

SECTION XIII QUALITY ASSURANCE AND QUALITY CONTROL

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SECTION XIV SYSTEM OPERATION, MAINTENANCE AND MONITORING

A. Introduction

No onsite wastewater renovation system (OWRS, regardless of the type or size, will operate properly for any length of time without adequate attention being given to operation and maintenance requirements. Inattention to such requirements can soon render properly designed facilities ineffective. These facilities must be operated and maintained so as to meet the required water quality and operating standards established by the Department and any other regulatory agencies having jurisdiction. It must be clearly understood that in undertaking the construction and operation of an OWRS, the owner(s) will be firmly committed to providing sufficient funding, qualified operating personnel and management direction to ensure the satisfactory construction, operation, maintenance and monitoring of such facilities.

The full-time presence of qualified operating personnel at most OWRS facilities is usually not provided or required, and operations should be automated to the extent feasible for the type and size of facilities. However, periodic visits must be made to visually inspect and monitor performance, adjust the operation of the facility equipment and processes as conditions warrant, conduct maintenance functions, maintain performance records, and prepare and submit a periodic discharge monitoring report (DMR) to the Department and any local regulatory agencies having jurisdiction.

In addition, the facilities operator or his assistant must be available on a 24 hour a day, 7 days a week basis to respond to malfunctions of any of the pumping or pretreatment facilities. On-site laboratory facilities and a trained laboratory technician acceptable to the Department are usually not available at OWRS facilities. Therefore, it will be necessary to contract with a state approved laboratory for performing certain testing of the raw and treated wastewater that may be required by the discharge permit issued by the Department. Also, it will be necessary to contract with persons or firms qualified in the mechanical and electrical trades for providing a quick response to any equipment malfunctions that the operator is not capable of correcting.

Periodic cleaning of septic tank(s) and any grease trap(s) will be required. A licensed septage hauler must clean these tanks. Grease traps must be pumped and the contents disposed of separately from the septage pumped from septic tanks, and the contents from both grease traps and septic tanks must be properly disposed of in conformance with Department regulations. The owner of an OWRS must make arrangements with a licensed septage hauler for disposal of the material pumped from these tanks prior to placing the proposed facilities into operation.

An Operation and Maintenance (O&M) Manual for an OWRS incorporating enhanced pretreatment facilities should be submitted to the Department for approval before construction of these facilities is completed and before a permit will be issued for operation of these facilities. The Department may require the approved O& M manual to be updated and revised as necessary during the first year of operation to reflect actual operating experience. The O&M manual should be regarded as a living document and further updating may be required from time to time as experience is gained in the O&M of the facilities. In addition to operation and maintenance instructions, the manual should list the wastewater sampling and testing requirements of the Department as well as such additional sampling and testing required for effective operation and control of the treatment processes.

The manual should also contain the information listed below.

- The name and address of the engineer responsible for design of the facilities.
- The name and address of the contractor(s) who constructed the facilities.
- A list of spare parts to be maintained on site.
- A list of manufacturers' and vendors' who provided equipment and services for the facilities, with addresses, telephone numbers and e-mail addresses of persons to be contacted for assistance.
- A list of tradesmen, including names, addresses and telephone numbers, who have been retained for quick response to any equipment malfunctions that the operator is not capable of correcting.
- A list of manufacturers' O&M manuals should be provided for each piece of equipment and the location where these manuals are filed.
- A list of the construction contract documents (drawings and specifications) used to construct the facilities and the location where these documents are filed.
- A list of approved shop drawings for all of the equipment and piping installed and the location where these are filed.
- A list of Record Drawings, depicting the "as built" facilities, with particular emphasis on the locations of all underground structures, piping and electrical conduit, and the location where these are filed.

These lists should be continually and promptly updated to record any changes in addresses, phone numbers, e-mail addresses, internet addresses, document locations, etc.

A complete description of the OWRS facilities and processes should be provided. Prior to the start-up and operation of the facilities, it is important for the system operator to fully understand the manner in which the various pieces of equipment will be controlled and the functions of all electrical control panels. A discussion should be given for the step-by-step procedure used to place each piece of equipment and each treatment process into operation and for removing them from operation. (i.e. start-up and shutdown procedures) A flow chart should be included, showing each different piece of equipment and each different treatment process, along with the location of each valve on a process piping schematic. Each valve should be given a number, and the position of each valve (open, close, throttling) should be described for each different operating phase. An example of a description of a unit operation (Alarms) is given below.

Description of Alarm System

A malfunction of a system or operating equipment sounds a horn, illuminates an alarm light, and closes a dry set of contacts for the remote automatic dialing alarm monitor. The alarm horn is silenced via an alarm silence button. The alarm light and dry contact stay on until the cause of alarm is corrected and the alarm-reset button is activated. All alarm functions are latched on, however transient. The alarm system is also equipped with a TEST-OFF-AUTO switch. At no time should the alarm system be left in the "OFF" position, as this will prevent an alarm signal from reaching the automatic dialing alarm monitor.

The manual should also contain references to the OSHA Safety and Health Standards referenced in Subsection F of this Section that may be applicable to the operation and maintenance procedures discussed herein.

B. Chemical Handling, Storage, Mixing and Feeding

Instructions for receiving, storing, mixing and feeding of chemicals should be given. Particular attention should be paid to such hazardous chemicals as ethanol, sodium hydroxide, and alum. Operation and adjustment of chemical metering pumps should be described. Material Safety Data Sheets (MSDS) for all chemicals used for treatment and cleaning purposes should be included at one location in the O&M manual.

Based on the anticipated wastewater characteristics and flow rates, the concentration and volume of chemical solutions in the chemical feed tanks should be given. However, only experience with actual treatment of the wastewater will determine how often these solutions will have to be replenished in their respective feed tanks. Therefore, it will be necessary to check these tanks daily during the initial period of operation of the treatment facilities, until a replenishment schedule can be developed. Even after such a schedule is developed, it will have to be modified if changes in wastewater flow rates and characteristics occur.

C. Maintenance

A written description of the maintenance schedule for all facilities and equipment should be provided, with reference to applicable instructions in the manufacturers' O&M manuals. A written report of all maintenance performed should be kept on file in an orderly manner. Forms should be developed to simplify the preparation of such reports.

A description of all inspection and maintenance tasks should be provided. A generalized example of such descriptions is given below. Not all of the tasks described below may be required at a particular facility, while other tasks that are not described below may be required.

1. Inspect Grease Trap(s) (if provided)

Make a visual inspection of the tank(s) and internal baffles. Report any observed deterioration of concrete or inlet and outlet piping. A visual inspection of the grease trap(s) should include a depth measurement of the scum layer and any bottom sludge layer as well as noting any unusual discoloration of the scum layer. Have grease trap(s) cleaned (pumped) by a licensed septic tank cleaning firm whenever (1) the depth of the scum layer exceeds 18 inches or interferes with the operation of the outlet filter, or (2) depth of the bottom sludge layer exceeds 6 inches; or (3) a period of not more than 3 months has elapsed since the tank was last cleaned.

2. Inspect Septic Tank(s)

Make a visual inspection of the tank(s) and baffles. Report any observed deterioration of concrete or inlet and outlet piping. Record depth of sludge and scum accumulation in septic tank(s). Have tank(s) cleaned by a licensed septic tank cleaning firm whenever (1) the depth of the scum layer exceeds 18 inches or interferes with the operation of the outlet filter, or (2) the top of the sludge layer accumulated in the bottom of the tank interferes with the operation of the outlet filter, or (3) a period of 1 year has elapsed since the last time the tanks were cleaned

3. Inspect Gravity Sewers

Check pipes and manholes for solids deposition. Remove any solids accumulated in manholes. Make visual determination of manholes' structural integrity. Be alert to accumulations of grit and to groundwater leakage into the pipes and manholes. Report any accumulations of solids or groundwater leakage in pipes to management. Inspection should be conducted annually.

4. Clean Force Mains

Arrange to have the force mains inspected and, if necessary, cleaned at least once a year by a firm experienced in such work. The need for more frequent cleaning may become evident if the pump hour meters indicate the pumps are running for increasingly longer periods while water use at the building(s) being served has not significantly increased.

5. Inspect Pump Chambers

Check for correct operation of pumps and controls. Record pump running time meter readings. Test high-level alarm by raising alarm float switch.

6. Service Pump Chambers

Pump down liquid in pump chamber to a level no lower than one foot above the bottom, remove accumulations of solids and grease, check each pump for operation. Check all float switches for proper operation. Remove pumps from pump chamber as indicated in the maintenance schedule, clean and check physical condition of each pump and associated piping and fittings, slide rails and slide rail fittings, electrical wiring, and float switches. Clean air vent holes in pump volutes. Do not remove pumps or float switches before padlocking pump disconnect switches in the "off" position! Be sure to unlock pump disconnect switches and turn them to the "on" position immediately after pumps have been replaced in the pump chamber.

7. Exercise Valve Chamber Valves

Turn valves fully closed and then fully open to check their proper functioning. These valves open by turning to the (left)(right) direction depending upon valve furnished. (Generally, valves should open counterclockwise). Indicate the direction used to open the valves. Count and record the number of turns from fully closed to fully opened valve position. Compare number of turns to those recorded previously. If there is a difference of more than 1/2 turn, advise management that further inspection and perhaps maintenance is needed. After valves have been turned to their original position, turn the valves slightly in the opposite direction to prevent them from sticking in position. Check condition of pump check valves. Operate valve levers to ensure that valves operate freely.

8. Inspect Emergency Overflow Tank

Make a visual inspection of the tank. Report any observed deterioration of concrete or inlet and outlet piping. Test high-level alarm by raising alarm float switch. Check for solids deposition. Have tank cleaned of any deposited solids. Exercise any valves in tank or between tank and pump chamber in same manner as described for pump chamber valves. Tank should be maintained in an empty condition between emergency uses.

9. Inspect Flow Equalization Tank

Check for correct operation of pumps and controls. Record pump running time meter readings as indicated in the maintenance schedule. Test high-level alarm by raising alarm float switch. Check condition of concrete, pump slide rail assemblies, piping for signs of corrosion and advise management if re-coating, repair or replacement is required.

Remember that this tank may receive anaerobic liquid from the septic tank. Therefore, conditions in this tank are apt to be such that dangerous gases could be present. Do not enter the tank or put your head down into any openings in the tank without first determining whether such gases are present. Refer to the section on confined spaces for further information concerning entry into such spaces.

10. Service Flow Equalization Tank

Pump out flow equalization tank as indicated in the maintenance schedule, remove accumulations of solids and grease, check each pump for operation. Check all float switches for proper operation.

Remove pumps as indicated in the maintenance schedule, clean and check physical condition of each pump, check valve and associated piping and fittings, slide rails and fittings, electrical wiring, and float switches. Clean any air vent holes in the volutes. Do not remove pumps or float switches before padlocking pump disconnect switches in the "off" position! Be sure to unlock pump disconnect switches and turn them to the "on" position immediately after pumps have been replaced in the pump chamber.

11 Exercise Flow Equalization Tank Valves

Exercise pump isolation gate valves as indicated in the maintenance schedule and in the same manner as given for valve chambers.

12. Inspect Enhanced Pretreatment Facilities

Inspect, clean and maintain enhanced pretreatment facilities, if any, in accordance with manufacturers' instructions. Note any departures from normal operating condition, correct if possible, or report to management if correction cannot be made. Record all observations.

13. Inspect and Maintain Flow Metering Equipment

Inspect flow meter(s) for proper operation. Service in accordance with instructions contained in manufacturers' O&M manuals.

Replace each flow meter chart as needed, making sure that the chart is set to "real time"; that is, that the pen contacts the chart at the true time of day on the right day of the week. Write the date and time that the chart was replaced directly on the chart. If problems at the OWRS facilities are encountered, mark the date, time, totalizer reading, and initials of person making such markings, on the chart at the applicable time position of the chart.

14. Inspect Dosing Tank

Make a visual inspection of the tank. Report any observed deterioration of concrete or inlet or outlet piping. Check for correct operation of pumps and controls. Record pump running time meter readings. Check for proper operation of the float switches. Test the high level alarm by raising the alarm float switch.

15. Service Dosing Tank

Remove pumps as indicated in the maintenance schedule, clean and check physical condition of each pump and associated piping and fittings, slide rails and fittings, electrical wiring, and float switches. Clean any air vent holes in pump volutes. Do not remove pumps or float switches before padlocking pump disconnect switches in the "off" position! Be sure to unlock pump disconnect switches and turn them to the "on" position immediately after pumps have been replaced in the chamber.

16. Exercise Dosing Tank Valves

Exercise the pump isolation gate valves as indicated in the maintenance schedule and in the same manner as given for valve chambers. Check condition of pump check valves. Operate valve levers to ensure that valves operate freely.

17. Inspect the Surface Condition at Location of SWAS

Visually inspect ground surface in the area of the SWAS. Note and record any evidence of surfacing of treated wastewater. Notify management and Owner's authorized agent at once if surfacing of treated wastewater is detected at locations other than at the riprap slope at the downstream end of any lateral sand filters. Check for sinkholes at location of flow distribution manifold valves and fittings. Ensure that grassed area over the SWAS is mowed at least three times per growing season. Remove any woody vegetation growing in the grassed area.

18. Measure Depth of Ponding in Leaching systems

Measure and record the depth of water ponded in the SWAS through the inspection ports and record the time and date of measurement on the forms provided. If an unusual depth of ponding is observed, advise management and Owner's authorized agent at once.

19. Exercise SWAS Distribution Piping Isolation Valves

Exercise the valves used to isolate various portions of the SWAS as indicated in the maintenance schedule in the same manner as described for pump chambers.

20. Inspect and Service Chemical Pumping Equipment

Check and service chemical solution and slurry metering pumps and any flushing systems provided in accordance with manufacturers' instructions. Flush chemical metering pumps and piping at least once per month.

If any explosive or flammable chemicals are used, check all grounding and bonding connections between metering pumps and feed tank. Make sure they are clean and tight.

Check and service mechanical mixers in chemical mixing and feed tanks in accordance with manufacturers instructions.

21. Check Manhole Covers

Check all manhole covers to see that they are in place and properly seated. Check all inside covers on watertight manholes to see that they are properly seated and locked. Verify that the gaskets are properly in place in the watertight manhole frames. Lock all lockable outside covers.

22. Flush Piping Low Points.

Flush piping low points at least once a month to clean out solids that may have settled at low points of the piping. Open valves slowly. After flushing, close valves slowly so as to prevent water hammer. Make sure that valves are closed tightly.

23. Clean Equipment and Control Buildings

Clean all rooms of equipment and control building(s) as needed to maintain them always in a clean condition. Be careful to leave door of explosive and flammable chemical storage and feed rooms open and well ventilated when working inside and do not use tools that could strike sparks. If any items are stored in a loft above the ceiling in a building, be certain that any such items are secure and not of a weight beyond the structural capacity of the ceiling structural members.

24. Inspect Groundwater Monitoring Wells

Measure and record the depth to groundwater from the reference mark on each monitoring well and record the time and date of measurement on forms provided for that purpose. Note and record the condition of each monitoring well, i.e., has there been any damage to the well, is it unobstructed from top to bottom, etc.). It is essential that sterile conditions be maintained during all work relating to the wells, so as to prevent well contamination or cross-contamination between different wells.

25. Inspect and Maintain Emergency Electrical Generation Equipment

Inspect and maintain any emergency electrical generation equipment serving pump stations and other electrically operated facilities in accordance with manufacturers O & M instructions for such equipment. Make sure that such equipment is exercised periodically under load for at least one-half hour. Ensure that an adequate fuel supply is available.

D. Manufacturer and Vendor O & M Manuals

The previously described generalized inspection and maintenance requirements serve to highlight the key operation and maintenance needs for an OWRS employing pump chambers and enhanced pretreatment facilities. In addition to the above, O & M manuals prepared by the vendors should be provided in separate three-ring binders. The operator should be familiar with these manuals and should heed the instructions with regard to operation and maintenance of the various items of equipment.

A listing of the O & M manuals and approved shop drawings should be provided in the main O&M manual. If any information is obtained by telephone from a manufacturer's representative that contradicts the instructions of the manufacturer's O & M manual, a log entry of the precise instructions received by phone should be made, including the representative's name, phone number, date, and reason for change in instructions. A copy of this log entry should be kept in the binder containing the manufacturers' O&M manuals and in the main O&M manual.

E. Inspection Forms

Forms should be prepared for reporting of inspections required by the Discharge Monitoring Permit for the OWRS. Copies can be used as a weekly or monthly check-off list for all of the inspections required, or similar forms can be prepared. In any case, a full log should be kept of inspections made and any actions taken as a result of such inspections. The person making such inspections should sign the inspection reports and log. An example of an inspection form is given on the following page.

F. OSHA Safety and Health Standards for the Workplace

OSHA (Occupational Safety and Health Administration) is charged with protecting the safety and health of the nation's workers. Accordingly, it has established standards and periodically inspects workplaces to assure that the requirements of those standards are being met. These standards are contained in Title 29 CFR (Code of Federal Regulations), Part 1910, and the subpart that contains requirements for confined spaces referred to on page 9 is just one of a number of subparts of Part 1910 that pertain to the construction, operation and management of wastewater collection and treatment facilities. The various precautions and procedures discussed in this Section XIV are not all inclusive of the various OSHA requirements. It is the responsibility of the designer, owner and operator(s) of on-site wastewater renovation systems and associated wastewater collection systems to determine and comply with the requirements of these standards.

Example of Inspection Report

Grease Trap #1:

	<u>Inlet</u>	<u>Outlet</u>	
Depth of Scum (inches)	<input type="text"/>	<input type="text"/>	Need Pumping y/n <input type="text"/>
Depth of Sludge (inches)	<input type="text"/>	<input type="text"/>	Covers Secured y/n <input type="text"/>
			Date Last Pumped <input type="text"/>

Grease Trap #2:

	<u>Inlet</u>	<u>Outlet</u>	
Depth of Scum (inches)	<input type="text"/>	<input type="text"/>	Need Pumping y/n <input type="text"/>
Depth of Sludge (inches)	<input type="text"/>	<input type="text"/>	Covers Secured y/n <input type="text"/>
			Date Last Pumped <input type="text"/>

Septic Tank #1:

	<u>Inlet</u>	<u>Outlet</u>	
Depth of Scum (inches)	<input type="text"/>	<input type="text"/>	Need Pumping y/n <input type="text"/>
Depth of Sludge (inches)	<input type="text"/>	<input type="text"/>	Covers Secured y/n <input type="text"/>
Tees Clear y/n	<input type="text"/>	<input type="text"/>	Baffles ok y/n <input type="text"/>

Septic Tank #2:

	<u>Inlet</u>	<u>Outlet</u>	
Depth of Scum (inches)	<input type="text"/>	<input type="text"/>	Need Pumping y/n <input type="text"/>
Depth of Sludge (inches)	<input type="text"/>	<input type="text"/>	Covers Secured y/n <input type="text"/>
Tees Clear y/n	<input type="text"/>	<input type="text"/>	Baffles ok y/n <input type="text"/>
			Date Last Pumped <input type="text"/>

Raw Wastewater Pump Station:

Grease Shelf on Walls y/n	<input type="text"/>	Grease Build Up on Floats y/n	<input type="text"/>
Scum (inches)	<input type="text"/>	Chamber Need Pumping y/n	<input type="text"/>
Floats Need Cleaning y/n	<input type="text"/>	Date Chamber last pumped	<input type="text"/>

Inspect pumps for operation:

	<u>Automatic</u>	<u>Manual</u>	
Pump #1 (ok or comment)	<input type="text"/>	<input type="text"/>	Liquid Level Drop y/n <input type="text"/>
Pump #2 (ok or comment)	<input type="text"/>	<input type="text"/>	Liquid Level Drop y/n <input type="text"/>

Inspect Float Switches For Operation:

Lead Float y/n	<input type="text"/>	Lag Float y/n	<input type="text"/>	Pump Off Float y/n	<input type="text"/>
		Confirm High Level Alarm Float Signal is received			<input type="text"/>
Disconnects Secured y/n	<input type="text"/>	Hatch Cover Secured y/n			<input type="text"/>

Operator's Signature: _____ **Date:** _____

G. Confined Spaces

One of the OSHA Standards (Sub-part J-1910.146) pertains to permits required for entry into confined spaces. Confined spaces at wastewater facilities include, but are not limited to, all manholes, underground tanks and pumping chambers and above ground structures with limited access. Entry into confined spaces must comply with OSHA practices and procedures.

Air normally contains about 21% oxygen by volume; the minimum concentration for safe entry in a confined (enclosed) space is 19.5% oxygen. The presence of sewage in a confined space can result in the formation of "sewer gas" and the presence of this gas can cause an oxygen deficiency. It is important to note that many of the deaths that occur in working around sewers and pump chambers, classed as asphyxiation, are traceable to a deficiency in oxygen. Sewer gas may also contain hydrogen sulfide, a toxic gas. This gas at very low concentrations can cause death in a very few minutes.

H. Safety Considerations

A section should be provided in the O & M manual that discusses steps to be taken to help prevent injury to treatment plant operating and maintenance personnel. Hazards discussed in that section should encompass various broad categories, such as:

- Gas related hazards (toxic, explosive, or oxygen deficiency).
- Entering tanks.
- Physical injuries (from mechanical or electrical sources).
- Bacterial infections.

Emergency phone numbers should be listed (and also posted at telephones). These might include phone numbers for fire departments, ambulance, hospitals, medical caregivers, and State Police.

Some of the items to be discussed under safety considerations might include:

- A general discussion on prevention of physical injuries
- Oxygen Deficiency & Toxic Gases In Confined Spaces
- Explosion & Fire Hazards
- Electrical Hazards
- Mechanical Equipment Hazards
- Bacterial Infection (Health Hazards)
- Suggested Safety Equipment

Examples of such discussions are given below.

1. Prevention of Physical Injuries

The prevention of physical injuries begins with good housekeeping. The facilities, including the grounds, must be kept in good repair and maintained in an orderly manner. Tools must be picked up, manhole and valve box covers promptly replaced, hatchway doors and removable grates kept closed, or properly barricaded when open. Walkways must be kept free of grease, oil, ice or other slippery material. Defective ladders should always be immediately destroyed. Loose or broken ladder rungs must be promptly and adequately repaired or replaced.

Temporary chains, cables, hoists, and ropes should never be left hanging after use, but should be removed, cleaned and properly stored. Hoses should be on reels, hangars, or neatly coiled when not in use. Grease, oil, sludge, scum and other spills should be promptly cleaned up. Reinstallation of all belt, gear or chain guards, etc. should be made when work is completed. The person working on a particular piece of equipment is responsible for such reinstallation.

The safety precautions for oxygen deficiency and toxic gases are similar, as follows:

- Do not enter an enclosed hazardous (confined) space, or allow any contractor to enter a confined space without authorization and without persons entering such spaces having received certified special training and being properly equipped.
- Do not enter an enclosed, poorly ventilated space without testing with portable gas detectors (oxygen, combustible gas, and hydrogen sulfide).
- Use a portable blower to supply ventilation in a suspect area. Blow fresh air into a confined space to provide a safe environment. Do NOT use a blower to exhaust vapors from a confined space unless the blower is completely explosion proof.
- If a hazardous area must be entered because of an emergency or other reason, use a suitable gas mask or air pack.
- When entering a tank or other limited access area, wear a safety harness and have an attendant "on watch" outside the tank.

More detailed information with regard to toxic gases and explosion hazards are presented below.

2. Explosion & Fire Hazards

As previously discussed above, whenever wastewater is present in a poorly ventilated enclosed space (such as a manhole, pump chamber or tank), sewer gas can form. Because of the presence of methane and hydrogen, sewer gas can be explosive. These gases will have a tendency to collect in manholes, sewers, pump chambers, and tanks.

Before entering any enclosed space that contains wastewater, the space should be checked for explosive gases with a portable combustible gas detector (see Suggested Safety Equipment). A portable blower should be used to direct fresh air into the enclosed space to clear out any explosive gases.

Explosive liquids or vapors include gasoline, cleaning materials, and paints and oils. These liquids should be stored in areas specially designed for their storage. Preventive measures that should be followed include:

- Practice good housekeeping.
- Vacuum-clean dust accumulations.
- Forbid smoking and restrict open flames anywhere inside the treatment facilities.

In the event an explosion does occur, it may be accompanied by fire, power outage, or flooding. The following steps should be followed in the event of an explosion:

- Evacuate personnel.
- Notify the fire department, police department, and the Department of Environmental Protection.

- Isolate the affected area by shutting down all electrical equipment and stopping or diverting wastewater flow into the area.
- When it is safe to enter the affected area, assess the damage to the system and determine what has to be done to restore service.

A fire prevention program is recommended. Good housekeeping is an essential part of the program. The removal of oily rags, paper, and other combustible materials will help minimize the chance of a fire by removing the source of fuel. The fire prevention program should emphasize the following items:

- Maintain good housekeeping practices.
- Know the location of all the fire extinguishers, which ones to use for each type of fire, and how to use them.
- Recognize and remove potential fire hazards.
- Be careful in the use of open flames (welder's torch) and volatile materials (paints or solvents).
- Provide proper preventive maintenance to minimize equipment related fires.

In case of a fire, the following procedures should be followed:

- Evacuate personnel.
- Call the fire department, police department and the Department of Environmental Protection.
- Consider the feasibility to combat minor fires with available equipment and personnel.

Recommendations for the safe handling of explosive and flammable liquids should be provided. Some items that should be discussed include:

- Effective employee education on safe handling of explosive and flammable liquids should be provided, and this should be accompanied by adequate supervision.
- Excessive or prolonged breathing of vapors should be avoided.
- All spills should be flushed with water promptly.
- Protection from spark ignition due to static electricity or stray currents during unloading or transfer operations should be effected by grounding and bonding of equipment and piping from the container being unloaded to the container being filled. This should be done before the containers are opened! Similarly, steam or air hoses should be bonded to the tank prior to a purging operation.
- All tools used around open containers should be spark resistant.
- Since grounding does not remove the possibility that sparking can occur on the liquid surface in the container being filled, loading lines or spouts should be extended to the bottom of this container to minimize splash and spray and thus reduce generation of static electricity.
- Tanks, equipment, piping, etc. should be drained and thoroughly cleaned with water and/or steam before being repaired.
- Waste mixtures containing flammable amounts of chemicals should not be permitted to enter drains or sewers where there might be danger of ignition.
- Under emergency conditions, (fire, exposure to hazardous liquid or vapor, spillage), follow instructions given in the MSDS for such liquids.

3. Electrical Hazards

Electrical shock hazards are similar to those that would exist in most modern plants or factories. Examples of safety measures that must be followed are as follows:

- Maintenance or repair work on electrical equipment, switch gear, motors, etc. should only be done by qualified personnel.
- When working on electrical equipment, the main power switch used to disconnect power from the equipment should be locked open and tagged. It is not sufficient to just turn off a manual or automatic control switch.
- Grounding of all equipment is essential. Portable power tools should be equipped with ground wire and special outlet and plug.
- Water and electricity do not "mix". Be sure hands and shoes are dry. A rubber mat should be used where appropriate, particularly around electrical control panels and switchgear.

Other examples of unsafe electrical conditions and corrective measures are listed in the following Table.

EXAMPLE OF UNSAFE ELECTRICAL CONDITIONS

<u>Unsafe Condition</u>	<u>Corrective Measures</u>
Worn insulation on extension and drop cords	Use Underwriter's Laboratories approved materials only. Spliced or worn cords should be removed from service
Unsafe wiring practices, such as using wires too small for the current being carried; open wiring not in conduit; temporary wiring; wiring improperly located.	Comply with recognized electrical code. Remove temporary wiring as soon as it has served its purpose.
Working on "live" low-voltage circuits in the belief that they are not hazardous.	Educate and train personnel in the hazards of low-voltage circuits.
Working on "live" circuits which are thought to be "dead".	Require that main power disconnect switches on all circuits being worked on be locked open and properly tagged. Use protective equipment such as rubber gloves and rubber floor mats.
Replacing fuses by hand on "live" circuits.	Open switch before replacing fuses; use fuse pullers.
Exposed conductors at rear of switch-board.	Enclose rear of switchboard to prevent exposure of unauthorized persons. Provide rubber mats for workers who must enter enclosure.

4. Mechanical Equipment Hazards

Here again, hazards are similar to those that would exist in most modern plants or factories. Examples of safety measures that should be discussed are as follows:

- Maintenance or repair work on rotating machinery or other mechanical equipment should only be done by qualified personnel.
- Belt guards, chain guards, railings, etc. should not be removed except when required for repair or maintenance. Guards, railings, etc. should be replaced as soon as work is completed.
- Switch gear should be locked open and tagged if an electrical drive is involved.
- A safety harness should be worn when working next to an area where a fall is possible.
- Loose clothing should not be worn when working near rotating machinery.
- Proper lifting equipment should be used if heavy objects must be lifted.

5. Pathogen Infection (Health Hazards)

Workers who come into contact with wastewater are exposed to all the potential hazards of water-borne diseases, including typhoid fever, amoebic dysentery, infectious jaundice, hepatitis, and other intestinal infections. Tetanus and skin infections must also be guarded against.

Except for minor injuries, a doctor should treat wounds. No cut or scratch is too minor to receive attention. A disinfectant should be immediately applied to all wounds or cuts.

Rubberized cotton gloves are inexpensive and afford good protection to the hands. In wet places, boots or rubber overshoes protect the feet from dampness and infection. Work clothes or coveralls should be worn in dirty places such as manholes, and should be laundered frequently. For extremely dirty jobs, such as cleaning out a pump chamber, there are rubberized fabric suits with hoods available that can be washed off with a hose. Wear safety goggles to protect against liquids and dust that may harbor pathogens.

Smoking should not be done in or within close proximity to the wastewater collection and pretreatment facilities. It is practically impossible to avoid contamination by wastewater to the ends of pipes, cigars or cigarettes. Smoking is also a potential source of ignition for any flammable vapor present.

"Keeping the hands below one's collar," while at work in tanks, pump chambers or while handling wastewater or sludge is an excellent rule. A majority of infections reach the body by way of the mouth, nose, eyes or ears. Hands should be washed before smoking or eating. Typhoid and hepatitis inoculations are strongly recommended.

6. Suggested Safety Equipment

Consideration should be given to requiring such safety equipment as:

- Gas mask (preferably an air pack).
- Portable fire extinguishers (CO₂-type).
- Face shields and safety goggles.
- Emergency Eye Wash Station
- First aid kit.
- Gas detectors (one each for oxygen, combustible gas, and hydrogen sulfide).
- Safety harness.

- Portable blower and flexible duct.
- Explosion-proof lanterns.
- Heavy neoprene gloves, suitable for working with chemicals.
- Disposal latex gloves.
- Heavy-duty aprons suitable for working with chemicals.

The operator must be familiar with the location and care of all safety equipment and trained in its use.

I. Testing for Monitoring and Control of Treatment Processes.

The periodic testing of influent and effluent wastewater quality required for submission of a Discharge Monitoring Report (DMR) to the Department is normally not sufficient for control of treatment processes because of the long periods of time between such testing.

Outside laboratory testing for various operating parameters is also often insufficient because of the delay (often many days) between obtaining the samples and receiving the test results.

The quickest onsite tests for process control are sensory in nature. Visual and olfactory observations of the effluent from enhanced pretreatment facilities and the operation of process equipment by a trained operator are often all that is needed for a first appraisal of the process operating status and efficiency. If the process equipment is observed and heard to be operating correctly with no unusual noises or vibrations, and the effluent looks sparkling clear and has no appreciable odor, the chances are that the treatment processes are stable and providing a satisfactory effluent. If such observations indicate problems, then additional testing is required.

There are several simple and effective on-site tests that can be conducted in a relatively short time, often no more than 1-2 hours per plant visit, if the necessary equipment and supplies are available. These include:

- Selective Ion Meter, equipped with pH, liquid temperature, dissolved oxygen (D.O.) and ammonia-nitrogen test probes.
- Prepackaged chemical test supplies and associated colorimeters for nitrates, alkalinity, and phosphorus.
- Turbidimeter, for determining clarity of effluent (which can also be calibrated against suspended solids tests so as to provide a surrogate method for rapid determination of the TSS in the plant effluent).
- Settleometer, for Settled Sludge Volume (SSV) tests.*
- High Speed Centrifuge equipped with centrifuge tubes, graduated in % concentration or milliliters, that swing out horizontally while the centrifuge is spinning.*
- Timer 0- 60 minute period.*
- Sludge blanket finder (e.g. Sludge Judge).*
- Secchi Disc.*
- Containers required for the tests indicated above.

* Only needed for suspended growth processes.

The equipment for running these tests can presently be obtained at a total cost on the order of several thousands of dollars and the cost of supplies required will usually be on the order of hundreds of dollars per year. The benefit gained from the test results will usually be greatly in excess of the costs and time involved. Where suspended growth processes are involved, simple methods for evaluation and control are given in Hobson (1993).

J. Facilities Operator

The facilities owner should retain an operator who will be in responsible charge for operation and maintenance of the facility. The certification and classification of the operator and the classification of the facility should conform to the requirements set forth in Section 22a-416 of the Connecticut General Statutes (“Regulations of Department of Environmental Protection concerning Wastewater Facility Operator Certification”).

K. References

Hobson, T. 1993. Activated Sludge. Evaluation & Controlling Your Process. Hobson’s Choice Press. Salina, KA.