

Preventive Maintenance Tasks for Tribal Drinking Water Systems

Guide Booklet



EPA 816-F-01-017
Office of Water (4604)
June 2001

Tools For Preventative Maintenance

What do these cards and booklet address?

The log cards and guidance booklet provide a schedule of routine operation and maintenance tasks for small drinking water systems that use a groundwater supply. They will help you develop a preventative maintenance program for your water system.

How is this booklet organized?

This booklet is divided into sections that outline daily, weekly, and monthly tasks, plus individual sections that describe specific tasks for each month of the year. Each section contains guidance notes that provide additional information on some tasks. The notes correspond to the tasks on the accompanying cards. Please note that we have not defined all tasks because some are self-explanatory.

Tools For Preventative Maintenance

How can I customize these tools for my system?

Based on your system's requirements, you can add or subtract tasks and logs from this preventative maintenance program. For example, the tasks in this set of tools apply to groundwater systems only. If your source of supply is surface water, you will need to perform additional preventative maintenance tasks. Guidance in outlining such tasks is available from a variety of sources, identified below. These cards and logs can also be adopted for use by wastewater systems as well.

How will a preventative maintenance program benefit my water system?

A preventative maintenance program can help you prevent problems, and can help you build and maintain the technical, managerial, and financial capabilities of your system. It can enhance public health protection, improve your system's reliability, and reduce the costs of maintaining your water system.

Tools For Preventative Maintenance

Who can help me develop a preventative maintenance program for my system?

Additional assistance and guidance are available from many sources. Your EPA Regional Office can help you develop schedules for monitoring and reporting, and other technical assistance providers may be able to contribute training and information. Please see the list of telephone numbers and web sites below.

Please note that this booklet does not take the place of a complete operation and maintenance manual.

Contacts

For more information, contact:

U.S. EPA Headquarters

Office of Ground Water and Drinking Water
(202) 260-5543 <http://www.epa.gov/OGWDW/>

American Indian Environmental Office
(202) 260-7939 <http://www.epa.gov/indian>



U.S. EPA Regional Office Phone Numbers and Tribal Websites

1	CT, ME, MA, NH, RI, VT	(888) 372-7341	http://www.epa.gov/region01/govt/tribes/index.html
2	NJ, NY, PR, VI	(212) 637-5838	http://www.epa.gov/region02/nations/indian1.htm
4	AL, FL, GA, KY, MS, NC, SC, TN	(404) 562-9655 (800) 241-1754	http://www.epa.gov/region4/ead/GovPartners/tribal.htm

Contacts

U.S. EPA Regional Office Phone Numbers and Tribal Websites, continued

5	IL, IN, MI, MN, OH, WI	(312) 353-2000 (800) 621-8431	http://www.epa.gov/r5water/sdw/dwwedo4.htm
6	AR, LA, NM, OK, TX	(214) 665-2200 (800) 887-6063	http://www.epa.gov/earth1r6/6xa/tribal/html
7	IA, KS, MO, NB	(913) 551-7003	http://www.epa.gov/region07/programs/wwwpd/wwwp.html
8	CO, MT, ND, SD, UT, WY	(303) 312-6i53 (800) 277-8917	http://www.epa.gov/region08/tribes/
9	AZ, CA, HI, NV, AS, Guam	(415) 744-1500	http://www.epa.gov/region09/cross_pr/indian/index.html
10	AK, IK, OR, WA	(206)553-4011 (206)553-0151	http://yosemite.epa.gov/r10/tribal.NSF/webpage/tribal+office+homepage

Contacts

Additional Contacts

DHHS Administration for Native Americans	(202) 690-7776 http://www.acf.dhhs.gov/programs/ana/
DOI Bureau of Indian Affairs	(202) 208-3711 http://www.doi.gov/bureau-indian-affairs.html
Bureau of Reclamation's Native American Affairs Office	(303) 445-2692 http://www.usbr.gov/main/programs/native-am.html
Indian Health Service	(301) 443-3593 http://www.ihs.gov/
National Rural Water Association	(800) 332-8715 http://www.nrwa.org/
State Rural Water Associations	For associations listed by State, see: http://www.nrwa.org/2001/members/assnlist.htm

Contacts

Additional Contacts, continued

Rural Community Assistance Program (703) 771-8636

<http://www.rcap.org>

Rural Utilities Service

(202) 720-0962

<http://www.rurdev.usda.gov/rus/index.html>

Safe Drinking Water Hotline: 1-800-426-4791 or

email: hotline-sdwa@epamail.epa.gov

Guidance Notes for Recommended Daily Operational Duties

Check water meter readings and record water production. The system should have a working, properly calibrated master water meter to accurately monitor usage. Take a daily water meter reading and then calculate total use during the previous 24 hours by subtracting the previous day's meter reading from the current day's meter reading. Comparing daily use to design capacity allows the system operator to determine whether the system's treatment capacity is adequate. If your customers have meters, they should be read on a monthly basis, totaled, and compared to your system's master meter. A daily water production log card is provided. Please note that dates are in reverse order to make calculations easier.

Check chemical solution tanks and record amounts used. Determine the amounts of chemicals, typically chlorine and fluoride, that are used daily. If you use a fluoride feeder (fluoride saturator) that is hooked to a metered water line, you can read the meter daily. To measure the amount of other solutions used, measure the current day's level, subtract it from the previous day's level, and multiply the difference in inches by the volume per inch (gal/min). *Task continues on next card*

Guidance Notes for Recommended Daily Operational Duties, Continued

Check chemical solution tanks and record amounts used (continued).

Please note when the tank is filled and at what level, so that an accurate usage calculation can be made the next day. As a final step, you should compare the volume of chemical usage to the volume of water produced. This will help you to determine whether your chemical usage is in an acceptable range based on the concentration of the chemical and the desired dose. Tanks should also be checked for leaks and blockages. A chemical solution daily usage log card is provided. Please note that dates are in reverse order to make calculations easier.

Check and record water levels in storage tanks. You should check the water level in each storage tank daily to ensure that tank levels are within the normal operating range. If the tank is overflowing, there may be a problem with the pump controls. If the tank's level is below the normal operating range, there may be a capacity or control problem. A storage tank daily water level log card is provided.

Guidance Notes for Recommended Daily Operational Duties, Continued

Check and record chlorine residual at the point of application. Chlorine is added to disinfect and improve the quality of treated water. Chlorine also helps control microorganisms that might interfere with the treatment plant processes. The free chlorine residual should not be less than 0.2 mg/L, and should stay below the maximum residual disinfectant level of 4.0 mg/L. A daily disinfectant residual log card is provided.

Check and record chlorine residual in the distribution system. Take chlorine residual readings at different points in the distribution system to ensure that the system is maintaining a residual of at least 0.2 mg/L at all points. Perform these checks at points where you expect long detention times of the water and loss of residual (dead end mains, oversized mains, mains with low water use, etc.) Move the sample point daily in order to cover the whole distribution system in one week. Use the daily disinfectant residual log card to record your readings.

Guidance Notes for Recommended Daily Operational Duties, Continued

Inspect chemical feed pumps for proper operation. Make sure the feeder is not broken or plugged up and that it is adjusted correctly. Check to see if the chemical feeder is supplying the correct dosage by measuring how much chemical is being fed and then calculating the dosage. You can measure the amount fed by checking how much chemical is removed from the day tank (or the glass calibration container in newer systems) over a certain time period. Calculate the dosage using the concentration of the chemical solution, the volume of solution fed, and the volume of water produced over the same time period. Refer to your system operation manual to determine the correct dosage. A daily chemical feed pump log card is provided. Please note that dates are in reverse order to make calculations easier.

Inspect booster pump stations. Check on the condition of the pumps and controls to ensure that booster pumps are operating properly. Check to make sure the pump operating times are equalized (i.e., that the pumps automatically switch over). If this is done manually, then make the appropriate switch-over. Check and record meter readings and pressure gauge readings on suction and discharge sides of pumps. A daily booster pump log card is provided.

Guidance Notes for Recommended Daily Operational Duties, Continued

Check and record fluoride concentration in the distribution system. Fluoride is added to water to reduce tooth decay. Too much fluoride can stain teeth brown. Optimum fluoride levels are a function of ambient temperature, but generally should remain between 0.7 and 1.2 mg/L, except in Alaska, where they should remain between 1.1 and 1.7 mg/L. Measure and record fluoride levels, remembering that the natural background level will affect the amount of fluoride that should be added. If you are using a specific ion electrode, be sure to consider the life of the electrode. If you are not using a specific ion electrode, check your tests against results from a certified lab at least once a month. A daily fluoride concentration log card is provided.

Record well pump running times and pump cycle starts. From the hour meter and cycle counter on the control panel, record the running times and number of cycle starts for your well pump. Be sure to take these readings at about the same time every day. Comparing daily numbers will alert you to potential well pump problems. A daily well pump log is provided.

Guidance Notes for Recommended Daily Operational Duties, Continued

Investigate customer complaints. Complaints are often the first indication of a significant or potentially significant problem and should be investigated immediately. A customer complaint log card is provided.

Inspect heater operation during winter months. Heaters should be checked throughout the winter on a daily basis to determine that they are working properly.

Inspect well pumps, motors, and controls. System operators should always be on the lookout for any defects in the system. Look, listen, and feel for unusual sounds or vibrations. Make sure seals are intact and the system is not “running hot.” Check all timers to ensure that pump operating times are equalized. Controls should be operated manually to verify that they are working. Make sure your backup power source will operate when needed. When you shut down or turn off equipment for repairs, make sure it will not start up accidentally and cause injury.

Guidance Notes for Recommended Weekly Operational Duties

Inspect chlorine and fluoride testing equipment. Testing equipment is essential for a comprehensive monitoring program and must be kept in proper working order. Make sure you are using the correct chemical reagents for each type of application. Reagents should be safely stored and clearly marked with the name and date of preparation. Manufacturer-prepared reagents should be discarded when the expiration date is reached. A chemical equipment weekly testing log card is provided.

Clean pump house and grounds. Keeping your pump house and grounds clean will help with overall maintenance and operation of your system. The useful life of bearings can be reduced if dirt gets into lubricants. Also, dirt and moisture will form an insulating coating on motor windings and can cause motors to burn out. In addition to cleaning, screen all drain and vent openings in the building to prevent entry by animals and insects, and in the summertime, mow the areas around the pump house and storage tanks. A weekly cleanliness log card that also addresses fire hydrant accessibility is provided.

Guidance Notes for Recommended Weekly

Make sure fire hydrants are accessible. Fire hydrants provide water for fire fighting and are a means to flush the system. The hydrants should be easy to get to and highly visible. This includes removing snow drifts during the winter, tall grass or weeds during the summer, and painting the hydrants a highly visible color. Hydrants should be color-coded according to the available fire flows.

Record pumping rate for each well or source water pump. Record the pumping rate from your well or source water pumps. You can do this if your system has a meter that registers flow. A change in pumping rate can indicate that you may have a pump problem. Keep in mind that pumping rates will vary based on water level in the well (i.e., the pump produces less when the well has been drawn down from static water level to the deepest pumping level) and based on the head the pump is pumping against (i.e., the water level in the gravity storage tank or the current pressure of the hydropneumatic tank). A weekly pumping rate log is provided.

Guidance Notes for Recommended Weekly

Inspect all pumphouse plumbing for leaks. Excess moisture in the pump room can damage motors and other equipment and create unsafe conditions for operators. Leaks also open pathways for contaminants to enter the water supply.

Guidance Notes for Recommended Monthly Operational Duties

Read electric meter at pump house and record. Monitor and note any unusual or unexpected changes in electricity use over time. If pumping accounts for a large proportion of your system's energy use, track water production. (In the winter, you will also need to consider energy use for heating.) A monthly electric meter log card is provided.

Take appropriate monthly water quality samples. Water quality samples should be taken routinely in accordance with SDWA and EPA requirements. Take samples according to approved procedures and submit them to a certified laboratory for analysis. Your EPA Regional Office can give you an annual schedule for your required sampling. A monthly sampling log card is provided.

Guidance Notes for Recommended Monthly Operational Duties, Continued

Check and record static and pumping levels of each well. This task is important for determining the reliability of the aquifer and for establishing baseline information that can be useful if others tap into the aquifer or take actions that will affect it (e.g., gravel mining). The static level is the level of the water table in a well when the pump is not operating. You can measure this level as the distance in feet from the centerline of the pump discharge. The pumping level is the distance from the centerline of the pump discharge to the level of the free pool while water is being drawn from the pool. You can check these levels by using bubbler lines, electrical sensors, or manual drop lines. A monthly static and pumping level log card is provided.

Inspect well heads. Well head covers or seals prevent contaminated water and other material from entering the well. Visually inspect all well covers and pump platforms. They should be elevated above the adjacent finished ground level, sloped to drain away from the well casing, and free of cracks or excessive wear. Make sure all seals and screens are intact and properly bolted and make sure all gaskets are in good condition.

Guidance Notes for Recommended Monthly Operational Duties, Continued

Inspect and lubricate locks. Locks should be inspected as they are used and lubricated as needed to protect against corrosion. They should also be inspected to ensure that they have not been tampered with. Defective locks should be repaired or replaced immediately.

Check on-site readings against laboratory results. It is useful to compare test results returned by the laboratory against on-site readings. Be sure you are comparing the results from samples that were collected at the same time. Major discrepancies should be noted and equipment or chemicals adjusted accordingly.

Guidance Notes for Recommended January Operational Duties

Overhaul chemical feed pumps (O rings, check valves, and diaphragm). Chemical feed pumps should be completely overhauled at least once a year. The overhaul should include cleaning the feeder head, cleaning and checking all valves and O rings for wear, and cleaning and checking the condition of check valves and pump control valves. Replace any worn out parts. Spare parts should be kept on hand so breakdowns can be repaired quickly and worn parts can be replaced when the feeder is disassembled for cleaning.

Inspect and clean chemical feed lines and solution tanks. To ensure that your chemical feed system functions properly, inspect the lines to make sure they're not clogged or kinked and that the solution tanks are clean. Regular cleaning of chemical feeders will prevent many breakdowns in this equipment. This should be done every 3 months.

**Guidance Notes for Recommended January
Operational Duties, Continued**

Calibrate chemical feed pumps after overhaul. At least every 3 months and particularly after the chemical feed pumps have been overhauled, the pumps should be re-calibrated to ensure that they deliver the appropriate amount of chemicals to the system. Measure the amount of solution withdrawn by the pump over a given time period and compare this rate with the desired feed rate. Refer to the manufacturer's instructions to adjust the feed pump accordingly. Be sure to record any new speed and stroke settings anytime a change is made.

Guidance Notes for Recommended February Operational Duties

Inspect chemical safety equipment and repair or replace as needed. Chemical safety equipment should be checked and tested at least once each year to be certain that it is operable. Follow the manufacturer's instructions on the proper upkeep of all safety equipment, including portable ventilators or respirators, safety harnesses or belts, goggles, gloves, hard hats, and protective clothing. Detection devices for hazardous gases should be calibrated based on the manufacturer's instructions. All equipment should be repaired or replaced as needed.

Operate all gate valves inside the treatment plant and pump house. All valves in a system should be inspected and exercised routinely. The frequency of inspection depends on the type of valve, but you should inspect the valves at least twice a year. The inspection should include completely closing, reopening, and reclosing the valve until it seats properly. Record the number and direction of turns to closure. Leaking or damaged valves should be scheduled for repair.

Guidance Notes for Recommended March Operational Duties

Inspect, clean, and repair control panels in pump house and treatment plant. The control panels in the pump house and treatment plant should be inspected at least once a year for corrosion and other problems that could cause shorts or failures. Control panels should be carefully cleaned with air. Repair the panels if needed.

Exercise half of all mainline gate valves. It is important to exercise all valves in the system at least once a year to ensure that you can locate them and that they can be opened and closed properly during emergency shut-down periods. Record the number and direction of turns to closure. Half of the gate valves should be exercised now, and the other half should be exercised in 6 months. You should develop a map that identifies the valves and their locations. Any failures should be scheduled for repair.

Guidance Notes for Recommended April Operational Duties

Flush the distribution system and exercise/check fire hydrant gate valves. The entire system should be flushed in one direction, outward from plant or storage facility, at least once a year depending on the quality of your source water. Flushing clears any sediment deposition in the lines. During the flushing, check the operation of the fire hydrant gate valves and observe the color of the water. Continue flushing until the water is clear. When operating a dry-barrel hydrant, you must open it completely so that the drain will become fully closed. Otherwise, water seeping through could result in hydrant damage from freezing. Make sure that any open hydrants are flushing away from private property.

Inspect and clean chemical feed lines and solution tanks. To ensure that your chemical feed system functions properly, inspect the lines to make sure they're not clogged or kinked and that the solution tanks are clean. Regular cleaning of chemical feeders will prevent many breakdowns in this equipment. This should be done every 3 months.

Guidance Notes for Recommended April Operational Duties, Continued

Calibrate chemical feed pumps. At least every 3 months the pumps should be recalibrated to ensure that they deliver the appropriate amount of chemicals to the system. Measure the amount of solution withdrawn by the pump over a given time period and compare this rate with the desired feed rate. Refer to the manufacturer's instructions to adjust the feed pump accordingly. Be sure to record any new speed and stroke settings anytime a change is made.

Inspect fencing and gates. Treatment, storage, and pumping facilities should be inspected at least twice a year to ensure that they provide adequate protection against vandalism and unauthorized entry. Appropriate fencing, locks, and locked well covers should be used to protect the facilities from stray livestock and tampering. Warning signs should be posted to deter trespassing.

Guidance Notes for Recommended May Operational Duties

Inspect storage tanks for defects and sanitary deficiencies. All storage tanks should be inspected at least annually to ensure that they are protected from contamination. Screen any openings to stop the entry of small animals, small insects, and other organic matter. Screens should be in place on vents and overflows (or a flap gate on any overflows). Thoroughly disinfect storage facilities after any construction or repair. The storage tank inspection should include:

- # Checking vents and screens for blockages or tears.
- # Checking for overflows.
- # Checking water level measuring devices.
- # Checking that hatches are properly sealed and locked.
- # Checking for any deterioration in the tank's walls or the tank's foundation.

Guidance Notes for Recommended May Operational Duties, Continued

Clean storage tanks if necessary. Thoroughly clean the tank after any construction, maintenance, or repairs. Add chlorine to the water used to fill the tank during the disinfection process and mix thoroughly. Maintain a chlorine residual of at least 50 mg/L for at least 6 hours and preferably for 24 hours. The storage tank also needs to be cleaned above the water line. When the disinfection procedure is complete, properly dispose of the disinfection water. You may have to declorinate the disinfection water before disposing of it. Improper disposal can lead to contamination of potable water due to backflow or to unlawful surface water pollution. If you use a strong disinfectant solution to clean the tank and afterwards fill the tank with water, the disinfection water may be diluted enough for pumping straight to the distribution system for domestic use. Procedures for large tanks (holding more than 1 million gallons) may be somewhat different. When you are planning to take a tank out of service for cleaning, make sure provisions are made to supply adequate water to the distribution system. If you are not sure how to provide service while the tank is off-line, contact the Rural Water Association or Indian Health Service for technical assistance.

Guidance Notes for Recommended June Operational Duties

Perform preventative maintenance on treatment plant and pump house buildings. Plant piping, buildings, and tanks should be painted regularly to prevent deterioration. Store all pipes, plumbing fittings, chemicals, tools, and other materials in a safe place. Pump house ventilation should be checked to ensure there are no blockages and that fans are operable.

Guidance Notes for Recommended July Operational Duties

Inspect and clean chemical feed lines and solution tanks. To ensure that your chemical feed system functions properly, inspect the lines to make sure they're not clogged or kinked and that the solution tanks are clean. Regular cleaning of chemical feeders will prevent many breakdowns in this equipment. This should be done every 3 months.

Calibrate chemical feed pumps. At least every 3 months the pumps should be recalibrated to ensure that they deliver the appropriate amount of chemicals to the system. Measure the amount of solution withdrawn by the pump over a given time period and compare this rate with the desired feed rate. Refer to the manufacturer's instructions to adjust the feed pump accordingly. Be sure to record any new speed and stroke settings anytime a change is made.

Guidance for Recommended August Operational Duties

Operate all gate valves inside the treatment plant and pump house. All valves in a system should be inspected and exercised routinely. The frequency of inspection depends on the type of valve, but you should inspect the valves at least twice a year. The inspection should include completely closing, reopening, and reclosing the valve until it seats properly. Record the number and direction of turns to closure. Leaking or damaged valves should be scheduled for repair.

Guidance Notes for Recommended September Operational Tasks

Exercise main line gate valves that were not exercised in March. It is important to exercise all valves in the system at least once a year to ensure that you can locate them and that they can be opened and closed properly during emergency shut-down periods. Record the number and direction of turns to closure. Any failures should be scheduled for repair.

Prepare system for winter operation. This includes checking all exposed facilities such as pumps, valves, and pipes. Make sure that all exposed facilities are properly insulated, the heaters in the treatment plant and pump house are operable and in good safe working conditions, and vents are closed. Also, check all fire hydrants to insure that they are drained, check that all propane or fuel tanks used for heating the pump house are topped off, and lower the water level in the storage tank just slightly (circulating more of your water in storage facilities helps to prevent freezing). Please note that this task may be postponed until October or November, based on local conditions.

Guidance Notes for Recommended October Operational Tasks

Inspect and clean chemical feed lines and solution tanks. To ensure that your chemical feed system functions properly, inspect the lines to make sure they're not clogged or kinked and that the solution tanks are clean. Regular cleaning (every 3 months) of chemical feeders will prevent many breakdowns in this equipment.

Calibrate chemical feed pumps. At least every 3 months the pumps should be recalibrated to ensure that they deliver the appropriate amount of chemicals to the system. Measure the amount of solution withdrawn by the pump over a given time period and compare this rate with the desired feed rate. Refer to the manufacturer's instructions to adjust the feed pump accordingly. Be sure to record any new speed and stroke settings anytime a change is made.

Inspect fencing and gates. Treatment, storage, and pumping facilities should be inspected at least twice a year to ensure that they provide adequate protection against vandalism and unauthorized entry. Appropriate fencing, locks, and locked well covers should be used to protect the facilities from stray livestock and tampering. Warning signs should be posted to deter trespassing.

Guidance Notes for Recommended November Operational Tasks

Prepare system for winter operation. This task should be completed now if you did not complete it in October or November. This includes checking all exposed facilities such as pumps, valves, and pipes. Make sure all exposed facilities are properly insulated, the heaters in the treatment plant and pump house are operable and in good safe working conditions, and that vents are closed. Also, check all fire hydrants to insure that they are drained, check that all propane or fuel tanks used for heating the pump house are topped off, and lower the water level in the storage tank just slightly (circulating more of your water in storage facilities helps to prevent freezing).

Guidance Notes for Recommended December Operational Tasks

Contact an electrician to check running amps on well pumps. A change in running amps can indicate a change in the condition of the motors or pumps. When pumps start drawing more amps, it generally means that the motors should be repaired. Checking the amps and voltage on pumps can be a complicated and dangerous task; do not attempt it yourself. Contact an electrician to complete this procedure. This task should be performed at least once a year and any time you sense a problem with your pump (i.e., unusual sounds, vibrations, or the pump is running hot).