Operations Management Part 1

What is in this lesson?

Why operations management is necessary

The advantages of a maintenance management plan

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Components of a maintenance management system

Three types of maintenance

Parts of an operations management plan

The roadblocks to the development of a maintenance management plan

What needs to be scheduled

Personnel requirements determination

Importance of work order systems

Components of a consumable inventory system

The importance of a consumable inventory control system

Importance of data collection and reporting

What data and reports need to be produced

Key Words

- Assets
- Consumable
- Life expectancy
- Maintenance management
- Preventive maintenance
- Service level
- Certification
- Critical spare parts
- Maintenance
- Non-routine task
- Routine task
- Time management

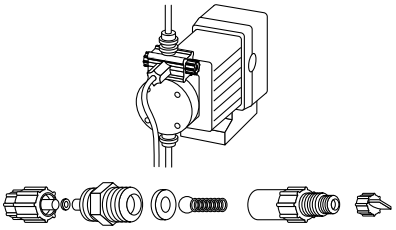
Operations Management Part 1

Introduction

Definition

Operations management is a systematic process of managing routine[1] and non-routine[2] operation and maintenance[3] tasks in order to achieve desired results.

ROUTINE

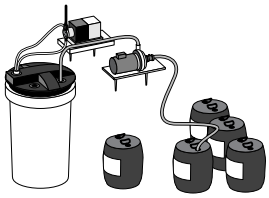


NON-ROUTINE

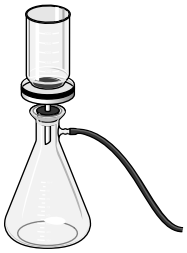
Operations

Typical operation task include:

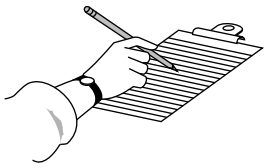
- Adding chemicals
- Sampling/testing
- Collecting data
- Installing new service
- Preparing reports
- Answering customer complaints



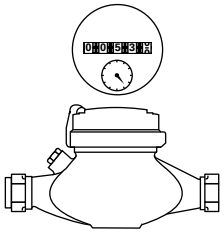
ADDING CHEMICALS



SAMPLING/TESTING



DATA COLLECTION



NEW SERVICE

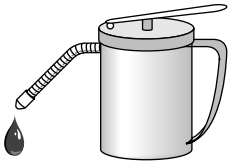
CUSTOMER COMPLAINTS

[1] **Routine task** - Tasks that are performed at least once each month.
[2] **Non-routine task** - A task that is performed less than once every month.
[3] **Maintenance** - Preventive, corrective and repair tasks performed on equipment or machines.

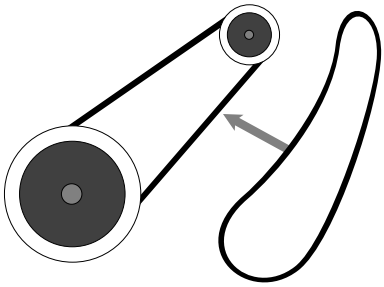
Maintenance

Typical routine and non-routine maintenance is divided into one of three types of maintenance:

- Preventive maintenance[4] tasks such as changing oil and checking bearing temperature
- Corrective maintenance such as replacing a worn belt before it breaks or rebuilding a chemical feed pump once each year
- Emergency maintenance such as repairing a broken water main



PREVENTIVE MAINTENANCE



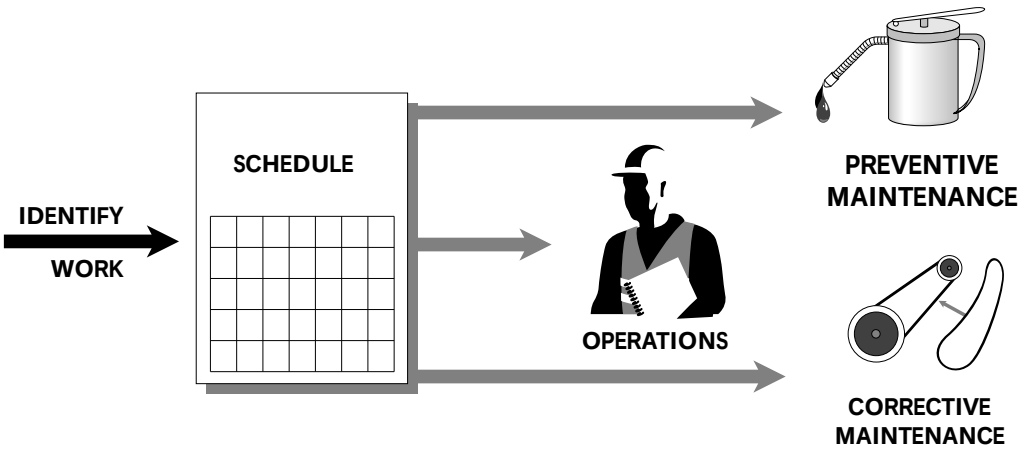
CORRECTIVE MAINTENANCE

EMERGENCY MAINTENANCE

In a small utility, preventive and corrective maintenance are grouped with routine operations tasks and are collectively called preventive maintenance.

Management Method

The most effective means of managing these operation and maintenance tasks is through a maintenance management[5] system. A primary portion of this system is focused on identifying and scheduling operations tasks, preventive, and corrective maintenance.



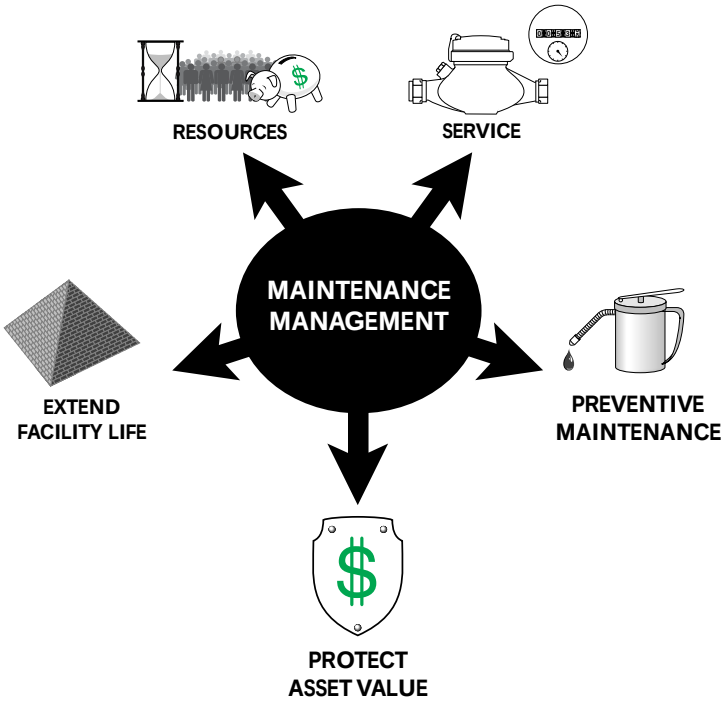
[4] **Preventive Maintenance** - The process of preventing or reducing failure of equipment by performing routine and non-routine scheduled maintenance.

[5] **Maintenance Management** - A systematic process of planning, organizing, scheduling and controlling preventive and repair maintenance so as to provide a defined level of service at a specific cost.

Why Develop a MM Plan?

There are five important reasons that a MM system is important to a small utility:

- Resources in a small utility are limited and decisions need to be made that allow the utility to be the most effective with its limited resources. The MM process clearly defines the workload and budget requirements for operations, preventive and corrective maintenance.
- The MM system is one of the most effective methods of determining the level of service that the utility can afford to deliver. A key in determining the cost of providing a specific level of service is the frequency of performing tasks. The greater the frequency, the greater the cost.
- The spending of a small amount of money for PM can have huge benefits later. For example, changing oil in a motor at a cost of $30 is better than spending $2,000 later for major repairs on that motor. In addition, failure to collect and test water quality samples at the correct time could result in additional, costly sampling and testing.
- Sanitation facilities are one of the highest value assets[6] in most communities. The MM system allows the utility to protect the investment in these assets.
- A properly instituted MM system can extend the life of some equipment beyond its original life expectancy[7], saving the utility considerable expense.



[6] **Assets** - The properties and valuables of an individual or organization, including: land, structures, system improvements, equipment, vehicles, inventory, receivables, investments and cash.

[7] **Life expectancy** - The length of time, usually in years, that an asset is expected to perform without major repairs.

Difficult to Develop

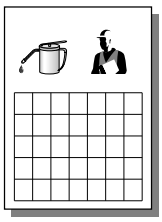
If a MM system will provide all of these benefits, then why are they not used in all small and large utilities? They are not usually used because they are difficult to develop and implement in the system. There are five roadblocks that create this difficulty:

- The development of this type of system requires considerable up-front time and effort, and requires special expertise.
- In many utilities it requires a change in attitude by utility personnel who do not believe that operation and maintenance scheduling and planning is necessary, or possible.
- Some operators and managers do not want the level of accountability that goes with this type of system.
- Most utility managers do not have a technical background and are not familiar with the equipment, regulations, and requirements. They have no reference point to start from and may not know that such systems are available or important.
- The process requires good organization, considerable paper work, and constant updating.

Parts of a MM System

There are six basic components to a Maintenance Management System:

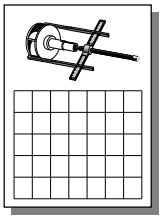
- Operation and preventive maintenance plan
- Work order system
- Utility contingency plan (emergency plan)
- Renewal and replacement (R & R) schedule
- Water quality sampling, testing, and report plan
- Consumable[8] and spare parts inventory system



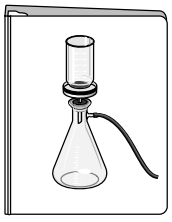
OPS & PM SCHEDULE

WORK ORDER

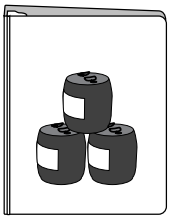
CONTINGENCY PLAN



RENEWAL & REPLACEMENT SCHEDULE



SAMPLING PLAN



CONSUMABLE & SPARE PARTS INVENTORY

Development Process

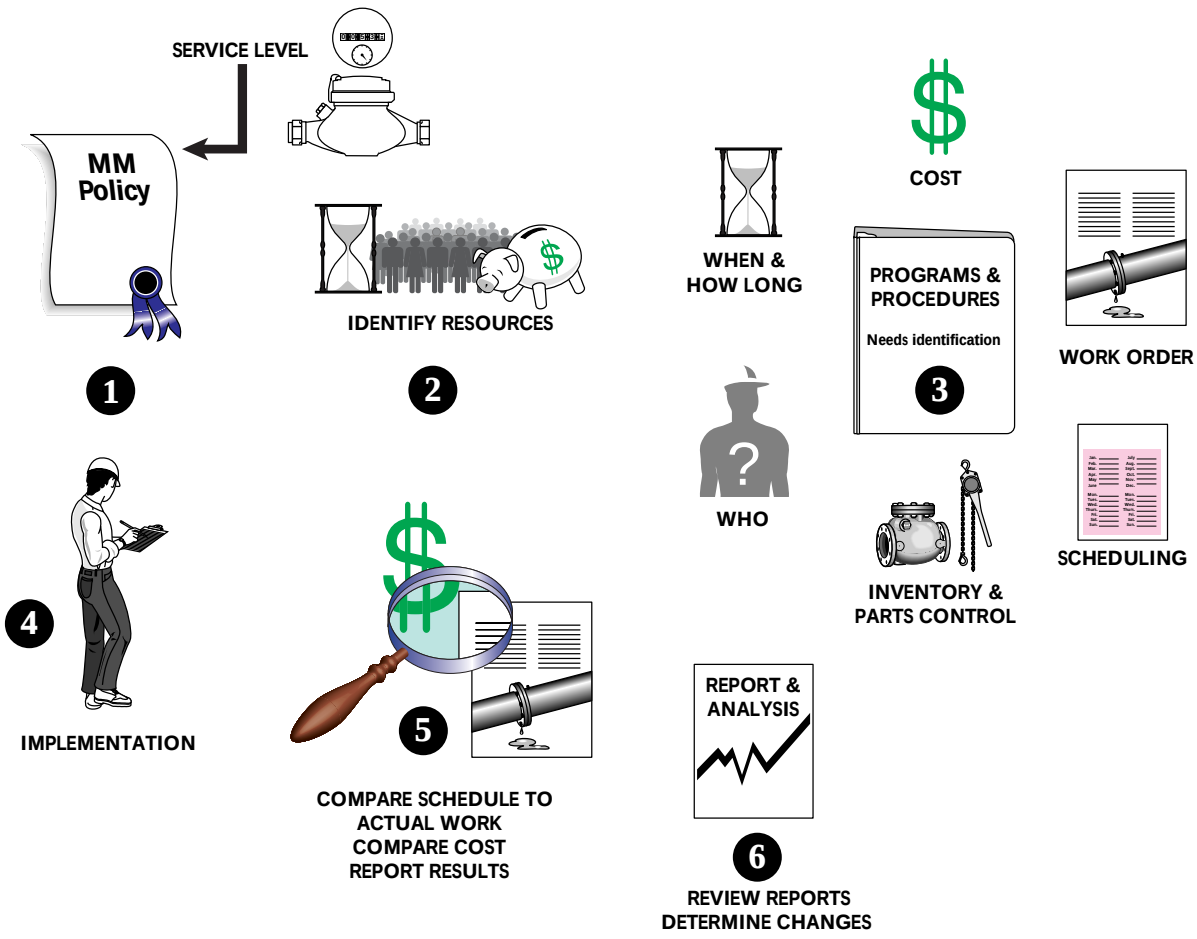
The most effective MM systems are developed using the following systematic process:

1. Start with the development of a MM policy by the manager and operator, with approval by the policy-making body. This policy clarifies responsibility, authority, and accountability for the development and

[8] **Consumables** - Supplies and materials that will be used up or converted within a year to provide a service. Consumables include chemicals, office supplies and repair parts.

implementation of the MM system. In addition, it clarifies the expectation of the policy-making body about the reliability and adequacy of the system to meet the customer's needs. This is the basis for determining the level of service to be provided as defined in the master plan.

2. The next step is to identify the resources available for the development and implementation of the system. This includes identification of all assets, number of operation and maintenance personnel available, amount of the O & M budget, and the records or information, such as O & M manuals, that are available.



3. This step involves the development of a specific programs and procedures: identification of what needs to be done, by whom, when, how long it will take and what it will cost. In addition, this step involves the development of schedules, a work-order system, and inventory control.

4. With the programs and procedures developed and tested, the system can be implemented.

5. With the system up and running, reports of the results of the scheduled work can be compared to actual work completed. Costs can be identified and compared and the results reported to managers, policy-making body, and necessary agencies.

6. The last step is a review of the reports to determine if changes need to be made in polices, procedures, or schedules.

Summary - Tie to Budget/Rates

The maintenance management system provides the labor-and-materials cost for normal operation and maintenance of the facility. These cost are based on a defined level of service. Once the costs have been defined, the manager can compare them with the estimated expenses in the budget. If the required amounts exceed the budget, the utility has two choices; reduce the level of service or increase the rates. If the decision is to reduce the level of service, then the maintenance management system is used to determine how this is to be accomplished.

Remainder of Lesson

The remainder of this lesson will provide additional details on the development and use of operation and PM schedule, work order system, inventory control system, and routine data collection and reporting. In addition, information on time management[9], and the use of computers to enhance operations management will be included.

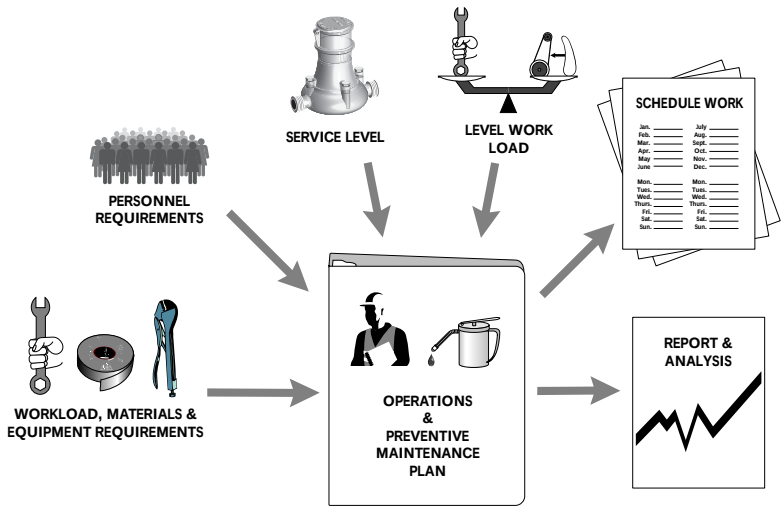
[9] **Time management** - A process of systematically taking control of the events that consume our time.

Operation and P. M. Plan

Introduction

The heart of the MM System is the operations and preventive maintenance plan. The plan provides the managers with the most important tool needed to direct and control work. How is this plan developed? There are Seven steps:

- Establish service levels[10]
- Identify work load, materials, and equipment requirements
- Estimate personnel requirements
- Level the work load
- Adjust personnel requirements
- Assign and schedule the work
- Track and report the results



Determine the Level of Service

The process of evaluating the quantity of work starts by establishing an acceptable level of service. To do this the developer asks the following questions:

- What is necessary to provide the adequacy and reliability desired by the customers as described in the master plan?
- What is the condition of the existing equipment?
- How critical is the equipment?
- How would a failure be determined?

Identify Work Load Requirements

Work load requirements are decided by;

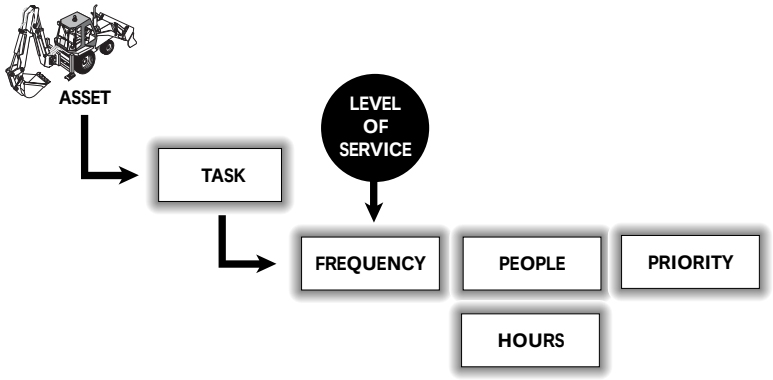
- reviewing all O & M manuals and maintenance literature for the facility and equipment in order to determine PM activities and spare parts,

[10] **Service level** - A standard for quality and frequency in the absence of state or federal regulation, set by the service provider in response to the customers' demands and the customers' willingness to pay. For example, will water be available at 20 psi for 4 hours a day or will water be available at a minimum 40 psi around the clock.

- reviewing the routine operations and data collection requirements with the operator and the O& M manuals,
- reviewing all sampling requirements obtained from the water quality sampling plan or by working directly with DEC,
- reviewing the renewal and replacement schedule,
- reviewing the utility safety program to determine training, evaluation and inspection requirements,
- identifying the operator training requirements for certification[11] renewal,
- identifying staff meeting requirements, and
- reviewing reporting requirements. (This may be in the O & M manual for the facility or work with the regional DEC office to obtain this information.)

Estimate Personnel Requirements

From the data collected in the identification process a list of all tasks that need to be completed and the time necessary to complete each tasks is compiled. The determine the frequency required for performing each task and when the task should be performed (For example, if it is annual, which month). In addition, estimate the number of hours required to complete the task, the number of people needed, and the priority of completing the task at the scheduled time.



Once this process is completed the total number of estimated personnel hours can be determined.

Level the Work Load

The personnel estimates are use to level the work load. This is accomplished by moving tasks so each day, week, and month has the proper number of work hours assigned. To accommodate changes in seasonal flow, vacations, and maintenance requirements it may be necessary to schedule more or less work on a specific week or month.

Adjusting Personnel Requirements

After the work load has been leveled, determine if there are enough people to perform the work. Some utilities

[11] **Certification** - Through a process of meeting experience and examination requirements, the Alaska Department of Environmental Conservation issues a certificate of competence to a water supply or wastewater system stating that operator has met the requirements for a specified system type and level.

may not have enough personnel to complete all of the required tasks. There are two ways to resolve this problem: One is to hire more people, which will increase cost, thus rates. The second is to not do some of the work.

There are Enough Personnel

If there is enough staff to complete all the activities, then compare the work task to operator skill requirements. Is there a need for training, special tools, equipment, etc? If yes, then compare the needs to the budget. If there is not enough money to pay for all of the labor requirements then:

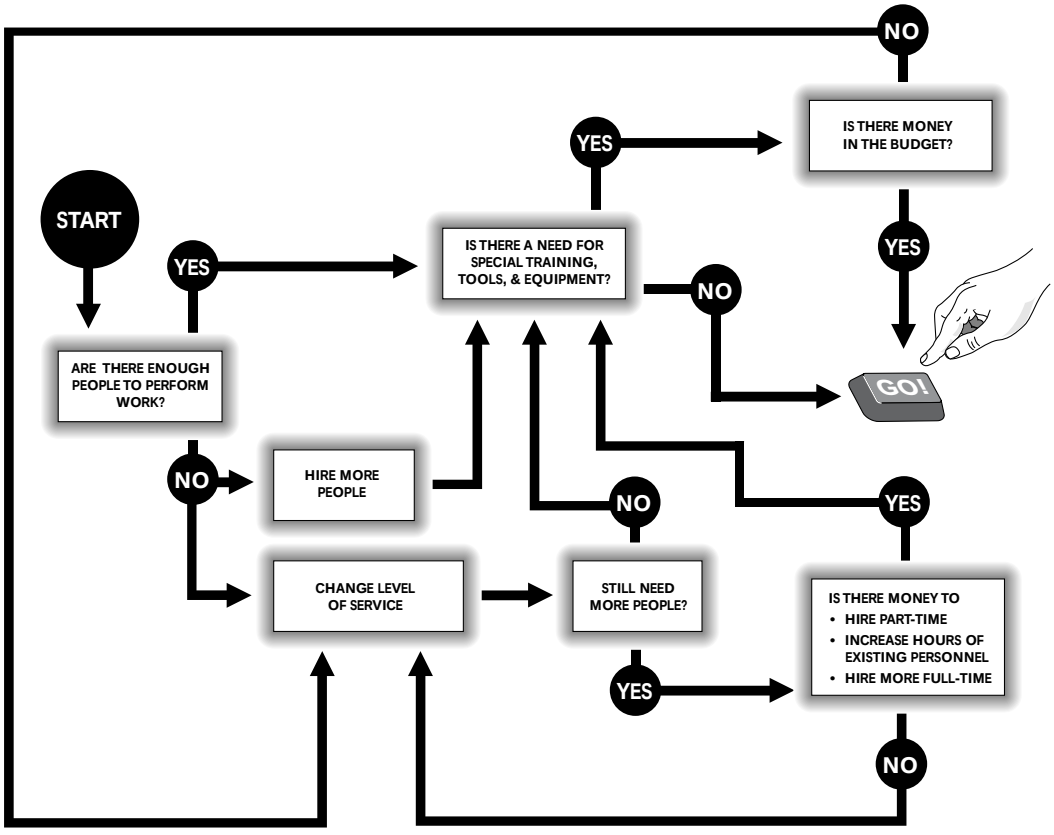
- Are all tasks necessary?
- Is the frequency of performing the tasks appropriate?
- What is the predicted result of not doing a particular task?

Once these questions are answered, the work load is adjusted as necessary.

Not Enough Personnel

If there is not enough personnel time to complete the task, then do one or a combination of the following:

- Use priorities to eliminate tasks.
- Determine who else can do some of the tasks, part-time help, volunteers.

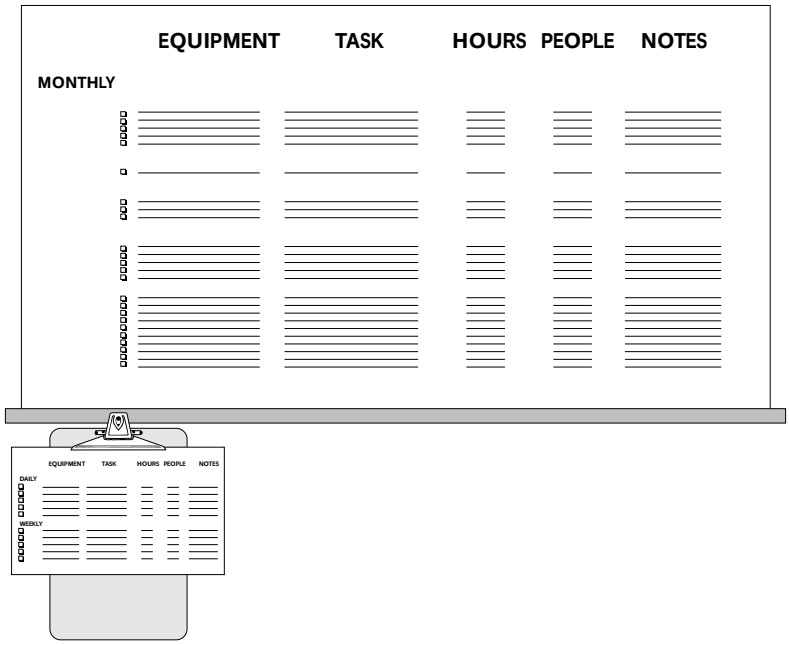


- If the need for more personnel is the conclusion, use the data to provide budget and subsequent rate information to support hiring more people or increasing the hours of existing personnel.

Assign the Work

Once the work load has been leveled, and personnel requirements adjusted, schedules can be produced. One of the more effective scheduling techniques for small utilities is to place all daily and weekly tasks into a single data collection and check-off list. Schedule the monthly, quarterly, annual, and other tasks to a specific date. This can be accomplished by using:

- weekly calendars,
- clipboards or white board with list for specific weeks or months,
- printed list of annual task, covered with plastic and as each task is completed, it is checked off, and/or
- a computer based scheduling program.



Tracking & Reporting Results

With a schedule system in place, the utility manager must implement a tracking and reporting system. This system provides the following benefits:

- Allows the manager to make sure that the tasks are being completed.
- Makes sure that a record of the completed work is being maintained .
- Provides information for a report to the policy -making body detailing the work accomplished, problems encountered and problems solved.
- Provides budget information necessary in determining staffing, materials, equipment, and service cost.

Work Order System

Introduction

Purpose

A work order system is an important part of the maintenance management system. It is through the work order system that consumable inventory use is documented and that repair work is authorized and documented.

Level of Complexity

In a small utility it is not necessary to develop a complex work order system. In fact, preprinted work order forms may not be necessary as long as the appropriate data is collected and stored.

Two Major Conditions

There are two types of repair work that can be tracked using a work order system: routine repairs and emergency work.

Routine Repairs

Could be Same

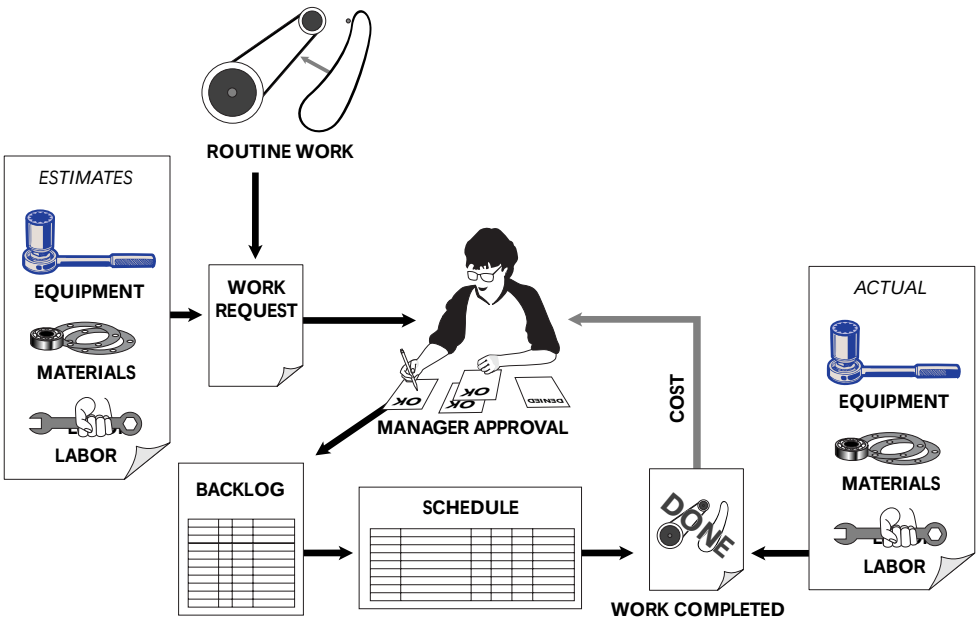
Routine work can be handled using any one of a variety of processes. The system described here uses work requests and work orders, which provides a high degree of scheduling and cost control.

Work Request

In this system, the operator fills out a work request providing estimates for materials, labor, and equipment. In addition, the operator sets a priority on the work and sets a suggested completion date based on the existing work schedule. (This work request can be provided on a preprinted form or simply on notebook paper.)

Approval - Work Order

The work request is given to the utility manager. The utility manager compares the request against the budget, the priority, and importance of the work. The manager either approves or denies the request for work. Once the request is approved, a work order is issued. This can be a simple note of approval, verbal approval, or a written work order.



Backlog

Once the work is approved, it is placed in a backlog of existing repair work (in a file, on a white board, on a note pad, etc.). The operator removes the work order from the backlog by placing the work into the schedule.

White Board

This entire process- work request, work order, backlog, and schedule– can be accomplished in a number of ways. One example is to use a white board. The board can be divided into boxes, the requested work placed in each box. The cost estimates also can be placed in the same box. When the work is approved, the operator can simply note “approved”and schedule a date for completing the work.

Added Advantages

By having a list or backlog of work with estimates of materials, labor, and equipment, the operator can check the inventory and order needed parts prior to starting work. In addition, if more help or special equipment is needed, there is an opportunity to schedule this prior to the start of work.

Emergency Work

When an emergency occurs, stopping to complete paper work only delays resolving the emergency. Once emergency work has been completed, the operator should record all materials, labor, equipment, and contractors used in completing the job. The emergency repair work orders are filed and summarized once each year for use in the development of the annual operating plan and budget.

Consumable Inventory Control

Definition

Consumable inventory are those items that are used in the operation and maintenance of the utility. This would include replacement parts, safety equipment, and chemicals.

Purpose

The inventory control system provides the operator and manager with a means of determining what spare parts and chemicals are needed, what quantity is presently available and the quantity that needs to be ordered. Having the necessary spare parts on hand is critical to keeping the system on-line. There by providing a consistent service to the customer.

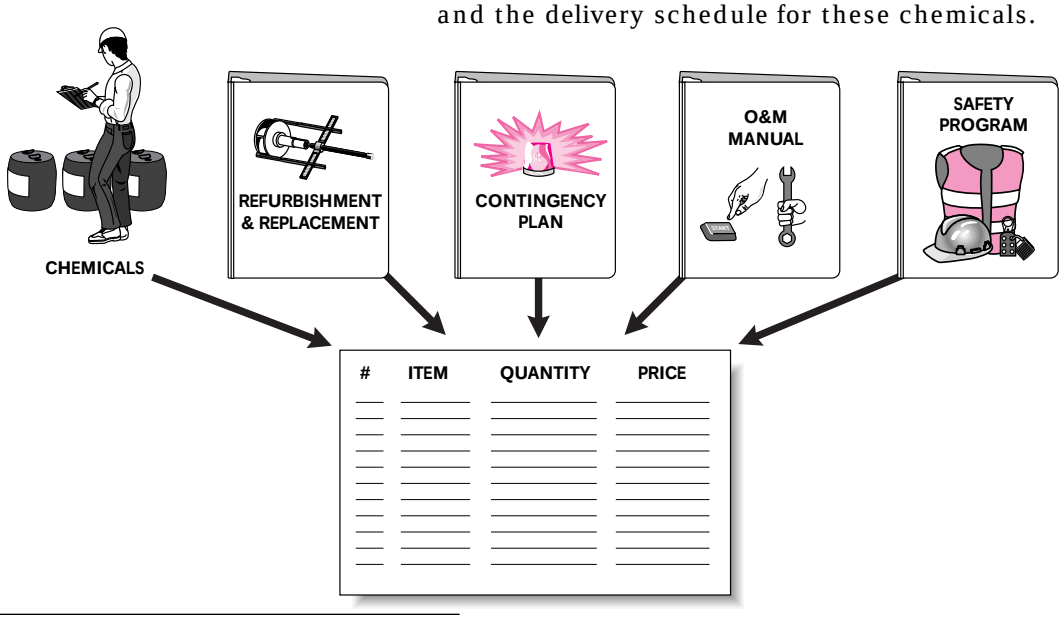
Development Considerations

There are three major components to a consumable inventory control system:

- Identification of what should be in the inventory
- A method of recording or listing all of the inventory
- A method of controlling the quantity in inventory

Identification

The method of identifying what needs to be in the inventory starts by identifying those parts indicated as critical spare parts[12] in the manufacturers literature and O & M manuals. Next, obtain the list of parts that were identified in the contingency plan (emergency response plan), the renewal and replacement plan and the parts identified as critical by the experience of the operator. Then determine the materials and equipment replacement needs from the safety program. Finally, based on previous year's usage, determine the quantity of chemicals needed for a year and the delivery schedule for these chemicals.



[12] **Critical spare parts** - The lack of these parts would contribute a health risk if the piece of equipment they were needed for failed.

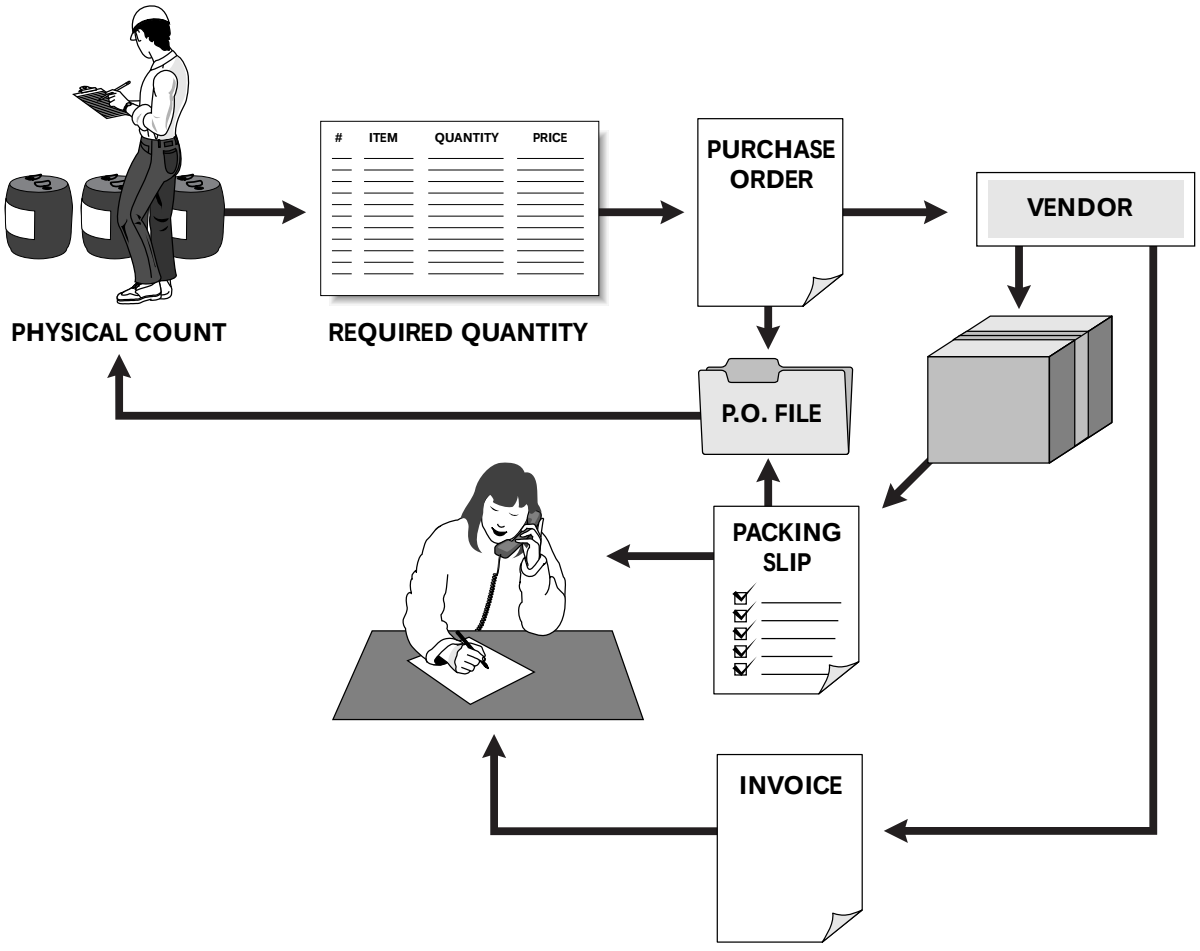
Recording

Assuming that the utility has sufficient funds for the purchase of the critical spare parts and chemicals, a list of the items together with quantity, cost and vendors, should be maintained. This can be done using a written list, a simple card system, a computer data base, or a computerized commercial inventory control system. For small utilities, a simple card system or computer data base are the most economical.

Control

The control system should be kept as simple as possible. Typical minimum components would include:

- An annual physical count to verify the quantity on hand
- A method of determining when it is necessary to purchase parts or supplies. (Typical methods include; monthly physical counts, card systems, and computerized inventory control systems.)
- A method of linking the order of parts and supplies to the purchasing system. (When an inventory item is ordered, the inventory system should allow you to note this order so when looking for a part an operator can easily determine what is on order.)



- A method to show that the parts and supplies ordered have been received. (This receipt process must be part of the existing purchasing system.)
- A method to reduce the quantity in inventory. (This is usually accomplished through the work order system.)

Reducing Inventory Quantity

Suppliers

One of the ways to reduce the quantity of inventory needed for a specific part is to work with the suppliers as well as the transportation schedule to determine the quantity and availability from a local supplier. Some criteria that can be used to determine if the parts should remain with the supplier or be purchased are:

- Will the loss of the component cause immediate failure to the system or represent a health problem?
- Can the part be supplied in winter and summer?
- Can it be supplied in a reasonable length of time?

Other Utilities

A second method of reducing inventory is to work with other utilities in your area that have the same equipment and spare part needs. If transportation is available, a group of utilities could cooperate in the inventory control and thus reduce each utility's inventory. Each utility would agree to keep certain critical spare parts on hand. This will require a lot of coordination and communication among utilities.

Conclusion

The establishment of an inventory control system can be difficult and appears complicated. However, once established, most inventory control systems are quite simple to operate and maintain. In addition, this is the primary means of ensuring that the utility does not run out of chemicals, can repair equipment, and has appropriate personal protective equipment on-hand.

Data Collection and Reporting

Introduction

Function

O & M data collection and reporting can serve a number of functions. Three of the most important:

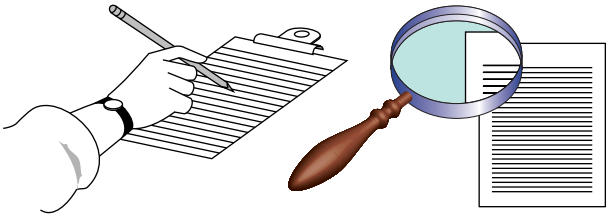
- The process of collecting and reporting data is a key component in developing accountability for the duties of the operator.
- In addition to the development of accountability, this process clarifies responsibility by identifying who will collect what data, who will report the results, and who will analyze the reports.
- From an O & M standpoint, this process provides a history of the conditions of the facility and allows the operator to identify and solve problems before equipment fails.

Components

There are three major components to this system:

- The development of a record-keeping process
- Data collection and analysis
- Reports indicating the results of the data

RECORD-KEEPING SYSTEM



DATA COLLECTION & ANALYSIS

Record-Keeping Process

Categories

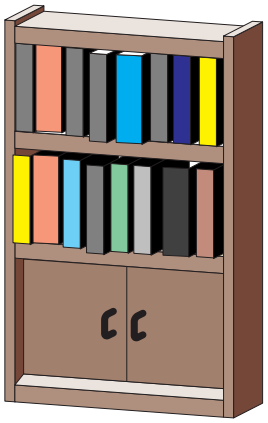
The records maintained by the operator can be divided into four categories:

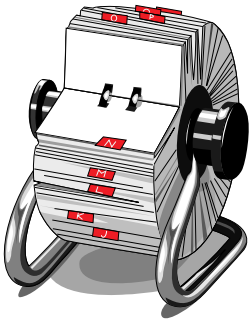
- Equipment
- General information
- Operations
- Scheduling

The following text describes only those records that would be found in the operations category.

Operations

Key tools for the maintenance of operations records are a rolodex, book shelf or file cabinet.and/or a computer.





Rolodex

The Rolodex can be used to maintain a file of vendor, agency, organization phone numbers. A second rolodex can be used to store the spare parts inventory.

Book Shelf

The book shelf is used to store; O & M manuals, training manuals, safety program, state regulations, and reference books.

File Cabinet

In a file draw labeled “operations” should be at least the following:

- Completed work orders - by month
- Backlog of work
- Packing list of materials ordered but only partially received
- Monthly report to State Heath or EPA - one folder for each year and one folder for each utility (keep water and wastewater reports separate)
- Monthly reports to council - by year
- Cost information needed for monthly report
- Operational data collection form
- Operational data reports - by year
- Copies of purchase orders of materials that have been received
- Laboratory reports of water quality testing
- Operator certification and training information

Computer

The computer can be used to store purchase orders, inventory control system, PM schedule, masters to the facility O & M manual, budget, and annual operations plan.

Data Collection and Analysis

Two Types of Data

There are two types of data collected by operations: routine and non-routine. Routine data is data collected at least once a month. Non-routine data is data collected less often than once a month. Operations personnel commonly refer to routine data collection as daily data collection.

Routine Data

Data that is collected once a day, once or more a week or once or more a month is called routine data. The form below is an example of a routine data collection form.

Water Treatment Plant Data Collection Form Month _____

Day	Water Level	Raw Water Meter	Gallons Pumped	Electric Meter	River Electric Meter	Gallons Fuel Pumped	Chlorine Tank Level	Gallons of Chlorine Used	Chlorine Dosage mg/L:	Chlorine Residual First Customer - mg/L	Chlorine Residual in System mg/L	Turbidity ntu	Water Heater Temp •F	Water Heater Pressure psi	Operator
1															
2															
3															
4															
5															
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30															
31															

Daily check for:	
water leaks	
fuel leaks	
unusual noises	
unusual vibrations	

Weekly	Week #1	#2	#3	#4	#5
Backflush infiltration system					
Check both heat trace's					
Clean all equipment					
Clean areas around equipment					
Sweep, mop and empty trash					

Monthly: (check off when completed)	
Test high/low alarms	
Test no-flow shut down sys.	
Service flow switch	

Non-Routine Data

Non-routine data includes events that occur less often than monthly. Examples would include annual and quarterly water quality testing and pump/motor data such as amperage, voltage and kilowatts. The form on the next page is used by a small utility to collect pump and motor data at their water treatment plant.

City of ________________
Pump History Data Collection Form

Date ____/____/____ (month day year)   Operator(s) ____________________

Time of Day ______:______ am pm

Clear Well Level ________ ft   Discharge Pressure __________ psi

Power Factor __________   Flow ____________________ gpm

Differential gauge on backwash pump __________ psi

Pump
- ❑ Backwash #1
- ❑ Backwash #2
- ❑ Jockey
- ❑ Pump 2
- ❑ Pump 3

Voltage Leads 1 - 3	Voltage Leads 1 - 2	Voltage Leads 2 - 3

Amperage Lead 1	Amperage Lead 2	Amperage Lead 3

Date ____/____/____ (month day year)   Operator(s) ____________________

Time of Day ______:______ am pm

Clear Well Level ________ ft   Discharge Pressure __________ psi

Power Factor __________   Flow ____________________ gpm

Differential gauge on backwash pump __________ psi

Pump
- ❑ Backwash #1
- ❑ Backwash #2
- ❑ Jockey
- ❑ Pump 2
- ❑ Pump 3

Voltage Leads 1 - 3	Voltage Leads 1 - 2	Voltage Leads 2 - 3

Amperage Lead 1	Amperage Lead 2	Amperage Lead 3

Date ____/____/____ (month day year)   Operator(s) ____________________

Time of Day ______:______ am pm

Clear Well Level ________ ft   Discharge Pressure __________ psi

Power Factor __________   Flow ____________________ gpm

Differential gauge on backwash pump __________ psi

Pump
- ❑ Backwash #1
- ❑ Backwash #2
- ❑ Jockey
- ❑ Pump 2
- ❑ Pump 3

Voltage Leads 1 - 3	Voltage Leads 1 - 2	Voltage Leads 2 - 3

Amperage Lead 1	Amperage Lead 2	Amperage Lead 3

Data Analysis

The collection of data can serve two purposes: reporting and analysis. The reporting aspect is discussed later in this chapter. Analysis is looking at the data and determining what can be learned. First, Are the readings normal? Second, Has anything changed? Third,What are the trends? Fourth, What can the numbers tell us about the systems operation?

Without any analysis of the data, there is little reason to collect and record the data. Additional analysis includes: determining the efficiency of pumping stations, why the pH is high or low, why the chlorine residual is high or low, what the water consumption or production is compared to weather conditions and previous months and years.

This is one of the key responsibilities of the operator. This analysis is necessary for personnel to properly operate the system, prevent system failures, and provide the manager with meaningful reports.

Reporting the Results

Four Types of Reports

There are four types of reports commonly prepared by operations personnel:

- Productivity reports
- Operations reports
- Regulatory agency reports
- Management reports

Productivity Reports

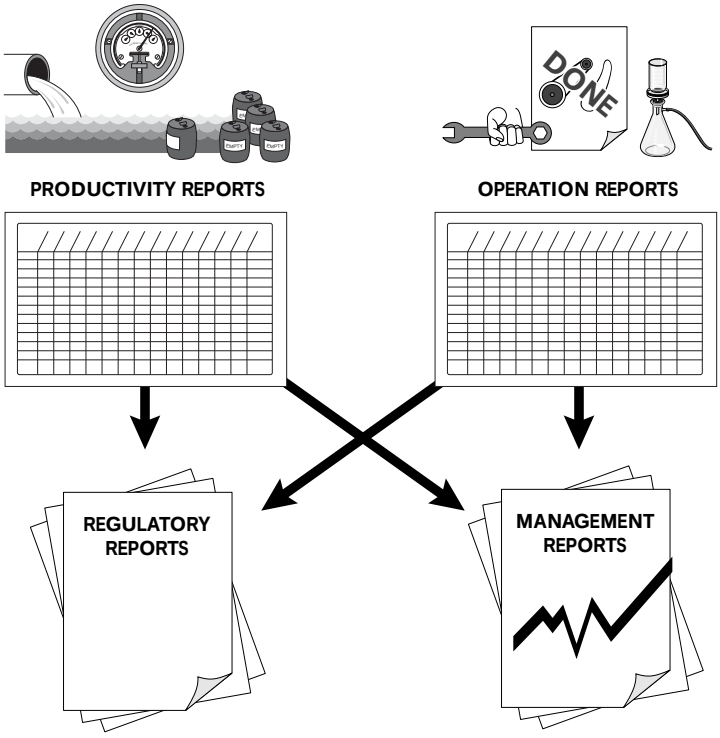
Productivity reports prepared by the operations staff include the daily water quality data collection, determination of the number of gallons produced in one day and one month, and the quantity of chemicals used.

Operations Reports

Operations reports include:

- Labor required for operations, maintenance, and repair
- Repair work completed
- Water quality testing results from outside laboratories
- The amount of PM and repair work scheduled compared to the amount accomplished
- The labor requirements for the month compared to the budget classifications for each labor class (operations, maintenance, training, safety, repair, etc.)

The operator should place summary information from these reports together with the productivity data into a single report and submit to the manager once each month.



Regulatory Agency Reports

Regulatory agency reports are usually required by law to be submitted on forms provided by the agency. Most of these forms require information on quantity and quality of treated water. The operator completes and signs the report, then submits it to the agency. A copy of this report should be given to the manager prior to sending to the agency. The copy is then returned to the operator for filing.

Management Reports

One of the most important reports that a utility manager will provide, is the manager's report. The data from this report can be incorporated into an overall utility report or be presented directly to the policy-making body. This report should include the following information:

- Summary of production and water quality data
- PM not completed – this takes less space and time than reporting all of the PM completed
- Work orders completed and cost
- Work order backlog, quantity, labor, and materials cost estimates
- Status of special projects
- Problems identified and not resolved
- Issues that should be of concern next month (sampling, etc).

Example

The following is an example of a management report form for a small community.

City of _____, PUBLIC WORKS
MONTHLY REPORT

For the Month of _____, 19 __ Prepared by _____

Water Consumption Small Well _____ MGD Water Consumption Large Well _____ MGD

Total Water Consumption _____ MGD Average Day _____ MGD

Last Month _____ MGD % Change _____ %

Last Year _____ MGD % Change _____ %

Power Consumption

Large Well house _____KWH Small Well House _____ KWH

Total Water System _____KWH

Lift Stations _____KWH Treatment Plant _____ KWH

Total Wastewater System _____KWH

Power Utilization

Small Well _____ MG/KWH Large Well _____ MG/KWH

Drinking Water Quality

Bac-T _____/100mL Avg. Fluoride _____ mg/L

Bac-T Compliance over the last 12 months _____.

Avg. Cl_2 _____ mg/L

Number of water quality complaints by customers _____

Comments on water quality

Wastewater Quality

BOD _____ mg/L TSS _____ mg/L Chlorine _____ mg/L

Comments on Water Quality

Chemicals Used

Water

Chlorine _____ pounds Fluoride _____ pounds

Comments _____

Wastewater

Chlorine _____ pounds

Comments _____

Personnel Utilization

Water System _____ hrs Wastewater System _____ hrs

Streets _____hrs Landfill _____ hrs

_____ % Preventive maintenance

_____ % Repair maintenance

_____ % Normal operation

_____ % Special projects

_____ % Training

Problems Resolved

Special Task Status

New Problems Identified

Preventive Maintenance Tasks Not Completed