Fact Sheet

DISTRIBUTION SYSTEM MANAGEMENT

Operations and Maintenance

Optimizing Systems through Proper Operations and Preventive Maintenance

Quick Facts

- Utility systems function best when emergencies are avoided through a comprehensive operations and maintenance (O&M) program.
- A basic O&M program includes asset documentation, task lists, standard operating procedures, maintenance schedules, and IT integration.
- While the overall process can seem daunting, templates, software, and sample documents are available to simplify and standardize the work.

Overview

The distribution system is the most structurally extensive and labor intensive part of a drinking water system in terms of operations and maintenance. It is prudent to develop a comprehensive program that details an efficient and systematic approach to O&M. A functional and effective O&M program includes these basic elements:

1. Documentation of asset type, location, age, and condition
2. Detailed task lists to optimize performance of the assets
3. Standard procedures or best practices
4. Regular schedule for testing and maintenance
5. Information technology system integration

Although utilities are very good at dealing with emergencies, the system functions best when emergencies are avoided through proper operations and preventive maintenance. Information derived from the O&M program can indicate overall system health and help guide the utility's financial decisions.

1. Documentation of Assets

Documenting a system's assets can be a daunting task. Assets will vary in type, age, and material composition.

Each asset plays a role in delivering safe drinking water: pipes, valves, hydrants, storage tanks, remote sampling stations, pump stations, instrumentation, vaults, hatches, and other appurtenances. Documentation helps staff understand the system better and makes it easier to properly test, maintain, repair, or replace these components. A good, high-level reference for documenting assets is *Implementing Asset Management: A Practical Guide* (AMWA et al. 2007).

Figure 1 demonstrates a simplified way to document assets by tiers. Tier 1 specifies that this is a large system. Tier 2 assets are main system elements like pipes and valves. Tier 3 divides the main system elements into subcomponents. Finally, Tier 4 provides further division by specifying the type of component or its material composition. (Godin et al. 2015)

For most utilities, information about assets will be in different locations—on various databases, asset management systems, physical maps, and other information systems. Templates and software are available through the WRF project, *Asset Management Planning and Reporting*

- Large
  - Pipes
    - Distribution Main
    - Fire Hydrant Service Pipe
  - Valves
  - Water Storage Facilities
    - Condition Monitoring
    - Level Meter
    - Line Valve
    - Pressure Management
    - Water Storage
      - Atmospheric/Hydropneumatic Tank
      - Elevated Tank
      - Ground Tank
      - Reservoir, covered
      - Reservoir, uncovered
      - Standpipe
  - Other Pipe Appurtenances
    - Access to Buried Assets

Figure 1. Simplified tiering of distribution system assets

Options for Utilities (Matichich et al. 2006), which help utilities define and catalog assets in a logical way. Regardless of how the asset list is obtained, it is important that it provides enough information to develop a task list for O&M activities. Documentation will most likely be undertaken in stages and amended as the utility's system grows and changes.

2. Detailed Task Lists

A list of operations and maintenance tasks is essential to optimize the performance of a utility's assets. A general O&M program will itemize specific programs with groups of related tasks. These are examples of typical programs requiring task lists:

- Routine flushing
- Storage tank inspection and cleaning
- Instrumentation calibration and maintenance
- Backflow prevention
- Leak detection
- New pipe cleaning, inspection, and bacteriological testing

A task may be a single simple step or a more complex multistep process. In general, task lists should be as detailed as necessary to convey the basic outcomes expected.

3. Standard Operating Procedures

Most tasks will be completely described in the utility's written standard operating procedures (SOPs). Whether a drinking water utility serves fifty people or five million, SOPs are essential. SOPs promote consistency in the way tasks are performed. They help avoid mistakes by serving as detailed training aids for new, temporary, or replacement staff.

SOPs should be based on industry best practices, such as American Water Works Association's extensive Standards Program (AWWA 2014). While standards can be written by staff, alternatives include using industry organization templates and sample documents, or borrowing and revising SOPs from neighboring utilities, which are likely to share similar geographic and regulatory characteristics. WRF's *Best Management Practices for the Maintenance of Water Distribution Assets* project has documents that could be useful starting documents for many SOPs (Godin et al. 2015). Regardless of the sources, SOPs should be field tested and amended for each particular utility.

4. Maintenance Schedules

Well-managed maintenance schedules, whether manual or electronic, can help prevent costly repairs and interruptions to water service. More sophisticated scheduling systems have many advantages. Resources such as manpower, equipment, supplies and replacement parts can not only be scheduled, but also reserved or procured in advance. Standard operating procedures can be referenced in the schedule for staff to review prior to maintenance activities.

5. Information System Integration

Modern electronic tools and databases make it easier to document and track assets and to schedule and complete tasks. Better access to asset data allows for more effective planning of capital improvements. However, these same tools, if not thoughtfully utilized, can become a drain on utility staff and finances.

Information technology should support business processes at all levels through good communications and appropriate data sharing. Collected data should be available for access and use for utility performance optimization. It is necessary for IT leaders to be involved in high-level business decisions within the utility, so that information systems are integrated into decision-making processes and aligned with business goals and strategies (Harris et al. 2013). Figure 2 demonstrates the expected benefits of aligning information solutions with business goals and strategies.

References

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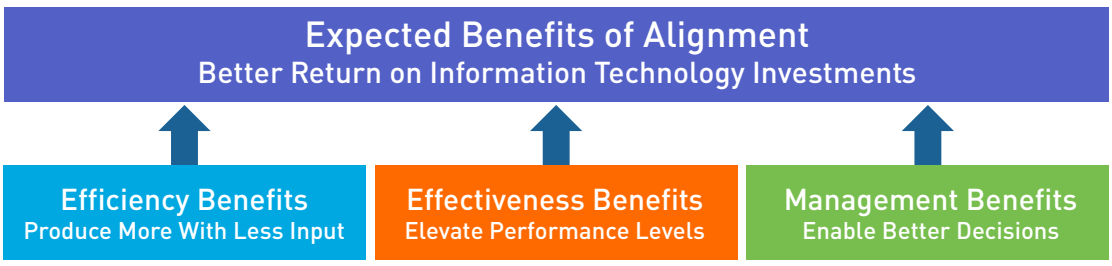

Source: Harris et al. 2013

Figure 2. Expected benefits of effective business-IT alignment