# USE OF INDICATORS ON ENVIRONMENTAL MANAGEMENT PLANS

*Lucilena R. Monteiro[1], Darilena M. Porfírio[2], Marycel E. B. Cotrim[3], Maria Aparecida F. Pires[4]*

***Abstract***—*In broader terms, Environmental Monitoring plans - EMP have basic items, these are: (1) Structure, (2) objectives, (3) plan requirements, (4) data and information archive, (5) sample collection and data acquisition, (6) data treatment and discussion and (7) data and plan evaluation. This work will discuss some critical aspects, such as objective definition, requirements and performance indicators to a company management, and not only to the EMP executors. The way how the data collection and the information quality are affected by those items will be presented as well. Follow up and improvement tools such as environmental performance indicators, will be presented related or not to field information. Easy routines to establish EMP, based on Plan-Do-Check-Act approach, that are applicable to small and medium size companies will be presented to achieve environmental protection, cleaner production and sustainability.*

*Index Terms — environmental monitoring plans, performance evaluation, selecting indicators.*

## INTRODUCTION

Some Brazilian companies implemented Environmental Monitoring Plans- EMP in order to comply with local legislation, like Ipen does [1]or with environmental management systems, such as ISO14001 standards, as Eletrobras Eletronorte for instance[2]. This is an increasing trend in public and private sectors that lead to decreasing operational costs comply with environmental trade codes and improve stakeholder's relations. However in Brazil, a confuse environmental legislation that presents federal, state and county layers and an enormous list of requirements discourages small and medium size companies to start an EMP. Some multinational perspectives of operation under environmental strategies [3]are quite different from the Brazilian legislation and social demand at the moment.

There still are more opportunities to save resources that are cost related, than the average manager suppose. This is one of the reasons for the use of performance indicators. Indicators are a useful management tool, usually described as profit saving data that at the end, proves to be also a good environmental action [4], or vice versa.

By this observation, it was previously decided that the indicators suggested in this paper should evaluate together the operational costs and the environmental performance. It was not our intention to describe all the Global Reporting Initiative –GRI or ISO14031 recommendations [5], but we would like to give some guidance about how to plan and start a good EMP with a few easy and understandable indicators that will improve all personal awareness about environmental aspects. Hopefully that will make managers more prompt to invest in environmental projects. This simple decision will make the implementation of EMP more likely to occur. In many companies we hope, that will be the first step in the long way of being truly "green".

## OBJECTIVE DEFINITION AND REQUIREMENTS

It is impossible to get ISO 14001 compliance without starting to get valid information about the company process. Valid information must be the key objective for a beginner company. That will assure the credibility and reliability of the company statements on environmental reports. Some authors [5] report an increase of the public cynicism about environmental statements because of the dissonance between company's daily operation and the yearly environmental report. The commitment to report equally "good" and "bad data" will define all further actions and how the employees and general public perceive the company as environmental friendly. The EMP may present bad performance at the beginning and that should be considered as an improvement opportunity. It must be defined, as well, which and how many persons will pursue the required information. The size of the company will help to define those parameters. In large corporations it is recommended that at least one person per department or division to be in charge to collect the information about how resources are used and spent in a timely manner (i.e. m3/h, m3/day, kWh). Usually accountants are considered to take care of the data inventory [5].In many cases those will be the company primary indicators. Depending on the stage of evolution other objectives will be presented, such as reduction, reuse and recycling of the identified items in this first step of data collection. Not only environmental and financial indicators should be defined, such as the number of millions of US dollars (or local currency) invested on

[1]Lucilena Rebêlo Monteiro, Tecnologista, Instituto de Pesquisas Energéticas e Nucleares, IPEN–CNEN/SP, Av. Lineu Prestes, 2242, Cidade Universitária- 05.508-000,São Paulo-SP,lrmonteiro@ipen.br
[2] Darilena Monteiro Porfírio, Analista Químico, Eletronorte Eletrobrás, Rod. Arthur Bernardes, s/n, 66115-000. Belém, PA,darilena.porfirio@eletronorte.gov.br
[3]Marycel Elena Barboza Cotrim, Gerente Adjunto do Centro de Química e Meio Ambiente – CQMA,Instituto de Pesquisas Energéticas e Nucleares, IPEN–CNEN/SP, Av. Lineu Prestes, 2242, Cidade Universitária- 05.508-000,São Paulo-SP,mecotrim@ipen.br
[4]Maria Aparecida Faustino Pires, Gerente do Centro de Química e Meio Ambiente, Instituto de Pesquisas Energéticas e Nucleares, IPEN–CNEN/SP. Av. Lineu Prestes, 2242, Cidade Universitária- 05.508-000,São Paulo-SP,mapires@ipen.br

environmental education, but also the number of participants reached by those programs.

## INDICATORS

Usually three main sets of indicators must be present in an EMP [6,7]. The operational, management and environment conditions indicators are presented in Table 1, and are often mentioned as minimum requirements to environmental reports.

TABLE I
SIMPLIFIED LIST OF CORPORATE ENVIRONMENTAL INDICATORS

| Operational indicators | | Management indicators | Environment Conditions |
|---|---|---|---|
| Input | Output | Employees related | Surveillance |
| Water* | Wastewater* | Trained staff* | Degree of compliance with regulation. |
| Energy* | Emissions* | Heath/ Safety | |
| Material* | Waste* | Frequency of audits/ sample collection<br>Number of employees in environmental actions* | Air or water quality in the surroundings of the plant |

*absolute values or relative per total production or per capita.

## TYPES OF ENVIRONMENTAL INDICATORS

The *operational indicators* are related to the mass and energy flows [6]. That can be linked to the company total production or to the total number of employees. Public sector companies or those in the service sector use the latest approach. The production or employee quotient is used in order to set a yearly monitored parameter that can be comparable despite any production change. The input-output analysis of material and energy flow is one of the early stages of the environmental performance evaluation. The first movement to optimize that figure is cost related, but clearly affects the environmental performance avoiding extra expenses of water, fuel and materials that may be wasted in the production process. Morhardt et al. [5] mentioned a direct and positive correlation between the Toxic Release Inventory reductions and the return on sales and/or return on assets, probably due to a general manufacture cost reduction and an increase in the product profit relation. The increase of the process efficiency could be observed by these indicators reduction.

The *management indicators* are related to the policy, number of employees, practices and procedures that are involved within environmental actions[7].Those will show how much effort the organization is applying to influence the environmental performance, but do not assess the company environmental impact [4,6]at all. The company culture and the manager ideas will be reflected on those indicators.

*Environment conditions indicators* correspond to the effect of air emissions to the surroundings air quality [6], or how a spill affects the groundwater quality over time. Morhardt et al. [5] evaluated the 40 biggest companies in 4 different productive fields against 5 environmental criteria (including GRI and ISO 14031) and those were the less disclosure indicators. Even 13 of the studied companies did not report any environment conditions indicator at all. In many cases those are the most difficult indicators to assess. Usually the investigation of those indicators is started only when the company is clearly the main responsible for significant change in the studied geographical area [4]. Also those are the more expensive to assess and the most difficult to find an improvement.

## DISCUSSION

Considering the three indicator classes previously presented, it is logical that all manager starts the environmental indicator evaluation by the Operational Indicators such as water, electricity and fuel bills. Logical as it seems, that is not a current practice on all public companies. Many public Brazilian companies have no electric or water reduction programs. Some public and private environmental mobilization scenarios are presented in Table 2.

TABLE 2
PUBLIC AND PRIVATE SCENARIOS FOR ENVIRONMENTAL MOBILIZATION

| Internal factors | Public company | Private Company |
|---|---|---|
| Corporate culture | Low level of autonomy | High level of autonomy |
| Positioning | No pressure from environmental organism | Aggressive but cost related |
| Environmental performance | Older facilities<br>Difficult to correct or adjust to new regulations | New facilities<br>Motivated by consumers demands |
| Chain of command | Large and decentralized | Small<br>Very centralized |
| **External factors** | **Public company** | **Private Company** |
| Environmental regulations | Less intensive | Very demanding |
| Cost | No direct pressure for reductions | Intensive pressure for reduction |
| Market factors | Social demand to a few sectors (i.e. energy, nuclear) | Intensive costumer pressure |
| Price composition | Environmental concerns do not impact on pricing | Direct relation between environmental adjustments and pricing |

Also in private companies it is usual to report total water consumption by a long period of time. In order to prevent losses, the yearly total amount is ineffective, especially later on reduction goals. If every building/department/ group of employees has no information about the individual expenses on each of these primary indicators, it will be difficult to identify a water pipe leakage, or even to convince the users to reduce the unnecessary electricity consumption. The human nature assures that an electricity bill expressed on GWh from the entire company (with 3000 employees) has less significance to each employee than his/her department consumption that increased 808kWh last month.

SZE´KELY and KNIRSCH [8]mention that an environmental indicator did not come before an economical or a social indicator evaluation. So companies that do not present their financial results are less prompt to report other performances indexes. That is the public or private (closed capital) companies case. To hide or to

ignore resources consumption (economic factor) will avoid any pressure for reduction (environmental index).Usually the reduction goals will be imposed by an environment agent as an inspector, a costumer or by social demand. Without any of these demands no change will be done.

Considering the pre-defined scenario for a small or medium size company to adopt cost related indicator, we strongly suggest a few indicators that could greatly impact in the company financial performance, such as:

- Productivity per employee (turnover per capita or product unity per capita);
- Resource consumption per employee (water/electricity/fuel per capita);
- Process yields (output/input);
- Process losses (waste/product unity or waste/material consumption);
- Recycling percentage (recycled waste/total waste);
- Achieved actions/ Planned Actions.

With those few indicators the manager will be able to identify the historical trend of the company/department/productive unity and avoid extra costs that could be prevented and optimize resources that could be saved.

The quest for efficiency in the environmental management must be also represented by the indicators choice, and must be more than a simply statement in the EMP policy, objectives or strategic planning.

It is important also to monitor the programmed actions per achieved actions ratios, independently if those actions are training, audits, external events, savings expectation, etc. Also indicators such as achieved goals on time per purposed goals, are qualitative and broad enough, but also demonstrate if these companies are able to plan and execute as previously planned. Mainly because in environmental audits, the tasks and goals are often mandatory; and neither the objective nor the velocity to reach it are previously defined. So when the managers and the team are committed, all the participants must make it happen as previously planned.

These indicators can measure the team commitment and the company agreement between the speech and the course of action. Beyond the environmental management efficiency that state the commitment with all the statements done.

By following-up those indicators, a reasonable and justifiable use of things and resources will be installed as a company culture.

## CONCLUSION

The use of indicators allows the EMP to be standardized, comparable by productive sector and easy to be understandable by the general public. However this tool must be also properly used in order to assure a reliable yearly report as a final product. Many companies intend to use the indicators and the environmental report as a marketing tool that makes this field of action discredited.

Once used, the environmental indicators have proved to be also a profitable tool to private and public companies [9]. Indicators use must be continuous in order to assure long term comparability. If possible that should be automatic in order to prevent gaps in the information that could threaten the EMP.

Also larger companies in sensitive sectors, such as energy and nuclear, could embrace this simple procedure in Brazil, in order to achieve international environmental standards and also to assure to general public that the same safety and surveillance procedures are locally applied.

## ACKNOWLEDGMENT

The authors would like to thanks to OCT - Center of Tecnologie of Eletrobras Eletronorte – Miramar and UHE-Tucuruí.

## REFERENCES

[1] Monteiro, L. R.; Gonçalves, C.; Costa, C. V. B; Cotrim, M. E. B; Pires, M. A. F. " USE OF MEAN REGULATORY QUOTIENTS IN WASTEWATERS FROM IPEN-CNEN/SP, BRAZIL", *Proceedings of 2011 International Nuclear Atlantic Conference*, Belo Horizonte, MG, Brazil, October 24-28, 2011.

[2] Eletrobras, Eletronorte, Manual do Sistema de Gestão Ambiental- UHE- Tucurui, 2010 http://www.eln.gov.br/opencms/export/sites/eletronorte/pilares/meioAmbiente/sistemaGestao/MANUAL_DO_SISTEMA_DE_GESTxO_AMBIENTAL..pdf

[3] Epstein, M.; ROY, M. J. “Managing Corporate Environmental Performance: A Multinational Perspective” *European Management Journal* Vol. 16, No. 3, pp. 284–296, 1998

[4] Bundesumweltministerium. A guide to corporate environmental indicators. Bonn: Umweltbundesamt, 1997.

[5] Morhardt,J. E.; Baird, S; Freeman, K. “Scoring corporate environmental and sustainability reports using GRI2000, Iso 14031 and other criteria”. Corporate Social responsibility and environmental management, 9(2002)215-233.

[6] Jasch, C. “Environmental performance evaluation and indicators” *Journal of Cleaner Production*, V. 8, 2000, 79-88.

[7] International Standard Organization Environmental performance evaluation ISO/DIS14.031, 1998.

[8] Szekely, F.; Knirsch, M. Responsibility:Metrics for SustainablePerformance European Management Journal Vol. 23, No. 6, pp. 628–647, 2005

[9] Ilinitch, A. Y; Soderstrom, N.A.;Thomas, T. E. “Measuring corporate environmental performance” Journal of Accounting and Public Policy, Vol 17, 1998, 383-408.