

Section 3: Monitoring & Measurement (Assessing how well your system is performing)

So far, you've identified your significant environmental aspects, set objectives and targets, and conducted a review of your operations and services to identify applicable regulatory and other requirements. You have also put procedures and work instructions (operational controls) in place to ensure that your environmental issues (i.e., significant aspects) are managed. The next step is to *monitor and measure* your progress in meeting your objectives and targets, and assess your compliance toward meeting your regulatory requirements.

Monitoring and measuring allows you to track your environmental performance and improve efficiency by managing what you do. Remember, you can't manage what you can't measure! The results of your objectives and targets and other environmental efforts are easier to demonstrate when current and reliable data are available and referenced against a defined baseline. These data can help you demonstrate the value of the EMS to top management, as well as to other interested parties such as your local community.

In this section you will develop ways to:

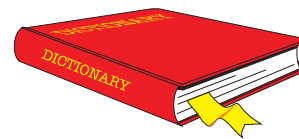
- Identify key characteristics of operations and activities that can have significant impact
- Track performance (including progress in achieving your objectives and targets)
- Monitor conformance with operational controls
- Calibrate and maintain monitoring equipment
- Periodically evaluate your compliance with applicable laws and regulations

Step-by-Step Guide for Monitoring and Measuring Your Key Environmental Activities

- Step 1) Determine What You Currently Monitor and Measure
- Step 2) Identify What You Need to Monitor and Measure to Determine How Your EMS is Performing
- Step 3) Assess Compliance and Track Your Environmental Performance
- Step 4) Develop an EMS System Procedure for Monitoring and Measurement
- Step 5) Check Your Monitoring and Measurement Procedure for EMS Conformance
- Step 6) Communicate Progress and Performance



Key Section Terms



Baseline – The starting point from which the meeting of an objective is to be measured. Establish “normalized” baselines to accurately measure how your facility’s environmental performance could change over time. Normalized baselines will measure your actual environmental performance changes rather than changes in production, customer demand, or other non-environmental related factors.

Environmental Aspect – Element of an organization’s activities, products or services that can interact with the environment. Aspects = Causes

Environmental Management Program (EMP) – A structured program with a set of specific identifiable actions (an “action plan”) providing the direction for EMS objectives and targets to be obtained and tracked. Your plan should assign tasks, resources, responsibilities, and timeframes for achieving your objectives and targets.

Environmental Objective – An overall environmental goal based on an established environmental policy, that an organization sets itself to achieve. Wherever possible, environmental objectives should be quantified to facilitate the evaluation of environmental performance and the measurement of progress towards specific environmental targets.

Environmental Target – A detailed performance requirement, quantified where practicable, that arises from the environmental objectives and that needs to be set and met in order for the objective to be achieved.

Key Section Terms, continued

Key Characteristic – An element of an operation or activity that can be measured or evaluated for environmental performance of objectives and targets.

Performance Indicators – Measurement tools, selected by management that can be used to support the evaluation of environmental performance in relation to a specific target. Performance indicators may be adjusted to meet specific management needs or as necessary to ensure progress towards specific environmental targets.

Three Keys to Success

(from wastewater facilities):



1. Evaluate the information that you collect for value. If you are going to spend the time and resources to collect it, make sure that it is useful.
2. Include top management and other decision makers in setting up what you will monitor and measure. Checking in with them will help you identify what you need to measure to provide meaningful results and maximize the benefits you'll receive from your EMS.
3. Remember your external stakeholders (i.e., city commissioners, citizen groups, etc.) as you determine what to monitor and measure.

Step 1) Determine What You Currently Monitor and Measure

Examine your wastewater operations and services and determine what you are currently monitoring and measuring. Your environmental regulations are a good place to start, since these requirements typically include monitoring, measuring, (permit limits, etc.) and reporting components (Toxic Release Inventory (TRI), etc.). How well do these measurements serve your EMS purposes? What additional monitoring or measuring might be needed as your organization continues to move beyond compliance?

Step 2) Identify What You Need to Monitor and Measure to Determine How Your EMS is Performing

Your organization will track data and information, collected through your EMS on a continuing basis, to determine whether and how your wastewater facility is achieving its environmental objectives and targets and to properly manage your significant aspects. Information collected by monitoring and measuring your key environmental issues can help make this determination and answer the questions: Is your EMS being carried out as planned? Is your organization achieving its commitments and its objectives and targets? What information is most valuable?

To determine what you need to monitor and measure, identify wastewater operations and services that affect your environmental performance. What are the key characteristics of the operations, services and related equipment and how do you measure these characteristics to ensure proper performance?

Monitoring and measurement takes the pulse of an organization. Their application can be the most important tools in a manager's toolbox with regard to setting goals, objectives and targets, and improving overall operations.

Rick Bickerstaff
Charleston, South Carolina
Commissioners of Public Works

REMEMBER



Start by looking at what's regulated and then look at the significant aspects and objectives and targets that you identified earlier.

Let's review the sanitary sewer overflow (SSO) significant aspect example again and make a sample list of the operational controls, key characteristics, monitoring and measurement methods, and calibration needs for operating and maintaining wastewater pump stations.

Operation with Significant Environmental Aspect	Significant Aspect	Operational Controls	Key Characteristics of Operation or Activity	Monitoring or Measurement Methods	Equipment & System Calibration Needs
Operate and Maintain Pump Stations	Sewer System Overflows (SSOs)	<ul style="list-style-type: none"> ◆ Pump Maintenance Manual(s); ◆ Work Instructions on Cleaning Sewer Mainlines; ◆ Emergency Generator Operations and Maintenance 	<ul style="list-style-type: none"> ◆ # of Alarms ◆ Flow per Capita ◆ # of Overflows ◆ # of Cleanings per Month 	<ul style="list-style-type: none"> ◆ Measure Quantities; ◆ Monitor Lift Stations; ◆ Census Data; ◆ Monthly Operating Reports 	<ul style="list-style-type: none"> ◆ Flow Meters; ◆ SCADA

A Word on Calibration

As part of meeting meeting your monitoring and measurement requirements, you will need to document calibration requirements and dates for equipment used in areas where you identified significant aspects, where you set objectives and targets, and in areas where you have compliance requirements. Example calibrated equipment could include gauges used to monitor stack air emissions or a pH meter used to measure effluent water quality. Make sure a regular schedule is in place to calibrate the equipment and make sure you retain your calibration records. Remember, some equipment may be calibrated off-site, so make sure the vendor supplies you with a copy of the records.

NOTE



Environmental measurement can be a combination of process and outcome measures. In other words, you may want to consider measurements that assess “how” you are doing something as well as measurements for “what” is produced.

- **Outcome measures** look at **results** of a process or activity, such as the amount of waste generated or the number of spills.
- **Process measures** look at “**upstream**” factors, such as the number of employees trained on a topic.

Consider selecting a combination of process and outcome measures that are appropriate to your wastewater facility. For example, using the SSO significant aspect example above, an outcome measure would be the number of overflows per year and a process measure could be the number of cleaning or maintenance activities completed per month to prevent line blockage and that would consequently reduce the chance for an overflow event.

Step 3) Assess Compliance and Track Your Environmental Performance

An EMS requires you to periodically evaluate your compliance with applicable laws and regulations. In practice, most organizations go through some form of compliance audit and this can be done either by internal staff or by an outside organization. While the compliance audit is generally a way to determine if you are actually in compliance, you should also use it as a way of determining if your organization is well

REMEMBER



Don't forget about the maintenance manuals that come with your equipment. They may contain calibration and/or measurement methods for your equipment. In addition, your equipment may have calibration procedures set by the manufacturer that must be followed.

Three Lessons Learned

(from wastewater facilities):

1. Start with a relatively simple monitoring and measurement process, looking at your legal requirements and significant aspects. It is OK to start small and build over time as you gain experience in evaluating your performance.
2. Select performance indicators that will provide the information you need to make effective decisions about your EMS.
3. Don't forget about on- and off-site contractors that calibrate and/or maintain equipment that is within your identified significant operations and services.



Three Things to Avoid

(from wastewater facilities):

1. Going out of your way to monitor and measure everything. Start with what is required by law and then examine your objectives and targets. Don't collect data for data's sake!
2. Not committing the necessary resources (human and dollars) to track performance information over time.
3. Not communicating the performance and progress of your objectives and targets to management and staff.

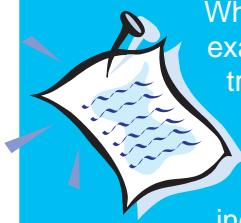
suited to address instances of noncompliance should they occur. In other words, are you able to effectively *manage* compliance as well as audit for it? When determining if you are effectively managing compliance, you should use this opportunity to make sure that proper procedures are in place to respond to instances of noncompliance, determine the root causes of noncompliance, and make any changes to your system to help ensure that the noncompliance does not recur. Effective compliance management is an essential part of an EMS.

Once you know what to measure and what indicators that you will use, assess and track your objectives and targets so you know how well they are performing. Remember to have regular checks on the progress of your objectives and targets and report the results to top management.

Remember to also assess and track your significant aspects. Keeping track of your significant aspects will let you know how well they are managed (being controlled) and also provide you with a baseline for potential future objectives and targets.

For example, have operational controls (procedures, work instructions, etc.) been documented for each of your significant aspects? Have employees been trained on any changes to emergency preparedness and response plans? Are your training records up to date and documented? Do employees whose work involves significant aspects understand their roles and responsibilities?

NOTE



What about issues that are not so easy to quantify? For example, better odor management in wastewater treatment plants, improved public image, and improved relationship with stakeholders? It takes some rather creative "indicators" to quantify these improvements. Talk to your peers in the wastewater industry to see how they measured these types of issues.

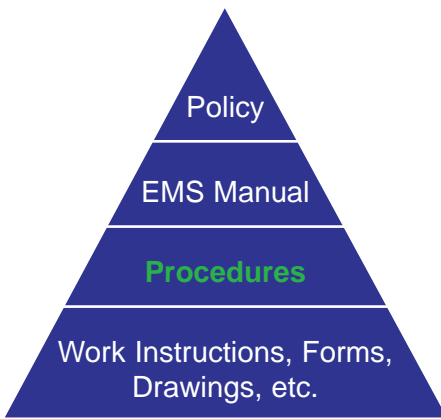
The top five performance indicators that the wastewater facilities that contributed to this Handbook used to monitor and measure their EMS performance are included below:

Wastewater Facility	Performance Indicator
Buncombe County, North Carolina	<ul style="list-style-type: none"> ● Quarterly internal audits ● Environmental compliance audits ● Quarterly management review meetings ● Monthly steering committee meetings ● Monthly ISO Team meetings.
Charleston, South Carolina	<ul style="list-style-type: none"> ● Random inspections to ensure conformance to standard operating procedures. ● Monthly reporting of objectives & targets associated with continual improvement. ● Regulatory monitoring is performed through established monitoring systems. Items are monitored on varied recurring cycles (each month to once every 3 years) depending on the regulatory requirements. ● Employees are encouraged (with incentives) to fill out Corrective-Preventive Action Requests (CPARs). These requests provide opportunities for preventing pollution and improving operations. ● Performance measurement is performed through our Productivity Measurement Program (PMP). Tasks are valued at certain levels based upon the length of time to accomplish with a specified manpower requirement. Incentives are provided for attaining set goals, and inter-departmental competition is also fostered.
Eugene, Oregon	<ul style="list-style-type: none"> ● Regulatory compliance and reporting ● Objectives and targets ● Internal/external audits (EMS, compliance) ● Training records (completion) ● Document control (reviews and updates)
Gastonia, North Carolina	<ul style="list-style-type: none"> ● Compliance ● Internal audits (EMS and Compliance) ● Public comments - Review of communications with external parties/customer satisfaction surveys ● Communication and cooperation among staff and management ● Costs and efficiencies particularly with regard to energy and chemical usage
San Diego, California	<ul style="list-style-type: none"> ● Sanitary sewage overflow reduction ● Targets and objectives tracking ● Recycled material tracking ● CPAR status ● Standard operating procedures status



REMEMBER

Remember to track and record your EMS benefits, especially the ones realized from our objectives and targets. These will make an impression with management as you move forward with your EMS.



A *Monitoring and Measurement system procedure* is required for this element. A system procedure defines the purpose (why the procedure is needed), scope (to what operations/areas/staff the procedure applies), roles & responsibilities (who needs to complete the tasks), and the tasks that need to be completed for this element.

NOTE



You can monitor and quantify other organizational benefits that the EMS brings, such as efficiency savings, reduced landfill costs from recycling efforts, and accidents/fines avoided, etc., when tracking your EMS performance.

Involving Contractors and Temporary Staff

It is important to involve contractors and temporary employees in this phase of your EMS, especially if they work in areas that can create a significant impact on the environment and/or monitor or maintain equipment for your significant aspects and/or objectives and targets. Communicate with and train contractors and temporary staff on their roles and responsibilities.

Step 4) Develop an EMS System Procedure for Monitoring and Measurement

When you're satisfied that your process for monitoring and measuring conforms to the EMS requirements, document the process in a system procedure. As with all EMS system procedures, it needs to clearly define what, who, when, how, and where.

For samples of Monitoring and Measurement procedures from wastewater facilities, see Appendix A.

REMEMBER



To be compliant with the requirements of ISO 14001, you also need to establish and maintain a documented procedure for evaluating compliance with environmental laws. You should have set up a Legal and Other Requirements procedure in your Planning Phase of the EMS.

Step 5) Check Your Monitoring and Measurement Procedure for EMS Conformance

Check to see if your procedure is working according to your plan. Here are some questions to investigate:

Check ✓

1. Have you identified operations and activities associated with significant environmental aspects, legal requirements and environmental objectives?
2. Have you completed a review of your legal compliance status?
3. Have you identified what needs to be monitored and measured?
4. Have you decided what performance indicators/metrics are appropriate?
5. Have you established a schedule for monitoring and measuring?
6. Have you reviewed what equipment needs to be maintained and calibrated?
7. Do you communicate performance information to management on a regular basis?

Step 6) Communicate Progress and Performance

Communicate and record the progress and performance of your objectives and targets to top management and to your staff. Management needs to know if resources are appropriate for what you want to accomplish and if you are on track with your environmental goals.

Remember, employees respond best to information that is meaningful to them. Putting environmental information in a form that is relevant to their function and work area increases the likelihood they will act on the information.

CASE STUDY

Eugene, Oregon Wastewater

"Paper Products Consumption"

To achieve the target of reducing overall paper goods consumption by 30%, we developed and implemented extensive facility-wide conservation, recycling, training, and purchasing programs.

We greatly exceeded our target, and actually reduced paper use by 50% total. We reduced janitorial paper use by 48%, and office paper use by 37%.

To achieve this substantial reduction, we implemented the following strategies:

- Provided easily accessible, shared information on alternative products (kitchen products, cornstarch plates and cups, etc.). We tested dish drying racks in the kitchens to reduce paper towel use, and we will use cloth towels for large events. Installed cloth towel mechanisms in most restrooms, reducing paper use by 4.6 tons compared to 2002.
- Implemented an extensive employee awareness program, including equipment use training that emphasized waste reduction for printers, copiers and fax machines.

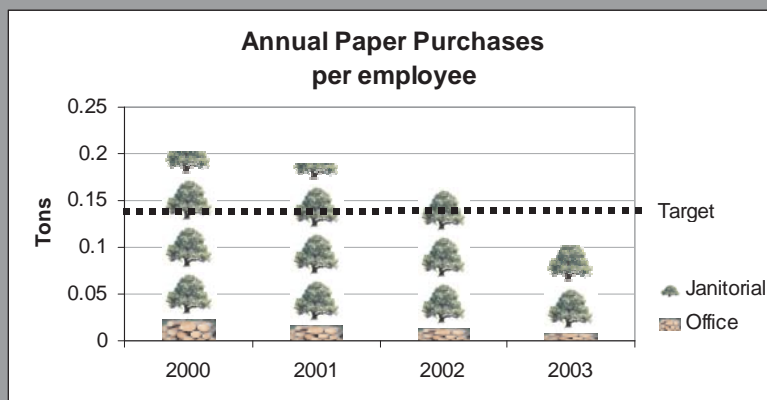
- Redesigned documentation to minimize paper waste, and use electronic distribution where possible. In addition, we are participating in the WADERS pilot project for regulatory electronic reporting, and transitioning to the maximum electronic reporting possible, resulting in a drastic reduction of office paper use.

2003 Savings from Reducing Paper Use by 7.6 Tons

- 129.2 trees
- 52842 gallons of water
- 3515 gallons of oil
- 4457 pounds of air pollution
- 23 cubic yards of landfill space
- 30988 KWh of electricity

- Developed procedures and purchasing guidelines that target reduced paper use and emphasize purchase of products with recycled content.

- Continued with our previous objective to purchase paper goods containing higher recycled content. We increased purchases of products with greater than 30% recycled content by weight from 97% to 98% from 2002.





Monitoring and Measurement

(Cut out this section for handy reference)




The **Purpose** of this EMS element is to:

- Monitor and measure the performance of your EMS, including your significant aspects, objectives and targets, legal compliance and operational controls.

The **Result** of this EMS element is:

- A procedure (EMS Document) to control monitoring and measurement activities that affect your significant environmental aspects and compliance requirements.

Before You Begin this EMS element:

- Complete your significant aspects and impacts analysis.
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ISO 14001 Requirements	Links to Other EMS Elements	Required Documents & Records	Optional Documents & Records
<p><i>Monitoring and Measurement</i></p> <p>The organization shall establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of its operations and activities that can have a significant impact on the environment. This shall include the recording of information to track performance, relevant operational controls and conformance with the organization's environmental objectives and targets.</p> <p>Monitoring equipment shall be calibrated and maintained and records of this process shall be retained according to the organization's procedures.</p> <p>The organization shall establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations.</p>	<p>Environmental Aspects - Determining your significant aspects will identify the operations and services that you will need to monitor and measure.</p> <p>Legal and Other Requirements - A status check on compliance needs to be assessed and continually monitored.</p> <p>Objectives & Targets - Your environmental goals need to be tracked and measured to determine how well they are performing and meeting your intentions.</p> <p>Operational Control - Your significant aspects must have controls (procedures, work instructions, manuals, etc.) in place.</p> <p>Management Review - Top Management will review the progress and performance of your objectives and targets to help determine if you are on track and/or to see if resources are allocated appropriately.</p>	<p>Monitoring and Measurement Procedure</p> <p>Calibration Records</p>	<p>Calibration and Maintenance Procedure</p> <p>List of devices, location, calibration frequency and method, etc.</p> <p>Maintenance Manuals</p>