements should be secured to ensure an effective system and achieve continuous improvement of performance.

2. INSPECTORATE STRATEGY

A proper description of the inspectorate strategy is a prerequisite for a successful operational activity of any inspectorate. For private businesses, it is accepted that without an appropriate strategy, failure is a matter of time. This is also true for public agencies, although " failure" and "time" may take different dimensions.

A regular update of the strategy is essential because conditions under which the strategy was developed might have changed and timely appropriate adjustments to changing conditions must be made. Rigid strategies and rigid types of organization and management will not survive in a continuously changing world.

Every time a new legislation comes into force, hundreds of facilities are subject to it. It is impossible for the inspectorate to continuously check for compliance at every facility. A challenging aspect of compliance and enforcement programs is, therefore, to develop strategies to make the most effective use of resources available to inspectorates.

Policies and strategies are often confused. In fact they are closely related, but while policies guide the decision making process at higher or lower levels of the organization, strategies are decisions already made to commit the resources of an organization in a given direction. It is obvious that policies and strategies should be consistent since they provide the framework of plans. In any case, a strategy must achieve the balance between the demands and the reality taking into account the capability and capacity of the facility.

2.1 Factors Influencing the Development of Strategies

A number of factors are taken into consideration when strategies are being developed. The development of inspectorate strategies is based on its mandate, the context in which it operates as well as on its knowledge of environmental status and criteria for setting priorities. The relative weight of these factors varies greatly from one country to the other and could lead to diverging inspectorate strategies. Although a higher homogeneity in these factors will probably result in a partial convergence of strategies, a strategy, by definition, is never totally imposed by its contextual inputs.

2.1.1 Clear mandate

The simple question of "what is it that we do" is not always as simple to answer. However, a clear answer is a prerequisite for the development of a strategy. Is the inspectorate mandate "to enforce laws", "to insure compliance" or "to contribute to the improvement of environmental conditions"? A strategy to fulfil one of these possible mandates is not necessarily responsive to the other.

2.1.2 Human, financial and material resources

- ***Internal capabilities***

The inspection and enforcement strategy depends to a great extent on the resources allocated to environmental protection. Resources will most likely fall short of all what an inspectorate should do to fulfil its mandate. The strategy therefore focuses on what the inspectorate would do within the resource constraints, to maximize achievements in the context of its mandate.

- ***External resources***

While devising the inspectorate's strategy, it should be clear that internal resources of the organization represent only a part of national resources that could be allocated for environmental protection. Mobilizing resources not totally under the inspectorate's authority is an important element of the strategy. Resources external to the inspectorate could be those of the regulated community itself which could be mobilized through self-monitoring and self-reporting requirements. Resources of other regulatory agencies could be streamlined through cooperation agreements or protocols.

2.1.3 Institutional context

- ***Roles and responsibilities of the different regulatory agencies***

In some countries, overlaps in inspection duties between different competent authorities are not totally avoided. Depending on whether and how the inspectorate will deal with this issue, it can be an advantage or a burden.

Effective coordination between concerned parties makes resources add up to those of the inspectorate. The experience of specialized personnel in their specific fields such as industrial safety, occupational health and irrigation water quality can be an asset to the inspection process, if properly exploited. Information about the facilities can also be made available to all parties minimizing expenditure of time and money.

The strategy of the environmental inspectorate should have a clear approach to coordination between different regulatory agencies which allows the optimization of resources whether on the financial or human level. It is also in the interest of the inspected establishments not to have to deal separately with different inspection entities. Coordination can take one or more of the following formats:

- Information exchange;
- Information sharing;
- Joint inspection campaigns;
- Inspection committees; or
- Joint planning.

- ***Self - monitoring requirements***

Some environmental regulations specifically require that facilities implement self-monitoring plans, approved by the regulatory authority. This means that once the plan is approved, inspectors will make sure that it is correctly implemented without having to repeat all measurements and analyses. This would alleviate the burden of inspection costs. However, extensive infrastructure is required to implement such requirements. The methods and protocols of measurements and analyses should be standardized, and should be undertaken by certified laboratories. Without standard methods and certification protocols, a self-monitoring scheme cannot be effectively implemented. Moreover, without an approved self-monitoring plan, the relevance of data generated by the facility to the inspectorate is not ensured.

- ***Self-reporting requirements***

Self-monitoring requirements do not necessarily impose reporting on the facilities. Data generated could be stored at the facility for inspection upon demand. Self-reporting is different; it requires facilities to report the data they generate to the regulatory authority. Depending on the critical nature of pollutants released, the receiving environment or the compliance history of the facility, reporting could be legally required to be either

- Periodically; or
- Continuously, which could be on-line through electronic communication;
- Cases of non-compliance are reported on the spot to allow for prevention of large-scale impact.

Self-reporting has essential requirements such as data transfer protocols. Self-reporting is also less effective when the data analysis capabilities of the inspectorate are limited. It might even be counter-productive if facilities realize that the data they provide does not produce relevant reactions.

2.1.4 National development plan

The national priorities of developing countries could lean towards economic and social development at the expense of environmental issues. This does not necessarily mean changing environmental compliance targets but will influence enforcement policies; where inspectorates could provide longer grace period for achieving compliance. In some cases, the law allows grace periods to be included in the permitting procedures. In other cases, especially with the absence of a system of environmental permitting, the periods should be determined according to clear decision rules included in non-compliance response policies. The inspectorate is not free to decide the grace periods; its role will be limited to adapting the principles of the non-compliance response policy to specific cases.

The non-compliance response policy should take into consideration the development priorities. Issues of concern might also include:

- Industrial migration from the “North” where environmental standards are higher to the “South” where standards are less stringent. Strengthening environmental legislations and effective enforcement is obviously a political issue in this context.
- Many industrial facilities in developing countries have old production lines and outdated technologies that generate large pollution loads. Waste treatment in this case, will not be the right solution unless rehabilitation is performed first. Waste minimization and pollution prevention measures should be a priority for these facilities.

The main objective of enforcement policies is to achieve compliance. The inspectorate should take into consideration whether a solution exists for a pollution problem. This solution should also be affordable for the facility to implement it. Requiring solutions that cannot be implemented with affordable cost is equivalent to either asking the facility to shut-down its operation or to pollute whenever the inspectorate is not "looking". This type of discrepancy between the legal requirements and the actual possibilities for implementation should not exist in a system detailing specific requirements in an environmental permit. However, it is often encountered in the case where general requirements, applying to all types (sizes, sectors) of establishments, are detailed in the law.

2.2 Environmental Status

Environmental status has two major components:

- ***Information related to emissions released by facilities***

Each inspectorate should allocate time to generating, maintaining and updating a databank of all potentially polluting facilities. A certain percentage of the available time should be allocated to update this overview. It is advisable to develop an accessible database, that can be easily updated by the inspectors. Sources of information could be inspection reports (whether on individual facilities or as a result of campaigns), self-monitoring data and public complaints. The latter, although not as quantified, gives an important check on environmental performance of the facilities.

- ***Ambient monitoring programs***

Air and water quality data in the different areas or for specific streams or water bodies should be available to the inspectorate management. Monitoring of ambient air and water bodies on the national level depends largely on the degree of development of the country. It is clearly a burden for developing countries, but the dependence of the inspectorate strategy's efficiency[3], among other environmental decisions, on the availability of this information should encourage the concerned parties to consider such investments not only in terms of its real costs but also its efficiency benefits.

It is also possible to reduce the costs of ambient monitoring through requiring the reporting of pollutant in terms of loads and not only in terms of concentration as some legislations require. For example, the Egyptian law prescribes self-monitoring concentrations and does not require general self-reporting. On the other hand, the law does not prohibit reporting. In fact, facilities are required to report only deviations of the monitoring results from prescribed discharge standards. In some cases, specific facilities in sensitive areas, especially large cement factories, are required to maintain a continuous on-line reporting of their monitoring results to the environmental authorities. The application of the GIS system to releases can categorize areas according to loads of specific pollutants and facilities according to their pollution profile.

The substantial time and effort spent by the establishments to prepare the pollutant release report and by the regulatory authority to prepare the database for the information system, is justified by the possibility to identify the level of pollution of a specific receiving media with a minimum number of sampling points thus saving future time and effort. Softwares have been used successfully for estimating air and water quality at a distance from the point source of release, which allows tracking back pollution to specific sources.

2.3 Setting Inspection Priorities

Inspectorate's strategy will ultimately lead to a feasible annual plan for inspections taking into account: human resources, available budget; compulsory inspections (by law); specific (thematic) inspection campaigns; complaints investigation; court actions; inspectorate

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[3] Inspection strategy efficiency is a measure of the achievements of the strategy (outputs) in relation to the effort exerted (input).

advisory functions (to permit authorities and to policy makers); annual reporting and contingency activities like addressing the press and public in special cases.

Inspection plan priorities are set according to the following criteria. The relative importance of these criteria will depend upon the inspectorate's strategy.

- Quantity of pollution generated;
- Industrial sector;
- Nature of the pollutant;
- Type of receiving medium ;
- Nature of area;
- Size of the establishment;
- Intensity of natural resources consumed;
- Special or new environmental laws;
- Number of inspections.

- ***Quantity of pollution generated***

The size of the facility is an indication to the generated pollution load within the same activity type. When comparing different sectors, it is important for the inspectorate to be aware of the pollution load generated even when the facilities are complying with environmental legislation. Such information will be important to assess parameters such as the carrying and regenerative capacity of the receiving media and hence inspection priorities for specific areas. Small Quantity Generators (SQG) discharging hazardous materials such as laboratories could have less impact, if properly managed, than Large Quantity Generators of a non-hazardous pollutant discharged within the regulatory concentration limits.

- ***Industrial sector***

Environmental pollutants differ from one sector to another. Some sectors are known for their high pollution loads such as the chemical industries, the petroleum sector and some activities of the textile sector such as dyeing and sizing. Accordingly, the type of industrial sector is an important factor in setting inspection priorities.

- ***The nature of the pollutant***

The impact of a pollutant varies according to the type of pollutant, its physical state, its hazardous nature, its degradability and its environmental fate. The nature of the pollutant is one of the factors that determine the targets of an inspection plan.

- ***Type of receiving media***

In some cases, the adverse impact of pollutants is reduced as the pollutant form is changed from the gaseous to aqueous to the solid state. However, it is believed that moving in such direction facilitates pollution control; accordingly in some cases, priority is given to air pollutants. For example, the presence of lead in the gaseous form requires the implementation of control measures and monitoring program, whereas lead contaminant of solid waste does not require such level of control due to its low leachability. The priority should thus be established according to the sensitivity of the receiving medium and its assimilation, criteria that are usually associated with the nature of the area and its carrying capacity.

- ***Nature of the area***

Some areas require special consideration for their economic, social or environmental importance. The nature of areas could be classified as follows:

- Sensitive areas such as coastal areas, major sources for potable water and for irrigation, agricultural areas;
- Specific areas such as tourist areas, important agricultural areas;
- Natural Protectorates;
- Highly polluted areas;
- Highly polluted residential areas where industries are concentrated.

- ***Size of the establishments***

Establishments can be divided into small, medium and large industries. Medium and large industries are quite similar but small industries have a specific nature as they usually lack the advanced technology and financial resources. Moreover, the number of employees in such facilities is usually small and the activities are limited, which makes it unfeasible to implement pollution abatement measures in each facility. In case a group of the same facilities is established in one area, it might be effective to consider the implementation of a central abatement measure. The implementation of such options requires an organizational effort that might be at a level higher than that of a single facility.

- ***Intensity of natural resources consumed***

Resource consumption is an important issue that is often not regulated. However, comparison in relation to baseline of typical consumption values in a specific activity gives an important lead to the possibilities of win-win interventions.

- ***Special or new environmental laws***

With the promulgation of new environmental laws or regulations, inspection priority will shift towards checking and promoting compliance with these laws and updating the information system of the inspectorate.

- ***Number of inspections***

Routine inspection activities are essential to the integrity of an enforcement programme. Accordingly, the inspection plan should be mainly based on such activities while allocating time for complaint-based inspection.

2.4 The Strategy Document

The inspectorate strategy document is essential for showing the structured and consistent approach in inspection activities. The document clearly indicates the limitations of the inspectorate and the goals to be achieved. The inspection strategy document should address issues such as:

- ***Inspection planning***

  - Criteria for setting inspection priorities;
  - Methodology to evaluate the inspection process.

- ***Coordination principles***

  - Information exchange mechanisms;
  - Cases requiring joint inspection;
  - Roles and responsibilities of each entity;
  - Joint planning mechanisms.

- ***Inspection approach***

  - The level of inspection whether to conduct detailed inspection of all processes or limit inspection to end-of-pipe and end-of-stack;
  - The ideal number of inspection necessary to achieve inspection objectives within the allowable limits;
  - Criteria for conducting administrative checking instead of field visits to save time and resources.

- ***Non-compliance response***

  - Criteria for implementing different enforcement approaches;
  - The adequate level of compliance promotion necessary to build up sufficient reproachability;
  - Criteria upon which facilities are pre-notified before implementation of enforcement activities;
  - The timeliness for implementing enforcement actions and coordination with other regulatory entities.

3. CODE OF CONDUCT FOR INSPECTORS/INSPECTION PROTOCOLS

Once the strategy of the inspectorate has been formulated and time-bound plans developed, inspectors must be given guidance to undertake inspections during which the inspector performs different roles.

- Gathering evidence related to environmental performance;
- Advancing the process of achieving compliance; and
- Representing a governmental agency.

There is a natural tension between the first two roles, which in addition to the third role, requires a professional code of conduct to which all inspectors should abide. The actual conduct of inspectors is related to two complementary tributaries:

- Personal qualifications of the inspector; and
- Procedural guidance, training and monitoring from the inspectorate.

Relying exclusively on one of these two necessary issues will always prove insufficient. Personal qualifications are addressed in chapter 5. On the other hand, the inspectorate must develop internal guidelines for the inspectors, such as:

- General code of conduct for inspectors;
- Procedural guidelines concerning:
  - o The inspection equipment to be used and sampling/analysis procedures to be applied;
  - o Inspection procedures including those guiding the fields visits as well as the pre and post field visit activities;
  - o Conducting interviews.

Moreover, the inspectorate should provide guidance to inspectors concerning their health and safety on the job.

3.1 Gathering Evidence

The inspector is responsible for gathering information to determine whether a facility is in compliance and for collecting and documenting evidence concerning violations that may have occurred. As described in chapter 1, this evidence is used to provide important inputs to all cycles of the inspection system. Moreover, it is used to support the development of enforcement cases, as well as, to help the inspector prepare for and give testimony when required. Therefore, inspectors are required to follow certain procedures to ensure that whatever evidence they collect will be admissible in a court of law. There are three major components to adequately perform this task:

3.1.1 Prove that a violation has occurred

Every inspection must be conducted as if it would go to court and be contested. Every shred of evidence and documentation supporting that evidence may be contested as inaccurate, misinterpreted or compromised. The enforcement case often hinges upon the expertise and professionalism of the inspector.

There are different means to collect evidence; each should follow its own acceptable and standard procedures.

- ***Conducting interviews***

The interview is one of the most significant tools authorized for conducting an inspection. How inspector asks a question can be more important than the question itself. Guidelines could be developed for inspectors including types and methods of interviews, and communication.

- ***Sampling and analysis***

Sampling and analysis may be necessary to document potential evidence of non-compliance. Therefore samples must be:

- Representative of a material or event. There must be an inspection plan to determine which chemicals or parameters to look for.
- Analyzed using appropriate Standard Operating Procedures (SOP). SOPs are written documented procedures that should be used for collecting any type of samples. This ensures reproducibility and consistency. Inspectors should use only laboratories that adhere to written SOPs. While there may be modifications of the method to fit unique circumstances, all deviations from the SOP must be exhaustively documented.
- Analyzed according to an appropriate method of analysis. What the inspector is sampling and why he samples will determine the method of analysis. Usually this is performed under a Quality Assurance Plan. Once the appropriate method is selected, the inspector must then determine the precision and accuracy of the results.

- ***Documentation***

Note-taking and documentation (collect registers, documents, samples, photographs, video) is very important for information gathering, statements recording (statements made by facility personnel, or issues verified by sight, smelling, or measurements). Guidelines could be developed for inspectors should include note-taking and information gathering techniques.

3.1.2 Establish that the procedures and policies were fairly and equitably followed

There are two major necessary conditions that should be fulfilled to support that the violator is not being unduly "picked on":

- ***The Selection of the facility***

The rationale for inspecting a specific facility should be based on e.g. the facility's compliance record, initiated by a complaint, is part of an inspection plan (random, pollutant-oriented, area-specific, or the like). Repeated inspections for a specific facility without acceptable reason could be challenged by the facility and could put the inspector unnecessarily in a compromising situation.

- ***Standard procedures are followed***

An inspection plan should be prepared before the actual field visit. Based on this plan, inspectors should get their equipment ready before the site-visit (cameras, sampling/measuring devices, containers). Inspectors should adhere to the inspection plan and follow inspection protocols. However, field conditions may dictate plan modifications. Reasons for such modifications should be thoroughly documented.

3.1.3 Support a potential court case

A necessary condition for a potentially successful court case is the evidence collected and supported to prove the violation. However, some additional information is also beneficial.

- The underlying environmental or public health need for the requirement being violated is already considered when the requirement is developed. However, it may be necessary to reiterate the importance of compliance with the requirement to justify and support an enforcement case. This is particularly true when a case is being argued in front of a decision-maker expected not to be familiar with the environmental or public health basis of the requirement.

3.2 Relation of the Inspection Team with the Establishment

In conducting field inspection, it is important that the inspection team maintains a good working relation with the industrial establishment and respects its constraints, rules and other rights. The following are the main principles that should be followed.

- Cooperation between inspectors and industrial establishment management is the best way to reach good results.
- Inspectors should restrict their on-site activities to the normal working hours of the facility, as much as possible, and minimize the disruption caused by the inspection visit. The inspectors should always be aware that the facility "raison d'être" is to do its own business.
- The inspection team should implement appropriate field note taking methods and proper document control procedures, particularly when the company asserts a

“confidential” claim. Respect for the facility’s constraints should always be the rule as long as it does not affect the proper conduct of the inspector’s duties.

- Confidentiality is also important for inspectors. Inspectors must assure that important documents are not left unattended at the facility. All inspectors should maintain sensitivity to multi-media issues and implications and freely discuss, with other members of the team, observations/findings relating to one or more fields covered by the environmental laws and other relevant laws. Sensitive discussions, however, should not take place in front of facility personnel or on company telephones.
- The inspectors represent the environmental authority, and thus must conduct themselves in a professional manner and maintain credibility. Polite and rational discourse is a mandatory skill. As an agent of the government, the inspector should constantly strive to maintain the highest standards of thoroughness, ethical conduct and quality assurance. Inspectors must set an example in the implementation of proper procedures.
- Fairness and equity must be cornerstones for the inspector’s work. The tendency to become obsessive of the authority and power given to them should be prevented, and literally fought, by all means. The power of authority should always be preceded by the power of knowledge and thorough work.

Based on such general principles, and the specific context of each country, the inspectorate should develop a handbook to provide detailed guidance to inspectors.

3.3 Health and Safety of Inspectors on the Job

Field inspections involve a certain degree of risk and the inspector also has the responsibility to protect himself from such risk. He also has the right to be provided with all information, equipment and authority to be able to protect him properly. Health and safety guidelines are developed to provide the inspectors with the information necessary to make the correct health and safety decision in the field. These guidelines present health and safety principles and identify methods to recognize and evaluate the hazards associated with field activities and select the appropriate protective equipment and clothing.

3.3.1 Planning and alertness

Inspections of manufacturing plants, laboratories, and wastewater treatment plants are each associated with various hazards. A safe field inspection depends on the early recognition, evaluation and control of hazards. This should be an integral part of inspection planning. However, it is not always possible to predict all possible hazards. The inspector should also be trained to complement the planning exercise during the visit with his focused use of the senses to detect any potential hazards.

3.3.2 Protection and risk minimization

During field activities, it is not always possible to totally eliminate hazards; however, it is possible to reduce the risk associated with these possible hazards, through:

- Use of monitoring or testing equipment;
- Use of engineering controls;
- Use of personnel protective equipment and clothes; and
- Employee training.

The information collected about potential risks, protective gears and equipment should be complemented by adequate training for inspectors so as not to overexpose themselves to risks. Lifting and climbing as well as sealing with power sources and electric equipments instructions are daily occurrences in the inspector's job and there are ways to reduce the risks associated with them.

3.3.3 First aid

Risks cannot be totally avoided, and accidents might happen. In order to minimize their negative effects, inspectors should be aware of basic first aid techniques.

4. FINANCIAL ISSUES, FUNDING AND BUDGETING

Available resources are the major limiting factor on the ability of inspectorates to carry out inspections. Moreover, although the inspectorate's expenditures are not limited to conducting inspections, this is normally the one item in which most of its budget is spent. Both operating and capital costs could be allocated to inspections. Operating costs generally include:

- Personnel, including training;
- Office supplies and publications;
- Laboratory material and chemicals;
- Vehicle/fleet maintenance;
- Maintenance for computers, laboratories and publication equipment;
- Field sampling material;
- Funds for contractor support.

Capital costs include significant one-time expenditures that have useful of at least one year. Examples include:

- Central and regional laboratories;
- Office space;
- Computers;
- Vehicles;
- Other miscellaneous items.

The inspection plans should, therefore, be closely linked to the preparation of budgets for inspectorates. It is most practical that inspection plan cover a time period, which is the same as the budgeting span of inspectorates.

The general concept under which the inspectorate is performing its duties has basically been that of the "Beneficiary Pays Principle". Society at large should benefit from a cleaner environment, which is a public good. Therefore, the inspectorate is financed through the general state budget. In fact, some segments of society benefit more than others from the inspectorate functions and should in principle have a higher support for the provision of this public good. However, it should be noted that those who benefit more are usually those starting from a lower environmental quality. In terms of fairness as well as political realities, charging those segments of the society a higher share is unacceptable.

However, as governments become leaner in human resources and budgets, funding for monitoring the state of the environment is becoming increasingly difficult. This trend causes a major problem in countries where national environmental management has reached a rather steady state. The problem is obviously more critical for countries where a major expansion of activities is still needed to improve environmental conditions.

In its search for more diversified resources, an inspectorate's funding is supported by other equally acceptable principles such as "cost recovery" and the "Polluter Pays Principle".

4.1 Assessing the Financing Gap

Before financing needs for the inspectorate are actually assessed, it is only possible to consider options for closing a financing gap at an abstract level. For example, whether a financing gap is expected because of an expected increase in activity, movement to more costly (sophisticated) activities or because there is a high likelihood of a budget cut, is necessary to seriously consider alternative approaches to closing the gap.

4.1.1 Establish the baseline

This is necessary in a number of respects. First, any projection will use historical data whether in a basic form such as level of employment, wage level, in a more dynamic form such as historical trends or in an analytical form such as person.days or average cost of laboratory chemicals per inspection. Second, and before any projections are made, the efficiency of the current operations and possible improvements should be assessed. Finally, the current assets and their expected useful lifetime is necessary for capital budgeting. It is clear that a thorough understanding of the current operations is needed to assess future needs.

4.1.2 Projection of costs

Even if activities continue at their current level, there is a projected increase in personnel costs (as a result of salary increase). Moreover, a periodic replacement of capital assets will be needed. A higher growth in expenditures should be well justified in terms of alternative programs considered and their cost effectiveness.

4.1.3 Constant feedback

Tracking costs and revenues should be a constant activity to indicate areas in which efficiency improvements are possible as well as areas where transfer between items are expected to balance out and improve effectiveness. It is also helpful in updating costs, rates and trends upon which future budgets are based.

4.2 Possible Lines of Action

Trying to increase resources seems to be the first line of action. A number of possible revenues sources are detailed in section (4.2.2). However, other options should be considered in conjunction with such effort. It should be noted that none of these possible options excludes the others.

4.2.1 Reducing demand

- ***Redistribute burdens***

A possible line of action to counteract the scarcity of resources is to prescribe monitoring obligations to the polluters. The self-monitoring of industrial activities and sometimes regular reporting to authorities is obligatory in a number of countries. This does not eliminate the responsibility of authorities to do their own monitoring and to ensure that laws, regulations, and permit conditions are complied with. However, this still transfers a major burden to the regulated community consistent with the Polluter Pays Principle. This option, however, needs a regulatory intervention. It also requires the existence of an extensive infrastructure especially in terms of authorized laboratories as well as the standardization of sampling and measurements methods.

- ***Out-source services***

A possibility to cope with the budget problems is to outsource monitoring of the quality of the environment. It is clear that this is possible if the total budget is not constrained but for example there is a ceiling on acquiring equipment, or if some of the potentially acquired equipment will not be frequently used, thus increasing the fixed costs per measurements. The other possibility where this approach would work is when there is a higher confidence in the efficiency of the private sector as a service provider. Another option opened by this approach will be to charge the facility for out-sourced monitoring services rather than spending the scarce resources of the inspectorate.

- ***Higher efficiency***

Given limited resources, the inspectorate should always thrive to a higher level of efficiency. An accurate definition, shared by all members of the inspectorate, of the nature of its output is a pre-requisite for efficiency. An output specified in terms of number of inspections is obviously different than that specified in terms of units of pollutant reduced. The selective focus on specific areas, sectors and pollutants is based on such definition.

An accessible and constantly updated database is another necessity for increased efficiency, saving the inspector's time that could have been spent in reconstructing case histories easily made available through adequate information management.

Inspection planning, implying an accurate identification of priorities and objectives, is also a necessary activity for a higher efficiency. Field inspection activities, and accordingly time and resources, spent should be limited to those implied by the inspection's objectives.

Multi-media inspections are generally more efficient than multiple single-medium inspections. A targeted investment in human capacity and technical skills can prove highly rewarding on the long term.

- ***Preserve effectiveness***

The inspectorate is involved in numerous activities including routine inspections, inspection campaigns, complaints-based inspection, enforcement activities, annual reporting, training and other needed activities. The use of available limited resources should optimize the involvement of the inspectorate in the different activities. This should be well planned so as not to overwhelm the inspectorate or result in a low involvement in any of the activities. As a principle, the inspectorate should not be totally involved in one activity while not active in the others. Being dormant in one activity, such as the routine inspection, affects other activities, for example, by leading to an increase in the number of complaints. Moreover, reduce planning activities might not allow for achieving the required objectives. As effectiveness is closely related to the quality of human resources, training should never be, as it is often the case, the first candidate for reducing expenditure.

- ***Synergies with other government authorities/programs***

Existing structures and functions within the government should be utilized to assist compliance and enforcement activities. Information exchange between various government entities would avoid duplication of effort and overlapping activities and would allow for the effective utilization of resources. Moreover, joint planning and periodic meetings are important to ensure effective cooperation. The extent to which government entities can share and leverage resources reduces the amount of revenue funding required not only for compliance and enforcement, but also for other government programs as well.

- ***Compliance promotion***

Recurrent and persistent non-compliance increases the costs to inspectorates. A higher level of compliance should, therefore, effectively contribute to the reduction of these costs. A comparative cost-effectiveness analysis should be conducted for options considered to complement the typical enforcement approach.

Several factors contribute to creating a responsive climate for compliance. They include:

- Provide awareness and technical assistance to the facility;
- Build public support;
- Publicize success stories;
- Provide economic incentives and creating financial arrangement;
- Build environmental management capability within the facility;
- Maintain a transparent enforcement system;
- Show flexibility in implementing enforcement actions.

4.2.2 Developing revenue sources

Revenue sources could be totally new or could already exist but need to be directed towards financing the inspectorate activities through a dedicated fund or an ear-marked allocation in a more general fund. An inspectorate cannot, and should not, be totally financially independent. As mentioned earlier, the public service rendered by the inspectorate, and the public good thus created, should mainly be financed by public funds. However, additional resources to support these public funds may prove necessary.

- ***Environmental charges and taxes***

These include product taxes and charges, effluent taxes and charges, and administrative charges. Environmental charges and taxes (on pollutant emissions) are more appropriate source of revenue than user charges/fees. User charges (water, solid waste, and wastewater) levied to recover the cost of public services, such as wastewater treatment, are the basis for the revenue of a specific fund aimed at financing the service (they are classified as cost recovery based instrument). These are, therefore, not totally appropriate as a revenue source for a general inspection fund. Only part of this revenue could be allocated to finance inspection activities directed to the specific user. Otherwise, the use of the funds will not be consistent with its definition.

Product charges have several advantages over emission charges including ease of collection and enforcement, and are more easily incorporated into the existing tax system, avoiding the need for wholly new systems of administration and control. In general all types of environmental taxes and charge systems will work best when they are simple and transparent.

- ***Environmental fines and non-compliance fees***

Penalties and fines can be used to provide a revenue source for environmental funds. Non-compliance fees are similar in being imposed on polluters which do not comply with environmental requirements and regulations. The main difference between these instruments is that the latter are proportional to selected variables such as damage due to non-compliance or profits linked with reduced non-compliance costs. Because both are related to a state of non-compliance, they cannot assure a stable revenue base on the long-run. They should not be relied on as the main sustainable source of fund revenues for inspection.

However, they are the ideal sources for the short term and, if legally possible in specific countries, they could be used to establish a dedicated fund for the inspectorate.

- ***Donations***

Inspectorates may receive donations from external and internal sources. Donations are also not reliable on the long run, but sometimes, depending on a country's economic situation, they are more reliable that state budget sources. They could complement the role of non-compliances fees and fines on the short term.

- ***Charges or services rendered against fees***

The following revenue options could be considered. However, they need to be tailored to avoid possible conflict of interest resulting from the dual role in some cases as service provider and a regulator.

- Administrative charge for review of environmental impact assessments (EIAs), as well as the proponent's appeal fees.
- Administrative charge for permits.
- Charge for conducting laboratory analyses to third parties and rental of laboratory equipment.
- Charge for sampling analyses for repeated non-compliance.
- Charge for environmental inspection (might also be in cases of repeated non-compliance).

4.3 Political Support

It should be clear to the inspectorate that whatever action it chooses to take, political support is needed for it to materialize. Budgets are allocated through other governmental agencies and innovative financing or funding initiatives might need regulatory actions. The inspectorate should have a dual approach to mobilizing this political support through bureaucratic channels as well as through public opinion. The balance of the two components depends upon the decision-making mechanisms of specific countries. In any case, it is most likely that inspectorates should earn their political support through the perceived value of their achievements.

5. HUMAN RESOURCES MANAGEMENT AND PERSONNEL PLANNING

Inspection is a labour-intensive activity. Therefore, the human resources in an inspectorate are crucial, both in terms of quality and quantity, as well as adequacy for the evolving functions of the inspectorate and the changes and trends that are inevitable in the field of environment.

5.1 Size of the Work Force

The optimal size of the inspectorate depends on many factors. These are:

- The actual involvement of the inspectorate in all elements of the inspection system (see chapter 1).
- The scope and extent of environmental requirements that have to be met, the complexity of the environmental regulations, and the type of inspection that is asked for.
- Desired ratio of inspectors to number of facilities that require inspection.

- Expected level of non- compliance.
- Administrative and management resources needed to support inspection and permitting activities.
- Complementary responsibilities with other governmental agencies.

The ratio of inspectors to the number of facilities to be inspected is the most critical factor affecting the optimal size of the inspectorate. It is related to the above factors as well as:

- The level of experience of inspectors;
- The complexity of the facilities to be inspected; as well as
- The inspectorate's strategy.

Given the specificity of each context, other countries' figures have minimal relevance. Rates, averages and trends should be locally based and continuously updated to feed into reasonably accurate human resources plans.

5.2 Different Activities Require Different Technical Skills

The activities performed by the inspectorate are dominated by inspections and this is reflected on the personnel profile. Moreover, other employees are usually related to the number of inspectors. However, as seen below, inspectors themselves are not a homogenous group. A thorough analysis of the skills needed for the different activities of the inspectorate is necessary.

5.2.1 Inspections

- ***Integrated/ specific inspections***

Integrated inspections require a pool of knowledgeable and experienced inspector while for specific inspections a more specialized inspector is needed.

- ***Emission and process performance checking***

Inspection to check emissions without looking at internal processes needs a generalist. However, a different type of inspector is required, if inspection requires process knowledge to establish compliance or to understand the causes of non-compliance. In a number of countries, generalists usually do the first inspections and specialists follow, if needed.

- ***The nature of the facility***

According to the nature of the facility, there could be a need for highly qualified personnel to execute detailed on-site inspections and quality reporting skills. In the case of highly complex facilities, an expert could be needed.

In case of simple small facilities, a junior inspector, with lesser experience in the field, but who have worked with a senior inspector on more complex tasks, will suffice. In some cases, only visual inspecting may be needed.

- ***Complaints***

In order to avoid the disruption of accumulated knowledge of facilities, it is not advisable to separate the pool of inspectors active in complaints from those active in regular inspections. In a number of countries, complaints are handled by a rotating crew of inspectors. In any case, it is important that inspectorate planning is not overruled by complaints so that the inspectorate does not become a complaint driven organization.

- ***Permits checking***

As described in chapter 1, permitting is often not within the mandate of the inspectorate. In the case it is, it needs technically trained personnel in administrative control of permits and application for permits. Rotating permit writers and inspectors will improve their performance in both activities.

The mix of inspectors' skills and number should ideally be driven by the inspection approaches and strategies adopted by the inspectorate. It is, however, more likely that the reverse happens. Strategies and approaches are constrained by the pool of inspectors available or acquirable.

Naturally, present and likely new resources have to be taken into account, when Short-Term and Long-Term Plans for Inspections are under preparation and when these plans are approved by the inspectorates. In fact, available resources dictate, how many establishments can be inspected in a certain time period and how efficiently inspections can be carried out. Available resources must be taken into consideration when formulating realistic inspection plans that can actually be executed.

5.2.2 Administrative, management and judicial actions

- ***Management***

Supervision and quality control requires one person per ten to fifteen inspectors at the most. For less experienced inspectors, more coaching will be required from supervisors. Accordingly, the span of supervision would be smaller. It is preferable that coordination with other authorities is undertaken by a restricted number of people, higher up in the organization. At the limit, this is limited to the manager supported by an administrative employee with experience is taking care of such duty. Other management activities would include the preparation of periodic plans for inspections and plans for resource development and capacity building.

- ***Post-inspection activities***

The number of inspections ending up in court cases depends on the legislation as well as the compliance status and culture of a specific country. Knowing the rate of these cases per inspections performed is important for identifying the human resources required to cope with the judicial aspects in the inspectorate. The number of experienced lawyers or persons with a degree in law will depend on this rate as well as the characteristics of the national judicial system.

- ***Administrative support***

Inspectors should write and type their routine reports according to a predefined formats and templates. However, in some cases, administrative support is needed for special report typing. Moreover, such support is needed for filing, telephone answering and keeping up agendas. Good support in this respect saves the inspector's valuable time for duties they are trained, and hired to do.

5.3 Common Personal Qualifications

The inspector's job requires a number of qualifications. Technical competence alone does not help the inspector perform properly. Specific work habits and personal characteristics are necessary conditions for inspectors whatever their special technical skills or level of expertise are. A professional inspector needs to be all of the following:

- Self confident;
- Objective, fair and consistent;
- Decisive, but also flexible as the situation dictates;
- Scrutinizer (probing, curious, thorough and meticulous, alert and rational);
- Communicator (receptive and clear);
- Team player (work with colleagues);
- Planner (plans ahead, uses resources effectively and always well prepared);
- Output oriented (completes paperwork, consults experts and understands bureaucracy);
- Morally superior (polite, punctual and ethical).

It is obviously difficult to find all these characteristics in one person. Part of this difficulty is overcome through team working while the major part should be addressed through proper hiring and continuous training.

5.4 Personnel Planning

In human resources management, inspectorates have at least to take care of the following:

- Personnel planning is an essential part of the human resources management.
- New staff should be accompanied with budgets and funding.
- A personnel management plan should be incorporated in the long term planning.
- Staff training is essential.

In the Egyptian law of labour, occupational health inspectors should be periodically trained to build their capacity and continuously enhance their performance.

Inspectorates should act ceaselessly to gradually increase the quantity and quality of inspection resources. As part of the Short and Long-Term Inspection planning, inspectorates should elaborate a justified Plan for the Development of Inspection Resources. The following items should be included in the plan:

- The quantity and quality of present human resources of the inspectorate for compliance inspections.
- Analysis of what can be done with present resources and what are the main factors related to resources, which restrict the ability of the inspectorate to carry out inspections efficiently.
- Analysis of needed human resources.
- Analysis of what will be the impact on the ability of the inspectorate to carry out inspections, if needed resources are provided, i.e. what could be done with new resources.
- A proposal/plan for the human and material resources.

- Which are of major importance i.e. which have to be organized/purchased most urgently (resources having the top-priority).
- Which are urgently needed and which should be organized/purchased as soon as possible (resources having a high-priority).
- Which are needed and which should be organized/purchased in the nearest future.

5.5 Inspectors Training

Training of inspectors and team leaders is one of the factors that develop and increase the efficiency of inspection on industrial establishments. Therefore, the inspectorate should provide sufficient basic training to all inspectors before they undertake inspection activities.

Both training courses and on-job-training are needed for inspectors, according to their qualifications and tasks. Formal examinations should be carried out in conjunction with courses to measure the capabilities of the inspectors according to scores and levels that inspectors must reach.

In order to prepare the inspectors to assume their duties, the early training modules for inspectors should cover the following aspects:

- Safety and occupational health;
- Objectives and importance of environmental inspection;
- Planning of inspection activities;
- Roles and responsibilities of the inspection team in different inspection stages;
- Important environmental regulations;
- Local industries, production processes, associated utilities and environmental pollution generated;
- Inspection of the facility registers and documents; environmental register and hazardous waste register;
- Using inspection checklists, preparing inspection reports and judicial impoundment records;
- Information collection methods, observation techniques and communication skills;
- Sound environmental management of industrial establishments, self-monitoring system and cleaner production technology;
- Pollution abatement systems for air and water pollution, management of solid wastes, management of hazardous substances and wastes, etc.
- Sampling and using mobile measuring equipment.

Training of inspectors is a continuous process. Inspectors should take part regularly in extensive training programs. These training programs can focus on specific issues or current general issues related to the ever-evolving context of industrial environmental inspections. The training should be tailored to the needs of the inspectors. Examples for general training modules could be found in the “Catalogue of North American Environmental Training Courses, Commission for Environmental Cooperation, 1996” and EPA, “Principles of Environmental Enforcement”, 1992 and “Training Course for Multimedia Inspectors”, 1998.

6. CENTRALIZED VERSUS DECENTRALIZED INSPECTION SYSTEMS

The nature of the inspection system imposes the decentralization of a number of its activities to provincial levels. This is due to the fact that:

- In most countries, establishments are spread on a wide geographical area, an aspect requiring inspectors to be nearer to the field.
- Establishments to be inspected are usually numerous and their inspection requires high human and financial resources that could never be made available in a centralized system.
- In a world of limited resources, decentralization will allow streamlining of a wider pool of resources.

Decentralization allows the national level to benefit from the involvement of local and regional levels in inspection activities. Such involvement varies from one country to another. Due to the differences in the social, cultural, political and economic nature of countries, it is difficult to set a standard opinion regarding the application of a certain level of decentralization. However, it is recommended that the level of decentralization takes into consideration the general administrative approach applied in the country.

The inspection system is one element in a larger network that is characterized by a high interaction between its components. The system is highly interrelated with other environmental systems such as environmental permitting. It is also related with non-environmental systems such as licensing and urban planning regulations. Problems arise when these systems are not compatible regarding the level of decentralization. The situation is more complicated when the environmental regulations are the responsibility of more than one entity. In all cases, it is important that the decentralization of the inspection system be compatible with other systems with which it interacts to ensure its effectiveness and the achievement of its objectives.

In exceptional cases, due to circumstances related to the nature of the country, the configuration of the inspection system might take one of two extremes:

- The first is a totally centralized system where only one entity is responsible for setting inspection policies, plans and implementation. This system is usually adopted in small countries where the number of establishments is limited. A totally centralized system is not appropriate in large countries with large number of establishments since the inspection activities would require extensive human resources for field inspection, hardly available in case only one entity is involved. Moreover, the application of centralized systems in large countries would allocate less time to activities related to planning, setting priorities, performance evaluation and feedback, which might affect the credibility of the inspection entity. The inspectorate's responsiveness to public complaints might make time allocated for routine inspection also limited.
- The second is a highly decentralized system where the local and regional levels are responsible for setting inspection policies, plans and implementation based on national directives. This approach is only possible when the political system itself is decentralized (e.g. in federal systems).

The most common decentralization levels are:

- Decentralization of inspection implementation at the local and regional levels based on inspection plans set at the national level. This approach to decentralization is based on a delegation of tasks.
- Decentralization of inspection planning and implementation activities to the local and regional levels based on policies set at the national level. The regional and local levels set their own individual plans based on such policy.

Given the existence of political will, the main barrier to decentralization is related to the low peripheral technical and financial capabilities. In some cases, the total lack of technical and financial resources at the regional and local levels does not allow for decentralization of inspection activities to be considered in the first place. However, in view of future benefits, costs of building technical and financial resources of provincial levels, upon which the decentralization of activities are based, should be considered as the transitional costs to be borne by the central level.

6.1 Prerequisites for a Decentralized Inspection System

In order to maintain an effective decentralized system, the following requirements are recommended.

6.1.1 Clear distribution of responsibilities

There should be a clear distribution of responsibilities between the different levels involved to ensure effective utilization of resources and avoid duplication of efforts. The distribution of responsibilities should take into consideration the available resources, technical capabilities and environmental context. This distribution should be based on clear criteria such as:

- Size of establishments;
- Complexity of activities;
- Sectors;
- Geographical location.

6.1.2 Coordination mechanisms

The development of coordination mechanisms between the different levels involved in the system is an essential pre-requisite to decentralization. The coordination mechanisms could include:

- Joint planning;
- Reporting;
- Meetings;
- Information exchange;
- Technical support.

6.1.3 Standardization of inspection tools

The standardization of inspection tools including inspection checklists, reports and methodology play a very important role in the homogenization of approaches to achieve set objectives and enhance the effectiveness and credibility of environmental inspection. Such standardization should be complemented through the development of operational procedural manuals and information generating mechanisms.

6.1.4 Quality control

Being a dynamic process targeting delegation and improved performance, the decentralization process is highly affected by the performance of peripheral authorities. Assessment, follow-up and quality control should be integral parts of the system. The quality control procedures would be highly important to identify needs for capacity building, administrative interventions or modifications in the inspection approach.

6.1.5 Capacity building

Capacity building of different levels involved should be undertaken to homogenize the inspectors understanding of inspection tools and methodology. Such capacity building activities should be tailored according to the nature of activities undertaken by each level.

6.1.6 Clear enforcement policy

With the decentralization of inspection and enforcement activities, it is essential to set a clear enforcement policy, to guide different levels during the process. A consistent and effective enforcement policy helps to ensure that establishments are treated fairly and contributes to building and strengthening the credibility of environmental requirements.

The policy should be jointly developed by policy makers, legal advisors and field inspectors. It should set the decision rules upon which appropriate enforcement procedures will be based taking into consideration the right of the facility to a clear justification for the implementation of a specific enforcement measure. The rules should be clear and flexible to avoid rigid approaches, which may be detrimental to the whole enforcement process and should include conditions to guard against the misuse of enforcement powers. The objective should always be achieving the compliance of the establishment and consequently environmental protection.

6.2 Gradual Decentralization

It is important that the shift from a centralized to a decentralized system be gradual so as not to overwhelm the periphery with inspection activities, which are usually mastered not only through advanced training, but most importantly through practical experience.

In inspection systems, this sequential decentralization is usually based on inspection activity, sector, size of establishment or location. In each of these cases, quality control and assurance are important aspects to evaluate the effectiveness of the process.

If decentralization will be gradual based on type of activities, it is preferable to begin by compliance checking activities. Field investigation required for compliance checking makes it a resource-intensive activity and thus the decentralization of such activity will allow the central level to benefit from the resources at the peripheral levels and allocating more time for planning and supervision of the decentralized activities. Moreover, the adoption of such scheme will allow time for the national level to implement quality control procedures, essential to identify problems and improve the system. The compliance checking activities could also be gradually decentralized by size or sector.

7. NON-COMPLIANCE RESPONSES

Checking compliance with regulatory requirements and identifying violations is only one step in the inspection system. This step is followed by the selection and implementation of the non-compliance response, with the objective of achieving environmental compliance rather than punishment. Non-compliance response strategy is an integral part of the inspectorate strategy since it provides the decision rules upon which post-inspection actions are based.

There are a number of approaches to non-compliance response; some of which are voluntary encouraging and assisting the change, while others are regulatory, based on law requirements that directly or indirectly reduce or prevent pollution. As detailed below, the success of the command-and-control approach depends to a great extent on the implementability and enforceability of the requirements.

7.1 Factors Affecting Enforceability

7.1.1 Authorities

Environmental laws are most effective if they provide sufficient authority, without which the enforcement process would not be able to create compliance. The credibility of an enforcement program will be highly affected if violators can successfully challenge its authority to take required actions. The authorities that are extremely important to an effective program include, *inter alia*, the following:

- ***Authority to regulate***

  - Authority to issue regulations, permits, licenses, and guidance to implement the law.
  - Authority to be flexible and adapt requirements to facility-specific circumstances.

- ***Authority to monitor compliance***

  - Authority to inspect regulated facilities and access their records to check their compliance.
  - Authority to require that the regulated facilities conduct self-monitoring, keep records of the results, report periodically to the environmental authorities and make the information available for inspection.
  -

- ***Authority to detect falsification of data***

  - Authority to undertake monitoring activities to check the self-monitoring results.
  - Authority to cross check applied practices through questioning facility employees.
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- ***Authority to respond***

  - Authority to adopt appropriate responses to non-compliance according to the nature of violation. Such authority should be backed by the authority to take legal action against non-complying facilities, for example:
    - o Authority to impose a range of fiscal penalties and other sanctions on violating facilities;
    - o Authority to impose criminal sanctions on violating facilities.
  - Authority to respond to violations that represent an imminent danger to health and/or environment including discontinuing polluting activities or facilities, requiring compensation or imposing clean-up.
  - Authority to seek a court order to impose sanctions or penalties.

7.1.2 Institutional framework

Authorities are seldom granted to a single party. The laws and regulations generally establish the institutional framework for their enforcement by indicating the responsible entities and the roles and responsibilities of each one. The coordination between such entities is a major factor to ensure the rational use of authorities and to avoid inconsistency or loss of system credibility.

Some laws may give citizens and non-governmental organizations the right to report violators to responsible authorities or sue polluters and regulators for failing to fulfil their duties under the law. Such right should be directed towards achieving the highest possible return from the available resources.

7.1.3 Balance between authorities and facility rights

In order to maintain an effective inspection and enforcement processes, the facilities rights should be taken into consideration in all activities, especially when regulatory authorities identify environmental objectives. It is important that all establishments be treated equally and fairly regarding enforcement actions. Apart from being one of the rights of the establishments, this specific issue is critical to the credibility of the regulatory authorities.

- ***Right to be notified of the violation***

In some laws and regulations, a notice of violation is issued before any formal enforcement action is pursued. This notice could be informal or formal according to the requirements of the laws. Such action provides the facility with an opportunity to rectify the violation within a specified time frame to avoid the implementation of enforcement action.

- ***Right to select method of rectification***

The facility should have the right to select the method of violation rectification according to its available resources and conditions. It is important that the environmental inspectorate does not impose any technical recommendations concerning the corrective actions for violating establishments.

- ***Right to issue appeals***

The factory should have the right to issue appeals, to the system, related to inspection results and enforcement actions. The facility might require the verification of measurements by an independent laboratory.

- ***Right for Information confidentiality***

All information and documents collected during field inspection are confidential and should be handled accordingly.

7.1.4 Environmental requirements

Environmental laws differ in approach used to address environmental requirements. In some laws, the environmental requirements are included in the form of emission limits or management practices that establishments should abide with. Other laws set the framework upon which the requirements are developed. Environmental requirements are either general, sector-specific, area-specific or facility specific.

- ***General requirements***

These are requirements applied to all types of facilities including regulations for emission concentration, waste management practices, conditions specific to raw material and products, maintaining specific records, self-monitoring requirements, among others.

- ***Sector-specific requirements***

These are requirements that only apply to specific sectors and are usually related to the technological processes used in the sector. Such requirements could be specified in environmental regulations or could be the result of voluntary agreements between the sector and the regulatory authorities. In the latter, the agreement usually involves the commitment of the sector to comply with certain emission levels which are in most cases less than those set by the laws.

- ***Area-specific requirements***

These are requirements relevant to areas of different nature such as industrial estates, touristic development, protected areas or to geographical regions based on their carrying capacities or pollution levels. These national requirements usually address the criteria that should be satisfied in specific development areas including conditions related to location, landuse, types of facilities, management systems and other development conditions.

- ***Facility -specific requirements***

It should be noted that each facility should abide by the general requirements as well as the sector-specific and area-specific requirements.

Facility-specific requirements are never included in a general regulation as they are only relevant to specific facilities. They are rather implemented as conditions to be granted licenses and permits given that the authority to customize facility-specific requirements is regulated. These requirements are set taking into consideration the activities undertaken in the facility and surrounding environment. They may be related to technological conditions, emissions concentrations, implementation of pollution control schemes or monitoring activities and may address one or more environmental medium. Such requirements are incorporated in environmental permits, in case these are stipulated by the regulatory framework of the country. They could also be in different forms such as in the approval of the environmental impact assessment study (EIA) prepared before the project establishment as necessary conditions to be granted the license. This gives the regulatory authority the right to revoke the license/permit in case the facility violated such requirements.

To ensure effective enforceability, all types of requirements should be implementable and feasible and should have the following characteristics:

- Clear regarding required level of compliance and expected enforcement actions in case of non-compliance;
- Comprehensive regarding the needed actions and deadlines for compliance ;
- Precise regarding the identification of regulated facilities;
- Flexible to be adapted to different regulatory circumstances.

7.1.5 Compatibility

In order to establish an effective response strategy, all environmental laws should be compatible and should not contradict one another, unless one is intended to supersede others. Environmental laws should reinforce and complement laws and policies in other sectors, such as:

- Heath; food safety, occupational health and safety, consumer products, pesticide use, etc.
- Natural resource management; water, energy, minerals, forests, etc.
- Land use planning; transportation, development, siting, etc.
- Industry and commerce.
- Agriculture.

7.2 Enhancing Enforceability

In order to enhance enforceability of environmental regulations, several principles should be adopted during all stages of the inspection process including laws formulation and implementation, permit development, inspection activities and non-compliance response.

7.2.1 Graduality in implementation

The success of an enforcement action in achieving its objective depends to a great extent on the nature of violating facility, size of the establishment, financial status of the establishment and many other factors. The ability of the establishments to react to sudden pressure exerted by enforcement measures differs according to technical and financial constraints. It is essential that the implementation of enforcement programs be gradual to achieve a sustainable accumulated progress on the long run rather than enforcing all requisites in a short time, which could overwhelm most facilities.

7.2.2 Balancing stringency and feasibility

The implementability and feasibility of corrective actions has a great effect on the degree of compliance. It is thus essential to achieve a balance between setting strict and ambitious environmental requirements and the feasibility of implementation to ensure a high level of compliance. This balance has to be found in the pre-permit negotiation, or in the formulation of regulations, as the case may be. The inspectorate may play a role in both cases depending on the legal, policy and managerial framework.

7.2.3 Preferential treatment for committed facilities

In dealing with violating facilities, committed or cooperative facilities that achieved progress regarding compliance should receive preferential treatment in comparison to other facilities. Such preferential treatment would encourage other facilities to rectify their violations. Moreover, differentiation should be making in dealing with industries that failed to achieve compliance for serious reasons and others which can reduce the pollution burden through adopting low cost procedures. In order not to project an image of double standards, this approach and the criteria governing it, should be made known to the regulated community, together with its rationale which is to encourage facilities to progress towards compliance. This approach is especially pertinent in the early phases of regulatory control, e.g. a new law, when non-compliance is the rule rather than an exception.

7.2.4 Improving the climate for compliance

Several factors contribute to creating a responsive climate for compliance. They include:

- Provide awareness and technical assistance to the facility;
- Build public support;
- Publicize success stories;
- Provide economic incentives and creating financial arrangement;

- Build environmental management capability within the facility;
- Maintain a transparent enforcement system;
- Show flexibility in implementing enforcement actions.

7.3 Response to Violations

Non-compliance response could only be initiated after the violation is proved based on field inspection and monitoring results. The adoption of different response mechanisms is highly related to the stipulations of environmental laws and regulations and to the flexibility they provide to the inspectorate. However, such flexibility should be well controlled through the development of a clear enforcement policy to streamline the adoption of different responses.

In implementing the response actions, two main approaches are used:

- Direct implementation;
- Negotiations.

7.3.1 Direct implementation

For such approach, the enforcement measures are directly implemented without allowing for any communication or discussion with the facility. In the following, the most common non-compliance responses are discussed.

- ***Notification***

In such cases, the facility is notified of the violation without implementing any enforcement actions and is directed to rectify it within a specified time period. This approach is effective when the actions needed for rectification are simple and do not require much time and that the violation does not represent an imminent danger to health or the environment. Moreover, it is best applied in case facilities have an outstanding compliance history such that informal notification is an incentive to comply. This type of response requires follow-up inspection after the specified period to ensure that the violation is rectified.

- ***Formal administrative actions***

Formal administrative responses are the most commonly used in enforcement. In such approach, the facility is officially notified of the violations and fines are collected, as specified by the law. The facility is requested to rectify the violation within a specified period of time. Follow-up inspection is conducted after such period and more stringent actions are taken in case the violation persists. The actions are usually related to imposing clean-up on the facility expenses, discontinuity of violating activities or facilities and requiring compensation. In cases of imminent danger to health or the environment, laws could necessitate the temporary closure of the violating facility until the violation is rectified. Most laws set higher penalties for repeated violations.

The rigid specification of the period for rectifying the violation by the law is not usually appropriate to all possible cases. Inspectors should have flexibility in indicating such periods according to the actions required for rectification. This is most applicable for violations whose rectification requires long periods of time. In such cases, the facility might be required to provide the inspectorate with an action plan including the time schedule for implementation. Follow-up inspection could be periodically conducted to examine the progress of compliance activities.

- ***Formal judicial actions***

In such cases, a judicial record is prepared and forwarded to the judicial authorities to initial a lawsuit. Such records are prepared by inspectors with judicial powers who are summoned in court as witnesses. Civil or criminal judicial responses are taken according to the type of violation (felony, delinquency or contraventions).

The main problem with such approach is the lengthy judicial procedures, which could affect the credibility of the regulatory authority.

7.3.2 Compliance promotion

In this approach, the facility is given a chance to negotiate conditions of the enforcement actions with the aim of achieving compliance. Such negotiations are usually related to periods given for violation rectification. Negotiation provides an opportunity to reach a solution that satisfies all parties and ensures the commitment of facilities to compliance. However, what usually brings the facilities to negotiation is the implicit threat of implementing enforcement measures.

The negotiation approach creates a cooperative and transparent relation between the facilities and the regulatory authorities. Negotiations will enhance the image of regulatory authorities because facilities will appreciate that the concerns and difficulties they encounter in achieving compliance are being taken into consideration. Moreover, the resulting settlement will alleviate the inspection load on the regulatory authorities for such facilities since their inspection will only be limited to follow-up of the action plan progress.

Because the negotiation is not a direct implementation of laws, it should involve concerned parties including the affected community and/or representative non-governmental organizations.

The negotiation results should be included in an official document formalizing a binding agreement that should be respected. This document could have different names including settlement, administrative consent order or judicial consent decree depending on the traditions of each country, and the process through which it is formalized. The unofficial condoning practices in many countries should be avoided. The agreement document should include fixed obligations, time schedules and penalties for non-compliance to maintain a constant pressure for compliance.

8. COMPLIANCE CHECKING ON VOLUNTARY AGREEMENTS

Voluntary agreements are policy instruments complementary to regulatory instruments to address environmental problems. They represent a tendency towards cooperation between environmental authorities and establishments. Such agreements provide flexibility in reaching the environmental objectives, relative to the traditional command and control regime.

The agreement involves a commitment from single facilities or industry sector towards achieving set objectives. The main advantage of these agreements is that they derive from a cooperative approach based on mutual understanding and trust from both sides, which requires the respect of the responsibilities of each party as indicated in the agreement.

These agreements should be consistent with the legislative system, which should allow such agreements and set the criteria for it.

8.1 Voluntary Agreements

8.1.1 Types of voluntary agreements

In some cases, facilities show their commitment to environmental protection through the implementation of unilateral voluntary programs. These are environmental improvement programs created by the establishments as a self-regulating[4] initiative in response to pressures. These arrangements are not inspected by regulatory authorities and are not legally sanctionable in case of non-compliance. Such arrangement is not considered an environmental agreement.

There are three categories of voluntary agreements with different participation of the governmental environmental authorities.

- ***Public voluntary programs***

These are environmental programs set by the public authorities and industries are encouraged to voluntarily participate in them. In such agreements, industries will be committed to comply with set conditions related to environmental performance and criteria for monitoring and evaluation. In return, the industry will benefit from the incentives provided by the authority in the form of technical assistance, subsidies, or enhanced public image. Based on an agreement, the industry will be expected to comply will all conditions with no actual negotiations, but with due consultation with the concerned industry.

- ***Negotiated environmental agreements***

These are mutual agreements between the regulatory authorities and an establishment or a sector. This is the most commonly applied type of environmental agreements. The agreement is reached after a process of negotiations resulting in a commitment that is formally recognized by the environmental authorities and that is subject to sanctions in case of non-compliance with the agreement terms.

- ***Private environmental agreements***

These are agreements in the form of contracts between an individual establishment or sector and a local or international organization, groups or NGOs. These agreements involve a minimal public authority involvement.

- ***Private environmental arrangements***

An example for such arrangements is the implementation of an ISO14001-based environmental management system. In such cases, the certifying body will be responsible for issuing the certificate and for periodic third party inspection. In all of these cases, the entity with which the facility has established the arrangement has the right to apply non-compliance responses based on the contract law.

8.1.2 Elements of a voluntary agreement

In all voluntary agreements, the contract and its conditions plays a key role in clarifying the rights and duties of each party. Factors that should be addressed in the contract include:

- Scope of the agreement;
- Clearly defined targets;
- Nature of obligations;

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4 Self-regulating initiative: is the case where the facility sets voluntary specific conditions or programs that it should comply with.

- Time schedule for achieving the targets;
- Arrangements for periodic reliable reporting and monitoring;
- Indicators of compliance with targets of the agreement;
- Measuring for dealing with circumstanced that may affect the conditions of the agreement;
- Arrangements for evaluating and monitoring compliance with the agreement including the approach adopted and the entity responsible for inspection;
- Measures to be taken in case of non-compliance with the agreement terms;
- Relation of the agreement with the current legislative system;
- The period for which the agreement is valid;
- Criteria for agreement termination.

Agreements may address several objectives including:

- Complying with existing laws and regulations;
- Supplement existing regulations by setting more ambitious environmental objectives;
- Addressing subjects not covered by regulations;
- Temporary measures that are taken in preparation for a new law.

8.2 Involvement of the Inspectorate in Voluntary Agreements

8.2.1 In the development of the agreement

For both public voluntary programs and negotiated agreements, the inspectorate could be involved in the agreement development phase. This involvement is either related to the inspection of the facility to establish baseline conditions before the development of the agreement or in the formulation of the agreement itself. The first role is usually undertaken in both agreements where it is important to evaluate the environmental status of the facility before setting the conditions for the agreement. However, the second role is mainly applied in case of negotiated agreements since the development of a public voluntary programs are usually done on the national level, with due feedback from the inspectorate and other environmental authorities.

In private environmental agreements, the inspectorate should be informed of the agreements and provide clearance for its contents to ensure its compatibility with relevant laws and regulations.

8.2.2 In the implementation of the agreement

The private environmental agreements are not made with governmental authorities and thus are not inspected by the inspectorate. However, such agreements generate a considerable amount of information that could be useful for the inspectorate. Chapter 9 presents the approach towards the Environmental Management System as an example for these arrangements.

The inspectorate should have copies of all agreements and should examine them before formulating the inspection plan and non-compliance response related to such facilities. Non-compliance response should adhere to the terms of the agreement.

Public voluntary programs and negotiated agreements include specific objectives to attain in specific time periods and accordingly, inspection will be limited to checking the compliance of the establishment with the terms of the agreement. Accordingly, compliance checking is undertaken on two steps.

- ***Self-reporting***

Self-reporting could be integrated in the conditions of the agreement. The facility will be required to submit reports to the inspectorate including the achievements accomplished in specific periods. The report could be coupled with self-monitoring results or calculated indicators as requested by the agreement. The inspectorate will analyze the report and could compare the achievements to the agreement.

- ***Field inspection***

Field inspection could be undertaken to check the facility performance as compared to the agreement conditions and the reporting results. The frequency of the inspection will depend on the time schedule indicated in the agreement and the analysis of the reports.

9. ENVIRONMENTAL MANAGEMENT SYSTEMS AND ENFORCEMENT

Increasing concern about environmental issues has significantly affected global practices in recent years as organizations strive to comply with increasing governmental regulations on one hand and to meet consumer expectations on the other. Companies try to achieve and demonstrate sound environmental control and active management of their environmental performance through developing, implementing and maintaining a well-structured environmental management system (EMS) integrated with the overall management system in the establishment.

An EMS is a framework that helps a company achieve its environmental goals through consistent control of its operations. This is achieved through the design and implementation of an environmental framework that defines the management policy, designates an implementation phase and allows for identification and correction of deficiencies. The ultimate aim is the continual improvement of the environmental performance. The EMS provides a proactive approach, which identifies the root cause of problems and addresses them to prevent their recurrence.

The most commonly used framework for an EMS is the one developed by International Organization for Standardization (ISO) for the ISO 14001 standard. This framework is the official international standard for an EMS. The Eco-Management and Audit Scheme (EMAS), adopted by the European Union (EU), enables industries to voluntarily[5] implement environmental management systems in order to improve their environmental performance. While ISO 14001 apply to organizations, EMAS is restricted to site-specific industrial activities.

Box 9.1: Elements of an ISO 14001 EMS

- Develop the company's environmental policy as a framework for planning and action.
- Identify environmental aspects of the company's activities and indicate significant one.
- Identify and ensure access to relevant laws and regulations and other requirements to which organization should adhere.
- Establish environmental objective and targets based on the policy and significant environmental impacts.

[5] In some countries such as Ireland, the implementation of EMS is one o the requirements of environmental permitting.

- Formulate environmental plans and programs to achieve objectives and targets.
- Establish roles and responsibilities and provide resources.
- Ensure that the employees are trained and capable of carrying out their environmental responsibilities.
- Establish processes for internal and external communications regarding environmental issues.
- Maintain information on EMS and related documents.
- Establish an effective document control system.
- Identify, plan and manage operations and activities in line with the environmental policy, objectives and targets.
- Identify potential emergencies and develop procedures to prevent and respond to them.
- Monitor key activities and track performance.
- Identify and correct cases of nonconformance and prevent their recurrences.
- Keep adequate records of EMS performance.
- Periodically conduct internal audits.
- Conduct periodic management review.

The implementation of EMS has provided establishments with many benefits such as:

- Improved corporate image among public, regulators and customers;
- Reduction in incidents that result in liabilities;
- Facilitating the attainment of permits and authorization;
- Competitive marketing image;
- Improved relations with insurance companies;
- Achieved saving in costs of energy and material;
- Reduced costs of waste management.

9.1 Relation between EMS and Legal Environmental Requirements

There is a basic requirement in different EMS standards for future commitment to compliance with applicable laws and regulations. Beyond that, the company has considerable latitude in defining the objectives of its EMS. Accordingly, a priority is given to achieving compliance with legal requirements.

Monitoring, measuring and evaluation are key activities of an EMS ensuring that the performance is according to the specified targets and within the timeframe set in the programs. This is achieved through self-monitoring programs, related to emission measurements, performance indicators and internal audits, geared to investigate the compliance of the facility with relevant environmental legislation and regulations as well as other conditions set by the EMS. The results of these monitoring activities are analyzed to determine areas of success and identify the need for corrective actions and improvement.

Moreover, the EMS requires the establishment of external communication links with interested parties such as environmental groups, customers, local officials, regulatory agencies and emergency responders. The facility should respond to any inquiries related to its environmental performance and EMS operation and should publicize information related to its environmental performance.

According to the EMS requirements, the establishment should maintain a number of environmental records which includes, among others:

- Periodic results for self-monitoring program with due comparison to the requirements of relevant environmental legislations;
- Internal audits reports and cases of non-conformances discovered;
- Register of environmental aspects including emissions and wastes;
- Record for all communication with environment authorities;
- Emergency preparedness records;
- Follow-up reports for environmental targets and programs and achievements.

Checking of compliance with environmental laws and regulations is an activity that depends to a great extent on monitoring activities undertaken either by the inspectors or by the establishments. These monitoring requirements are often addressed either explicitly or implicitly.

Accordingly, the implementation of an EMS in any establishment represents an added value not only for the establishment but also to the regulatory authorities. Apart from the benefits already mentioned, the EMS puts the establishment in a better position when inspected by environmental regulators as the establishment becomes well prepared with its monitoring results, records and other information.

On the other hand, the environmental authorities are provided with a wealth of information from which the inspectorate can evaluate the environmental compliance of the establishment. The EMS normally provides more reliable data to verify a single unrepresentative sample that may be obtained during routine inspection.

Such information is especially valuable when the environmental laws do not explicitly require self-monitoring. However, in most cases, this added value is not fully recognized or appreciated by authorities when checking compliance. It should be noted that the EMS provides the inspectorate with information that could be used to evaluate the establishment compliance status, however, such information could not replace the role of the regulatory authority to assess compliance by means of field inspection, it rather supplements such role.

9.2 Inspection Policy Towards Facilities Implementing EMS

Due to limited resources, the inspectorates should set priorities regarding inspected facilities. Such priorities are based on different criteria including size, sector, a history of compliance or a commitment to achieving compliance.

Whether an establishment implements EMS could well fall under such criteria. Accordingly, the frequency of regulatory inspection for such facilities could be reduced, provided that there is enough proof that such facilities are committed to environmental compliance. In doing so, the inspectorate will depend on two main elements.

- ***Self-monitoring results***

The first routine inspection for these establishments is very important to investigate the operationalization and effectiveness of the EMS in achieving compliance and checking the truthfulness of self-monitoring results. Once this is established, the regulatory authority should ensure the reliability of the self-monitoring program. This could be done through:

- Checking the self-monitoring plan;
- Checking quality control and quality assurance procedures;
- Verifying the specified measurement methods.

It is expected that such checking be conducted by technical staff, appointed by the inspectorate.

In the following visits, the inspectorate might depend more on the self-monitoring results and environmental registers of the establishment.

- ***Information requested from the facility***

Agreements could be made with the facilities to inform the inspectorate of monitoring results deviations or environmental accidents. These agreements are already required in a number of laws and regulations. Other information or documents related to the environmental performance of the facility could be provided to the inspectorate upon request. The agreement between the facility and the inspectorate will operationalize the communication link that should be established between both parities, as indicated by EMS standards. Information includes:

- Register of environmental aspects including emissions and wastes;
- Record for all communication with environment authorities;
- Emergency preparedness records.

The internal audits reports and performance indicators include internal information concerning the EMS, which will not be of any value to the inspectors. All the environmental-related results will be included in the self-monitoring records. It should be noted that although at face value, the inspection of a facility having an EMS might be expected to be less resources intensive, in practice, it could require more time and effort for the simple reason that there is more transparency, communication and data available.

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Part II

GENERAL PROCEDURAL ISSUES

TABLE OF CONTENTS

PREFACE

Part II of the guidelines manual to an effective enforcement layout and formulation is aimed to focus herein on the less obvious issues in stake. Here we talk about enforcement programs in general and how to fit one to an ever-changing situation in the environmental arena in the diverse region of the Mediterranean Sea. We talk about how to regulate and enforce without significant investment of effort and resources, through the use of self-compliance methods, self-monitoring systems, application of technology and the invaluable investment in the public domain.

We try also to give the reader a quick glance into negotiation procedures and to highlight the basic mechanisms through which to achieve a good agreement for the sake of the environment while considering and taking into account the interests of the counterparts. Included is a chapter describing pros and cons of multi-governments enforcement efforts and how such efforts might progress to a better Trans-boundary environment.

Some thought and direction has been given herein to the issue of permits in general and permits that license the discharge of effluents to the marine environment, in particular. Such permits if not constructed well, have the power to cause irreversible destruction of delicate ecosystems. An attempt is made to define the basic concepts of well-structured enforceable permits and permitting systems.

Finally, we introduce herein a new approach to tackle the non-compliance pattern of environmental problems. Based upon the thoughts of Professor Malcolm Sparrow, he feels that regulatory systems are best run by recognizing risks and problems and then applying a tailored made intervention for each problem, pattern of non-compliance, or risk concentration. The basis for such method is recognition of the analytical phase in the identification process of the problems in hand.

At the end of the day, a regulator or an environmental enforcement agency should be able to take this guide and apply some or all of the ideas presented here and implement it to the local system of environmental law enforcement inspection and control.

1. DESIGNING ENFORCEMENT PROGRAMS

In this chapter, we will review the common basics that build enforcement programs. Such programs are the main tools of the regulatory agency when it wishes to cover the range of vast polluting sources to the environment. It will also be essential to come to terms with several definitions.

Key issues and glossary terms for further elaboration:

Inspection procedures, sampling, reporting, performance measurement, self-monitoring and self-reporting, workforce problems and technological measures, voluntary agreements, compliance.

Before we speak of enforcement programs and the parameters to consider when trying to design one, we should take a very careful look at what exactly we mean by enforcement programs, who should be the designer, with whom should the designer consult before making decisions and may we say even further – what exactly do we expect from an enforcement program.

We should bear in mind always – and this theme will repeat itself in this chapter in particular – that we as the regulatory agency, in whichever country or entity we function, are perfectly entitled to practice enforcement actions. It is our duty and obligation. However, this is not a self-standing aim as the goal is not simply enforcement. The basic thing we often forget is that our actions are aimed n many directions, including: preventing crime (in police work), enhancing worker's safety (occupational safety organizations), providing a steady flow of income for state budgets (customs, internal revenue system) and in as the present case, making sure the environment is protected and pollution is minimized or prevented.

So it is essential that the enforcement program will not be detached from other means of achieving the final goal, which is a better environment with less nuisance and hazards. Figure 1 illustrates main elements of compliance assurance. Enforcement is just one part.

1.1 What Is an Environmental Enforcement Program

We define enforcement program as the whole array of planning, procedures, targeting, actions, result measurement, feedback and operation improvement that a regulatory agency should take into account. Enforcement program, therefore, should consist of the following features:

- **Target of the enforcement program** – for example, lowering effluents or stopping the discharge of waste, deterring violators, punishment, applying the "polluter pays" principle and other various legitimate goals.

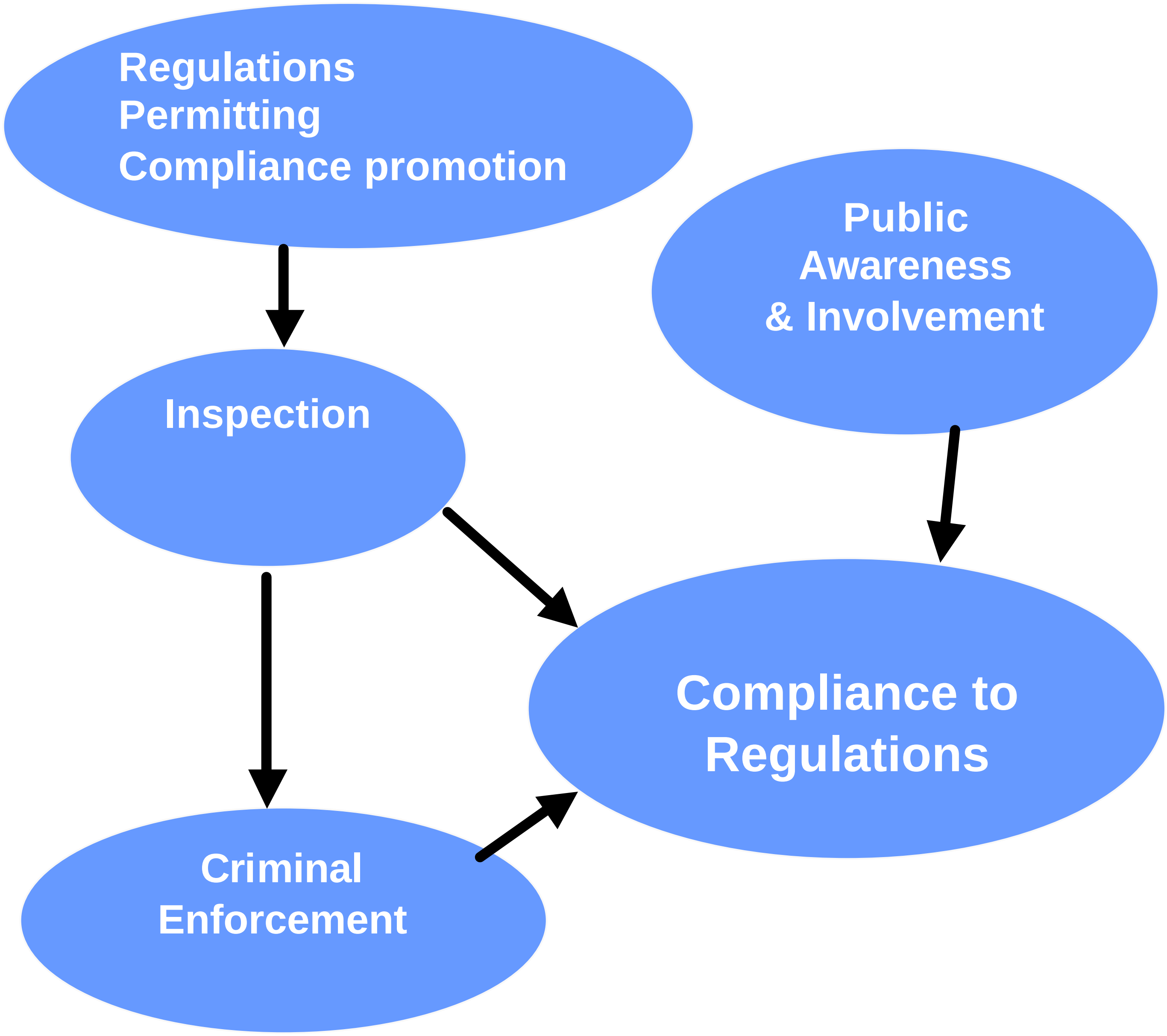
- **Definition of the problems at stake** - through prioritization and quantification. This is actually the stage that sets the problem forth, estimates its true risk and sets a reference base line to relate to later on.

- **Planning and procedures** – beginning with who are the constituencies and the co-regulators. We have to either write or use established procedures of initiation, creation of action plan and assign the operational personnel. This stage involves also the exact methodology of collecting information, collection of evidence such as laboratory samples, photographs, reports and expert's opinion.

- **Measuring successes** – outputs or outcomes, deterrence effect.

Figure 1

Compliance components



The competent authority in charge is the leading agency that should create and finalize the enforcement program and its details. For example, if an enforcement program is local in its nature, then it will only be reasonable that the local authority will carry out the main tasks. If the problem is national in nature-and not to speak of trans-boundary problems, then the national enforcement agency will be in charge of designing and implementing the program. Off course the leading agency should cooperate with relevant bodies. Such bodies could be the customs office, health authorities, maritime and shipping authorities and of course the police and international enforcement agencies when applicable.

Let us discuss a few general items that are worth relating to in this context of preparing a solid and sustainable enforcement program.

Inspections and their purpose

It is the basis of solid, long-term relationship with the facilities and industrial sector. It is important to establish a common language and routine that can be carried out through a regular inspection program under a firm and known checklist of routine inspections. Such actions should be performed regularly and therefore should detect malfunctions and possible pollution causes, preferably before they occur. Another way to look at the purpose of inspections is to create and establish a system, which enables the regulator to initiate a "credible threat[6]", as the game theoretic would call this situation of lasting deterrence from the enforcement agency's side.

Facilities to be inspected

Obviously; this is site and time specific for each country. However, the general guideline should refer to "worse polluters first". It might be private sector or public, heavy industry or municipal sewage. Each country should carry out its "Hot spots" survey and act accordingly. For example in some Mediterranean countries, there is an ever-growing problem of scarcity of underground water and therefore salination. Their policies state that the facilities that discharge clean brine out of ion exchangers or clean salty sewage from food factories are perfectly welcome to discharge their wastes into the sea, under permits, but accompanied by only flexible supervision.

Reports and follow-up strategy

Here the strategy has to specify frequency, priority, when visits should be carried out, documentation according to guidance booklets, and filing reports after each visit has terminated.

In addition, it is most important to conduct periodic work meetings with all officials in charge of the inspection system. The objective of such meetings is to establish actions against the non-compliant polluters and serial offenders. In such meetings the team should examine the evidence collected, including laboratory samples, pervious reports and all information available from neighboring agencies and take decisions on further actions needed. Where applied, these periodic meetings have been proved essential for any enforcement program's success.

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6 Conceptual references have been drawn from Thomas Schelling's *The Strategy of Conflict* (Cambridge, MA: Harvard University Press, 1980). In short, the *credibility* of a threat depends on the *costs* and *risks* associated with fulfillment of the threat for the party making the threat. If a threat is perceived as too costly for the party making the threat, the adversary will not view the threat as credible. A threat signifies to the adversary that the party making the threat has altered his incentive structure. It makes one's course of action conditional on the adversary's response (pp. 123-24).

Enforcement actions to be carried out

By definition, enforcement means making someone do things against his or her own will or better described, simply causing one to comply, whether one objects to the matter or not. This usually causes reactance that might take numerous forms and this should always be kept in mind.

In general, a good program should state prior to its initiation the preferred actions and their sequencing, so as to create solid impression, seriousness in application and reliability toward the public and "the rest of the world". The general rule of thumb might be as follows:

1. Extract the maximum from non-coercive methods – negotiate, use of public, use of media, threats and promises, budgets (where applicable and possible).

2. Administrative/civil enforcement - for minor to medium offenses and first-time offenders **a letter of notification** is possible. Second time offenders might get an **official warning letter** with a specific threat and time limit for corrections needed. Third time offenders or hard cases of pollution may be called in for **interrogation and a criminal investigation** may be carried out.

   Still under this branch of options lies several additional means.

   - Civil/administrative decree – under national legislation, in many countries it is within power of the enforcement agency to issue a decree that tells the violator what steps to take in order to comply with violations, such as to remove piles of solid waste, remove hazardous substances to a proper storage place, decrease effluents or air emissions.
   - Shut down decree – this is also a possibility under several legislations in several countries. This decree is rather an extreme step, which is taken by the enforcement agency. It gives the power to shut down operations of the plant. To be used with caution while assessing the consequences.

3. Criminal enforcement – usually will consist of some form of investigation, evidence collection, and lawsuit and court litigations. The fines here are the highest, the deterrence is the maximum and the punishment usually takes the form of personal guiltiness and prosecution. However, in most countries this branch of action is the longest, the most expensive to the regulator and for the judicial system. Moreover, in many cases it does not solve the immediate hazard to another mean enforcement that the regulator should pay attention to. This is the expected reactance to the criminal investigations and the fertilized soil it creates for the rising of crime to avoid regulator all together. That does not mean we should not use it. It means we have to be aware of its consequences in compare to the alternatives.

4. Another tool of enforcement, which is highly recommended for its efficiency, is the hearing process. It is carried out when the offender is considered to be either "heavy" client or politically connected or a serial offender of minor and medium environmentally significant offenses. This step is sign of both good intentions and strict policy on behalf of the regulatory agency. The aim here is to try to solve the environmental problem or hazard with out getting into complicated long interface with the "client" that may end affirmatively – legally speaking – but the environmental hazard will not disappear so quick. In a hearing the violator is invited to say in his defense what are the idiosyncratic reasons that have prevented him from compliance. He will hear what are the expectations of the regulator and the summation will be written down as a protocol for further follow up. Such a process should be followed up and inspected very carefully thereafter. Often in has been shownthat the effectiveness

of this process to move the violators towards compliance without practicing full coercive means.

Important notice: Serious offenses should be treated by an immediate retaliation action on behalf of the regulatory agency. This is to maintain the credibility of the regulator. Such retaliation should suit each country's legislation and the special case in hand. This could be in the form of a fine, a criminal investigation, or any other means suitable.

Authorities involved

This is, again, very singular and should be fitted to each country and its special characteristics. However, it has been proven in several countries, to let the local authority carry out close and frequent inspections and also be in charge of the on-line monitoring and laboratory samples and analysis. The national authority is the one, which by definition is disconnected from the local level oriented facilities and therefore, is able to function as the "whip" and enforcer.

Enforcement and inspection information system

It is crucial to our opinion, to create an information system that will bring together all details of the inspected and enforced community. Such system should incorporate the ability to provide the basic details, manage regular and routine inspections and findings, issue warnings and other documents, manage investigation details, fines and law suits in case necessary. When all inspectors have access (to a computerized information system, their actions should be automatically coordinated and the inspection history is shared to all branches and departments that deal with the facilities.

Compliance promotion

This huge subject is being discussed in details in special chapters, mainly chapter 3 and 7 which deal with self-compliance and self-monitoring. However a few words here are also required.

It is obvious that the regulators would want the regulated community to comply with the laws and regulations with minimum action and efforts. It is also common knowledge that the regulatory agency will not succeed in covering everything by legislation and can never be fully certain that no pollution will ever occur.

The outcome of this fundamental understanding is that we should create an atmosphere that will promote self-compliance and self understanding with the constituencies' interest to apply BAT, to inform of irregularities and malfunctions and to want an on-line continuous monitoring systems.

To enhance such behavior, there are several steps possible:

- "carrot and stick" management;
- Public involvement and NGOs (see Public Participation – Chapter 8);
- dissemination of electronic information;
- task force to solve problems (see Environmental Problem Solving – Chapter 9).

1.2 Compliance Promotion and Financial Enforcement Mechanisms

Internationally, pollution charges are increasingly becoming a popular tool for the implementation of environmental policy, in order to provide incentives to operators to reduce emissions and as a way of raising revenue for governments. This trend applies to many environmental hazards such as power plants, motor companies, solid waste facilities, and petroleum sector, shipping industry and maritime affairs and many more.

In brief, such financial enforcement mechanisms include emissions charges, charges on services, charges on products and penalties for non-compliance.

For example we will take the petroleum sector. Charges for discharges and emissions are the most commonly used instrument, as summarized below:

Emission Charges

In the context of petroleum operations, emission charges are applied in a number of jurisdictions. For illustrative purposes let us take Norway. Charges were originally introduced as an inducement to reduce the flaring and venting of associated methane gas and to reduce the volume carbon dioxide emissions to the atmosphere. In the case of Norway, the Carbon Dioxide Tax Act 1990 (as amended in 1996) imposes a carbon dioxide tax on offshore installations used in conjunction with the transportation or production of petroleum in relation to:

Petroleum, which is burnt.
Natural gas, which is vented.
Carbon dioxide, which is separated from petroleum and discharged to air.

In accordance with the 1993 Measurement of Fuel and Flare Gas Regulations, the operator has direct responsibility for the management of a carbon dioxide monitoring system.

Operators on the Norwegian Continental Shelf who have stated that the carbon dioxide tax is an impediment to investment and production and estimate that it costs the industry $350 million per year have questioned the effectiveness of the Norwegian Carbon Tax. Some commentators have criticized the effectiveness of the tax in providing an incentive to reduce emissions, claiming that operators find it cheaper to pay the tax than to invest in emission-reduction technology.

It is worth noting that other independent studies (e.g. the World Bank's 1998 Pollution Prevention and Abatement Handbook, "Pollution Charges: Lessons from Implementation") have found that the effectiveness of a levy in achieving its aims depends on the use of other policy instruments in conjunction with the charge. Furthermore, it has been established that emission charges are most effective when they are fixed at a high level for a restricted number of sources and pollutants.

When deciding upon the efficacy of introducing discharge/emission charges for any operation within an enforcement program, the following considerations need to be taken into account:

1. The scope and impact of pollution must be analyzed and the targeted areas must be identified.
2. Priority pollutants that are of major concern in terms of ambient quality and health and environmental damage must be identified.
3. The major sources of pollution must be identified and attention must be paid to the scope of the pollution.
4. Administrative costs of implementing the pollution charges policy must be scrutinized.
5. The existing fiscal system of the target area should be examined in relation to the targeted pollution sources and the best policies for that fiscal system should be identified and implemented.

Another important point to take into consideration is to what extent could these charges or fees are turned back to improve the environment. Experience in various countries has shown that when fees of such sort could be actually be returned to the public as means of investment in the environment, the chance of acceptability of such taxes are significantly higher.

On the basis of the above considerations and depending on local conditions, a case could be made for introducing discharge or pollution charges. This should be done according to the specific laws and to pollution sources, primarily. The enforcement program therefore, can and should use tool such as emission charges or similar to gain compliance.

Charges on services

In order to decrease an operation or specific kind of activity, which has a polluting potential, there is the possibility to apply charges on services connected to this activity. For example, if a permit to hold hazardous noxious substances (HNS) or a permit to dump waste to the sea is needed by law, the regulator can apply a charge on the service of issuing and handling processes of permits.

This should cost an operator a non-neglectful sum of money, which in turn should encourage it to find some other alternative. If the charge is wisely formed, then the direct connection to compliance to environmental laws and targets is more obvious.

For example let us assume a charge to possess HNS is based on parameters such as the distance from population center or the total quantity. A permit holder would pay a twice-greater fee if the location of the storage place were in a perimeter of 500m to residence houses, then if it was 2000m away. Similarly he would pay greater fees according to the gross tonnage of substances he stores, calculated by a known and established key of asymptotic nature of some sort. This way the enforcement agency is actually putting into service an efficient tool, which might promote compliance.

Charges on products

A good example for a charge on products is the tax being applied on bottles and cans in several countries. This tax is implemented in the frame of a law or regulation, which is aimed at reducing bottles and cans away from the waste stream while returning it through recycling processes to another product. In order for such aim to gain compliance within the public and industry, the best-proven way was to apply a “refund tax” on these beverages containers. This tool is a success almost in every country that adopted the system. It fits very well in the theme of the regulatory agency that has to enforce environmental laws, by using ever y mean in its disposal. This tool may be applicable and should be considered before getting to design and enforcement program.

Another example of product's charges is the tax put on leaded fuel. This creates a planned bias through the customers to prefer the unleaded fuels, which are far less polluting.

Penalties for non-compliance

In virtually every jurisdiction with a legal framework for environmental protection and nature conservation, the implementation of the Polluter Pays Principle (PPP) is evident in relation to many laws.

In Tunisia, for example, the national waste management program is based on two overriding principles – the principles that the polluter pays and the producer is responsible for recovery/treatment. In particular, Law 96-41 states that in cases where wastes are dumped in the natural environment without due respect for the national legislation and standards, the competent authority shall define the necessary remediation measures. Under Article 5 and 6 of Law 96-41, if the party responsible for the offence does not remove the waste and remedies the site without delay, the competent authority will take responsibility for the remediation process. However, this does not exonerate the responsible party who must pay for the remediation.

In Israel for example, the Oil Marine Pollution Prevention Ordinance 1980, gives the government the power to order the polluter of a full recovery and remediation of damages, done by oil spills. A full compensation is then received if by the insurer (P&I clubs most usually when talking of marine vessels) or by a court verdict.

Monetary Sanctions for Non-compliance with National Environmental Legislation could be addressed through the many mechanisms. Since environmental felonies are often economically driven, then this stick of financial sanctions has been proved to be effective.

One more extremely important tool of financial nature is the emission trade, which is gaining more and more fans throughout the world. This is true mainly for air emissions but also for water emissions and the scope is even larger. The principle is simple in essence, where each entity has a right to emit a certain amount of substance, set according to its present situation and its financial strength. These limits of emission are tradable. In other words, if a country is entitled to release 1000 tons of C to the air each year and each ton of C is worth 1 million USD/year then it gives this country an incentive to reduce the C released. This country might want to translate this tool to an economic benefit, so it may sell its rights to emit 1000 to other country, which is less developed and cannot afford to enter to a modern technology and environmental friendly world.

1.3 Enforcement Program – An Example

We chose to bring an existing and running example of enforcement program, which is activated in the Israeli Marine and Coastal Environment Division (MCED), within the Ministry of the Environment, since 2000.

It should be mentioned that as was already been expressed above, there are endless versions of enforcement programs. This one is based on the knowledge of the single inspector, assuming she/he is working under strict procedures and set criteria of priorities. Determining the facilities, visit frequencies and follow-ups are at his judgment call.

This program deals with the land-based sources of marine pollution to the Mediterranean Sea. The target of the program is to reduce - and when plausible, remove completely - the point source pollution contributors from Land-based origin to the sea. Quantitative goals were set site specifically, to achieve less flow rate, less chemicals concentration, improved "housekeeping" of facilities, strict timelines to apply BAT[7] and transparency principles of information flow.

MCED inspectors, each in his/her territory, carried out a survey in order for a national discharge priority to be set up and selection criteria list to be created. All based on flow rates, levels of contaminants, and their impact on the marine environment. Each inspector in consultation with the national headquarters engineers and lawyers finally made the determination. Their job was to consolidate and coordinate efforts and synchronize and guide the field operators.

Inspection database of the past few years has resulted in the recent completion of an inspection & enforcement handbook, which has been put into operation during the first

7 Best Available Technology. Usually refers to also as best available and economically achievable technology.

quarter of 2001. It is based on USEPA & Dutch manuals and was tailored to suit the needs and capabilities of the Ministry of Environment in Israel. It includes everything an inspector needs in order to effectively conduct his/her visits and field inspections: checklists, forms, guides for tests and photograph shooting, contact lists, laws and regulations.

The inspection program for a certain plant or facility, is based on a first inspection which is carried out 'wall to wall' to set ground zero for further control. This is followed by periodically visits of the facility, depending on its potential of marine pollution. A basic inspection would be searching first and foremost for 'good housekeeping' symptoms of the facility. When this will not be the case, the plants will automatically set it self on a priority list to further checks and visits.

Inspections are being carried out both randomly (along 24 hours of a day) on short notice or no notice at all, or with pre-informed and announced visit to the body to be inspected. This applies to any body discharging its effluent directly or indirectly into the marine environment, including - publicly & privately owned treatment plants, industrial facilities, etc'.

The frequency of inspections is set by the inspector, according to the need that develops with time, for revisiting the permit holder, according to a set of parameters such as – rate of self reporting, validity of reporting, compliance & non-compliance, geographical position & possible harmful affect on the environment in any case of non-compliance.

Periodical reports from all inspectors are gathered & processed to give an overall view of a compliance/non-compliance balance over time, to assist in evaluating future conduct in dealing with a specific permit holder, such as legal actions that may be needed, or in certain cases less severe actions may be sufficient.

The inspectors are continually trained, to better their professional abilities within the various fields of inspection, such as municipal treatment works, hazardous substances, field tests of water quality, etc. regular meetings are being held in order to keep the teams in track, follow up trends and apply feedback.

The Haifa Bay area was selected as the most prominent contributor, of both contaminants & flow rates into the marine environment. For this reason the implementation of this program, has been made primarily for the Kishon River, into which about 80% of Israel's industrial sewage flows regularly. Measurements and reports from the main pollution facilities show that this enforcement programs in the Haifa Bay was in fact a success. Reduction of 90 percent – in some cases, hundreds of percent reduction - of pollutants, heavy metals and organic compounds has been demonstrated, giving a first hand reassurance of the enforcement program good targeting, layout and operation. Although great improvement has been achieved in terms of levels of contaminants, not all set goals has been achieved, hence the application of this enforcement program and stringent actions are still under close supervision and activation. Expansion of the program thorough the introduction of new technologies and techniques is under consideration. For example, on-line "end of pipe" sensors are being installed to increase the ability for immediate response to abate malfunctions and also for the thorough, serial collection of data (see next part of present Chapter: "special tool in service of enforcement").

1.4 Special Tools in Service of Enforcement

One should never seize to seek for sophisticated paths to reach his goals. This is particularly true when thinking of the toolkit of enforcement gear and enforcement personnel trying to do their unfavorable work with limited means. Let us therefore discuss a few gadgets that might help carrying successfully their work.

- **Digital cameras**

This has become a quite useful devise that is not only cost effective for the organization as a whole in terms of saving money (no film usage, no picture development) but it has numerous advantages for the field agents and inspectors. The flexibility of taking pictures as you please, according to the situation, store them on portable media and having the ability to ship them through computer network or via modem or internet on near real-time situation. These devices are equipped nowadays with ultra resolution of 3.3 to 5 mega-pixels, tele-zoom options, and quick connection to computers and video and long life batteries.

The advantages for field operatives are the quick flexibility and enormous storage space and the excellent resolution of the pictures.

There might be some judicial problems arising from the fact that such picture files are so easy to manipulate. These problems are theoretical because so far we are not aware of any precedents of that source. However, one should bare in mind the complexity that might be hidden here and the legal aspects to be taken care of.

- **Laptop computers**

Assuming inspectors are spending most of their precious time in-situ, rugged portable computers are almost a necessity. Reports formats, computerized databases, environmental models, word processors, are all a matter of fundamental to every inspectorate whose goal is to have an effective and ordered way of managing its data and information resources. Add to that the ability to transmit via modem or wireless devices digital files such as documents, pictures, audio files, and we have a great leverage to an enforcement agency that is short of manpower and wants to extract the most out of the existing potential. In most countries, the field inspectors are mobilized and have to travel tens if not hundreds of Kilometers in order to conduct their assignments. With portable computers they can increase their time savings by not having to get to base too often, they save fuel; they are efficient in putting to writings important facts and evidence collected in the minimum time after been collected.

- **Portable precision laboratories**

In most of the environmental inspections done by environmental enforcement agencies, there is a fundamental usage and rather intensive one, of chemical and physical samples for laboratory analysis. The problem of many agencies is double: first, the time that passes from taking a sample until getting result and expert analysis from the laboratory might take much too long for the inspector to get the results, needed for decision making. Second, agencies find themselves waste a ton of money on false alarm samples.

A possible solution therefore, may be acquisition of portable laboratories that may compensate the deficiencies listed above. These laboratories take a certain training to operate correctly, but then they may save a lot of time for inspectors who are present in the field and would like to get a first impression of possible non-compliance. The organization will evidently save a lot of money on the long run.

- **On line sensors monitoring (end of pipe, other)**

Another optional devices that might help an agency conducting a long-term enforcement program, are on-line sensors placed in the end of the outfall or a pipe or other outlet, which are capable of transmitting to a center, located in the agency's headquarters, emission or effluents parameters within a preset interval.

Such data might be processed in a manner that will alert the inspector if abnormal levels are detected. In such a case the inspectors gets a wireless warning of some kind (pager, cellular) which in turn leads to an immediate inspection in-situ and as soon as possible. These monitoring sensors also serve as a deterring mean, which increases compliance. This will happen because the management of the pollution contributor knows that whenever serious deviations will occur, the enforcement agency will know of it on the spot, and might retaliate severely. They also know, given the very short time to organize, that what ever happened will be very difficult to hide. Therefore we have here an excellent tool, cost effective, to gain compliance within many forms of enforcement programs.

- **Remote control video cameras / Utilization of internet cameras (web cams)**

These devices are similar to said above concerning transmitting to the headquarters center, a data in regard to a special area or facility in concern. The difference is that here the data coming in is a visual data, which has its advantages and weakness. The advantage is off course getting a flowing streaming picture that gives the dispatch the ability to detect visual abnormalities. For example, a color of emission, oil spillage from a terminal, entrance of vehicles or people to an environmentally sensitive area and so forth. The weakness of such visual monitoring is dual: it needs careful monitoring on a visual basis by manned position, and it is limited by day light and by the very few uses of it. These cameras however, are extremely cheap; they can be placed and connected to the enforcement agency's network easily. Moreover, many cameras like the proposed here are already in place by many bodies and institutions around the Mediterranean and are called WEBCAMS. They are constantly connected via Internet and may be accessed by anyone who wishes to do so. So an enforcement program may by all means, make an effective use of such devices, depending on the goals and targets of it.

- **Remote sensing (airborne or satellite)**

This area of concentration is well developed to many uses; most of them are for planning and research purposes. However remote sensing for near real-time uses is developing quickly.

The uses of remote sensing and surveillance have been well developed for military purposes and lately the technologies are being shifted to the civilian use. The EU FP5 program has supported several initiatives for putting into practice such technologies. For example, the project called SISCAL, which is run by a consortium of bodies from Germany, Norway, Israel, France and Denmark, is making use of existing satellite data to create an algorithm that will analyze many environmental aspects of marine pollution, and will give the partners an extended ability to control and track marine pollution causes on regular basis with almost no investment of manpower or budgets. More uses of remote sensing technology may be such as the possibility to make extensive use of aerial photography and multi-wavelength photometry to have long-term control and inspection of behaviors and geographical trends, for enforcement and surveillance.

- **Information dissemination**

Additional tool in the enforcement plan would be the usage of dissemination of pollution discharges via electronic means such as the Internet. The principle is simple. For example, a permit holder will be notified that his discharges of pollution and parameters relevant to it will be publicly published via the organization's website. This simple action will hopefully bring the managing directors to the recognition that such transparency might be harmful to their business if they might not comply with the law's demands. A similar system such as this, have brought hazardous substance emissions to a major cut down in the USA. That system is called TRI and is reachable through the USEPA's website.

- **Computerized database**

  Another major improvement to be considered before framing a solid enforcement program is a computer system that will support all enforcement actions and will actually coordinate them almost inherently.

  This should be tailor made software that allows the operator or the user to control all facets of the plants and facilities within his\hers jurisdiction. The software should be user friendly, and contain database and management system of all nuisances, polluters, plants and facilities. It also should hold all criminal and past information, which is valuable for any investigator or inspector in their work.

2. ENFORCEABILITY OF PERMITS

Permits and licensees of all sorts are the main tool the regulatory and enforcement agencies have, in order to communicate the compliance terms and conditions to the polluter in potential. These tools are to be very carefully structured so as to cover and mitigate most of the probable causes of pollution and, most important, have the built-in enforceability capability.

Key issues and glossary terms for further elaboration:

Permits and licenses, discharge to marine environment, multimedia inspection system.

Permits are the two-side contract the regulator has with the entity regulated, which has to be monitored and comply to, according to the law issued by. The regulator's obligation according to this contract is essentially to allow the permitee a certain kind of operation or action or doing. The permitee's obligation according to this contract is subject to its specific substance and it is essentially to comply with the regulator's terms. It is mandatory for the permitee to make sure that the allowance of operation is done under these terms and conditions, specific schedule, limitations and standards, and any other obligation set forth in the permit - the contract.

The environmental regulatory community throughout the world has adopted several categories of permitting operation and action of the permitees. Here are sample representatives:

- Permits to build;
- Permits for general operation;
- Permits for single media subject (air emission, discharge to sea sewage or river, toxic possessions and releases, and so forth);
- Permits of multi-media (integrated) environmental issues;
- Permit to ship or trade hazard material or waste.

As said above, there is no difference in essence among all kinds of permits and licensees in the sense of the possibility of the regulatory agency to make the permitee comply with them. This is as long as they are clear, structured according to the law, or in other words, enforceable.

The minimum requirements and conditions in environmental permits must fulfill the following, in order to reach enforceable conditions:

1. The permit must be drawn from a national/local law or regulation. It must therefore refer to the specific regulation it is written according to and specify and relate to other laws and regulations in force, if stands to reason.
2. The application and description of the activity to be undertaken are part of the permit unless conditions in the permit supersede the information of the application.
3. The permit conditions shall be described in legally enforceable terminology.
4. The permit shall cover items and conditions regarding emissions or discharges, risks, terms of possession, monitoring and reporting, and cover all media - as needed - in an integrated way and in an explicit description.
5. The permit may contain specific conditions, and be more stringent as regards various issues, in order to take care of the environment in the area (for example, a license of operation to a waste processing plant may include the maintenance of the perimeter of the plant in terms of keeping it clean from litter).
6. The permit shall clearly describe what will happen if conditions are not met or if false information is given. It shall specifically declare that revoking the permit, hearings, penalties, investigations and criminal interrogations, and liability charges for damages are among the possible consequences of violations.
7. The permit shall indicate what should be done in case of change in operation processes or procedures, malfunctions that might endanger the environment, change of ownership, and any other incidents affecting the environment.
8. The permit shall indicate the period since it is in force. It will indicate as well, when a renewal of the permit is due and what actions have to be taken to renew the permit. It should be absolutely clear to the permitee that any action needed to make the permit or license in force, is the responsibility of the permitee and not having a permit for the certain activity will automatically fall under the criminal side of the law.

A fundamental question is often being asked whether to unify several single media permits into one multimedia permit. The tendency is indeed to move towards a single permit, "all in one" so to speak. The advantages of such a permit are several, but this chapter is not the place for such fundamental discussion.

However as regards enforceability of permit, the all-in-one system has a great advantage, which is the avoidance of making overlapping, non-consistent several kinds of permits. This situation is unfortunate but not rare, when there are several permits and licensees issued by several agencies. In such cases even well structured permits might invalidate or contradict one another. In such a situation, the permitee will have the courts and the law on its side in a possible litigation, and all because of the clumsiness of bureaucracy.

2.1 Permits to Discharge to the Marine Environment - An Example

Let us consider a case of permit to discharge into the marine environment, to illustrate some considerations. This is an example of how a permitting system gives the regulator a strict tool to keep the environment sensibly clean and healthy even if there is apparent dissonance in "permitting" to pollute the sea.

Permitting is a main tool in our toolbox, which allows us to reduce the pollution contributors to a minimum pollution potential. By permits to discharge, which are carefully managed by a well-known procedure, we are able to create a regular scheduled progression towards applying advanced treatment technology, thus less pollution and less problematic substances are discharged.

According to the LBS[8] protocol of the Barcelona Convention (1976), the discharge of effluents is to be eliminated unless some conditions are met and a permit to discharge is issued complied to and enforced as necessary.

This is an example of single-media permit that also might cover several issues concerning other permits. For example: sewage treatment, treatment facilities to extract heavy metals, centrifuges and DAF[9]s to remove oils, good housekeeping to avoid contamination of runoff water - all these are issues that are in the jurisdiction of anti water-pollution professionals, hazardous materials professionals, in addition to occupational health and safety personnel.

Let us see how might a good permit cover the possible arrays of subjects and still may be enforced. How should we construct this permit and who are the partners.

We will analyze therefore, what should be the purpose of a permit and its goals here:

- Minimize discharges to sea to the greatest degree possible by reviewing land-based alternatives such as connection to municipal sewage systems, irrigation reservoirs or source reduction in every plausible way;
- Minimize pollutant emissions through installation and operation of Best Available Technology;
- Require continuous improvement of wastewater treatment facilities and alternative land-based solutions, to stipulate conditions and requirements in permits, and to follow up on results;
- Allowing discharge to sea of wastes which may damage land resources but not the marine environment, such as brines;
- Permit discharge of authorized wastes only through regulated coastal Outfall;
- Require wastewater quality monitoring and/or marine monitoring;
- Operate according to stringent and advanced international standards;

So according to the specifications above, a permit to discharge effluents or brines to the marine environment is written and sent for the signature of the permitee. It should be noted, that the procedure of how to receive a permit in terms of pre-conditions and intra-agencies coordination (especially important when dealing with multimedia permits, as mentioned above) is not dealt herein at all. Basically the whole procedure of getting a permit is to be considered separately.

There are however, certain “rules” to be used when writing the permit.

[8] Land Based Sources. Point sources of pollution to the marine environment originating from land.

[9] Dissolved Air Flotation (DAF) is the process of removing suspended solids, oils and other contaminants via the use of air bubble flotation.

Permits writing - tips for the road

- The permit should be written and signed according to the specific national law, and by an authorized person. It should be formal and send via mail (complementary to email or fax). Remember that it is a legally binding contract.
- Use simple, clear and correct language. Do not lecture not use poetry phrases. Cut wording as a matter of habit.
- State the purposes of the permit and state under which law exactly does it apply. State its entering into force date and outing of date, as well.
- Set the conditions and terms in a logical way. Make sure that the terms and condition are practically achievable. If there is no assurance that a condition is achievable, there are two options: inquire within the parallel industry the applicable technologies or management systems. Or get into negotiation process aimed to find out the possible ZOPA (see chapter 4), long enough before having to write the permit.
- Make sure you have covered all possible non-compliance occurrences stated by the law. For example, if the law says that a permit to discharge wastewater to the sea is limited to no more then 40 mg/lit of mineral oil, make sure that this parameter is written specifically.
- Do not, on the other hand, try to mix subjects and regulations that might apply only generally, or indirectly. This might be proved later on as too much for to less, and missing the point.
- Permits should contain explicit threats about what the law says, in a case the permitee will not comply. Make sure the obligation is clear and it is apparent, and be vigilant about it.
- Always keep in mind that the terms set in the permit are to be inspected, checked and if there where any non-compliance, enforce. That means that when writing a permit, a permanent structure, archetype should be used and it should be written with the advice and the view of the field inspectors.
- The structure of a permit should always be consistent along with time scale (permits should be kept consistent along the years, given nothing substantial changed), and be consistent among other permit holders to avoid non-consistency and possible cause for suspiciousness and discrimination.

3. REGULATORY REFORM AND SELF-COMPLIANCE

Most regulatory and enforcement agencies are continuously and consistently working under shortage of trained personnel and serious budget constraints. One way to overcome such disabilities is to let the constituencies do part of the inspection work themselves and then report to the competent authority. Indeed it is preferable for the regulatory agency that full compliance will be reached without intervening at all. The concept is compiling significant advantages to consider both for the regulator as for the regulatees.

Key issues and glossary terms for further elaboration:

Regulatory agency, monitoring program, voluntary agreements, environmental covenants, Agenda 21 (1992).

During the last decade and a half, one could observe a new trend within the regulatory and enforcement agencies throughout the world. This trend can be summarized as follows:

Cut short the offensive “good old” enforcement actions, and turn to the themes taken from the modern private and public sectors jargon, namely: customer services; negotiated rulemaking; reach out to the constituencies and the public; self regulation approach.

In short, the establishments through the regulatory level have been trying through the last two decades to shift the responsibility for compliance to the laws and regulations, as much as possible towards the client. The clients from their point of view have been cooperating in general, because they have been seeing a chance of getting more tolerance, understanding and playroom to promote interests while complying with the demands of the establishment. Moreover, the concept of self-compliance and self-monitoring is good for business. It has been proven as good because all over the world, the industry is becoming more and more involved in environmental management (see Chapter 7) and its straightforward connection to the economic well being of the facility itself.

Obviously it was and still is more complicated, and in reality there were many facility owners that took advantage of this tolerant attitude and manipulated the circumstances according to their limited interests in a somewhat cynical way. This has to draw the attention of the regulators when entering a negotiation stage to reach a self-compliance program of a facility.

This general tendency, or regulatory reform, has evolved from the tendency of politicians to lay down the coercive way of regulatory agencies to deal with the violators in the environmental arena, as the major tool to achieve compliance. In stead they were thinking that a more friendly and understanding approach might create in advance better grounds for compliance, with less activation of coercive power. For example, the Israeli Industrial Association had signed in 1998 a covenant with the Ministry of the Environment to gradually adjust air emissions to the standards requested by the Ministry. This treaty has the positive consequence that many polluting facilities were put in a position that they knew the tendency, their official representatives publicly obliged them and this understanding was achieved with out application of any coercive power and enforcement efforts. On the other hand, if from various reasons a certain polluting facility will sign this covenant and not make the time schedule of compliance to the requests, the Ministry will find it a bit harder in court to prove this facility is not complying or is intentionally not cooperating (because it would claim its intentions are pure environmentally – he did sign, did he not? - and only temporary difficulties made him slightly late).

This new tendency has created some inherent dissonance within many regulatory agencies that suddenly were instructed to reduce their conservative enforcement actions and become sort of environmental consultants.

Self-compliance is actually a general name for a holistic approach that brings the regulated community to set several systems – single one or preferably all of them - to promote compliance with the environmental laws. The main systems to account for are:

1. Self-monitoring system – set to measure the outputs of the facility, parameters, frequencies, places and special points to pay attention to, quality and quantities emitted or discharged, environmental impacts etc. as demanded.
2. Self-reporting system – create a reliable method and procedures of reporting regularly emission and discharge summaries, advancement in applied BAT, major changes in equipment and facilities and periodic updates. All reports are to be addressed to the competent enforcement agency. At the information age, special consideration is given to the electronic formats to be submitted together with the traditional hard copy reports. This includes especially and importantly, formal notification procedures in cases of emergency events.
3. Environmental management system - Quality control, records keeping, assurance programs and environmental audits (as described further in Chapter 7).

Several principles should be applied and taken into consideration by the regulatory agency, in order to increase and promote self-compliance within the constituencies:

- Create a complete relationship based on trust and faith;
- Encourage balanced “carrot and stick” management (threats and promises);
- Enhance the facility's responsibility for conducting monitoring and reporting program;
- Encourage public involvement and NGO's (see chapter on Public Participation);
- Increase and encourage dissemination of electronic information and full transparency;
- Assign task force to solve problems, if suitable (see Chapter 9 EPS).

Negotiated rulemaking

One of the buzzwords worth relating to under this chapter is "negotiated rulemaking". This term refers to a process in which the regulators turn to all stakeholders in regard to a certain initiative, and strive together to set environmental standards, formulation of guidelines and references and set acceptable timetables for implementation by whomever should apply them among the stakeholders.

The stakeholders may be other ministerial officers, public representatives, academia and research personnel and of course the industry and the potential pollution contributors. The process of negotiated rulemaking is a negotiation process in essence. It might include an agreement that the outcome must be a consensus and if such is not possible, then conflict resolution and arbitration process must be incorporated in order to reach a consensus.

In similar words, the process is aimed to achieve the environmental goal through the use of consensus type if approach. However, through all this process it must be transmitted to all parties that if this process fail, the final word will be the regulator’s.

If a country wants to enter such a process in order to promote ambient or emission standards or any other regulations that worth promoting through this mechanism, several guidelines are advisable to account for:

1. Apply important environmental principles such as "the polluter pays[10]" or "sustainable development[11]" or "precautionary approach[12]" or "prevention at source[13]". This according to Rio declaration and Agenda 21 (1992) and other global environmental conventions and obligations.
2. Transparency and openness to the public and NGO's, during deliberations.
3. Insure cost effectiveness and efficient implementation. This includes strict and well-defined timetable of entering into force and binding conditions. Stages are to be defined as necessary.

[10] A principle in environmental management which states that the costs of cleaning and recovery operations should always be on the polluter expense. The instruments may be laws and regulations, insurance, bonds etc.

[11] First announced in Rio declaration: Development, which meets the needs of the present without compromising the ability of future generations to meet their own needs.

[12] Where there are threats of serious of irreversible damage lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

[13] A principle in environmental management that acknowledges both environment and economy postulates and states that it is by far preferable for society to minimize pollution of all sorts in source, then treat it afterwards.

<u>Additional points to keep in mind</u>

The concept of self-compliance and self-regulation is very appealing, friendly and social in theory. Indeed in many cases it has been proved true. However, too many times it has been also proven that many facilities were taking advantage of the tolerant approach, in such way that gave them just enough space to play with the establishments on the gray fields of partial self-compliance to regulations and yet no obvious hard case of non-compliance.

It so happens that many times this phenomenon takes place when dealing with the hard cases of non-compliant facilities. This is so because these factories/facilities are most problematic environmentally speaking and they have therefore, much to invest in cleaning technologies. In addition, the bigger and wealthier they are, the more political influence they have, which in turn, is turning as pressure against the enforcement officers. In such cases the most advisable way to promote compliance is site and place specific, but the use of public opinion may come handy here.

Second point is the possible use of monitoring data and operational material collected by the self-compliant industry.

It is undesirable to use this material for purposes of enforcement. There should be an unwritten understanding that no usage will be made for such purposes in a straightforward manner. The reasons are simple. If an enforcement act will be committed, which will be based on the report or a set of measurements done by a certain facility, it will signal them that there might be penalty for good behavior.

For example, an inquiry or even a criminal investigation as a result of some abnormalities might cause the same facility - and in turn we might expect a wave of them - to react to any initiative to support any move of self-compliance methods. Moreover, the case might not withstand in the court of law as is, without further evidence.

The suggestion, therefore, is to use the information supplied by the regulated self-compliant community in two ways:

1. Use it as a base for warning letters, scientific ground base for calling the regulatee for a hearing, or disseminate it under the freedom of the public to know to the public or NGO's. In other words, use this information for by-enforcement and for indirect pressure to comply.
2. When abnormalities or non-compliance are revealed, use trained inspectors to verify the findings on your own and with objective tools. In other words, when irregularities are found, the agency should conduct a full inspection with sampling and measurement to create our own set of criminal findings to be based upon.

3.1 Self-Monitoring

Compliance by its core-strict definition is best achieved - say social psychologists - under deep understanding and internalization[14] of the subjects and demands put forth. Otherwise the regulator might cause reactance, opposition and non-compliance that will need to be addressed in various non-friendly ways, which surely cost money and efforts for the government.

In a way, the term "self compliance" is therefore contradictory to itself.

[14] Acceptance, deep understanding. Look also for further description concerning the phrase “compliance” in Myers Book, in references.

This is why self-monitoring is an important system to bring the regulated community to comply without activating excessive force or efforts. As part of the policy to let the regulated community reach its own conclusions and come to terms with the obligations put forth by the regulator and the law, the use of self-monitoring is a major tool. It is major because it lets the regulatee or the permitee see - first hand - what it is that he emits or discharge, regulate its manufacture components accordingly, and win two fold: close inspection of the industrial process and close inspection on the environmental vicinity.

First and foremost, when letting the regulated community perform self-monitoring program, it is clear that any action required t this context, must be restrained in a well-constructed permit or licensee.

In the permit it should be stated what are the obligations of the permitee, what is the role of the regulator and what is the operator's responsibility in this context. For example, approving the monitoring and reporting procedures, receiving the data in certain frequency, require adjustments as needed and disseminate information to third parties are the regulators rights (or may we say, obligations) that have to be stated vigilantly, in a written document.

Self-monitoring program is - by definition - site and time specific, so the regulator should follow these general rules:

1. Conduct thorough inspection, in situ and over engineering plans, as broad as possible, to get to know the specific facility/industry/other in discussion. Check and cross check other media and potential hazards or nuisances possible from the site. The goal is to know quantitatively and qualitatively what is the environmental risk here and what exactly do we need to know fluently, regularly and consistently, in order to maintain minimum potential to the environment.
2. Write down the draft for a complete monitoring program - Decide what **parameters** do we need to control (heavy metals? Organic matter? Nutrients? Oils?) In accordance with the previous findings. Decide what are the **frequencies** to sample the different parameters. Decide where are the best **places to sample**. Decide according to which **standard methods** should the permitee follow (German TUV? USEPA standard methods? Other?). Set the **preferable laboratory** or list of laboratories that are approved by the regulatory enforcement agency. Set the desirable **reporting procedure** of the results (format, frequency, electronic, scope of coverage, dissemination to whom, etc.)
3. Get into negotiation process with the permitee. The goal is to make them understand that this program is for the best comprehensive evaluation of their emissions and the advantages are clear for the facility and the regulator both.
4. Make adjustments as needed and send it formally as a part/annex to a license or a permit. Make sure that any case of non-compliance to maintain this monitoring program is enforceable (see Chapter 2).
5. Set an ambient monitoring program, as needed. This is sometimes the whole monitoring program by itself. Usually it is a supplementary module to consider.
6. Set a verification inspection plan for the first period of running to ensure correct operation according to plan. This should include cross sampling and comparing of results as needed.
7. Assuming the regulated entity is cooperating in a decent manner with good will, give feedback and help stabilizing the system. Ignore minor malfunctions in terms of activating coercive tools of enforcement. Know on the other hand, that the threat of enforcement will not be credible if not applied vigilantly as needed.

In addition, since self-monitoring schemes are technical in essence, there is a large room for advanced technology applications and innovations, which may make life for the regulated community easier, cost effective and cheaper. Moreover, introducing such technologies will strengthen the ability to be more perform precise, accurate and reliable measurements with less human intervention and high costs.

For example, introducing monitoring devices such as close video cameras, on-line sensors (see Chapter 1, page 13), web cameras and so forth, may promote the monitoring programs straightforwardly.

3.2 Voluntary Agreements and Enforceability

The preferable way as said above, would be to achieve compliance with applying minimum effort on behalf of the regulatory agency. That may be true when letting the constituencies reach conclusion they will be better off complying with regulations, voluntarily.

Voluntary agreements with potential polluters are supposedly a good way to achieve compliance without applying too many efforts. This has been shown on several cases throughout the world during the last two decades.

The scheme is theoretically simple. When the regulatory agency will tackle rather "heavy" problem with industry or other sources of pollution, among the probable courses of action let us concentrate on two, quite diverse one from the other, and see the connection thereafter.

One course of action is to initiate a traditional command-and-control program followed with a comprehensive enforcement program to ensure compliance and maintain high level of alert and hopefully sufficient deterrence thereafter. Naturally this might require initiating a full-scale operation to tackle the problems discovered and dealing with it with the traditional tools of enforcement - civil fines, administrative decrees or criminal investigations. This of course is not the best cost-effective way to reach compliance to our environmental laws, given the definitions we described above.

Second course of action is trying to reach an understanding with the regulated community and the rest of the stakeholders involved. If we are speaking of a single plant or facility, then this "understanding" may be in the form of a usual ordinary permit or license. No complications needed here.

However, in the case of phenomena, a pattern of non-compliance or a grouping of repeated occurrences of environmental behavior, this "understanding" may take the form of a signed agreement, a covenant, a treaty or any other legally binding contract.

The regulatory agency will try to get into negotiations with any one of the facilities and reach a consensus to a compliance program. In case of difficulties, they will try to reach an agreement through well-established mediation or arbitration processes.

The concept of voluntary agreement is based on the assumption that there is basically mutual interest in promotion of standards and regulations to prevention of pollution causes in source, on the one hand, and there are hard economic incentives for the industry to go along with the regulator and be part of the fabric, on the other hand.

The industrial community in most countries understands by the break of the 3rd millennium that being part of promulgation of environmental agenda is good for business and it shows as hard currency eventually.

Voluntary agreements could be made with the industrial sector concerning number of factors. These could be:

- Abatement of air pollution and setting emission standards from plants;
- Abatement of air pollution and application of BAT as regards motor vehicle's mechanical structure and usage of fuels;
- Abatement and prevention of various sources of pollution to the marine environment;
- The phasing out of harmful substances and toxic elements from municipal sewage systems.

For example, the electric power companies who emit the largest quantities of NOx and SOx on the one hand, and have an unquestionable political power, on the other hand, are a suitable client to turn to with a proposal for an environmental agreement. Such and agreement will have to set forth the standards required, and the time schedule to implement them and to meet them.

Another example is the convention signed by the shipping industry, the MARPOL 73/78. This extremely important convention is done to abate all possible pollution sources from merchant ships such as oil pollution, pollution from hazardous and noxious substances, air pollution, and municipal solid waste and sewage discharges. This convention structures a row of changes the shipping industry have to embrace in which they would not have or would taken long time to, if it were not made from a complete cooperation. Moreover, the international Maritime Organization (IMO) using its Marine Environmental Protection Committee (MEPC) is using the tool of voluntary agreement to actually change the shipping world. The transformation in the building structure of oil tanker's hull is a global move with extreme importance that would not have occurred if it would have not been done together with the shipping industry and the large shipping companies. This has proven again only lately, when the MEPC's directive to phase out the use of organotins (TBT) as antifouling paints on ships.

Another example of the use of voluntary agreement is the efforts to lower the sulfur in a diesel gas for heavy trucks. In several countries this has been done effectively together with the transportation companies and the fuel and gas suppliers.

Yet another small-scale agreement may be aimed at maintaining the cleanliness of certain areas or coastlines of a country. It depends of course who is the competent authority in charge by law for maintaining the beaches clean. However, this is usually a fair ground to try and implement an agreement, which intercepts all interests, and try to give the public its money worth services, with minimum investment of public (enforcement) efforts.

The question remains for the regulatory agency, is how to make sure theses covenants or agreements do work. If it is a voluntary agreement, could it be enforced? And how should it stand in front of the judicial hierarchy, in case of harsh Non-compliance?

The answers are not simple. It is rather dependent on the idiosyncratic situation, the laws applicable, the mentality of the country's establishment and people and other Variables. However, it has got to do explicitly with the terms and conditions of this agreement. It has to be stated clearly, that not withstanding with the signed agreement might initiate a full-scale criminal enforcement concentration over the non-compliant facilities. The carrot and stick should word here hand in hand.

4. NEGOTIATING A BETTER ENVIRONMENT

It is clear that the regulatory agency has to communicate to its constituencies the demands, conditions and terms in order to bring them to comply with the law. However, the other side has its needs, constraints and interests. Those are to be acknowledged and brought into consideration by the regulator. This procedure often involves negotiations, and sometimes *arbitration, mediation and application of conflict resolution techniques. Let us explore some of the common situations, definitions and techniques in practice.*

Key issues and glossary terms for further elaboration:

Arbitration, conflict resolution, negotiation, interests, compliance through negotiations.

It might seem odd in first glance, that a regulatory agency, supported by state laws and regulations, might need negotiating apparatus in order to promote compliance and agreements. However, it seems also that such techniques are so common and sometimes even obvious, that it is actually inherent in almost every aspect of the regulatory agency actions.

It begins with the lowest level of enforcement officers that have to deal with their parallels within the plants and facilities. Going on with mid-managers that have to negotiate more substantial conditions to their counterparts concerning standards they have to meet, deadlines they have to meet, new initiatives they would like to promote. And finally a vast array of negotiation is inherent of the top managers of the organization, trying to withstand political and partisan pressures, persuading NGO's and citizen groups, trying to create grounds for organizational changes and improvements.

We will therefore try to review some of the more common strategies, tips and elements of the negotiation procedure, to be implemented. Then we will see some representative situations and see the connecting fabric.

4.1 Basic Strategies and Techniques in Negotiations

All negotiation textbooks stress several main themes to remember when entering a negotiation process. Regardless if the aim is to have an entity comply with environmental demands, or for that matter, if you want to buy a new house and have to negotiate the terms of the purchase, the basic rules are essentially the same. We do not claim to cover this huge subject here; however some of the basics are illustrated herein.

1. Complete analysis of all aspects of the situation is fundamental as a pre work. We can sub group it, as follows:

    - A complete quantitative-qualitative-political nuances analysis of the parties to the table, so as the data will be all available at the table, before starting the process.
    - Know our side. Think hard about the alternatives. What our courses of action in case of anticipated no-agreement. What is our BATNA[15]* and ZOPA** (according to Uri and Fisher's "getting to yes - introduction to negotiations analysis").
      Searching for alternatives - creative activity of listing unusual innovative ideas. Use brainstorming with other personnel. Try mirroring, paraphrasing and gather ideas.
    - Know the other counterparts. Know the issues at the table, and the some times the multi level feature of the negotiation. If more then one party, know the relationships among them, the potential coalitions. You might consider drawing a deal diagram in which the actual and potential involved parties are represented and their stakes rewards are well illustrated.

[15] ***BATNA** is the best alternative to negotiate agreement. Meaning what is my best option in case I don't achieve any agreement.
****ZOPA** is the zone of possible agreements. This is the space of all possible resolution to the negotiation process or in other words all the spectrum of achievable agreements between parties.

- Consider carefully our interests. Consider the differences in interests as a source of joint gains, trade offs between issues. There are most probably linkages to make and compensations to make as a result, or in other words, can I make life better for you at no cost for me, or vice versa. Put yourself on the same side of the table as your counterpart.
- Prepare the details of: how will you set the stage (first move, opening offer); recognize escalation potential and collude to de-escalate conflict and tension; avoid making immediate counterproposals, think first; do not attack the other side, this usually creates a conflict spiral; provide information that helps the other side understand your constraints.

2. The tendency is to get locked on positional starting points and from there it will be extremely hard to make progress. Focus only on interests, of both sides, and they will be the guiding light of the negotiation process. Always remember that the counterpart has interest and needs. Assess and prioritize the full set of interests of each side involved, carefully distinguishing position on issues form underlying interests (including ours).

3. People factors and behavioural assessment are a key. Sometimes you can't separate the people form the problem. Sometimes people ARE the problem and they are therefore, the solution.

   - Negotiations rarely take place among hyper rational, emotionally neutral beings, with fixed interest and clear perceptions and flawless information processing routines. Therefore consider individual cognitive biases such as: irrelevant information, contrast principles, selective perceptions, connected to past actions and sunk costs, stereotyping, mythical images of fixed pies.
   - Consider social psychological dynamics that might lead to reactive devaluation of concessions by certain groups, which may lead to needless polarization and escalation of the process.
   - Personal relations between the people have been proved again and again as a corner stone of a good agreement (and also as a major pitfall if the relationships are not well). This may be translated to a coalition with the entities, cooperation based on long term relationships and not just one-time compliance to a certain request of the regulatory agency.

4. At the table try to understand the counterpart's expectations about the process. The ability to craft the optimal solution matters as much as mastering the process itself. Remember there are no ready-made answers.
   Try to establish claiming tactics at the table and away from it. Think hard about the patterns of concessions, anchoring and framing techniques, controlling information, worsening alternatives and protecting against opportunistic behavior and ethical dilemmas.

5. At the table it is crucial to create an atmosphere in which opportunities are created for everyone to express their views on the topic at hand. It must not be seen, as there is a party, which is the "host" and one, which is a "guest". Therefore the place of the process will usually be chosen to be neutral one.

6. Always bear in mind: the zone of possible agreements must be explored, expanded as possible, discovered, but not wished into being. In other words, sometimes no agreement is the best outcome.

7. Reaching closure. There is the natural tendency to settle quickly and doing that, not paying attention to details that might turn very important at the future. Do not rush into agreement and keep vigilant at all times.

8. Keep in mind cognitive biases in negotiation. These are some systematic errors negotiators do:

- Irrational escalation of commitment – maintain a course of action even when proved wrong.
- Mythical fixed pie beliefs – Zero sum[16] games instead of beneficial trade offs. We will be better off with the concept of "it is either we or they".
- Anchoring and adjustment – there is the chance that the anchor is based on faulty misleading data.
- Framing – the issues that are perceived and framed can influence the person to be either risk averse or risk seeker. May affect the judgment.
- Availability of information – it should be clear and simplified.
- The winner's curse – the settling too quickly gives the person a discomfort feeling that he could have done better.
- Overconfidence – overestimate their probability of being successful and their less likelihood to compromise.
- The law of small numbers – extrapolator from previous limited experience on situations. A problem of us experienced negotiator.
- Self-serving biases – the tendency to underestimate the role of the situation and overestimate the role of the person (also called in social psychology the fundamental attribution error). Sometimes the people on the other side of the table are holding completely different ideas. The role they are playing now is the agent role.
- Ignoring others cognition – failure to consider the other party's thoughts and preferences.
- Reactive devaluation – a subjective reaction to other party's concessions by devaluing them just because they made them.

9. How to improve communication in negotiation, several suggestions to remember:

- The use of questions – for getting more info; generate thoughts; support arguments. There is also an unmanageable use of questions that is likely to cause the other party to feel uncomfortable and less willing. Questions can serve as gates to stalled situations.
- Listening - Active listening and reflecting are very important. You can restate what you hear to your words.
- Passive listening is receiving message without providing feedback, a useful tool to a talkative partner.
- Acknowledging – sufficient responses, minimized, may be taken as an agreement on what has been said.
- Roll reversal – may be a useful tool for understanding the other party's position. May be even done by actual wording.
- Special communication considerations at the close of negotiations -Avoiding fatal mistakes.
- Achieving closure – avoid unnecessary remarks; avoid needless information; do not react to remarks; keep written form at the end.

[16] One wins all, one looses all. One plus minus one equals zero. Taken from game theory concepts.

At the end of the day, the agreement should be **better then the BATNA, legitimate, innovative, and sustainable**.

4.2 Representative Situations - Environmental Negotiations

Having put forth the basics on the tip of the fork, let us now consider some representative situations, an enforcement agency or personnel might encounter while on the job.

The basic background is essentially the same: the regulatory and enforcement agency is trying to bring a single facility or a group of permitees or a group of owners of identical line of business, to comply with their requirement under the existing or future planned legislation and regulations. The road to reach these goals is covered with bumps of all sorts, strong economical motives, political pressures, public interest and NGO's pressures personal relationships and different perceptions of the fabric economy-public-environment.

So the option is either to "command and control" and get ready to act with coercive power with all its implications. Or, begin with negotiation techniques to try and extract the maximum with talking and persuading the "clients".

It must be emphasized to the wondering, inexperienced reader, who thinks (straight and with a bagful of just) why should an enforcement agency negotiate with the violators. He might say that the present concept should be applied to preliminary stages of permit issuing and general terms and conditions, only.

The answer is realistically simple. The actual real enforcement officer’s life is not black and white. The pressures, conflicts, interests are so complex that many times compromises has to be made, and this is exactly where managing the negotiation skill may be proven crucial.

There are three major levels of environmental negotiations we can focus on. Obviously there are numerous situations that might fall in between these levels, or superimpose one on the other. For simplicity we will focus on these three.

- **Local**

  This may be a negotiation process of various sorts considering the substance of the local level. For example it might be a persuasion attempt to make a facility owner to comply with new directive or regulation, which is not yet active, but still the regulatory local officer wants to push the industry to apply steps in the wanted direction. It might also be a long process in which the regulatory agency wants to enforce a best available technology on a certain plant or facility. This could not be made usually with out the actual cooperation of the industry, the permitee itself, because they are the most up to date in their area of expertise. Therefore in such a case the negotiation wisdom and practice must be mastered.

  A negotiation practice may become handy even to the simplest interaction on the local level between a law enforcement officer to the facility manager or worker. When trying to achieve compliance on the most fundamental issues of running the facility, and under the assumption that moving into coercive options is not desirable, usage of basic negotiation tips should be practiced.

- **National**

  Here, a negotiation process is rising up as regards the level of the negotiators (high level officials and managers of corporations), the complexity of the issues on the table, the amounts of investments in stake, the political pressure turned to the heads of the agency and the multi-party negotiations and potential coalition building when national interests are involved.

For example, let us assume a regulatory agency that wants to begin a new enforcement program to make the private car owners be mindful about the emission of CO and heavy metals from their car exhausts. Such a move would better succeed if supposedly the enforcement agency will consult with the ministry of transportation, the "drivers union", and probably get into negotiation process with them.

- **International**

These are the most complicated situations for a regulatory agency that usually is a matter of multi-issue, multi-party**,** multi-level negotiation process. Here the international political situation is of prime importance. Here the agent/messenger and his relationship to the agency are a factor to be considered. These negotiations usually are about international (bilateral or multi-lateral) interests concerning transboundary pollution potential or movement and shipping of harmful substances. There are of course the global negotiations in nature when there are the international conventions. Such may be similar to the Kyoto protocol, Basel convention, IMO meetings, Rio declaration and so many more. Here the interests are complex and are to be addressed carefully. A good example for this global complexity and intervention of many non-environmental interests is the Kyoto protocol for the abatement of greenhouse gases. After signing the treaty the USA - the largest single atmospheric carbon contributor - declared in the words of President Bush, that it is pulling out of its commitment and would not ratify the convention.

Negotiations with colleagues

Another common situation worth mentioning herein is the negotiation processes that are taking place within the organization. These sometimes might be strict, blunt and aggressive as might be any negotiation "outside" the organization. Be therefore prepared to apply all the tips and principles above towards "inside" as well. The only difference naturally is that when doing this, one must take into account the totally different set of interest package, the fact that it no longer negotiating on behalf of the establishment to get compliance, rather it is more of the same level starting point and pure effort to promote subjects on this same level.

Environmental negotiations

There are several points to remember when entering a negotiation process of an environmental characteristic with a permitee or regulatee.

- You have a better opening hand because of your legitimate power. However, do not let it fool you. Do not forget the weakness of the strong. This might be apparent when you find out for example, that your counterpart has prepared coalitions, has made its homework well and so forth. Many times the counterpart uses the fact that he is "standing alone against the establishment" to make a point and this itself should be considered when entering the negation process.

- Understand your counterpart's interests. Do not lock on positions as a general rule. Your goal is to achieve a better agreement for the environment then the present situation. The easier thing to do is to state your position, which is a well-matched presentation of the law. However, the interests of the permitee will be many times economical; representative (towards its customers and the public); and more. So if a regulatory agency wants to gain the most out of a negotiation process it should prepare the process right, according the above mentioned rules.

- Being able to see the whole picture at all times and focus on the environmental interest is a prime issue. The negotiation process might involve to a complex multi-party, multi-level and multi-issue process. Under these circumstances, it is very easy to get carried away from main goal. So it is very important for the negotiation team/person to reassess the outcomes and see if the results do suit the main purpose. Remember that usually there are many interests of many parties but the only body that is in charge strictly on environmental issues is the environmental regulatory and enforcement agency.

Whenever a major project is on the table, negotiations will be present in many forms. Building a port, a highway, bridge, airport, waste dump or sewage treatment plant, are obvious cases to consider. But even a diversion of a side road will take negotiating with the municipality, the close-by residents and the contractors of needed acoustic walls and well-prepared drainage systems. A small-scale improvement in a discharge standard that takes an investment of 50 thousand USD will have to be negotiated successfully unless the regulatory agency wants the judicial level to rule out. It takes the expert team to make value and be able to justify it and then claim it during the process.

This is why basic negotiation techniques must be ruled by almost anyone inside the enforcement agency.

5. NON-POINT SOURCE POLLUTION AND COMPLIANCE STRATEGIES

In principle it is relatively easy to apply inspection techniques and enforcement strategies when speaking of point source of pollution. It is much more difficult to apply such measures to non-point sources of pollution. Imagine a lead concentration measured in a pipeline outfall in compare to an ambient pollution of vaporized lead concentration in the air, caused by vehicles. How should we get compliance to a proper suitable legislation and then enforce it?

Key issues and glossary terms for further elaboration:

Point source pollution, air pollution, public domain, ambient air and water standards, NGO's[17].

There are several examples one can think of, trying to identify such sources of pollution, which are non-point source in nature. Such might be:

Heavy metals originating from car exhausts resulting in ambient air concentrations; marine pollution from organic matter and nutrients, originated in rivers and run-offs; soil and sub soil pollution from fertilizers and primary treated sewage effluents; marine pollution from oil and fuel spillage which were undiscovered; C&D[18] debris discarded out at the public domain.

What are then the possibilities to control such sources of pollution and who exactly the regulatory agency address, if there is no one specific target or entity - geographically located or substantially defined.

As a starter, we will use the definitions of power categories to try and articulate what should we take into account and what measures could we incorporate, or exclude, when dealing with that subject. Thus we shall begin by general remark of what would probably not work: The use of coercive power here is probably meaningless. Where there is no one clear entity

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17 Non Governmental Organization.
18 Construction and Demolition.

to address, no punishment mechanism will work in favor of solving the problem or creating any deterrent effect.

The rest may play a role in the general manner:

- Expert power - facilitation of alternatives that might inhibit the pollution source; explore possibilities together with the constituencies.
- Reward power - the possibility of the government to enhance alternatives to the source of pollution by granting special budgets.
- Positional power - of the regulatory entity towards the industry should be used smartly through public, communications, media, NGO's and political influence.

Course of action

Initiating information collection about the nature of such pollution, possible contributors, amounts, concentration, risk analysis, health effects, situation in other places, is the fundamental stage to begin with. This should be done of course according to the nature of pollution. Constant monitoring programs such as in marine environment or ambient air quality monitoring systems are essential for reliable information. In other cases, aerial reconnaissance may prove a good choice of information gathering. In the case of solid waste discarding in public areas, this might prove a tool that will help to assess the scale of a problem before one try to confront it. For example: on a certain coast in the eastern Mediterranean, along a strip of about 15 km, a high concentrations of lead (Pb) were found in the shallow water and on the coast sand itself. These were higher as much as twice to three times than in other places which were sampled as well. It was postulated that these concentrations were due to the heavy use of vehicle, as it is the most densely populated area, with heavy traffic of all sorts. So in such case, a special plan was needed in order to cope with this non-point source of lead. But first it was essential to carry out a survey that will tell what in the highest possible accuracy, is the likelihood of the origin postulated. Furthermore, what do these concentrations mean in terms of the ability to cut down emissions so as to lower significantly these amounts.

Several ways are suggested to cope with such non-point sources of pollution.

1. **Design long term program, which is drawn from and backed up by a proper legislation or regulations, to get compliance within all contributing parties to the pollution.**
   For example river mouths are "point source" by geographical identification but are considered "non-point source" because of large variability of pollution origin. Sewage treatment plants are discharging treated sewage to rivers and then to the marine environment. By doing that they emit large quantities of nutrients (N and P mostly) which in turn might cause eutrification[19] and toxic blooming of algae at sea. These plants often enough are located way upstream of river's basin. These facilities are the main contributors to the river's pollution. So in a careful analysis we might find that the "non-point" is in fact a puzzle of many well identified point sources. Therefore a wise program to tackle this problem will try to either remove as much discharge for land based reuse or make sure that what is discharged is treated with the BAT to reduce such pollutants. The program would incorporate mainly heavy investments. Here we might also consider the use of enforcement actions per se.

[19] Blooming of algae in marine environment. Caused by excess load of nutrients in water.

2. **Address the public and use every mean of communication in order to get compliance within the constituencies.**
   Sources of ambient air pollution like vehicles pose one of the worse pollution problems of the modern world. It is by far, the worse non point-source pollution-factor in urban areas, affecting seriously the health of millions of people. In this case a regulatory agency that strives to reduce such ambient pollution must create a holistic approach which has to take into account mainly the acknowledgment of the public. This has to create a compliance program which firstly sets achievable goals, second creates motivation within the industry and importers to go along with a step that will surely cost millions if not more. Such a step should incorporate public and mass media for a long effort to change public opinion and divert it towards the hazards of vehicle pollution. Then, try and convince (using expert and positional powers) the customers to give priority for purchase of less polluting vehicles and preferably ride public transportation. It is important to remember however, that it will all depend on this well structured and thoughtful approach to the public (see also chapter 8).
3. **Address the one major source of the material that is contributing directly or indirectly to the sources of pollution.**
   There are cases of well-identified pollution sources - by substance or even origin - but they are considered non-point source. These might be detergents in washing machines that contribute substances as Boron[20], which in turn increases the salinity of agricultural soils that are being irrigated with treated municipal sewage. It also might be hazardous material such as TBT[21], which is used as an additive in antifouling paints used to paint the underneath hulls of vessels, and being a strong biocide slow-released into the marine environment it is a powerful persistent pollution agent.
   In these cases, although it is non-point source pollution, it is well defined and therefore is subject for direct compliance program. In the case of Boron for example, the program should target two kinds of publics, both use expert powers of the organization and long procedure of negotiations. The first are that manufacturers of detergents, which have to be persuaded to substitute their materials to a more environmentally friendly material. Here the aid of NGO's is advisable. Here there is also the law to help us (permits to operate; permits to store substances; and others) in contrast to what we said in the preface of the current chapter. The second, more complicated public, are the end users themselves. Here a compliance program that sets the goal for example to reduce detergent use by 30%, must convey this message to the users with no ability to check upon them nor to apply any coercive power over them. Therefore the program here must also rely on some kind of public campaign.

4. **Address the public directly in these cases when it is the public itself whom is the source of pollution.**
   There are non-point sources of pollution, which are similar to air pollution by motor vehicles but are simpler in nature. For example smoking cigarettes, or discarding of trash in the open within public domain. The principle here is essentially the same for the enforcement agency as described above, with a little exception. In these cases the program should to a certain extent, incorporate in its actions the use of coercive power. In both cases - cigarettes smoking in public and littering - the agency should not give up "old enforcement" methods as citations and other

[20] Boron is a chemical component in washing detergents and one of the contributors to salination of agricultural soils.

[21] TriButilTin - a strong biocide used in antifouling paints of marine vessel's hulls.

monetary fines. They only have to do it giving it the right publicity and only when it is a part of a wide and fundamental program not just a goal self-standing for itself.

6. INTERNATIONAL COOPERATION

Many of the marine pollution sources are international in nature. The seas are, by definition, the connection between different lands and governments. An immediate recognition should come to face that governments must cooperate in order to prevent land-based pollution to the seas and other forms of pollution that cross boundaries. So is the situation as regards illegal shipments and trade with wastes and other potentially polluting substances.

Key issues and glossary terms for further elaboration:

International conventions, hazardous waste, developing countries, transboundary shipping, international cooperation and enforcement, INECE.

Maritime sources of pollution to the seas are handled and mitigated through the comprehensive legal tool of the maritime pollution prevention convention, the MARPOL 73/78. This convention under the hospice of the IMO proves that there is in fact well-established cooperation framework between countries in order to prevent pollution to the marine environment in particular.

Environment does not know any political borders or boundaries. This well-known phrase has a completely true meaning in reality. Simple examples: an oil spillage that occurs in an open international water in the Mediterranean might easily heavily impact two or maybe three countries, their coastline, their infrastructure and their amenity beaches. For that matter, air pollution originated in one country's industrialized zone might easily be carried away hundreds of Km away, causing increased concentrations of polluting substances in other different countries down wind.

The question is, therefore what should governments do about the phenomena of pollution causes that cross boundaries. How should we incorporate enforcement programs and initiatives when speaking of different countries, different cultures, different legislative structure and enforcement agenda and different interests as regards environmental aspects? Signing and ratifying conventions is a main tool to enter an international commitment. Naturally such a step will enhance the legislation of competent national legal tools. This is usually the first step forward to promote international cooperation.

It should always be kept in mind of the decision-makers of the environmental field, that when speaking of international compliance the lead term is setting firm environmental goals and persuading the parties to withstand and cooperate to these goals. For example, the MEDPOL phase III under the Mediterranean Action Plan has set the SAP - Strategic Action Program - which is setting firm environmental goals based of solid scientific data, collected for almost 25 years. This program sets the limits and goals to which the contracting parties of the convention must reach by the year 2025. This is a good example of international cooperation and compliance just out of commitment and moral authority with no real sanctions and enforcement measures.

6.1 Transboundary Pollution and Compliance Assurance

Illegal shipping of hazardous materials (under the provisions of the Basel convention); illegal shipping of CFC's and other Ozone depleting substances (under the provisions of Montreal convention); illegal trade in endangered species; illegal trade in wastes and wastes that are suspected with a radioactive nature. These are some of the transboundary pollution that has an intended manner of happening. In other words, these are not consequences or unintended by-products of activities, rather these are active operations done by people with incentives and hard motives.

As stated above, there is a second set of an on-going transboundary pollution occurrences of many characteristics. These might include:

Major oil spills to marine environment; the continuous flow and discharge to the marine environment of sewage and industrial effluents from various sources; the flow of NOx, SOx and other substances of atmospheric nature which travel hundreds of miles away from their source.

These sources are being “manufactured” in certain states, and cause pollution to other states, and in some cases to a whole regional area or even the global community.

Most if not all of these environmental felonies are motivated with strong economic drives. The transboundary movement of goods and substances cross the borders and along thousands of Kilometers is a global phenomenon and we have to think in such terms when trying to achieve compliance to rules and regulations targeted at reducing these occurrences.

What are the problems in such activities that we have to acknowledge?

- For the pollution occurrences per se, it is obvious. It is clear that when speaking of marine pollution, airborne toxic and pollution substances, river basin pollution, underground water pollution, one country is in the "upstream" contributing pollution to other country, which is the suffering end of the pipe. It so happens that this simplicity is orders of magnitude more complex in reality, when involved are many contributing entities and as many "sink" entities. It gets even more complicated when we are all a pollution-contributing source, on the one hand, many countries suffer or might suffer as a result and the damage might not even be certain yet, or at least is up to a dispute.
  Take for example the case of global warming as a result of increased "greenhouse" gases increase in the upper atmosphere. This complicated issue is par excellence a case of transboundary pollution, in which all countries are involved, a probable global effect, and the theoretical solution is in humanity's hands (the Kyoto Protocol is the legal effort which the global initiative had come up with. So far this is also an example of global non-compliance to this urgent issue).
- As for the case of transboundary shipments and trade as potential pollution sources, it is a slightly different story. Here there are several issues to consider:

  1. The export of hazardous and uncontrolled substances away from their origin to places (usually developing countries) where there is no suitable treatment, improper technology and procedures of safe handling, no safe disposal sites nor proper recycling techniques and equipment.
  2. The illegal export is carrying with it the probability of black marketing, potential additional hazards and "added value" of crime (organized international crime).
  3. The unsafe and uncontrolled procedure of handling and shipping in non-supervised way is a major hazard and pollution potential along the way.

So as a beginning, a smart and comprehensive compliance program - for each country involved - that will undertake such occurrences would be a program that has to have:

- An international network, with designated focal points and competent authorities. This network should administer the free flow of information as regards the substances or pollution sources.
- Cooperation, tailored to meet the financial base of these environmental crimes.

- Common legislative tools and trained and equipped inspection system.
- A common obligation, interest and prioritization in exercising discretion in enforcement actions.
- A firm organization with the expertise, the know-how, the minimum supporting technology.

First and foremost, each country has to identify specifically its main problems in regard to transboundary shipments and transboundary pollution sources.

For example as regards the shipment and trade with wastes, after defining specifically what is in stake, the goals of the state should be:

- Making sure that everything is being done to assure maximum reduction in wastes and application of BAT to achieve that.
- Making sure that local disposal of wastes is kept local and close to its generation.
- Making sure that shipments of wastes are reduced to the possible extent as a whole, and when they do occur, they will be kept strict and managed in an environmentally sound manner.
- Applying strict regulations and enforcement measures within the border control authorities, in regard to illegal shipments of merchandise with environmentally pollution potential.
- Making sure that whenever such shipment occurs, it will be done to a country that is capable of handling, storing, recycling or disposing the materials in an environmentally sound manner and have the technological and the know-how of doing that.

Each country should explore and join the existing global or regional legal tools, which were created to tackle different problems. A partial list of such tools:

- Basel Convention to control the transboundary movements of hazardous waste and their disposal 1989 (in force since May 1992).
- Vienna convention for the protection of the Ozone layer.
- Montreal Protocol on substances that deplete the Ozone layer.
- Kyoto protocol to reduce greenhouse gases (1996).
- Convention of biological Diversity (1995).
- MARPOL 73/78 (six annexes) for the prevention of marine pollution.

Such conventions and treaties are meant to give the words "think globally" and "act locally" a meaning. To achieve compliance therefore, countries should implement the legal tools to comply with the international guidelines. Then the system should be created in terms of educating the constituencies of what is expected from them considering the new demands and standards. This should be accompanied with the aid of the public and NGO's as much as possible t increase understanding and persuasion of the people, in order to create the right political situation and support.

To promote compliance an adequate system and procedures should be set up, in accordance with the issues on the agenda. Sufficient training of workforce, facilities for testing and sampling, sufficient databases and information transfer setup is crucial. Another obstacle, which has to be dealt with as soon as possible, is inter-ministerial objections and lack of cooperation. This is to be settled in advance because otherwise the country might find itself in an uneasy situation when coming to international forums and conventions, justifying its failure to comply only because of inner problems and difficulties.

The cooperation between parties of a certain convention or agreement or even when these are absent must be constructed on the recognition that it is for the welfare of all citizens of the region. Therefore reaching compliance must be set upon firm relationship that incorporates: Developing monitoring program and mutual information flow (bilateral or multilateral); Developing partnerships among the industries within all parties; Free transfer of technologies, know-how, technical standards and procedures; Training and capacity building of inspectorate, border control personnel, custom officers, police officers, and law people; Capacity building within designated laboratories.

As regards the case of transboundary pollution and international cooperation, compliance will be done according to the specific cases of pollution sources. For example, the MAP protocol of the prevention of marine pollution from land based sources. It sets the general guidelines of provisions, sets parameters of discharges, sets the principles of permitting discharges and gives the countries the guidelines for how to implement the system for the compliance for prevention of pollution to the Mediterranean. Adopting the local legislation to the spirit and guidelines of the protocol is doing this. Each country has to make it own modifications when the goal is set: minimize pollution sources quantities and set parameters of discharge high as possible (apply BAT). The compliance to such international guidelines is obligatory only through the mechanism of MAP/MEDPOL. Principles such as information sharing concerning hot spots and monitoring activities promote this international transboundary compliance in this case.

6.2 Intergovernmental Enforcement

Environmental felonies, crimes and violations have various motives according to the nature of the offense. However, one would find often the economic motive strong and present. Those felonies that are transboundary in nature have the same drive and thus any enforcement cooperation must bring into account strong counter motives so to address them properly. Intergovernmental enforcement in this context means in fact the cooperation that different states and countries have to have in order to make sure that the substances and pollution sources are reduced and are not left without attention among international borders. For example, countries should address indirectly the markets of a certain material that should be phased out. Within the reduction of CFC's (Montreal Protocol), countries have banned the use of Methyl bromide - with specific reduction in annual phases - so to create an alternative developing market for soil pesticides. One of the outcomes of such intervention from the governments is the raised price of the banned material, which is a result of the diminishing quantities on the market. This way the alternative methods and substances are increasing attraction to potential customers.

1. Transboundary illegal shipments of hazardous substances

- Legislation in place - national legislation, regional agreements are being implemented. It has to be understood that many times the national or local mechanism is not fully compatible with the international agreements. It has to consistent with the interpretations of the international text to avoid later on misunderstandings in applying enforcement.
- National commitment - it seems many times that although countries sign international agreements, they act differently inside. This causes an internal dissonance between what is declared in the international arena and the preparedness of a state to fully apply its commitment in terms of regulating and acting to enforce. This is particularly true - so experience tell us - in developing countries.
- Competent agency - is being assigned and equipped with the working force, training and the necessary arrangements for free information flow.
- Border control - competent, has the know-how and treats the matter as any other illegal trade traffic.

- Inspection teams - whom have the authority by law, have a sufficient training, know the procedures and work by a workplan and an enforcement strategy.

2. Transboundary pollution sources

- Marine pollution from vessels and land based sources - application of Port State Control (PSC), initiate regular MARPOL inspections by dedicated trained inspectors. Apply BAT and enforce as needed through all the phases of the program (including negotiations and activation of the public, see appropriate chapters).
- Airborne substances - usually enforcement of such is somewhat complex and problematic. It can only incorporate the feedback of pollution assessment of air quality to the contributing country. International enforcement in this context might be proven extremely hard to be done. However, in the eastern states in the USA, during the year 2000, political pressure on the Midwestern and northern states was applied to act to reduce airborne pollution emissions and to apply stricter emission standards and other measures.
- Underground water and river and lakes pollution - happens when one state is on the upstream aquifer. Here also it should be noted that international collaboration to mitigate such pollution sources is done mainly through bilateral or some other multi-lateral, but regional, agreements among the states. Enforcement of these agreements must count on the other side good intentions of reducing or stopping this pollution (and this is the general idea as a thread, when talking about international cooperation to reduce pollution).

The way to apply that is of course, by applying national laws together with international programs. All other parties should be always kept informed on regular basis, mutual formal update meetings should be called and informal network of the responsible and competent authorities are to be on regular alert and communication system.

An example could be given concerning the RAMOGE program among France, Italy and Monaco which has a long term goal of preserving and protecting the marine life and environment of the gulf of Genoa.

7. ISO 14001/EMAS AND COMPLIANCE & ENFORCEMENT

Let us look into some other possibilities in having the constituencies comply with regulations and environmentally sound ways of operation through the mechanism of the international standards organization for environmental management system, assuming what could be achieved on a preventative scale of measures is preferable.

Key issues and glossary terms for further elaboration:

Environmental management system, European Union directives, self compliance,

The International Standards Organization (ISO) has developed, since the beginning of the '90s, a set of Environmental Management Standards (EMS) known as the ISO 14000 series. This voluntary set of standards has become universally recognized and has been formally adopted as the set of environmental national standard in a number of countries. For example Israel recognized and adopted it formally in 1997 and Egypt had done so in 1996. Furthermore, for many major companies accreditation of specific projects under ISO 14001 has become increasingly important for the purposes of achieving and demonstrating sound environmental performance.

ISO 14001 was granted final approval by ISO on 1 September 1996. These standards specify the structure of an EMS that an organization must have in place if it seeks to obtain certification, and stresses that the EMS must include a commitment to comply with applicable legislation and regulations.

ISO 14000 are not the only environmental standards. There are the EMAS developed by the EU and adopted by the European community in 1993. This set is a bit different because according to it is obligatory to conduct an initial survey, it is site specific and it takes a full audit once every 3 years.

ISO 14001 is the set of standards that has to be accredited and certified by the national competent ISO certification authority.

ISO 14001 also emphasizes that environmental management is an integral part of an organization's overall management responsibility. To this end, it sets out key principles for managers implementing an EMS. These include the following:

- Recognition that environmental management is among the highest corporate priorities.
- Establishment of a dialogue with internal and external interested parties.
- Determination of the legislative requirements and environmental aspects associated with the organization's activities, products and services.
- Encouragement of environmental strategic planning throughout the product or process life cycle.
- Establishment of a disciplined management process for achieving targeted performance levels.
- Provision of appropriate and sufficient resources, including training, to achieve targeted performance levels on an on-going basis.
- Assessment of environmental performance against appropriate policies, objectives and targets and quest for continual improvement where appropriate.
- Establishment of a management process to review and audit the EMS and to identify opportunities for improvement of both the system and environmental performance.
- Co-ordination of the EMS with other systems (e.g. health and safety, quality, finance).

Specifically, ISO 14001 requires the following:

1. **Environmental policy**: An environmental policy must be devised that incorporates a commitment to continual improvement. The policy must be relevant to the nature, scale, and environmental impacts of the company for which it is drafted. The policy must be documented and communicated to all employees and made available to the public.
2. **Planning:** Planning is to encompass all relevant environmental aspects of a company's activities, legal and other requirements, objectives and targets and environmental management programs. Following the institution of an environmental policy, companies must implement environmental planning relating to procedures to identify the company's environmental impact, its processes, services, activities, procedures to identify all statutory and regulatory requirements applicable to the company's activities, documented objectives and targets. Similarly, a review procedure for assessment of all environmental impacts associated with the planning, design, production, marketing and a disposal stage of the company's activities is required.
3. **Implementation and operation**: To obtain ISO 14001 certification, companies must devote adequate human, technological, and financial resources to ensure implementation and operation of the EMS. This phase also involves training of all

employees whose work may impact on the environment, internal and external communication procedures, and environmental documentation and document control.

4. **Checking and applying corrective action**: Companies must institute checking and corrective action procedures. These include the monitoring of the company's processes that may have a significant impact on the environment. In cases of non-conformance with the company's targets and objectives, the company must establish and maintain procedures for initiating corrective and preventive action. The company must also establish a system of periodic EMS system audits. These may be conducted internally or externally.
5. **Management review**: ISO 14001 requires documented review of the EMS by management at periodic intervals.

Although other environmental management systems have been developed (e.g. the EU's Eco-Management and Audit Scheme- EMAS), accreditation, in particular, under ISO 14001 has become an important objective for many major companies with international interests.

For example, in the context of offshore installations and operations, where active inspection and enforcement are logistical difficult, EMS in general provides an effective means of self-regulation. As a result in mature hydrocarbon provinces, the use of EMS has become standard practice. For example, nearly one hundred percent of companies operating in the US Gulf of Mexico participate in the Safety and Environmental Management Program (SEMP), which was developed by the Mineral Management Service (MMS) and the American Petroleum Institute (API).

Why is it good?

The basis of adopting the environmental management standards concept is that the regulated community had internalized that they rather adopt this concept that in other words is saying: "Pollution prevention pays", in contrast to the concept to "the polluter pays". In general, these standards set the procedures a facility should withstand, in order for it to succeed in getting the environmental approved results. It is does not state a definite goal or does it set emission or discharge levels. Rather it gives the guideline the management needs, to run the production while abating water, air, marine soil, noise, waste and HazMat pollution. The standard determines that the facility should always comply with the environmental local laws and regulations and should always strive to apply the BAT which is also the economically feasible and achievable. It should be stressed that this is a dynamic and continuous obligation in essence.

Why would the industrial sector commit itself to such binding standards?

There are many advantages for the regulated community in the adoption and certification of the ISO14001 and similar standards. Here are some, not necessarily in a certain order:

1. Prevention of liability in case of accidents. When procedures are set, there are fewer accidents and fewer claims for possible liability of the management. Saves time and money.
2. Inherent demand to fully comply with the law. Of course that means less friction with the authorities, which itself saves time and money.
3. Detection of possible malfunctions and failures. When standards are set and followed, higher probability to detect on time malfunctions that might cost the owner money in the failure itself and its possible consequences.
4. Considerable simple and effortless way to get licenses and permits from the authorities. When in compliance, it is simpler to extend all formal documents.
5. Adoption of standards may lead to considerable layoff of the regulatory agency, as regards monitoring activities, inspections and audits.

6. Acknowledging the lower risk to the environment, actual reimbursements and compensation are given in some countries to facilities that have adopted the standards. These may come in the form of tax exemption, lower electricity or water fees, lower insurance premium etc.
7. Financial relations with the international commerce. Here are lying several conveniences such as signal to investors about the seriousness and attitude of the owners. The open door for global financial tools as world band and various funds. The considerable comfort of receiving a loan with improved interests and terms of loan return.
8. The "green" image, Turns out to be an important public market salesperson.
9. In many countries, the certification is a limit when applying for a bid or RFP processes. In some countries the company has to prove accreditation in order to enter a market with a new product.
10. A friendly contact with the immediate environment and local community and municipality. These are interested parties in the life of every plant. The adoption of environmental standard allows it to abate resistance and in turn help it to advance building permits and expansion of the facility.

So, for the regulator it is important to promote as possible this instrument within the industry and even local communities and public sector. The military units in various countries for example are great target to facilitate such standards, given their pollution potential and their centralist structure.

Why is it good for the regulatory agency?

For the regulator it means less routine inspection work, because the ISO14001 makes the regulatee conduct continuous control and supervision according to parameters set and approved by the accreditation process. Then it conducts a periodic environmental audit, which gives the management a means for self-control to check its compliance. The audits may be conducted by certified workers of the facility, or once in every while by external professional firms.

Many regulatory agencies strive hard to promote and bring about the ISO14000 series and other environmental standards. To stress its importance many give special treatment to these parts of the industry and public facilities and local authorities. It may come in terms of a priory tolerable attitude towards the client and it may come with actual funding for conducting environmental surveys.

The experience gathered in various countries so far indicates clearly, that industries, which have adopted the environmental management standards, are:

- Involved less in environmental accidents.
- Produce relatively less effluents and less emissions.
- Handle better their toxic inventory.
- Comply to the sustainable development trend in managing the facility in an environmentally sound Manner.
- Are fruiting their investment in various ways through improved economic management.

Again it should be stressed that ISO and EMAS systems are helpful, effective tools to bind the industry to self-compliant procedures. However these systems are not replacing the responsibility of the regulators to make sure the standards are met and the final situation is always a win-win situation.

8. PUBLIC PARTICIPATION

There is a lot of confusion within the regulatory and enforcement agencies throughout the world in regard to the roll of the public, when speaking of transfer of obligations and commitments, rather then services. Who is the "public"? Are they "with us" or "against us"? Should “they” be disregarded or perhaps we should embrace them and try to win their cooperation and active participation.

Key issues and glossary terms for further elaboration:

NGO, sources of power, education, outreach, civilian aid, information dissemination, transparency.

The public is a vast word, incorporating an entity that is, in fact, all of us. When referring to the public, the IRS in the USA means more or less each and every working person in its jurisdiction and it does not matter whether he is an alien or a citizen. The police refer to the public usually as the entity who is using their services, the entity that should be protected. However, the highway patrol might refer to the public as its chief target as a potential violator. The Environment agencies might refer to the public also (not only) as the pollution creator who should be taught and educated.

When speaking of enforcement agencies one of the most profound and basic issues, cross-organizational yet somewhat ambiguous in definition, is the matter of **interaction with the Public**.

The “Public” has many definitions and also multifunctional roles within every regulatory agency’s agenda, ranging all spectrum, from the fundamental role of representing public interests, as the “customer”, “stakeholder”, “society”, in police work or environmental protection for example, all the way to treating public as the target for enforcement actions, “object”, “violator”, such as in tax enforcement agency.

The focus is therefore:

How fundamental is the subject of public involvement, passively or actively, in the regulatory enforcement agency’s life, and in what ways. Is it good, or perhaps bad? Are there any limitations present?

Attempting to concentrate, the focus is on the public capacity as a stakeholder, as a customer, and as society, rather then potential violator and as an enforcement actions target (as might be the case from tax agency’s point of view).

We have identified several of the functions the public could be of use to the enforcement agency, while identifying aspects of public involvement, as bystander or a customer.

In other words, thoughtful management of all enforcement agencies should be aware and beware of at least three major functional elements:

1. **The public as an information source -** Information regarding violations, complaints, progress trends or compliance, opinion supplier regarding procedures and formalities, are all sources not to be neglected, moreover, to be used wisely by the enforcement body.
2. **The public as an active supporter of enforcement and compliance efforts -** Volunteers to police or environmental protection activities, public aid in special efforts, and public as a partner in promoting compliance goals in community.

3. **The public as a target for preventative measures** - Educating public about regulations and lawful ways, integrating media in specific compliance-oriented campaigns of all sorts.

These elements are discussed in more detailed fashion, on the following pages. A Fourth part is a short discussion of several shortcomings and **problematic aspects of public engagement with enforcement activity**. The distinction, which is made among elements, is from a practical and logical point of view, although there is occasional overlapping.

The public as an information source

Information is power. This has always been the case and in the age of information technology, it is much more explicit. The public is an endless source of information therefore developing methods to use that tool effectively is a prime for an agency. Information gathering, intelligence, and ways of processing them are critical for enforcement actions.

Information gathering from the public

First, the public should be considered as a supplier of information on regular basis. It could be fresh information about violations of health and safety regulations by employees, or other. Collecting information from public complaints should be a standard and valuable source of information across agencies. In police work, street informers are invaluable source to identify trends, mark targets and get a reliable feel of the street. For many tax-collection agencies throughout the world snitchers are important source of tax violation information.

Second, public supplies priceless data of potential and actual emergencies. It could be a report of Hazardous material spill, a person identified, or it could be citizen complaint of irregular polluting emissions that cause immediate health problems to residents. In Israel for example, Marine and Coastal Environment Inspectors are constantly using the use of public awareness as s source for potential and actual oil spills in ports and marinas.

Responses from the public

A regulatory enforcement agency should be aware of public opinion and public satisfaction of its perceived role and effectiveness in reaching their goals. Such critique and data is to be used by the agency in order to improve services or even change drastically its tactics or a strategic goal. The method here is to try to listen and internalize what really upsets the people.

One possible way, therefore, to gather relatively reliable information is by polling. Using representative polls conducted according to sample theory, to check public opinion of the agency's efforts, might prove itself as a useful source of assessing effectiveness of actions, reconsidering methods and tactics and maybe measure performance results.

Information stream goes the opposite direction also. That is, from the regulatory agency to the public. Enforcement authorities hold this powerful tool as for example, the Police department when it distributes information of convicted sex offenders. We will relate to this tool when speaking of getting compliance by preventative measures.

The public as an active supporter of enforcement and compliance efforts

Here also are several subsets of relevant issues and examples: **Encouraging private interest group to force agencies** to act. This is a well-established procedure in environmental protection, unfortunate, because it paradoxically emphasizes a certain impotency of the agency. Often enough because of public interest pressure the agency will be forced to act to enforce laws and regulations. This has happened numerous times in many countries when citizen's litigation had stopped unlawful building projects along the seashore. In the Asarco case[22] it is noted that in 1982 the state of NY took EPA to court and as a subsequent the district court ruled that EPA has to publish regulations and guidelines for arsenic emissions. Concerned citizens initiated this move. The concept of "Environmental Justice" is one of the most important trends in USEPA in recent years. It was born as a result of increased public awareness of inequality of socio-geographic pollution burden, thus directing enforcement actions accordingly.

Civilian aid in affecting compliance and enforcement

Citizen group involvement is an important feature of incorporating the public in the enforcement work, mostly as an observers or overseers. An example may be the use of citizen advisory committee or complaints committee. The public here functions as an independent watchdog and the use of such indifferent power might be a resource for any agency's management.

Three cases worth mentioning as illustrative examples:

The Asarco case- a plant of metal plating in Seattle, USA - provides an excellent example of the enforcement agency using the public as a partner, a stakeholder, in considering the preferable course of compliance action. Moreover, the public has been addressed smartly to actually take part in setting emission level and was a major player in that sense. This involvement was paving solid base to future similar discussions.

The EPA TRI[23] case is where public has acted formally and less formally, as the major driving mechanism to the increased reduction rates of toxic emissions in the USA. The public was the driving force behind the initiative of the Congress legislation and it was public interest groups to criticize USEPA of not exercising (to their opinion) its coercive power against industrial emissions. Once the TRI system went online and raw data – accurate more or less – became apparent to every potential eye, the public as an invisible and threatening entity played its effective role in aiding the enforcement agency to increase emission reduction rates. The industry management went over a transition, by acknowledging their sudden transparency and vulnerability with this electronic data dissemination. Using this trend the EPA went on with the 33/50 plan that was considered a success. It is arguable to what extent was the TRI effective, however it is clear the exposure to public eyes affected the industry's behaviour and considerations. This is a case one could learn of how the public uses its power to actually improve the environment without having the industry to comply with any law.

The Israeli "Cleanliness Trustees"[24] are an example of activating public in an effort to practically enforce the Cleanliness Maintenance Law, 1984. The law prohibits littering in public domain, and since field inspectors of the Ministry of the Environment are only about 30, the legislator empowered the Minister to appoint these civilian volunteers. As of today they count more then 200,000 people, however only about 5000 of them are considered active (at least one report per year). This is a public that even if not reporting violations, is assumed (was never actually checked) to be highly- aware and a good "salesman" of the environment protection as a whole (goes also for preventative measures enhancement).

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22 "Managing Environmental Risk: The Case of Asarco", page 4 KSG case No. 847.

23 "The Toxics Release Inventory: Sharing Government Information with the Public", KSG Case No 1154.

24 According to Israeli "Cleanliness maintenance law, 1984", a civilian who has the right by law, after approved by the Minister of the Environment, to issue a report on littering violation. The report is checked and often translated to a fine of up to 120$.

Activating public in police work, as the following show, stresses the fact that a skillful use of public has an advantage in police operations in ways that are far from obvious. This may also be applied partially to environmental aspects in certain countries, so the resemblance is worth looking into.

Volunteers to civil guard are a public available source of work force to police, subject to a proper legislation. An example for using public in this manner is the Israeli civil guard - "Mashaz". This is an integral service force of the National Police, counting 40,000 nation-wide. In its most common configuration, it is made up of civilian volunteers, under regular police commanders. They patrol their neighborhoods against crime. Members of "Mashaz" are commissioned as deputized police officers, while on duty, and are given basic instruction in crime-control, first aid, firearms, and police Procedures. The innovation in this regard has emerged on late 1998, when these volunteers were incorporated in environmental crime enforcement. They were given proper guidance and were combined into enforcement programs of the Israeli MoE, mainly in the area of solid waste operations and also protection against sand thefts and domestic animals abuse crimes.

Informers, as I mentioned in the previous section, are integral part of any good intelligence organization within an enforcement agency, many of which are civilians.

Civilian volunteers could be an aid to police forces in Traffic control. Simple assignments like assistance in road blocks, towing obstacle vehicles, directing traffic in city centers, could free up professional policemen to more complicated jobs.

Search parties and aid in search for missing persons is long being used. The public here, functions as an emergency rescue team in some of the cases, while in others it is simply a large extension of ears and eyes to the police department.

In fact, even the call upon a grand jury in US court system is an example of the usage of public in law enforcement. This is however substantially different. These people cannot be influenced or mobilized in any way, and are subject to well-defined, single mission.

The public as target for enhancing preventative measures

One of the ways to use preventative approach to reach compliance goals is to educate and notify public of these goals that needed their continuous support and attention. Notification of the regulations and laws that exist, the proper ways to behave and act, and the consequences of improper action and misbehavior on the self and surrounding society is a valuable tool. Again, the Asarco case provides an opportunity to see how the local DOE takes the advantage – using public hearings - to educate and widen the public's knowledge of potential hazardous Arsenic emissions. This way the organization builds trust and may in the future; use this trust as leverage for other preventative measures.

Education and outreach to community levels provide a formal or informal ways to increase public awareness. It can be systematic as in the case of police educational lessons, held in public schools, in which children are thought of the hazards of drinking and usage of narcotics or safe driving lessons. It can also mean teaching health and safety regulations in industrial arts or home economics classes, and it can also mean enrichment courses to interested community groups. These are all preventative measures that should engage the public in a positive way to the agency's mission. In places where cultural habits might interfere with enforcement action, an educational effort might help. For example, giving lectures in the after hours time, by trained environmental enforcement personnel should be encouraged. When giving lectures and enrichment classes to youth, the dividend for society is enormous in the long run, and cannot even be scaled.

Media oriented campaigns

Another tool of using public opinion is making the enforcement action more transparent by media coverage or enhancing compliance goals using multimedia means such as TV, Cables, Radio, Written word, and outdoors-posting. A successful campaign should increase compliance by understanding and internalization and might reduce felonies committed out of ignorance. Using these means is another step as proactive approach and foreseeing the agency's mission, while doing it with minimal friction.

IT accessibility. This had become widely spread phenomenon, in which public is exposed to enforcement efforts, to the extent of Web browsing periodic reports of accomplished tasks and updated data. Almost every agency has a Website that provide the public accessibility and information concerning laws, regulations, Q and A's, and an understanding about the agency's mission, and also the opportunity to freely observe and criticize it on his own time. This gives the agency, on the other hand, an excellent equal opportunity to enhance its goals among public. The EPA TRI, which was mentioned above, provides an extraordinary demonstration of the power of information dissemination electronically. Increased public awareness and subsequent influence is the meaning of prevention enhancement here.

A profound public involvement worth mentioning, that falls under neither of the above sections, is the rather trivial and common case where **the public, is the one being abused**. This should be a fundamental principle in the agency's mission (Police: "Protect and Serve". Who? The public of course). Any public relations in an environmental enforcement agency know the huge quantity of complaints in this regard.

Other aspects of public engagement with enforcement activity

It is highly inaccurate if one tries to present the issue of public engagement as only beneficial, as far as enforcement institutions are concerned. On the contrary, this involvement is a delicate matter that could yield difficult situations that often backlashes onto the agencies.

The Asarco[25] case mentioned above gives an example how public groups backed by the media, attacked the EPA's administrator for his initiative to turn to public's advice. One would argue that the management of an agency should anticipate these kinds of public attacks. Nevertheless, it takes a tough and committed manager to withhold to such attacks, Otherwise, a whole innovative effort or other important work might be lost to too "deep" public involvement.

Another example for this complicated issue is brought in the other side of the mentioned EPA-TRI case[26]. There the public is the main "tool" in the EPA's arsenal, trying to impose reduced toxic emission releases. However, the public must not be perceived as unified educated, knowledgeable body of people, capable of right interpretation of highly complex, raw and ambiguous data. On the contrary, an absolute part of the "public" cannot rightly interpret the data shown in TRI records; moreover, it might wrongly interpret it to create some kind of scandal or hysteria. Even worse, publicly disseminated information might be used viciously to manipulate industry by groups advocating their personal interests (NIMBY syndrome)[27].

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[25] "Managing Environmental Risk: The Case of Asarco", KSG case No. 847.

[26] "The Toxics Release Inventory: Sharing Government Information with the Public", KSG Case No. 1154.

[27] NYMBY – Not In My Back Yard.

Sometimes ordinary people may be motivated by different motives from the agency, which might in turn cause harm. For example, snitchers for the Tax authority might make that move out of simple revenge feelings to their neighbor. A Cleanliness Trustee in Israel might issue a report for the same or other “creative” unlawful and unjust reasons.

Activating public with no official training or education in the context of the enforcement agency is often result-oriented and ignores the long-term implications of such involvement. For example, one could guess only few would argue for any educational benefit as a byproduct of encouraging snitching to the tax agency of being non-filers. Or am I wrong?

Conclusions

Preventative measures and “volunteered compliance” are connected to general public, when talking about tax regulations, traffic behavior and of course environmental awareness.

The term “Informational Conformity”[28] is used in social psychology to describe an informational influence to gain conformity out of accepting evidence about reality provided by other people. Clearly, the preferred way for regulatory organizations is to get compliance by internalization, that is, get the object to conform by deep understanding and changed thinking and attitude. This element must be recognized and facilitated by regulatory bodies that interact continuously with public, as shown above. Explaining, persuading repeatedly, and hopefully influencing the public as a stakeholder, to reach his conclusion voluntarily could create extra promotion of a subject.

There are five major sources of power[29] identified in the psychology literature, which could be used to illustrate the point of exercising power by a regulatory agency towards the public, acting not as a violating client (not regarded as the one to be “enforced”):

Positional power - Formal, authoritative in origin.
Reward power - The ability to reward a follower for compliance.
Coercive power – The ability to punish for non-compliance.
Expert power - Technical, administrative, or other know-how.
Referent power - personality or behavioral style Impact.

When interacting with the public in the above manner, the use of “expert” with “positional” power may gain commitment and compliance through internalization, which most times is the preferred way to deal with Public. The use of coercive power is the second and last resort, simply because it usually results in reactance/resistance, and it is usually more costly to the organization by any standard. Reward and referent power would succeed mostly when dealing with individuals or specific organizations or industry.

The public is considered to be a background entity, a “decoration”, or the scenery for most environmental enforcement actions. Nevertheless, the public is a major player in the enforcement arena, either as a stakeholder or as a violator. It is a multi faceted entity, specific to the situation of each country and to its laws, and to the results to be achieved for specific time and place. Though it seems obvious and not worth mentioning, it should be stressed that public should **always** be taken into account and not be neglected by the regulatory agency as a central concern.

A citation from USEPA-TRI Website describes the essence of creating a direct bridge to as broad public as possible:

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28 Myers D, “Social Psychology”, sixth edition, 1999, pp 210-237.
29 Rosabeth Moss Kanter, Men and Women of the Corporation, Structures and Processes-power, 2nd edition, 1993.

“Accessing TRI - The Toxic Release Inventory is only as valuable as the number of people who use the information. It is as important as ever to raise awareness of the value and availability of TRI. Individuals and organizations using TRI knit together concerned citizens with top corporate and government decision-makers… A concerted effort has been made to offer TRI… at a broad range of public facilities. TRI products have been distributed to over 4,000 locations, many of which are public libraries where individuals can use the TRI data free of charge.“

9. SOLVING ENVIRONMENTAL PROBLEMS

Enforcement actions by themselves rarely improve our environment. Imagine a well-organized enforcement agency, well equipped, well-designed, armed with known and established procedures and know-how, having the best professional, manpower. Will they succeed to tackle the most risk-posing problems? Could they make the environment a better place? Not just verbally would they have the ability to prove its success in terms of salient performance measurement? Is this possible when we know reality in each country and each organization is in fact so complex? The answer may be affirmative. However, too often it's negative or, not necessarily so. Let us explore a possible method, which may clarify the fog.

Key issues and glossary terms for further elaboration:

Risk management, pattern of noncompliance, performance measurement, bean count.

The usual most profound practices in enforcement agencies can be concisely described and be looked into through the following questions:

How is it that so many professional personnel within various enforcement agencies feel that their organization often demonstrates Incompetence dealing with lasting routine problems? Many agencies are being reactive instead of proactive (preventive), is it so common indeed? True of false, there is a consistent lack of salient and reliable performance measurement – outcomes not outputs (most agencies count enforcement actions instead of environmental successes. The innovative "customer service" attitude or “good old enforcement” does not work as might be expected in the regulatory agencies agenda. Why is it so? Exercising discretion among inspectorate personnel turns to be a crucial question. Who, in what level, should make the judgment call? Is it a procedure or a flexible idiosyncratic judgment call? Are enforcement actions proved deterrent towards the next environmental potential crime?

These questions and similar, are not rare in the corridors of environmental enforcement agencies. They bring many to recognize slight frustration resulting from inherent-no body’s fault – situation.

This chapter tries to feed the reader on a tip of the fork, the headlines of this somewhat provocative method of dealing with true environmental problems and the way to meet them incorporating all means necessary including enforcement, but not only enforcement. If this chapter found intriguing, further reading is suggested ("The regulatory craft" by M. Sparrow).

The theme of "problem solving" (or "risk management") as a term, means that the regulatory agency has to construct a method, a prescription, to abate and control successfully, patterns of non-compliance by addressing each problem concentration with a thoughtful, tailor made intervention.

The description above though simple and obvious is not simple in any aspect. The arrival and understanding of this need, described above, starts when an enforcement organization's management would see usually four occurrences appearing in their agency, not necessarily in orderly fashion and quite randomly.

1. Managers of the organization are forced to act differently in terms of how to manage their operation in reference to their political constituencies. As happened in many places in the world, political pressure has brought about the tendency to cease "traditional enforcement" as interrogations, lawsuits, fines and other coercive punishment measures. Instead the politicians drove to voluntary agreements, self-compliance, or what is called in short negotiated rulemaking. This phenomenon has turned out to be similar to pendulum for various enforcement agencies throughout the world, crossing many enforcement disciplines.
2. These same political powers had caused the regulatory agencies to adopt the more friendly approach to the permitees and clients that is basically taken from the private sector and is incorporating first and fore most the "customer services" and customer is (always) right. The inherent problem here is that enforcement agency cannot act as a supplier of goods and unfortunately it delivers obligations and services not always wanted by the clients. These agencies are dealing with risk control methods and as such it is different then the private sector.
3. All of a sudden the management sees that advances and progress is made within the organization and sometimes risk control operations do succeed and are fruitful. The problem is that too often these successes are originated not in some carefully planned effort or enforcement program, nor as a result of some long constant designed action. These are often one-time innovations of a person or a small team of persons, who found a way to make things happen. Usually they are the people in the field, close to the problems, who took upon themselves to solve a little problem. Now how should the management "copy - paste" it to other parts of the organization?
4. Last but not least is happening when the management of the agency seeks to demonstrate their results. Usually, what they have been doing so far is the counting of activities - fines, cases, litigation, reports, income in monetary means - which yields very little in terms of inferring these data pieces to real advance in environmental improvement or abatement. In other words, most of the enforcement agencies are measuring output instead of outcome.

Professor Malcolm Sparrow of JFK school of government, Harvard University, defined and described the problem of regulatory and enforcement agencies - all over the world - in many areas that deal with the obligation of getting compliance to the law by their constituencies.

He said among other things: "Reforms focused on process Improvement fails to take account of the distinctive character of regulatory responsibilities: Delivery of obligations not just services."

The Problem solving strategy vis-à-vis Prof. Sparrow, realizes that regulatory and enforcement agencies all over the world tackles the same difficulties:

- Lack of connection between field level operatives and senior management when defining the mission and managing discretion within the enforcers and across the disciplines to be enforced.
- “Good people locked in a bad system” syndrome. This is a frustrating feeling in regard to many innovative single workers that feel they know what should be done, but are detached and cannot convey their know-how and skills to the top level, in a regular and ordered fashion, as a paradigm to other places.
- Incompetence in dealing with problems that extends the usual, routine frame of enforcement and inspection. And this is in fact a common characteristic of the environmental area.

- Performance measurement - The “bean counting” effect of counting output and actions instead of outcome and results.
- The inability to act proactively rather then reactively on the core problems. The reality points that we are constantly finding that we are preparing for "the last war" instead of preventing the next one.

There are many more characteristics to the continuing mutual difficulties in the everyday life of an enforcement and regulatory agency, which is true for all agencies from Customs and Police to Environment agency and Safety at work agency.

Enforcement actions strict and straightforward or negotiated rulemaking and client service. Which better serves the goal?

According to Prof. Sparrow, the method principle is simple:

Find Important Problems and Fix them

Each and every word in this phrase has a special meaning. Think about it.

We have to have a strict method of selecting the really important problems but once we find them, we will keep the solution team result-oriented, focused on environmentally measurement of success (or failure) and free to tailor their own form of solution to the carefully described problem.
For example, let us take District Managers in a certain country. They are key players in addressing the problem of LBS of pollution to sea.

So in order for them to apply strategic and operational analysis they have to act in the following procedure of the "problem solving" method:

Identify the major problems within their areas in terms of environmental and health risks and set priorities based on all data gathered. When identifying the problems, attaching them baseline quantitative characteristics. Then, they have to set performance measures to account for hopeful progress, form problem-oriented task forces, make sure the team has established an insight with a view to action, set follow up schedule and meetings.

Districts will be responsible and held accountable for exercising discretion with enforcement actions, and for developing their own specific measures of identifying compliance rates, which are diverse and multi-disciplinary and highly complex.
Doing that, they will most probably have to collaborate with other government units but also municipalities, other ministries and the public.

Task force in a District will make extensive use of existing software and other database measures to explore patterns of risks, concentrations (industrial, geographical), possible sources for cooperation within near agencies, and possible political and public implications.

The concept of “Intelligence-Led Policing” applied to the inspection units of the enforcement agency and other inspection and supervising units, could create an accurate, real-time database material for operation and risk control decision-making.
This is emphasized because many environmental violations are in fact involving risk-conscience, economically driven opponents.

In other words, the method suggests a possible frame of action as the following

1. The agency should create a mechanism for selection of patterns on non-compliance, concentration of risks that were never abated successfully.

2. Then the directing team of high-level directors would appoint a task force, among the people, which connected to the field and the problem or risk.
3. This task force would have to carefully analyze and re-think of all possible causes, effects, sources and possible side effects any problem has. This is major to the environmental problem solving method. The out come of such analysis would be:
   - Exact definition of the problem (where, when, how much) and why is it important to solve;
   - Set quantitative reference point and set the quantitative goal and its measurement parameters.
4. The task force would have to come up with:
   - A suggestion for other parties to share operation with and identify all stakeholders;
   - A suggested carefully planned action plan with detailed explanation;
   - A time frame and measurement of success.
5. The directing team will call for a periodic update of the action team, survey it, inquire proceedings, follow the measurement parameters as set apriory, and advise for changes.
6. The problem will be declared solved, when the goal is reached.

Possible conclusion

If same difficulties appear all over the world in the field of environmental enforcement, we should try and look a bit differently what we must improve to really manage the risks. How should we act so our enforcement action could really account for reducing these risks? We think that this theme of "Environmental Problem Solving" should be given a fair chance, because it gives us several advantages and answers. The most important one in the context of the present set of guidelines is the ability to connect enforcement actions to measurable environmental risks and problems, in a flexible substance, yet rigid framework.

This method is implemented in the Department of Environmental Protection of the state of Florida for few years now. They have begun with a small pilot project of reoccurring sewage-water spills in Orange County. The success story of this pilot project has been regenerated to become the DEP's main working program to improve and solve environmental problems. (See Annex 1 for further details).

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Annex 1

Problem solving applied, DEP Florida, USA

David Herbster's comment to a question regarding the application of this method in the DEP of Florida state:

> "I think there were four key ingredients. First, was commitment at the top of the agency to try a more structured, focused and informed way of solving problems. Second, was high-level training for a few key staff (internal "consultants") that taught the concept of problem solving and pitfalls to avoid. Third, was enthusiastic staff who were frustrated enough with seeing the same regulatory problems over and over. Fourth, was infrastructure for identifying problems, selecting projects, supporting the projects and learning from the results. In a nutshell:
> Top-level support
> Technical training
> Enthusiastic (and frustrated!) staff
> Infrastructure to support it all
> We've done it so far with no additional funding. That makes problem solving extra work in many people's minds. And it is almost always extra effort"

DEP INNOVATORS WIN AWARD FOR PRODUCTIVITY
Approach leads to restoration of 87 shorelines and saved 1400 hours of staff time.

ORLANDO – Today, the Department of Environmental Protection announced that Team Beaches, an environmental problem-solving team charged with initiating shoreline restorations on two Outstanding Florida Waters, won a Davis Productivity Award for their efforts. The Davis Productivity Awards honor individuals and work units in Florida state government for innovative and creative work that measurably increases performance and productivity in the delivery of state services and products.

Team Beaches was commissioned to deal with a growing environmental problem in Central Florida. Monitoring of the Butler Chain of Lakes and Clermont Chain of Lakes during the fall of 1999 turned up over 90 cases of homeowners stripping shorelines of natural vegetation, and in some cases filling in with sand. The resulting "beaches" lead to erosion, removed wildlife habitat, and violated state and county environmental regulations. The 90 cases had the potential to swamp DEP's compliance staff in the Orlando area. Central District Director Vivian Garfein challenged Team Beaches to find an innovative approach to address the problem in a more efficient fashion.

The team decided to handle the violators as a group rather than as individuals. Town meetings were held and violators were offered amnesty if they would sign restoration agreements the night of the meeting. In a year, Team Beaches' approach lead to restoration of 87 shorelines and just four enforcement cases. Angry citizens, who had been frustrated over confusing state and county regulations, became allies. Local news media coverage informed numerous others about the importance of protecting shorelines. In the process, conservative estimates show that Team Beaches saved over 1400 man-hours and $28,500 in associated salary. In addition, their approach has been used successfully elsewhere in Florida.

"We are very proud that Team Beaches' creativity and efficiency has led to measurable results as well as this prestigious Davis Award," said Garfein. "Team Beaches accomplished what DEP is after – more environmental protection and less process."

The solving of Orange county sewage spills

The team was composed of a group of inspectors, supervisors and a mapping expert. They named Themselves Team SOS (Sewage Overflows and Spills). They adopted a routine of weekly one-hour meetings with homework in between. Jobs one and two were to clearly define the problem, then measure it. The problem became clearer as they measured it, so they went back and forth -- defining, then measuring, then re-defining, then measuring again. Measurement made the problem statement clear:

In one year (FY 1996-97) in Orange County, 181 spills of raw sewage totaled over 900,000 gallons. This was a potential public health threat and many of these spills 70% wound up in Orange County surface waters.

Team SOS was thorough in measuring the problem. They broke down the spills into categories based on number of spills and gallons spilled. Then they further broke those categories down according to:

1. Spills by cause (due to blockage, electrical problems, equipment failure, or line breaks),
2. Location of the spills -- particularly "repeat offenders" (mapped using GIS),
3. Destination of the spill (spills to surface water or the ground),
4. By season (rainy vs. dry), and
5. By size of the spill (1000 gallons, 10,000 and larger).

This analysis brought them productively close to "paralysis by analysis" and gave them a clear and undeniable picture of the problem. Interestingly, they did not need to dig for data -- they just needed to take a closer look at the reports DEP had received for years.

That look showed:

1. Most of the spills were due to blocked sewage lines, but that the biggest spills were due to electrical problems.
2. The spills due to line breaks clustered along Highway 441 and that spills due to blocked lines clustered in Pine Hills.
3. Over 70% of the gallons spilled reached surface waters.
4. There was no significant seasonal variation, though it had been expected during the wet season.
5. A few of the spills (less than 10%) released most of the gallons (over 75%).

With the problem clearly understood, they discussed ways to solve it. This lead to two interesting questions. First – "Do we work *with* Orange County Utilities or take enforcement action?" Enforcement would have left no doubt that DEP took action. But there was no promise of the desired results – fewer and smaller spills. Working with Orange County Utilities sounded more effective since solving the problem would require analysis and imagination on both sides. Still they kept enforcement as a possible option.

The second question was, "When can we declare success?" "Significant improvement" was the goal, yet very hard to quantify. They were afraid of setting the mark too low and getting a half hearted effort from Orange County. They also feared setting the mark too high and defeating Orange County Utilities with unreasonable expectations.

The resulting action plan reflects decisions on both of those questions. The action plan was as follows:

Meet with officials of Orange County Utilities monthly during 1998 to discuss:

- *The problem -- sewage spills (show data.)*
- *Our position -- too many spills*.
- *Our goal -- significant improvemen.t*
- *Our offer -- compliance assistance (review maint. plan, visit spills, visit sites of chronic spills, input from Chuck Collins)*.
- *Our options -- If successful, give recognition (joint-presentation at Comp/Enf. Workshop and press releases). If not successful, possible enforcement action and "recognition" (press releases).*
- *Our expectation -- Orange County Utilities would name a point person(s) as our contact, take measures to make significant improvement, meet with us monthly to discuss the measures taken and results.*
- *Action taken to improve performance and results.*

Report to Vivian and Director Orange County Utilities.
August, 1998: Present results to date at DEP's annual Compliance/Enforcement Workshop (joint presentation with Orange County Utilities, if there is "significant improvement".
December, 1998: Decide how to apply lessons learned from this effort to problems in Ocala and other cities in the Central District. Still need to decide:

6. When and if to choose #'s for "significant improvement".
7. What to do at the conclusion of 1998.
8. When the project is over.

Mission Control approved the action plan and the team met with Orange County Utilities in December of 1997. They showed the problem, then asked for comments. Orange County Utilities insisted that the problem could only be solved by new ordinances and capital improvements -- both of which were years away. Still they committed to try, to meet monthly with DEP and to discuss the latest spills.

Over the next 12 months, Team SOS met with Orange County Utilities to look at the latest spill results and discuss efforts to address them. Two important things resulted. First, the scrutiny that the utility was under got the attention of Orange County Utilities management. That attention got them extra money and manpower to work on the problem. Second, utility staff began to adopt an analytical approach similar to Team SOS'. With that came imaginative ideas that did not wait on ordinances and capital improvements. For instance, Orange County has worked on the following:

9. installing cell phones auto dialers on lift stations to report imminent spills before they happened;
10. raising citizen's awareness by mailing out refrigerator magnets that explained what to do if they saw an overflow;
11. diverting hydrogen sulfide away from switch boxes at the lift stations to reduce the corrosion that leads to malfunctions;
12. educating restaurant owners about grease with a "TRAP YOUR GREASE" poster and how to prevent it from blocking lines;
13. focusing teams on areas where there were recurring problems.

By the fall of 1998, Orange County Utilities was so pleased with this effort that they made plans to teach others to try it.

By years end, Team SOS had marked results. Those results included:

- 31 fewer spills.
- Gallons spilled reduced by 270,000 gallons.
- Gallons spilled to surface waters cut by 65%.

To date, there are still categories of spills that need improvement.

Part III

HUMAN INFRASTRUCTURE

TABLE OF CONTENTS

Page

1. INTRODUCTION

The purpose of this compliance and enforcement manual is to assist Mediterranean countries combat pollution of the Mediterranean Sea. The sources of pollution will vary from country to country. In general, however, they are likely to include:

- Discharge of liquid effluents directly into the sea, or into the rivers or sewers that flow into it.
- Release of pollutants from buried waste or contaminated land, by way of groundwater.
- To a lesser extent, deposition on the surface of the sea of pollutants originally discharged into the atmosphere.

All significant sources of such pollution will be subject to some form of environmental law governing the operation of polluting processes and protection of the environment. They will be subject also to checking for compliance with the permits or agreements made under the relevant legislation and supporting regulations. The form of legislation and, more particularly, the systems adopted for securing compliance with relevant permits or agreements, or for achieving associated environmental objectives, may differ widely depending upon the regulatory approach adopted by individual countries.

The following approaches are typical of modern environmental regulatory systems.

- The Traditional Policing approach. This is what is known as a "regulation of process" approach in which environmental and/or performance standards are defined in an operating permit. It is also described as a "command and control" approach. Checking for compliance with permit conditions is carried out on a routine basis and sanctions of various kinds are applied in cases of non-compliance.
- The Goal-Based approach, in which environmental objectives or targets are defined in a permit, or in an equivalent regulatory document, after agreement with the operator who is then responsible for proposing management arrangements for achieving the agreed objectives or targets. Compliance checking in this case is a matter of ensuring that the management arrangements are in place and working satisfactorily, and that the appropriate objectives and targets are being met. Enforcement action would follow any failure to comply with the defined objectives and targets in an appropriate and timely way.This is otherwise described as a "regulation of outcome" approach.
- The "Environmental Management System (EMS)" approach. This is very similar in principle to the "Goal-Based" approach but, in situations where an EMS*,* certified to a defined standard such as ISO 14000, is in place and where regulators can be confident about the quality of the audit process, an element of the formal compliance checking may be delegated to the accredited auditors.
- The "Voluntary or Negotiated Agreement" approach in which an operator or, more usually, a sector of industry agrees at Government level upon environmental or performance objectives, and takes the initiative for their delivery. This approach has the attraction of allowing industry to work constructively and co-operatively with Government in achieving desired environmental outcomes. Governments would be ill-advised, however, to embark on such an approach without the necessary infrastructure for taking enforcement action if the voluntary agreement does not work.
- The "Economic Instrument" approach in which financial incentives or penalties are devised in order to influence the environmental behaviour of polluters.

The choice of regulatory approach is usually a matter of policy or culture, specific to individual countries. Within each of these approaches, further operational choices have to be made about the extent to which inspectors promote compliance by education and persuasion or concern themselves simply with deterrence and enforcement, and about the extent to which inspectors may exercise discretion in achieving desired outcomes as opposed to adhering strictly to defined procedures and systems. In actual practice, however, it is likely that any modern approach to environmental protection and regulation will be some combination of the above approaches, applied appropriately to different sources of pollution or sectors of industry. The choice of regulatory approach, or combination of approaches, will inevitably influence the precise role of an inspector but the essential characteristics of the role, and of the types of individual best suited for the role, are generic to most of the regulatory approaches and associated operational choices.

2. DUTIES OF INSPECTORS

The activities associated with regulation and control of environmental pollution generally involve the following steps.

- Policy planning and setting of environmental protection objectives.
- Development of legislation and supporting regulations.
- Permitting or making agreements about objectives and targets.
- Compliance promotion.
- Compliance checking.
- Enforcement.
- Assessment and feedback of information to legislation or permitting.

This sequence of steps, with feedback of information to the legislative step or to the permitting step, is now widely recognised as a generic “regulatory cycle”.

In all of the conventional regulatory systems, the inspector will certainly be involved in the steps of compliance control, enforcement, and assessment and feedback of information about the effectiveness of the system in achieving its objectives. In well-established systems he or she is also likely to be involved in other steps as described below.

<u>Policy planning and setting of environmental protection objectives</u>:
This activity is the usual Government response to a generally accepted need, or to pressure from domestic society or from the international community. The planning of environmental protection policy and the setting of associated objectives at Government level involves recognising and balancing various factors, including social and economic issues as well as environmental considerations. The inspector’s role at this stage is to contribute professional experience and knowledge of sources of pollution, of their effects in the environment and of the practicality and implications of various courses of action and, hence, to assist in the setting of practical objectives for environmental protection. Involvement in this work is invaluable background for the subsequent task of explaining to operators, and to members of the public, the broad context of regulatory requirements.

<u>Development of legislation and supporting regulations:</u>
The experienced inspector plays a key role in this step by advising legislators on the practicability and enforceability of proposed legislation and regulations. Absence of inspector involvement at this stage may result in legislation that is unenforceable or otherwise deficient and which, therefore, fails to deliver the desired policy objectives.

Permitting or making agreements about objectives and targets:
Depending upon the administrative or organisational arrangements within a regulatory body, the inspector may be directly responsible for the issue of permits or for agreeing environmental targets or objectives. Even if he or she is not directly responsible for this task, however, the inspector will be almost invariably called upon to advise on the conditions and limitations to be included in permits or on practically achievable objectives or targets for a particular process or installation.

Compliance promotion:
The Inspector is usually at the critical interface between Government policy makers, operators of industrial installations and members of the public. Advantage may be taken of this situation by giving the inspector a responsibility for promoting good environmental performance, in the sense of educating or influencing operators towards improved environmental behaviour and practice. The role, in this context, is to explain to all concerned the relevant environmental objectives and targets, together with the reasons for them, and where appropriate to provide guidance and support to operators without subsuming the operator's responsibility for his installation.

Compliance control:
This is the core task of an inspector in any regulatory approach, and it is generally described as "Inspection".

In its broadest sense, it entails:

- Checking the compliance of industrial installations with requirements stated in laws, regulations, ordinances, directives, prohibitions, agreements and/or permits etc.
- Monitoring the general and environmental impacts of specific industrial installations that might indicate the need for enforcement action or for more detailed investigation.

The key elements of this task are:

- Planning, i.e. setting out a clear framework for inspection activities.
- Collection of site-specific information from visits, site surveys etc.
- Analysis of results and follow up at the site/company level.
- Regular evaluation and reporting of inspection activities.

The findings from each site visit need to be carefully evaluated. They should lead to clear conclusions regarding any further action and should be properly recorded in a formal site visit report. Incidents, accidents or non-compliances need to be followed up rigorously by:

- Establishing the cause, or causes, of failure, and clarifying the resulting impact on the environment.
- Determining the actions to be taken for mitigation of environmental impacts.
- Specifying the action to be taken to prevent further such accidents, incidents or non-compliance.
- Carrying out subsequent inspection to ensure that the operator completes all the required actions on the appropriate timescale.
- Forwarding a report of conclusions to the enforcement authority as appropriate.

Enforcement:
Depending upon administrative or organisational arrangements, and upon the extent of the inspector's authority, he or she may have to exercise legal sanctions in the event of any non-compliance with the terms of a permit or agreement. In any case, the inspector's report, together with any additional advice, will be required for the exercise of sanctions provided by the law. In most regulatory systems, however, the inspector's authority will extend at least to

requiring immediate action upon discovery of imminent risk of serious harm to the environment. Thus, he or she will be required to exercise powers of discretion and of reasonable or proportionate regulation, having regard to environmental, economic and social factors.

Assessment and feedback of information:
On the basis of his or her experience of implementing the regulatory system, the inspector will be required to evaluate its effectiveness in delivering the policy objectives set by Government, and to help in formulation of any necessary improvements. These may be at the fundamental level of changes to primary legislation or to supporting regulations but, in the short term, are more likely to concern the processes of drafting and issuing permits or the setting of environmental objectives and operational targets. For these purposes, it is clearly helpful for the inspector to have been involved in the early steps of the regulatory cycle.

3. PROFILE OF AN INSPECTOR

The authority and credibility of a regulatory body, and the respect in which it is held by operators of industrial installation and by the public, depends in large part upon the reputation of its inspectors. This is reflected in the widely accepted view that an effective body needs to employ a sufficient number of personnel with the necessary qualifications, skills and experience to undertake all of its functions and responsibilities. Within any regulatory body there may be positions of a general nature and of a more specialist nature, as well as positions that are a combination of both, depending upon the structure, managerial arrangements and precise role of the organisation. It must be expected, therefore, that the profile of necessary qualifications, skills and experience across the corps of inspectors will vary from organisation to organisation.

In the context of the range of duties described in the previous section, however, the skills and attributes that constitute the profile of an inspector are most usefully categorized and described by way of:

- Personal attributes and competencies.
- Technical knowledge, skills and experience.

3.1 Personal Attributes and Competencies

The personal attributes that describe the ideal, fully effective inspector include the following:

- Mature.
- Professional and disciplined.
- Able to communicate.
- Integrity.
- Helpful and constructive.

Mature:
This is not necessarily a matter of age, or years of experience. It is the innate characteristic that allows an inspector to exercise a natural authority in dealing with operators at the most senior level, and to command respect while retaining the ability to exercise sensible discretion where appropriate. It also allows the inspector, in discharge of other duties, to interface effectively with policy-makers, legislators, Ministers and with members of the public. In essence, it is the attribute of an inspector who is confident in his or her understanding of the inspector remit and of the legal and technical issues associated with it, and who neither abuses his or her authority nor concedes it under pressure.

Professional and Disciplined:

It is perfectly normal and desirable for environmental regulatory bodies to attract staff with an interest in the environment and a commitment to its protection. The inspector's role, however, is to exercise powers granted under the environmental law, whose provisions will have been designed to implement Government policy and to balance environmental, social and economic factors. He or she, therefore, needs to be able to differentiate between any personal views, on the one hand, and his or her legal remit, on the other. This may bring the inspector into occasional personal confrontation, with single-issue pressure groups of one kind or another for example, but the professional discipline to carry out his or her duties according to legal provisions is essential for delivery of government policy, and for avoidance of legal challenge.

Able to Communicate:

The role played by the inspector at the interface between policy-makers, operators, and the public requires an ability, natural or acquired by training, to communicate effectively in terms that are comprehensible by the relevant audience. This is essential for effective explanation of regulatory decisions, and their associated policy context, to operators and the public and for effective feedback of information on practical implementation to policy-makers and Government.

Integrity:

This attribute is closely related to the attributes of professionalism and discipline but it includes, also, the innate resistance to improper influences by whatever means. The credibility of the regulatory body, and the respect in which it is held by the public and by its peers, depend heavily on the assurance that the inspector's decisions relevant to protection of the environment are not subject to inducement by those with an interest in influencing his or her judgment for whatever reason. This attribute might be described otherwise as being "firm but fair and honest".

Helpful and Constructive:

In the context of the wider duties described in the previous section, an inspector needs to be both helpful and constructive. His or her ready co-operation and willingness to share knowledge and experience will be welcomed by policy-makers, operators, the public and colleagues alike. It is a key element in building respect for the individual inspector, and for his or her team, and it is an essential part of extending the influence of the regulatory body as a whole.

In terms of identifiable personal competencies, the ideal inspector should display most of the following abilities or skills.

- Self-motivation
- Judgement
- Thoroughness
- Assertiveness
- Persuasiveness
- Relates to others
- Resilience
- Organisation and time management
- Planning to achieve objectives
- Analytical capability
- Negotiation
- Networking
- Self development
- Application of experience

These may be defined simply as follows:

Self-Motivation:

Willing and committed to pursuing own and organisational plans and objectives.

Judgement:
Researches and evaluates data and opinions. Studies problems from many perspectives. Reaches balanced decisions, giving proper weight to all relevant considerations. Sets clear priorities, based on legal requirements and policy objectives.

Thoroughness:
Compiles as much relevant information as possible within time constraints. Checks and examines date before coming to decisions. Checks details of all communications to and from operators and others. Verifies and validates information before acting on it. Checks own judgements with others. Complies with organisational procedures.

Assertiveness:
Speaks and acts forcefully in order to achieve objectives, but in a way that does not impede or deny the rights of others.

Persuasiveness:
Expresses facts and ideas fluently in face-to-face contacts and on public platforms. Is discreet, honest and consistent in communication. Encourages others to express their views, and listens actively. Shows understanding of other points of view, and is open to reasoned argument. Uses persuasion to achieve environmental improvement where appropriate.

Relates to Others**:**
Interacts easily and effectively with others, irrespective of their status or background. Able to establish professional relationships with people, regardless of their status. Acts with integrity towards others to build trust. Monitors and modifies relationships to maintain professional integrity and independence.

Resilience:
Able to cope with high levels of pressure at work, and in hostile situations. Recovers quickly from setbacks and disappointments.

Organisation and Time Management:
Allocates own time, plans targets, sets priorities and manages caseload efficiently. Arranges information systematically, and processes paperwork and other information effectively and in timely fashion. Personally well organised. Builds trust by keeping to commitments.

Planning to Achieve Work Objectives:
Sets clear goals and develops detailed strategies and schedules to meet them. Anticipates obstacles and makes contingency plans. Obtains resources necessary to achieve goals and objectives.

Analytical Capability:
Persists in finding out what is happening. Does not take information at face value. Questions facts and is willing to change course of inquiry if necessary. Draws justifiable conclusions from quantitative and qualitative information. Applies scientific and engineering principles and techniques, as appropriate, to identify problems and potential solutions.

Negotiation:
Resolves differences when necessary by identifying best, mutually agreeable solutions. Uses negotiation techniques, when appropriate, to promote and protect organisational and policy objectives. Prepared to compromise wisely in order to resolve issues and achieve progress.

Networking:
Identifies key people who have the motivation and ability to contribute to achievement of objectives. Builds and joins relevant networks. Uses appropriate channels of communication to exchange information, test opinion and to influence.

Self Development:
Keeps professional, political and commercial knowledge and understanding up-to-date. Invites and provides clear and constructive feedback to enhance learning. Knowledgeable on a broad front about the organisation, its functions and methods of operating. Actively promotes cross-functional interaction and awareness.

Applying Experience:
Reviews and learns from own experience. Identifies how to use experience to deal with current and emerging challenges and issues. Recognises the difference between useful experience and simple repetition of past practice.

3.2 Technical Knowledge, Skills and Experience

In addition to the personal attributes and competencies described above, an inspector must have a range of relevant technical knowledge, skills and experience in order to be fully effective. The precise requirements will depend upon the range of duties he or she is required to undertake. This, in turn, will depend upon the precise remit of the regulatory body and upon the way it organized and managed. In the context of environmental regulation, however, the inspector's main duties will normally be in the steps of compliance control and enforcement, but the knowledge, skills and experience necessary for these functions will equip him or her adequately for effective contribution to the other steps in the regulatory cycle.

For practical purposes, the necessary knowledge, skills and experience, described generically as "competencies", may be sub-divided into three groups as follows:

- Core competencies.
- Clusters of role-related competencies.
- Specialist competencies.

The core competencies are required of all inspectors in an environmental regulatory body. They represent a base of knowledge and understanding of the environmental regulatory role that may be used as a foundation for further development for a particular role. Clusters of role-related competencies are relevant to inspectors assigned to the related role. (For the purposes of this document, the relevant role is taken as "compliance control and enforcement". Other roles such as assessing permit applications and the writing of permits may require a slightly different cluster of competencies.) Specialist competencies are required of those inspectors who may have a specialist role within the regulatory organization or who may have a need for such competencies in order to carry out a particular assignment.

The portfolio of competencies required of individual inspectors may vary, at the level of detail, depending upon how the regulatory body is organized and upon the extent to which it relies on inspectors working in teams. In team-based organisations, the key requirement is for the team as a whole to have the full range of competencies and to be managed accordingly.

3.2.1 Core competencies

The core competencies include areas of knowledge that underpin, at a general level, most of the activities associated with environmental regulation. These include:

Environmental Law:

This includes a general knowledge of the legislation relevant to the role of the regulatory body and of the statutory basis for its regulatory duties and powers.

Pollution Control and Regulatory Principles:
This includes an understanding of the regulatory policies adopted by the regulatory body for pollution prevention and control, and for exercise of sanctions in cases of breach of the law.

Legal Procedures:
This covers understanding of the legal process that applies in cases of non-compliance or legal breach. Where prosecution is a relevant sanction, it should include matters concerned with the proper collection of evidence and its production before a court of law.

Scientific and Engineering Principles:
This includes a basic knowledge of the behaviour of pollutants in the environment and of how to detect and measure them. It may also include some understanding of the chemical engineering of potentially polluting processes, together with relevant abatement techniques, and may extend to the principles of electrical or electronic engineering associated with process instrumentation, control and monitoring systems.

Risk Assessment:
This aspect borders on a specialist area but it is desirable for an inspector to have some understanding of the relationships between sources of hazard, pathways in the environment, receptors or potential targets for impact, probability and consequent risk.

Environmental Management:
The general principles and logic of environmental management systems should be understood, from assessment of environmental affects, through development of environmental policies and targets and organising and managing their delivery, to reporting on achievements and progress and identifying areas for further improvement.

Team Management:
This is relevant for inspectors destined to be managers of teams and should include knowledge or experience of organization and management of multi-disciplinary teams, of finance and other resources, and of related performance statistics.

3.2.2 Cluster of competencies related to compliance control and enforcement

This cluster of competencies is broadly relevant to the main duties of an inspector under any form of environmental regulatory regime. The detailed specification of the cluster needs to be tailored to the particular remit, policies and objectives of the individual regulatory body but the essential elements are largely generic. The key competencies, described here in terms of activities, are as follows:

Site Assessment and Advice to Operators regarding Permission to Operate in Compliance with Specific Legislation:
This involves assessing sites covered by environmental legislation, regulations or agreements, establishing appropriate contact with the site operator and advising him of the relevant legal requirements and of how to prepare and submit the necessary application for a permit.

Assessment of Applications and Issue of Permits: (Where appropriate to inspector role)
This requires checking and validating the content of an application for a permit, specifying conditions and limits which apply to the permit, specifying programmes for process improvement or modification, and determining the programme for monitoring of the process

by the operator. It also involves all the administrative steps, including public consultation etc, associated with preparation and issue of the permit.

Securing Compliance with Statutory and Environmental Objectives:
This involves keeping up to date with developments in technology, business operations and the economy of an industry sector, guiding operators towards continuous improvement and reviewing/revising regularly the terms and conditions of existing permits. It also involves inspecting sites and assessing process releases for compliance with the requirements of relevant permits, and investigating any breaches or complaints against the site operator.

Instigating formal Enforcement Action:
In cases of non-compliance this may involve issue of various kinds of formal enforcement notice ranging from a simple notice requiring some specified improvement through to a prohibition notice requiring shutdown of a process in the event of imminent risk of serious harm to the environment. In cases where prosecution is intended it also involves gathering and recording evidence of breach and eventual presentation of evidence in court.

Emergency Response:
Where it is within the inspector's remit, this means ensuring that the necessary action is taken to recover control of the source of emergency, to protect people and the environment and to keep the public informed. It then involves ensuring that any necessary remediation is undertaken, that all possible lessons are learnt and action taken to avoid repetition, and that any appropriate enforcement action is taken.

Monitoring Releases and Assessing their Environmental Impact:
This involves planning an environmental and release monitoring programme, reviewing the results of it and assessing the impact on the environment. It then means considering whether environmental objectives are being achieved by way of existing permits and seeking their modification if necessary.

Representing the Regulatory Body at Meetings with the Public, Local Authorities and other Bodies:
In situations where others need to be consulted or informed about developments or incidents on sites under the inspector's control, this generally requires explanation of the regulatory role, of the events or developments of concern, of actions proposed by the regulatory body and of how others may make representations and how they will be dealt with.

Contributing to the Development and Continuous Improvement of Regulatory Policy and Operations:
In the light of experience of the above activities, this involves feedback of information to those responsible for developing legislation, regulations and regulatory policies and procedures, with a view to improvement if necessary. It also involves sharing of experience and accumulated knowledge with fellow inspectors and specialist staff.

3.2.3 Specialist competencies

These competencies cover areas of specialist knowledge or skills required by the regulatory body for effective discharge of its duties. The acquisition and maintenance of such competencies is generally such that inspectors skilled in these areas are likely to provide an internal specialist advisory or consultancy service to more generally qualified colleagues who have the broader compliance and enforcement role. The range of specialists required will depend upon the remit of the regulatory body but typical specialist competences include the following:

- Sampling and analysis of particular pollutants in the environment (e.g. dioxins).

- Characterisation and modelling of groundwater movement.
- Modelling of pollutant dispersion in the atmosphere and aquatic/marine environments.
- Risk assessment.
- Detection of causes of ecological damage.
- Knowledge of major industrial processes and associated abatement techniques. (i.e. Best Available Techniques (BAT)).
- Knowledge of contemporary continuous monitoring techniques and their application.
- Remediation of contaminated land.
- (Drafting and issue of complex permits).
- (Presenting cases for prosecution in court).
- Management of R&D.

3.3 Profile of New Recruits

It is most unlikely that new recruits to a regulatory body will comply fully with this profile. The essential requirement of new staff is that they demonstrate evidence of having at least the personal attributes and competencies and the potential to acquire, by practice or specific training, the further professional regulatory and technical competencies. Decisions by individual regulatory bodies on the level of experience and technical competence required of new recruits will depend to a large extent on the availability of appropriate training programmes, internal or external, or on the availability of fully trained staff to provide internal tuition, support and supervision.

3.4 Accreditation of Inspectors

Individual regulatory bodies will also have to decide, on the basis of their legal or constitutional situation, whether or not inspectors need to be formally accredited to carry out inspections. If accreditation is necessary, they will also have to decide what level of competence must be reached for this purpose, and by what means should it be tested and maintained.

4. INSPECTION POLICIES

Various important aspects of inspection policy need to be decided before planning any inspection programme or specifying techniques to be used. In this context, “inspection” refers primarily to the routine checking of compliance with laws, regulations, permits, etc. It is not concerned, in the first instance, with reactive or “ad hoc” inspections for the purpose of investigating accidents, incidents or complaints. The policies adopted for routine inspection by individual countries or regulatory bodies are generally influenced by factors such as national regulatory culture, relationships with operators and other interested stakeholders including the public, available resources and, possibly, by the existence of certified Environmental Management Systems (EMSs) and properly accredited certifying bodies. Policy aspects that need to be addressed include:

- Regulation of “process” or “outcome”, i.e. choice between deterrence and enabling role.
- Extent of direct supervision by inspectors of compliance with laws, permits, etc.
- Extent of dependence on operators’ own monitoring data. (So-called “self-monitoring”).
- Announced or un-announced inspections.
- System for quality assurance of inspection standards.
- Procedures for prevention of “issue-blindness, regulatory capture or simple corruption.

- Role of cost-recovery charging, if any, for inspection and environmental monitoring.

4.1 Regulation of “Process” or “Outcome”

This is an important choice which effectively defines the nature and tone of the inspector’s approach to regulation. Regulation of “process” is generally recognised as a “command and control” approach in which environmental and/or performance standards are defined in an operating permit. Checking for compliance with permit conditions is carried out on a routine basis and sanctions of various kinds are applied in cases of non-compliance. The general tone is one of traditional policing, and deterrence from violation of well-specified laws, permit conditions etc.

In the regulation of “outcome” approach, environmental objectives or targets are agreed with an operator who is then responsible for proposing management arrangements for achieving the agreed objectives or targets. Compliance checking in this case is a matter of ensuring that the management arrangements are in place and working satisfactorily, and that the appropriate objectives and targets are being met at the appropriate time. This is a goal-based system that requires a somewhat different approach from the traditional policing approach.

The choice of regulatory approach is largely a matter of national regulatory culture. The regulation of “outcome” has the advantage that the operator is involved in the setting and agreement of objectives and targets and can reasonably be expected to be committed to delivering them. This means that the regulatory activity can be concentrated on ensuring the ultimate of objective of protecting and improving the environment. It involves an element of trust that the operator will deliver, but with the disadvantage that breach of such trust would inevitably have to result in severe regulatory sanctions. The regulation of “process” has the advantage that compliance checking against conditions in a permit is a more straightforward and transparent approach, but it has the disadvantage that unless permits are carefully written the operator may be in full compliance without necessarily achieving the desired environmental outcome.

4.2 Extent of Direct Supervision by Inspectors

Three broad policies may be identified as follows:

- Frequent checking for compliance with laws, permits, etc. on a daily or weekly basis.
- Regular, but less frequent, checking for compliance, typically on a 3-6 monthly basis.
- Partial delegation of compliance checking to accredited certifying bodies in cases of installations where a certified EMS is in place.

<u>Frequent checking for compliance.</u>
This policy is appropriate in situations where there is serious doubt on the part of the regulatory body, or on the part of the concerned public, about the reliability or integrity of individual operators or, more usually, operators within a particular sector of industry. Until such time as operator practices or attitudes can be changed by education, persuasion or rigorous exercise of legal sanctions, it may be necessary to adopt a policy of frequent checking in order to provide the necessary assurance that all legal requirements are being met, that government objectives are being achieved and that the environment is being properly protected. This policy does, however, checking is carried out by less experienced staff, it may be appropriate depend to a large extent on the discretion of an experienced inspector and, where compliance for senior management to set minimum inspection frequencies.

This is a regime of almost constant supervision, in effect. It is very resource intensive and is generally regarded as a last resort. It is most likely that, if such a policy is necessary at all, it will only be for a limited period of time or only for limited sectors of industry. (In some countries, in the past, the waste disposal business has been such a sector, requiring the daily presence of an inspector to prevent improper disposals or disposal practices.)

Regular, but less frequent, checking for compliance.
This policy is appropriate in situations where there is a substantial measure of trust and respect between operator and regulator. The regulator must trust the operator to notify him or her in the event of incidents resulting in, or likely to result in, breach of any legal provision or condition, and to provide him or her with a full and frank account of events and environmental performance in the period between inspections. Equally, the operator must trust the inspector in a professional and proportionate manner, given that this policy may require an element of self-incrimination by the operator.

This regime is appropriate for sectors of industry that are generally committed to efficient operation, with sound management and supervision systems in place, together with proven concern for the environment and associated business reputation. It is relatively economical with regulatory resources but, because it depends on trust, there must be a clear regulatory commitment to severe punishment of any breach of trust such as concealment of information or falsification of data.

The confidence of the public in the effectiveness of regulatory control under this regime also needs careful attention. The regulatory body and operators must ensure that the public understands the nature of their relationship and is reassured, by ready access to relevant information for example, that there is no improper collusion and that the interests of all stakeholders are properly protected.

Delegation to an accredited EMS-certifying body.

This is a relatively new concept in the field of environmental regulation. It depends, firstly, upon an operator having in place ***an EMS certified to a defined standard such as ISO 14000,*** and upon the regulatory body having confidence that the operator is committed to protection of the environment and to compliance with the law. It also depends upon the regulator's confidence in the ability of the certifying body's auditors effectively to check and validate compliance with certain elements of a permit. In essence, this system entails agreeing the environmental policies and targets upon which an EMS is based, then relying on accredited auditors to validate certain elements that are common to the EMS and the permit while conserving regulatory resources for checking elements that are specific to the permit or that require an inspector's statutory powers.

This system requires a large measure of mutual trust by all parties and requires, in particular, that the public is sufficiently reassured as to the level of environmental protection provided by it. In this regard, it is similar to the "Regular but less frequent checking" approach.

The Environmental Protection Agency in Ireland has applied this approach to a small number of larger processes. After rigorous inspection to ensure that all systems are operating properly, and that audit arrangements are sound, it reduces its inspection frequency to once in about five years. The Brussels Inspectorate for Management of the Environment, in Belgium, applies a similar policy for smaller processes, and the Environment Agency in England has been testing the potential of the system. As yet, however, there is no substantial body of experience with this system, and there are still some doubts about its ability to provide the required measure of public reassurance.

4.3 Extent of Dependence on Operator's Own Monitoring Data

This is an aspect of policy that has implications for maintenance of public confidence in the regulatory system, and also has substantial implications for the staff and financial resources required by the regulatory body. Generally, the public and other interested parties will look to information about releases of pollutants from an industrial installation for reassurance about its effect on the environment. If this information has to be provided entirely by way of the regulatory body, or some independent contractor hired by the regulator, in order to maintain public confidence, the costs of the regulatory process will be high, regardless of the question of who has to pay for them. If these costs are to be avoided, or reduced, the regulator may choose to depend on monitoring data gathered by the operator in the course of plant operation, and as specified in a permit. This is sometimes described as "Self-monitoring", a term that may raise doubts in the public mind about validity of the information. In this case, some provision for ensuring the validity of the data must be made. This may be by way of a smaller, independent "check- monitoring" programme whose results may be compared with the operator's data. Alternatively, the operator's information may be gathered by way of instrumentation and systems that are subject to certification and independent validation. **This is discussed in more detail in Part D, under the heading of "Self-monitoring",** but it will be clear from this brief description that regulatory choices for this aspect of policy will have substantial implications for the planning and conduct of inspections and for the deployment of regulatory staff.

4.4 Announced or Un-announced Inspections

This is a policy choice that is normally influenced by the record of operator performance or behaviour. In situations where there are doubts about operator reliability or integrity, or any suggestion of concealment or falsification of information, the choice will almost certainly be for unannounced inspection. In other situations it is sometimes judged more effective to announce inspections some time in advance, so that an operator may be well prepared with relevant staff available and relevant records and data ready for presentation. In normal circumstances, however, and for consistency of policy, it would be normal to adopt a policy of unannounced inspections.

4.5 Quality Assurance of Inspection Standards

The senior management of any regulatory body will generally wish to be assured that the quality of inspections carried out by its staff is of a consistently satisfactory standard. Where individual site inspections are carried out by only one inspector, or by only a few inspectors, it is often difficult to gather the necessary information to provide this assurance, and the issue may need to be addressed as a matter of policy. Various options are available for dealing with this, including the occasional oversight of site inspection by an experienced senior manager. Another effective, and more formal system involves the creation of a small group of experienced inspectors to carry out occasional "team inspections" of individual sites and to report their findings to senior management. Such inspections may be incorporated into any specific inspection campaign that may be planned for other reasons. The choices for this aspect of policy will have implications for staff numbers, the deployment of staff and for the programming of routine inspections.

4.6 Prevention of "Issue-blindness", "Regulatory capture", etc.

Issue-blindness arises where an inspector has become so familiar with a particular site or installation and has become so accustomed to the operational arrangements that he or she no longer recognises some feature as a hazard to the environment. Regulatory capture is close to the issue of corruption and may arise where, for whatever reason, an inspector has formed an improper relationship with an operator, to the extent that his or her regulatory judgement is compromised and, again, there may be an unchecked hazard to the environment. Methods of dealing with these issues are likely to be tailored to individual situations and to be influenced by national regulatory culture. Common ways of dealing with both, however, include regular rotation of inspectors' duties or requiring that inspectors work in pairs and that pairings change from time to time. Hence, policy choices in this area have implications for programming of inspections and for inspection techniques. **This topic is discussed in more detail in Section C, under the heading of "Code of conduct for inspectors/inspection protocols".**

4.7 Role of Cost Recovery Charging

The "polluter pays principle" is sometimes implemented, as a matter of policy choice, by charging to operators the cost of regulatory activities, including site inspection and environmental monitoring. If this policy choice is made, and if specific financial allocation has been made for the relevant activities, then planning of inspection programmes, allocation of inspector time and design of monitoring programmes will all have to take this aspect into account. In some cases this may constrain choices for inspection frequency and the extent of independent monitoring, for example.

Furthermore, arrangements will be required for the recording of inspector time against specific activities and of costs of environmental monitoring.

5. INSPECTION PLANNING

Effective management of a regulatory body requires a systematic, overall plan for checking and promoting the compliance of industrial installations with relevant environmental laws, permits, etc. This is separate from the planning of individual inspections, which is described in Section 6 under the heading of "Inspection Techniques and On-Site Activities". This overall plan should cover all installations within the remit of the regulatory body and should cover a fixed period of time, with clear arrangements for its renewal or revision as necessary. The plan should reflect both long-term environmental goals and short-term objectives as well as the regulatory body's choice of inspection policies, and it should take account of the available staff and financial resources. In general, the plan should cover routine inspections, including inspections that are part of planned specific campaigns. It should also make some allowance for the inevitable reactive inspections required for the purpose of investigating accidents, incidents or complaints. The extent to which this plan is made publicly available will depend, to some extent, on the policy choice between announced and un-announced inspections and, if cost recovery charging is applied, on the extent to which details of cost-recoverable activities have to be published in advance, in a corporate plan for example.

Essential elements of planning and prioritisation of inspections include the following:

- Database of installations to be inspected.
- Number of inspectors available.
- Total effort available for inspections.
- Specific commitments.
- Frequency of inspections.
- Estimating resources for inspections.
- Reactive inspections.
- Prioritisation.
- Evaluation and Reporting.
- Revision of the Plan.

5.1 Database of Installations to Be Inspected

A definitive list of all the installations within the remit of the regulatory body needs to be prepared. When the list has been developed, an appropriate data management system should be employed to record, maintain and up-date relevant information about each installation. This information should be sufficient to allow the classification and grouping of installations for the purpose of calculating the total resources required and allocating duties to inspectors. An effective database is likely to include information on the following:

- Statutory or legal basis of the permitting and inspection system for an installation.
- Location of installation by region or area.
- Operator contact information and permit number.
- Details of the installation and process.
- Permit types, conditions and other relevant data including expiry dates.
- Inspection dates and details.
- Non-compliances, enforcement actions and complaints relating to the installation.
- Information supplied by installations, e.g. from operator self-monitoring.
- Environmental impact information (air, water and soil).
- EMS audit information, if relevant.
- Reporting of other data, for example consultant reports or relevant reports from other regulatory authorities.

5.2 Number of Inspectors Available

The balancing of staff resources and duties requires information on the total amount of inspector time available to the regulatory body. This requires a review of the number of qualified, in-house inspectors available. It might also include personnel from agencies, consultancies or certifying bodies, or otherwise available by way of secondment or short term contracts, for example. Some inspectorates have their complement of permanent staff fixed by the legislation that created the inspectorate itself, as in the Brussels Inspectorate for Management of the Environment, for example In such circumstances it is sometimes difficult to vary the numbers of permanent staff to match increased workloads. In Brussels, Ireland and in some regions of Germany, for example, it is common practice to employ contractors on short or medium term contracts. In the UK, the Environment Agency has also adopted the practice of employing staff seconded from technical consultant organizations to supplement the complement of inspection staff.

5.3 Time Available for Inspections

In addition to the total number of inspectors available, detailed calculation of effort available for inspection requires analysis of all the other duties of an inspector. This will vary from country to country and from regulatory body to regulatory body, depending upon organisational remit and managerial arrangements. The typical duties of an inspector, in addition to inspection, may include permitting, administration, advising other inspectors in any areas of personal expertise, advising on the development of legislation and supporting regulations, training, responding to general queries, presenting or attending seminars, research management, report writing, attending meetings on behalf of the organisation, and enforcement actions including prosecutions. Some allowance will also have to be made for unscheduled leave of absence or, conversely, for the working of extra hours. This will be a matter of management judgement based on past experience.

This analysis will allow estimation of the total in-house inspector time available for inspection. It may also afford the opportunity to evaluate the relative effectiveness of the duties carried out by inspectors and to determine the best use of inspectors' time. For example, time spent advising policy-makers or legislators on the practicalities of new environmental legislation or regulations may seem at first sight to be an unjustified diversion of inspectors from their proper role. However, analysis of the time spent on such activity, together with an evaluation of the benefits of having legislation which is practical and enforceable, is likely to show that time devoted to giving such advice is well spent for the longer-term effectiveness of the regulatory process and for protection of the environment.

5.4 Specific Commitments

International/Regional/National commitments:
A regulatory body may be committed by its national government to deliver certain actions in regard to protection of the environment beyond its own national boundaries, as well as within them. This may arise from environmental legislation, international or regional treaties or simply as a result of action agreed on the basis of reports on the state of the environment in a specific region, e.g. the Mediterranean Sea. Such actions may include a campaign of inspections in a particular location, or in a particular sector of industry that uses a particular type of equipment or releases particular substances. A commitment may be made to prioritising inspection of certain installations with the objective of effecting improved environmental performance by reduction of emissions through enhanced compliance with permit conditions, or by revision or issue of new permits. Planning of inspection programmes will generally be required to accommodate such commitments.

Regulatory body commitments:
For reasons based on review of reports on the state of the domestic environment, or on the performance of particular installations, a regulatory body may also commit to a specific campaign of inspections in a particular location or on a particular sector of industry, as described above. Again, to the extent that this is an organisational commitment, the planning of inspection programmes will be required to meet it.

Commitment to co-operation with other regulatory bodies:
Where responsibility for inspection is shared with other regulatory bodies, e.g. for Occupational Health and Safety, the inspection plan will have to take account of the requirements for coordination and interaction with the other bodies. In addition, details of the plan will need to be agreed with other such bodies in advance.

5.5 Frequency of Inspections

Before preparing an inspection plan, regulatory bodies should set baseline frequencies for each classification or group of installations, categorised by reference to the database of relevant information. It is most likely that such groups or categories will be based, in the first instance, on the nature of the processes involved. Baseline frequencies will have to take account of risks to the environment, of any relevant national regulations or guidelines, of any specific policy choices in regard to regulatory approach, and of the need to use available resources efficiently and effectively.

In order to establish the inspection frequency appropriate to individual installations, it is then necessary to develop an assessment and scoring system for adjusting the baseline frequency for each installation according to its specific circumstances and the level of risk it poses to the environment. Regulatory bodies will wish to select such a system according to their own national culture and regulatory policies, but suggested criteria for assessing the overall risk from an individual installation may include:

- the previous environmental performance of the operator;
- any previous prosecutions, orders or administrative fines;
- the technical knowledge and competence of the operator;
- the scale of pollution hazard represented by the installation;

- use by the operator of self-monitoring systems such as continuous measurement systems and/or remote control data-combined systems;
- presence of a certified EMS, such as ISO 14001;
- results of monitoring of the state of the environment (for example, water, air, soil quality);
- complexity of facilities;
- age and condition of plant;
- the local situation taking into account the sensitivity or vulnerability of environmental receptors, the distance to residential areas, hospitals, environmental protection areas, etc.;
- a change of operator, which may require checking of knowledge and reliability, and giving advice.

Whatever system is selected for assessing the relevant criteria and for adjusting baseline frequencies for individual installations, it will inevitably depend finally on the professional judgement of a knowledgeable inspector. This judgement should be made at the time of issuing a permit, and then reviewed at periodic intervals thereafter. An example of a well-developed system for assessing the risks associated with operator performance and pollution hazard is described at Annex 1.

5.6 Estimating Resources for Inspections

In order to calculate the total time required for a particular inspection programme and, hence, to plan the number and types of inspections possible with available staff resources, it is necessary to estimate the time taken to carry out each type of inspection. Different types of inspections require different amounts of time. This depends on the nature of activity to be undertaken, the number of inspectors involved, on practicalities such as the travelling distance to the individual installations and on the time required for related, follow-up actions.

The various types of inspections and site-related activities include:

- a subject specific inspection;
- an investigative inspection;
- a broad scope inspection;
- an environmental management audit ;
- checking of compliance data;
- a monitoring inspection (e.g. sampling, measurement or analysis);
- assessing self-monitoring data;
- assessing data prepared by a consultant or other bodies.

The related follow-up activities may range from report writing, through analysis or survey of supplementary information, to various types of enforcement action. It is essential that the time required for these important inspection-related activities be recognized in balancing the resource requirements of the inspection programme with the available resources.

5.7 Reactive Inspections

All regulatory bodies will have to carry out reactive inspections in response to accidents, polluting incidents or to complaints by members of the public. It is difficult to calculate the time required for such events for the purpose of programme planning, but it is possible to review past experience and to extrapolate into the future. Based on such an estimate, a proportion of time may then be set aside for foreseeable but unplanned events. The plan for inspections should take into account any procedures or guidelines prepared by the regulatory body for carrying out reactive inspections. If no such guidelines exist, it may be advisable to improve the estimate of time required for such inspection by categorising incidents according to their environmental significance and allocating an amount of time to the responses in each category. Experience is likely to show, for example, that the majority of reactive inspections are in response to complaints by members of the public and that such responses, individually, need less time than investigation of a major pollution incident.

5.8 Prioritisation

The information above will allow calculation of the amount of inspector time available to the regulatory body for conducting inspections and related activities, and will allow estimation of the staff and financial resources required for a fully effective inspection programme. In the likely event that there are insufficient resources available, of course, priorities will have to be assigned to the various activities and the planning process reiterated until resource requirements and available resources match. Such prioritisation will be a matter for the regulatory body and government, and will have to consider whether the final programme will deliver the necessary environmental objectives. If the process results in an inadequate level of inspection, the information and related calculations may be a valuable element of any submission for more staff or financial resources. Publication of such information may be required, in any case, if cost recovery charging is implemented and if related information has to be made available to operators and others. The process of prioritisation may also be assisted by reference to information on the risks associated with operator performance and pollution hazard of the kind described in Annex 1.

5.9 Revision of the Plan

Progress of inspections against the plan should be reviewed regularly. Where there are significant changes in circumstances, or in available resources, the plan should be reviewed and revised, if necessary, on the basis of agreed priorities. In any case, performance against the plan should be reviewed at the end of its allotted time period and a new plan created, having regard to the results of the review.

6. INSPECTION TECHNIQUES AND ON-SITE ACTIVITIES

The regulatory step of compliance control requires inspectors to conduct on-site inspections of individual installations, according to the overall plan described in the previous section. The precise nature of any particular inspection will be defined, in the first instance, by the regulatory approach adopted by the regulatory body, i.e. regulation of “process” or “outcome”, as described in Section 4 under “Inspection Policies”. It will also depend on whether it is to be routine or reactive and, if routine, which of the particular types of routine inspection, as described in Section 5.6, it is to be.

For any type of inspection, however, the generic techniques and activities may be described broadly as follows:

- Preparation for on-site inspection.
- On-site activities and procedures.
- Production of inspection report.
- Follow-up activities.

6.1 Preparation for On-site Inspection

Inspection planning concerns all activities related to the scheduling, organisation, timing, execution and follow-up of inspection work. The degree of preparation for an inspection depends on the type of inspection and the size, scale and complexity of the installation, but it is the key to success and therefore should be done carefully.

Review of Details of Installation:
The first step is to assemble and review all relevant details about the installation to be inspected. In general, all relevant information should be available in the files of the regulatory body. For inspectors new to a particular installation or process, consultation of any related technical guidance, standards or handbooks on the specific activities and/or production processes is also very useful.

The files are likely to include the following details:

- Location and name of operator;
- Installation permit, with reference to related legislation, and details of the application;
- Management organisation chart;
- Technical drawings and site lay-out drawing the plant;
- Process diagrams;
- New plants;
- Essential environmental facts, including information about permitted releases;
- Incidents which have taken place on-site;
- Earlier infringements or non-compliances;
- Aspects of the company's operations which have not been thoroughly investigated and approved during a previous inspection;
- Reports and letters, etc. from previous inspections;
- Notices sent to the installation;
- Complaints by members of the public;
- Research reports or environmental reports.

The inspector should confirm that all details are up to date and, on the basis of this information, should determine the most important environmental issues relating to the installation and the type of inspection to be carried out. He or she can then determine the way in which the inspection is to be carried out and what its focus will be. For inspectors new to a particular installation, discussion with previous inspectors or senior managers will also be useful in preparation for a first on-site inspection.

Development of an inspection plan:
The development of a clear inspection plan, before going on-site, is essential for the conduct of an effective inspection. It provides the inspector with a step-by-step guide to compiling relevant evidence about the procedures and practices that are to be included in the scope of inspection of the installation, and it serves as a record of the reasons for the inspection.

The detail and complexity of the inspection plan may vary according to of the type inspection and the nature of the installation but it should at least:

- State the reason for inspection: a brief history of why the inspection is taking place and the inspection objectives (i.e., what is to be accomplished).
- Record the scope of the inspection: identifies the functional areas, assessment topics, and level of inspection.
- Specify inspection procedures and associated rationale: which field and analytical techniques will be used to collect what information; what record-keeping systems will be reviewed; which personnel will be interviewed; which samples will be collected.
- Permit clear definition of task assignments, objectives and time scheduling.
- Detail resource requirements (costs) based upon planned activities and time allocations.
- Provide clear specification of evidence to be collected and documented.
- If the inspection plan includes a Quality Assurance Project Plan (e.g. if the inspectorate is certified according to an ISO management standard), it should include a set of well-

defined targets for objectives to be met and the method for showing that these objectives have been met.
- Identify a personal safety plan, where required. This is particularly relevant in case inspection takes place upon the occurrence of an accident.

The following checklist summarises the main elements of a good Inspection Plan.

Objectives:
- What is the purpose of the inspection?
- What is to be accomplished?

Tasks:
- What records, files, permits, regulations will be checked?
- What co-ordination with laboratories, other State or local authorities is required?
- What information must be collected?
- What samples will be taken and/or tests will be conducted?

Procedures:
- Announced or unannounced inspection?
- What specific facility processes will be inspected?
- What procedure will be used?
- Will the inspection require special procedures?
- Has a Quality Assurance Plan been developed and understood?
- What equipment will be required?
- What are responsibilities of each member of the team? (If more than one inspector involved).
- How will the reporting be organised?

Resources:
- Which colleagues, if any, will be required?
- Which of the operator's staff will be required?
- What equipment will be required?
- Has a safety plan been developed and understood?

Schedule:
- What will be the time requirements and order of inspection activities?
- What will be milestones? What is essential/what is optional?
- What follow-up is likely to be required?

Inspection tools:
The inspection plan is only one of the tools for on-site inspection. Other tools may need to prepared or acquired. They may be specific to the type of inspection planned or to the particular installation to be inspected but typical requirements are as follows:

- Warrant or identity card;
- Copies of relevant extracts from legislation, regulations, standards, guidance, etc;
- Relevant parts of the installation file,
  - The permit and details of the application;
  - Technical drawings of the premises and the plant;
  - Process diagrams;
  - Reports and letters, etc. from previous inspections;
  - Notices sent to the installation;
- Writing material/laptop computer;
- Equipment for sampling and/or analysing liquid discharges, waste, soil, air-emissions, noise-emissions etc.;

- Mobile phone where appropriate (permission may be required to bring on the site);
- Photo/video camera (permission may be required to bring on the site);
- Personal protection equipment:
    - Safety glasses;
    - Safety shoes/boots;
    - Special clothing;
    - Safety gloves;
    - Safety helmet;
    - Overalls;
    - Ear protection;
    - Face protection.

Administrative arrangements:
Before preparation for an on-site inspection is complete, a decision is required as to whether the inspection is to be announced to the site operator or not. Announced and unannounced inspections both have advantages. Announcement will allow operator and inspector the opportunity to discuss the scope of the inspection so that the operator may have the appropriate staff available and the necessary documentation ready for presentation. The advantage of an unannounced inspection is that the installation is likely to be seen in its normal operating condition. If an announced inspection is chosen, preparation will include making the necessary arrangements with the operator and his staff.

Also, where other inspectors, or the staff of other regulatory bodies, e.g. Occupational Health and Safety regulators or Local Authorities, need to be involved in the inspection or in related activities, preparation needs to include the necessary administrative arrangements.

6.2 On-site Activities and Procedures

On-site inspection is the primary face-to face interaction between a regulatory body and an operator. The credibility and respect in which the operator holds the regulatory body depend to a large extent, therefore, on the behaviour, appearance and professionalism of the inspector. (Refer to Section 3.1 “Personal Attributes and Competencies.”) In this regard, first impressions are important. If the inspection has been announced and appointments made, it is good practice to arrive a few minutes ahead of schedule and wait patiently at reception. This is not time wasted. Much can be learned about an organisation by standing in reception and looking, listening and, in some cases, smelling. In the case of an un-announced routine or reactive inspection, which may cause some inconvenience, the inspector must be firm but above all polite and reasonable.

An inspection will generally comprise the following basic stages:
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- Arrival and opening meeting.
- The examination of the installation, or other aspects related to the nature of the inspection.
- Preliminary evaluation of findings.
- A closing meeting.

Arrival and opening meeting:
On arrival at the installation the inspector should register his presence on-site according to normal site procedures. He or she should be aware of the operator’s on-site safety arrangements and should comply with them. The instrument of the inspector’s authority, i.e. warrant or identity card, should always be carried and produced when identification is required.

Upon meeting the operator's representative on-site, the inspector should allow about 15-30 minutes for an explanation of the purpose, scope and expected duration of the inspection. A typical agenda, or checklist, for an opening meeting is as follows:

- Introductions of personnel involved.
- Objectives and scope of inspection, together with any brief, explanatory review of past history.
- Plan and schedule for inspection.
- Any limitations, constraints or exceptions.
- Administrative arrangements.
- Arrangements for covering matters that involve confidentiality.
- Arrangements for closing meeting.
- Questions.

The inspector should record the names and positions of participants in this meeting for his or her inspection report.

<u>Examination of the installation, or other aspects etc.:</u>
Having regard to the objectives of the inspection and to the details of his or her inspection plan, the inspector should then proceed directly with checking for compliance with the terms of the installation permit and with any agreements made, or, in the case of a reactive inspection, with appropriate investigation. If, for any reason, it becomes obvious that the inspection cannot be carried out according to the prepared plan, the inspector should modify the immediate objectives without, if practicable, losing sight of the overall objectives and priorities.

Generally, the inspector will have powers to inspect any aspect of the installation. Although not exhaustive, the following list illustrates the likely, main areas of inspection:

- The operating plant;
- Abatement systems and the associated control and alarm systems;
- Control room;
- Alarm testing log books;
- Drain systems;
- Sample points and sampling equipment, both liquid and gaseous;
- Storage areas;
- Analytical laboratory; testing and calibration procedures;
- Compliance monitoring results log books;
- Abnormal incident reporting log book;
- Public complaints log book;
- Process operation procedures.

In checking compliance with the terms of the permit, the inspector first must check that no new plant or equipment has been installed without having been registered in the permit. He or she then needs to check whether the plant is operating according to the conditions in the permit. Typically, the inspector will address the following questions:

- Are the plant and its pollution control equipment still as described in the permit, or in the related application?
- Is it well maintained and fully operational (see logbooks etc.)?
- Do the staff follow all operating instructions referred to in the permit?
- Are the logbooks and administrative records (required by the permit) complete and up to date, without any alteration that is not transparent and signed?
- Have the required periodic tests been carried out, and what were the results?

In addition, he or she may take samples, e.g. of liquid discharges, waste materials or soil. Measurements of gaseous emissions, or of noise level, may also be made. In some cases inspectors may be qualified and empowered to take all the samples and make relevant measurements for compliance checking purposes. In most cases, however, the results of the analyses of samples taken by the inspector, and his or her measurements, will be considered only indicative, as sampling, analysis and measurement, for compliance checking purposes, will normally involve certified systems, procedures and personnel.

If there is a requirement for self-monitoring in the permit, this must be examined to evaluate operation of the relevant systems. This should address the following questions:

- Does the self-monitoring system cover all important emission aspects?
- Is the self-monitoring system sufficient and reliable?
- Does the system ensure that the self-monitoring procedures prescribed in the permit are followed?
- Are the results from the operator self-monitoring adequately reported to the authority?
- Are the results of the self-monitoring in accordance with the terms stipulated in the licence?
- Do the self-monitoring reports from the installation give a clear picture of level of compliance?

Where an installation has a certified EMS, and it is clear that the operator takes his environmental responsibilities seriously, consideration of an alternative the approach to on-site inspection may be possible. In most countries the presence of an EMS still has little influence on the approach to compliance checking. In some others however, the compliance checking arrangements are somewhat different. Although the operator of such an installation is still obliged to comply with the environmental law, regulations and a permit, the regulatory approach may be different. Such differences may include the following:

- Essential environmental objectives and targets are set in the permit and become the key issues for inspection;
- The management arrangements for their delivery are covered by the management system of the EMS;
- Assessment of environmental performance (emissions, measures, etc.) may be carried out on the basis of audits, which may be conducted on behalf of the regulatory body by accredited auditors;
- Even with a properly certified EMS, site inspections by the authorities will remain necessary, but may need to be done less frequently. (Refer to Annex 1, “Operator and Pollution Risk Appraisal).

Even if such inspections are conducted at a more administrative level, however, non-compliance with the permit, in whatever form, will still entail the full regulatory response with exercise of all appropriate sanctions and a likely reversion to the traditional regulatory approach.

<u>Preliminary evaluation of findings:</u>
After physical examination of plant, equipment, records, etc, or after particular parts of the examination, the inspector should take some time to make and record a preliminary evaluation of his or her findings, and to resolve any points of doubt. Where it appears, on preliminary evaluation, that there is some non-compliance, it should be drawn to the attention of the operator's representative and recorded in the Inspector’s Note Book for further consideration. Details of any non-compliance recorded should include the date, time, names of those present and any comments made. The Inspector’s Note Book is a record that should be acceptable as a reference document in a court of law. Hence all entries should be made in permanent ink and where entries are deleted or corrections made, the previous entry should be struck through by a single line to ensure that the original entry is still legible. Re-

instatements of deletions should be made by inserting the word "stet" adjacent to the deletion.

Where the Inspector is of the opinion that there is a significant risk of release of any substance likely to have serious consequences for the environment, he or she should consider the courses of action open to him or her under the law, and within his or her powers. If the law and the inspector's powers allow for ordering of shut-down of the installation, and if it is the appropriate course of action, this is the time to prepare the instruction or order, which will need to describe the fault or likely failure, the associated hazards and the actions that need to be taken by the operator. In the absence of such powers, he or she will have to take such action as is appropriate under the law.

Closing meeting:
The closing meeting is the formal completion of an on-site visit and is an important of the inspection process. Its purpose is to maintain constructive dialogue with the operator and his staff by giving them immediate feedback on the results of the inspection. It is also to ensure that that they are aware of and fully understand the initial findings, their implications and the likely follow-up action. A typical agenda, or checklist, for such a meeting is as follows.

- Introduction of personnel, if different form opening meeting.
- Thanks for co-operation, administrative arrangements, etc.
- Résumé of objectives for inspection, with any modifications that might have been made during its conduct.
- Summary of general findings.
- Indication of preliminary evaluation of any non-compliance found.
- Indication of any corrective actions required, and of any other follow-up activity, that will be formally notified by letter in due course. (In the case of a significant risk being found, and depending on the law and inspector's powers, this will be the time to issue any formal instruction or order).
- Questions.

Details of this meeting should also be recorded by the inspector for future reference.

Additional note on reactive inspection:
Where a reactive inspection is made because of some incident, accident or abnormality on the installation, the extent and character of the incident should be determined as quickly as possible. In the case of serious or extended incidents, involvement of and co-ordination with fire brigades, emergency services etc. should take place. In the case of a public emergency the inspector should be aware that issues of safety and the work of the emergency services might take precedence over his or her environmental concerns and issues.

In case of more limited or local incidents, the following procedure may be followed:

- Ask for the responsible site representative. In most cases this person is known from previous visits or from previous correspondence with the company;

- Explain the purpose of the inspection;

- The inspector should question the site representative and other site operators/staff as necessary to establish the exact details of on site-operations and potential problems that have resulted in the incident. Also, the installation fire brigade and/or Environment, Health and Safety department may be involved;

- If the incident is more serious, the inspector should be accompanied by a colleague in order that corroborated legal evidence may be collected if necessary, and any staff being questioned should be given the caution that any information given may be used in evidence in court;

- All relevant areas of the installation and the neighbouring area should be inspected unless the incident has resulted in conditions which are unsafe; the inspector must follow the site safety requirements;

- The site representative should be given the opportunity to accompany the inspector on the inspection (in some large sites the inspector should not enter the site unless accompanied by a site representative);

- Where appropriate, samples of discharges etc. should be taken and, if necessary, should be taken in accordance with the legal procedures (which differ from country to country) for use as evidence;

- The inspector should write down all statements made by the site staff and if appropriate take photographs or video recordings as information or as evidence;

- Where appropriate, information and advice should be given to the site operator regarding action that may stop an ongoing incident, prevent a recurrence, or remedy damage caused. In some circumstances, depending on his or her legal powers, the inspector may strongly recommend or insist that certain action is taken to stop an incident and/or prevent further pollution;

- Before leaving the site the inspector should ensure that the site representative is aware of any further action that is required by the operator, and that the inspector's course of further action is clear.

Effective follow-up of such a visit is important in order to assess the operator's response to any instructions or guidance from the inspector.

Additional note on Personal Incidents:
Personal incidents or accidents involving the inspector in the course of on-site inspection, no matter how trivial, should be recorded in the installation accident record book, or equivalent log, before leaving the site and should also be reported to the inspector's own management.

Summary of general guidance for on-site inspections:

- Be well prepared.
- Be on time.
- Ensure operator understands purpose of inspection.
- Do not argue with operator's staff.
- Use the inspection plan.
- Discuss problems when they are found.
- If information is not available from one part of the installation, seek it elsewhere.
- If faced with non-cooperation from any person, try another.
- Always seek evidence to verify any verbal statements.
- Follow investigations to ultimate conclusion.
- Return to areas or staff for more information, clarification or confirmation if necessary.
- Ensure operator understands findings and seek agreement to them as appropriate.

6.3 Production of Inspection Report

The results of an on-site inspection must be recorded in a formal, written report. Proper documentation of an inspection is essential for the purpose of providing a factual record, including information about measurements made and samples and other data collected during the inspection. It may also become evidence in the case of any legal actions or sanctions arising from the inspection.

The basic requirement of an inspection report is that it organises and presents all evidence gathered in an inspection in a comprehensive, useable manner. It is not the place for analysis and conclusions about non-compliance or other operator failures. To meet this objective, information in it must be:

- Accurate. All information must be factual and based on sound inspection practices and procedures for the taking of evidence. Any subsequent enforcement action must be able to depend on the accuracy of all information.
- Relevant. Information in an inspection report should be pertinent to the subject of the report.
- Comprehensive. The subject of the report should be substantiated by as much relevant information as is feasible. The more comprehensive the evidence, the better and easier it is for any subsequent enforcement action.
- Objective. Information should be objective and factual.
- Clear. The information in the report should be presented in a clear, well-organised manner.
- Co-ordinated. All information pertinent to the subject should be organised into a complete package. Documentary support (photographs, statements, sample documentation, etc.) accompanying the report should be clearly referenced so that so that anyone reading the report will get a complete, clear overview of the subject.

The actual contents of any inspection report will depend on the nature of the inspection but the following outline for an inspection report may be adapted to most situations.

Introduction

- General information
  - Purpose of the inspection
  - Facts of the inspection (i.e. date, time, location, name of the site representative)
  - Participants in the inspection

- Summary of Findings
  - Brief summary of the inspection findings
  - Names and titles of staff interviewed

- History of Facility
  - Status of the facility
  - Size of the organisation
  - Related firms, subsidiaries, branches, etc.
  - Type of operations performed at the facility under inspection

Inspection Activities

- Opening Meeting
  - Procedures used at arrival, including presentation of credentials and written Notice of Inspection (the latter only if required)
  - Special problems or observations if there was reluctance on the part of site officials to give consent, or if consent was withdrawn or denied

Topics discussed during the opening meeting; what is the inspector's objective?

- Records
  Types of records reviewed
  Any inadequacies in record-keeping procedures, or if any required information was unavailable or incomplete
  Note if record-keeping requirements were being met

- Evidence Collection
  Statements taken during the inspection
  Photographs taken during the inspection
  Drawings, maps, charts, or other documents made or taken during the inspection

- Physical Samples
  Purpose for which samples were obtained
  Exact location from which they were obtained
  Sampling techniques used
  Physical aspects of the sample
  Custody procedures used in sample handling
  Results of laboratory analysis (if available).

- Closing Meeting
  Receipts for samples and documents given to facility officials
  Procedures taken to confirm claims of confidentiality
  Recommendations made to facility officials

Attachments

- List of Attachments
  List of all documents, analytical results, photographs, and other supporting information attached to the report

- Documents
  Copies of all documents and other evidence collected during the inspection. All documents should be clearly identified

- Analytical Results
  Sample data and quality assurance data

6.4 Follow-up Activities

Distribution of report:

When the factual inspection report has been completed, the inspector will need to distribute it to appropriate individuals and bodies. This will vary from country to country depending upon the remit of the regulatory body, upon statutory arrangements for enforcement and non-compliance response **(Refer to Part C, "Non-Compliance Response Strategy")**, and upon the policy for making such information available to the public and others.

Review of results:

He or she will then need to review the recorded information, examine it for evidence of non-compliance and communicate the conclusions to the operator and/or enforcement authority as appropriate. At this point it may be necessary to arrange for further sampling or analysis to be carried out, or for some further investigation in order to verify details and draw definitive conclusions.

<u>Enforcement action:</u>
When conclusions have been drawn, and confirmed according to any regulatory body quality management system, items requiring action by the operator, or significant issues resulting from the inspection, such as the need to modify a permit, should be communicated to the operator in writing, or notified to the appropriate enforcement authority or permitting body if that is not the regulatory body itself.

Where non-compliance has been identified and confirmed, the inspector will have to follow procedures defined under relevant policies for non-compliance response **<u>(Refer to Part C, "Non-Compliance Response Strategy")</u>** and may have to prepare for supporting any prosecution with evidence from his or her inspection.

<u>Follow-up checking:</u>
Where an operator has been required to carry out specific actions, such as remediation actions or changes to plant or procedures, the inspector should set a time for carrying out a check to confirm that the actions have been satisfactorily completed.

<u>Follow-up administration:</u>
When all details have been verified and actions completed, or satisfactorily under way, the inspector should bring the installation file up to date by recording all the relevant information. Where arrangements are in place for publication of environmental data, e.g. in a Pollution Emissions Register or State of the Environment Report, he or she should also ensure that the necessary information is delivered to those responsible for compilation of such documentation.

Finally, the inspector should review his or experience of the on-site inspection and related activities to see if there are lessons to be learnt for the future and, if so, feed them back to his or her management.

7. TRAINING OF INSPECTORS

The profile of an effective inspector has been described in Section3, where it was also emphasised that the authority and credibility of the regulatory body depends, in effect, on the development and maintenance of this profile. For this purpose, a regulatory body needs to have a structured process for training and development of its staff that will be robust enough to reassure all stakeholders, including the public, that its staff are competent for all of their duties and that a system is in place for assessing their competence and keeping it up to date. In this context, it is important to recognise that the process must deliver the two functions of training new inspectors and also of refreshing and developing the skills of established inspectors. This section outlines such a process and discusses its main elements.

7.1 Outline of Training and Development Process

The process has five key elements as follows.

- <u>Definition of competencies:</u> Description of inspector capabilities and activities that need to be of a satisfactory standard for effective conduct of his or her assigned duties.
- <u>Personal development plans:</u> Statement of what an individual inspector needs to learn or become proficient in, together with a plan and programme for achieving it. This is based on assessment of current status of competencies and on management plans for his or her deployment. These should be prepared for all new inspectors and kept under review as part of a regular process of staff appraisal.
- <u>Training:</u> Formal learning opportunities, such as structured courses, probably away from his or her job.

- Planned experience. Learning on the job by doing it, with coaching and support from a manager or experienced colleague.
- Assessment: Evaluation of competencies to check that required learning has taken place and has been effective. This should also be carried out routinely, as part of the regular appraisal of staff performance, and the results fed back into personal development plans.
- Management of training programme. Formal arrangements by which the regulatory body ensures that all elements of process are properly conducted.

7.2 Definition of Competencies

The competencies of a fully effective inspector have been described in Section 3, in the context of “Inspector Profile”. This covered:

- Personal competencies required of any inspector (many of these are inherent in the character of individuals best suited to be inspectors).
- Role-related, technical competencies.

The technical competencies were those associated with the duties of “compliance control and enforcement” in a typical environmental regulatory body. They were sub-divided into:

Core competencies that all inspectors in such a body should have.

- Clusters of competences that relate to the duties of a typical, generalist site inspector engaged in compliance control and enforcement.
- Specialist competences likely to be confined to inspectors in defined specialist roles supporting the tasks of compliance control and enforcement.

These competencies were described in broad terms in Section 3.2, recognising that precise details depend on the remit of the regulatory body and on the regulatory approach adopted. In the context of regulatory approach, the required range of competencies will be influenced, at the level of detail, by the policy choice between a traditional policing (“process”) approach and a more goal-based or educative (“outcome”) approach. In the case of the latter, goal-based approach, inspectors are likely to have to be more knowledgeable about the effect of releases into the environment, about setting environmental objectives and targets, and about environmental management systems. In the traditional approach, the emphasis is more likely to be on knowledge of particular processes, plant operation and process control, treatment and management of waste, etc. In either case, however, training programmes for the staff of environmental regulatory bodies with a typical range of responsibilities are likely to have to include the following subjects. These are set out below on a sector basis although, in practice, they may be applied in an integrated or cross-sectoral basis.

Air Quality

- Air quality management strategy development and implementation.
- Securing of any statutory ambient air quality standards.
- Establishing conditions and limits for permitting of discharges to atmosphere.
- Ambient air quality monitoring and assessment.
- Preparing plans for dealing with exceedance of air quality limit values.
- Establishing a system for public notification when alert thresholds are exceeded.
- Compilation of national inventory of emissions to atmosphere.
- Implementing phase-out of ozone depleting substances.

- Maintaining inventory of greenhouse gas emissions and preparing national programme for limiting emissions under UN Framework Convention on Climate Change.

Water Quality

- Developing methodology for establishing water quality objectives.
- Establishing programmes for water quality protection and risk management.
- Establishing programmes for reduction of emissions to aquatic environment.
- Establishing and enforcing technical standards and codes of practice in relation to the achievement of water quality objectives (surface waters, groundwaters, bating waters).
- Reducing marine pollution and mitigating its effects.
- Deciding and establishing emission limit values.
- Establishing conditions for permitting of discharges to sewerage systems and to the marine environment. .
- Maintenance of a discharge register.
- Notifying wastewater treatment plant about potential pollution incidents.
- Enforcing measures for emission control of priority substances.

Waste Management

- Assessing and verifying qualifications and suitability of permit applicants and holders.
- Preparation of technical standards and codes of practice for waste management.
- Establishing conditions for permitting of waste management activities and establishments.
- Establishing producer responsibility and compliance schemes for recovery and recycling/treatment of certain waste categories.
- Controlling transboundary movements of waste.

Pollution Control and Risk Management on Major Industrial Installations

- Current awareness of best available techniques for major processes.
- Identifying establishments with increased risk of major accident hazard.
- Reviewing emergency plans.
- Implementing a system of inspection relating to major accident hazards.
- Arrangements for response to major accidents.

Nature Protection

- Establishing policies and guidelines.
- Designating sites and species for enhanced protection.
- Establishing species protection measures and plans.
- Implementation of plans and policies.
- Issuing licenses and permits for import and export of listed species of plants and animals.
- Control of development on, or affecting, protected sites.
- Establishing management practices for protecting sites and species.
- Data collection and reporting.

Cross-sectoral matters

- Permitting and inspection of installations or sites.
- Monitoring, sampling and analysis.

- Negotiating self-monitoring arrangements for installations.
- Initiating and pursuing enforcement actions in cases of non-compliance.
- Licensing, inspection, monitoring, data collection and reporting on activities involving Genetically Modified Organisms.
- Providing for public access to environmental information.
- Evaluation of Environmental Impact Assessments.
- Principles and auditing of Environmental Management Systems.

7.3 Planned Experience and Training

Implementation of the training process first requires identification of the most appropriate method of developing the competencies described above, and those described in Section 3. Planned experience, i.e. training on the job, will be appropriate for some, and structured education courses or seminars for others.

Planned experience means that inspectors and their managers have to look for opportunities for the inspectors to work on issues that have been identified in Personal Development Plans. Also, managers have to be able, and have to have the time, to coach staff to a satisfactory level. Otherwise, they have to be prepared to devote the time of experienced colleagues to do it. Learning on the job is a generally a progressive process involving, first all, an element of demonstration, or “showing how to do it in practice”, followed by an indeterminate period during which mentoring or advising is adequate. The selection of competencies for development in this way, and the progression of the coaching and mentoring process, are essentially matters of judgement by the relevant manager or “competence assessor” having regard to the abilities of the particular candidate for training and to any other relevant circumstances such as the number of staff under similar training at the same time.

Training by way of courses or seminars is likely to include foundation or induction training for groups of new inspectors. The contents of such training will include practical information about the regulatory body and its administrative, financial and management systems together with appropriate elements of the core technical competencies described in Section 3.2.1 such as relevant environmental law, pollution control and regulatory principles, and legal procedures.

Other courses or seminars will need to address specific issues for the purpose of professional development. These may be relevant for both new inspectors and established inspectors. In the first instance, new inspectors will need to attend courses and seminars in order to complete development of their core technical competencies and to build the cluster of technical competencies relevant to their assigned duties. Established inspectors may need to develop a new cluster of technical competencies upon change of assignment or may need to refresh existing skills. Therefore, the design of training programmes needs to differentiate between:

- Basic technical training for new inspectors in general.
- More advanced technical training for inspectors likely to be engaged on complex duties, such as inspection of major industrial processes.
- Specialised training for specialist inspectors.
- On-going professional development of established staff, and refreshment of existing skills and knowledge.

Such courses and seminars can be delivered in various ways. They may be organized and taught internally by staff of the regulatory body or by invited lecturers. In the case of a regionalised regulatory body this may be done at a local level or at a central, national level. They may also be organized and taught externally by way of colleges, learned institutions, or industrial companies or associations. In the case of external sources, there may also be the opportunity of “Distance Learning” by way of computer-based packages. A variation of the learning process, which lies between planned experience and external courses, is secondment to another regulatory body or to an industrial company for experience.

The detailed design of an overall training and development programme is, therefore, largely a matter of choice by individual regulatory bodies and is likely to depend heavily on the size of the body, the rate of recruitment of new staff, the availability of in-house mentors and lecturers, and upon the financial resources available for buying external training.

7.4 Assessment

Training and development is an on-going, cyclic process, and the step of assessment applies at the beginning and end of the cycle. It is the procedure used first of all to evaluate the existing competencies of an inspector, to identify any outstanding requirements and then, subsequently, to confirm that training has been successful in bringing him or her to the necessary standard.

Ideally, the procedure should be carried out by the inspector’s manager, provided he or she has sufficient personal competencies to make a credible judgement of what an inspector requires for satisfactory conduct of his or her assigned duties. If this is not practicable for any reason, the manager may wish to delegate the task to another senior colleague. Assessment of new inspectors should be carried out upon recruitment and should be the basis of a first personal development plan. It should be carried out regularly, thereafter, as part of the routine appraisal of staff performance and updating of personal development plans.

This procedure is important for effective performance of any regulatory body, but it assumes a special significance if inspectors are warranted or accredited for their duties on the basis of having achieved defined standards of competence. Any regulatory body operating on this basis must have a policy for dealing with the possibility that an established inspector may fall below the required standard and be unable or unwilling, for whatever reason, to refresh his or her skills and to re-acquire the necessary level. Such a policy will also have to address the possibility of appeal against the results of assessment.

The allocation of time for training depends upon the relevant knowledge and experience of inspectors and upon the complexity of the processes they regulate. It also depends on the technical development of processes and upon changes to the regulations. Against this background, and in addition to general induction training and learning on the job, a well resourced inspectorate might allow 6-7 weeks over a two year period for the technical training of a beginner engaged on inspection of basic processes with a further 2-3 weeks for those engaged on more specialist or complex processes. For experienced inspectors, whose requirement is for training on new developments in technology and legislation, an allocation of 5-10 days per year may suffice, depending upon the extent of relevant developments.

7.5 Management of Training Programmes

Depending upon the size and complexity of the regulatory body, management may wish to make special arrangements for supervision of the training and development programme. Appointment of a competent supervisor is likely to ensure that assessments are undertaken when due, that appropriate courses or “on the job” training is organised, that personal development plans and records of training are kept up to date and, particularly where accreditation depends on the acquisition and maintenance of competencies, that management is informed of any difficulties arising from the assessment process.

ANNEX 1

OPERATOR AND POLLUTION RISK APPRAISAL (OPRA)
Guidance on Implementation

1. System Overview

OPRA consists of two separate appraisal packages: Operator Performance Appraisal (OPA) and Pollution Hazard Appraisal (PHA). The two packages have identical structures and scoring systems. Both OPA and PHA contain seven attributes that are considered to represent the main issues affecting operator performance and pollution risk.

Each attribute is evaluated and given a score of 1, 2, 3, 4 or 5. Each attribute has an associated weighting factor that represents the relative importance of each attribute. The OPA and PHA scores are derived for the *process as a whole,* irrespective of the size and complexity of the process. However, processes may be considered as several smaller 'sub-processes' in order to assist the derivation of overall process scores. This may be appropriate for large or complex processes. The approach to deriving an overall process score from sub-processes is different for OPA and PHA, as discussed in the following sections.

Guidance on selecting a score for each attribute is provided in this annex. Application of the guidance by trained inspectors will ensure maximum consistency and transparency of the approach. Specific guidance on what might constitute a score of 1, 3 or 5 is provided; scores of 2and 4 are for intermediate cases. Where no information is available on scoring of a particular attribute, a default value should be selected. Default values will be derived as experience is built up with the system. In the absence of specific defaults, a general default score of 3 should be selected and a comment placed on the form to indicate this. In scoring any given attribute it is important to remember that overall OPRA scores will be used for work planning on a national level that is across all installations. Therefore the scale of 1 to 5 is not specific to any particular process, geographical area or industry sector. The full range of scores from 1 to 5 should be encountered.

OPERATOR PERFORMANCE APPRAISAL

OPA evaluates operator performance against seven key attributes:

- OPA1:- recording and use of information;
- OPA2:- knowledge and implementation of permit requirements;
- OPA3:- plant maintenance;
- OPA4:- management and training;
- OPA5:- process operation;
- OPA6:- incidents, complaints and Non-compliance events;
- OPA7:- recognised environmental management systems.

The purpose of OPA is to evaluate operator performance in relation to managing risks to the environment from the process; this requires consideration of the systems and procedures in place, but also whether they are effective in achieving the operator's stated objectives in relation to environmental performance. Performance in terms of productivity, health and safety, etc. is not relevant to the OPA score. For each of the attributes the OPA score should reflect both the presence of the relevant systems and their actual effectiveness. For each OPA attribute the inspector should ask:

- Do the appropriate systems exist?
- Are the systems used as intended?
- Are the systems effective in achieving stated objectives?
- Is there appropriate monitoring/feed back on system performance?
- Can evidence be provided to demonstrate all of the above?

It is important to avoid 'double-counting' specific issues relating to the operator's performance which may affect more than one attribute score. Each attribute must therefore in all cases be scored separately. Where an issue may affect several attributes the inspector should determine which attribute is most affected and derive the score for that attribute to reflect the overall effects. Where it can be argued that more than one attribute should be affected, this must be stated and justified.

Each attribute is evaluated on a scale of 1 to 5, where 1 represents low performance and 5 represents high performance. For those attributes which relate to compliance with permit conditions, the relationship between the OPA score and compliance is broadly:

1 below requirements and may need enforcement action;
3 fully meets requirements of permit;
5 above requirements in terms of actual environmental performance.

The use of 'requirements' in this context refers to the average requirements normally expected for the process type in general, rather than the specific requirements included in the permit for the process in question. It is emphasised that OPA measures overall performance in managing environmental risks, within which compliance is only one factor. OPA does not assess the acceptability of the operator's performance, and a low overall OPA score may be entirely adequate for a process with a low PHA.

For large processes with variable management conditions over different sections of the process, it may be deemed necessary to consider several 'sub process' sections in order to derive an OPA attribute score for the process as a whole. A score is produced for each sub-process and an overall score for the process generated by aggregating the sub-process scores. In general the approach to aggregation is to weight each sub-process score by the relative importance of that sub-process to the overall process environmental risk. Where there is doubt the lowest sub-process score should be taken as the overall process score. The inspector must exercise judgement in this area.

A similar approach may be taken where an attribute score is the product of a number of factors. These factors may be considered as 'sub-attributes' which can be scored separately and then combined to obtain the overall attribute score.

POLLUTION HAZARD APPRAISAL

Pollution Hazard Appraisal (PHA) evaluates the overall environmental pollution risk inherent in a process. A PHA is performed by evaluating the following seven attributes on a scale of 1 to 5 (1 low hazard potential, 5 high hazard potential). The attributes and their basic meaning are as follows:

Code	Title	Basic Meaning
PHA 1	Presence of hazardous substances.	Inherent environmental hazard posed by the properties of the representative hazardous substance present in the process.
PHA 2	Scale of hazardous substances.	Amount of hazardous substance that could be released from the process.
PHA 3	Frequency and nature of hazardous operations.	Frequency of hazardous releases given the nature of the process and associated operations.
PHA 4	Technologies for hazard prevention and minimisation.	Steps taken to control the hazard at source.
PHA 5	Technologies for hazard abatement.	Steps taken to control the hazard through the incorporation of abatement systems.
PHA 6	Location of process.	Vulnerability and significance of environmental receptors within range of the hazard
PHA 7	Offensive characteristics.	Offensive characteristics of the process and strength of adverse public perception.

Attributes PHA1 - PHA6 represent the sequence of factors which must be evaluated in performing an environmental risk assessment of the releases from the process, starting from identification of potential hazards to assessing impacts on the environment. PHA7 is a separate evaluation of the offensive characteristics of the process, which do not constitute a risk of actual harm to the environment, but generate an adverse public perception. It is very important to separate these out from the 'real' risks to the environment determined in PHA1 - PHA6, given that real and perceived risks may be very different but may both affect the regulatory effort required for any process.

Given that the overall risk is a combination of attributes PHA1 - PHA6, these must be evaluated so that they are consistent with each other. Thus, the risk level will depend on the hazardous properties of substances, the amounts and frequencies of releases and the environment into which they are released. Any process is likely to present a variety of different risks to the environment, from routine releases, accidental releases, air emissions, water discharges, different substances, etc. **In principle, all releases that may potentially harm the environment need to be considered within OPRA.** The key to performing a PHA for any process is to identify, as part of the PHA1 evaluation, the substance and release scenario which represents the major risk to the environment from the process. This may be a routine release, relating to a planned discharge of pollutant; or it may be a loss of containment incident affecting an inventory of substance in the process.

Once the **representative substance** is identified, PHA1 - PHA6 must be scored in relation to that substance to ensure consistency. Each attribute must be scored separately in order to avoid 'double counting' of influencing factors, as is the case with the OPA attributes. For example, if the main pollution risk is a metals discharge to water, PHA1 is based on the aquatic toxicity of the metals, PHA2 relates to the scale of discharge of the metals, PHA3 relates to the frequency and nature of discharge operations, PHA4 and PHA5relate to technologies to prevent/minimise and abate the metals, and PHA6 relates to the proximity and vulnerability of surface waters to such releases. Note that PHA6 is not scored higher it the metals are particularly toxic; this is already reflected in the PHA1 score.

The appropriate representative substance is that which contributes the major proportion of the overall pollution risk. This corresponds to the substance which results in the highest sum of PHA1 -PHA6 scores. For some processes (for example large or complex processes handling a range of different substances) it may be necessary to consider the process as several sub-processes and score PHA1 -PHA6 for each separately, in order to determine which process area and substance gives the highest overall sum. The inspector should use judgement and knowledge of the particular process to narrow the choice of candidate substances in order to minimise the number of separate iterations.

It may be difficult to fully characterise the environmental risk from some processes based on one representative substance, for example where there is a highly hazardous material present in small quantities and a less harmful material present in large quantities. The inspector may judge it appropriate to increase individual PHA attribute scores for the representative substance by one or two points to reflect the additional risk from other substances. Typically the PHA1 score may be increased for a process with several significant but different types of environmental risk. Where several substances give rise to similar types of risk, the PHA2 score may be increased. PHA4 and PHA5scores may be incremented to reflect other specific issues of concern relating to prevention/ minimisation and abatement of hazards. The inspector should exercise particular care in incrementing scores and record this explicitly on the relevant comment boxes in the forms.

The overall PHA score should be consistent with the information contained in the process permit details. Information contained in operator safety and environmental studies may also be consulted to assist the PHA process.

2. Detailed description of OPA attributes

OPA1: RECORDING AND USE OF INFORMATION

OPA1 summarises the following aspects of performance:

- nature of monitoring arrangements and frequency of monitoring activities;
- records of current and historical operating conditions;
- documentation of all reportable/non-reportable events;
- use of information in assessing and managing environmental performance.

This attribute evaluates whether the operator's records are comprehensive in accordance with the process requirements and industry best practice, and that the records are accessible and used appropriately, that is the information is fed back to enable performance to be measured and actions taken to rectify any concerns identified. A complete set of records would be expected to include monitoring arrangements and data for releases to air, water and land, process operation data relevant to environmental performance, reportable events and significant deviations from routine conditions, on-reportable events and 'near misses'. Information on monitoring arrangements includes details on both systems and procedures for monitoring of releases and process data, for example measurement locations, frequency, equipment/personnel requirements, operating requirements, maintenance/calibration of equipment, etc.

Inspectors should make their evaluation based upon whether:

- monitoring is being carried out to meet or exceed the specified frequency for all relevant conditions and releases as required in the permit and by industry good practice;
- monitoring is conducted properly using appropriate techniques;
- records are sufficiently accurate to reflect the present and historical operating conditions of the process;
- information is available on future process operating conditions and releases, changes of workload and other process parameters;
- records are documented and stored to enable easy access, the system audited and the information regularly used to check process trends, compliance and performance;
- the operator uses such information in assessing environmental effects from the process, managing performance and taking corrective action, and communicating with the public.

The inspector should probe the available information to gauge whether all required information is being passed onto the regulatory body, for example in relation to complaints received.

OPA2: KNOWLEDGE AND IMPLEMENTATION OF PERMIT REQUIREMENTS.

OPA2 summarises the following aspects of performance:

- access to permit details by relevant staff;
- understanding of permit details by relevant staff;
- implementation of permit requirements in process activities;
- compliance with requirements specified by the permit.

Inspectors should make their evaluation based upon:

- whether the current permit is readily available to all relevant employees, that both management and operators are aware of the conditions and that management is aware of the residual requirements of relevant legislation;
- whether operators show sufficient understanding of the permit details (and any associated improvement programmes) and their implications for the process;
- how well the requirements in any permission, and any residual duties, are implemented, monitoring, improvement programmes, etc;
- the extent to which the operator is auditing performance against compliance requirements.

OPA3: PLANT MAINTENANCE

OPA3 summarises the following aspects of performance:

- existence of a clearly defined maintenance programme;
- use of appropriate industry standards of maintenance;
- extent to which maintenance programme considers environmental effects;
- effectiveness of maintenance programme in terms of environmental performance.

Inspectors should make their evaluation based upon whether:

- a suitable, effective maintenance programme has been clearly defined and is used to plan, monitor and record maintenance operations. The operator's programme should

take appropriate account of the most suitable of industry standards and/or manufacturers' recommendations;
- the maintenance programme identifies and manages process parameters and equipment critical to environmental performance;
- the maintenance programme is audited in relation to environmental effects and kept up to date with current conditions and process equipment;
- an appropriate mix of preventative and breakdown maintenance is employed, based on potential hazards arising from equipment failure, process design considerations, and environmental effects of maintenance operations themselves;
- inspection and monitoring are carried out to ensure maintenance is performed in a timely and appropriate fashion;
- environmental effects of maintenance operations are managed (for example work permits address environmental issues);
- monitoring equipment is properly maintained.

In addition to actual breakdown, equipment performance may deteriorate with time, potentially reducing process environmental performance. The inspector should evaluate to what extent the maintenance programme addresses performance deterioration as well as breakdown, whether these effects are significant, how they are detected and whether appropriate corrective action is taken. If equipment critical to process environmental performance is maintained on a breakdown basis, the effect of this on overall performance should be evaluated.

Parameters which may reflect the effectiveness of the maintenance programme with respect to environmental performance include: breakdown frequency of process, monitoring, control and protection equipment; frequency and nature of environmental releases due to deteriorating performance or malfunctioning equipment; frequency and nature of releases related to maintenance operations. The inspector should review the history of a few critical operating equipment items to determine the effectiveness of the maintenance system.

OPA4: MANAGEMENT AND TRAINING

OPA4 summarises the following aspects of performance:

- senior management commitment to environmental performance;
- environmental policy, objectives and management plans;
- definition of responsibilities and resources for environmental performance and compliance;
- reporting relationships, manning and skill levels;
- training programme;
- awareness of environmental effects of activities and. substances.

Inspectors should make their evaluation taking into account whether:

- there is a clear commitment to environmental performance from senior management, supported by the relevant policies, objectives, management plans, manuals and associated auditing;
- the plant is effectively manned with personnel of appropriate skill levels;
- an appropriate training programme exists and the extent to which it covers all grades and types of personnel;
- there are clearly identified reporting relationships which are known and understood, particularly for fault or emergency conditions;
- there is at all times a clearly defined responsible person for ensuring permit conditions are complied with;

- all relevant personnel have received training and information on the environmental consequences of releases.

The extent of manning, skill levels and reporting relationships should be evaluated in relation to different conditions (for example routine and periodic operations, emergencies, staff unavailability, etc), and also to the hazard, scale and complexity of the operations undertaken. The extent to which training covers all aspects of process operation which may affect environmental performance should be determined, including training in process operation, compliance with permit conditions, inspection, monitoring, maintenance and reporting. The approach of the operator to management of change should be evaluated as this can play an important role in the control of losses and incidents.

OPA5 PROCESS OPERATION

OPA5 summarises the following aspects of performance:

- clearly defined operating procedures;
- completeness of procedures with respect to all process conditions and permit requirements;
- full execution of these procedures in operation of process;
- effectiveness of procedures in operating process;
- auditing and updating of procedures.

OPA5 covers the complete management cycle in relation to operation, taking into account the quality of written procedures, whether they are carried out in practice, the effectiveness of process operation in terms of environmental performance, and the extent to which the process operation is audited and updated to reflect experience and practice.

The OPA5 score should reflect the degree of experience, control and management of process operations which is applied by the operator and underpinned by the operating procedures. In particular the inspector should take into account whether:

- operating procedures cover all process conditions (for example normal, abnormal, emergency conditions) and include specific factors such as shift handovers, operations outside normal working hours, use of contractors and suppliers, environmental implications of operations, etc;
- procedures are clearly written, easy to understand and accessible;
- procedures ensure that the consequences of change are assessed and approved before any changes are implemented;
- procedures critical to environmental performance are identified.

Evidence of the degree of process control may be accounted for in the OPA5 score. For example, the occurrence of “near-miss” events and process deviations, which do not trigger an actual incident but tend to indicate erratic process control, may be reflected in the OPA5score. Actual incidents would be reflected in OPA6.

OPA6: INCIDENTS, COMPLAINTS AND NON-COMPLIANCE EVENTS.

OPA6 summarises the following aspects of performance:

- frequency of environmental incidents, justified complaints and non-compliance events;
- severity of environmental effects of events;
- degree of justification of complaints;
- company response to events.

OPA6 represents the overall environmental track record of the process, in terms of the number and severity of reportable incidents and justified public complaints, where these relate to the operator's control of the process or the occurrence of unauthorised releases. Non-reportable incidents and unjustified complaints, or incidents unrelated to control and releases, are generally not relevant. Incidents may relate to actual releases to the environment, or other conditions such as non-compliance of process conditions, failure to report, non-compliance with improvement programme, etc.

The frequency of events should be based primarily on the previous 12 months of records, that is the latest annual average frequency. Earlier events may be taken into account if there is concern that recurrence is possible. The effect of earlier events on the OPA6 score should, however, be reduced according to the elapsed time since their occurrence. Where the reporting of incidents is dependent on the operator, the completeness of the track record may need to be judged in relation to the operator's systems for recording and use of information. The inspector should decide whether it is necessary to take the OPA1 score into account in setting the OPA6 score.

In the event that an incident occurs on the process in question, the OPRA score may require re-evaluation, both in terms of revising the frequency for OPA6 and establishing it any other factors relevant to the other OPRA attributes contributed to the incident. Several OPRA scores could therefore change as a result of an incident. This enables the OPRA score and therefore the level of regulatory attention to naturally adjust to reflect the recent performance of the process. It should not, however, be assumed that an incident automatically requires other OPRA scores to be changed.

The OPA6 score should take into account the severity as well as frequency of events. Severity relates to the extent to which any compliance limit was exceeded and the actual environmental impact of the incident. The following should be considered in determining severity:

- To what extent was any limit exceeded, and for how long?
- How significant was the limit, in terms of environmental protection and the degree of safety margin built into the limit?
- What environmental harm was caused by the event?
- How did the operator remedy/mitigate the consequences of the event?

In the event that a release limit is reduced and the frequency of non-compliance events increases, it will be important to evaluate the severity of new events in order to determine whether a lower OPA6 score is justified; the increased frequency may be offset by the reduced severity of the events under the new limit. However, if a limit has-been reduced because the previous limit was inappropriate, it may be necessary to set a lower OPA6 score.

OPA7: RECOGNISED ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS).

OPA7 summarises the following aspects of performance:

- extent to which environmental management system(EMS) has been externally certified to recognised EMS standards.

Inspectors should make their evaluation based only upon the implementation by an operator of the following:

- EMS certified to a nationally recognised standard, such as hternational Standard IS014001.

Environmental management systems in the process of gaining certification/verification may be given limited recognition in the OPA7 score. Internally developed systems, or certificates based on quality systems such as IS09000, are not relevant to this attribute. Environmental management systems which are effective in managing environmental performance, irrespective of whether they have obtained IS0 14001, should naturally be reflected in the OPA1 – OPA6 attributes, since these relate to basic EMS components such as procedures, training, management, etc. OPA7 does not measure overall environmental performance; that is the purpose of the overall distribution of OPA scores. The specific purpose of OPA7 is to determine the extent to which an operator has gone through a systematic processor objectively verifying the environmental management system to nationally recognised standards.

3. Summary of Guidance for Quantifying Operator Performance Appraisal (OPA)

Attribute	OPA score of 1	OPA score of 3	OPA score of 5
1. Recording and use of information.	Limited or non-existent monitoring or records. No evidence of use of information. Failure to record all data required by permit.	Information available as required by permit. Records used in process management.	Recording and assessing environmental information to higher level than specified in conditions. 100 per cent records kept available, copies submitted promptly to inspector. Information used to high level in process management. Use of information in public communications. Information systems audited regularly
2. Knowledge and implementatio n of permit requirements.	Permit unavailable. Operator not aware of legal requirements. Significant outstanding relevant improvement programmes.	Key personnel aware of/have access to main permit details, and understand main requirements.	Current registration/permit displayed or immediately available, and relevant staff fully aware of registration/permit conditions and residual statutory requirements. No significant outstanding improvements. Compliance audited regularly
3. Plant maintenance.	No coherent maintenance programme, taking no account of environmental effects and dependent solely on breakdown. No priority assigned to environment-critical items. Plant operating requirements riot defined, haphazard maintenance	Formally developed maintenance programme based on appropriate industry standards, which takes into account environmental effects of breakdowns and maintenance operations. Intermediate frequency of breakdown and	Advanced and regularly audited maintenance programme, placing priority on environmental effects of breakdown and maintenance. Plant maintenance procedures clearly defined and followed. All critical equipment and operating parameters monitored and maintained accordingly. Low frequency of breakdown/ maintenance-related releases. Maintenance programme ensures equipment environmental

Attribute	OPA score of 1	OPA score of 3	OPA score of 5
	procedures. High frequency of breakdown /maintenance-related incidents. Equipment performance deteriorates significantly between maintenance activities.	maintenance-related releases.	performance does not deteriorate significantly.
4. Management and training.	Ineffectively manned, inappropriate skills, poorly defined reporting structure and no clearly identified responsible person. Personnel not aware of consequences of releases. Little or no training on process or environmental issues.	Plant effectively manned with well-trained, competent personnel who are aware of consequences of releases. Controlled by responsible person at all times. Formal training programme.	Advanced training in place, involvement of senior management, availability of replacement staff at all times, emergency/abnormal conditions allowed for. Staffs receive broad training, refresher courses, further education encouraged. Training process audited thoroughly. Commitment to environmental performance demonstrated within management and policy.
5. Process operation.	No (or poorly written) procedures/instructions. Operation of plant haphazard, changes not fully controlled. Frequent process deviations/near misses.	Effective operating procedures available and implemented. Adequate control of process operations, shift handover and non-routine operations. Limited process deviations/near misses.	Fully documented, up-to-date and comprehensive procedures and instructions are in place, audited and being followed. Process operation well controlled. Rare process deviations/near misses. Procedures identify environmental effects of operations.
6. Incidents, complaints and non-compliance events.	Repeated incidents causing complaints, or one or more serious incidents. Failure to comply with improvement notices. Enforcement action necessary.	Fewer than three minor incidents and no serious incidents in last year. Full compliance with improvement notices. No more than one strong letter from regulator.	No reportable incidents or justified complaints about the process in last year. No action taken by Regulatory body, no strongly worded letters sent to operator.
7. Recognised environmental management systems.	No recognised environmental management systems.	Process has environmental management system based on ISO14001.	Process environmental management system is certified to ISO14001.

4. Detailed description of PHA attributes

PHA1: PRESENCE OF HAZARDOUS SUBSTANCES

PHA1 summarises the following aspects of hazard:

- presence of hazardous substances;
- selection of representative substance;
- inherent hazard level of representative substance.

PHA1 indicates the nature of hazards presented by the overall process, due to the presence of hazardous substances and the degree of inherent hazard posed by those substances based on their properties alone. The overall hazard is determined by further considering amount, barriers to release, etc, in subsequent attributes. PHA1involves hazard identification and selection of the most representative substance for the process, and a rating for that substance in terms of its potential to cause harm to the environment. The selection of representative substance within PHA1 is very important and it should be decided at this stage whether an iterative approach (as described in Section 1 of this annex) is needed.

The first step in PHA1 is to determine the presence of any hazardous substances which could be a significant source of pollution risk. The inspector should consider raw materials, intermediates, products, by-products and possible mixtures (particularly where reactions or synergistic effects are possible) in identifying the presence of hazardous substances. The permit details should be consulted to assist in the identification of substances of concern. Alternative release scenarios should be considered, including both pollution incidents and releases from normal operations. Incidents may include abnormal releases from discharge points, emergency conditions or accidental releases due to equipment failure. Potential 'domino' incidents (that is, combined failure of more than one process item) may also be considered, although these are unlikely to be the critical issue on most processes. Normal operations may cause a risk from the direct effects of routine emissions, or from uncertainties such as variations in weather conditions, changes in the environment or uncertainties in environmental impacts. Examples of the latter may include progressive or cumulative effects on the environment, for example if threshold concentration in the environment is close to being breached. For installations that are also major hazard sites, accident risks affecting humans and the environment should be covered separately and would generally not require consideration within PHA.

A representative substance should then be selected which is judged to best indicate the overall risk from the process as a whole, that is, it is the major contributor to the total risk. Default representative substances for different process types will be generated where possible through future use of OPRA, although site-specific features such as location and hazard control systems should always be considered in selecting the representative substance. As discussed in Section 1, for some processes it may be necessary to take an iterative approach, that is, carry out 'mini' PHA assessments for individual candidate substances and then base the PHA on the substance which gives the highest overall PHA value. Selection of a substance should include consideration of the different sections of the process and possible different set-ups/ feed stocks for the process, noting this as necessary in the recording of the PHA.

The final stage in PHA1 is to score the process based on the intrinsic hazardous properties of the representative substance. Properties that may need to be considered include:

- acute ecotoxicity (in air, water and soil), for example LC_{50} values;
- chronic ecotoxic effects;
- carcinogenic/mutagenic properties;
- pH;
- surface water or benthic blanketing properties;
- Chemical/Biological Oxygen Demand;
- temperature;
- health risk to humans, for example occupational exposure limits;
- persistence in the environment;
- bioaccumulation properties.

In principle the inherent hazard level for a given substance can be determined from a combination of these properties. In practice this may be time consuming and limited by the availability of data. Default scores for each substance maybe generated as the OPRA system is used. In the absence of a default, the inspector should make use of available information on properties, for example VOC classifications (A-C), regulatory threshold inventory limits, Occupational Exposure Levels and other sources of data. In the absence of detailed information on substance properties, it is recommended that a simple approach be taken to assigning scores, as follows:

Substance characteristics	Guide score
Highly harmful effects and persistent.	5
Highly harmful effects but not persistent; or moderately harmful and persistent.	4
Moderately harmful, not persistent.	3
Slightly harmful.	2
Low level of harm	1

As stated in Section 1, the PHA1 score may be increased by one or two points if it is judged that there are other substances present which merit concern and which present a different type of hazard to that of the representative substance.

PHA2: SCALE OF HAZARDOUS SUBSTANCES.

PHA2 summarises the following aspect of hazard:

- amount of representative substance present in the process.

PHA2 represents the scale of the process, in terms of the amount of representative hazardous substance present that may be released to the environment. PHA2 should be scored in relation to the nature of the release scenario identified in PHA1: if a routine release of a pollutant is the key issue, PHA2 depends on the pollutant release rate. For accidental releases or short-term emissions of a substance used in the process, PHA2 may be determined by the inventory and/or the relevant process flow rate.

The scale of hazardous substances should be scored in relation to all other processes that use or release the same type of substance. Regulatory threshold inventories or concentrations may be used to further guide the evaluation of scale.

If there are several additional substances which may contribute a similar risk to the representative substance and which the inspector considers should be taken into account, the PHA2 score for the process may be increased.

PHA3: FREQUENCY AND NATURE OF HAZARDOUS OPERATIONS.

PHA3 summarises the following aspects of hazard:

- nature, range and complexity of operations;
- frequency of operations.

PHA3 represents the frequency (or likelihood) of the representative hazard occurring on the process. PHA3generally relates to the frequency and nature of operations and the number and type of equipment items, which may give rise to releases or changes in the release rate of the representative substance. PHA3 may also need to take into account the variability in environmental conditions that may affect the environmental impact of the release.

In evaluating PHA3, the inspector should consider the following factors:

- Nature, range and complexity of operations, that is, are there many different tasks required, are they by nature inherently prone to incidents, are the tasks complex in nature, do they happen on an ad hoc basis or are well-defined and planned?
- Frequency of operations within the process, that is, how often are changes made to the operation of the process and how many equipment items are in use in these operations? Examples include variation of load factor in a continuous process, changeover of feedstock in a batch process, start-up and shutdown of both the process plant and any abatement systems. Thus, any intervention that affects the process is an operation in this context.

The above factors determine the inherent frequency of incidents. In practice the actual frequency may be higher or lower than this frequency, depending on management systems factors such as training, procedures, etc. In particular, an operation may occur infrequently and therefore have a low generic incident frequency, but the actual incident frequency may be higher than expected due to lack of familiarity. Studies of human error rates as a function of task frequency have indicated that the error rate per task for a rare task may be a factor of around 100 times higher than for a frequent task. However such effects are difficult to quantify in a general and simple manner. For the purposes of determining PHA3, these effects may be neglected and the frequency of releases assumed to be fully proportional to operations frequency. Non-linear effects such as familiarity with rare operations are reflected in OPA scores. This is consistent with the concept that PHA measures inherent risk, and OPA measures the effect of the management system on the inherent risk.

PHA4: TECHNOLOGIES FOR HAZARD PREVENTION AND MINIMISATION.

PHA4 summarises the following aspects of hazard:

- technological methods for eliminating hazards at source.

Inspectors should make their evaluation on whether the process technology has been designed to prevent or minimise releases into all media, for example by the use of alternative raw materials or a route for synthesis which eliminates by-product formation. PHA4 relates specifically to process technology including process instrumentation and control systems for prevention and minimisation of harmful releases, but not management techniques such as maintenance and training, which are considered in the corresponding OPA attributes.

The inspector should consider the following aspects and the evaluation should reflect an overall view having taken into account each one:

- age of plant;
- design and construction standards;
- complexity of process plant;
- suitability of instrumentation and controls;
- extent to which the process constitutes best available technique in relation to the inherent process design. A process may be below existing plant standards but subject to substantial improvement programmes.

The PHA4 score is not directly proportional to factors such as age and complexity but rather on the ability of the plant to eliminate or minimise hazards at source. The inspector should appraise whether the plant is functioning within design requirements and seek guidance, from other inspectors if necessary. The permit details for the process should also provide input to the evaluation of PHA4. A simple indicator for PHA4 is the ratio of the main hazardous stream concentration to that of any existing new plant standard concentration, measured upstream of any abatement systems.

PHA5: TECHNOLOGIES FOR HAZARD ABATEMENT.

PHA5 summarises the following aspects of hazard:

- technological methods for mitigation of hazard.

Inspectors should make their evaluation on whether the abatement plant is appropriate for the process and is operating as intended, including all associated instrumentation and control systems. As with PHA4, management techniques relating to the operation of abatement systems are evaluated in OPA attributes.

The PHA5 rating should take into account both the effectiveness and reliability of the abatement equipment in rendering harmless releases to the environment. For example, passive containment systems may be considered more reliable than active systems. Assessment of systems for removal of pollutants from releases to air or water should take into account the factors which determine the ability of the system to maintain its performance under different conditions, for example system capacity and normal operating level, how the system is regenerated, standby systems, etc. The inspector should seek guidance from other inspectors if necessary. As for PHA4, a simple indicator for PHA5 is the ratio of the main hazardous stream concentration to that of any new plant standard concentration, measured downstream of any abatement systems. Inspectors should also appraise the characteristics of any release point to determine the adequacy of dispersion of the substances released, for example for releases to air, the stack height and efflux velocity should be adequate; for releases to water, the efficiency of mixing may vary with flow conditions.

PHA6: LOCATION OF PROCESS.

PHA6 summarises the following aspects of hazard:

- proximity of process to environmental receptors;
- sensitivity of receptors to hazards;
- significance of harm caused to receptors.

The inspector should consider the proximity of the process to human populations and other environmentally sensitive areas. This is evaluated in terms of whether potentially sensitive environmental receptors are within range of the representative hazard from the process. The range depends on the available pathways from the process to the receptors, and the dispersion of representative substance from the process via these pathways. This is determined by the size of the release, the mobility of the released material and environmental factors (such as environmental capacity, topography, meteorology and hydrology). The scale of effects being considered in PHA is generally short to medium range, that is, within 10-20km of the process boundary. Only those receptors within the expected effect area of releases should be considered. However in some cases more long-range effects may need to be considered, for example for $S0_2$ releases and critical load impacts. In cases where the scale of effects is regional to international due to the representative substance and type of harm (for example $C0_2$ for global warming effects), the exact location of the process becomes less important and the PHA6 score would be expected to converge on the average value, that is 3. The inspector should identify if there are any clear pathways from the process to the environment and potentially vulnerable receptors for the sort of releases that are being considered. For example, for the release of liquids of high aquatic toxicity to present a risk there must be a pathway from the site to rivers, groundwater, etc. The analysis of pathways should identify factors such as the presence of water abstraction points, possibility of detection, sewage or water treatment works, etc, which may provide a pathway or obstacle for the pollutant in the environment. Note that releases from remote sites are less likely to be detected. Transport and fate characteristics of the representative substance should also be considered in evaluating pathways, for example does the material sink or float, does it adsorb onto particulate matter, does it react with air or water, etc?

The sensitivity of receptors is the potential level of harm that may be caused given the nature and severity of the hazard specified in PHA1 and the type of receptors within range of the hazardous releases. This may not be straightforward to determine and the inspector should consult with expert bodies if necessary. Other considerations for sensitivity are:

- For surface waters, what water quality classification has been given, and what water quality objectives apply?
- What are the uses of the land or surface water body?
- Are any receptors present within the potential effect area, which may be particularly sensitive to the representative substance?
- What is the duration of effects on the environment and how will it subsequently recover?

The significance of harm caused to receptors is based on an evaluation of the above factors combined with a judgement of the relative importance of the receptors affected. This requires considerable care given the nature of the judgement; again, the inspector may need to consult with expert bodies.

PHA7: OFFENSIVE CHARACTERISTICS.

PHA7 summarises the following aspects of the process:

- offensive characteristics which give rise to public concern.

A large amount of regulatory work can arise from public concerns and complaints due to a public perception of risk that may be unrelated to actual environmental risks. Public perceptions can be strongly affected by offensive characteristics such as odours and visible releases. For these reasons it is necessary to evaluate the overall offensive characteristics of the process that give rise to public concerns. These need to be treated separately from actual environmental risks as they can arise for very different reasons.

Inspectors should make their evaluation of offensive characteristics based upon the intrinsic offensiveness of substances present in the process. Offensiveness is particularly related to odour, appearance, taste and/or loss of amenity. Offence is most likely to be caused by airborne releases; examples of these include visible plumes, dust deposition on property, and odours arising from the process. Offence from waterborne releases, for example through discoloration of water or taste problems in water supplies, should also be considered. The overall public perception of a process can be further gauged from knowledge of local views held and the record of complaints and campaigns against the process that may not be directly related to specific, substantiated problems arising from the process. It is possible that the local public may, however, become accustomed to certain offensive characteristics of processes. These may be considered of lower significance than if they were introduced into another location. The overall score for offensive characteristics of the process should take these factors into account.

5. Summary of Guidance for Quantifying Pollution Hazard Assessment (PHA)

Category	PHA rating of 1	PHA rating of 3	PHA rating of 5
1. Presence of hazardous substances.	Low toxicity, little or negligible potential to cause harm, for example inert non-hazardous particulates, low-grade heat, $C0_2$.	Medium potential to cause harm, for example NOx, $S0_2$, PM10's, smog-related VOCs.	Could result in serious harm to humans and/or the environment, for example chlorine, fluorine, carcinogenic VOCs, asbestos, dioxins, PAHs.
2. Scale of hazardous substances.	Small-scale process with low inventories/releases of representative substance relative to normal industry, concentrations and amounts well below thresholds.	Medium-scale process, average inventories/releases of representative substance, concentrations and amounts around thresholds.	Major undertaking in relation to industry norm, large-scale inventories/releases of representative substance, concentrations and amounts above thresholds.
3. Frequency and nature of hazardous operations.	Infrequent and simple changes made to hazardous operations. Clearly defined repetitive operation with little variability possible. For example, simple process operation changed only several times per year.	Relatively frequent or complex hazardous operations.	Complex and frequent hazardous operations. Irregular and highly variable schedule of operations. For example, process with frequent load changes, feedstock variations, equipment outages.
4. Technologies for hazard prevention and minimisation.	Meets or exceeds new plant Standards. State-of-the-art, or inherently low polluting processes. No outstanding relevant improvement programmes.	Meets requirements for existing plant standards.	Outmoded/poorly designed processes; significant relevant improvement programmes outstanding.
5. Technologies for hazard abatement.	State-of-the-art abatement processes; good dispersion. No outstanding relevant improvement programmes.	Stack heights adequate, dispersion sufficient from discharge points.	Outmoded/poorly designed/unreliable abatement; significant relevant improvement programmes outstanding; plume grounding at significant concentrations.

6. Location of process.	Low sensitivity area, for example, heavily industrialised, low quality surface waters, not used for abstraction, absence of designated areas, remote from populations (including other industry workforces) and amenity locations. Additional pollutant releases not likely to cause significant deterioration in environment or exceedance of environmental quality criteria.	Medium sensitivity environment, mixed industrial/residential area, low-density populations nearby, or highly sensitive areas at some distance but potentially in effect range.	Close proximity downwind/downstream to areas of high population and/or highly sensitive environment, for example river used for water abstraction, groundwater, designated areas, etc. Further pollutant releases may exceed critical levels or lead to further harm.
7. Offensive characteristics.	Inoffensive process containing substances causing no offence; for example, $C0_2$ releases to air, CH_4. No record of unsubstantiated public concerns or complaints.	Moderately offensive characteristics, for example, odours from esters, aldehydes, ketones, solvents. Water discoloration or foaming in releases. Moderately visible plumes. Some local public concerns.	Highly offensive characteristics. Extremely unpleasant or annoying, either due to sight or smell. For example, mercaptans, amines, highly visible smuts/particulates, highly visible plumes. Strong local concerns.

6. Practical application of the OPRA system

GENERAL

This section discusses the general approach to the use of OPRA in practice. Comprehensive procedures for performing OPA and PHA have been produced separately. The OPRA system is to be applied in such a way as to enable regular assessment of the OPRA score for the process, without adding significantly to the time and resources required of the inspector and operator. The system and associated procedures are designed to achieve this goal. The initial generation of an OPRA score would generally require all attributes to be evaluated. Thereafter, it is only necessary to identify and re-evaluate those attributes which may have changed. It should be noted however that, given the nature of PHA attributes, a change in one attribute would generally require all other attributes to be reviewed. The evaluation process itself requires judgement and experience to be employed, using information from existing sources and acquiring new information through sampling. A key feature of the system is that all main assumptions and the basis for the evaluation should be recorded alongside the scores.

RESOURCE/TIME REQUIREMENTS

The time expected to perform an OPRA depends on several main factors:

- whether OPRA has been performed for the process previously;
- complexity and size of the process;
- amount of information required to produce confident scores;
- number of attributes that require re-evaluation (in many cases no PHA re-evaluation will be needed, and maybe only one or two OPA attributes will need re-evaluation);
- special circumstances, for example incident, complaint, non-compliance;

- degree of concern from operator as to particular scores or details, and need for justification of scores;
- experience of inspector with process in question and with the OPRA system.

An experienced inspector might be expected to take up to about three hours to complete the first OPRA for a process. Updating of OPRA on subsequent occasions would generally take up to about one hour, and in many cases little or no change may be required to the OPRA scores. These estimates relate strictly to time required to determine the score for a process with which the inspector is already familiar. The inspector is responsible for determining whether a full, partial or no OPRA is required on each occasion. Supporting criteria are given in the procedures.

An indication of any new scores should be given to the operator at the end of the inspection. The inspector will need to be able to justify scores to the operator; however, where the operator has a concern over the score, the inspector may invite the operator to submit further information in writing to the Regulatory body, which may be taken into account later. This should limit the time spent by the inspector justifying the score.

It is expected that an OPA should be performed at least once a year in order to ensure it is up-to-date. A PHA should be performed at least once every four years, given this is less subject to change.

USE OF SAMPLING AND JUDGEMENT IN GENERATING SCORES

While there are detailed techniques available for assessment of operator performance and environmental risk, OPA and PHA are designed as simple screening tools which can be used on a regular basis and enable inspectors to make a rapid and transparent assessment of the process. OPRA is therefore based on simple analysis methods using the inspector's knowledge of the process, supported by sampling and judgement. Thus OPA does not require detailed review of all records or discussions with numerous staff, as may occur with an audit. Similarly, PHA does not require the detailed calculations that may accompany a full quantitative risk analysis, such as estimation of frequencies and consequences of individual releases.

The inspector will generally review records and documents, hold discussions with site staff and carry out physical inspections of equipment as a normal part of inspections. In many cases it will not be possible to cover all records, staff and equipment associated with the process. The inspector should decide what proportion of the total should be covered in order to have sufficient confidence to derive the corresponding OPRA scores. Clearly, a greater amount of information may be needed if a particular attribute is considered to be crucial or a concern has been identified. Where it is not possible to review sufficient information, the inspector should note this on the relevant comments section of the OPRA form. It may be appropriate to perform a more detailed review of specific aspects of the process or management systems on subsequent inspections in order to reduce key areas of uncertainty.

APPLICATION OF PROCEDURES

The OPRA methodology involves filling in two worksheets, one each for OPA and PHA. Example forms are shown below. Details of the OPRA (process, date, inspector, etc) should be filled in each time any OPRA score is to be changed. Scores should be assigned to each box, either from the previous appraisal or based on a new evaluation. Spaces are provided in the standard OPA and PHA forms for comments relating to the overall process and each attribute in particular. These should be used to explain the reasoning behind any new scores assigned and where necessary the reason for not giving an alternative score (for example why an OPA was scored at 4 and not 5).

A full OPRA re-evaluation is unlikely to be required following each inspection; in many cases the inspector will simply need to determine whether the OPRA results from the previous evaluation are still applicable or if some updating is required. The emphasis of the OPRA procedure is to ensure that the OPRA score for the process is kept up-to-date. In general the PHA will change only if there has been a major variation to the process; it may additionally require review if new information is obtained on hazards or the environment. OPA may require more regular updating and the inspector should consider if there is the need for changes to any OPA scores at the end of each inspection visit.

Multiple process sites may share common systems, such as maintenance and record keeping systems. Where an inspector is able to establish that these systems are indeed common to several processes, the scores for the corresponding OPRA attributes may be assumed to be the same. However it is important to determine whether the common system is equally appropriate to the different processes. If the common system is more suitable for one process than another, the corresponding OPRA attributes must be scored separately.

As discussed in Section 1, a large or complex process maybe considered as several smaller sub-processes for the purposes of deriving the overall OPA and PHA scores. If necessary, separate worksheets should be filled in for each sub-process. In general however it would be expected that sub-process scores and the overall scores may be shown on a single worksheet.

The role of the operator in deriving OPRA scores is to provide information and allow access to records, site areas, etc as needed, and to answer questions to clarify the scoring process. The operator may draw to the attention of the inspector any issues considered relevant to the scoring. The inspector should discuss the OPRA scores fully with the operator at the time of derivation. It is then a matter for the inspector to consider the relative weights of the OPA and PHA scores and to assign some value of overall risk to the individual installation that will allow him or her to adjust the baseline frequency for inspection and, in the case of setting priorities, to rank the relative risks of all installations. A simple guide as to how to combine the OPA and PHA scores into zones of overall risk level (from 1-5) is shown in graphical form in Figure 1. This does not include any attempt to weight the individual components, which must be a matter of judgement by an experienced inspector with knowledge of all the relevant circumstances of the installation.

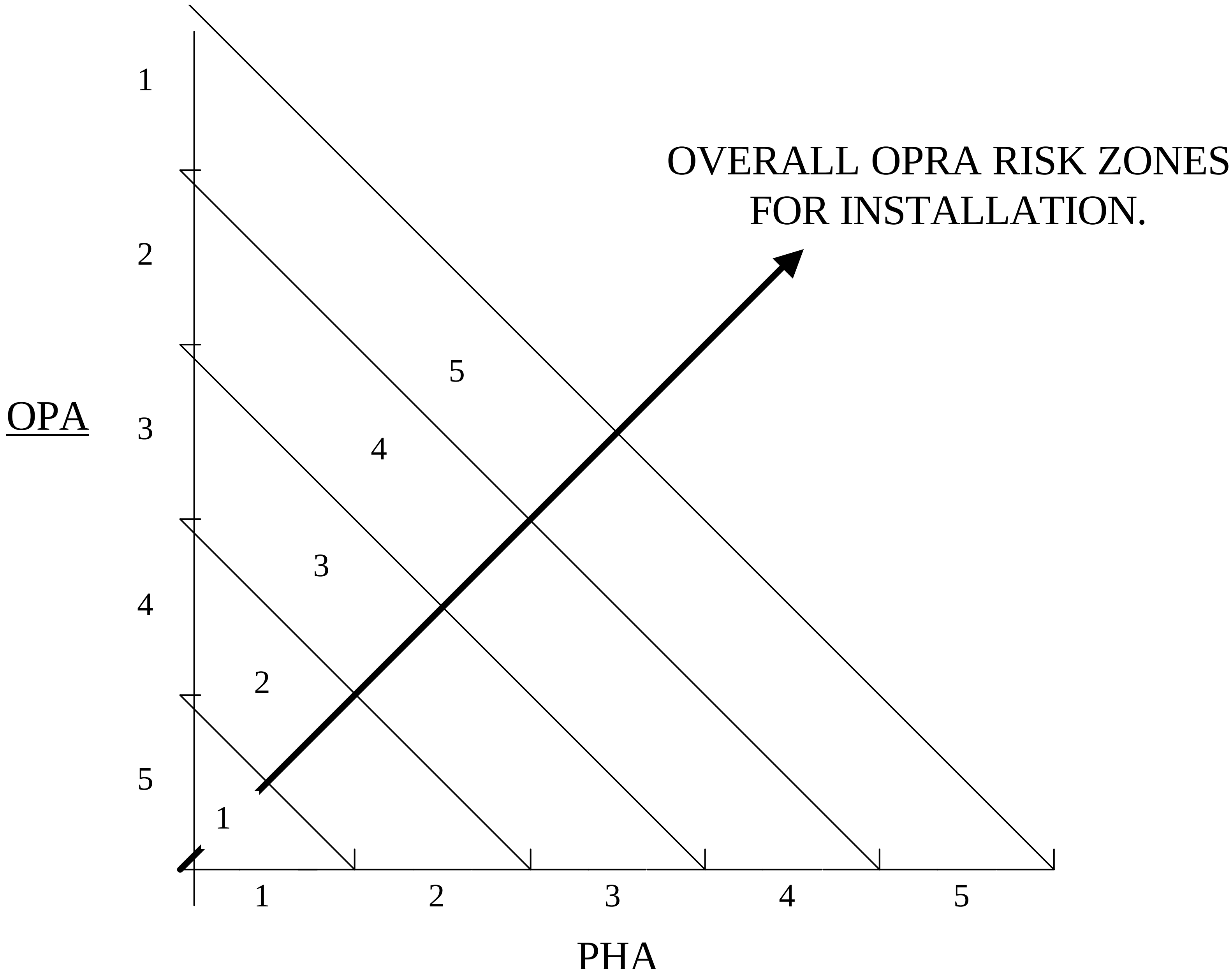
OPERATOR PERFORMANCE APPRAISAL WORKSHEET		
Permit No.	Ref.	Date.
Site name.	Address.	Inspector.
General Comments.		

Attribute.	Rating. (1 to 5)	Comments.
1. Recording and use of information.		
2. Knowledge and implementation of permit requirements.		
3. Plant maintenance.		
4. Management and training.		
5. Process operation.		
6. Incidents, complaints, non-compliance, etc.		
7. Recognised EMS.		

POLLUTION HAZARD APPRAISAL WORKSHEET		
Permit No.	Ref.	Date.
Site name.	Address.	Inspector.
General Comments.		

Attribute.	Rating. (1 to 5)	Comments.
1. Presence of hazardous substances.		
2. Scale of hazardous substances.		
3. Frequency/nature of hazardous operations.		
4. Technology for hazard prevention and minimisation.		
5. Technology for hazard abatement.		
6. Location of process.		
7. Offensive characteristics.		

FIGURE 1. OVERALL LEVEL OF RISK FOR INSTALLATION



Part IV

SAMPLING

TABLE OF CONTENTS

1. INTRODUCTION

Taking representative samples requires special skills and experience. This part of the Reference Manual document should there for not be seen as the manual for inspectors to perform all these measurements them self. For example, taking air-samples special expertise in this field is required; of course in other fields less expertise could be necessary. The aim of this part is to give the inspector more understanding in problems and difficulties that will come with environmental sampling.

1.1 Role of the Sample

Emissions and pollutions are very different all over the world. Not only the sorts of emissions and pollutions, but also the quantities, often depending on geographical, economical and social circumstances. Sometimes countries have well developed systems of industry's self monitoring. In licenses or sometimes in the law itself prescriptions can be found how to monitor. In more and more cases industries themselves have their own environmental management system of which monitoring programmes are part. Sometimes however these systems are completely absent.

Several reasons exist to monitor. Analysing trends, determining fate and transport of pollutants, defining critical areas or measure the effectiveness of conservation practices. But also to evaluate program effectiveness, to make waste load allocations, to model validation and calibration, to define an environmental problem or to conduct research.

In this toolkit however we will not focus on these reasons. Our reason will be sampling as a form of compliance assessment. Of course there will be overlaps between monitoring activities for other reasons. The results of this monitoring, the way in which it was done, the trust authorities have in the monitoring, etc. may and probably will be taken into account in deciding whether or not to assess compliance through sampling. Nevertheless sampling will never be the exclusive territory of situation where no monitoring at all takes place. Also in situations where monitoring is done, it will be of importance to assess compliance every now and then. Not only to check whether the monitoring results of industries themselves are correct, but also to prevent that forms of self-monitoring will cause that the responsible people in industry may feel free as they like. This might easily lead to abuse.

Monitoring programmes, either by industries of by government(s) may cover:

- Controlled emissions of waste gases and airborne particulate to air via chimney stacks;
- Controlled discharges of waste water via sewers to and from effluent treatment plants, directly to receiving waters such as the sea, lakes, rivers and streams and to land via septic tanks and soakaways;
- Controlled disposal of solid waste to landfill sites;
- Controlled disposal of solid and liquid wastes, including organics, to incinerators;
- Process raw material inputs (e.g. trace contaminants) and operating conditions (e.g. process temperature, pressure and flowrate);
- Fugitive releases to air, water and land; being those that are not coming from a defined point but rather from a number of widespread points;
- Energy efficiency and water consumption;
- Noise and odour nuisances;
- In addition, receiving environments (e.g. ambient air, grass, soil surface and ground waters) may be monitored.

Monitoring programmes may be a routine exercise of sampling at regular intervals or may be short-term campaigns with a concrete objective. These programmes include stages of planning, preparation, implementation, data analysis and reporting. In this toolkit we will only discuss these aspects against the background of compliance checking and enforcement.

Sampling is a step in the overall compliance checking and enforcement process. It is a key element. Samples collected during an inspection must be of known quality and collected following sound technical procedures to ensure their reliability for use as evidence. Effective communication with the laboratory is a critical component in the process.

Official samples, as well as records and other information obtained during sampling, must always be collected and treated as though the material will be used as evidence in an enforcement action. This involves ensuring that each sample is properly collected, prepared, and documented. The primary factors to consider when collecting a sample are:

- Communicating effectively with the receiving laboratory;
- Ensuring that an adequate amount and representative portion of a batch of the product is collected for analysis;
- Assuring that no cross-contamination occurs during sampling of large containers and that proper containers and caps are utilized;
- Assuring that all official samples are properly identified, preferably with a unique numbering or other identification system;
- Recording the inspector's observations of the sampled batch, such as photographs, copies of records, data, correspondence, and/or results of interviews;
- Obtaining any labelling and literature that pertain to the sampled product or batch;
- Obtaining signed statements or sworn affidavits from persons who may potentially serve as witnesses.

Duplicate samples are collected on the request of the person (or establishment) that has a direct (legal) interest in them. In general national legislation will determine who is entitled to be given these kinds of samples. These samples should be collected, identified and sealed using the same equipment, techniques and sampling protocols used to collect official samples. This could be identified as an equal amount of the product taken in the same manner from the same site, stack, container, etc. It might even be an equal portion acquired by subdividing the samples taken by the inspector. This will only be possible in case the sampled portions were of sufficient size to do so. Subdividing small-size units may not be preferable, because:

- The integrity of the sample as evidence is more difficult to maintain and defend;
- Cross-contamination is minimised;
- The possibility of exposure during sampling is minimised;
- The laboratory can determine the net contents, if necessary.

Convenience, accessibility, and safety should also be considered when selecting a sample site.

1.2 Accuracy and Precision

To serve as evidence most legal systems will demand a high decree of accuracy and precision. Not only the sampling itself but also the way in which the analysis is carried out will be crucial for the trust in the results. According to chemistry definitions *'accuracy'* denotes the nearness of a measurement to its accepted true value and is expressed in terms of error. *'Precision'* refers to the reproducibility of results. It is the agreement between the numerical value of two or more measurements that have been made in an identical fashion.

In the discussion on accuracy and precision variables such as samples technique, calibration of field and/or laboratory equipment, inspector's skills in technical and chemical sampling, quantity of target material, etc. play a role.

Laboratory reports frequently mention a confidence factor which may be measured in plus or minus percentiles. Other chemicals may disturb the picture of the target chemical. In that kind of situation it is good to question whether the data can still be used.

Putting the right quality of manpower on sampling and following the appropriate sampling protocols is to state the obvious. Even a lager team of qualified persons may be necessary to get accurate and precise results.

All the characteristics of the sampling methodology (see 1.4) should be written in a label attached to the sample, in order to perfectly identify the sample. This label should also include:

- A unique sample identification number assigned from a sequentially number register;
- Date and time of sampling;
- Sample preservation (if applicable);
- Process relevant details;
- References to measurements made at the time when the sample is taken.

1.3 Quality Considerations

A sample's quality is co-determined by the method used. This method should be determined by the what and why of the sampling activity. It should be assured that the right method is selected and documented properly. The one who is leading the sampling (which may be the individual inspector on his own) carries responsibility for the sample's quality. He must control and insure that proper methods and procedures are followed throughout the entire process from acquiring clean sample containers and other tools, transportation of these containers (without contaminating them), taking the samples, transporting them back to the laboratory without contaminating them, determining the method of analysis, what chemicals to analize for and how small of a concentration they should look for.

Hints

Use clean sampling containers and tools
Don't contaminate them during transport
Determine the method of analysis
What chemicals to analyse
What concentration to look for
Don't take samples of which the quality cannot be guaranteed!!!

If you cannot guarantee the quality of the samples you should not take them at all!

The integrity of a sample and the continuity of evidence must be maintained so that if the sample does show non-compliance with the law, it can be used as evidence of the violation. Continuity of evidence is the control of evidence from the time it was taken to the time it was analysed. This means documenting anyone who had contact with, or had care of the evidence.

In case of necessary transfer of evidence to another person or move it to another location, personal delivery by the person already in possession of the evidence is the best practice. Secure methods of mail or shipment may also be used. Seal the evidence and be sure it is adequately identified. Ensure that the package is locked or securely fastened. Retain original bills of lading and other shipping documents. Contact the recipient to arrange for pick-up or receipt. Tell the recipient how the evidence is sealed and marked. In this way the recipient can determine whether the evidence has been disturbed.

Issuing a license it is considered best practice to include quality considerations in the monitoring requirements with the relevant limits. This should help the measurements to be reliable, consistent and auditable. The main quality considerations to be recognized can be found in the table 1.

Table 1

Quality considerations	
Calibration, maintenance and certification	The monitoring system should regularly be calibrated and maintained, and relevant instruments, personnel and analytical laboratories should be certified under recognised schemes
Updating of monitoring requirements	The monitoring programme should regularly be reviewed and updated to take account of: changes in limits the latest compliance situation of the process new monitoring techniques
Off-scale situations	Under some temporary process situations monitoring equipment may go off-scale e.g. during abnormal conditions or during start-up or shut-down. In such cases it is important that the permit states how long the monitoring is allowed to be off-scale before emissions are judged to be non-compliant
Availability and breakdown of monitoring equipment	The permit should state if/how long a process is allowed to continue operating in the event of a breakdown of monitoring equipment. Consideration should be given to specifying requirements for data capture, off-line maintenance/calibration periods and back-up monitoring (e.g. taking of occasional spot samples while continuous monitors are available)

1.4 Representativeness and methodology

Regardless of the procedure all samples must be representative of the material or event. Together with methodology, representativeness is a prime issue.

Does your sample represent a specific waste stream, site, event or activity? Is it representative for what you needed to evaluate for compliance?

Representativeness includes that the sampling is carried out according to a relevant instruction or standard. Sampling is a complex operation that strongly affects the analytical results and the conclusions derived from them.

The sample must be representative in the time and also in the space. This means that if the discharge from an industry is being analysed, the sample taken to the laboratory should represent all that it has been discharging during, e.g. a day of work (*time representativeness*); or if a material is being monitored, the portion of sample should represent the thousands of tonnes that are being introduced in the plant (*space* *representativeness*). Samples should be collected from a location that is representative of the facility's discharge. If the facility has more than one discharge point it may be necessary to collect samples from several locations in order to adequately characterize the facility's entire discharge.

The sampling should be carried out with no change in the composition of the sample. In fact, there are parameters in a sample that should be determined, or somehow preserved, in situ as their value may change with time, e.g. the pH and the content of oxygen of a wastewater sample. If we are sampling lime or NaOH we have to preserve it immediately to prevent contact with air as they react with the air to give carbonates.

Of course complexity increases as the sample to analyse may range from a few grams up to thousands of tonnes, and the substances to be analysed can vary widely in their nature. The material may be homogeneous, in which case sampling at a single point is enough. But there are few homogeneous materials. Generally the materials are heterogeneous, and several samples from different points will be required in order to have a spatially representative sample.

On the one hand, solid, gaseous or liquid samples can be found; which in turn can be mineral, vegetable, or animal samples; on the other hand the concentration of what is being monitored may range from trace levels upwards. Therefore it can be concluded that it is difficult to provide general rules for sampling all type of substances of materials.

A number of factors determine the methodology. Methodology can be defined wide or narrow. In this toolkit we will use the wide approach. The following factors are part of this approach.

- The ***location*** at which the samples are to be taken should be such that the material is well mixed, and it should be taken always from the same defined points. In order to have homogeneity in composition and temperature the sampling should be carried out far enough from mixing points. When monitoring particles it is also important that samples are taken from points far enough from flow disturbances, such as bends, which could make particles to be distributed non-uniformly in the bulk to be sampled.
- The ***frequency*** at which the samples are to be taken is usually decided on a risk basis, taking into account the variability of the flow, its composition, and the magnitude of the variability with respect to limit unacceptable values.
- The ***sampling 'method'*** and/or ***equipment.***
- The ***size*** of individual samples and bulking arrangements to provide composite samples.
- The ***type of sample*** e.g. sample for single or multiple determinant analysis.
- The ***personnel*** in charge of taking the samples should be skilled.

2. PREPARING THE SAMPLING

2.1 When, Why and How to Take a Sample

Sampling can be an expensive activity. As such this is a reason to question why to take the sample. But let's assume that not all sampling is expensive and that we will only sample if useful and cost-effective.

In general the environmental inspector will take a decision on the questions 'when' and 'why' to sample.

When to sample is determined by the best chance to obtain a representative sample. The amount of the product(s) to be collected depends largely on the amount of material required for the anticipated laboratory analysis and to assure representativeness, including the quantity required for quality control purposes (i.e. splits, repeat examinations and replicates). Considering these sampling needs, the sample size is to be kept to a minimum to reduce the burden of disposal of the unused sample portion and to mitigate potential human and/or environmental exposure.

Why a sample is taken is more subjective. It is initiated if there is a lack of confidence in available data or because of incomplete data at the facility or home office. Sampling may be required by the law or a license. But also data needed to document an event can be a reason. In this toolkit the 'why' will focus on compliance checking and enforcement.

Sampling procedures include designation of sample types, volumes, containers, and preservation methods to be used for each pollutant parameter as well as sample identification and documentation procedures. These are general procedures. Specific information on each facility should also be developed. This may include pollutant parameters to be sampled, sampling location and safety concerns. Obtaining this information before the sampling trip will allow the sampler to bring the proper equipment, know where to sample and what pollutants to sample for, and be familiar with necessary safety precautions.

Hints

- The sample must be representative
- Use the appropriate standard operating procedure
- Identify the analysis method in your site specific quality assurance plan
- Notify the laboratory of the specificity and chemical concentration required in the analytical report

Sampling (analysis) will be needed to clarify whether there is compliance or non-compliance. The most fundamental types of samples are composite samples[30] and grab samples[31]. Both types of samples can be either planned or samples of opportunity[32]. Standard operating procedures should be kept on file at the inspectorate, insuring defensible repeatability and consistency and a written record of what was done. Deviations from standard procedures must be thoroughly documented. Several years after the event, it may be necessary to refer to the sampling. Only laboratories should be used that adhere to written standard operating procedures.

Standard operating procedures supplement site specific procedures as e.g. laid down in a license or in a sampling plan as part of a company's environmental management system.

30 Composite samples are collected over time (either by continuous sampling or by combining individual grab samples) and reflect the average characteristics of the sampled material during the sampling period. Composite samples are either 'flow proportional' or 'time composite'. Composite samples may be needed to determine the average characteristics of the sampled material, particularly if the material has a highly variable pollutant concentration or flow rate. Composite samples should be collected during the entire period the facility is operating and discharging, e.g. 12 hour a day in case of 12 hours of discharge that day.

31 Grab samples are individual samples collected over a period of time representing the sampled material under the conditions only at the time the sample is collected. Grab samples are usually taken manually but can be collected using an automatic sampler.

32 Samples of opportunity are events that were not generally anticipated. They may be required because of a new process or expansion or the may be necessary because of a spill or discharge.

2.2 Information Sources

To place the decision to sample, what to sample, where and how to sample, in the right context, sufficient basic information is necessary. This information can be drawn from different sources. It can be information in written or spoken form, but also visual observations, electronic information, etc. Written information will very often turn out to be the most important information source. And as we will see in this paragraph there can be very many of them.

The most common written information sources will be the license of the company, other legal provisions and the documents that are in the company's file at the office of the inspectorate. The license and these documents probably contain information on the processes in the company, telling the substances that may or may not be used, the emission limits, the obligation to monitor emissions, the registration of emissions and waste streams, the allowed size of the storage of these substances and the conditions under which this is allowed.

But also the company's floor plans are very much worth to study to get knowledge of the position of different activities, about the electric system, the sewer system, safety routes, etc.

Documents with monitoring information can not only tell whether there was compliance with existing rules, but also about substances and their concentrations present at the company's premises. Process flow charts can be important in calculating streams of incoming and outgoing materials and the possible exceeding of licensed emissions.

An historical examination of the company may indicate which substances are at stake. This is important in order to minimise risks and take effective measures and have the proper sample analyses done. It may be possible to determine the origin of certain wastes, which can give indication on its nature. Will it be dangerous or will it not? Questions that have to be answered in these matters are:

- which are/were the company processes, the products, the raw and auxiliary materials used for that and the waste coming from it;
- what does the inspection and enforcement history of the company look like;
- what is in the company's license;
- which transporting company's worked for the company;
- how about the quantity and composition of the industrial waste removed from the company's premises;
- how about the way in which the company's administration is run;
- what about the date on the company's buying and removing;
- what do other inspections organisations or colleagues know of the company;
- what can the license, the Chamber of Commerce of citizens/NGO's tell about the way the company works;
- have complaints or offences of the company been reported.

Also topographical information, information in e.g. municipal files on the composition of the soil or ground water streams, electric cables, underground sewer systems, pipelines etc. at the company's premises can be useful to know.

Also labels on packaging can provide an indication, although one always has to be careful not to take the label as a guarantee! There may be something different in the packaging!

Another source may be found in the files of the police in case the company has been prosecuted and/or convicted before, because of acting against the law. This information may include the reliability of the persons that are in the lead of the company and thus of possible offences against the law. Dependent on the ruling national legislation this information may or may not be used as a source for environmental inspectors.

Complaining citizens or non-governmental organisations (NGO's) may provide useful information on forbidden activities. This can occur through personal contacts with inspectors, but also through a special telephone (or internet) service provided by local, regional or national authorities in order to take citizens complaints seriously into account. In many countries environmental inspectors consider complainers as allies. Of course an inspector will always take care to verify the information of any complainer or witness before taking it as the truth. The higher the consciousness of citizens on environmental problems, the better the quality and quantity of their information supply towards the authorities.

Observing a company may also supply an inspector with valuable information, e.g. the number of trucks entering or leaving the company grounds with raw materials, waste or end products, the colour of the surface waters in nearby streams, the colour the nearby soil, the state of the vegetation nearby the company, near surface water borders or following the dominant direction of the wind. But also the 'smell' that hangs around a company.

These observations can be supported by taking pictures, not only from the landside but – if available- from the air, if possible even with infrared photography. This can provide very useful information about the spots of possible (illegal) emission sources.

The internet becomes more and more an important source of information, also for environmental inspectors. It may provide a lot of technical information on a company's processes, not only because an individual company may have an internet-website, but also by searching information on the web on issues found in written files. Sometimes even a comparison can be made in case of company's that work in more than one country and present themselves on the web. This may reveal difference in approach in different countries. It can be interesting to investigate why this is.

2.3 Qualification and Training of Inspectors

Taking into account the accuracy and precision, the quality considerations and all safety precautions, getting a good sample in safe way is not an easy job. So far as known there are no special educations or certifications needed to take samples, which can also be used as evidence. For example in The Netherlands any inspector could take samples as long as the accepted guidelines for sampling are followed.

Nevertheless it's of great importance an inspector is to practice his or her skills on a regular basis. In practice it happens some inspectors take samples on an almost daily basis while others only take a few samples a year or even less. Recommended is to have a yearly training. This could be done within the organisation itself (for example by the sample coordinator (if present) or by a third party.

The training should provide inspectors with proper sampling skills for a variety of media, i.e. solid, liquid or gas phase. It should include: safe techniques; laboratory requirements; sampling protocol; location selection; and, other related topics. The training should also be concentrated on the presentation of demonstrated "best available technologies" related to field techniques, laboratory expectations, standard operating procedures as defined within published standards/regulations

2.4 Inspection Attendees

An inspector may carry out the sampling on his own. Certainly not always this will be possible. This may be because of the complexity of the sampling in a technical way (for example: taking representative air samples should always be taken by special experts within this field) or in a physical way; but also because of safety reasons. For that reason it is good practice that inspectors are attended by others.

The need may be determined by things like the place where the site is located (rocky area, swamp, industrial area, stack, hostile area, etc.), when the sampling will take place (daylight, night, snow, rain etc.), the kind of sample (air, water, noise, soil etc.), technical complexity.

Depending on the specifics of these circumstances the inspector may be attended by:

- Another inspector;
- Someone from the ministry of environment;
- Local or regional officials;
- A technologist from a laboratory;
- An expert (or experts);
- A (or more) police-officer(s).

To avoid misunderstandings and thus to safeguard the sampling quality it is recommended to conduct the sampling by two people at least. Of course in all cases it has to be established who is in the lead. This has to be determined before arriving at the site. This person is responsible for the coordination of the inspection and the on-the-spot decisions.

2.5 Making a Sample Plan

Prior to conducting a sampling a sample plan has to be developed. This plan will serve as a guide in performing the sampling. The amount of detail necessary depends on the purpose of the sampling and to whom the results will be submitted. As a minimum, the plan should include the following.

1. Introduction

Reason: define the reason for sampling.
Purpose or aim: define the purpose or aim of sampling. The aim is leading for the strategy that will be followed. The purpose can be:

- Determination of the chemical substances in water, soil, air or waste. The strategy should be aimed for representative samples. Important in this is the amount of sample points, the location, depth of sampling and the question if composition samples should be made.
- Determination of the source of the pollutants. The strategy should be aimed on the relation between pollutants and emissions. Important in this is describing the situation, and to support this with spot samples.
- Determination of the dimension of the pollution. Important in this is to spread the sample points as good as possible over the sample area.

Describing the location: where is the location situated, what kind of surface and activities are taking place, orientation in space (the background).

2. Describing object

How does the non-compliance record regarding permits and legal obligations looks like. Are there any suspicions, complaints or statements about illegal activities.

Description strategy: describe in the plan the components that will be sampled and the strategy that has to be followed.

Note: If is a criminal investigation in progress, if so the sample strategy will have to follow the criminal investigation strategy.

The characteristics of the substance to be sampled: during the sampling a pollution of the substances has to be assumed. Possible pollutants have to be identified and safety regulations will have to be taken.

Register and report: in most cases it is recommended to take photos or videos of the situation before the sampling start (before getting the technical evidence). A situations sketch should be made which will include locations, sample points and measurements. Further, sample registration forms should be used to describe the composition, the amount and the method of sampling.

Note: if any products (like pesticides) are being sampled, make sure to make all necessary arrangements for confiscating (chain-to-custody).

3. Sampling equipment

Define the necessary equipment; like sampling materials, registration material and tools.

4. Packaging and transport

Packaging: for every kind of sample the package material should be defined.
Transport: describe by whom, how and when the samples will be transported. Further if transfer to the laboratory will take place right away or if the samples will first be stored.
Storage: define the storage conditions; don't forget the contra-samples.

5. Co-ordination

Co-ordination of the sampling: address the function of co-ordinator. He will be responsible for the progress of the sampling, the safety of the people taking the samples, and when necessary to call-in help from experts.

Contacts with participants: the co-ordinator will maintain the contacts with the suspect and other people involved.

6. Safety

The characteristics of the substances: define the hazardous substances that will be encountered and the protective equipment will have to be used during sampling.

Measurements: describe when, which and how measurement will take place.

Personal protective equipment: describe the personal protective equipment and other safety materials. Describe how used clothing will be handled afterwards.

Responsibilities: describe who is responsible for safety. This can be the sample co-ordinator like described above or a special safety co-ordinator.

Note: The plan should also mention that any instructions from the (safety) co-ordinator will have to be followed at once.

7. Composition of the team

Describe the composition of the sampling teams (names, function or duty) and describe the workload, the way of communication and the estimated time path.

2.6 Measurement Methods

Monitoring must be based on recognised and validated methods, which are generally termed "standard" methods, where they are available. Standard methods are produced by CEN, ISO and the national standards organisations in the different states. Two key issues in relation to standard methods are:

- who chooses, proposes or specifies the standard method for use in a given situation;
- how is this method judged to be acceptable.

Standard methods may be chosen, proposed or specified for use in a compliance monitoring programme by:

- the competent authority - this is the usual procedure;
- the operator – this is usually a proposal which still needs approval by the authority;
- an expert – this is usually an independent consultant who may propose on behalf of the operator; this proposal still needs approval by the authority.

When deciding whether to approve the use of a method the competent authority is generally responsible for deciding if the method is acceptable, based on the following considerations:

- fitness for purpose - is the method suited to the original reason for monitoring as shown for example by the limits and performance criteria for an installation;
- legal requirements;
- facilities and expertise – are the facilities and expertise available for monitoring adequate for the proposed method e.g. technical equipment, staff experience.

The choice of measurement method may be constrained and/or informed if it is:

- defined in legislation;
- recommended in published technical guidance.

2.7 Duration of the Monitoring

The total duration of a monitoring programme is often aligned to the operating life of a process, particularly when the timeframe(s) of any harmful effects are short compared to the operating life. However, monitoring may sometimes need to start before a process has begun operating (e.g. to establish baseline ambient concentrations before any extra impacts from the process). Similarly, monitoring may sometimes need to continue after a process has ceased operating if its harmful effects are more long-lived (e.g. monitoring of groundwater after closure of fuel depots, landfill sites or nuclear installations).

2.8 Frequency of the Monitoring

The frequency of monitoring refers to the time between individual measurements or groups of measurements at a process or in a receiving environment. It can vary widely between different situations (e.g. from one sample/year to on-line measurements covering 24-hours/day). Monitoring frequencies can be divided into two main categories:

- continuous;
- non-continuous.

Non-continuous monitoring can be further divided into four sub-categories:

- periodic;
- response;
- reactive;
- campaign.

Descriptions of the possible approaches, which should be considered, are noted below:

- Continuous monitoring: This involves an ongoing series of measurements that provide data with a high time resolution (e.g. continual readings from rapid-response instruments). The data are often available in real time (e.g. as instrumental read-outs or electronic displays) and so are useful for short-term process control purposes. Continuous monitoring may be relatively expensive compared to non-continuous monitoring depending on the required frequency of periodic measurements. Also, it may not be an option for some pollutants / situations. This may be because appropriate continuous instruments have not yet been developed, or detection limits are too high to allow measurements without pre-concentration of samples, so that pollutant samples must be accumulated over a period in order to be detectable.
- Non- continuous periodic monitoring: This involves measurements made at regular intervals in order to cover a defined part of the operating time of a process. It may involve spot measurements made at regular intervals, analysis of samples accumulated over regular periods, or instrumental data obtained at regular intervals during operation of the process. The periods of monitoring should be specified in advance (e.g. in a permit or legislation) and designed to be representative of the total operation.
- Non- continuous response monitoring: This involves measurements made in response to special events which are foreseeable but cannot be precisely scheduled (e.g. start-up and shut-down conditions, low and high utilisation conditions). The monitoring is done at irregular intervals. It is "routine" because the events to be measured can be anticipated but not their timing.
- Non- continuous reactive monitoring: This involves measurements made in reaction to special events such as exceeding of limits, which cannot be foreseen. The work is therefore devised on an ad-hoc basis rather then being specified in advance, and is done at irregular intervals. Because of the nature of this monitoring it may not be possible to specify the measurement methods in advance.
- Non- continuous campaign monitoring: This involves measurements made in response to a need or interest in obtaining more fundamental information than routine, day-by-day monitoring normally provides. The types of events which may trigger campaigns include evidence of epidemiological effects, and permit applications for new processes where baseline monitoring is needed to aid assessments. Campaign monitoring usually involves measurements that are relatively detailed, extensive and expensive, so that they cannot be justified on a regular basis. Examples are: sampling of dioxins in soil around incinerators; detailed speciation of volatile organic compounds for odour or other investigations, studies to verify more conventional measurements and estimate uncertainties, eco-toxicological surveys, and fundamental research studies.

3. SAMPLING TOOLS

3.1 Sampling Equipment

The laboratory can provide information on the types and volume of samples needed for particular pollutant parameters, sample preservation methods and holding times, and shipping instructions. They may also provide equipment, such as samplers, pH meters, sample containers, chain-of-custody forms, sample labels, tags and seals.

Prior to the sampling trip, any required sampling and safety equipment should be assembled, cleaned, and checked to ensure that it is in proper working order. All necessary paperwork should also be prepared prior to the trip. This may include assembling and marking, as possible, the required sample container labels or tags, forms an lab request sheets. Sampling and field analytical equipment such as pH meters should be calibrated.

Equipment and materials:

- Certificate of designation, identity card or badge
- Camera/video camera
- Notebook
- Watch
- Explosion-proof flashlight
- Checklists
- Pens
- Important telephone numbers
- Site file
- Spare batteries
- Soil sample drills
- Sealing materials
- Spark-free vessel key
- Stainless steel spade
- Glass pipette
- Plastic container (chemically resistant)
- Glass container (for oil, grease, phenol, organic samples)
- Amber glass containers (for iron cyanide)
- Containers with Teflon lined lids (for volatile organics)
- Electronic thermometer
- Electronic pH/C thermometer
- Plastic bags that can be sealed
- Aluminium dip sticks
- Storage crate
- Measuring tape (roll-up)
- Compass
- Cool box

3.2 Clean Tools / Equipment

Sample tools can easily be contaminated. Cleaning them is crucial under all circumstances. In case of oil or greases it can be clever to put and transport them in sealed plastic bags. The best way to act is to clean sampling tools and protective clothing immediately after use and to store them separately where necessary. The laboratory that will be performing the sample analyses may be contacted for specific cleaning instructions. Some laboratories may provide pre-cleaned sample containers.

To clean sampling materials and protective clothing the following cleaning products may be used:

- green soap;
- benzene;
- nitric acid (0,1 M);
- water;
- (soft) brushes;

- cleaning cloths;
- tube brush.

Try to remove the contamination with cold or hot water using brushes, non-perfumed tissues and cleaning cloths.

Inorganic contaminations can be removed with water with some acid. Organic contaminations can be cleaned with benzene, denatured alcohol, green soap or another phosphate free detergent. Equipment of stainless steel and Teflon may be cleaned in a dish-washer. High-pressure spraying pistols and steam cleaners are very good to clean drill pipes. In all cases the equipment should finally be rinsed out with water. Let the equipment dry in warm or cold flow of air and store it dry and dust free.

In case it is no longer possible to clean the equipment or in case deficiencies on the equipment are discovered, the equipment should be replaced as soon as possible. Some equipment has only a limited life-time and has to be replaced anyhow. For example gas tube filters, gas detections tubes, safety helmets.

Other means (of detection), like the pH-meter, need calibration from time to time. Take care that you have an administrative system to take care that this happens in time.

Inspectors should be aware of all requirements regarding the proper disposal of sampling equipment. Where equipment has been damaged or contaminated to the point that it is no longer usable, such equipment should be properly cleaned, sealed, and deposited in the appropriate waste containment facility. Broken glass bottles or jars and glass thieves require wrapping in multiple layers of newspaper prior to placing in bags. If contaminated, this broken glassware will require depositing in an approved hazardous waste storage or handling facility. If it is necessary to reuse glass or metal sampling equipment, inspectors will need to decontaminate these implements after each sample. As described before, decontamination normally requires washing and rinsing, which creates a waste that should be disposed of in accordance with the applicable regulations.

4. TAKING THE SAMPLES

4.1 Air

We started this part of the Reference Manual document by explaining the aim of this manual “Environmental sampling”. Again we would like to emphasize this chapter is give the inspector more understanding in problems and difficulties that come with waste gas monitoring and thus better understanding in interpretation of the measurements results, and not to perform all these measurements them self.

4.1.1 General aspects of waste gas sampling

Emissions from a process include both gaseous and particulate pollutants and the sampling and measurement techniques required to provide an accurate measurement of each are entirely different.

Particulates are an inhomogeneous suspension in the gas stream and rather more complex sampling procedures are applied to obtain a representative sample. In contrast the gaseous pollutants can be regarded as being a relatively homogeneous mixture in the stack gases and it is a fairly simple matter to obtain a representative sample. The main problems in sampling gaseous pollutants occur with fairly reactive gases where sample transport and conditioning is of paramount importance.

Continuous and periodic (discontinuous) monitoring

Both particulate and gaseous pollutants can be monitored continuous or periodic. The basic differences between continuous and periodic monitoring are:

- Periodic sampling, carried out by manual methods, is generally labour intensive and requires relatively well trained staff to obtain representative results;
- Periodic monitoring does not give a continuous record of the process emission conditions. Many separate measurements have to be made to provide data which will stand up to statistical analysis;
- Periodic manual sampling provides more accurate results from the point of view of being more easily traceable and therefore such methods are often used for calibration of continuous monitors;
- Continuous monitoring is more capital intensive but, with a service contract for maintenance and calibration, may be comparable with manual sampling in the long term;
- Whether continuous monitoring is justified may depend on the size of the process, the emission limits which have been set and the availability of suitable continuous monitoring equipment;
- Continuous monitoring equipment is only available for a limited number of pollutants although most pollutants can be monitored continuously at a price;
- Continuous monitors give a continuous record of the emissions from the process and provide instant indications of problems with emission control equipment. For this reason they are favoured by regulatory authorities wherever instrumentation of reasonable cost is available e.g. NOx;
- Continuous monitors may be less accurate in an absolute sense than manual standard methods but they are amenable to statistical analysis because of the vast numbers of data points obtained;
- Continuous monitors require periodic calibration against standard manual methods.

As a general rule manual standard methods are required to verify the results from continuous monitors but continuous monitors, provided that they are properly calibrated and maintained provide better information for regulatory authorities and plant operators alike. Cost is likely to be the deciding factor in many cases.

In situ and extractive monitoring

Continuous monitoring can be subdivided into in-situ monitoring where the duct is (in effect, the measuring cell) and extractive where the sample is extracted along a sampling line to a measurement station which may be quite remote from the duct. If a sample has to be withdrawn from the duct, handled and passed on to a measurement system, errors are introduced. Therefore, if the measurements can be carried out in-situ, without the need to extract the sample and handle it in any way, the errors are much reduced.

However, it is more difficult to standardise or calibrate in-situ instruments. On the other hand, in extractive systems great care is required in designing the gas handling system in order to preserve sample integrity but calibration of the instrumentation with standard gases is relatively easy.

A wide range of techniques are involved not all equally applicable to each measurement situation. In making measurements to test regulatory compliance, instrumentation needs to be of a high standard and some countries, for example Germany, operate an approval procedure. The typical approval procedure is designed to check instrumentation under laboratory and operating conditions to ensure satisfactory performance and reliability both from the point of view of the measurements made and with respect to safety and robustness. As a result of this procedure it is possible for the German Government to produce a manual on continuous emission measurement which contains lists of manufacturers and equipment which is approved for regulatory compliance measurements.

4.1.2 Gaseous pollutants

When sampling any gas, care is necessary to ensure that the integrity of the sample is preserved between the sampling point and the collector or analyser. In in-stack techniques this requirement is obviated because the sampling stage is avoided. For most gases it is necessary to sample the gases through a heated line constructed from an inert material. The heated line is necessary to prevent condensation of water and subsequent loss of water soluble gases from the sample. In addition, volatile organic compounds can be lost by condensation. An alternative to extraction using heated lines is a dilution probe system. This technique involves the addition of an inert, stable zero gas (such as dry nitrogen or synthetic air) at the probe to reduce the dew point of the sample gases thus eliminating the problem of condensation.

It is necessary to construct the sampling lines, and other surfaces exposed to the sampled gases, of inert materials, otherwise losses of reactive components will occur. For example sulphur dioxide and oxides of nitrogen both undergo reactions with stainless steel. Hydrogen fluoride reacts with almost everything and only PTFE (which can only be used below its temperature of decomposition) has been shown to be an adequate material for the sampling lines.

Periodic monitoring of gaseous pollutants

There are several aspects that must be taken into account while caring out the monitoring. A general idea of the compounds that are present is necessary, in order to choose a suitable analysis method in which interferences are reduced to a minimum.

Sample time: Generally sample must be collected at least until it is detectable, or at least make sure that the concentration is less than a certain value. If the time for sampling is too short it is necessary to have a more sensitive analytical method, which may be more expensive. If the sampling time is too long it might be necessary to dilute the sample to have a concentration in the optimum range of detection of the analytical method.

Sampling time / contamination level: When the mean value of the concentration of a pollutant is the desired result, the longer the sampling time the closer we are to that mean value. On the other hand, when what is wanted are the peak values the sampling time should be short enough so that peak values are not hidden by averaging in time.

Flow rate-control: A way to shorten the sampling time could be to increase the flow rate; but this flow rate must be adequate. If too high the efficiency of the collector is decreased, the filter could break, and preferential lines in the collectors could appear.

Stability of the sample: Frequently, the pollutant to be analysed can be altered, decomposed, or transformed into other compound during the sampling process itself and the period before analysis. Some pollutants may be absorbed onto the walls of the container and onto the sampling equipment; consequently it is recommended that the sample is not stored for a long period. In order to avoid these problems the sample should be kept in darkness, at a low temperature (typically less than 4 degrees) and occasionally some chemical reactants could be added for preserving the properties of the sample unit analysis. In general, the materials that are in contact with the sample are made of borosilicate glass or PTFE.

Parameters to measure while sampling: The personnel of the field should provide also some additional data of the conditions of the sampling point, particular the pressure and the temperature.

Equipment for periodic monitoring of gaseous pollutants

The methods for periodic monitoring generally include the use of sampling trains, which may be included in the same apparatus as the particle-sampling device. This equipment should consist of at least three devices:

- A flow measurement device to calculate the volume of flow to sample. It should be exact and properly calibrated;
- A pump to extract the sample, it is advisable that the pump is of constant flow type since the volume of air extracted can then be more easily calculated;
- A sample collector, whose mission is to collect the gaseous compounds to be determined, it is desirable that this collector has both high efficiency and known efficiency for the gas that is being sampled. There are several methods in use:

  - *Absorption by solutions*: usually called impingers. The most widely used. The gas is bubbled through a suitable solution and is trapped in the solution by direct solutilization or by chemical reaction.
  - *Adsorption on fine solids*: some gases can be adsorbed onto finely divided solids.
  - *Cooling techniques*: they consists of containers that are kept at temperatures increasingly lower, so that in each container there is the condensation of those gases whose boiling point is higher than the temperature in that container.
  - *Detector tubes*: the simplest manual method for monitoring gaseous pollutants. Detector tubes consist of a glass tube packed with a chemical reagent which changes colour on contact with the specified gas. The length of stained reagent is proportional to the concentration of the gas in a measured volume of sample. These methods are semi-quantitative in that the samples have to be taken in exact accordance with the manufacturer's instructions, they suffer from interference problems, the confidence limits are wide and they were developed for workplace atmosphere monitoring rather than source monitoring. Nevertheless under certain circumstances, where it has been shown that there is reasonable agreement between the detector tube and a standard method, tubes may be useful for an approximate indication of pollutant emissions.
  - Other simplified methods: such as sample bags or personal sampler pumps can be used if appropriate.

Continuous monitoring of gaseous pollutants

Extractive systems are those in which the gas is extracted from the stack continuously along a sampling line, transported and conditioned before entering the analyser unit. The sampling point should be selected so that it is representative of the gas stream.

Great care should be taken in the transportation and conditioning of the gases. The sampling lines must be made of material that ensures that no reaction occurs with the compounds of the gas, the compound to be measured is not absorbed/adsorbed onto the line, and materials from the sampling line is not added to the gas.

Condensation of water in the sampling lines must be avoided since there could be losses of gases that are dissolved in the water; in addition condensation of other gases should be avoided. There are two usual procedures to avoid this, the first is by heating the lines to maintain the gases above their dew point, and the second by diluting the gas with an inert gas (for example with nitrogen).

Extractive systems should be calibrated as complete systems to avoid problems caused by absorption/adsorption within the system prior to calibration.

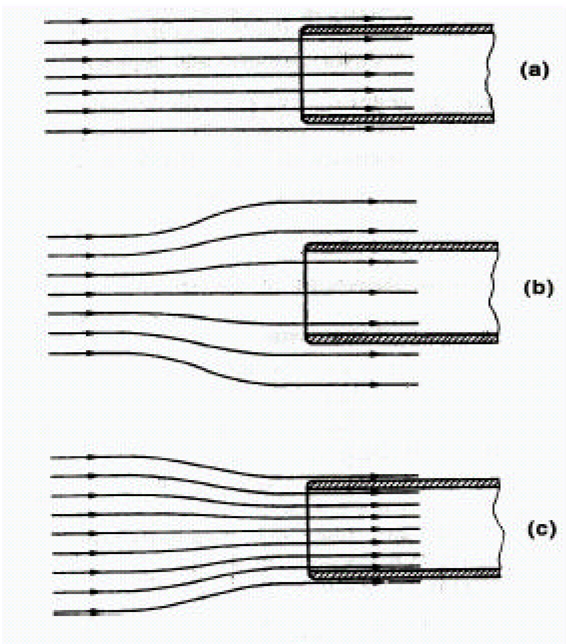
In-situ systems are those in which the measuring cell is the duct itself; they are based on a beam of a certain wavelength that crosses the duct and it is attenuated proportionally to the concentration of the compound. As there is no extraction of the sample the problems related to its handling are not discussed further. The window through which the beam passes must not absorb radiation at the selected wavelength and should be maintained perfectly clean.

4.1.3 Particulate pollutants

Periodic monitoring of particulate pollutants

In order to ensure representativeness of the sample, providing the wide range of particle size, it is necessary to sample isokinetically; this is that the velocity at which the sample enters the sampling nozzle is the same as the gas velocity in the duct. This is necessary because the particles of small size (say less than 5µm) follow the flow lines, as in picture a, and if the sample is not taken isokinetically there will be increase or a decrease of the particles sampled.

If the sample velocity is less than the gas velocity in the duct, as in picture b, there will be a reduction of small particles captured and, consequently, the percentage of large particles (larger than about 5µm) in the sample will be higher. If the sample velocity is higher than the gas velocity in the duct, as in picture c, there will be an increase in particles captured and the percentage of small particles in the sample will be higher.



Picture 1 (Illustration of the Principle of Isokinetic Sampling)

Because of the importance of isokinetic sampling in particulate sampling one of the most important facets is the measurement of flue gas flow profiles within the duct at the point of sampling. The relationship between the highest, lowest and mean pitot-static readings are used to decide whether a particular sampling point is suitable for making particulate measurements.

It should be emphasised that an isokinetic sampling does not cause a sharp cut off at a particular particle size. At any particular sampling rate, some particle sizes will be sampled totally; others will not be sampled at all. Particle sizes in between will be partially affected and the magnitude of the effect will be dependent on the degree of divergence from the isokinetic condition. The choice of 5µm to illustrate what is a small particle is fairly arbitrary and is used simply as a guideline.

Equipment for periodic monitoring of particulate pollutants

The equipment for sampling particulates include a sharp sampling nozzle, carefully designed, a sampling flow rate measurer, and a particle separator, which can be located inside or outside the duct. If it is outside the duct, provision to avoid condensation of compounds should be made by heating the probe and the particle separator. The separator can be a cyclone, a filter, or both. An adequate filter should comply with the following:

- The material of the filter should be selected so that it does not react with the material of the particles and dissolve it.
- The filter should be temperature resistant, according to the level of temperature of the particles.
- Where the composition of the sample is required care must be taken so that the filter does not add or change any compound of the sample.
- The capture efficiency of the particle size that we want to sample should be known.

The sampling point for periodic monitoring of particulate pollutants

The sampling point should be located, if possible, at least four pipe diameters downstream and two upstream of any obstruction or change in flow direction. For rectangular pipes, the hydraulic diameter is used instead of the diameter. In any case a minimum distance of not less than one pipe diameter and preferably upstream from any disturbance should be used. If particles could be large enough to have an appreciable settling velocity the location of sampling point should be in a vertical duct.

A preliminary test should be done to check the suitability of the sampling plane. Velocity and temperature are measured in a number of points equally distributed across the sampling plane; if the temperature differs more than 10% from the adjacent points the location is not suitable and another location where the flow is more homogeneous should be sought.

Once the sampling plane has been chosen the number of sampling points and the distribution of them across the sampling plane can be selected from the following table. It's recommended that the number of points is not less than 4. See table 2.

Table 2

Recommended number of sampling points	
duct diameter (in meter)	**number**
0 - 0,8	4
0,8 - 1,5	8
1,5 - 2,2	12
2,2 - 3,1	18
3,1 - 4,2	24
4,2 - 5,5	32
5,5 - 7,0	40
>7,0	>40

The duration of the sampling depends on a number of factors, including the concentration of particles and the accuracy of the weighting. Under ideal conditions in the duct, the inaccuracy is about 10% of the particle concentration.

Continuous monitoring of particulate pollutants

There exist several types of continuous particle monitors; these are in-situ equipment, where the duct is, in fact, the measuring cell. Since they make the measurement through the whole stack cross section, the location of these instruments is not critical; but it should be noted that these methods are calibrated against standard manual methods which should be placed as close to the in-stack monitor as possible and complying the basic provisions stated above.

Equipment for continuous monitoring of particulate pollutants

Continuous particle monitors should be of a high standard and approved by the competent authority. They include the use of:

- Transmissometers, which are based on the transmittance of light through the absorbing gas stream. They are the most frequent used. Range from 10 mg/m^3 to 2000 mg/m^3.
- Beta attenuation monitors, which are based on the attenuation of a beam of Beta rays. Range from 2 mg/m^3 to 2000 mg/m^3.
- Light Scattering instruments, which detect under 15-degrees-scattered light. For low concentration up to 1 $mg/m^{3.}$ No standard manual methods are available for calibrations.
- Tribo-electric systems, which measure the current created when a particle collides with a rod, which depends on the particle size distribution and composition. For concentrations less than 1mg/m^3. This system needs careful calibration.

However all these methods are only as accurate as the calibration undertaken by way of an extractive system, which is about 10%.

4.2 Water

There are two basic types of samples: grab and composite samples. Both types can be used in open en closed wastewater systems.

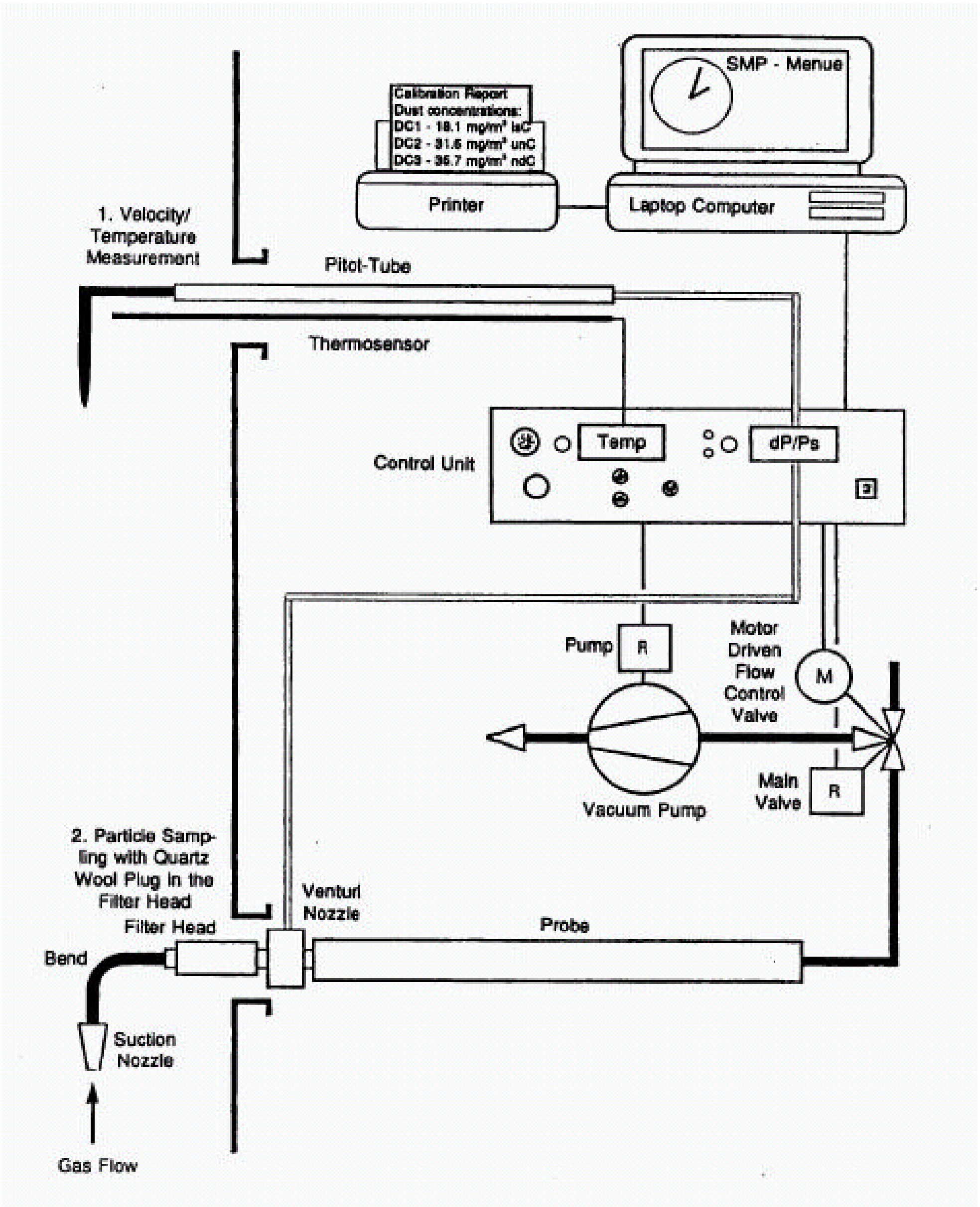
4.2.1 Grab samples

Grab samples are individual samples collected over a period of time not exceeding 15 minutes and represent waste stream conditions only at the time the sample is collected. Grab samples are usually taken manually but can be collected using an automatic sampler. Grab samplers may be appropriate for batch discharges, constant waste conditions, to screen the discharge to see if particular pollutants are present, or if extreme conditions such as high pH are characteristic of the discharge.

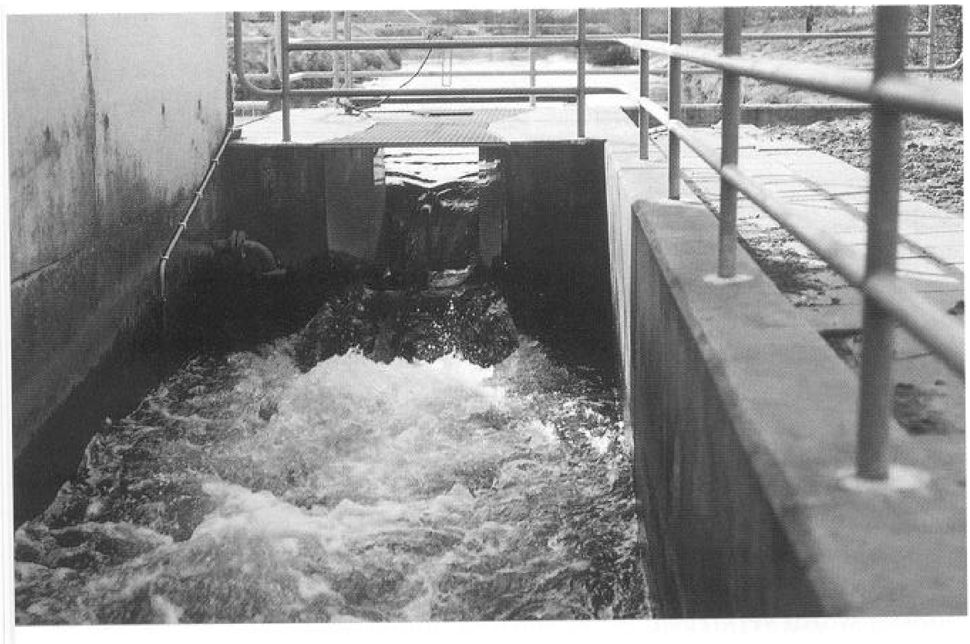
Further, grab samples should be collected for pollutants that tend to change or decompose during the composition period such as pH, cyanide, total phenols, and volatile organics. Also, grab samples should be collected for oil and grease samples since oil and grease tends to adhere to sampling equipment.

Location

Grab samples should be taken in the turbulent and well mixed area of the flow, where the chance of solids settling is minimal, except if the samples that have to be analysed are volatile compounds and dissolved gasses. When sampling, the surface should not be skimmed nor should the channel bottom be dragged. Samples should not be collected from stagnant areas containing immiscible liquids or suspended samples.



Picture 2 (automatic Isokinetic Sampler)



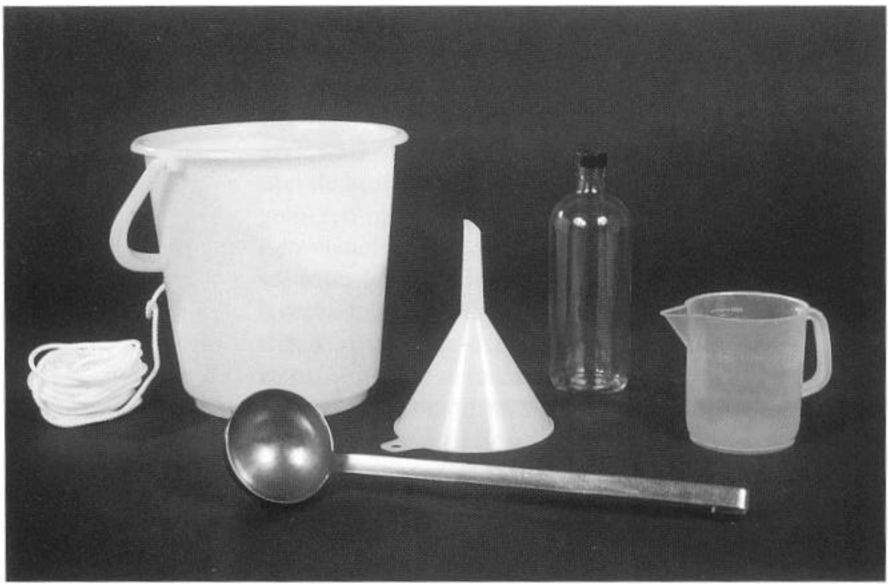
Picture 3 (open water system)

Method

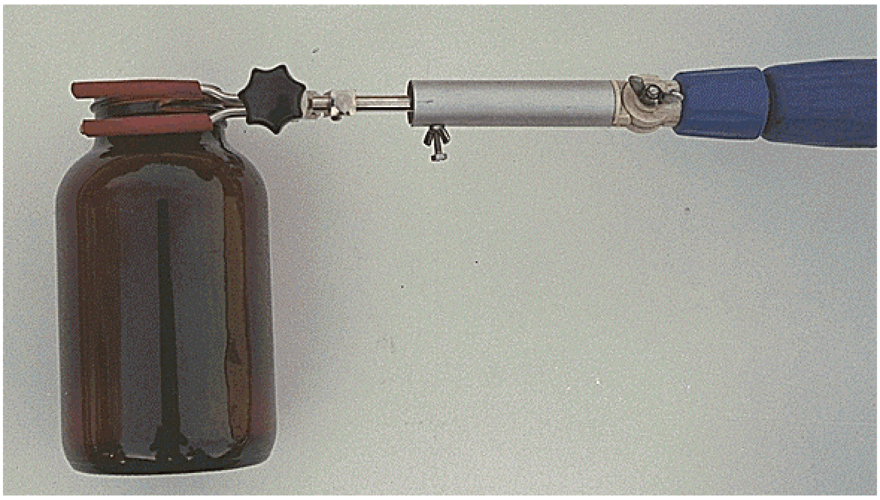
Wastewater streams can be distinguished in open and closed systems.

Samples from an open system (for example a channel) can be collected by:

- sample bowl: with a simple sampling bowl it's possible to take an amount of water from the stream, A funnel can be used to pour the water in a sample bottle;
- bucket: if the sample should be analysed on more parameters, and there for more bottles should be filled, it is to be recommended to use a bucket to take an amount of water from the stream. With the sample bowl water can be taken from the bucket using again the funnel to fill the bottles;
- sample bottle with stick: the bottle (which can be connected to a stick) should be hold down in the waste water stream to fill it up.



Picture 4 (simple sampling tools)



Picture 5 (bottle connected to a stick)

Samples from a closed system (for example a pipe) can only be taken if facilities for sampling are installed. A sampling facility could be:

- Automatic sampling device: which has the possibility to take manually a grab sample on any chosen time;
- Connection with a tap or valve: before taking the sample this part of the system should be flushed.

The tools should be made of inert material which will not influence the later to perform analysis. Actions like shaking and pouring should be minimized to the most necessary. During the sampling contamination of the sample should be avoided.

4.2.2 Composite samples

Composite samples are collected over time and reflect the average characteristics of wastewater during sampling period. Composite samples can be taken either by continuous sampling (automatic samplers) or by combining individual grab samples (manually). Composite samples are either flow proportional or time composite:

- In flow proportional sampling, the volume of sample collected is proportional to waste flow at the time of sampling. Flow proportional samples can be obtained by collecting various sample volumes at equal time intervals in proportion to flow or by collecting a constant sample volume per unit of wastewater flow. In case of automatic sampling the sampler will be controlled a flow indicator;
- Time composite samples consist of constant volume sample aliquots collected in one container at equal time intervals. For example, 500 millilitres of sample collected every 15 minutes over a 24-hours period. In case of automatic sampling the sampler will be controlled by a clock.

Composite samples may be needed to determine the average characteristics of waste streams, particularly if the waste stream has a highly variable pollutant concentration or flow rate. Composite samples should be collected during the entire period the facility is operating and discharging. For example, if the facility has processed that discharge 16 hours a day, samples should be collected during the entire 16-hours period.

Methods for automatic sampling

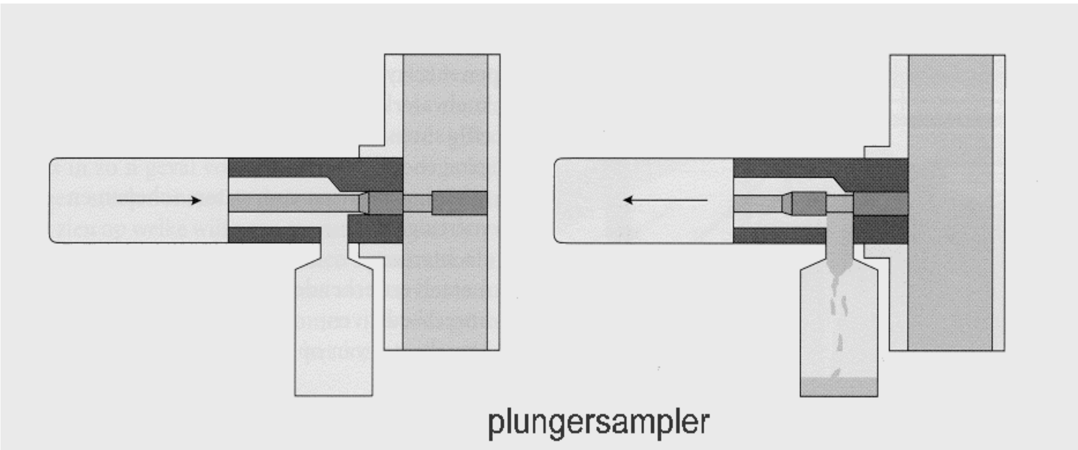
In this part a short survey of equipment will be given that can be used for automatic sampling of waste water streams in open and closed systems.

Open systems:

- Vacuum sampler: this is the most common method for open systems. With this equipment samples are collected with a vacuum pump through an intake nozzle (or suction pipe) to a sample container;
- Double check valve with pump: with this equipment part of the waste water stream is continuously pumped around through a by-pass. Samples are taken through the double check valve at an estimated time to a sample container (this system is also suitable for taking samples from pressure pipes);
- Hose pump sampler: with this equipment samples are being sucked by a hose pump and directed to the sample container.

Closed systems:

- Double check valve: with this equipment samples with a fixed volume are collected from a by-pass to a sample container;
- Plunger sampler: with this equipment samples with a fixed volume are collected with the use of a plunger from the main pipe or a by-pass to sample container.



Picture 6 (plunger sampler for closed water systems)

Location

Composite samples should be taken on a place were there is turbulence. With automatic sampling equipment in open systems the suction point should be located as close as possible downstream from an obstruction. With automatic sampling in a closed system the sampling point should not be located in a bend or a constriction. If wastewater is discharge by a pump the sampling location should be on the pressure side of the pump.

If using a vacuum sampler in combination with a closed system, the suction point of this equipment should be located on the position where the closed system is discharging into an open discharge system. With vacuum sampling the suction point should always be subsurface.

Distance between sampling location and sampling equipment

With vacuum sampling the suction hose or pipe should always be under a slope and as short as possible. The suction hose should be protected against freezing and direct sunlight, and should not have any twists or unnecessary bends.

Diameter pipes

To prevent any blockage in the sampling equipment the diameter of all streaming parts (from suction point to the outlet in the sample container) should be at least 13 mm.

Further, out of research a significant dfference is shown in the chemical oxygen demand (COD) in samples taken with equipment using 9,5 mm pipes and equipment using 13 mm pipes.

Suction speed (vacuum and hose samplers)

The average suction speed should be at least 0,3 m/s.

However, out of research there is no significant difference in COD results with speed of 0,3 m/s or 0,6 m/s.

Sampling interval and volume of sample

The sampling interval should be estimated in a way that a twenty-four hours sample should at least consist out of 100 small samples.

The sample volume needed for analysis depends on the type and number of analyses to be preformed.

HINT
The sampler should contact the person of the laboratory that will perform the analysis to determine sample volumes needed for a particular sampling event.

Sample containers

Sample containers should be made of chemically resistant materials that will not affect the nature or concentration of pollutants being measured. Containers must be large enough to hold the required sample volume.

- Glass containers should be used for oil and grease, phenol, and organics samples.
- Amber glass sample containers should be used for pollutants such as iron cyanide that oxidize when exposed to sunlight.
- Containers with Teflon lined lids should be used when collecting volatile organics.

In general, plastic containers are easier to handle and less likely to break, so this may be the best type of container if glass is not needed. Sample containers should be properly cleaned prior to use.

HINT **The laboratory that will perform the sample analysis should be contacted for specific cleaning instructions. Some laboratories may provide pre-cleaned sample containers.**

At the discharge of the sample to the sample container it should be prevented to let air into the container. If the composite sample is to be analysed on volatile organics the discharge of the sample into the sample container should be in a way that loss of volatile components is prevented.

4.2.3 Preservation and holding time of the sample

Many pollutants are unstable and may alter in composition prior to analysis. There for to ensure that samples remain representative, they should be analysed as soon as possible after collection. If immediate analysis is not possible, samples should preserved to minimize the changes in pollutant concentration between collection and analysis. There are three basic types of preservation:

- cooling;
- pH adjustment;
- chemical fixation.

The sample (sample container) should be stored at a temperature between 0ºC en 4ºC. This temperature should be reached as soon as possible after collecting the sample. Freezing of the sample should be prevented.

Out of research is significant difference is shown in COD results from samples stored at a temperature lower than 4 ºC and samples stored at a temperature higher than 15 ºC. Cooling suppresses biological activity and volatilization of gases and organic substances. Table 3 shows the holding time for a few parameters.

Even with proper preservation, samples should be analysed within certain recommended holding times. These holding times are the maximum times allowed between the time the sample is collected and when it is analysed. If composite samples are collected, the holding time limitations begin when the last aliquot is added to the sample. Performing sample analysis within the allowable holding times helps ensure that the analytical results are valid and representative of the wastewater. Certain pollutant parameters such as pH have no standard method of preservation and should be analysed immediately.

Table 3

Parameter	Temperature during storage	Chemical fixation	Max. storage life
Biochemical Oxygen Demand if suspected BOD < 50 mg/l	between 0^oC en 4^oC	-	24 hours
Biochemical Oxygen Demand if suspected BOD ^{3} 50 mg/l	between 0^oC en 4^oC	-	24 hours
	≤ -18^oC	-	72 hours
Chemical Oxygen Demand (COD)	between 0^oC en 4^oC	-	48 hours
		adjust pH to < 2 with concentrated H_2SO_4 (18M)	5 days
	≤ -18^oC	-	5 days
KjeldahlnItrogen	between 0^oC en 4^oC	-	48 hours
		adjust pH to < 2 with concentrated H_2SO_4 (18M)	5 days
	≤ -18^oC	-	5 days
Heavy metals (excluded Hg)	between 0^oC en 4^oC	adjust pH to < 2 with HNO_3 (15M)	1 month
Hg	between 0^oC en 4^oC	adjust pH to < 2 with HNO_3 (15M) and supplement min. 0,5 g $K_2CR_2O_7$ / ltr	1 month

4.3 (Hazardous) Waste

Sampling is generally conducted to verify the identity of a waste or to identify potential releases of hazardous wastes or constituents to the environment.

In most cases, sampling will not be performed during routine inspections. However, the inspector should be aware of, and identify, potential sampling requirements that may need to be fulfilled in future inspections, particularly in cases where the inspector has identified potentially non-complying conditions or criminal activity during the course of the inspection.

Reasons for sampling

There are many possible conditions or activities which may lead the inspector to determine that sampling will probably be necessary.

Examples of some of these conditions include situations in which:

- The owner/operator is handling a potentially hazardous waste as a non-hazardous waste. (Sampling may be required to verify that the waste is hazardous or non-hazardous).
- In-plant waste handling practices indicate that mislabelling/misidentification of waste is likely to occur, or that wastes may vary significantly in characteristic over time and be mismanaged as a result. (Sampling may be required to demonstrate that the facility is mislabelling or misidentifying wastes).
- There is visible or other observable evidence of possible releases of hazardous wastes from waste management units, satellite storage areas, waste generating areas, etc.(Sampling media and wastes may be required to demonstrate that a release has occurred or is occurring).
- Wastes may be being managed improperly, i.e., in an inappropriate treatment or disposal unit. (Sampling may be required to verify that the correct wastes are being managed in the facilities various waste management units).

4.3.1 Procedures for sampling liquid waste

Liquid waste stored in small unit

A small unit is defined as a package-unit smaller than 200 dm^3 (200 litre), like barrels and tins etc.

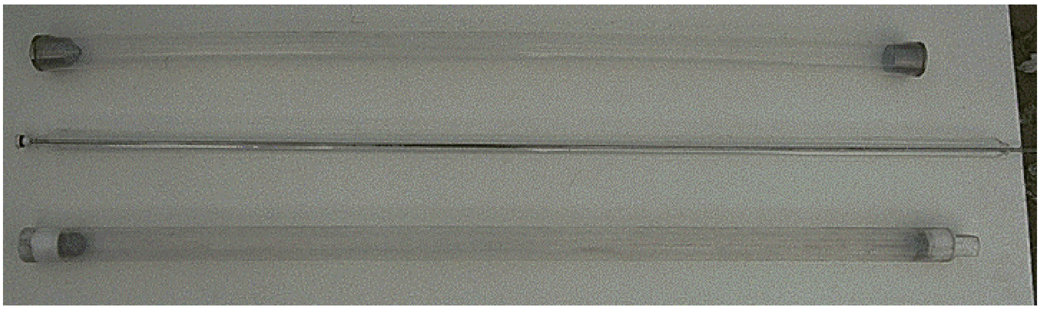
Defining the sample area

If more package-units are present, every single package-unit has to be considered as a sample area. Depending on the aim of the investigation all package-units or a few package-units will be picked out for sampling. The samples from the different package-units should not be mixed.

Sampling method

Make sure the cap or the lid of package-unit is on the top side and let the content of the unit come to rest. Provide a connecting bond between the package unit (if this is made out of metal) and a ground probe to prevent any discharging or accumulation of static electricity while sampling. Wear footwear with adequate conductivity. If the use of tools is necessary to release the cap make sure they are made of material which will not cause sparks. Copper is often used in this. Release the cap from the packaging-unit very slowly so pressure or underpressure can disappear. Remove the cap.

- Sampling siphons: Lower a sampling siphons into the package-unit and take a sample of the whole content (0,35 tot 1 dm^3). The complete content should be placed in the transport sample bottle. This method is often used for cylindrical barrels and other small package-units (see picture 7).

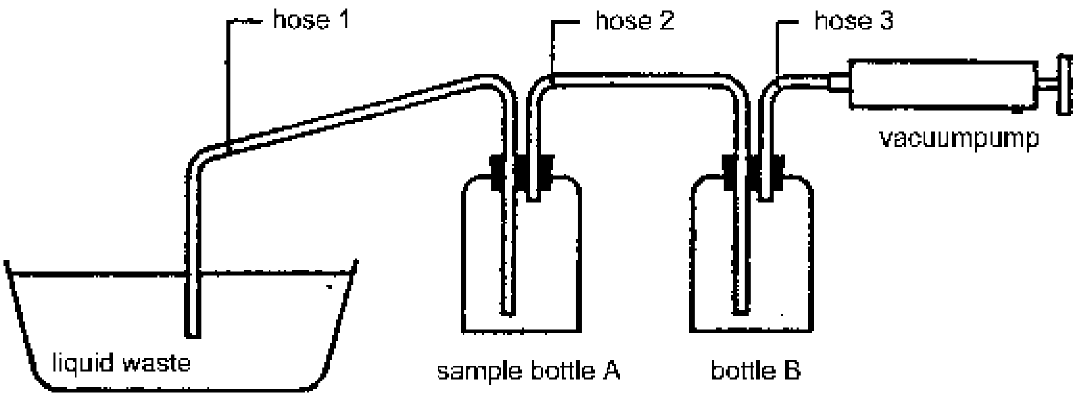


Picture 7 (sampling siphons)

- Pump or sample bottle: Take with a pump or with a sample bottle, samples from the middle of the top layer, the middle layer and the bottom layer of the package-unit. Work from the top to the bottom to prevent any turbulence of sediment in the lower layer. The volume of the samples should be 0,35 to 1 dm^3. The samples should be added to make the composite samples. This composite sample can be divided in to the transport sample bottles. Make an estimation of the volume of the different layers. In a later stage it could be important to calculate the average concentration from volume and the concentration of the different layers.

Liquid waste stored in cylindrical tanks

A cylindrical tank is defined as a lying, round package unit with a volume around 20 m^3, like a tank (lorry), tank wagon or stationary tanks.



Picture 8 (pump with bottle)

Defining the sample area

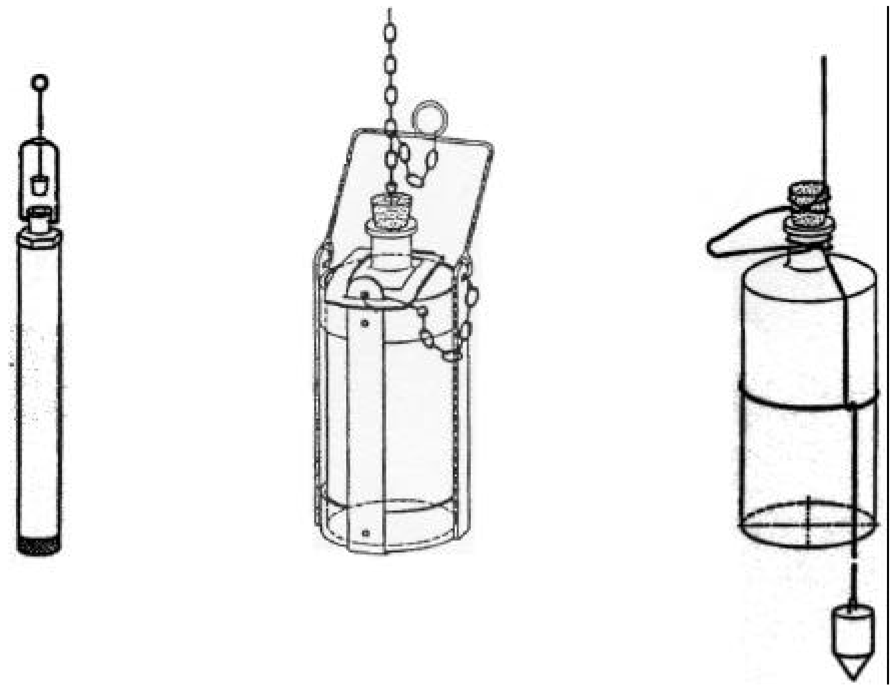
Any compartment within a tank should be considered as one sample area. If the tank is non-compartmentalised, the tank itself is to be considered as one big compartment. All compartments should be sampled individually. The samples from the different compartments should not be mixed.

Sampling method

Open the lid of the tank very slowly and carefully so any pressure or underpressure can escape. Caution: because of pressure in the tank the lid can lift itself with great force. Make sure to wear protective clothing and respiratory protection.

- Sample jug or sample bottle: depending on the level height of the liquid a top, a middle and a bottom sample, or only a middle and a bottom sample or just a bottom sample should be taken. See table 4. Work from the top to the bottom to prevent any turbulence of sediment in the lower layer The volume of the samples should be 0,35 to 1 dm^3. The samples should be added, in the volume percentage given in table 4, to make the composite samples. This composite sample can be divided in to the transport sample bottles. Make an estimation of the volume of the different layers. In a later stage it could be important to calculate the average concentration from volume and the concentration of the different layers. See picture 9.

- During unloading: It's also possible to take samples during unloading of the liquid. Be aware of static electricity; a truck or wagon should be connected to a ground probe. Take samples of 1 dm^3 after 20%, 50% en 80% of unloading. Before taking the sample the tap should be well flushed. See method sample jug or sample bottle for preparing the composite sample.



Picture 9 (different types of sample jugs / bottles)

Table 4

height of **liquid level in %**	**sampling level *in* % from bottom to the top**			*proportion of the composition sample in %*		
	top	middle	bottom	top	middle	bottom
100	***80***	***50***	***20***	***30***	***40***	***30***
90	***75***	***50***	***20***	***30***	***40***	***30***
80	***70***	***50***	***20***	***20***	***50***	***30***
70		***50***	***20***		***60***	***40***
60		***50***	***20***		***50***	***50***
50		***40***	***20***		***40***	***60***
40			***20***			***100***
30			***15***			***100***
20			***10***			***100***
10			***5***			***100***

Liquid waste stored in large unit

A large unit is defined as a package-unit larger than 20 m^3, like storage tanks on land and sea ships.

Defining the sample area

Every compartment within these sea ships and storage tanks should be considered as one sample area. If the sea ship or storage tank is non-compartmentalised, the ship or tank itself is to be considered as one big compartment. All compartments should be sampled individually. The samples from the different compartments should not be mixed.

Sampling method

Open the lid of the tank very slowly and carefully so any pressure or underpressure can escape. Caution: because of pressure in the tank the lid can lift itself with great force. Make sure to wear protective clothing and respiratory protection.

- Sample jug or sample bottle: Take with the jug or bottle a top, a middle and a bottom sample. Work from the top to the bottom to prevent any turbulence of sediment in the lower layer The volume of the samples should be 0,35 to 1 dm^3. The samples should be added to make the composite samples. This composite sample can be divided in to the transport sample bottles. Make an estimation of the volume of the different layers. In a later stage it could be important to calculate the average concentration from volume and the concentration of the different layers.
- Taps on tank: If the tanks are equipped with taps at different levels these can be used for taking samples. Before taking the sample the taps should be well flushed. See method sample jug or sample bottle for preparing the composite sample etc.
- Running sample or all-level sample: taking a representative running-sample requires a lot of experience. The idea is to lower the sampler in the liquid and after reaching the bottom raising it again in a constant speed. The sampling is correct if the sampler isn't filled completely (not 100%). The complete content of the sampler should be placed in the transport sample bottle.
- During unloading: It's also possible to take samples during unloading of the liquid. Be aware of static electricity; a sea ship should be connected to a ground probe. Take samples of 1 dm^3 after 20%, 50% en 80% of unloading. Before taking the sample the tap should be well flushed. See method sample jug or sample bottle for preparing the composite sample.

4.3.2 Procedures for sampling solid waste

Solid waste stored in small unit

A small unit is defined as a package-unit smaller than 200 dm^3, like barrels, tins and bags etc.

Defining the sample area

If more package-units are present, every single package-unit has to be considered as a sample area. Depending on the aim of the investigation all package-units or a few will be picked out for sampling. The samples from the different package-unit should not be mixed.

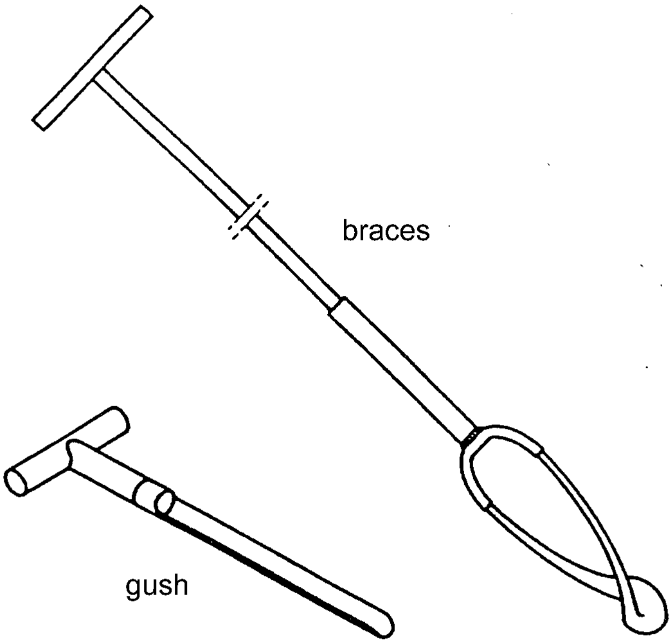
Sampling method

Make sure the cap or the lid of package-unit is on the top side or the bag is standing up right. Release the cap or lid from the package-unit carefully or make a hole in the bag.

- Gush: Depending on the waste material it's possible to use the Gush. Take a sample over the complete column (depth) of sample area. The volume of the sample and thus the size of the sampler depends on the size of structure of the waste. See table 5. The complete content should be placed in the transport sample bottle.
- Braces: If taking a sample over the complete column (depth) with the Gush isn't possible, the Braces is a good alternative. With the Braces it's possible to take a top, middle and bottom sample from the sample area. For the size of the samples see table 5. The samples should be added to make the composite samples. This composite sample can be divided into the transport sample bottles. See picture 10.

Table 5

Max. size in mm of structure	Min. diameter in mm of "guts"	Min. volume of sample and transport sample
5	15	1
10	30	2
20	60	5
40	120	10
80	use heavy equipment	40
> 100		100



Picture 10 (Gush and Braces)

Solid waste stored in large units

A large unit is defined as a package-unit larger than 200 dm^3, like trucks, containers, ships etc.

Defining the sample area

Every compartment within these trucks, containers or ships should be considered as one sample area. If the truck, container or ship is non-compartmentalised, the truck, container or ship itself is to be considered as one big compartment (sample area). At the samplers discretion a few compartments should be picked out for sampling. The samples taken from these compartments should not be mixed. When sampling a compartment is practically not possible a sample area within this compartment is to be defined. This sample area should have at least a volume of 5 m^3 with a depth of 1 meter (if the package unit allows this).

Sampling method

Make an estimation of the volume of the compartment (sample area). Define the number of sample point according to table 5 and formula below.

SP = 5 + (S / AD)

where:
SP = min. number of samples points (to be round up)
S = number of samples according to table 3
AD = average depth of the compartment or the sample area

Divide the sample points equally over the surface of the container or sample area (use a raster if necessary). Take a sample of the waste at each sample point over the complete depth of the container or the sample area that was defined.

- Gush and Braces: depending the structure of the waste material the Gush or the Braces should be used. The complete sample can be obtained by taking sub-samples at different depths until the column (the complete depth of the container) is completely drilled through. The volume of the sample and thus the size of the sampler depends on the size of structure of the waste. See table 5.

- During unloading: It's also possible to take samples during unloading of the waste. For example when unloading by conveyer belt. The min. amount of samples to be taken depends on the total volume of the waste. Divide the period of unloading in time intervals using the formula below and table 6.

TI = U / S

where:
TI = number of time intervals in hours to take a sample
U = period of unloading in hours
S = number of samples according to table 3

Add all the sampled materials (described in the methods above) to one composition sample. Divide the composition sample into one or more transport samples.

HINT
When sampling during unloading, make sure to take enough sample material since the sampling method cannot be repeated.

Table 6

total volume of compartment or sample area (in m^3)	min. number of samples
0 to 1	1
1 to 2	2
2 to 5	4
5 to 10	6
10 to 15	8
15 to 20	10
20 to 50	20
50 to 100	30
100 to 150	40
150 to 500	50
500 to 1000	60
> 1000	60 * √ (volume) / 1000

In case the compartment could not be sampled completely and therefore a sample area had to be defined, it's recommended to take some indicative samples from the rest of the compartment. These indicative samples can be added to one composite sample. The results of this indicative sample can be used to support the results of the samples taken in the sample area.

Solid waste not stored in units

Waste not stored in units is defined as waste dumped on a pile or spread over the ground.

Defining the sample area

Every separate amount of dumped waste which can be identified as a separate unit should be defined as a sample area. Investigate if within this sample area the type of waste is the same. If more types of waste can be identified, more sample areas has to be defined.

Sampling method

The sample area that has been defined should be sampled according to the method described for "solid waste stored in large units".

4.3.3 Sediment, slurry and sludge

Sediment, slurry and sludge is defined as a mixture of water and not or hardly solved solid materials, without a liquid and solid layer that can be identified.

Defining the sample area

Sediment, slurry and sludge are to be sampled in the same way as described for liquid waste. If this is not possible the sampling method for solid waste should be used.

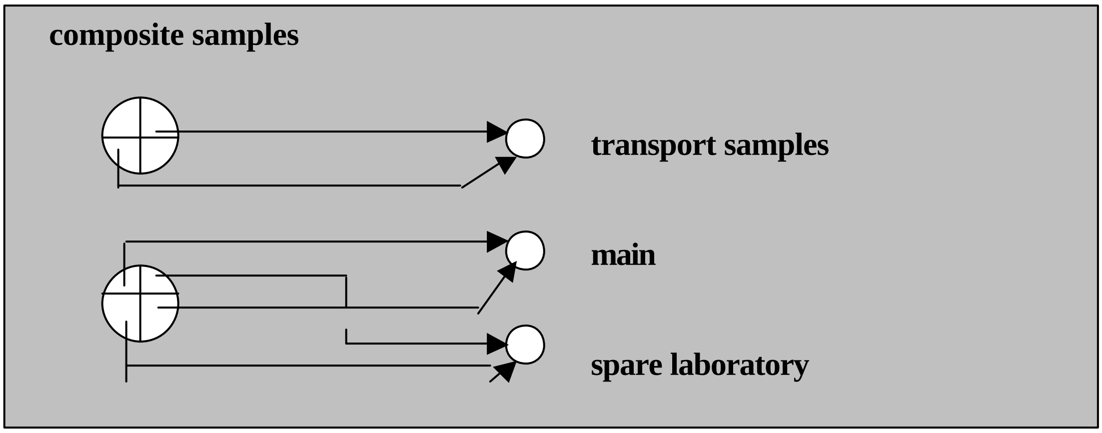
4.3.4 Transport samples

As described in previous chapters, samples should be added to make a composition sample from which transport samples can be made.

Number of transport samples

Depending on the aim of the investigation it is recommended to take one spare sample for the laboratory analyses and one spare sample for contra expertise. This makes the total of three transport samples for every sample point.

Dividing the composition sample into transport samples in case of solid waste the next method can be followed.



Picture 11 (dividing the composition samples into transport samples)

HINT
mixing the different samples into a composite sample can be done at the sampling area itself out of practical consideration, but it is to be recommended to do this at the laboratory.

Packaging

The most common used package unit for transport sample units is the bottle or jar made out of dark glass with screw cap. The dark glass will protect the material against the influence of light. If the material consists hydrogen fluoride or very strong acids glass can be affected and synthetic bottles have to be used.

- When transport sample consist of large amount of solid waste it's possible to us plastic bags.
- When transporting volatile organic materials the bottle or jar should be filled completely and should be closed gasproof.
- When transporting material that can develop gasses like sludge from a sewage treatment plant the bottle or jar should be filled for 75 %.

HINT
Out of safety precaution it's recommended to put the bottle or jar into a plastic bag.

4.4 Soil and Groundwater

This chapter describes the sampling of soil and groundwater (or soil water). For sampling soil there are similarities with sampling Solid Waste. To avoid duplication references to this chapter are made when necessary. In case of groundwater references will are made to the chapter Water.

Reasons for sampling

There can be many different reasons for sampling soil or groundwater, but the reasons for an inspector are most always connected to the knowledge or suspicion of contamination. This can be because an incident took place, a malfunction of an installation, the way a storage facility is operated or because of other clear visible indications (like colour of the soil).

In case of groundwater there can be another important reason next to determining the level and the substances of a contamination. If a contamination has been located or if there is a potential risk an operation could contaminate the soil or groundwater (for example a landfill) it could be important to see if there is no leaching into the groundwater. In this case sampling becomes monitoring. Effective water monitoring will provide early warning of water pollution and should allow corrective action to be taken in good time.

4.4.1 Procedures for sampling soil

Soil dumped on a pile or spread over ground (max. 1000 m^3)

- Make an estimation of the volume of the sample area.
- Determine the amount of sample points according to table 7.

Table 7

Volume (m^3)	<150	150-500	500-1000
number of samples	40	50	60

- Determine the amount of sample point by dividing the amount of samples by 5 and the average depth (in meters) of the sample area.

$$SP = S / (5 * AD)$$

where:
SP = amount of sample points
S = amount of samples according to table 1
AD = average depth of the sample area

- Divide the sample point equally over the sample area. Use if necessary a raster.
- Take on every sample point a column of soil over the whole depth of the sample area. Use Braces (see waste). Every sample should be about 150 gram soil. Is same as volume of Braces.
- Samples from the same sample area should be added to make the composition sample.
- Make transport samples out of the composition sample (see waste).
- Determine amount of transport samples according to table 8.

Table 8

Volume (m^3)	<400	400-1000
Number of transport samples	1	2

- Label the samples package units.
- Send the samples to the laboratory.

Make contra expertise sample for the owner ground.

Soil in a container

- Make an estimation of the volume of the sample area.
- The amount of soil within a container will always be less than 150 m^3. The minimum amount of samples to be taken is there for always 40.
- The amount of sample point for a container is always 8.
- Divide the sample point equally over the sample area. Use if necessary a raster.
- Take on every sample point a column of soil over the whole depth of the sample area. Use Braces. (see waste). Every sample should be about 150 gram soil. Is same as volume of Braces.
- Samples from the same sample area should be added to make the composition sample.
- Make transport samples out of the composition sample (see waste).
- Label the samples package units.
- Send the samples to the laboratory.
- Make a contra expertise sample for owner ground.

Transport and packaging

See chapter 4.3.4, Waste.

4.4.2 Procedures for sampling groundwater

To sample groundwater first a borehole should be drilled. The selected depth and diameter of the borehole depends on the hydrogeological conditions and the physical characteristics of soil and groundwater. Every site setting is unique.

Drilling

The choice of drilling method and equipment should therefore be made on a site-specific basis whilst considering the following.

- The depth and diameter of drilling required and likely depth of first water strike.
- The ability to penetrate the formations anticipated.
- The degree of contamination anticipated.
- The ability to obtain samples and identify different formations.
- The ability to identify groundwater inflows.
- The extent of disturbance to ground materials during drilling.
- The impact of drilling technique on groundwater quality.
- Ability to install sampling or monitoring equipment.

For drilling boreholes for monitoring purposes a competent professional should undertake specification of drilling position and depths. The following knowledge should be taken into account:

- the depth and lateral extent of the groundwater system to be monitored. If this lies below perched or other groundwater systems, steps need to be taken to ensure a seal is maintained between systems both during drilling and following installation of the monitoring point;

- the likely depth and seasonal variation in water table in unconfined groundwater systems. Normally drilling should continue below the lowest level of seasonal water table variation, to a depth sufficient to allow adequate purging and sampling;

- the most likely depth of contamination arising. This will vary depending on factors such as where exactly contamination enters the groundwater system, how far down-gradient of the site the monitoring point is located and the hydraulic characteristics of the groundwater system. For example in a flood plain there will be a component of groundwater movement vertically upwards which will be the result of discharges to surface water so that monitoring points can probably be designed to relatively shallow depths. Conversely, a location on a hill top may require deeper monitoring points due to the tendency for groundwater to move vertically downwards;

- the vertical distribution of contamination. This may require the provision of multi-level, nested or clustered boreholes.

Drilling methods

The most commonly used drilling methods are:

- conventional rotary drilling;
- cable percussion (shell and auger);
- augers (hollow stem, continuous flight or single flight).

A summary of advantages and disadvantages of conventional drilling methods is presented in table 9.

Addition of water during drilling

It is sometimes necessary and unavoidable for water to be added either as a circulating fluid for rotary drilling or to loosen up unconsolidated materials in percussion drilling. Where water is added it must come from a source of known quality. Where critical, a sample and analysis of the added water should be provided as a reference against water samples recovered from the borehole during drilling or from monitoring installations.

Sample containers

For collecting the samples see chapter 4.2.2 (Water).

Table 9

Drilling Method	**Advantages**	**Disadvantages**
Cable Tool	• Inexpensive • easily cleaned • easy to identify lithological changes • and water strikes • bulk and undisturbed samples possible • minimum use of drilling fluids • use of temporary casing allows accurate installation of lining and • annular fill	• slow • cannot penetrate hard rock • can smear sides of borehole
Rotary Auger	• rapid • inexpensive • easily cleaned • hollow stem augers allow continuous • sampling in unconsolidated materials • lining can be installed directly into hollow stem augers • no drilling fluids needed	• cannot penetrate hard rock • hollow stem augers cannot penetrate • where cobbles or boulders are present • sampling depth and water strikes • difficult to identify using solid stem • augers • solid stem augers cannot be used in • loose ground (hole collapses) • unable to install annular fill and seals in collapsing ground
Other Rotary Methods	• an be inexpensive • fast in consolidated materials • can be adapted to drill all formation types • continuous samples can be cored in consolidated rock and clay	• can be expensive • fluids need to be added (e.g. air, foam, water, mud) • possible introduction of contaminants (including oil from air compressor) with circulating fluid • recovery of samples can be slow when drilling at great depths • can smear sides of borehole • synchronous casing methods in unconsolidated formations only allow installation of narrow diameter lining

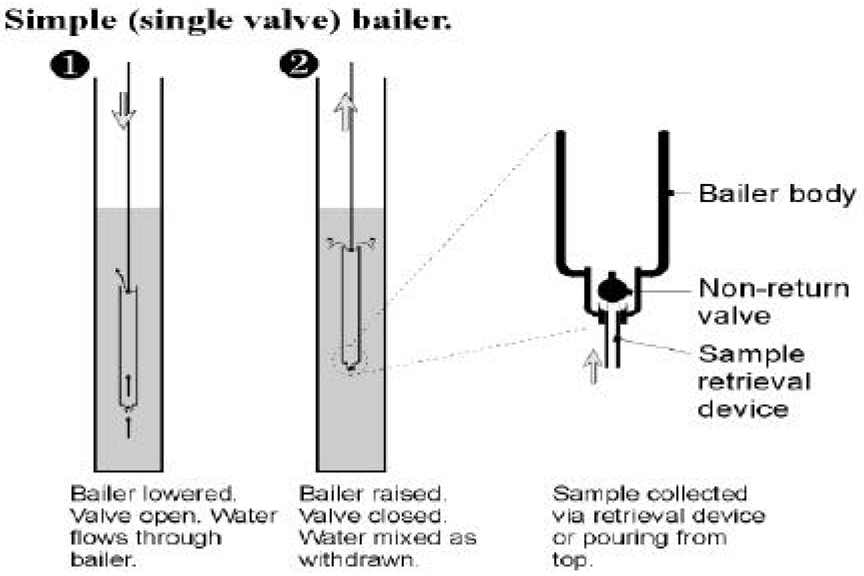
Sampling equipment

There are many sampling methods and types of sampling device capable of obtaining groundwater samples from boreholes all of which have their advantages and disadvantages. The most common methods and devices currently in use are:

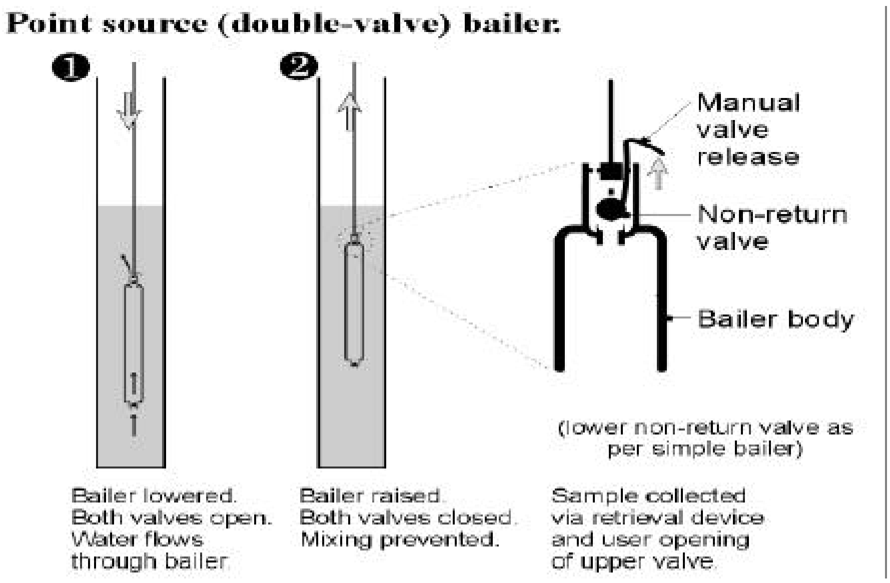
Bailers and depth samplers: they can be obtained for use in sampling and monitoring points over a wide range of diameters, and can be constructed from a wide range of plastics (PVC, polypropylene, PTFE (Teflon) or stainless steel. These devices provide a simple means of obtaining a “grab” sample either from the top of the water column (bailers) or from a specific depth in the water column (depth samplers). Both methods involve manually (or mechanically) lowering the sampling device into the borehole on a rope or wire and then withdrawing the device full of water to ground surface.

The bailer may be of varying levels of sophistication.

- Bucket type (open top, sealed base).
- Bottom check valve only (see picture 12). A ball and seat arrangement remains open during the sampler's descent, but closes under the weight of liquid in the sampler during removal.
- Double check valve bailer (see picture 13). Both the upper and lower check valves close once the bailer stops descending through the water column, to collect a point-specific sample. Double check-valve bailers allow depth sampling within the borehole.

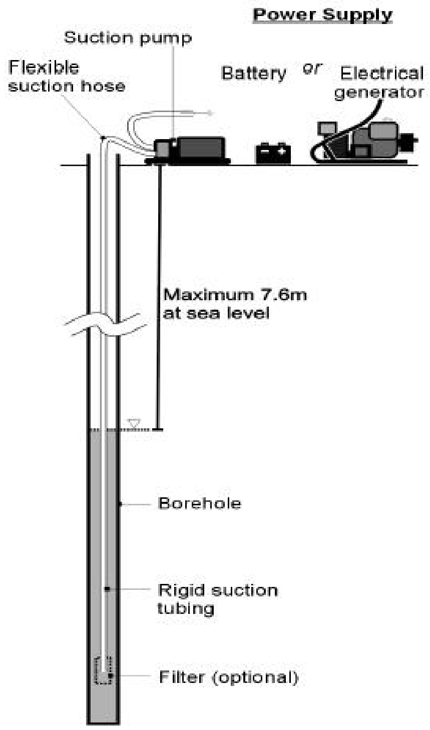


Picture 12

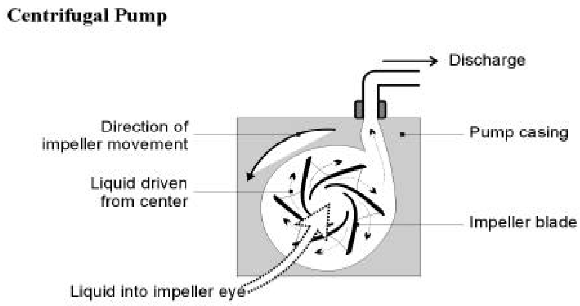


Picture 13

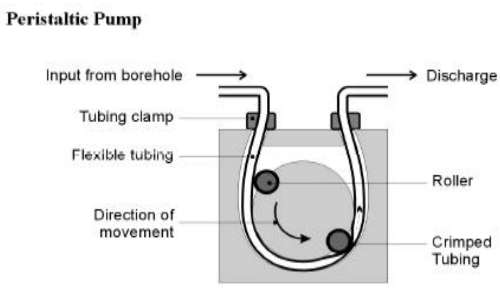
Suctionpumps: these are surface mounted pumps (see picture 14), either electrically, diesel or petrol powered. Due to the practical limit of suction lift of approximately 7.6 m (at sea level), this method of sampling is only practical for shallow water levels. The most commonly employed suction-lift pumps are the surface centrifugal pump (see picture 15) and the peristaltic pump (see picture 16). The centrifugal pumps are capable of very high delivery rates. The peristaltic pumps are low-volume vacuum pumps but particularly useful where samples have to be collected from narrow access tubes. Both however are, because of the negative pressure caused by the vacuum, not suited for sampling volatile compounds.



Picture 14



Picture 15



Picture 16

Inertial pumps: these pumps are comparatively cheap and suitable for a wide range of applications. The operating principle of the pump is based on the inertia of a column of water contained within a riser tubing. The pump consists of a foot valve connected by a rigid or semi-rigid rising main that runs to ground level. The whole system is alternately lifted and lowered at a rate sufficient to drive water continuously upwards to discharge at surface. The pump can be operated manually at shallow depths, though is better used with a powered mechanical drive system to achieve greater lifts (e.g. to 60 m in a 50 mm diameter borehole).

Electric submersible pumps: These pumps operate by driving water upwards using helical rotors or gears. Both types of pumps have an electric motor below the pumping mechanism, which draws in water under slight suction, then pressurises it for discharge.

Gas displacement and bladder pumps: These pumps operate on the same principle, using hydrostatic pressure in the water to fill the pump chamber and compressed air to displace the water to the surface.

Monitoring

As mentioned in the paragraph ‘reasons for sampling’ there can also be a reason to monitor the groundwater. In this case it’s important this will be done at least 5 meters from the source. If this is less it will be a question of monitoring (sampling) at the source.

4.5 Pesticides

This chapter is about taking samples from pesticides. While in the four previous chapters samples are being taken to pollutants or the level of pollutants in air, water, soil and waste. In this chapter samples are taken to determine if the product itself is legal or not. The physical sample collection is only a step within the overall-sample collection, which takes place at the pesticide producer or marketplace establishment. The other steps, like planning, reporting etc, will be described in other chapters.

Pesticide product samples include formulated materials from companies that manufacture, formulate or otherwise process pesticides (i.e., producers) and from commercial entities that sell wholesale or retail pesticides (i.e., dealers). Sometimes pesticide product samples are collected at the user level or at a port of entry.

4.5.1 Sample collection

The overall sample collection and analyses process includes:

- Sample collection planning;
- Sample collection (including documentation);
- Sample identification;
- Transfer to the laboratory;
- Analysis of the sample(s);
- Reporting of analytical results;
- Evaluation of analytical results;
- Case preparation, enforcement action, and final disposition.

4.5.2 Quantity of sample to be collected

The amount of each product to be collected depends largely on the amount of material required for the anticipated laboratory analysis and to assure representativeness, including the quantity required for quality control purposes (i.e., splits, repeat examinations, and replicates). Considering these sampling needs, the sample size is to be kept to a minimum to reduce the burden of disposal of the unused sample portion and to mitigate potential human and/or environmental exposure.

4.5.3 Sample units

Small-size Sample Units (Retail)

Small-size sample units are those that contain 5 litre or less of liquid or 10 kg or less of solids. These units are characterized by market-ready packages typically intended for retail distribution. Samples of these pesticide products will consist of an entire container (or group of containers) that is purchased from the producer, dealer, or user. Samples are preferably taken from original, previously unopened transport cases.

Large-size Sample Units

Large size sample units, or bulk samples, are those that contain more than 5 litre of liquid or more than 10 kg of solids. These are also units that are typically supplied to marketplace establishments for direct commercial use. When sampling these large-size units, it is recommended that smaller samples be removed from these larger containers in the field. This will reduce costs for larger amounts, make handling during sampling and subsequent analysis easier, and reduce the amount of material to be disposed of following testing.

In some situations, such as granular or pelletized lawn-care products the entire retail unit should always be collected and submitted to the laboratory. Experience has shown that these granular products are almost always non-uniform in nature and it is much easier for the laboratory to obtain an adequate portion for analysis than for the inspector to try and obtain a small representative sample in the field.

4.5.4 Equipment and techniques

Sampling from Containers

When sampling from large containers in the field, care should be given to the selection of sampling equipment and sample container composition. Physical samples should not be placed in direct contact with incompatible materials. Organic materials, such as plasticisers, may leach from rubber and some plastics into the pesticide sample. Similarly, some pesticides can leach through plastic containers. To minimize these problems, glass or stainless steel construction materials are recommended; however, plastic tubing, scoops, etc. may be used for sampling where the pesticide material is in direct contact for only a short time. A chemical substance should never be placed directly into a plastic bag or plastic bottle for storage or transport.

Some formulations, such as aqueous-based ant-microbial products are often packaged in plastic; these original containers are suitable for storage and transport as long as there is no sign of deterioration. If deterioration or other leakage is noted the sample should be transferred to a glass container to assure adequate containment during transport to the laboratory.

Sampling from large-size Solid Units

When planning the inspection for sampling of solid unit material, equipment such as a grain trier, or a disposable plastic tube or scoop should be included in the equipment list. Additional sampling tools should be taken on the inspection to avoid having to decontaminate sampling equipment in the field. Samples should be taken from the predominant batch or lot. To avoid contamination, a new or cleaned sampling tool should be used for each sample taken. Glass containers should be used to store and transport samples. Lid liners should preferably be made of Teflon however, polyethylene has also proven suitable for most formulations; aluminium foil or latex liners should not be used. Following sampling, non-disposable grain samplers should be cleaned with soap and water and solvent (e.g., acetone) and dried prior to reuse. Plastic tubes and scoops are to be disposed of following the method identified on the product label for empty containers or other authorized procedure.

Equipment needed to collect samples of dry materials includes the following:

- Protective gloves and eye wear;
- A grain sampler. This item can be found in several forms;
- Wide-mouth glass jars with Teflon-lined lids;
- Data sheets, identification tags, 4 mil plastic bags (various sizes), official seals, and chain of-custody forms (if necessary).

A recommended procedure for collecting dry samples from bags is as follows:

1. If possible, turn the bag of pesticide product over several times, both horizontally and vertically, and then lay the bag on its side on piece of protective paper or other disposable covering.
2. Through the opened seam or a tear in one of the top corners of the bag, insert the closed grain sampler (with the outer sleeve opening facing up) or plastic tube in a diagonal direction into the bag.
3. If a grain thief is employed, push the closed grain sampler to the opposite corner of the bag, then open and close the grain sampler to collect the sample. The intent is to collect a representative sample of the material from different portions of the bag. If a plastic sampling tube is used simply push it to the opposite corner of the bag.
4. Withdraw the sampling device containing the sample, being careful to avoid spilling and puffing the contents into the air. The plastic sampling tube can be tilted slightly downward (covering the open end of the tube with the thumb) while withdrawing the tube so as to fully retain the sampled material.
5. Transfer the material from the sampler by tilting the tube into a glass jar; label, officially seal, complete chain-of-custody form, and prepare for transport to the laboratory.
6. If more sample is needed, take a similar sample from the other top corner of the bag.
7. Samples from the same unit may be composite; samples from different units of the same batch are to be placed in separate containers; however, the same sampling tube may be used without decontaminating. Samples from different batches of the same product require use of new or decontaminated sampling equipment.

These procedures for collecting samples of solid material from bags can be modified as needed to collect solids from other types of containers. By carefully following a sampling protocol, cross -contamination during sampling can be minimized. If plastic tubes are used to collect samples, it is recommended that they be destroyed after each use by cutting them up and disposing of the pieces in an authorized manner.

Sampling from large-size Liquid Units

Samples should be collected in the field from producer establishment and marketplace liquid pesticide products in containers in excess of 1 gallon in size. Liquid units should be sampled using a siphon device with unused disposable type plastic tubing, or a new or decontaminated reusable glass thief for each batch or lot to be sampled. If the label directions indicate that the product to be sampled should be mixed before use, the unit should be agitated prior to sampling. Glass containers should be used to store and transport all samples. Teflon lid liners are preferred; however, polyethylene may also be used in most cases. Rubber, aluminium foil, or paper-lined lids must not be used. Plastic tubes should be disposed of by the method identified on the product label for disposal of empty containers or other authorized procedure.

Equipment needed to collect sub-samples from liquid units include the following:

- A new or decontaminated glass thief or siphon device with disposable tygon tubing;
- Glass bottle with Teflon-lined lid;
- Identification labels, plastic bags, and official seals;

- Labelled transport container(s) with appropriate packing material and other office supplies, transport forms, official seals, and chain-of-custody forms.

The following is a recommended procedure for collecting samples from larger units in the field:

1. Thoroughly agitate the material to be sampled, if required, by shaking or rolling the unit before sampling.
2. Insert siphon hose or glass tube (thief) through the access port in the bulk container being sampled.
3. Collect a composite sample from three depths: near the bottom, the middle, and the top of the liquid level. If a glass thief is employed, a representative sample may be obtained by slowly lowering the thief to the bottom of the container, allowing liquid to fill the glass tubing as it is submerged.
4. Cover the top of the thief tightly with the thumb and carefully transfer the sample into the glass sample container. If sediment, layering, or phase separation is observed, collect a duplicate sample using the same thief or tubing; decontamination is usually not necessary.
5. Label, officially seal, and package the sample container for transport.
6. Properly dispose of the hose and other disposable sampling equipment. Clean other contaminated sampling equipment with soap and water, rinsing with water and acetone, and allowing to dry before using to collect additional samples.

Sampling from tanks

Techniques for collecting liquid samples from tanks, such as those utilized in bulk repackaging operations, have not been well established or standardized. At a minimum, the inspector should discuss with laboratory personnel and their supervisor the proposed method for sampling bulk repackaging tanks or other large storage units. In such cases it may be desirable to consult with hazardous waste inspectional staff to assure the collection of a representative sample in a safe manner. If the unit does not look secure, sampling should not be attempted without supervisory approval. The inspector should also be aware that a sample collected from a release valve or discharge spigot may not be representative of the contents of the entire tank.

4.5.5 Duplicate samples

Duplicate samples are collected only at the pesticide product establishments request; however, the inspector must make the offer. These samples should be collected, identified, and sealed using the same equipment, techniques, and sampling methods. Duplicate samples can be defined as an equal amount of the product taken in the same manner from the same container.

While a firm may request that duplicate samples from small-size units be prepared by dividing the contents of these units into equal portions, small-size units are not to be subdivided. The reasons for this are: (1) the integrity of the sample as evidence is more difficult to maintain and defend; (2) cross-contamination is minimized; (3) the possibility of exposure during sampling is minimized; and (4) the laboratory can determine the net contents, if necessary.

4.5.6 Safety practices

This chapter will address the basic issues associated with pesticide product inspections. For general safety precautions see chapter 6.

It is the responsibility of each inspector to protect themselves and others during pesticide handling and sampling activities associated with an inspection. The inspector can best achieve this by staying current with all required health and safety training. To minimize risks during sampling, appropriate protective clothing and safety equipment must be used. Protective gear must be adequate to prevent accidental exposure to pesticides through the eyes, nose, mouth, and skin. At a minimum, the inspector should follow the safety precautions specified on the label of the product being sampled. The inspector should be aware of the establishment's safety requirements and basic emergency treatment. While on-site, it is advisable that the inspector be familiar with the location of medical assistance in the event of an emergency.

Selecting the appropriate safety equipment for sampling depends on the type and volume of pesticide to be sampled. Collecting small-size samples from marketplace establishments will usually require only a minimum of safety procedures and equipment. When taking samples from larger-sized containers at producer, dealer, or user sites, inspectors must heed the handling precautions found on pesticide labels. Similarly, instructions for the use of safety equipment (i.e., compatibility warnings) must be followed. At a minimum, the following safety equipment should be used during sampling:

- Hand protection - organic liquid-proof gloves, preferably of latex or synthetic rubber, long enough to protect the wrist;
- Eye protection - goggles or face shield;
- Protective footwear in the form of rubber soled, non-skid, metal-toed shoes and plastic disposable shoe covers, or rubber/neoprene boots;
- Hard hat;
- Coveralls made of closely woven fabric or Tyvek or long rubber apron;
- Respiratory protective device when sampling toxic materials from large size units.

Various cartridges must be used to protect against different chemical vapours and gases. The inspector should be careful to select the appropriate cartridge for the product being sampled. Note: The use of respiratory protective devices requires appropriate training and fit-testing. Before using this type of equipment, the inspector should ensure that their training and fit-testing is current.

Before sampling any pesticide, the precautionary statements on the label should be read to determine whether the pesticide is toxic through dermal absorption, inhalation, or ingestion. Some pesticides may be injurious through all three routes. After determining which exposure routes should be avoided for the particular pesticide to be sampled, the proper safety equipment may be selected. The inspector should always be careful when collecting samples, regardless of the declared toxicity of the pesticide. There is always the risk that the pesticide product may be mislabelled or improperly formulated.

When collecting samples, the inspector should remain alert to hazards such as spilled or improperly stacked materials, moving equipment, poor ventilation, and bad lighting. The following general guidelines are provided for the safe handling or sampling of pesticides:

- Read the label and, at a minimum, follow the handling instructions for mixing and loading;
- Use care and the proper tools when opening and closing larger containers;
- Open and sample pesticides in areas where leaks and spills can be cleaned up easily and properly;
- If chemicals are spilled on clothing or directly onto the skin, remove the clothing immediately and wash the exposed dermal area thoroughly with plain water. Always keep a change of clothing on hand for such emergencies;
- Wash hands immediately after sampling;
- Do not use the mouth to siphon and do not put hands near the mouth and eyes during sampling operations;
- Keep a supply of clean water and waterless hand cleanser readily available;

- Know the limitations of the protective equipment being used, especially respirators;
- Have the phone numbers of local hospitals, doctors, or poison control centres available.

4.6 Sample Preparation

Each sample should be identified in the inspector's handwriting with the date, sample number, and the inspector's initials. When more than one sample is collected, each sample should be further identified with an additional number or letter. This identification is normally written on the label or an adhesive strip placed on the bottle, or jar.

In case of large-size pesticide unit, the handwritten label should also provide the following information for the safety of those handling the sampled product:

- Name of the product;
- Principal active ingredients and concentration;
- Company name and address as shown on label;
- Distinguishing marks or code numbers;
- Label should be stamped in red ink with "POISON" and skull and crossbones if the products label was so marked.

Samples should be sealed by placing an inverted plastic bag (4 mil thickness, recommended), tying a knot, and turning the excess amount of bag back over the knot and taping the excess bag below the knot. It is important that the sample label be legible through the plastic bag. It is preferable to have each glass unit sealed in a separate bag, or at a minimum, packaged so that is there no direct contact of glass upon glass.

4.7 Chain-to-Custody

A complete and accurate chain-of-custody record is a critical component of official sample documentation. The purpose of an irrefutable chain-of-custody is to trace possession and assure integrity of an official sample from the time it is collected until it is introduced as evidence in a legal proceeding. An accurate, written record of the movement of the sample should be maintained on a chain-of-custody form.

4.8 Temporary Storage and Transport to the Laboratory

Following collection, documentation, and initiation of chain-of-custody, the officially sealed samples should be stored in a secure area prior to transfer to the laboratory. All documentation will normally accompany the sample(s) to the laboratory. At a minimum, the laboratory should receive the label, an investigation summary report, any chain-of-custody forms, as well as any correspondence or records related to the products ingredients, stability, or mixing for use. Whatever the method of transfer is , the inspector and/or laboratory personnel must maintain a record of how the sample was transferred, including all transport papers and receipts.

Regardless of which method is employed for sample transfer to the laboratory, several requirements need to be followed:

- Glass containers must never be packaged directly against each other, either within the same plastic bag or within the same transport container;
- The sample label should always be legible through the protective plastic bag;

- Liquid samples should not be packaged with solids in the same transport container;
- A copy of an investigative summary report or equivalent form should be included with the samples, protected in a plastic bag or sleeve;
- The laboratory director or designee should be notified by telephone that the samples are being transported, the mode of transfer, and the expected arrival date.

5. DOCUMENTATION AND REPORTING

5.1 Sample Documentation

The objective of sample documentation is to validate sample integrity. The sample must be uniquely identified continued through all subsequent activities. Additional necessary documentation regarding the nature and circumstances of each sample needed as evidence should be reported. At a minimum, the following items should be documented:

- Sample site identification and/or project number:
  - General location (e.g., address of facility);
  - Specific location (of sampled products in facility);
  - Area description and related observations.
- Date and time of sampling.
- Sample description:
  - Container contents (specific material collected);
  - Name of substance for which analysis is needed;
  - Reason for collection;
  - Quantity of sample collected (volume, number, weight);
  - Identity (sample numbers) of related samples, if any.

- Sampling method:
  - Composite, grab, or pre-packaged unit;
  - Devices and tools used – Pre-cleaning of equipment and decontamination between uses.

- Storage and transport:
  - Primary container and lid type and any pre-cleaning used;
  - Packaging procedure;
  - Preservation, if applicable;
  - Method of transfer to laboratory (including date and time).

- Other documentation:
  - Custody and document control records;
  - Books and records information;
  - Photographs;
  - Statements and affidavits;
  - Technical and professional remarks;
  - Correspondence, phone logs, notes, etc.

5.2 Sample Reporting

The report involves summarising and presenting the sample results. Next to the information which is documented during sampling the following should be reported:

- Tests-results;
- Legal requirements;
- Comparison and conclusion about compliance.

5. SAFETY PRECAUTIONS

6.1 General Caution

Inspectors should arrive at the site well prepared. Not only as far as the sampling or other work is concerned, but also as far as their own safety is. Unless the law says so, it may not be expected that the site-owner will provide the required safety equipment.

When conducting sampling, samplers need to be aware of health and safety hazards and take the proper precautions. Safety requirements can be gathered from file information, personnel that have previously sampled the facility, or by contacting the facility. Samplers need to be properly clothed and have adequate safety equipment available. Entering confined spaces should not be done unless the inspector is properly trained to do so and has the proper equipment such as rescue equipment and respirators. Confined spaces should never be entered unless first tested for sufficient oxygen and lack of toxic and explosive gases. Two persons should be present, one to enter the space and the other one to be outside. The entering person should wear a safety harness attached to a retrieval system. This system can be used to rescue the sampler in the confined space without requiring anybody else to enter.

Safety hints
Study the safety situation before the sampling trip Prepare you safety equipment before the sampling trip DO NOT enter confined spaces, unless properly trained Do regular health and safety trainings Read safety labels Be aware of the facility's safety requirements and emergency treatment (first aid) Not only have, but USE your safety equipment Be prepared for improperly stacked materials, bad lighting, poor ventilation, moving equipment and spilled materials Always use the proper tools, don't improvise Have clean water at hand during the sampling Have a cellular telephone and emergency numbers at hand during the sampling

Despite safety precautions an inspector should always be careful during the sampling. There is always the risk of unknown factors, mislabelling of products or improper formulation of documentation or information from other persons. The inspector should remain alert to hazards such as spilled or improperly stacked materials, moving equipment, poor ventilation, and bad lighting. The inspector should always use the proper tools on the one hand to prevent contamination of the sample, on the other hand to safeguard his safety and that of others. During the sampling process it is advised to think about possible accidents, how to prevent them and – in case of occurrence- how to minimise the risks for the inspector and other people as well as for the environment.

Safety precautions and actions during the sampling can be:

- In case of a spill of chemicals on clothing or directly onto the skin, remove the clothing immediately and wash the exposed dermal area thoroughly with plain water. Always keep a change of clothing on hand for such emergencies;
- Wash your hands immediately after sampling (first with your gloves still on);
- Do not use the mouth to siphon;
- Do not put hands near the mouth and eyes during sampling operations;

- Keep a supply of clean water and waterless hand cleanser readily available;
- Know the limitations of the protective equipment being used, especially respirators;
- Don't smoke and don't use open fire during sampling;
- Don't mix substances in case of the possibility of or the uncertainty of a reaction;
- Have the phone numbers of local hospitals, doctors, or poison control centres available.

6.2 How to Identify Danger

Preventive measures limit the risks, while corrective measures minimise the possible effect of an incident. The use of safety equipment is part of the corrective measures. To find out which preventive or corrective measures could be taken, we will have to determine the dimensions of the risk.

This can be done by analysis per risk-area, meaning that risks are mapped concerning the sample itself and concerning the working circumstances. This analysis can be performed by the inspector himself. The method we will describe here will mainly be useful in case of on-site inspections.

The inspector will start his analysis by writing down the risks. He may use a 'sampling point form'. For an example see Annex A.

In the form is important:

1. to get an overview of the possible composition of the sample, both under normal circumstances and under calamities. As basic material for this we can use existing documentation on chemical substances and their dangers;
2. that the followed sampling procedure is described in short;
3. that the necessary personal safety equipment is written down.

This form is not only useful for the inspector himself but also for his colleagues that may visit the site later on. He will also fill out a 'site visit form'. See Annex B for an example. The filled out form will contain the following:

- a short description of the site: what is being produced, what technology is being used; this can be done by using e.g. the license, but also on the basis of a personal talk with company staff;
- a map of the site containing process- and storage rooms with increased risks; escape routes (in case of calamities) and route to the sampling point;
- the necessary personal safety equipment for the visit to this specific company;
- personal hygiene before, during and after the site visit;
- point of attention concerning the visitor's regulations (e.g. announcement of arrival, alarm points, personal guidance by company staff);
- preliminary and final risk level of sampling at the site.

It can be considered to add a summary of the license to the site visit form.

After the risk analysis the inspector will be able to categorise the different risk-levels, which we could indicate as follows:

low

↓

high

Risk level 1

- There is no or only minor danger for the inspector to be exposed to dangerous concentrations, both in nature as in quantity, and
- The sampling circumstances (quality sampling point, weather conditions, accessibility in case of calamities) are reasonable, and
- In case of on-site inspection: the industrial activities (process of manufacturing, storage of substances) are of low risk level or slightly increased

Risk level 2

- Increased danger for the inspector to be exposed to dangerous concentrations of substances, in nature or in quantity, or
- The sampling conditions are bad, or
- The manufacturing activities have an increased risk level (dangerous manufacturing process, storage of dangerous substances at a distance of more than 15 m, or
- The accessibility for other persons is difficult or impossible

Risk level 3

- High danger for the inspector to be exposed to dangerous concentrations of substances in nature or in quantity, or
- Unknown how high the risk for the inspector in this concern is, or
- The sampling circumstances/facilities are unknown, or
- The storage of dangerous substances at a distance of less than 15 m, or the possibilities of these substances being present in the water, air or soil to be sampled

We can list some examples of the different risk levels. Please note that these are **just examples**, not all situations are mentioned and actual circumstances can make that another risk level is more appropriate!

Risk level 1
- waste water treatment plants
- restaurants, pubs
- routine inspections of ship yards
- waste water sampling at dairy farms
- bilge water under good circumstances
- assisting at environmental inventories
- thermally polluted waste water
- routine inspection at a high altitude (storage tanks)
- suspected soil and waste
- chemical process industry/metallurgical industry with good provisions concerning labour circumstances

Risk level 2
- chemical process industry/metallurgical industry, other than level 1
- investigating locations with suspected dredge
- non-routine inspection at high altitude
- near traffic
- bilge water under unfavourable circumstances

- possibility of dangerous gasses and or aerosols that are given off
- without specific sampling facilities
- surface water sampling from the shore, gangway inspection ship etc.
- during weekends, evening and night time
- near waste water streams with a possible very high pH value (pH = 10) or very low pH value (pH = 3)
- site inspections with possibly increased concentrations of dangerous substances in the streams to be sampled
- manure in storage tanks or ships

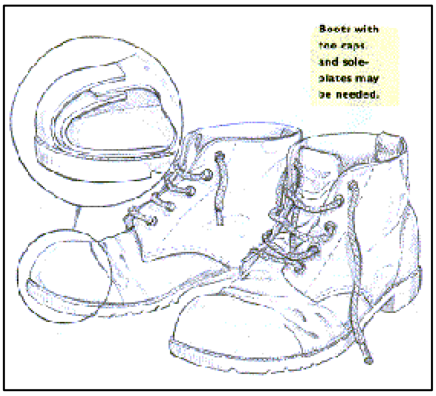
Risk level 3
- all non-routine investigations
- unforeseen circumstances, like disturbances in the manufacturing process, fire
- at the discovery of peculiar situations
- chemical process industry/metallurgical industry, other than level 2
- sampling tank trucks or tank boats
- circumstances/working under time pressure

6.3 Protective Clothing

It is the responsibility of each inspector to protect themselves and others during the sampling activities associated with an inspection. A regularly repeated health and safety training is important for inspectors to stay sharp with the latest developments in this field. To minimise risks during sampling, appropriate protective clothing and safety equipment must be used. Protective gear must be adequate to prevent accidental exposure to chemicals, pesticides, etc. through the eyes, nose, mouth and skin. At a minimum the inspector should follow the safety precautions specified on the label –if present- of the product being sampled. The inspector should be aware of the establishment's safety requirements and basic emergency treatment. While on-site, it is advisable that the inspector be familiar with the location of medical assistance in the event of an emergency. Selecting the appropriate safety equipment for sampling depends on the type and volume of material to be sampled.

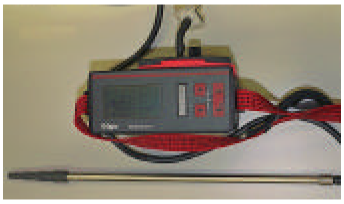
As a minimum the following equipment should be used during sampling:

- Hand protection – organic liquid-proof gloves, preferably of latex or synthetic rubber, long enough to protect the wrist; always fit the sort of glove to the material to be sampled. Don't fold the gloves, this will weaken them. Don't put the gloves away inside out. Wash your gloves (while still on your hands) with water before storing them in a cool and dry spot. Never store them in the sunlight!
- Eye protection – goggles or face shield.
- Ear protection.
- Protective footwear in the form of rubber soled, non-skid, metal soled and toed shoes and plastic disposable shoe covers, or rubber/neoprene boots. Always pay attention that the sole is resistant against chemicals, oil and grease.
- Hard hat.
- Container with plain water.
- Swimming jacket (in case of dangerous situation when sampling surface waters).
- Safety line (sampling surface waters).
- Coveralls made of closely woven fabric of Tyvek® or long rubber apron.



Picture 17

- Respiratory protective device when sampling toxic materials from large size units. Use the proper cartridge against the specific chemical vapours and gases or dust. Be careful in the selection of the appropriate cartridge[33].



Picture 18 (gas detector)

Picture 19

(Standard) safety equipment
hard hat
work boots/safety shoes (steel toes and soles, heat resistant, oil resistant, slip resistant)
Safety vest (‘Public works department’)
Cotton overall
Polyflex trousers
Polyflex coat
Coveralls made of closely woven fabric or Tyvek® or long rubber apron
Fire and acid proof overcoat
Safety gloves
Respirator
Safety harness
Safety glasses (poly-carbonate)
Cover glasses (blanc)
Ear defenders
Explosion risk meter
Compressed air escape unit
First-aid kit
Explosion proof torch
Fire extinguisher
Cellular telephone

[33] Beware: the use of protective devices requires appropriate training and fit-testing. Before using this type of equipment, the inspector should ensure that their training and fit-testing is current. Wrong use can be dangerous!!!

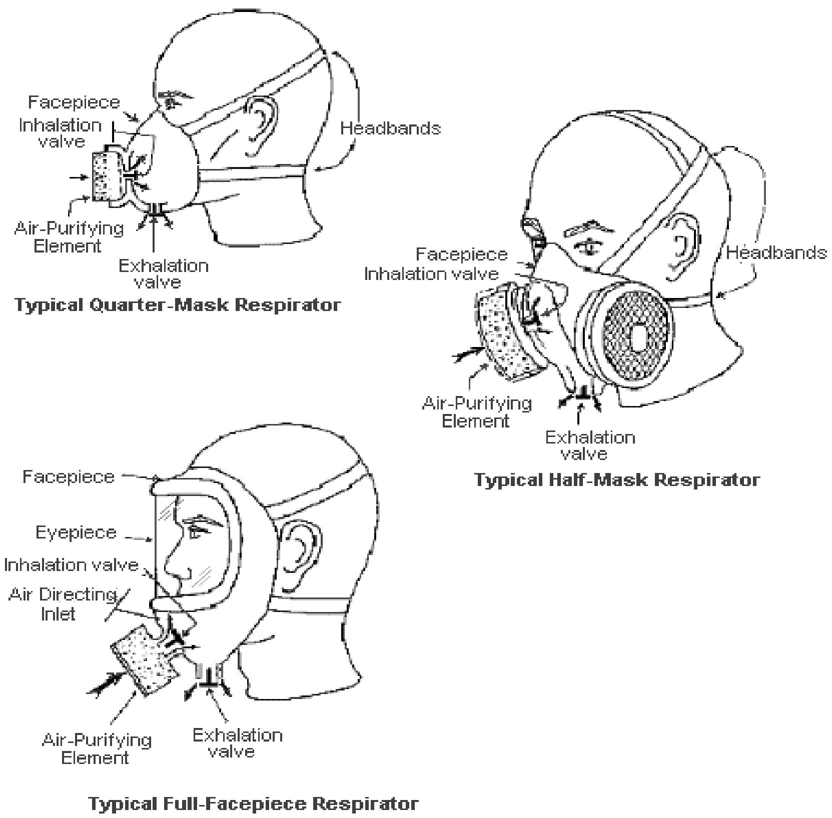
6.4 Respiratory Protection

6.4.1 Purpose

The purpose of a respirator is to prevent the inhalation of harmful airborne substances and/or an oxygen-deficient atmosphere.

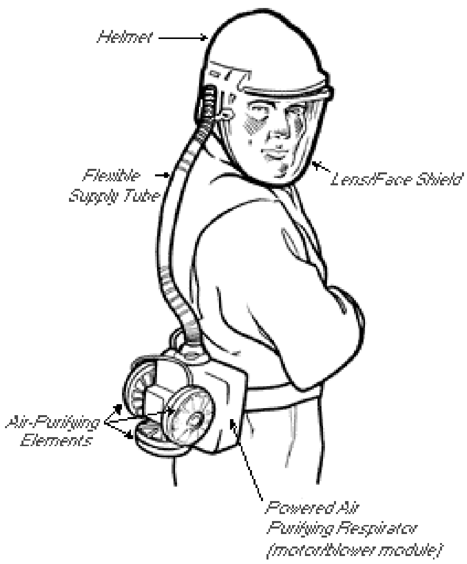
Functionally, a respirator is designed as an enclosure that covers the nose and mouth or the entire face or head. Respirators are of two general "fit" types:

- The tight-fitting respirator is designed to form a seal with the face of the wearer. It is available in three types: quarter mask, half mask, and full face piece. The quarter mask covers the nose and mouth, where the lower sealing surface rests between the chin and the mouth. The half mask covers the nose and mouth and fits under the chin. The full face piece covers the entire face from below the chin to the hairline (see picture 20).



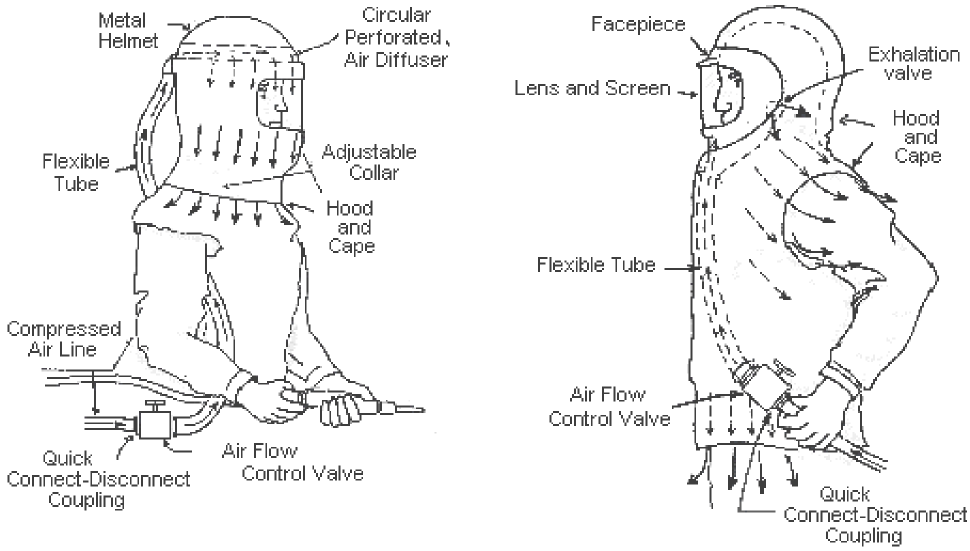
Picture 20 (tight-fitting respirators)

- The loose-fitting respirator has a respiratory inlet covering that is designed to form a partial seal with the face. These include loose-fitting face pieces, as well as hoods, helmets, blouses, or full suits, all of which cover the head completely. The best known loose-fitting respirator is the supplied air hood used by the abrasive blaster. The hood covers the head, neck, and upper torso, and usually includes a neck cuff. Air is delivered by a compressor through a hose leading into the hood. Because the hood is not tight-fitting, it is important that sufficient air is provided to maintain a slight positive-pressure inside the hood relative to the environment immediately outside the hood. In this way, an outward flow of air from the respirator will prevent contaminants from entering the hood (see picture 21).



Loose-Fitting Facepiece

Picture 21a (loose-fitting respirators)



Abrasive Blasting Respirator (Hood Respirator)

Loose-Fitting Hood with Blouse

Picture 21b (loose-fitting respirators)

6.4.2 Airborne (or respiratory) hazards

This may result from either an oxygen deficient atmosphere or breathing air contaminated with toxic particles, vapours, gases, fumes or mists. The proper selection and use of a respirator depend upon an initial determination of the concentration of the hazard or hazards present in the workplace, or the presence of an oxygen deficient atmosphere.

Airborne hazards generally fall into the following basic categories:

- Dusts: particles that are formed or generated from solid organic or inorganic materials by reducing their size through mechanical processes such as crushing, grinding, drilling, abrading, or blasting.
- Fumes: particles formed when a volatilised solid, such as a metal, condenses in cool air. This physical change is often accompanied by a chemical reaction, such as oxidation. Examples are lead oxide fumes from smelting, and iron oxide fumes from arc-welding. A fume can also be formed when a material such as magnesium metal is burned or when welding or gas cutting is done on galvanized metal.
- Mists: a mist is formed when a finely divided liquid is suspended in the air. These suspended liquid droplets can be generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomising. Examples are the oil mist produced during cutting and grinding operations, acid mists from electroplating, acid or alkali mists from pickling operations, paint spray mist from spraying operations, and the condensation of water vapour to form a fog or rain.
- Gases: gases are formless fluids that occupy the space or enclosure and which can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature. Examples are welding gases such as acetylene, nitrogen, helium and argon; and carbon monoxide generated from the operation of internal combustion engines. Another example is hydrogen sulphide, which is formed wherever there is decomposition of materials containing sulphur under reducing conditions.
- Vapours: vapours are the gaseous form of substances that are normally in the solid or liquid state at room temperature and pressure. They are formed by evaporation from a liquid or solid, and can be found where parts cleaning and painting takes place and where solvents are used.
- Smoke: smoke consists of carbon or soot particles resulting from the incomplete combustion of carbonaceous materials such as coal or oil. Smoke generally contains droplets as well as dry particles.
- Oxygen deficiency: an oxygen deficient atmosphere has an oxygen content below 19.5% by volume. Oxygen deficiency may occur in confined spaces, which include, but are not limited to, storage tanks, process vessels, towers, drums, tank cars, bins, sewers, septic tanks, underground utility tunnels, manholes, and pits.

6.4.3 Respirator classifications

Respirators provide protection either by removing contaminants from the air before they are inhaled or by supplying an independent source of respirable air. There are two major classifications of respirators:

- Air purifying respirators: devices that remove contaminants from the air.
- Atmosphere-supplying respirators: devices that provide clean breathing air from an uncontaminated source.

Each class of respirator may have tight-fitting and loose-fitting face pieces. An important aspect of respirator operation and classification is the air pressure within the face piece. When the air pressure within the face piece is negative during inhalation with respect to the ambient air pressure, the respirator is termed a negative-pressure respirator. When the pressure is normally positive with respect to ambient air pressure throughout the breathing cycle, the respirator is termed a positive-pressure respirator. The concept of negative and positive pressure operation is important when considering potential contaminant leakage into the respirator.

Air purifying respirators are grouped into three general types: *particulate removing, vapour and gas removing,* and *combination.* Elements that remove particulates are called filters, while vapour and gas removing elements are called either chemical cartridges or canisters. Filters and canisters/cartridges are the functional portion of air-purifying respirators, and they can generally be removed and replaced once their effective life has expired. The exception would be filtering face piece respirators (commonly referred to as "disposable respirators," "dust masks," or "single-use respirators"), which cannot be cleaned, disinfected, or resupplied with an unused filter after use.

- Particulate-removing respirators are designed to reduce inhaled concentrations of nuisance dusts, fumes, mists, toxic dusts, radon daughters, asbestos-containing dusts or fibres, or any combination of these substances, by filtering most of the contaminants from the inhaled air before they enter the breathing zone of the worker. They may have single-use or replaceable filters. These respirators may be non-powered or powered air-purifying. A powered air-purifying respirator (PAPR) uses a blower to force the ambient atmosphere through air purifying elements to the inlet covering.
- Vapour- and gas-removing respirators are designed with sorbent elements (canisters or cartridges) that adsorb and/or absorb the vapours or gases from the contaminated air before they can enter the breathing zone of the worker. *Combination* cartridges and canisters are available to protect against particulates, as well as vapours and gases.

Atmosphere-supplying respirators are respirators that provide air from a source independent of the surrounding atmosphere instead of removing contaminants from the atmosphere. These respirators are classified by the method that is used to supply air and the way in which the air supply is regulated. Basically, these methods are: self-contained breathing apparatus (air or oxygen is carried in a tank on the worker's back, similar to SCUBA gear); supplied-air respirators (compressed air from a stationary source is supplied through a high-pressure hose connected to the respirator); and combination self-contained and supplied-air respirators.

6.4.4 Limitations of respirator use

Not all workers can wear respirators. Individuals with impaired lung function, due to asthma or emphysema for example, may be physically unable to wear a respirator. Individuals who cannot get a good face piece fit, including those individuals whose beards or sideburns interfere with the face piece seal, will be unable to wear tight-fitting respirators. An adequate fit is required for a respirator to be effective. In addition to these problems, respirators may also be associated with communication problems, vision problems, fatigue, and reduced work efficiency.

In principle, respirators usually are capable of providing adequate protection. However, problems associated with selection, fit, and use often render them less effective in actual application; these problems prevent the assurance of consistent and reliable protection, regardless of the theoretical capabilities of the respirator. Occupational safety and health experts have spent considerable effort over the years developing fit-testing procedures and methods of measuring respirator effectiveness, thereby improving protection for those employees required to wear them.

6.4.5 Respirator protection program

Whenever respirators are required to be worn, a written respirator protection program must be developed. The program must consist of worksite-specific procedures governing the selection, use, and care of respirators. The program must be updated as often as necessary to reflect changes in workplace conditions and respirator use.

The respiratory protection program must cover the following basic elements:

- Procedures for selecting respirators for use in the workplace;
- Medical evaluations of employees required to use respirators;
- Fit testing procedures for tight-fitting respirators;
- Use of respirators in routine and reasonably foreseeable emergency situations;
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, and otherwise maintaining respirators;
- Procedures to ensure adequate air quality, quantity and flow of breathing air for atmosphere-supplying respirators;
- Training of employees in the respiratory hazards to which they are potentially exposed;
- Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and maintenance procedures; and
- Procedures for regularly evaluating the effectiveness of the program.

6.4.6 Respirator selection

Respirator selection requires correctly matching the respirator with the hazard, the degree of hazard, and the user. The respirator selected must be adequate to effectively reduce the exposure of the respirator user under all conditions of use, including reasonably foreseeable emergency situations. Proper respirator selection involves choosing a device that fully protects the worker from the respiratory hazards to which he or she may be exposed and permits the worker to perform the job with the least amount of physical burden.

Selection factors

Many factors must be considered carefully in respirator selection. In choosing the appropriate respirator, one must consider the nature and extent of the hazard, work requirements and conditions, and the characteristics and limitations of the respirators available. The following categories of information must be taken into account:

- Nature of the hazard, and the physical and chemical properties of the air contaminant;
- Concentrations of contaminants;
- Relevant permissible exposure limit or other occupational exposure limit;
- Nature of the work operation or process;
- Time period the respirator is worn;
- Work activities and physical/psychological stress;
- Fit testing; and
- Physical characteristics, functional capabilities and limitations of respirators.

6.4.7 Medical aspects

Persons assigned to tasks that require the use of a respirator must be physically able to perform the work while using the respirator. Accordingly, employers have the responsibility of ensuring that employees are medically fit to tolerate the physical and psychological stress imposed by respirator use, as well as the physical stress originating from job and workplace conditions. Employees must be medically evaluated and found eligible to wear the respirator selected for their use prior to fit testing or first-time use of the respirator in the workplace.

6.4.8 Use of respirators

Once the respirator has been properly selected and fitted, it is necessary to ensure that the respirator is used properly in the workplace. The following conditions may compromise the effective use of the respirator and jeopardize worker protection:

- Face piece seal leakage;
- Removing the respirator at the wrong times in hazardous atmospheres;
- Not properly performing user seal checks;
- Not properly repairing defective parts.

In these circumstances, there is the danger that employees may have a false sense of security in feeling that they are protected while they are not.

6.4.9 Maintenance and care

It's strongly emphasized the importance of a good maintenance program which includes at least:

- Cleaning and disinfecting procedures;
- Proper storage;
- Regular inspections for defects (including leak check); and
- Repair methods.

In addition the manufacturer's instructions for inspection, cleaning, and maintenance of respirators should be consulted to ensure that the respirator continues to function properly.

7. GLOSSARY

BOD*: Biochemical Oxygen Demand is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions.*

COD*: Chemical Oxygen Demand Chemical oxygen demand (COD) is a measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water.*

Compliance monitoring: *process to compare actual emissions of pollutants for an installation with permitted emission limit values within a defined degree or confidence.*

Emission*: discharge of a quantity of substance, energy or vibration into the environment (air, water, soil ..). The emission can be expressed as a total quantity in absolute or as a rate per a defined period of time.*

Groundwater: *all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.*

Isokinetically**:** when the velocity at which the sample enters the sampling nozzle is the same as the velocity in the duct.

Monitoring: a *continuous or regular periodic check to determine the on-going nature of the potential hazard, emissions, conditions along environmental pathways and the environmental impacts.*

Sample plane: Area or section, for example within a pipeline, where the sample points are positioned.

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- Respiratory protection, Technical manual – OSHA.
- Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water - Environmental Agency UK.
- Reference document on general principles of monitoring (draft) – EU commission.
- Monsterneming – Commissie Intergraal Waterbeheer.

ANNEX A

SITE VISIT FORM

Name of the enterprise : --

License dated : --

Safety contact (name) : --

Consultation with the company (dates) : --

Description of the company (to be made with/by the company's safety expert)

……………………………………………………………………………………………………….

……………………………………………………………………………………………………….

……………………………………………………………………………………………………….

? Map (*) ? Flow chart production method (*) ? Internal safety prescriptions (*)

Preparation site visit

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…………………………………………………………………….
…………………………………………………………………….
…………………………………………………………………….

? smoking ban
? safety shoes
? boots
? dust filter
? gas filter
? special clothing
? safety glasses/mask
? safety gloves
? ear protection

Routing inside the company, including escape routes

……………………………………………………………………………………………………..
……………………………………………………………………………………………………..
……………………………………………………………………………………………………..
……………………………………………………………………………………………………..

? Indicated on the map

What to do in case of calamities

……………………………………………………………………………………………………..
……………………………………………………………………………………………………..
……………………………………………………………………………………………………..
……………………………………………………………………………………………………..

Personal hygiene

……………………………………………………………………………………………………..
……………………………………………………………………………………………………..

(*) to be provided for by the company

ANNEX B

SAMPLING POINT FORM

Name of enterprise: ---

Date : --------------------- Name inspector: ------------------------------

No. **Description sampling point** (location at site, approach sampling point etc.)

Expected composition of the samples ***(routine wise / in extremes (calamities))***

Substance	Name	Toxic risk level	Fire risk	Remarks
1. --------	------------------------------------	-------------------	------------	-----------------
2. --------	------------------------------------	-------------------	------------	-----------------
3. --------	------------------------------------	-------------------	------------	-----------------
4. --------	------------------------------------	-------------------	------------	-----------------

Other remarks

ANNEX C

International symbols of danger

Explosive
Substances that can explode trough contact with fire or are more sensitive to bumping and rubbing than dinitrobenzene.

Oxidizing
Substances that can, through contact with other substances, especially flammable substances, react strongly in an exothermal way.

Inflammable

Liquids with a flashing point of less than 0° C and a boiling point of 35° C or more, as well as substances that:

- at normal temperature exposed to the air, without supply of energy can rise in temperature and can finally catch fire;
- in solid condition, by short impact of an ignition source, can easily be ignited and after removal of the ignition source continue burning and glowing;
- in liquid condition, have a flashing point of less than 21° C
- in gaseous condition under normal pressure, are inflammable with air by contact with water of humid air, develop easily inflammable gasses in a dangerous quantity.

Toxic
Substances that by inhalation or by entering through mouth or skin, can cause very serious acute or chronic dangers or even death.

Harmful
Substances that by inhalation or by entering through mouth or skin, cause dangers of a limited nature.

Corrosive
Substances that, through touch, have a destructive effect on living tissues.

Dangerous for the environment
Substances of which the use has or can have an immediate or delayed effect on the environment.

LIST OF MAP TECHNICAL SERIES REPORTS

Please note that the MTS Reports are available from our web site at www.unepmap.org

MTS 149. UNEP/MAP/MED POL/WHO: **Guidelines on environmental inspection systems for the Mediterranean region**. MAP Technical Reports Series No. 149, UNEP/MAP, Athens, 2004. (English, French).

MTS 148. UNEP/MAP/MED POL/WHO: **Guidelines on management of coastal litter for the Mediterranean region.** MAP Technical Reports Series No. 148, UNEP/MAP, Athens, 2004. (English, French).

MTS 147. UNEP/MAP/MED POL: **Plan for the management of hazardous waste, including inventory of hazardous waste in the Mediterranean region**. MAP Technical Reports Series No. 147, UNEP/MAP, Athens, 2004. (English, French).

MTS 146. UNEP/MAP/RAC/CP: **Guidelines for the application of Best Available Techniques (BATs), Best Environmental Practices (BEPs) and Cleaner Technologies (CTs) in industries of the Mediterranean countries.** MAP Technical Reports Series No. 146, UNEP/MAP, Athens, 2004. (English, French).

MTS 145. UNEP/MAP/RAC/CP: **Plan for the reduction by 20% by 2010 of the generation of hazardous wastes from industrial installations for the Mediterranean region.** MAP Technical Reports Series No. 145 UNEP/MAP, Athens, 2004. (English, French, Arabic).

MTS 144. UNEP/MAP/MED POL: **Plan on reduction of input of BOD by 50% by 2010 from industrial sources for the Mediterranean region.** MAP Technical Reports Series No. 144, UNEP/MAP, Athens, 2004. (English, French, Arabic).

MTS 143. UNEP/MAP/RAC/CP: **Guidelines for the application of Best Environmental Practices (BEPs) for the rational use of fertilisers and the reduction of nutrient loss from agriculture for the Mediterranean region.** MAP Technical Reports Series No. 143, UNEP/MAP, Athens, 2004. (English, French)

MTS 142. UNEP/MAP/RAC/CP: **Guidelines for the application of Best Available Techniques (BATs) and Best Available Practices (BEPs) in industrial sources of BOD, nutrients and suspended solids for the Mediterranean region.** MAP Technical Reports Series No. 142, UNEP/MAP, Athens, 2004. (English, French).

MTS 141. UNEP/MAP/MED POL: **Riverine transport of water, sediments and pollutants to the Mediterranean Sea.** MAP Technical Reports Series No. 141, UNEP/MAP, Athens, 2003.

MTS 140. UNEP/MAP/MED POL**:** **Mariculture in the Mediterranean**. MAP Technical Reports Series No. 140, UNEP/MAP, Athens, 2004. (IN PUBLICATION)

MTS 139. **UNEP/MAP/MED POL:** Sea Water Desalination in the Mediterranean: Assessment and Guidelines. **MAP Technical Reports Series No. 139, UNEP/MAP, Athens, 2003**. **(English and French)**

MTS 138. UNEP/MAP/PAP : **MAP CAMP Project "Malta": Final Integrated Project Document and Selected Thematic Documents.** MAP Technical Report Series No. 138, UNEP/MAP, Athens, 2002. (English).

MTS 137. UNEP/MAP/BLUE PLAN : **Free Trade and the Environment in the Euro-Mediterranean Context, Montpellier/Mèze, France, 5 – 8 October 2000**: Volume I: Technical Report of the Workshop; Volume II: Regional and International Studies; Volume III: National Studies; Volume IV: Environmental Aspects of Association Agreements. MAP Technical Report Series No. 137, (4 Vols), UNEP/MAP, Athens, 2002. **Libre-échange et environnement dans le contexte euro-méditerranéen : Montpellier/Mèze, France, 5 – 8 octobre 2000** (Parts in English & French).

MTS 136. UNEP/MAP/MED POL: **Guidelines for the management of fish waste or organic materials resulting from the processing of fish and other marine organisms**. MAP Technical Report Series No. 136, UNEP/MAP, Athens, 2002. (English, French, Spanish & Arabic).

MTS 135. PNUE/PAM: **PAC DU PAM "Zone côtière de Sfax": Synthèse des études du projet, rapport de la réunion de clôture et autres documents choisis.** No. 135 de la Série des rapports techniques du PAM, PNUE/PAM, Athènes, 2001. (French).

MTS 134. UNEP/MAP/PAP: **MAP CAMP Project "Israel": Final Integrated Report and Selected Documents.** MAP Technical Reports Series No. 134, UNEP/MAP, Athens, 2001. (English).

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MTS 128. UNEP/MED POL/WHO: **Municipal Wastewater Treatment Plants in Mediterranean Coastal Cities.** MTS no. 128, UNEP, Athens 2000 (English and French). PNUE/MED POL/OMS**: Les Stations d'épuration des eaux usées municipales dans les villes cotières de la Méditerranée.** (Anglais et français).

MTS 127. UNEP/BLUE PLAN: **Minutes of the Seminar, Territorial Prospective in the Mediterranean and the Approach by Actors,** Sophia Antipolis, France, 7-9 November 1996. MTS No. 127, UNEP, Athens 2000. PNUE: **Actes du séminaire, La prospective territoriale en Méditerranée et l'approche par acteurs,** Sophia Antipolis, 7-9 novembre 1996. (In French with English introduction and 1 paper).

MTS 126. UNEP/MCSD/Blue Plan: **Report of the Workshop on Tourism and Sustainable Development in the Mediterranean,** Antalya, Turkey, 17-19 September 1998. MAP Technical Reports Series No. 126, UNEP, Athens 1999. (English and French). PNUE/CMDD/Plan Bleu: **Rapport de l'atelier sur le tourisme et le développement durable en Méditerranée**, Antalya, Turquie, 17-19 septembre 1998. (Anglais et francais).

MTS 125. UNEP: **Proceedings of the Workshop on Invasive *Caulerpa* Species in the Mediterranean,** Heraklion, Crete, Greece, 18-20 March 1998. MAP Technical Reports Series No. 125, UNEP, Athens 1999. (317 pgs). (English and French). PNUE: **Actes de l'atelier sur les especes *Caulerpa* invasives en Méditerranée,** Heraklion, Crète, Grèce, 18-20 mars 1998. (Anglais et francais).

MTS 124. UNEP/WHO: **Identification of Priority Hot Spots and Sensitive Areas in the Mediterranean.** MAP Technical Reports Series No. 124. UNEP, Athens, 1999. PNUE/OMS: **Identification des "Points Chauds" et "Zones Sensibles" de polution prioritaire en Méditerranée.**

MTS 123. UNEP/WMO: **MED POL Manual on Sampling and Analysis of Aerosols and Precipitation for Major Ions and Trace Elements.** MAP Technical Reports Series No. 123. UNEP, Athens, 1998.

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MTS 121. PNUE: **MED POL Phase III. Programme d'évaluation et de maîtrise de la pollution dans la région Méditerranéenne (1996-2005).** MAP Technical Reports Series No. 121. Athens 1998, (123 pgs). (In publication)

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MTS 61. UNEP: **Integrated Planning and Management of the Mediterranean Coastal Zones. Documents produced in the first and second stage of the Priority Action (1985-1986).** MAP Technical Reports Series No. 61. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1991 (437 pgs.) (Parts in English or French only). PNUE: **Planification intégrée et gestion des zones côtières méditerranéennes. Textes rédigés au cours de la première et de la deuxième phase de l'action prioritaire (1985-1986).** (parties en anglais ou français seulement).

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MTS 59. UNEP/FAO/IAEA: **Proceedings of the FAO/UNEP/IAEA Consultation Meeting on the Accumulation and Transformation of Chemical contaminants by Biotic and Abiotic Processes in the Marine Environment (La Spezia, Italy, 24-28 September 1990), edited by G.P. Gabrielides.** MAP Technical Reports Series No. 59. UNEP, Athens, 1991 (392 pgs.) (English).

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