



Laying the Foundation

Environmental performance and compliance, sewer system overflows, capacity assurance — all very hot topics for today's wastewater collection operations. And things are sure to get even hotter in the future, thanks to the Capacity, Management, Operation & Maintenance (CMOM) regulations proposed by the U.S. Environmental Protection Agency (EPA). When it receives final approval (which is expected this year), the CMOM program will specify a standard framework for improving operation, maintenance, and planning for wastewater collection systems.

The proposed program is extremely complex; however, there are resources available to utilities that can ease the way (more information on the program is available on the EPA's Web site: www.epa.gov/region04). In addition, at the Charleston Commissioners of Public Works, we've found that establishing an environmental management system (EMS) has given us a solid foundation on which to build a CMOM program.



An environmental management system is a great first step in launching a CMOM program

Rick Bickerstaff, Adrian Williams, and John Cook

Taking the Next Step

CMOM regulations are at the forefront of a movement in the wastewater industry aimed at enhancing utilities' environmental performance — a movement that, in our opinion, has been needed for some time. The overall intent of the CMOM program is to prevent sewer system overflows (SSOs), and this is accomplished through best management practices, such as diligent maintenance, preventive maintenance, proper staffing and equipment, emergency response, planning, documentation, and effective system evaluation.

EMS programs are at the forefront of the same environmental performance movement, and it could be argued that an EMS brings even greater potential for regulatory compliance and environmental protection (see the article on p. 14). EMS and CMOM programs are similar in that they have both arisen out of a perceived need for continual improvement in a utility's pursuit of operational excellence.

We believe that every utility has a fundamental obligation and responsibility to protect public health and the environment. In fact, we are obligated not only to *protect* the environment but also to *improve* it. For example, meeting a National Pollutant Discharge Elimination System (NPDES) permit limit protects the receiving stream's water quality, but optimizing treatment plant performance improves water quality. Obviously, measures designed to prevent any harm to the environment need to be established, but creative and innovative initiatives to improve the environment must be explored as well. The development and implementation of an EMS and a CMOM program are both potentially important tools in achieving this lofty but imperative goal.

Application of EMS and CMOM management principles (discussed below) has more practical, bottom-line benefits as well; these principles increase cost-effectiveness and environmental compliance and improvement, reduce risk-related liabilities, and promote technological advances. EMS and CMOM programs also demonstrate to customers, stake-

holders, and the general community that an organization is committed to environmentally safe processes, the prevention of pollution, and continual environmental improvement — not just regulatory compliance.

Though completely voluntary from a regulatory perspective, the goal of an EMS is to make environmental management an integral part of an organization's overall management system. For example, the ISO 14001 Standard (see ANSI/ISO Standard 14001-1996) offers significant improvements to existing management systems by encouraging an interactive process that organizes structures, responsibilities, practices, procedures, processes, and resources in a cohesive, integrated framework. This framework provides internal consistency and connectivity throughout all sections, departments, responsibilities, and operations of an organization when implementing environmental policies, objectives, and targets, all of which can be coordinated with improvement efforts in other areas, e.g., operations, finance, quality, and occupational health and safety.

What's more, an EMS makes it possible to improve competitiveness and reduce operational costs through in-depth examinations of operational processes and the pursuit of leveraging technology. By exploring new technologies while evaluating existing processes and practices, a utility often can develop improved methods of performing business functions. At the Charleston Commissioners of Public Works, our pursuit of a more cost-effective process of lateral rehabilitation, which involved evaluating our current repair and rehabilitation methods, staffing, and equipment, resulted in an exceedingly improved rehabilitation process. A workable method was established, with proper equipment and setup, using fewer workers. These improvements were initiated through the use of a working EMS.

EMS as the Foundation

An EMS, whether it employs ISO 14001 or another form, incorporates a management structure very similar to that required for a CMOM program. In fact, by establishing an EMS, an organization has put in place many of the elements needed to meet CMOM requirements (see Figure 1). With the inclusion of a few additional initiatives, the organization will have met and exceeded CMOM requirements.

Obviously, constructing an EMS or a CMOM program is no simple task. It takes full commitment and "buy-in" from all levels of an organization, especially management. It's been our experience that a common vision drives cultural change, so all associates must be educated on the benefits of this new management style to encourage full participation. They also need to know that their efforts will not go unnoticed and will in fact result in improvements of enormous importance to the environment and public health.

Clearly, the programs share a great number of common elements, making it possible for an organization to construct or "launch" a CMOM program from the framework of an existing EMS.

Figure 1. Comparison of CMOM and EMS Program Elements

Program Element Comparison		
Elements	CMOM	EMS
Planning	Short-term / Long-term	Continual Environmental Improvement
Structure and Responsibility	SSO Response / Inspections / Reporting	All Operations Related to Significant Environmental Aspects
Legal and other requirements	Internal and External	Internal and External
Goals & Objectives	Short-term and Long-term Planning	Requirement for Continual Improvement
Operations & Maintenance	Operational Controls / Preventive Maintenance	Operational Controls
Training, Awareness and Competence	Operational Knowledge & Awareness	Operational & Environmental Knowledge & Awareness
Communications	Internal, External & Regulatory	Internal, External & Regulatory
Monitoring & Measurement	Complete Program	Complete Program
Emergency Response	SSOs (Environmental Impacts) / Communication	All Environmental Impacts / Communication
Records Management	Complete Records Management / Reporting	Complete Records Management / Reporting
System Auditing	Self-assessments / Regulatory Agencies	Self-assessments / External Audit (for Certification)
Management Review	Significant Involvement	Significant Involvement

Planning

Planning is critical to a successful EMS. Establishing an EMS policy will be the first step in planning and promoting the organization's new "mission" — protecting and improving public health and the environment. This mission can likewise be the philosophical driving force behind a CMOM program.

An EMS, such as one developed in accordance with ISO 14001, is a management system framework implemented by the utility to improve environmental quality and ensure continual improvement. An organization using the ISO 14001 Standard would interpret the standard and apply it to the organization by establishing a company-wide environmental policy and simple and clearly defined company-wide procedures. In implementing the EMS, the utility then would determine how to align company objectives and targets for environmental improvement with the environmental policy and more-detailed environmental procedures. The policy and procedures would thus serve as the foundation on which the EMS is developed. This process can serve as the common base of a CMOM program as well.

An important component of an EMS is the consideration of *environmental aspects* of the organization. Basically, an environmental aspect is any operation or activity the organization performs that affects the environment — air, water, land, natural resources, flora, fauna, humans, and public health. Subsequently, *significant aspects* are those operations that have a greater effect, usually adverse, on the environment. All operations are graded by the organization to assign levels of significance. For example, our organization identified SSOs (which the CMOM program is designed to prevent) as a significant aspect.

Structure and Responsibility

A clearly defined organizational structure and a detailed list of each associate's responsibilities are vital to a successful EMS. Documentation is needed to delineate the tasks of those associates responsible for environmental compliance, environmental performance, documentation, and program coordination. This can be accomplished through a combination of appropriate job descriptions, organizational charts, flow diagrams, or written responsibilities specific to environmental performance.

In a CMOM program, the list of SSO responsibilities must indicate which associates are responsible for responding to SSOs, reporting overflows, and preparing monthly and yearly spill reports. The program also requires a formal chain of communications, from the initial report to final reporting to the regulatory agency.

Legal and Other Requirements

Under an EMS, all legal and regulatory requirements applicable to the organization must be identified. These requirements must be met at all times and communicated where appropriate to ensure compliance.

In an EMS, "other requirements" are self-imposed (i.e., not required by a governmental agency) regulations directly relat-

ed to the wastewater industry. They may include such regulations as grease interceptor standards, cooling tower requirements, wastewater backup provisions, tap requirements and inspections, renewals, impact fees, unit contributory loading guidelines, category waste standards, industrial pretreatment requirements, surcharges, design and construction guidelines, and emergency procedures.

Regulatory assessments performed by an internal team are required by an EMS. These assessments can be performed as often as regulations require or, if there is no regulatory requirement, as frequently as the organization deems necessary. All assessments must be documented for future referral and audits. This process is another effective management tool; with proper use, the legal and punitive liability of the organization is narrowed.

Management of Environmental Goals and Objectives

An organization always must be moving forward, pursuing short- and long-term goals and constantly seeking to identify trouble areas. Without goals, objectives, and measurable performance indicators, continual improvement is impossible. Because all deficiencies can't be corrected immediately, it is important to obtain the "biggest bang for the buck." Hence, analysis tools for cost-effectiveness and life-cycle impact become important.

To return to the example of SSOs, to stop overflows it is necessary to know where most have occurred or are occurring; therefore, an appropriate tracking process is needed. Once overflows are identified, problems should be defined and categorized (a capacity problem, grease problem, cleaning problem, inflow and infiltration problem, etc.) using a thorough wastewater system investigation. Each problem will require a plan to alleviate it, complete with goals and metrics for measuring progress. Both an EMS and CMOM program share this goal-oriented approach.

Operational Controls

Operational procedures, standard operating procedures (SOPs), and specific instructions are important parts of both EMS and CMOM programs. For instance, an EMS requires that any significant aspect (a process that has a great and usually adverse impact on the environment) must have a control method to protect the environment. This control method usually consists of SOPs, specific standards, or training programs to support environmental conformance and stewardship. Having control methods in place to ensure corrective, preventive, and predictive maintenance contributes to the success of an EMS.

Similarity, a CMOM program requires maintenance and preventive maintenance of applicable facilities. Mapping and data maintenance are also integral parts of a CMOM program. A computerized maintenance management system (see Figure 2), which provides automated work orders, scheduling features, historical information, job cost data, material use, and other information, is an appropriate tool to meet these requirements, in concert with SOPs for performing maintenance

Figure 2. Computerized Maintenance Management System Display

activities. Ensuring that management receives accurate information for proper system evaluation and capital planning is also crucial.

Detailed schedules for corrective, preventive, and predictive maintenance complement these operational controls. Indeed, this structured approach to maintaining systems is a vital part of good asset management; without it, reactive maintenance dominates. And with set schedules, management can sleep better at night, confident in overall system reliability.

In addition, operational controls and design and construction standards help organizations ensure that wastewater systems aren't being overloaded. Standards must be established to effectively ensure proper engineering evaluations, particularly with new systems, that result in long-term capacity availability.

Training, Competence, and Awareness

Not surprisingly, training is a vital element in EMS and CMOM programs. Associates must be trained on the elements of each management program and on any responsibilities and job requirements relating to the environment, legal requirements, emergency operations, etc.

Competence goes hand in hand with training. In an EMS, associates must demonstrate competence in their job responsibilities to ensure that their work performance has a positive impact on the environment, and this competence must be documented.

Before designing an EMS training scheme, an organization should take the time to identify the critical elements of the program that must be understood — and accepted — throughout the organization. It's a good idea to select an individual to coordinate training and to identify key associates to conduct it. This spreads out the responsibilities and makes the training program more manageable.

Finally, outside developers, vendors, and contractors must be made aware of the overarching provisions of the EMS and the operational controls put in place to ensure compliance and appropriate environmental performance. Providing these parties with written procedures prior to planning, design, or construction is essential. This benefits all involved and can be accomplished through a combination of written correspondence and pre-design and pre-construction conferences.

Communications

Communications, an essential element in both EMS and CMOM programs, is considered on two levels: internal and external. In addition to specific training and awareness, internal communications can include posting of the environmental policy, environmental aspects, significant aspects, control methods, objectives and targets, and audits. This can be accomplished through company memos, newsletters, Web sites, bulletin boards, and a host of other options.

Because customers and the public are considered "interested parties," the organization's environmental policy must be made available to them (through Web sites, postings in public locations, and mailings, for example). Other interested parties could include regulators, board members, elected officials, and water treatment facilities "downstream" of the collection system. In a CMOM program, an organization is required to notify these parties of program development. This can be accomplished through written notifications, information on a Web site, e-mail communications, and/or bill inserts.

External communications in both EMS and CMOM programs also involve receiving customer complaints and/or concerns and following up on them. Both programs require efficient logging of complaint and concern calls or reports of overflows, with documentation of responsibility and notification of the concern to responsible parties. A detailed procedure (formal logs, call-in databases, etc.) is needed to track the initial notice of concern and follow-up through completion.

SSOs offer the perfect example of the importance of external communications. If one occurs, an organization is required to notify the public, health agencies, drinking water suppliers, and any other affected entity immediately if the overflow could imminently and substantially endanger human health. In this case, door hangers or flyers could be used as an effective means of communicating with those directly and immediately affected.

Also, when drafting the SSO response plan (the SOPs/emergency response to be followed when an overflow occurs), interested parties must be consulted to establish an effective program for all involved. With a good communications program, this requirement can be fulfilled easily.

Furthermore, effective response to complaints and issues of concern, whether SSOs or other issues, should be integrated into the larger public relations or public education effort. The public needs to be told of the utility's efforts to resolve problems and to be educated concerning a reasonable schedule and funding level to achieve goals for improvement.

Monitoring and Measurement

In EMS and CMOM programs, monitoring can involve a vast number of tasks in several areas. For example, a treatment plant will need a means of monitoring the overall treatment process and also must ensure that equipment is checked and calibrated to make certain the process is working properly. Monitoring also may include the preparation of operating reports to examine process effectiveness, progress, goal achievement, regulatory compliance, etc. The overall EMS or CMOM program also can be monitored using periodic evaluations, monthly operating reports, charts, graphs, improvement programs, goals and objectives, and targets.

Control methods or SOPs must be established to effectively analyze either system (EMS or a CMOM program) from start to finish. As an illustration, appropriate inspection standards must be established for effective inspections. A grading system should be used for mid-level supervisors and managers to conduct a proper evaluation of the inspected systems. Subsequently, appropriate grade documentation with a structured approach to deficiency correction is necessary. This structured approach should involve short- and long-term improvement projects and programs linked to the organization's overall goals and objectives.

With respect to CMOM activities, a Sewer System Evaluation Survey is an essential tool in monitoring and measuring the collection system. These surveys can help a utility prioritize areas for rehabilitation and can provide recommendations for methodical system improvements and capital planning. By studying survey results and applying the recommendations, a utility can concentrate its improvement efforts in the right locations, producing effective rehabilitation initiatives. Of course, the long-term goal is to decrease excessive inflow/infiltration and to document the organization's success (see Figure 3).

With both an EMS and CMOM regulations, monitoring implementation and effectiveness is vital. An implementation schedule keeps the organization and those responsible for achieving objectives on track and accountable. In addition, timelines and program tracking should be incorporated during program implementation. This can provide associates with a visual depiction of progress and responsibility, further aiding implementation.

With CMOM, the utility must maintain the program and keep it up to date. Therefore, a written description detailing key elements of the program is required. This description should be kept accurate through periodic evaluations and updates of the program. These

can be performed annually, or as required to aid internal and external audits.

Emergency Preparedness

In an EMS, all potential emergencies must be identified and each must have a documented response. This requires a great deal of planning, which must take into account an organization's past experience with emergencies (such as natural disasters, chemical spills, and large-scale plant and system failures) while also forecasting the effects of potential emergencies, such as terrorist acts.

A comprehensive emergency response plan is critical. In an emergency, it can be difficult to respond in what is essentially chaos. Careful planning allows the organization — and its associates, whose judgment can suffer in times of crisis — to follow a predetermined plan. A good emergency response plan also spells out the responsibilities of all parties involved. This allows an organization to avoid confusion caused by panic and enables everyone involved to know what other team members or departments are supposed to do.

In a CMOM program, an SSO emergency response plan must be in place to protect water supplies, the public health, and the environment (see Figure 4). The plan must spell out which agencies need to be notified of the overflow; contact personnel names and numbers, as well as any other emergency numbers, are included in the plan to speed notification.

Proper training is critical in communicating the organization's emergency plans. This training, which should occur annually at the very least, keeps key players informed of what is required of them should an emergency occur. Conducting drills also can be an effective method of enhancing emergency response. The panic of a situation often is reduced if people have already experienced it, even in a simulation.

An EMS program requires that post-incident reviews be conducted after the "smoke has cleared." This is another highly effective management tool for improving the overall response

Figure 3. Comparison of Customers and Treatment Flow Showing Improvement Due to EMS Planning

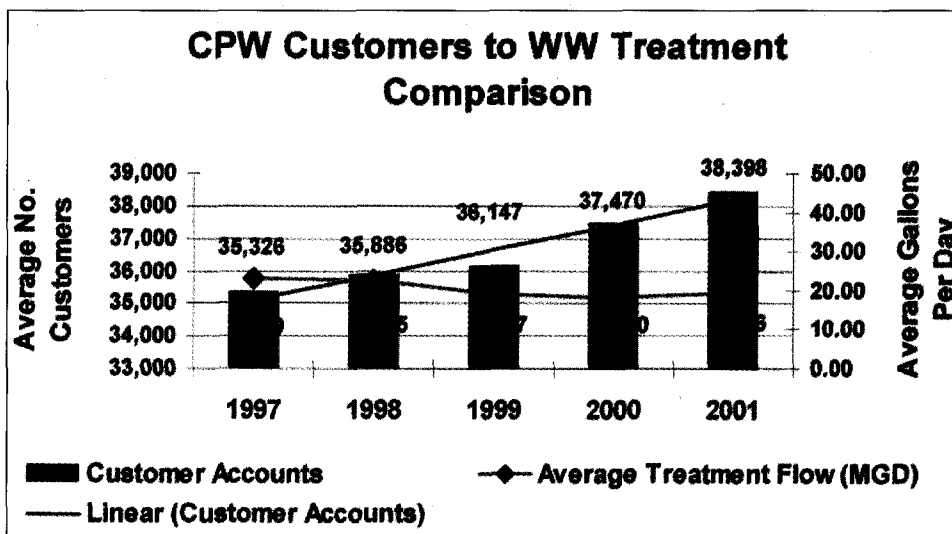
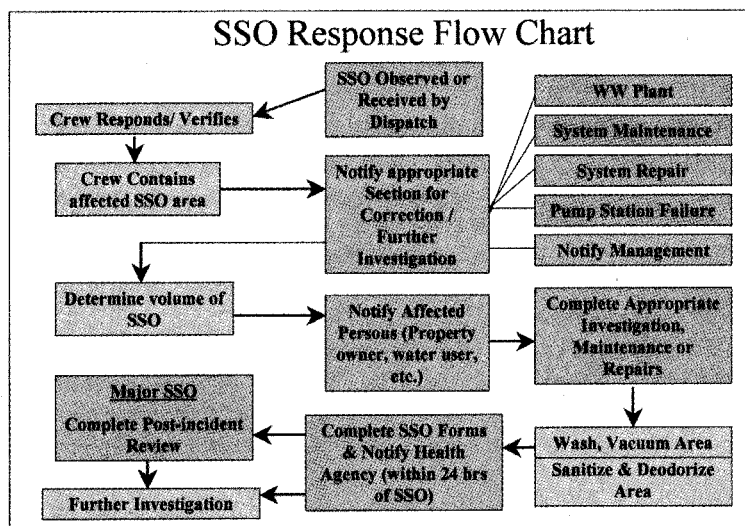


Figure 4. SSO Emergency Response Plan



of the organization; team members can regroup after the event to compare notes and discuss possible improvements to the emergency response plan.

Documentation and Records Management

To evaluate operational activities effectively, good documentation and records management are essential. Records give a "snapshot" in time, indicating the organization's performance with respect to certain job and operational responsibilities. Furthermore, accurate records allow an organization to identify trends in performance and monitor a given program's success.

Efficient management of records associated with environmental impacts is required in an EMS. Procedures at many levels, depending on the size of the organization, must be documented. Records must be labeled and maintained appropriately, with proper disposition clearly established. These records must include those associated with training and audit results.

The records need to be legible, identifiable, and traceable to the specific activities, products, or services involved. They should be stored properly to protect them from damage, and they must be readily retrievable. Of course, records seem to multiply over time; therefore, a retention schedule is required to facilitate records management.

With respect to CMOM requirements, records management focuses on SSO reporting and summary reports and documentation associated with the same. Retention times also are required for formal and associated documentation. Records associated with customer complaints, SSO forms, and reports must be kept for a period of at least 3 years from the date of the incident.

Management Review

Senior management needs to know how its management system — whether EMS or CMOM — is working. An EMS requires that management be kept informed of and

involved in review of the EMS to ensure the system's continued suitability, adequacy, and effectiveness. This can be accomplished through audit results, regularly scheduled management meetings, and other forms of communication.

An EMS requires periodic audits to confirm that the system has been implemented and maintained properly, and audit results must be communicated to senior management. Procedures established to provide guidance through audits must include the audit scope and frequency and the methodologies associated with the EMS. If external registration to a standard, such as ISO 14001, is sought, it is helpful to conduct periodic internal audits prior to going through an external audit.

Other management reviews include having top management assess the need for possible improvements to an EMS. Changes to an EMS policy, the status of objectives and targets, and a comparative evaluation of the strategic plan are all important items to consider during such a review. Also, changes in the organization must be evaluated to determine their effect on an EMS. In addition, senior management must ensure the organization's commitment to continual improvement, pollution prevention, and regulatory compliance.

With a CMOM program directly associated with a NPDES permit, the utility or a regulatory agency (or both) must conduct program audits appropriate to the size of the system and the number of SSOs experienced. A record of the audit and/or a summary report confirming compliance and detailing deficiencies and the steps identified to respond to them must be submitted to the regulatory agency. It is currently unclear if internal and external audits will be required; however, it would be advantageous to conduct the internal audit prior to the external one regardless of the final regulatory disposition. Obviously, an organization with an EMS would be prepared and familiar with audit practices.

Two Roads, One Destination

EMS and CMOM programs have much in common. They share a common goal — using a structured management system to enable an organization to prevent pollution and continually improve its environmental performance. Not surprisingly, the key elements in both systems are in many cases as similar as the systems' desired results. This being the case, having a robust EMS in place as an initial framework will enable an organization to more easily implement and ensure the success of a CMOM program when one becomes necessary.

Rick Bickerstaff is assistant superintendent, Wastewater Collection Department; *Adrian Williams* is superintendent, Wastewater Collection Department; and *John Cook, P.E.*, is assistant general manager and engineer at the Charleston (S.C.) Commissioners of Public Works.