

Environmental Performance Indicators:





One of the most significant long-term trends affecting the future vitality of the petroleum industry is the public's concerns about the environment. Recognizing this trend, API member companies have developed a positive, forward looking strategy called STEP: Strategies for Today's Environmental Partnership. This program aims to address public concerns by improving our industry's environmental, health and safety performance; documenting performance improvements; and communicating them to the public. The foundation of STEP is the API Environmental Mission and Guiding Environmental Principles.

API ENVIRONMENTAL MISSION AND GUIDING ENVIRONMENTAL PRINCIPLES

The members of the American Petroleum Institute are dedicated to continuous efforts to improve the compatibility of our operations with the environment while economically developing energy resources and supplying high quality products and services to consumers. The members recognize the importance of efficiently meeting society's needs and our responsibility to work with the public, the government, and others to develop and to use natural resources in an environmentally sound manner while protecting the health and safety of our employees and the public. To meet these responsibilities, API members pledge to manage our businesses according to these principles:

- To recognize and to respond to community concerns about our raw materials, products and operations.
- To operate our plants and facilities, and to handle our raw materials and products in a manner that protects the environment, and the safety and health of our employees and the public.
- To make safety, health and environmental considerations a priority in our planning, and our development of new products and processes.
- To advise promptly, appropriate officials, employees, customers and the public of information on significant industry-related safety, health and environmental hazards, and to recommend protective measures.
- To counsel customers, transporters and others in the safe use, transportation and disposal of our raw materials, products and waste materials.
- To economically develop and produce natural resources and to conserve those resources by using energy efficiently.
- To extend knowledge by conducting or supporting research on the safety, health and environmental effects of our raw materials, products, processes and waste materials.
- To commit to reduce overall emission and waste generation.
- To work with others to resolve problems created by handling and disposal of hazardous substances from our operations.
- To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.
- To promote these principles and practices by sharing experiences and providing assistance to others who produce, handle, use, transport or dispose of similar raw materials, petroleum products and wastes.

Environmental Performance Indicators: Methods for Measuring Pollution Prevention

Health and Environmental Affairs Department

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EXECUTIVE SUMMARY

This report identifies a variety of methods for demonstrating performance and progress towards pollution prevention in each sector of the petroleum industry. The tools discussed here are based on pollution prevention techniques that are already in use at companies or facilities, or that have been used in other industrial sectors in similar situations.

API invites its membership to review these measures as an aid for developing internal pollution prevention programs, or to measure the effects of programs already in place. Application of these measures may include the following benefits:

- *Support for internal planning or tracking of pollution prevention efforts.* Where companies have put programs in place, these measurement techniques may help produce uniform data on program effectiveness.
- *Support for management performance goals.* Where companies have adopted pollution prevention goals as performance targets for managers, these tools may be applied to evaluate management performance.
- *Public discussions.* Because pollution prevention is a topic of strong public interest, companies may use the methods in this document to measure pollution reductions in new ways to increase the public's understanding of complex issues. Where pollution prevention programs are already in place, companies may find the data generated by these tools to be valuable for outreach on environmental issues.

The various measurement parameters that were identified in this study were organized into five categories, ranging in nature from least quantitative to most quantitative, and are described below.

Program-oriented Measurements. A simple indicator of pollution prevention activity is the presence of pollution prevention or waste minimization programs to reduce waste. While these programs may contain specific elements that actually *quantify* wastes reduced, the presence of the program itself is the element described in this category.

Activity-based Measurements. Activity-based measures are semi-quantitative measures of pollution prevention efforts that are related to equipment or procedures already in use. The activities use specific processes or operating practices that may be part of an overall program to reduce a particular waste stream or chemical release. In order to use an activity-based measurement, it is necessary to have specific information on the benefits of particular processes or equipment. The use of solvent-free paint stripping processes and the use of mixers in storage tanks to prevent the depositing of settleable solids are examples of processes and equipment that can be used to develop activity-based measurements.

Mass-based Measurements. Mass-based measurements attempt to provide quantitative information on the amount or mass of waste or residual materials produced or managed. Mass-based measurements can be exact measures achieved by weighing individual loads of material or they can be estimates supported by professional judgements and/or mathematical assumptions. Because estimation

accuracy can vary widely, mass-based measurements must be used with care when comparing a single facility year-to-year or when comparing two different facilities. When collected periodically and consistent methods are used, however, mass-based measurements can provide an indication of the performance of a facility. The chemical quantities reported as estimated releases in the Toxics Release Inventory and the quantities of residual streams reported as generated and managed in API's Refining Survey are examples of mass-based measurements.

Normalized Efficiency Measurements. Normalization provides a method of relating one variable to another item. By doing this, facilities of different sizes can be compared to each other on a "per unit" basis to determine the efficiency of their respective practices. Normalization also minimizes some of the problems that can occur when reviewing operations at one facility over time. Because one parameter is indexed against another variable (e.g., an activity, production) for a similar period of time, the performance or efficiency of the activity can be determined, independent of changes in operating rates.

Measures of the efficiency of pollution prevention activities can be normalized or indexed against a variety of related measures. Three methods of normalizing are discussed in this report:

- By activity/operation
- By production
- By residual generation

Concentration-based Measurements. In chemistry, concentration refers to the amount of one substance contained in another substance. Concentration measures are typically expressed as units of weight or mass by volume or capacity (e.g., mg/kg, mg/l, mg/cm³). Those typically used in the petroleum industry include the concentrations of petroleum hydrocarbons in drilling muds destined for disposal, concentrations of phenols in the effluent process water in the refinery, and concentrations of chromium-based compounds in cooling tower blowdown.

CONCLUSIONS

While no one measurement can be considered to accurately reflect pollution prevention performance, it does not necessarily follow that the appropriate course is to mount a multi-dimensional measurement project. It generally holds that several measures are better, but companies must choose a complement of measures that make sense--both economically and environmentally--to them.

Ultimately, the determination of the most appropriate parameters for measuring pollution prevention progress must be made at the company or facility level, based on knowledge of site-specific operations and conditions, with consideration given to available resources and to merits and limitations of the measurement technique itself.

INTRODUCTION

Why Pollution Prevention??

Pollution prevention has become the preferred option for dealing with residual materials and wastes. Under a pollution prevention scenario, if a waste is reduced or eliminated at the source or recycled, it requires no further management and will not pose a threat to human health or the environment. In addition, future liability for potential cleanup from waste treatment and disposal is eliminated. Despite its broad use, pollution prevention is a term with no uniformly accepted definition. It is usually defined in terms of the environmental management hierarchy (sometimes known as the waste management hierarchy) -- source reduction, recycling, treatment, and disposal -- but there is disagreement over which elements of the hierarchy it spans. Some see pollution prevention exclusively as source reduction or more strictly, product substitution or toxics use reduction, whereas others are willing to include some types of recycling. Few are willing to include treatment.

Pollution prevention should be viewed as a dynamic process that includes the idea of continuous improvement, such as movement up the environmental management hierarchy. EPA Administrator Carol Browner endorsed this hierarchical approach to reducing risk in her Pollution Prevention Policy Statement of June 15, 1993:

[P]ollution prevention is not the only strategy for reducing risk but it is the preferred one. Environmentally sound recycling shares many of the advantages of prevention--it can reduce the need for treatment and disposal, and conserve energy and natural resources. Where prevention or recycling are not feasible, treatment followed by safe disposal as a last resort will play an important role in achieving environmental goals.

API's definition also recognizes the need for a complementary set of strategies, referencing the principles of waste minimization (from the Hazardous and Solid Waste Amendments of 1984), and explicitly addresses the concern that pollutants have been transferred from one medium to another under the single-media statutes:

Pollution prevention is a multi-media concept that reduces or eliminates pollutant discharges to air, water, or land and includes the development of more environmentally acceptable products, changes in processes and practices, source reduction, beneficial use and environmentally sound recycling.

Although pollution prevention is usually thought of as applying to manufacturing, it is relevant to all industries, including agriculture, energy, and transportation. Successful implementation of pollution prevention, however, requires a broad based cultural change: those who generate residual materials¹

¹ API uses the term "residual materials or residuals" to refer to what many call "wastes." This terminology reflects petroleum industry practices--the use of many of these materials as feedstocks or for recycling, reuse, and reclamation. This change helps to reconcile the utilization of these materials in the petroleum industry with the regulatory usage of the term "waste."

and waste--even consumers--must anticipate and internalize the costs of this pollution, and devote energy to determining cost-effective means to reduce residual materials and waste at the source.

State and local governments moved quickly to enact pollution prevention legislation that is still under debate within the federal sector. By June 1993, 30 states had enacted some type of pollution prevention legislation; 20 states included facility planning provisions. As a result of these initiatives, many facilities are now required to develop plans for reducing waste and periodic reports on the progress made toward implementing such plans.

The petroleum industry itself is moving towards a self-assessment process that will aid companies in monitoring their environmental progress. In 1990, the American Petroleum Institute (API) added a set of Guiding Environmental Principles to its bylaws. In the following year, API endorsed in principle a process to demonstrate adherence to the Guiding Environmental Principles that include management practices, company self-assessment to monitor progress in implementing the management practices, and resource materials that companies may find helpful in implementing the management practices.

To determine which pollution prevention practices are most appropriate, API encourages the use of facility-specific assessments followed by the development of plans that include goals for attainment over time. This strategy allows for maximum flexibility and consideration of site-specific conditions to be factored into the planning process.

Measuring Performance and Progress: The Driving Forces

Pollution prevention can be achieved through a variety of practices. Regardless of the specific techniques employed, a key aspect of pollution prevention is how to measure it to determine how successfully implementation is being achieved. Quantification of pollution is central to this activity.

Quality management theory identifies three generic forms of metrics:

- **stakeholder metrics** taken at the "end" or "side" of a process at the interface with the external environment and/or marketplace (e.g., analytic measures used in risk assessments; public opinion polls)
- **results metrics** that quantify the results desired by stakeholders; and
- **process metrics** that are necessary to assure that the process is under control.

These three metrics form a logical hierarchy: if the process is under control, preferred results will be attained; if the preferred results are attained, stakeholder needs will be met.

Metrics are useful tools. They can provide information on progress and business objectives and, for those factors that are within one's sphere of influence, they track the quality of business decisions and the need to allocate additional resources to improve practices. It is crucial to note that some metrics are useful for explaining results, but these parameters may not be anything that one has much influence over. Other metrics may also measure improvement, but are of outcomes that are subject to our rational control.