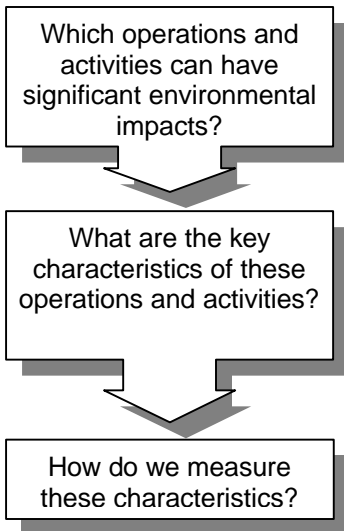


Monitoring and Measurement

Assessing how well the system is performing

“If you can’t measure it, you can’t manage it.”

- Peter Drucker
Management Expert



- Attributes of effective measurement programs
- simple
 - flexible
 - consistent
 - ongoing
 - produce reliable data
 - communicate results

An EMS without effective monitoring and measurement processes is like driving at night without the headlights on—you know that you are moving but you can’t tell where you are going! Monitoring and measurement enables an organization to:

- **evaluate** environmental performance;
- **analyze root causes** of problems;
- **assess compliance** with legal requirements;
- **identify** areas requiring **corrective action**, and,
- **improve performance** and **increase efficiency**.

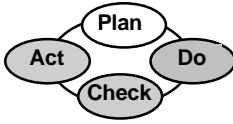
In short, **monitoring helps you manage your organization better**. Pollution prevention and other strategic opportunities are identified more readily when current and reliable data is available.

Your organization should **develop procedures** to:

- **monitor key characteristics** of operations and activities that can have significant environmental impacts and/or compliance consequences;
- **track performance** (including your progress in achieving objectives and targets);
- **calibrate and maintain** monitoring equipment; and,
- through internal audits, periodically **evaluate your compliance** with applicable laws and regulations.

Getting Started:

- Monitoring and measuring can be a resource-intensive effort. One of the most important steps you can take is to clearly **define your needs**. While collecting meaningful information is clearly important, resist the urge to collect data “for data’s sake.”
- Review the kinds of monitoring you do now for **regulatory compliance** and other purposes (such as quality or health and safety management). How well does this serve your EMS purposes? What additional monitoring or measuring might be needed?
- You can start **with a relatively simple** monitoring and measurement process, then build on it as you gain experience with your EMS.



EPA policies provide incentives for effective compliance management programs. See "Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations" (<http://es.epa.gov/oeca/finalpolstate.pdf>) and "Small Business Compliance Policy" (<http://es.epa.gov/oeca/sbcp2000.pdf>)



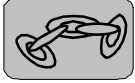
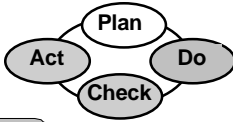
Employees should have a mechanism to report regulatory violations (or other EMS issues) without fear of retaliation by their employer



Focus on things that you can do something about

Hints:

- **Monitoring key process characteristics:** Many management theorists endorse the concept of the "**vital few**" — that is, that a limited number of factors can have a substantial impact on the outcome of a process. The key is to figure out what those factors are and how to measure them. Process mapping can help you determine what those factors might be.
- Most effective environmental measurement systems use a combination of **process** and **outcome** measures. Outcome measures look at results of a process or activity, such as the amount of waste generated or the number of spills that took place. Process measures look at "upstream" factors, such as the amount of paint used per unit of product or the number of employees trained on a topic. Select a combination of process and outcome measures that are right for your organization.
- **Equipment calibration:** Identify process equipment and activities that truly affect your environmental performance. As a starting point, look at those **key process characteristics** you identified earlier. Some organizations place critical monitoring equipment under a special calibration and preventive maintenance program. This can help to ensure accurate monitoring and make employees aware of which instruments are most critical for environmental monitoring purposes. Some organizations find it is more cost-effective to subcontract calibration and maintenance of monitoring equipment than to perform these functions internally.
- **Regulatory compliance:** Determining your compliance status on a regular basis is very important. You should have a procedure to systematically **identify, correct, and prevent** violations. Effectiveness of the compliance assessment process should be considered during **EMS management review**. EPA encourages "systematic discovery" of regulatory violations, which means detecting potential violations through environmental audits or compliance management systems that show due diligence in preventing, detecting and correcting violations.
- **Operational performance:** Consider what information you will need to determine if the company is implementing operational controls as intended. The example on Page 62 illustrates the relationship among monitoring and measurement, operational controls and significant environmental aspects.
- **Progress on meeting objectives:** You should measure progress on achieving objectives and targets on a regular basis and communicate the results of such measurement to top management. To measure progress in meeting objectives, select appropriate performance indicators (see below).



- **Environmental Aspects**
- **Legal/Other Requirements**
- **Objectives & Targets**
- **Operational Control**
- **Corrective Action**
- **Management Review**

- **Selecting performance indicators:** Performance indicators can help you to understand how well your EMS is working. Start by identifying a few performance indicators that are:
 - **simple** and understandable;
 - **objective**;
 - **measurable**; and
 - **relevant** to what your organization is trying to achieve (i.e., its objectives and targets)

Data collected on performance indicators can be quite helpful during **management reviews**. So, select indicators that will provide top management with the information it needs to make decisions about the EMS.

Make sure you can commit the necessary **resources** to track performance information over time. It is OK to **start small** and build over time as you gain experience in evaluating your performance. Keep in mind that **no single measurement** will tell your organization how it is doing in the environmental area.



The value of periodic monitoring:

St. Joseph's Mercy Hospital noticed an increase in its discharge of silver to the local wastewater treatment plant. They investigated what had changed at the Hospital and found that a new x-ray processor had been installed without a silver recovery system. Once the recovery system was installed, silver discharge levels returned to permitted levels.

- **Communicating performance:** People respond best to information that is meaningful to "their world." Putting environmental information in a form that is **relevant to their function** increases the likelihood they will act on the information. Be sure to link your measurement program with your **communications** program and other elements of the EMS (such as management reviews, as discussed later).
- **Compliance auditing guidance:** The USEPA has prepared guidance documents and protocols for conducting environmental compliance audits under a number of its regulatory programs. For more information, check the EPA web site at www.epa.gov/oeca/index.html.

☆☆ **POLLUTION PREVENTION** ☆☆

A Pitney Bowes Inc. facility formed a Zero Discharge Task Team to design projects to reduce emissions over a five-year period. Wastes were ranked ordered in terms of their potential risks to the environment and employee safety. Those with high rankings were evaluated on a priority basis. Through the implementation of many projects, the facility has reduced hazardous waste generation by 69%, EPCRA 313 air emissions by 98% and treated wastewater by 93%. Projects included finding substitutes for parts cleaning and degreasing, replacement of all cyanide processes, and installation of fume scrubbers on plating lines, among others.

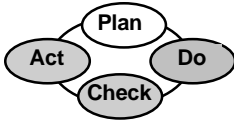
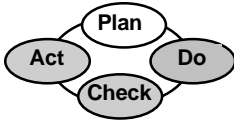


Figure 10:
Linking Monitoring Processes to Operational Controls: One Example

Operation with Significant Environmental Aspect	Operational Controls	Key Characteristics of Operation or Activity	Monitoring or Measurement Methods	Equipment Calibration Needs
Surface Coating Operation	<ul style="list-style-type: none"> • Approved list of coatings 	→ <ul style="list-style-type: none"> • Type of coating 	→ <ul style="list-style-type: none"> • Compare to approved list 	→ <ul style="list-style-type: none"> • None
<i>(significant aspect is VOC emissions)</i>	<ul style="list-style-type: none"> • Coating work instruction 	→ <ul style="list-style-type: none"> • Rate of application 	→ <ul style="list-style-type: none"> • Measure quantity applied 	→ <ul style="list-style-type: none"> • Flow meter
		→ <ul style="list-style-type: none"> • Frequency of application 	→ <ul style="list-style-type: none"> • Use coating log book 	→ <ul style="list-style-type: none"> • None
	<ul style="list-style-type: none"> • Permit report procedure 	→ <ul style="list-style-type: none"> • Emissions of VOCs 	→ <ul style="list-style-type: none"> • Calculate based on use 	→ <ul style="list-style-type: none"> • Flow meter
Liquid Waste Storage	<ul style="list-style-type: none"> • Generator procedure 	→ <ul style="list-style-type: none"> • Use of proper containers 	→ <ul style="list-style-type: none"> • Inspections of storage area 	→ <ul style="list-style-type: none"> • None
		→ <ul style="list-style-type: none"> • Segregation of incompatibles 	→ <ul style="list-style-type: none"> • Inspections of storage area 	→ <ul style="list-style-type: none"> • None
<i>(significant aspect is potential for spills)</i>	<ul style="list-style-type: none"> • Storage area procedure 	→ <ul style="list-style-type: none"> • Availability of spill equipment 	→ <ul style="list-style-type: none"> • Inspections of storage area 	→ <ul style="list-style-type: none"> • None

Examples of EMS Performance Indicators

- Pounds of VOC emitted per unit of production
- Pounds of hazardous waste generated per year
- Percentage of employees completing environmental training
- Average time for resolving nonconformities
- Energy use per unit of production
- Percentage of solid waste recycled / reused



Capture the Learning: Monitoring and Measurement Worksheet

<p>Have we identified operations and activities associated with significant environmental aspects, legal requirements and environmental objectives? If, not how will this be accomplished?</p>	
<p>What type(s) of monitoring and measurement do we need to ensure that operational controls are being implemented correctly?</p>	
<p>What type(s) of monitoring and measurement do we need to ensure that we are complying with applicable legal requirements?</p>	
<p>What type(s) of monitoring and measurement do we need to ensure that we are achieving our environmental objectives & targets?</p>	
<p>How do we identify the equipment used for any of the monitoring or measurement listed above? If not how will this be accomplished?</p>	
<p>How will we ensure that monitoring and measurement equipment is properly calibrated and maintained?</p>	
<p>What process do we have to periodically evaluate compliance with legal requirements? How effective is this process?</p>	
<p><i>Our next step on monitoring and measurement is to ...</i></p>	