MEASURING ENVIRONMENTAL PERFORMANCE:

A Primer and Survey of Metrics In Use

Global Environmental Management Initiative

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Table of Contents

List of Figures

List of Tables

About the Global Environmental Management Initiative

The Global Environmental Management Initiative (GEMI) is a non-profit organization of leading companies dedicated to fostering environmental, health, and safety excellence worldwide. Through the collaborative efforts of its members, GEMI also promotes a worldwide business ethic for environmental, health, and safety management and sustainable development through example and leadership.

GEMI's member companies as of June 1997 are:

AT&T
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Browning-Ferris Industries
Ciba Specialty Chemicals Corporation
The Coca-Cola Company
Colgate-Palmolive Company
Coors Brewing Company
The Dow Chemical Company
Duke Power Company
The DuPont Company
Eastman Kodak Company
Georgia-Pacific Corporation
Halliburton Company
Johnson & Johnson
Merck & Company, Inc.
Olin Corporation
The Procter & Gamble Company
Southern Company
Tenneco Inc.
Waste Management

Preface

During early 1996, the GEMI Metrics Work Group surveyed members on their environmental performance measurement systems[1]. The survey revealed a variety of metrics in use by member companies and interest in improving tools for measuring environmental performance. As a result, GEMI decided that a primer discussing the considerations for designing a metrics program and a compilation of indicators would be a helpful aid to GEMI and non-GEMI companies.

The purpose of this primer is to present a survey of environmental performance measurement tools (or "metrics") and present considerations for designing a metrics program; selecting appropriate metrics; and for implementing, evaluating and improving such a program.

This primer is directed to large companies wishing to compare or improve their programs, as well as smaller companies seeking to establish a program for the first time.

Because a metrics program must be responsive to industry and company-specific cultures and concerns, this primer does not present a recommended program to be used by any company. Instead, it identifies the considerations that a company should address, suggests a process for developing an effective metrics program, and provides case studies (examples) in order to assist companies and organizations in developing or enhancing their systems.

The first chapter is a survey of metrics for measuring environmental performance that are currently in use. Key concepts are defined and explained, and the advantages and limitations of various metrics are discussed.

[1] Many, but not all companies report health and safety metrics, such as the number of job-related accidents, illnesses, and most workday cases, along with environmental performance measurements. In this report, the term environmental performance can be understood to include health and safety performance.

Chapter 2 presents considerations for selecting, designing, implementing, evaluating, and improving a metrics program. The chapter is divided into four sections that parallel the Plan-Do-Check-Act format presented in the 1992 GEMI Total Quality Environmental Management Primer.[2]

Chapter 3 presents a brief discussion of emerging trends in environmental performance measurement. The appendices contain studies of some exemplary GEMI and non-GEMI metrics programs.

[2] *Total Quality Environmental Management: The Primer*, Washington, D.C, 1992.

Acknowledgements

This primer was developed under the auspices of GEMI's Environmental Metrics Work Group. David Mayer (the Georgia-Pacific Corporation), the Chair of the Work Group, directed this project. The primer was written by Mark A. Ethridge of Earth Tech, Inc. (a subsidiary of Tyco International, Inc.) with oversight from Montgomery Lovejoy III, also of Earth Tech, Inc. The case studies in the appendix and information in the text of the report were adapted from materials or presentations prepared by the following GEMI members, who also provided substantial oversight and input:

Mike Fisher, Procter & Gamble
Maria Bober Rasmussen, Eastman Kodak Company
Jerry Schinaman, Bristol-Myers Squibb Company
Bill Sugar, Anheuser-Busch Companies
Darwin Wika, The DuPont Company

In addition, one case study was provided by a non-GEMI member, Margaret R. Sexton of Stanley Works.

The Work Group also received generous support and input from other GEMI member company representatives, including:

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Patricia Walsh, AT&T
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Executive Summary

Selecting meaningful and effective tools for measuring environmental performance is becoming increasingly important due to the increasing costs of environmental operations; market, regulatory and public pressures; voluntary initiatives, such as the International Chamber of Commerce Business Principles for Sustainable Development; and international standards, such as the International Organization for Standardization (ISO) 14001.

Many metrics are already in use. These include lagging indicators, which measure outputs such as pounds of pollutants emitted or discharged; leading indicators, which are in-process measures of performance; and environmental condition indicators, which measure the direct effect of an activity on the environment. Each type of indicator has its own strengths and weaknesses, and different audiences; most organizations use a mixture of them.

Other means of measuring progress include benchmarking against other companies or average industry performance; evaluating progress against codes of management practices developed by trade associations such as the Chemical Manufacturers Association (CMA) or the American Petroleum Institute (API); measuring progress against principles, goals, or corporate management system standards; and development of indices to evaluate progress from year to year.

Metrics can measure the business value of environmental programs or progress as well as the environmental performance of business operations. This can be particularly effective in demonstrating the value of environmental efforts to management. It can also provide data with which business units can design more efficient processes, decreasing material usage and environmental impacts while at the same time increasing yield and profitability.

The last several years have seen the development of several trends in environmental metrics. Some of these trends are:

- the globalization of metrics,
- increasing emphasis on sustainability in its environmental context (the efficient use of resources) and efforts to develop sustainability metrics,
- increasing use of environmental management systems as benchmarks of environmental performance,
- and emphasis on the integration of environmental performance with business performance with the goal of reducing costs and material losses, and improving yield, market share, and profitability.

There are a number of points to consider when designing, implementing, evaluating, and improving a metrics program. The single most important consideration, however, is to realize that no single approach is suitable for every organization. Each company has its own particular products and services, organization, financial structure, legal and regulatory requirements, customer demands, data collection and management systems, and environmental impacts. The approach selected must also be responsive to a variety of potential audiences such as management, employees, regulators, shareholders, and the public.

Underlying any successful metrics program are the concepts of alignment, accountability and continuous improvement. Alignment involves blending environmental performance measurement with business measurement, data collection, reporting and management to ensure consistency, and to minimize redundancy and incompatibility. It also means ensuring that metrics are appropriate to the needs of the company, business units, and other audiences. Accountability is a two-way street; not only must employees and business units be held accountable for environmental performance, but management must clearly define expectations and should encourage business unit participation in the development of performance criteria. The third major concept, continuous improvement, is a key link in the plan-do-check-act cycle. It should be remembered that measurement occurs not for the sake of measurement, but to drive performance towards reduced environmental impacts, more efficient use of resources, increased profitability and a sustainable future.

Chapter 1.
SURVEY OF TOOLS (METRICS) FOR MEASURING ENVIRONMENTAL PERFORMANCE

Selecting meaningful and effective tools, or metrics, for measuring the environmental consequences of a company's operations and activities is becoming increasingly important. This need is being driven by the increasing environmental costs of business operations; market, regulatory, and public pressures; and voluntary initiatives, such as the International Chamber of Commerce's (ICC) Business Charter for Sustainable Development, or international management system standards, such as the International Organization for Standardization (ISO) 14001, and the Eco Management and Audit Scheme (EMAS). A variety of metrics are available for measuring environmental performance. This chapter discusses the various types of tools that exist to accomplish this objective.

Types of Environmental Performance Metrics

Individual metrics can also be referred to as environmental performance indicators. Some indicators are common to many companies, such as quantities of various government-regulated chemicals emitted to the air, discharged to water, or disposed of as hazardous waste. Other indicators are unique to a certain industry, such as energy usage per gigabyte (computer manufacturers) or number of offshore oil spills (petroleum transportation). To help illustrate the diversity of environmental indicators, Table 1 lists some of the most frequently used environmental, health, and safety measurement criteria used by 41 companies participating in an environmental management survey conducted during 1995.

Table 1
EXAMPLES OF MEASURES IN USE

Measure	**Number of Companies Using Measure**
Number of recordable injuries/illnesses	33
Number of lost workday cases	33
Amount of hazardous waste generated	31
Quantity of toxic chemicals released	25
Number of notices of violation	23
Type/volume of non-regulated materials recycled	22
Type/volume of non-regulated materials disposed	21
Amount of dollar fines	21
Number/type of reportable releases	21
Permitted air emissions	18
Amount/type of fuel used	18
Amount of water used	16
Total annual EHS operating costs	15
Number of regulatory inspections	14
Ozone depleting substance use	13
Total annual EHS capital costs	1

Source: National Association for Environmental Management, "Performance Measurement of EHS Management Programs Survey," November 16, 1995.[3]

[3] For copies of this survey, contact George Nagle at Bristol-Myers Squibb Company, Environmental, Health and Safety Services, P.O. Box 182, E. Syracuse, New York 13057; Telephone (315) 432-2731.

Leading Versus Lagging Indicators

Environmental indicators can be broadly classed into two types of measures: end-of-process measures, otherwise known as lagging indicators, or in-process measures, also known as leading indicators. Most environmental metrics programs will contain both types of measures. Table 2 summarizes the main aspects of both kinds of indicators.

Table 2
LEADING VS. LAGGING INDICATORS

	Lagging indicators	**Leading indicators**
Type of Measure	End-of-process or output indicators	In-process or management indicators
Approach	Quantitative	Qualitative and quantitative
Example	Pounds of toxic chemicals released to air, water, and land	Percent of facilities conducting self audits
Strength	Easy to quantify and understand; generally preferred by the public and regulators	Reflect current or future, rather than past performance
Weakness	Timelag in feedback loop; root causes not identified	May not address all stakeholder concerns; can be difficult to quantify and evaluate; hard to build support for use

Lagging Indicators

Lagging indicators are the type of metrics most commonly reported. These indicators "lag" or measure the results of environmental practices or operations currently in place. Types of data include tons of waste generated, number of fines and violations, number of accidents or lost work days, or pounds of packaging produced. Frequently these types of data are collected because federal environmental laws require that they be reported. For example, since 1988, Section 313 of the Superfund Amendments and Reauthorization Act (SARA) has required generators of certain toxic chemicals to report annually releases of chemicals to air, land, and water. Table 3 presents 1988-1994 SARA data for Hughes Electronics Corporation.

Table 3

HUGHES ELECTRONICS SARA DATA 1988-1991 (POUNDS)

	1988	1989	1990	1991
Releases	5,301,995	4,756,022	3,520,747	2,911,465
POTW*	441,079	228,278	148,676	154,760
Offsite Transfers	1,398,219	1,556,860	699,505	1,65,177
Recycled	NRR	NRR	NRR	4,989,640
Total	7,141,293	6,541,160	4,368,928	9,709,032

HUGHES ELECTRONICS SARA DATA 1992-1994 (POUNDS)

	1992	1993	1994
Releases	2,004,990	1,050,991	460,656
POTW*	77,776	89,957	120,904
Offsite Transfers	1,415,521	1,468,474	227,156
Recycled	4,418,599	2,056,314	616,027
Total	7,916,886	4,665,736	1,426,743

Key: NRR = No Reporting Required

Source: Hughes Electronics 1996 Annual Environmental Report

* Discharges to publicly owned wastewater treatment works

The principal advantages of using lagging indicators are that they are usually readily quantifiable and understandable, and the data are often collected for other business purposes. The main disadvantage is that, as the name implies, they lag or reflect situations where corrective action can only be taken after the fact, and often after incurring some type of cost, whether it be in fines or decreased credibility with regulators or the public. Also, these indicators do not identify the root cause for the deficiency and how its reoccurrence may be prevented. Furthermore, the effects of corrective measures already taken may not show up until next year's results. Conversely, performance may be overstated, because underlying factors may have already changed.

Leading Indicators

Leading or in-process indicators measure the implementation of practices or measures which are expected to lead to improved environmental performance. For example, instead of the numbers of fines and violations, a leading indicator would be the number of internal environmental or health and safety compliance audits conducted during a year. If such an audit program is implemented, and root causes are identified and corrected, it should lead to a decrease in the lagging indicators, fines and violations. The major advantage of such a metric is that corrective actions can often be taken before deficiencies show up in reduced performance. Unfortunately, leading indicators can be difficult to quantify (some may be qualitative rather than quantitative), and the results may not address the concerns of some stakeholders (such as the public), who may still want to know the quantities of chemicals released into the environment, or the number of health and safety violations. In practice, however, this is not an "either or" situation; companies use both lagging and leading indicators.

The following are examples of leading indicators:

Quantitative:

- Number of purchasing reviews completed
- Number of voluntary initiatives participated in
- Raw material use
- Number of community outreach activities
- Number of internal self assessments completed
- Number of EHS reviews completed
- Regulatory issues identified proactively and resolved[4]

Qualitative:

- Adoption of a corporate policy on self assessments
- Implementation of a program to improve community outreach efforts
- Certification under ISO 14001

The implementation of management practices contained in voluntary industry codes of environmental performance represents a type of leading indicator. The Chemical Manufacturers Association (CMA) Responsible Care® and the American Petroleum Institute's (API) Strategies for Today's Environmental Partnership (STEP) are examples of a collection of management practices that cover various areas of environmental, health and safety performance.

Environmental Condition Indicators

The Draft ISO 14031 standard, "Environmental Performance Evaluation" defines a third general type of indicator, called an environmental condition indicator (ECI). It defines an ECI as "a measurement of a quality or property of a component of the environment." It states furthermore that this is not a measure of environmental impact, although values may be used to evaluate impacts. Examples of ECIs as presented in the Draft ISO 14031 include contaminant concentrations in air, water, groundwater and soil, and changes in crop yield or the size of a population of a particular species in a given area.

4 These quantitative leading indicators were selected from a presentation given by Bill Sugar of The Anheuser-Busch Companies at a GEMI Workshop on April 8, 1977.

The advantage of using this type of metric is that it can be used to measure direct effect of an activity on the environment (environmental aspects of operations). However, collecting these data can be time consuming and expensive, since the required data often are not routinely collected and may need to be collected over many years in some cases. Also, making a correlation between an organization's operations and an effect can be difficult, since there are many variables that can be contributing to the observed effect.

An example of this type of performance measure is reported in American Electric Power's annual environmental report. The company cites that a dramatic improvement in air quality (due to reduced electric utility air emissions) in the Ohio River Valley can be corroborated by a twenty-five year research study of lichens, fungus-like organisms that grow on rocks and trees.[5]

Benchmarking

Another way of measuring a company's performance is to compare it against best-in-class companies with similar operations. This measurement technique is called benchmarking. Benchmarking is defined as a process of comparing and measuring an organization's business processes against best-in-place operations to inspire improvement in the organization's performance.[6] A good example of a benchmarking study is the program developed by a group of northeastern utilities led by Niagara Mohawk Power Corporation from 1992 to 1995.[7] A simple type of benchmarking is to compare an organization's performance against the average number of events in a particular category for the industry as a whole. This is the approach often taken by environmental groups in ranking companies according to their SARA releases to air, water, and land. A more sophisticated approach is taken by the Investors Responsibility Research Council (IRRC) which compiles environmental profiles on various companies and compares their performance in various areas, e.g. number of oil and chemical spills, remedial actions, toxic chemical releases, and number of penalties to industry averages.

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[5] American Electric Power's annual enviornmental report, "Beyond Compliance." As reported on the company's website: http://www.aep.com.

[6] As defined in "Benchmarking: The Primer." GEMI, Washington, D.C., 1994.

[7] Center for Economics Research, Research Triangle Institute, "Environmental Benchmarking Program," December 1994.

Measuring Conformance with Voluntary Initiatives or Management System Standards

Another type of benchmarking is to measure performance against a set of principles or standards. Some companies have measured the number or percentage of the various management practices implemented that comprise Responsible Care. The Dow Chemical Company has chosen this approach.[8]

Performance can also be measured against principles established by other voluntary initiatives. GEMI has developed an Environmental Self-Assessment Program[9] that measures corporate performance against the 16 principles of the International Chamber of Commerce (ICC) Business Charter for Sustainable Development. Bristol-Myers Squibb, for example, uses the Environmental Self-Assessment Program to measure corporate environmental performance. For each of the sixteen principles, overall company-wide performance is measured on a scale of 1 to 4. The results are shown graphically in Figure 1.

Another type of leading indicator measures the elements of an environmental management system in-place. ISO 14001 is an example of such a system. Elements of the ISO system include 1) environmental policy; 2) planning; 3) implementation and operation; 4) checking and corrective action, and 5) management review. ISO 14001 does not establish absolute quantifiable requirements for environmental performance "beyond commitment, in the policy, to compliance with applicable legislation and regulations and to continual improvement." A company's environmental management system can then be audited against the various elements to determine whether it is ISO certified.

Alternatively, a company can assess conformance with the elements of its own management system. P&G is an example of this approach. The company regularly audits its facilities throughout the world in the areas of government and public relations, people capability, direct environmental impact, incident prevention, and continuous improvement. Standards in each of these areas are developed at the facility

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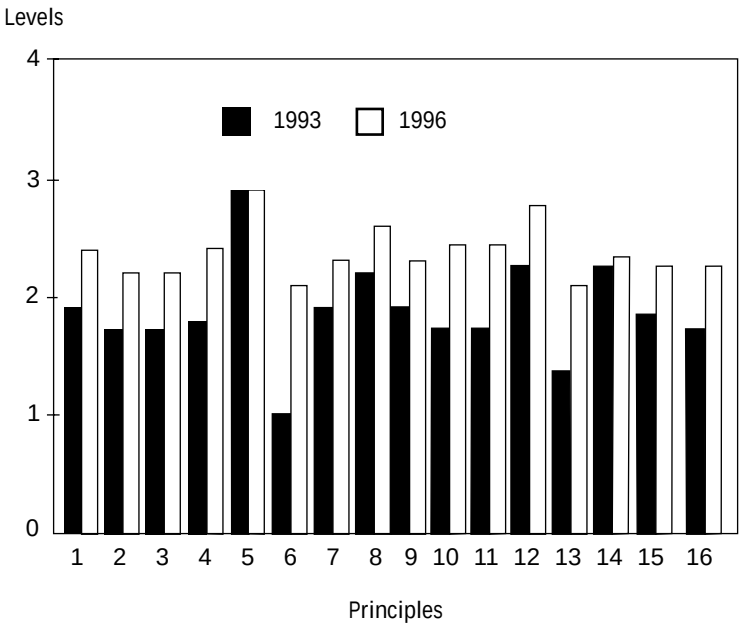
[8] See Dow Chemical Company 1996 Annual Environmental Report. Available via the Internet at http://www.dow.com.

[9] GEMI, Environmental Self Assessment Program, November 1994.

Figure 1

Management System Performance Measurements- Bristol-Myers Squibb Results



Levels

- Level 1 - compliance with laws/regulations/company policies
- Level 2 - management systems compliance
- Level 3 - integration of EHS responsibilities
- Level 4 - innovations to improve/enhance programs

Principles

1. Corporate Priority
2. Integrated Management
3. Process of Improvement
4. Employee Education
5. Prior Assessment
6. Products and Services
7. Customer Advice
8. Facilities and Operations
9. Research
10. Precautionary Approach
11. Contractors and Suppliers
12. Emergency Preparedness
13. Transfer of Technology
14. Contributing to the Common Effort
15. Openness to Concerns
16. Compliance and Reporting

level ensuring business unit commitment and support, and a score is generated for each facility. A more detailed discussion of P&G's metrics program is included in Appendix B. Baxter has also developed a metric for measuring performance against a series of state-of-the-art management procedures. The system is similar to ISO 14001 in that the procedures comprise an environmental management system. Facility, division and corporate office performance is audited against these elements. The company has gone to great effort to eliminate the subjectivity in defining conformance with the elements by developing a detailed set of protocols.[10]

Environmental Performance Indices

An environmental performance index (EPI) can be a useful way of measuring environmental performance. Companies that have developed EPIs include the Niagara Mohawk Power Corporation, a northeastern electric utility; Nortel, the Canadian-based telecommunications firm; Rhone-Poulenc, the French chemical and pharmaceutical company; J.M. Huber Corporation, a diversified company; and Polaroid Corporation, the imaging company.

An EPI usually consists of one number or a score that represents an aggregation of the environmental performance of all of a company's operations. It is benchmarked against a base year. For example, an index rating of 153 might indicate that corporate performance has improved substantially from the base year value of 100. Since EPIs are constructed in different ways, the concept is best illustrated with an example. Nortel has developed one of the best-known EPIs. The Nortel system considers 25 performance parameters in 4 broad categories:

10 See the Baxter 1995 environmental Performance Report; available via the Internet at http://www.baxter.com

- Compliance: Notices of violation, fines, exceedances, and incidents
- Environmental releases: releases to air, water, land and the global environment
- Resource consumption: thermal energy, electricity, water consumption, and paper purchases
- Environmental remediation: number of remediation sites and risk factors[11]

Index scores are derived by benchmarking against a base year, with negative scores awarded for increased environmental impact and positive scores for decreased environmental impact. Each of the four categories is then weighted based on 1) its impact on the environment; 2) how directly the parameter measures environmental performance; 3) what control the company has over the parameter (e.g. use is influenced to a large degree by weather); and 4) financial and public risk to the company. Finally, the environmental data are normalized to the costs of goods and labor.

Such a system has its advantages and disadvantages as shown in Table 4:

11 Adapted from an overhead transparency presentation on Nortel's EPI by Arthur D. Little dated May 20, 1996.

Table 4

ADVANTAGES & DISADVANTAGES OF INDICES

Advantages:

- Provides a single number that is easily understood by corporate management and external stakeholders;
- Identifies areas in need of improvement or corrective action;
- Provides a means of facility-to-facility benchmarking.

Disadvantages:

- May be difficult to develop, aggregate and interpret
- Subjective judgments concerning data not included and weighting can skew results;
- The taking of timely corrective action may be hampered because the index is usually based on lagging indicators;
- Users may focus on index number rather than real environmental performance.

Kodak has developed an EPI that relies more on leading than lagging indicators, but is not aggregated into one number for the entire company. Rather, each manufacturing site sets its own goals that are then reviewed by the manufacturing director. A performance matrix is developed with specific numeric goals for each progress measure within the matrix. This index is discussed in detail in Appendix C.

Measures of Sustainability

Sustainability, as defined by the United Nations Commission on Environment and Development, means "meeting the basic needs of all the world's people today without compromising the ability of future generations to meet their needs."[12] In an environmental context, sustainability refers to an efficient use of resources that minimizes impact on the environment. Novo Nordisk, a Danish pharmaceutical and

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12 As quoted in Paul V. Tebo and Dawn G. Rittenhouse, "Sustainable Development: Creating Business Opportunities at DuPont." *Corporate Enviornmental Strategy*, Vol. 4, No. 3.

chemical company, has developed a type of sustainability index that it calls an Eco-productivity index. The index measures the use of raw materials, water, energy, and packaging relative to use in the base year of 1990. Table 5 shows the evolution of Novo Nordisk's EPI from 1993 to 1995.

Table 5
DEVELOPMENT IN EPIs FROM 1993 TO 1995*

	1993	1994	1995
Raw Materials	122	123	124
Water Consumption	135	138	150
Energy Consumption	134	142	148
Packaging Consumption in Health Care Business	121	133	127
Packaging Consumption in Enzyme Business	122	115	126

*Higher numbers represent more efficient resource use.

Source: Novo Nordisk 1996 Annual Environmental Report.

Measuring the Business Value of Environmental Performance (Aligning Environmental Performance with Business Performance)

So far, the discussion has focused on measuring the environmental impacts or performance of business operations. Conversely, metrics can also be developed to measure the business value/performance of environmental programs. These types of metrics can be invaluable in demonstrating the value of a proactive environmental program to corporate management and shareholders. Baxter, for example, has developed an "environmental financial statement" where the company has

estimated the environmental costs of its environmental program and compared it with the environmental program benefits in terms of income, savings and cost avoidance. Savings are generated through reduced hazardous material usage, decreased hazardous and non-hazardous waste disposal costs, energy conservation, and packaging cost reductions; income is generated by recycling. Furthermore, the company has estimated the benefits occurring in the present year from past years environmental efforts. Waste reduction initiatives not only produce cost avoidance (savings) in the year initiated, but also in future years in which the waste remains eliminated from processes and packaging. By this measure, the business value of the company's environmental programs far exceeds their costs ($87.4 million vs. $25.2 million in 1995).[13] Organizations considering such an approach, however, should ensure that their environmental accounting is aligned or compatible with their financial accounting systems.

Conoco, a subsidiary of DuPont, has measured environmental costs for spill cleanup, remediation, waste disposal, water and air pollution control and has expressed in them in cents per barrel of refined product. Figure 2 shows that an environmental benefit is derived by a decrease in environmental costs from 1993 to 1995.

Another way of envisioning the business value of environmental performance is to view wastes and releases as the result of inefficient use of resources such as chemicals, energy, water, and packaging materials. This is compatible with the concept of sustainability. In this case, waste is not only a cost, but lost product or an opportunity to improve yield — a traditional business way of viewing resource use.

DuPont has pioneered the practice that environmental improvements are business opportunities. For example, the company has quantified improvements in raw material yields for chemical processes, cost savings from reduced energy use, increases in sales and market share and reduced capital investments due to environmental innovations. It has also led in the re-engineering of products and services to minimize environmental impacts. DuPont's sustainability metrics are discussed in more detail in Appendix A.

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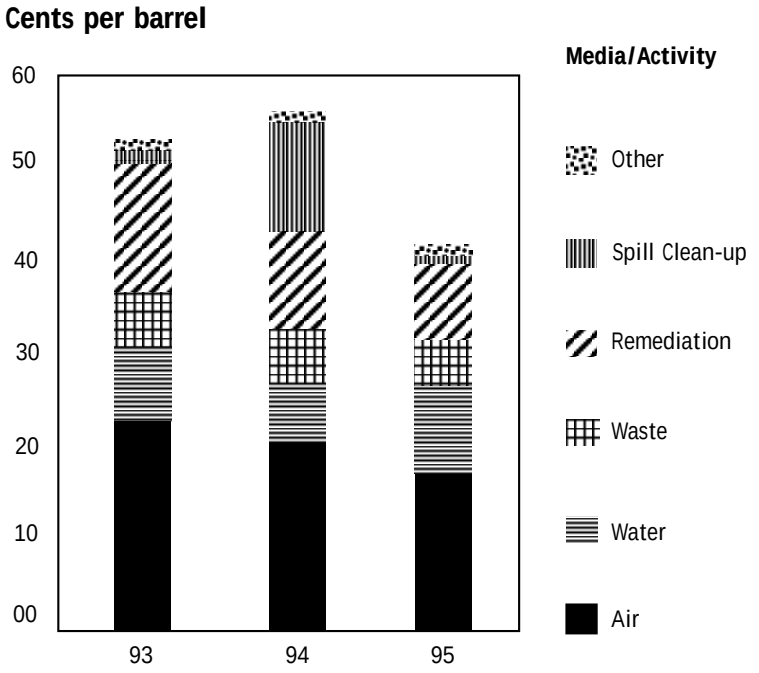
[13] See the Baxter 1996 Environmental Performance report previously cited.

Figure 2

CONOCO ENVIRONMENTAL COST-EFFECTIVENESS INDEX

Worldwide Downstream Operations

Cents Per Barrel of Refined Product

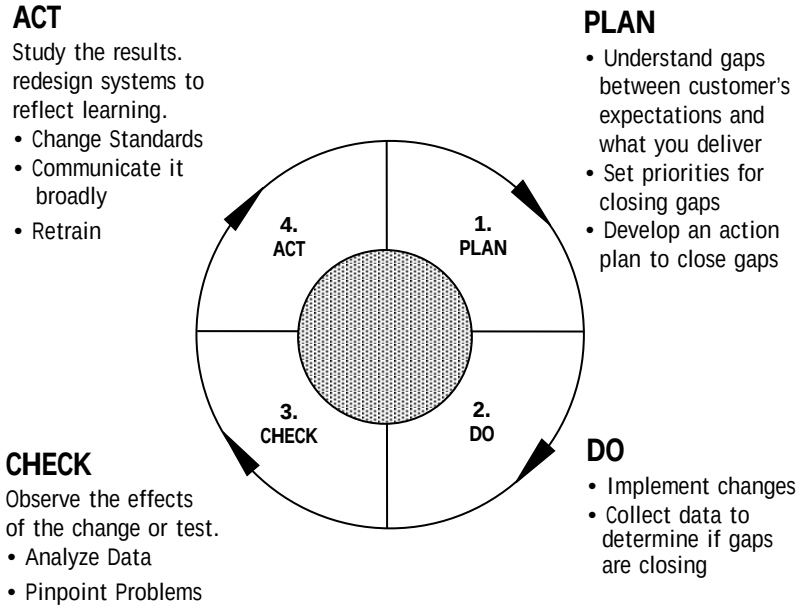


Source: Conoco 1996 Annual Environmental Report.

Chapter 2
CONSIDERATIONS FOR DESIGNING, IMPLEMENTING, EVALUATING, AND IMPROVING A METRICS PROGRAM

This chapter presents a series of considerations to review when designing (planning), implementing (doing), evaluating (checking), and improving (acting) a metrics program. The chapter is organized according to the Plan-Do-Check Act (PDCA) cycle format that forms the basis for total quality environmental management and which Figure 3 illustrates below:

Figure 3
The Plan-Do-Check-Act-Cycle



Step 5. Repeat Step 1, with knowledge accumulated.
Step 6. Repeat Step 2, and onward.

Underlying the specific considerations presented here, however, are several broad concepts that need to be incorporated into all aspects of a program. These program elements are alignment, accountability, and continuous improvement.

With respect to metrics, alignment has several different meanings. First, there is the alignment between environmental metrics and business metrics. This involves blending as much as possible and ensuring consistency and compatibility between environmental and business data collection, reporting, and management systems. Second, there is the alignment between the metrics and the organization's operations and environmental objectives. Are metrics appropriate to and consistent with the organizations operations and goals? Third, there is the alignment between the metrics and the audiences—are the metrics responsive to the needs of target audiences such as management, business units, employees, regulators and the public? Finally, there is the broadest aspect of alignment — where environmental considerations are not separate from the business process but incorporated into all stages of the business process, including strategic planning, accounting, marketing, sales, product development, and R&D.

Accountability also has more than one meaning. Accountability signifies, on the one hand, identifying individuals who are responsible for ensuring that environmental performance goals are attained. However, accountability is not just a top-down concept. It is important that management allows business units to participate in the development of their environmental performance criteria, so that management gains their buy-in into the environmental performance measurement and goal-setting process.

Continuous improvement should drive the entire metrics plan-do-check-act cycle. A metrics program should never be established solely to measure performance. Rather, the metrics selected should spur environmental innovation and improve performance. In an ideal situation, a metrics program will encourage institutional innovation where business units compete with each other to improve environmental performance.

Planning a Metrics Program

The reader will notice that considerably more text is dedicated to the planning of a metrics program than to program implementation, evaluation, and improvement. This is because careful planning will eliminate many problems in the other stages. Once the system is in place, adjustments become much more difficult.

Consideration #1: One size doesn't fit all — consider your company's operations, organization and its unique environmental impacts.

The first thing to consider when selecting a metrics program is that one size doesn't fit all. Each company has its own particular products and services, organization, financial structure, legal and regulatory requirements, customer demands, data collection and management systems, and environmental impacts. Metrics appropriate to one company may be of less interest to another. Measuring the reduction in the use of packaging materials may be important to a company that produces household consumer products, whereas emergency management and pollution prevention may be more important to a petrochemical company, and air emissions of special concern to an electric utility. Conforming with international standards such as ISO 14001 may be important to companies with global operations, but of lesser importance to a local power company. In addition, corporate management, stockholders, and other internal and external stakeholders will dictate what tools are used and how performance is measured.

Furthermore, many companies are conglomerates that provide a wide spectrum of products and services, and metrics may vary from one facility or division of a company to another. For example, in a large multinational company, the type of metrics may vary according to the type of operations, e.g. packaging versus manufacturing, or type of product, e.g. personal healthcare versus chemical or pesticide manufacture, or from one country to another. Metrics may also vary according to the level in the management structure, e.g. division vs. facility vs. corporate.

Consideration #2: Determine the audience for your metrics.

One of the fundamental principles of verbal or written communication is to know your audience. The same can be said when designing a corporate environmental metrics program. The decision as to what type of metrics program to select will in large part be dictated by who is requesting the data on environmental performance. Typically, there will be a combination of internal as well as external audiences.

Table 6 lists the responses of 41 companies to a question of why they measure environmental, health, and safety (EHS) performance. The informal survey was conducted by the National Association for Environmental Management in December 1995. The responses show that the most important audiences or drivers, from most to least mentioned, include corporate management, government regulatory agencies, voluntary business initiatives (e.g. the ICC Business Charter and CMA Responsible Care®) the public, investors, employees, insurance companies and local communities.

Table 6
REASONS FOR MEASURING ENVIRONMENTAL PERFORMANCE

Reasons	# of Responses
Management need to control significant costs	23
Government regulations	17
Voluntary business initiatives	15
Public reporting	10
Public relations	7
Investor demands	5
Employee considerations	3
Market pressure	3
Insurance requirements	2
Community concerns	2
Other Reasons (internal tracking; requested by Board of Directors, determination of value added, corporate requirement, measure improvement, shows operational performance)	7
Total	**94**

Source: National Association for Environmental Management, "Performance Measurement of EHS Management Programs Survey", November 5, 1995.[14]

[14] For copies of this survey, contact George Nagle at Bristol-Myers Squibb Company, Environmental, Health and Safety Services, P.O. Box 182, E Syracuse, New York 13057; Telephone (315) 432-2731.

Each of these groups is interested in different types of performance data and metrics. A local community, for example, might be especially interested in releases of toxic chemicals from the facility adjacent to their community; employees on workplace injuries and illnesses and the strength of the management commitment to an EHS program; whereas management and investors will likely be interested in the costs of the EHS program and the value it adds to business as well as in EHS performance data. Regulatory agencies require the collection and reporting of certain type of data such as air emissions, discharges to water, and releases and spills of hazardous substances. Most companies will choose to respond to a variety of audiences.

Consideration #3: Establish goals/objectives.

The interests of the various audiences are usually incorporated into the company's corporate environmental, safety and health policy and objectives. These objectives often provide the criteria against which corporate performance is measured. In many cases, these principles are based on principles developed by voluntary business initiatives, such as the Public Environmental Reporting Initiative (PERI), the ICC Business Charter for Sustainable Development, and the Coalition for Environmentally Responsible Economies (CERES). In addition, management practices developed by CMA Responsible Care® and API (STEP) and other trade associations can also be used as goals and objectives. Specific performance goals for business units, however, should be established with the participation of those units in order to ensure their "buy-in" into the metrics program.

Consideration #4: Determine whether health and safety metrics will be included in the program.

Health and safety metrics are not always integrated with environmental metrics. Baxter, for example, collects and reports health and safety data separately from environmental data. For purposes of public reporting, however, most companies report health and safety metrics with environmental data. There is no one correct answer, but the issue should be resolved prior to implementing a metrics program.

Consideration #5 : Select metrics that drive performance.

The metrics selected should drive performance rather than just measure environmental outputs. For instance, a company striving to improve its compliance record with regulators should develop in-process metrics that identify and measure root causes of non-compliance. If lack of environmental training is identified as a root cause, measuring the number of employees receiving such training as well as the number of repeat violations could help to drive the company toward a better compliance record.

The Stanley Works, a producer of household and industrial tools, uses a scatter diagram to prioritize sites for corrective action. The company's metrics are discussed in detail in Appendix D. The system has been a strong driver of environmental performance.

Selection of an inappropriate metric can have unintended consequences. Measuring hazardous waste generated rather than reduction in hazardous material usage could drive managers to simply recycle certain materials, rather than substitute for or eliminate them from the production process. Focusing on the number of first aid cases on the shop floor may result in underreporting and more serious injuries later.

Scoring or indexing facilities certainly helps to measure progress from previous years and drive continuing improvements. Progress can be quantified and compared against previous years' performance or against corporate goals.

Consideration #6: Ensure that the program is sustainable.

Even the most successful metrics program will not remain so without documentation, and institutionalized procedures for collecting, evaluating and reporting data. The program must be sustainable or in other words, capable of enduring if key personnel leave the company (or, are transferred elsewhere.) For this reason adequate documentation is a key element of ISO 14001, the Environmental Management System standard. Exxon also makes documentation a key element of its Operations Integrity Management System (OIMS). Each facility is assessed not only according to its environmental performance, but also according to status, which includes on-site documentation.

Consideration #7: Be consistent from year-to-year.

A metrics program should be reasonably consistent from year to year, although flexible enough to allow continuing improvement. Changing metrics will not only be confusing to data gatherers and evaluators, but it can involve substantial costs to modify information management and accounting systems. Furthermore, it will make it difficult to assess progress from one year to the next.

Consideration #8: Select metrics that are understandable and compatible with the company's operations and information systems.

It is important to select metrics that are understandable to target audiences and business units and are compatible (aligned) with the company's operations. An environmental performance index may be difficult to implement and aggregate and thus not particularly useful to a company with diverse operations and divisions. On the other hand, it may be very useful to a company engaged in one type of activity. For international companies, a metric that is clear to a domestic site may not be understood in another country.

Consideration #9: Use data that are already being collected for other business purposes, where possible.

Data collection and reporting of environmental performance will be facilitated and costs minimized to the extent that existing data collection systems can be used. The costs of an environmental metrics program will of course be of major concern to corporate management especially in smaller companies.

Data that are routinely tracked and reported are data that are required by regulatory agencies. Federal, state and local government regulations require the collection and reporting of large amounts of environmental data, such as:

- Hazardous wastes generated
- Releases of toxic chemicals
- Spills of oil and hazardous substances
- Air emissions and wastewater discharges
- Work related accidents and illnesses

In addition, government enforcement activities may generate notices of violation, fines and other penalties which are usually tracked closely.

Other data that are tracked for business purposes, but that may also useful for environmental metrics, include:

- water usage
- energy usage/unit of product
- number of internal audit findings
- environmental remediation costs
- percent of employees trained
- amount of materials recycled
- raw material usage/unit of product

Consideration #10: Define performance expectations and identify who is accountable.

It is important to be specific when defining performance expectations, especially if business units and managers are going to be held accountable for environmental performance as measured by metrics. Companies with successful performance measurement programs link compensation with environmental performance. Most often it is a plant or site manager; in some cases, it is more fully integrated to all employees. Kodak ties facility managers' pay to their environmental performance. The company has developed performance standards for the environmental aspects of its operations, and has developed clear expectations for performance.

Facilities that are supplying data should know the results of their efforts. An internal survey within Bristol-Myers Squibb indicated much better cooperation if facilities understand why data are collected and how they are used. [15]

15 Memorandum from Jerry Schinaman, Bristol-Myers Squibb Company to Mark Ethridge, Earth Tech, May 15, 1997.

Consideration #11: Identify clear data collection processes — when and how will data be collected and reported.

Prior to implementation of a metrics program, it is essential to define when and how data will be collected and reported. Data should be collected so that they are supplied to management in time to take effective action. In addition, regulatory requirements may dictate when certain data are collected and reported, e.g. annually for SARA release data. Other important considerations are **1)** what type of information management system will be used to manage the data, **2)** what type of computer software will be used to report data (if it is entered electronically), **3)** who will collect what kind of data, **4)** how site personnel will be trained to collect data, **5)** and how accuracy of the data will be verified.

Consideration #12: Normalize Data.

Normalization of data is an important technique for tracking environmental performance. Tying emissions, releases, and resource consumption to a unit of production helps clarify whether positive environmental trends are the result of pollution prevention activities or simply the effect of decreased manufacturing (for example from plant closings or a shift to contract manufacturers).

Implementing a Metrics Program

Once a program has been designed and selected, the following points should be seriously considered:

Consideration #1: Get upper management support.

No metrics program can be successful without the support of upper corporate management. Strong management support will ensure that adequate personnel, financial and information management resources are dedicated to the task. DuPont and Monsanto are examples of companies where the upper management is firmly committed to an

aggressive environmental metrics program. At Monsanto, CEO Robert Shapiro has made sustainability the focus of the company's strategic thinking. He has organized seven sustainability focus teams, one with the task of developing metrics by which business units can measure or not they're moving toward sustainability.[16] DuPont's CEO, John A. Krol, has also committed the company to an aggressive goal of zero injuries, illnesses, incidents, and emissions.

Consideration #2: Get the support of business units.

Committed upper management alone can not guarantee the successful implementation of a metrics program. It is also necessary to get the support of business units. One way of securing such support is to have the business units participate in defining the metrics to which they will be held accountable. This is the approach taken by Procter and Gamble, Bristol-Myers Squibb and Kodak. The Procter and Gamble and Kodak metrics programs are discussed in greater detail in the Appendices.

Consideration #3: Consider flexible systems for diverse operations.

If a company has diverse operations or operates in many different parts of the world with different operating and regulatory environments, it may consider developing metrics that are flexible and adaptable to the specific situations. A relatively simple facility with few potential environmental impacts may be graded on fewer criteria than a large and complex manufacturing facility. Procter & Gamble is an example of this approach (see Appendix B).

Consideration #4: Avoid using too many metrics.

In terms of metrics, more is not necessarily better. As a general rule, the use of too many metrics should be avoided. Collecting, evaluating and reporting metrics requires time, personnel and money, and the more metrics that are used, the greater the resource requirements.

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16 Monsanto's CEO Raises the Bar on Sustainable Development.", *Environmental, Health and Safety Management*, March 3, 1997, p.3.

Furthermore, collecting too many metrics can become confusing and frustrate staff and managers who may already be stretched thin because of other responsibilities. Reporting too many metrics can also overwhelm and confuse target audiences. WMX Technologies, for example, decided against developing quantitative metrics for each of its 14 environmental principles stated in its annual external environmental report, and instead focused on a smaller number of measures to satisfy the information needs of its stakeholders.[17] Polaroid Corporation, a pioneer in performance measurement and public reporting, has just simplified its metrics in order to better drive internal performance and be more meaningful to external stakeholders.

Evaluating the Effectiveness of Metrics

In order for continuous improvement to occur, metrics should be evaluated to determine if they are useful and appropriate. This section discusses some points to consider during this phase.

Consideration #1: Are the right data getting to key people in time to take action?

In order for data to be useful, they need to be reported to the appropriate corporate officials in time for meaningful action to be taken. In addition, the right kind of data need to be reported. Evaluate whether the metrics selected are accomplishing these objectives.

Consideration #2: Are the metrics consistent with other reporting measures?

Now is the time to verify whether the metrics chosen are consistent with other reporting measures. For example, are data reported to the public consistent with those reported to government agencies? Are environmental data collection efforts duplicating data collection for other business purposes?

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17 "*Environmental Reporting in a Total Quality Framework*," GEMI, 1994, p. 21.

Consideration #3: Are the metrics driving the right behavior?

Verify whether the metrics are driving performance and leading to continuous improvement. Also, failure to develop the appropriate metric may produce a result different from what was intended.

Consideration #4: Get stakeholder feedback—employees, business units, public, stockholders.

In order for continuous improvement to occur, the developers of metrics should solicit and receive input from the users of metrics. Companies have held workshops to solicit such input. DuPont and Monsanto have established standing committees comprised of external stakeholders who review and improve metrics programs. Bristol-Myers Squibb and IBM have also invited stakeholders to evaluate their metrics, and have added new measures to their program to respond to stakeholder concerns.

Improving a Metrics Program

If the metrics collected and reported aren't providing the type of information desired by the various target audiences, then it may be appropriate to consider abandoning or modifying the existing measure and substituting another. The results of the evaluation may call in question what to measure. For example, simply measuring the number of deficiencies discovered during corporate self assessments may not give management a measure of the seriousness of these deficiencies. To accurately track compliance a new metric that classifies findings according to their severity may be desirable. In this case, the planning phase of the PDCA cycle will be revisited, and the continuous improvement loop will be completed.

Chapter 3
TRENDS IN ENVIRONMENTAL PERFORMANCE MEASUREMENT

"The green economics and lifestyles of the 21st Century may be conceptualized by environmental thinkers, but they can only be actualized by industrial corporations. Industry has a next century vision of integrated environmental performance. Not every company is there yet, but most are trying. Those that aren't trying won't be a problem long term, simply because they won't be around long term. That is the new competitive reality."

E.S. WOOLARD, JR.
Chairman, DuPont

A. The Globalization of Metrics

Environmental performance measurement is becoming increasingly a global phenomenon. This is occurring for a number of reasons. First there is widespread recognition that many environmental problems are global, such as ozone depletion, acid deposition, the greenhouse effect, deforestation and species extinction issues. Environmental issues that would have concerned only local communities are now the focus of international concern. Second, market forces are driving a global approach to metrics. The flow of goods, services, capital, and information is accelerating across national boundaries, and many companies are competing in more and more markets. Governments, stockholders, and consumers are also demanding environmentally responsible management. Third, international standards organizations and voluntary initiatives are spurring the development of environmental management systems and better metrics. These trends are likely to continue into the 21st century, enhancing the importance of global metrics programs.

B. Emphasis on Sustainability

Although the concept of sustainability is not new, the Rio summit of 1992 heightened its visibility. Increasing emphasis on sustainability is reflected in corporate annual environmental reports. As mentioned earlier, Monsanto has made sustainability a focus of its environmental programs, and has established seven corporate management teams to promote the concept throughout the company. Other companies highlighting sustainability include DuPont, Bristol-Myers Squibb, Novo Nordisk, Baxter, and Rhone-Poulenc.

C. Increasing Emphasis on EMS

Many of the larger Fortune 500 companies have environmental management systems. More and more these systems are viewed as a means of measuring, tracking, documenting, and managing environmental performance. They also are an attempt to go beyond merely complying with environmental laws and regulations. The development of ISO 14001 is encouraging the development of such systems. In addition, EPA is promoting the development of environmental management systems. The EPA Environmental Leadership Program (ELP) has developed an EPA-approved EMS.

D. Integration of Environmental Performance with Business Performance

In today's environment of corporate downsizing and cost-consciousness, it is becoming more and more important to develop metrics that show the connection between environmental performance and profitability. Too often environmental programs have been viewed as a necessary burden—costs that must be incurred for the public good, but which detract from profitability. What is developing is a new mindset that sees environmental innovations as ways to not only to reduce costs, but actually as a means of increasing revenue through the more efficient use of resources. At the same time, environmental considerations are being integrated into other aspects of business such as policy and planning, accounting, product development, life cycle costing, and process design. This blending of environmental with business performance is likely to continue. An example of this environmental-business integration is provided by DuPont in Appendix A.

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Appendix A.
CASE STUDY - DUPONT:
INTERGRATING ENVIRONMENTAL WITH BUSINESS PERFORMANCE MEASURES [18]

DuPont is a large chemical and energy company serving global markets. Its key achievement in environmental metrics is the integration of environmental thinking into the business process. The company's vision has gone beyond compliance and environmental outputs by measuring environmental innovations in terms of such traditional business measures as reduced costs, improved product yield, and increased market share and stockholder value. Ultimately, environmental improvement is viewed not only as a reduced cost or liability, but as a business opportunity. This vision is compatible with the concept of sustainability: creating economic growth without increasing adverse environmental impacts. It is a vision that cuts across all business functions, including operations, sales, R&D, marketing, and finance. Exhibit A-1 illustrates this vision.

Stretch Goals

DuPont's first step toward sustainability was the development of corporate stretch goals. The goals include eliminating all injuries, illnesses, incidents, waste and emissions as a way of improving business performance. This step has simplified measurement of environmental performance and stimulated continuous improvement throughout the company (Exhibit A-2).

Assessing the Cost of Waste/Improving Yield

Understanding the cost of waste is the first step in helping business understand the link between environmental performance and business performance. One business unit at DuPont was able to measure the value of their wastes, not only in terms of disposal costs, but also ingredient costs and lost yield (Exhibit A-3). Thus, a waste is not only

[18] This case study borrows extensively from an article by Paul V. Tebo and Dawn G. Rittenhouse titled, "Sustainable Development: Creating Business Opportunities at DuPont, " published in *Corporate Environmental Strategy*, Vol. 4, No.3; and from a presentation prepared by Darwin Wika of DuPont.

a cost, but unused product, and an opportunity to improve yield and profitability. Another business unit was able to reengineer its manufacturing process and obtain a first-pass-yield improvement from 78 to 93 percent that translated into a savings of $15 million per year of variable cost, $20 million per year of fixed cost, and an overall reduction of $120 million in capital investment. Yield improvement, a business metric, translates into source reduction and pollution prevention. The 64% yield improvement represented a 70% reduction in emissions and an 80% reduction in unused product waste. Exhibit A-4 lists other examples where wastes have become a business opportunity.

Exhibit A-1

The Journey

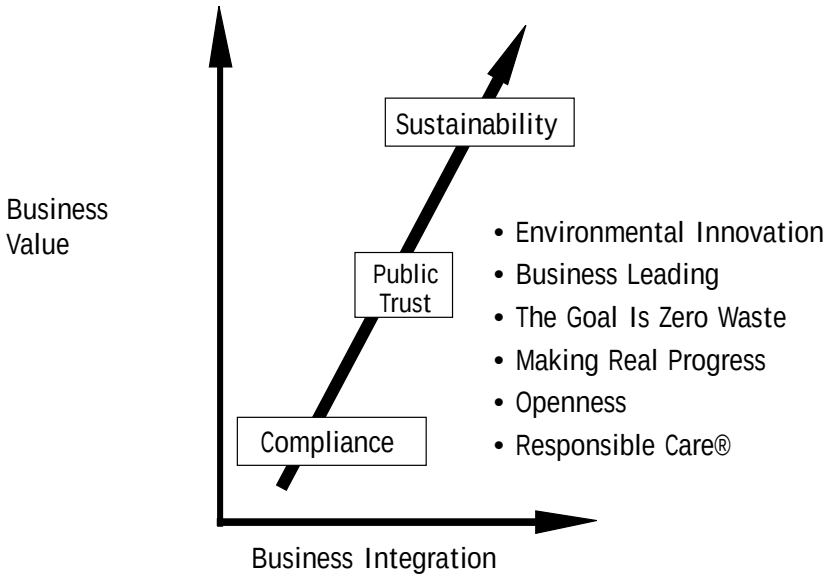


Exhibit A-2

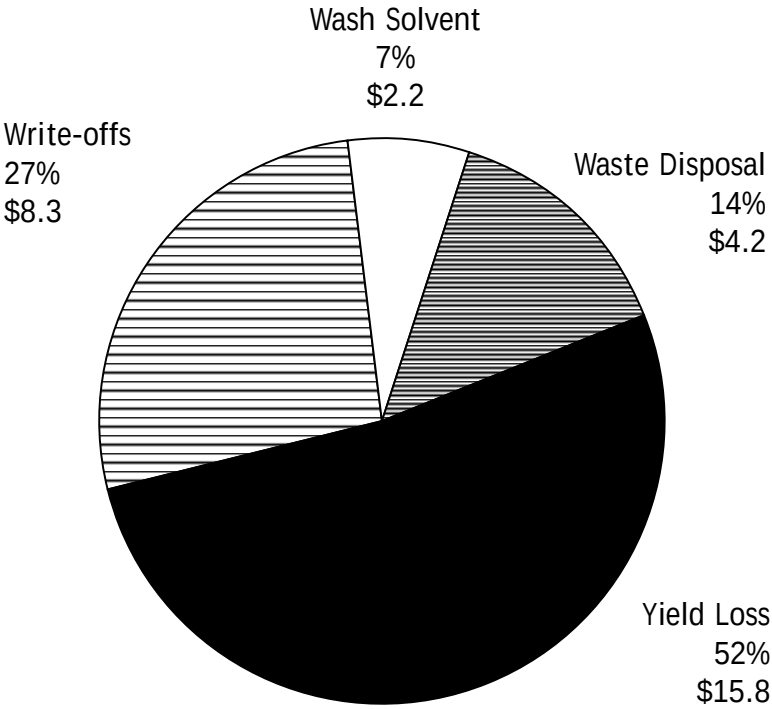
Zero Waste & Emissions

- U.S. Airborne Carcinogens down 68% (1994/1987) *Year 2000 projection 91%*
- U.S. EPA 33/50 chemical releases down 60% (1994/1980) *Year 2000 projection 75%*
- Global product packaging waste to landfills down 29% (1994/1991) *Year 2000 projection 49%*
- TRI (releases and transfers) down 19% (1994/1987); excluding deepwells, down 46% *Year 2000 projection 51%*
- TRI (as generated) down 27% (1994/1991) *Year 2000 projection 41%*
- Ozone-depleting chemical emissions down 52% (1994/1991) *Year 2000 projection 80%*
- Greenhouse gas emissions down 12% (1994/1991) *Year 2000 projection 60%*
- U.S. landfill and land-applied wastes down 35% (1994/1988) *Year 2000 projection being developed*

Exhibit A-3

Waste is a Cost

Cost of Waste for One DuPont Strategic Business Unit



Total = $30.5 Million

Exhibit A-4

Waste is an Opportunity

for example:

- Nylon from used carpets is recycled into auto components, soil stabilizers,...
- Waste milk jugs become 25% of Tyvek® envelopes, earning DuPont 100% of U.S. Post Office business.
- 80% pre-customer recycled Dacron® polyester fiber is used on DuPont's Thermoloft and Thermolite performance insulation products.
- Corian® pieces, once sent to landfills, are now crafted into high value specialties like watches, pen and pencil sets,...
- Neoprene business eliminates packaging waste while improving market share by developing Rotim® bag that becomes part of the product.
- DuCare® business receives 97% customer satisfaction rating due, in part, by recycling all customers' waste associated with using DuPont products.

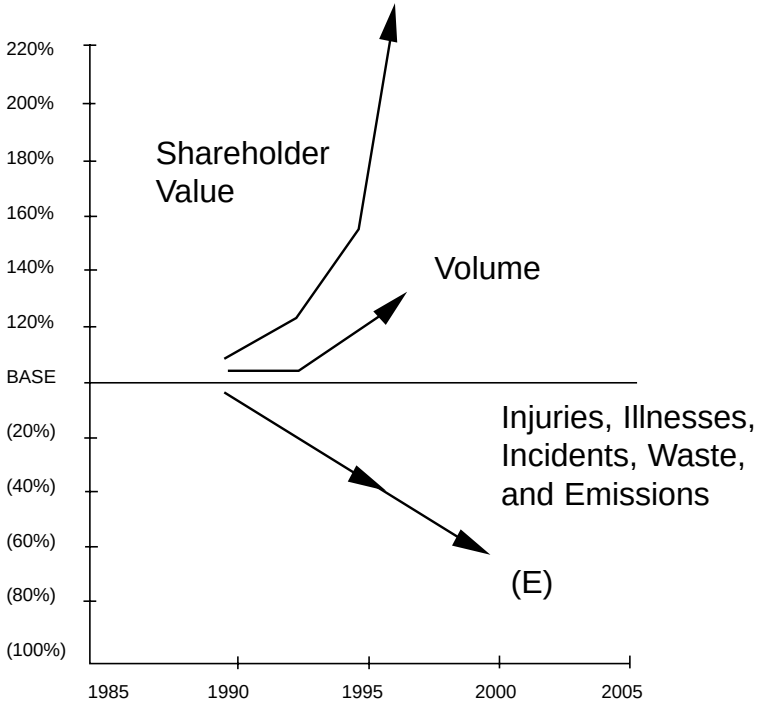
Environmental Innovation as a Business Opportunity

Environmental improvement can sometimes be measured in increased market share and new business. An example of this is DuPont's "DuCare" business. DuCare is a way for graphic arts customers to eliminate film processing effluent. The R&D organization was able to substitute a relatively non-toxic chemical for hydroquinone, a suspected carcinogen, and use twenty-five to forty percent less chemicals than traditional systems. Further improvements led the team to develop a closed loop recycling system so that customers could return the chemicals in their original packages to DuPont. The company is then able to regenerate the chemicals and resell them. As a result, 370,000 tons less effluent was sent down the drain, DuPont generated $0.5 million in new business, and DuCare became the leading product offered to graphic arts customers.

DuPont is currently working on developing a metric that will define sustainability in terms of its four stakeholders: stockholders, society, employees, and customers/consumers. DuPont has defined stockholder improvement as increasing shareholder value, and is just beginning to develop a metric for the other stakeholders of sustainable development. However, experience is showing that environmental progress is also leading to improvements in business performance. Exhibit A-5 shows environmental improvement occurring simultaneous with increasing shareholder value. Although other factors account for much of this increase, DuPont's experience shows that business metrics and environmental metrics are indeed related.

Exhibit A-5

Progress

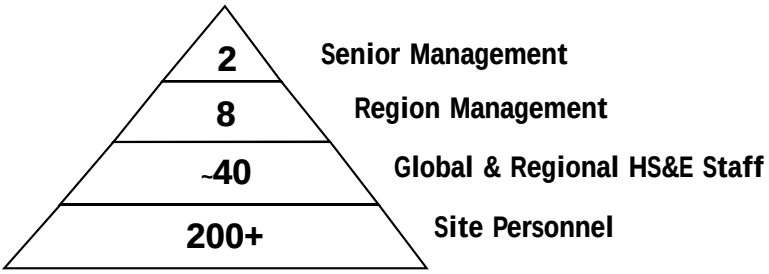


Appendix B.
CASE STUDY - PROCTER & GAMBLE:
A GLOBAL, YET FLEXIBLE APPROACH TO HS&E METRICS

Procter & Gamble (P&G) is a global consumer products manufacturing company with 150 manufacturing facilities worldwide; 100 of these sites are located outside of North America. The distinctive aspect of P&G's Health, Safety, and Environmental (HS&E) metrics program is that it is flexible enough to account for a wide variety of manufacturing activities and operating environments worldwide, yet retain common global expectations. Another advantage of the P&G system is that it encourages accountability at the site, because site personnel are empowered to determine the best method for achieving these expectations at their facility.

The P&G metrics system resembles a pyramid in which each level of management hierarchy has the appropriate metrics needed to drive expected HS&E performance results. For example, senior management reviews aggregated data for the two measures described below. At the bottom of the pyramid, sites are expected to maintain the necessary metrics to establish compliance with the law and company policy. This will often involve 200 or more different HS&E measures. In the case of performance outages, region management and HS&E staff are expected to explain the gaps and plans for closing the gaps. Figure B-1 illustrates this bottom-up process.

Figure B-1
HS&E Metrics System



Environmental Management System (EMS)
Audit Rating

At the core of the P&G metrics system is a numerical audit rating for each of the HS&E programs. For its EMS, the company conducts annual site audits to assess a site's complexity (i.e., environmental aspects and issues) as well as its capacity to manage that complexity. As shown in Exhibit B-1, many environmental aspects are rated including wastewater, soil/groundwater, air emissions, hazardous waste, solid waste, and community issues. Management system capability is rated in the areas of compliance with the law, community relations, staff capability, system and equipment design, incident management and continuous improvement.

Exhibit B-1 shows typical criteria used for rating site complexity and ultimately defining the level of management attention required at the site. The example given is for the category of wastewater discharge. A site with only rainwater and sanitary discharges requiring no on-site treatment would be rated low and receive a complexity score of "0". However, a facility with on-site treatment operating at more than 75% capacity and discharging more than 1000 liters of effluent per hour would be place in the high category, and assigned a maximum complexity score of 20.

Exhibit B-2 shows typical rating criteria for environmental management of a facility in the area of people capability. The specific rating criteria are designed to appropriately address the site's environmental complexity and include the certification status of key environmental personnel, support of site management, frequency of environmental training, program documentation, contractor selection and assessment procedures and measures for corrective action. Note that site management systems are expected to have at least 80% of the maximum possible score.

Significant HS&E Performance Defects

In addition to these key numerical audit ratings, sites are also expected to eliminate significant HS&E performance defects. Significant performance defects are:

- Compliance issues unresolved for more than 12 months;
- Total injury rates exceeding global targets; and
- Key ingredient sensitivities exceeding global targets.

Other Site HS&E Performance Measures

Other measures considered in the facility HS&E assessment are:

- Trained and certified HS&E program leaders;
- HS&E resource productivity and costs;
- Waste generation, disposal, energy usage, and costs;
- Worker's compensation and costs;
- Insurance and property losses; and
- Significant HS&E incidents.

Once collected, these performance data are appropriately provided to site, regional and global personnel for evaluation and corrective action (improvement plans).

Exhibit B-1

Environmental Complexity and Management Rating Form

Site Name _____ **Audit Date** _____

Audit Team _____

Environmental Complexity Rating	**Maximum Possible**	**Actual Score***
1. Wastewater Discharges	20	
2. Soil and Groundwater Issues	10	
3. Air Emission Sources	20	
4. Hazardous Waste Generation/ Storage Disposal	15	
5. Solid Waste Generation/ Storage/Disposal	15	
6. Community Capabilities & Issues	20	
Class III 0-44 Total	**100**	

Environmental Management Rating	**Maximum Score**	**Mg'mt KEA Score***
1. Government and Public Relations	25	
2. People Capabilities	20	
3. Direct Environmental Impact	15	
4. Incident Prevention	20	
5. Continuous Improvement	15	
6. Reduction of Site Complexity	5	
Management Rating ÷ 10	**10**	

Expected Score + 8.0+

*See attached for typical rating criteria.

M.T Fisher 7 March 97

Exhibit B-2

Typical Environmental Complexity Rating Guide

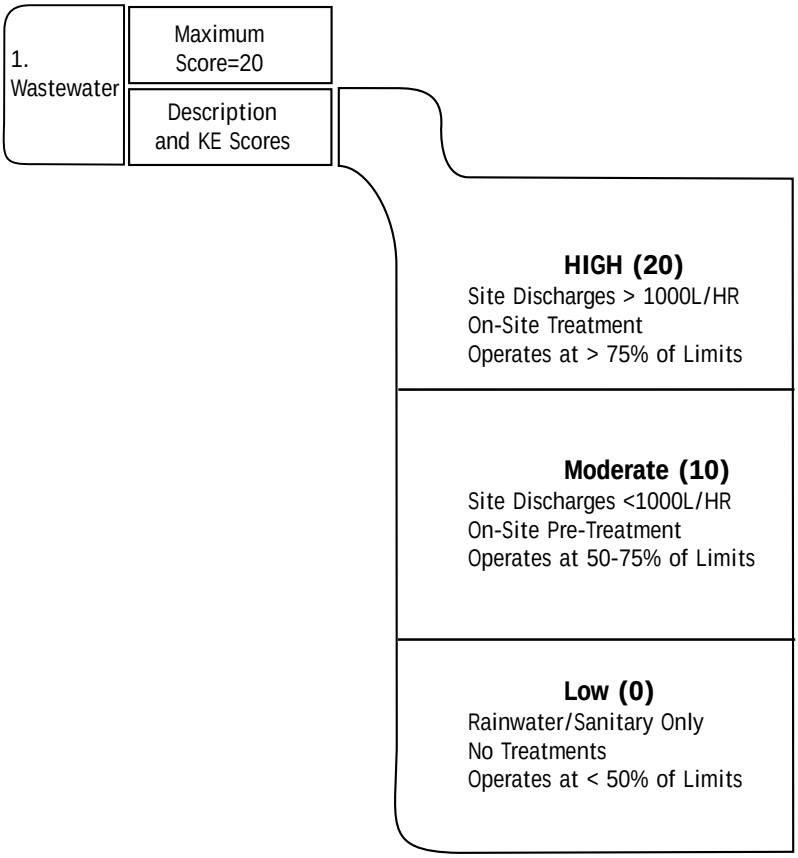
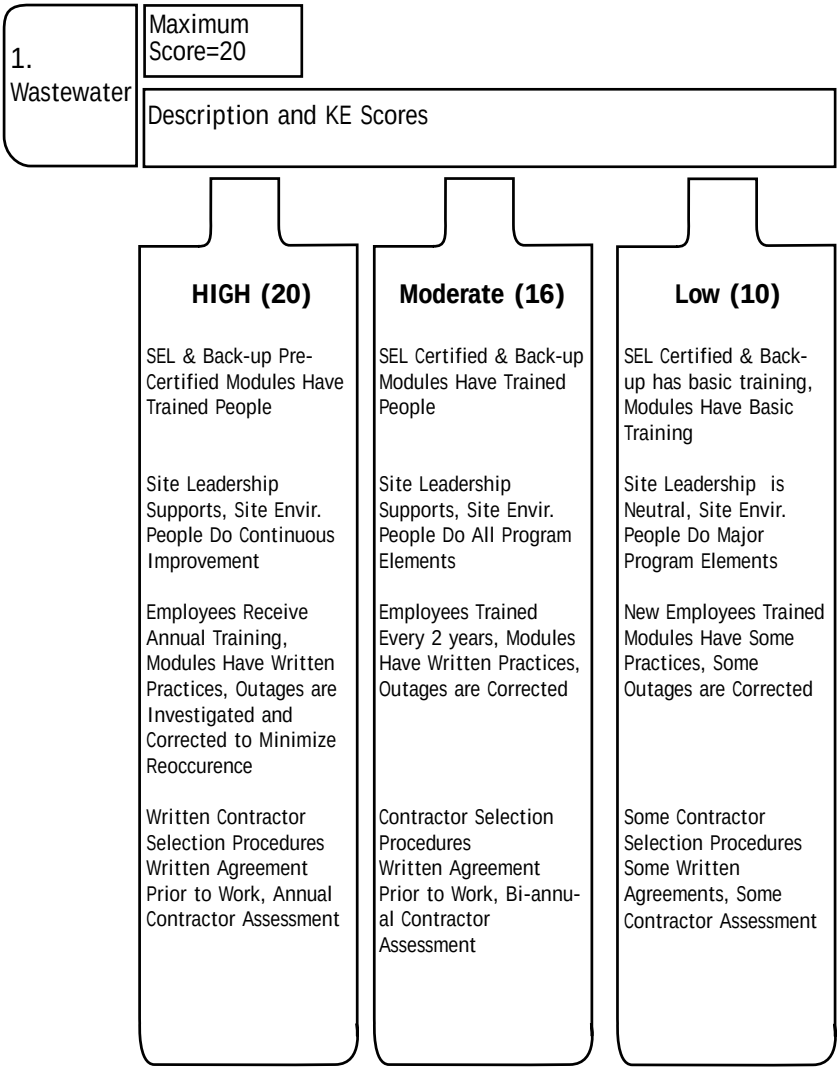


Exhibit B-2 (continued)

Typical Environmental Management Key Element Rating Guide



Appendix C.
CASE STUDY - KODAK:
DEVELOPMENT OF AN ENVIRONMENTAL PERFORMANCE INDEX[19]

Eastman Kodak, the worldwide imaging and film processing company has developed an environmental performance index (EPI) for measuring progress at its manufacturing sites. The index is based on a series of performance measures that are appropriate to the manufacturing site. The Kodak system, like the P&G system discussed earlier, allows sites to develop performance criteria that relate to the operations of each facility. The system is supplemented by corporate environmental performance standards audits for all facilities.

The EPI is expressed in terms of a matrix as shown in Figure C-1. Progress measures are selected by the facility (with the approval of management) which are appropriate to the unit's operations. Three different performance levels are selected for differing levels of implementation of the performance measure: a baseline level, a goal, and a stretch goal. In Figure A, the rating for the measure in the first row (safety program implementation) is based on the level of implementation of 18 Responsible Care® practices. Four points are assigned for full implementation (18x4=72 total possible score) and 5 points after one year of implementation (18x5=90) total possible score after one year). The baseline is 54 points; the goal is 63 points, and the stretch goal is 90 (full implementation of all practices for one year). The individual progress measures are then assigned a weighting factor that reflects the relative impact of each measure on overall environmental performance. In the example, the weight assigned is 25. The actual value recorded is 65. This represents full attainment of performance level 5. The level(5) times the weight (25) equals the score, or index value, (125) for this example. The annual goal is a score of 700, with a maximum score of 1000 for full implementation of all measures.

[19] The information for this case study has been taken from "Safety Performance Indexing: Metrics for safety performance improvement projects" by Eastman Kodak Company, 1994.

The objective of the EPI is to drive continuous improvement by identifying improvement projects that target a facility's most significant HSE programs. According to corporate guidance, every performance measure used in the matrix should:

- Address the most significant problems identified for that group
- Represent practical, do-able activities appropriate to that group
- Promote the overall environmental goals of the organization as a whole
- Establish goals for improvement that meet or exceed the organization's expectations

The result is a set of matrices that are all linked directly to the organization's fundamental environmental goals and expectations, but that are custom-tailored for the individual groups or work areas.

Figure C-1
Safety Performance Index (with associated matrix and definition of progress measures) for XYZ Shops

Example:
XYZ Shops Division

XYZ Shops Division has 107 employees: 82 operators in the shops, and 25 office/engineering /management personnel.

This is XYZ Shops' safety performance index and its associated matrix for the month of June.

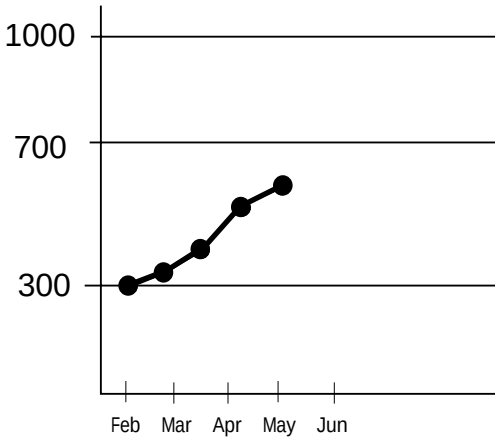


Figure C-1 (Matrix)

Progress Measures	Performance Level											Calculations			
	0	1	2	3	4	5	6	7	8	9	10	value	level x wt.		=score
Safety program implementation	<18	18	36	54	59	(63)	67	**72**	78	84	90	65	5	25	125
Employee training	5	10	15	20	35	51	(66)	**82**	90	99	107	70	6	10	60
Safety inspection				11	15	19	23	(**27**)	31	35	39	28	7	15	105
Corrected action items	<30	30	40	50	60	70	80	**90**	93	96	100	73	5	15	75
Job hazard analysis	<5	5	15	25	35	45	55	(**65**)	70	75	80	68	7	20	140
Noise abatement	>11	11	10	9	8	7	(6)	**5**	4	3	2	6	6	15	90
														Total Score=	**595**
				↑ baseline				↑ **goal**			↑ stretch goal				

Program Measure Definition

Safety program implementation

Cumulative rating based on the level of implementation of 18 Responsible Care practices (Employee Health and Safety Code); 4 points for full implementation (18x4=72 possible score), 5 points after 1 year of full implementation (18x5=90 total possible score after 1 year)

Employee training

employees completing basic safety training program (82 operators to be trained, with highest-exposure work groups to be trained first; the 25 remaining workers are less-exposed, and will be trained after the higher-exposure groups are trained)

Safety inspections

safety inspections completed (both scheduled and unscheduled)

Corrected action items

$$\frac{\text{\# action items corrected}}{\text{total \# action items identified}} \times 100\%$$

Job hazard analysis (JHA)

$$\frac{\text{\# JHAs completed}}{\text{total \# “jobs” identified}} \times 100\%$$

Noise abatement

#noise zones

Appendix D.
CASE STUDY - STANLEY'S ENVIRONMENTAL PERFORMANCE EVALUATION PROGRAM

Stanley's Environmental Performance Evaluation Program
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ABSTRACT

Since 1995, The Stanley Works has successfully utilized its Environmental Performance Evaluation (EPE) program to reduce variability between sites and advance best management practices throughout the Company. The EPE format — a "road map" — has helped sites achieve cost savings and identify cost avoidance opportunities. The EPE/Risk diagrams serve as an excellent tool for determining the appropriate allocation of resources to sites. Additionally these diagrams provide a succinct, simple visual representation of the program performance and have proven beneficial in presentations to both executives and line management.

DISCUSSION

In 1995, Stanley's Company Environmental Council (CEC) began to evaluate the Company's environmental management systems performance via the EPE program. The EPE program has three main goals:

- provide an objective measurement "tool" to evaluate performance,
- identify those areas[20]/sites that require additional resources,
- develop a document that would also serve as a "road map" for those sites striving for environmental excellence.

[20] Compliance management, pollution prevention, best management practices, etc.

The EPE program criteria describes best management practices that, if implemented, would give The Stanley Works the best environmental management system for the least cost. A high EPE score correlates to the optimum compliance management strategy.[21]

The EPE is formatted to function as a guidance document for those sites choosing to pursue environmental excellence. In addition, the EPE will be a critical component of any site's effort to obtain ISO 14000 certification.

The EPE Format

The EPE is divided into seven environmental areas—or performance measures. In 1997, these performance measures include: (1) management participation, reporting and recordkeeping, auditing follow-up; (2) compliance management practices — group one; (3) compliance management practices — group two; (4) training and communication; (5) pollution prevention; (6) emergency response preparedness and prevention; and (7) facilities management. Each performance measure is further subdivided into subcategories, or indicators. Every indicator is composed of five elements, each of which builds on the previous one.

The EPE is designed so that each site will be able to evaluate itself as it progresses through each of the indicator elements. By choosing a progressive format for the evaluation (indicator elements), each site will be able to choose the rate of change it deems necessary.

[21] The EPE should not be confused with a compliance audit. Compliance auditing evaluates a particular moment in time; The EPE is designed to assess a site's ability to sustain consistent performance over time. The EPE is a performance based tool.

Risk Measurement

Additionally, each site's regulatory risk — a site's likelihood of regulatory entanglements — is measured through the use of an environmental exposure evaluation form. This form identifies the environmental regulations that apply to the site and the volume of emissions released from the site. The range for this measurement is 0-100 and is established by the CEC. The risk measurement scale correlates to compliance costs. A high "risk score" is indicative of high compliance maintenance costs.[22]

EPE/Risk Scatter Diagrams

By graphically plotting a site's EPE score against its risk score, a scatter diagram is produced (the EPE is the y axis and risk is the x axis.) The scatter diagram is further divided into quadrants by using the midpoint risk score (50) and the 1995 mean EPE score. Figures 1 and 2 on the following page are the EPE/Risk scatter diagrams for 1995 and 1996 respectively.

With few exceptions, sites improved their EPE score. In 1995, there were 35 sites below the mean score of 68.5; in 1996 there are only 6.

[22] It is important to note that although the risk measurement is correlated to the activities at a site, it is possible to lower a site's risk score through reduced emissions and subsequent regulatory disengagement.

Figure 1

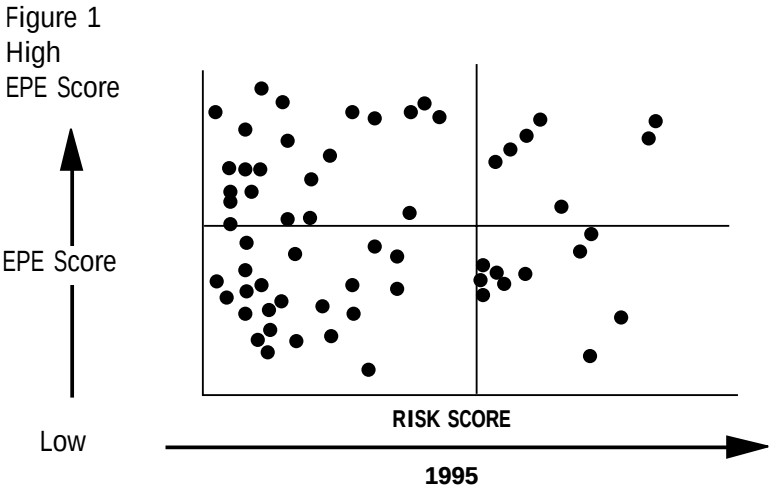


Figure 1. Position of Stanley locations within the scatter diagrams The dots represent each site's EPE/Risk coordinates. In 1995, there were 35 sites below the mean score of 68.5 and 10 low EPE/high risk sites (Quadrant 4).

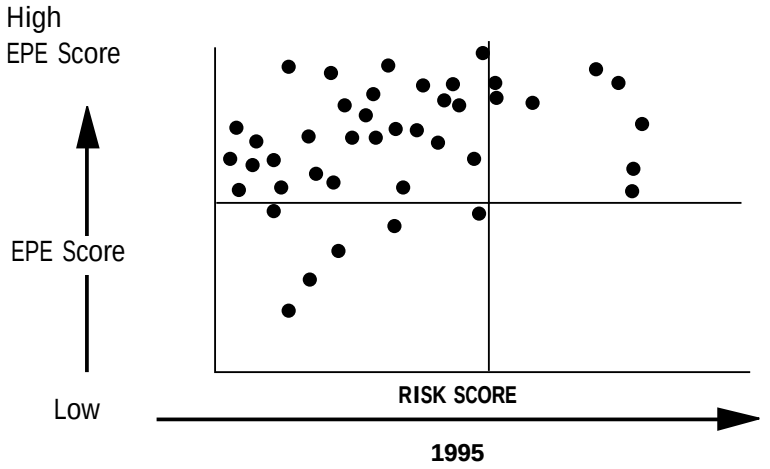
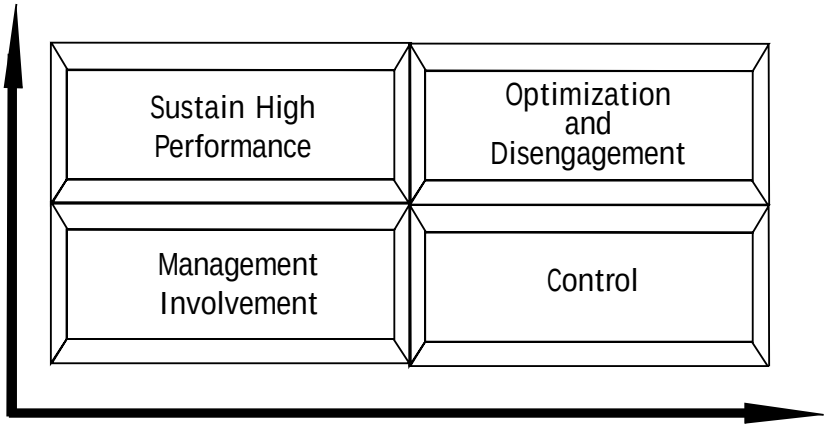


Figure 2. Position of Stanley locations within the scatter diagram. The dots represent each site's EPE/Risk coordinates. With a few exceptions, sites improved their EPE score from 1995. In 1996, only 6 sites scored below the baseline mean of 68.5 and none were considered low EPE/high risk (Quadrant 4).

1997 Strategies For Improvement

Environmental performance continuous improvement strategies are developed for the four quadrants of the scatter diagram as follows:



- 1st Quadrant Facilities: High EPE/Low Risk sites will be encouraged to perfect and sustain their environmental management systems.
- 2nd Quadrant Facilities: High EPE/High Risk sites need to focus on process optimization and/or process change opportunities—which will ultimately allow them to disengage from regulatory burdens.
- 3rd Quadrant Facilities: Low EPE/Low Risk sites need to develop management programs and practices that will move them toward sustainability.
- 4th Quadrant Facilities: Low EPE/High Risk sites must focus on process control and develop better management programs and practices.

SUMMARY

Stanley's Environmental Performance Evaluation (EPE) program is an annual performance appraisal. It is administered through the Company Environmental Council (CEC) and is performed at each manufacturing location. The EPE produces a numeric (quantitative) evaluation of each site's environmental performance. The numeric scoring aspect of the EPE allows each site to gauge its performance against a Company or Division average and against a known standard—the EPE indicator criteria. Additionally, each site is given a "risk score" determined through the environmental exposure evaluation form. By graphically plotting a site's EPE score against its risk score, a scatter diagram is produced (the EPE is the y axis and risk is the x axis.) The scatter diagram is further divided into quadrants by using the mid-point risk score (50) and the 1995 mean EPE score. Environmental continuous improvement strategies are developed for the four quadrants of the scatter diagram.