# Drinking Water Inspector's Field Guide

## For Use When Conducting a Sanitary Survey of a Small Groundwater System

1999

# Drinking Water Inspector's Field Guide

## For Use When Conducting a Sanitary Survey of a Small Groundwater System

1999

National Environmental Training Association, Inc.
5320 N. 16th Street, Suite 114
Phoenix, Arizona 85016
(602)956-6099, Fax (602)956-6399
neta@ehs-training.org www.esh-training.org

ISBN 1-880996-17-0

Copyright © 1998, 2000 National Environmental Training Association, Inc.

National Environmental Training Association, Inc.
5320 N. 16th Street, Suite 114
Phoenix, Arizona 85016
(602)956-6099, Fax (602)956-6399
neta@ehs-training.org www.esh-training.org

ISBN 1-880996-17-0

# Preface

This sanitary survey field guide is designed for those  with responsibility for conducting an effective and comprehensive sanitary survey of a small groundwater system. Personnel using this field guide must have basic knowledge of small ground water systems and on-the-job experience in conducting sanitary surveys. They must be able to identify sanitary risks that may adversely affect the ability of a small groundwater system to produce a safe, reliable, and adequate quality and quantity of potable water to the consumer.

This field guide is not intended to be an official procedure manual for conducting a sanitary survey, rather it is to be used as a basic reference. Specifically, this field guide focuses on the need-to-know material necessary to recognize and identify conditions or practices that may contribute to a sanitary risk. Also, the organization of this field guide addresses the eight elements of a sanitary survey as defined in the EPA/State Joint Guidance on Sanitary Surveys and basically parallels most Sanitary Survey Inspection Forms that are used to document the inspection of small water systems. Unless otherwise noted, the standards and rates mentioned throughout the guide have been taken from the following publications:

*Technologies for Upgrading Existing or Designing New Drinking Water Treatment Facilities*, U.S. EPA Office of Drinking Water Center for Research Information, Cincinnati, OH 45268 EPA/625 4-89/023

*Recommended Standards for Water Works*, 1992, Health Education Services, Health Research Inc., P.O. Box 7126, Albany, N.Y. 12224 (518) 439-7286

This sanitary survey field guide is one of three publications for the EPA training course “How to Conduct a Sanitary Survey of a Small Water System.” There is a second field guide for Surface Water and the Learner’s Guide. The Learner’s Guide contains all the sanitary risk questions and graphics for the two field guides. The Learner’s Guide also provides background information along with a brief statement as to why the sanitary



# Preface

This sanitary survey field guide is designed for those  with responsibility for conducting an effective and comprehensive sanitary survey of a small groundwater system. Personnel using this field guide must have basic knowledge of small ground water systems and on-the-job experience in conducting sanitary surveys. They must be able to identify sanitary risks that may adversely affect the ability of a small groundwater system to produce a safe, reliable, and adequate quality and quantity of potable water to the consumer.

This field guide is not intended to be an official procedure manual for conducting a sanitary survey, rather it is to be used as a basic reference. Specifically, this field guide focuses on the need-to-know material necessary to recognize and identify conditions or practices that may contribute to a sanitary risk. Also, the organization of this field guide addresses the eight elements of a sanitary survey as defined in the EPA/State Joint Guidance on Sanitary Surveys and basically parallels most Sanitary Survey Inspection Forms that are used to document the inspection of small water systems. Unless otherwise noted, the standards and rates mentioned throughout the guide have been taken from the following publications:

*Technologies for Upgrading Existing or Designing New Drinking Water Treatment Facilities*, U.S. EPA Office of Drinking Water Center for Research Information, Cincinnati, OH 45268 EPA/625 4-89/023

*Recommended Standards for Water Works*, 1992, Health Education Services, Health Research Inc., P.O. Box 7126, Albany, N.Y. 12224 (518) 439-7286

This sanitary survey field guide is one of three publications for the EPA training course “How to Conduct a Sanitary Survey of a Small Water System.” There is a second field guide for Surface Water and the Learner’s Guide. The Learner’s Guide contains all the sanitary risk questions and graphics for the two field guides. The Learner’s Guide also provides background information along with a brief statement as to why the sanitary

risk question is important and how to use the information gained from the question.

This field guide represents a national compilation of questions to be considered during a sanitary survey of a small groundwater system. In many cases there are questions presented in any given section of the guide that exceed the number and types of questions asked by a given state during a sanitary survey. The objective is to present a comprehensive collection of questions so individual states can select the questions that are appropriate for their specific conditions. In some cases, questions are listed to assist in determining the operator's knowledge of the system (e.g. what is the depth of grout?). Questions on safety are provided to create an awareness for personal safety rather than to address health and safety regulations.

The development of this field guide was accomplished through an EPA Drinking Water Assistance Agreement project with the University of Florida's Center for Training, Research and Education for Environmental Occupations (TREEO). Dr. William Engel, CET, director of the University of Florida TREEO Center, was the overall project director. U.S. EPA Education Specialist Kenneth M. "Ken" Hay was the Federal project officer. Andrew A. Holtan, CET and president of International Studies and Training Institute, was the project coordinator. This guide could not have been developed without the project advisory committee and those individuals who participated in the review process. Please refer to the Appendices in the Learner’s Guide for a list of these individuals.

# Notice



ii

risk question is important and how to use the information gained from the question.

This field guide represents a national compilation of questions to be considered during a sanitary survey of a small groundwater system. In many cases there are questions presented in any given section of the guide that exceed the number and types of questions asked by a given state during a sanitary survey. The objective is to present a comprehensive collection of questions so individual states can select the questions that are appropriate for their specific conditions. In some cases, questions are listed to assist in determining the operator's knowledge of the system (e.g. what is the depth of grout?). Questions on safety are provided to create an awareness for personal safety rather than to address health and safety regulations.

The development of this field guide was accomplished through an EPA Drinking Water Assistance Agreement project with the University of Florida's Center for Training, Research and Education for Environmental Occupations (TREEO). Dr. William Engel, CET, director of the University of Florida TREEO Center, was the overall project director. U.S. EPA Education Specialist Kenneth M. "Ken" Hay was the Federal project officer. Andrew A. Holtan, CET and president of International Studies and Training Institute, was the project coordinator. This guide could not have been developed without the project advisory committee and those individuals who participated in the review process. Please refer to the Appendices in the Learner’s Guide for a list of these individuals.

# Notice

Publication of this guide does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Environmental Protection Agency, the University of Florida TREEO Center, the National Environmental Training Association, individual advisory committee members, or project reviewers. Developed through U.S. EPA Assistance Agreement T-902854.

# Table of Contents





# Table of Contents

Introduction
- Definition of a Small Water System ....1
- Definition of a Sanitary Survey....1
- Safety Precautions ....2
- Personal Protective Equipment (PPE) ....3
- Inspector's Field Test Equipment ....3
- Relationship with Operator and Top Management ....4
- Documentation and Follup-up ....5

I: Regulations ....I-1

II: Water Sources
- Quantity....II-1
- Quality ....II-2
- Source Protection ....II-2
- Groundwater ....II-3
- Table 3-2 ....II-6
- Springs....II-7

III: Groundwater Treatment
- Chemical Feed Systems ....III-1
- Iron and Manganese Removal ....III-3

iii

iv

Softening ..... III-5
Corrosion Control ..... III-7
Aeration ..... III-7
Disinfection ..... III-8
Hypochlorination ..... III-9
Gas Chlorination ..... III-10
Fluoridation ..... III-13
IV: Distribution
Piping Materials ..... IV-1
Material Standards ..... IV-1
Water Quality ..... IV-2
Maps/Drawings and Planning ..... IV-3
Distribution System Monitoring ..... IV-3
System Operation and Maintenance ..... IV-4
Safety Considerations ..... IV-5
Disinfection Procedures ..... IV-5
Design and Operational Constraints on Water Quality ..... IV-6
Design and Operational Constraints on Reliability ..... IV-6
Construction Considerations ..... IV-6
V: Finished Water Storage
Gravity Storage Tanks ..... V-1

Direct Contamination Concerns ..... V-2
Hydropneumatic Storage Tanks ..... V-5
VI: Cross-Connection ..... VI-1
VII: Pumps and Pumping Facilities and Controls
Pumping Station/Well House ..... VII-1
Pumps and Motors ..... VII-3
Appurtenances ..... VII-4
Controls ..... VII-4
Safety ..... VII-5
Auxiliary Power ..... VII-5
Operation and Maintenance ..... VII-6
VIII: Monitoring and Lab Testing ..... VIII-1
IX: Management and Operations
Organization ..... IX-1
Planning ..... IX-2
Personnel ..... IX-3
Safety Program ..... IX-3
Operations ..... IX-4
Finance ..... IX-4

# Introduction

## Definition of a Small Water System

The EPA frequently analyzes compliance trends of public water systems based on five size categories: Very Small (serving a population of 25-500); Small (serving a population of 501-3,300); Medium (serving a population of 3,301-10,000); Large (serving a population of 10,001-100,000); and Very Large (serving a population of more than 100,000). Within the federal regulatory program, a small water system is defined as one that regularly serves a population of 3,300 or less.

## Definition of a Sanitary Survey

A sanitary survey, as defined in 40CFR 141.2 (Definitions), means "...an on-site review of the water source, facilities, equipment, operation, and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation, and maintenance for producing and distributing safe drinking water."

1

# Introduction

## Definition of a Small Water System

The EPA frequently analyzes compliance trends of public water systems based on five size categories: Very Small (serving a population of 25-500); Small (serving a population of 501-3,300); Medium (serving a population of 3,301-10,000); Large (serving a population of 10,001-100,000); and Very Large (serving a population of more than 100,000). Within the federal regulatory program, a small water system is defined as one that regularly serves a population of 3,300 or less.

## Definition of a Sanitary Survey

A sanitary survey, as defined in 40CFR 141.2 (Definitions), means "...an on-site review of the water source, facilities, equipment, operation, and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation, and maintenance for producing and distributing safe drinking water."

## Safety Precautions

Another aspect of the sanitary survey is safety. This is a concern for the field inspector as well as for the operating staff of the system. There are a number of safety hazards including the following:

1. Electrical shock
2. Exposure to chemicals
3. Drowning
4. Entering confined spaces
5. High-intensity noise
6. Sprains and strains due to lifting
7. Slips, trips and falls

Prior to the on-site inspection, the sanitary survey inspector should ensure that personal protective equipment is available. We acknowledge that many state agencies do no provide this equipment. However, the inspector may wish to provide some of the equipment and assure that items such as respirators are available at the site.



## Safety Precautions

Another aspect of the sanitary survey is safety. This is a concern for the field inspector as well as for the operating staff of the system. There are a number of safety hazards including the following:

1. Electrical shock
2. Exposure to chemicals
3. Drowning
4. Entering confined spaces
5. High-intensity noise
6. Sprains and strains due to lifting
7. Slips, trips and falls

Prior to the on-site inspection, the sanitary survey inspector should ensure that personal protective equipment is available. We acknowledge that many state agencies do no provide this equipment. However, the inspector may wish to provide some of the equipment and assure that items such as respirators are available at the site.

2

## Personal Protective Equipment (PPE)

Prior to the site inspection, inspectors must ensure that they have the appropriate PPE for that particular site and that they have been trained on the equipment. Depending on site conditions, they must consider a wide range of equipment:

- Safety hats
- Goggles
- Gloves
- Steel-toed safety shoes
- Respirators

## Inspector's Field Test Equipment

At a minimum, certain field equipment is recommended:

- pH meter, portable (digital, not analog)
- Residual chlorine test kit (hand held colorimeter or portable spectrophotometer)
- Camera with automatic time stamp
- Binoculars
- Flashlight

3

## Personal Protective Equipment (PPE)

Prior to the site inspection, inspectors must ensure that they have the appropriate PPE for that particular site and that they have been trained on the equipment. Depending on site conditions, they must consider a wide range of equipment:

- Safety hats
- Goggles
- Gloves
- Steel-toed safety shoes
- Respirators

## Inspector's Field Test Equipment

At a minimum, certain field equipment is recommended:

- pH meter, portable (digital, not analog)
- Residual chlorine test kit (hand held colorimeter or portable spectrophotometer)
- Camera with automatic time stamp
- Binoculars
- Flashlight

## Relationship With Operator and Top Management

If the survey is be successful, the inspector must establish a good relationship with the small water system decision makers. It is important that the inspector contacts the person directly responsible for the overall management of the system prior to the on-site inspection. This person should be able to assist the inspector in gathering needed information and coordinating efforts with the system personnel.

The establishment of good relationship with the small water system operational personnel is equally important to the success of the survey. In many cases, the operator is responsible for all aspects of the system from operating the plant to budgeting for equipment. The water operator may have a basic working knowledge of the water system and processes but not necessarily of the regulatory requirements. Therefor, it is desirable that the operator view the inspector as a resource for help and assistance. The inspector may take the lead in establishing relationships with operator and top management.For additional Material regarding relationships, is it recommended the inspectors view the EPA/NETA seventeen minute video titles, “Sanitary Survey Inspection - BEFORE YOU BEGIN...Wells.”

Note: always provide an oral briefing to the owner/operator before leaving the inspection site. In the briefing, cover the highlights of the inspection (pros and cons) and inform the parties concerned that the system will receive a formal written report.



## Relationship With Operator and Top Management

If the survey is be successful, the inspector must establish a good relationship with the small water system decision makers. It is important that the inspector contacts the person directly responsible for the overall management of the system prior to the on-site inspection. This person should be able to assist the inspector in gathering needed information and coordinating efforts with the system personnel.

The establishment of good relationship with the small water system operational personnel is equally important to the success of the survey. In many cases, the operator is responsible for all aspects of the system from operating the plant to budgeting for equipment. The water operator may have a basic working knowledge of the water system and processes but not necessarily of the regulatory requirements. Therefor, it is desirable that the operator view the inspector as a resource for help and assistance. The inspector may take the lead in establishing relationships with operator and top management.For additional Material regarding relationships, is it recommended the inspectors view the EPA/NETA seventeen minute video titles, “Sanitary Survey Inspection - BEFORE YOU BEGIN...Wells.”

Note: always provide an oral briefing to the owner/operator before leaving the inspection site. In the briefing, cover the highlights of the inspection (pros and cons) and inform the parties concerned that the system will receive a formal written report.

# Documentation and Follow-up

## Documentation

Each sanitary survey must be documented by the inspector in a final written report of the survey, using the state format. The final written report should be used to notify water system owners and operators of the system's deficiencies and encourage them to take corrective actions where deficiencies are noted. This written report will provide a record for future inspectors, as well as information that can be useful during emergency situations. It will also serve to document the need for technical assistance and training. Information contained in the report should be used to update records in the state's database management system.

It is strongly recommended that certain information is documented in the report, regardless of the report format used within a state:

1. The date the survey was conducted and by whom;
2. The name(s) of those present during the survey besides the inspector;
3. A schematic drawing of the system and, where appropriate, photographs of key system components;
4. The findings of the survey, along with the signature of the inspector(s); and
5. Specific recommendations for improvement (e.g. regulatory issues, sanitary risks, potential sanitary risks, etc.) in order of priority and within a certain time frame.

5

# Documentation and Follow-up

## Documentation

Each sanitary survey must be documented by the inspector in a final written report of the survey, using the state format. The final written report should be used to notify water system owners and operators of the system's deficiencies and encourage them to take corrective actions where deficiencies are noted. This written report will provide a record for future inspectors, as well as information that can be useful during emergency situations. It will also serve to document the need for technical assistance and training. Information contained in the report should be used to update records in the state's database management system.

It is strongly recommended that certain information is documented in the report, regardless of the report format used within a state:

1. The date the survey was conducted and by whom;
2. The name(s) of those present during the survey besides the inspector;
3. A schematic drawing of the system and, where appropriate, photographs of key system components;
4. The findings of the survey, along with the signature of the inspector(s); and
5. Specific recommendations for improvement (e.g. regulatory issues, sanitary risks, potential sanitary risks, etc.) in order of priority and within a certain time frame.

## Follow-up

The inspector should complete certain activities as follow-up:

1. Compile and complete the sanitary survey report that will go in the official file;
2. Provide appropriate notification of survey results;
3. Follow-up on technical questions/assistance requested by owner/operator; and
4. Notify owner/operator of any variance between the written evaluation and the verbal debriefing or of any draft versions of the report.

The findings of the inspector should be transmitted to the system owner/operator soon after completion of the inspection. At a minimum, the report should identify the deficiencies noted during the inspection and should request that the system provide its recommendations for corrective action with a timetable for the completion of such action. The report should also notify the system of the actions that the state may take if the deficiencies that require action by the system owner/operator are not corrected.



## Follow-up

The inspector should complete certain activities as follow-up:

1. Compile and complete the sanitary survey report that will go in the official file;
2. Provide appropriate notification of survey results;
3. Follow-up on technical questions/assistance requested by owner/operator; and
4. Notify owner/operator of any variance between the written evaluation and the verbal debriefing or of any draft versions of the report.

The findings of the inspector should be transmitted to the system owner/operator soon after completion of the inspection. At a minimum, the report should identify the deficiencies noted during the inspection and should request that the system provide its recommendations for corrective action with a timetable for the completion of such action. The report should also notify the system of the actions that the state may take if the deficiencies that require action by the system owner/operator are not corrected.

# Regulations

1. Is the current information in state files accurate for population served and number of services?
2. Is the current information on the status of the system correct, i.e. large enough to be a PWS, type of system, i.e. CWS, NCWS, NTNCWS.
3. Is the system in compliance with various provisions of the National Secondary Drinking Water Regulations( NPDWR), including siting of facilities, coliform monitoring, filtration and disinfection, lead and copper corrosion control, organic and inorganic contaminants, direct and indirect additives, record keeping?
4. Has the system made modifications to its source, treatment process, chemicals used or distribution system without state approval?
5. Is the system using chemicals and coatings as approved by ANSI NSF or other third party?
6. Is the system staffed by qualified operators?
7. Are appropriate account records maintained?
8. Is the system complying with conditions set forth in any variances, exemptions or orders?

I-1

# Regulations

1. Is the current information in state files accurate for population served and number of services?
2. Is the current information on the status of the system correct, i.e. large enough to be a PWS, type of system, i.e. CWS, NCWS, NTNCWS.
3. Is the system in compliance with various provisions of the National Secondary Drinking Water Regulations( NPDWR), including siting of facilities, coliform monitoring, filtration and disinfection, lead and copper corrosion control, organic and inorganic contaminants, direct and indirect additives, record keeping?
4. Has the system made modifications to its source, treatment process, chemicals used or distribution system without state approval?
5. Is the system using chemicals and coatings as approved by ANSI NSF or other third party?
6. Is the system staffed by qualified operators?
7. Are appropriate account records maintained?
8. Is the system complying with conditions set forth in any variances, exemptions or orders?

I-2

# Water Source

## Quantity

1. What is the total design production capacity?
2. What is the present average daily production?
3. What is the maximum daily production?
4. Is the safe yield sufficient to meet current and future demands?
5. Is the source adequate in quantity?
6. If permits are required, is the facility operating within the limits? Are permits available?
7. Does system have an “operational” master meter?
8. How many service connections are there?
9. Are service connections metered?
10. Does the system have interconnections with neighboring systems or a contingency plan for water outages?
11. Does the system have redundant sources?
12. Are there any abandoned, unused, or auxiliary sources?

II-1

# Water Source

## Quantity

1. What is the total design production capacity?
2. What is the present average daily production?
3. What is the maximum daily production?
4. Is the safe yield sufficient to meet current and future demands?
5. Is the source adequate in quantity?
6. If permits are required, is the facility operating within the limits? Are permits available?
7. Does system have an “operational” master meter?
8. How many service connections are there?
9. Are service connections metered?
10. Does the system have interconnections with neighboring systems or a contingency plan for water outages?
11. Does the system have redundant sources?
12. Are there any abandoned, unused, or auxiliary sources?

## Quality

1. Does the system monitor raw water quality?
2. Is the source adequate in quality?
3. Is the system utilizing the highest quality source available?
4. Is there a trent of decreasing raw water quality that would suggest the need for a new source or changes in treatment in the future?
5. Does raw water quality monitoring point to an immediate sanitary risk?

## Source Protection

1. Is the watershed or  aquifer recharge area protected?
2. What is the size of the owned/protected area?
3. What is the nature of the protection area?
4. How is the area controlled?
5. Has management had an area survey conducted?
6. Is there an emergency spill response plan?



## Quality

1. Does the system monitor raw water quality?
2. Is the source adequate in quality?
3. Is the system utilizing the highest quality source available?
4. Is there a trent of decreasing raw water quality that would suggest the need for a new source or changes in treatment in the future?
5. Does raw water quality monitoring point to an immediate sanitary risk?

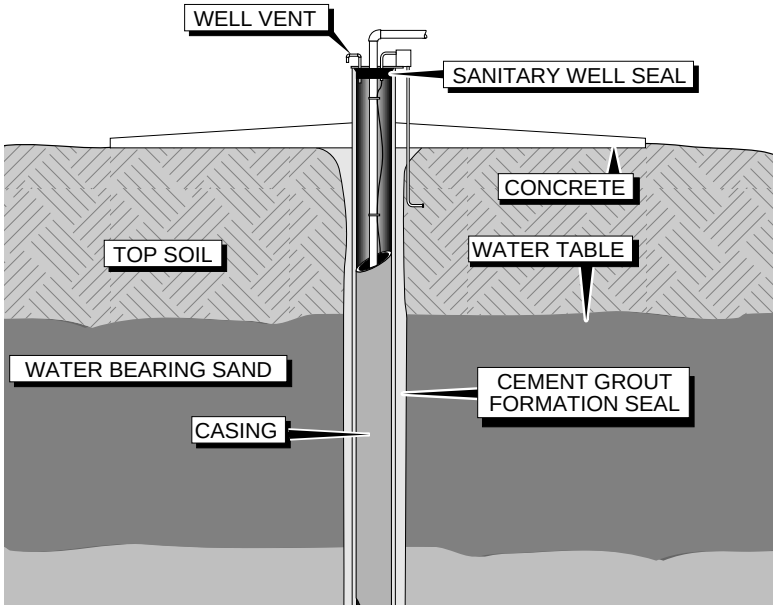
## Source Protection

1. Is the watershed or  aquifer recharge area protected?
2. What is the size of the owned/protected area?
3. What is the nature of the protection area?
4. How is the area controlled?
5. Has management had an area survey conducted?
6. Is there an emergency spill response plan?

II-2

# Groundwater

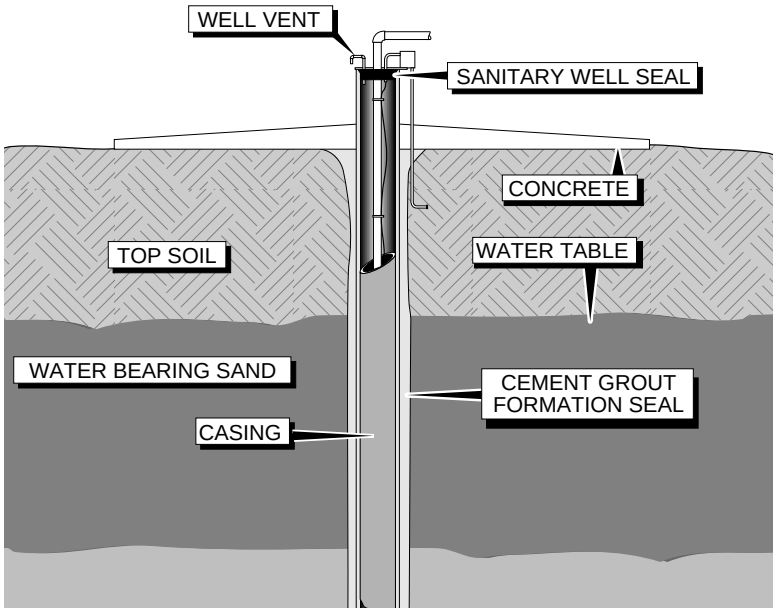
1. Is the well in a confined or unconfined aquifer?
2. Is the site subject to flooding?
3. Is the well located in the proximity of any potential sources of pollution?
4. What is the depth of the well?
5. Is drawdown measured?
6. What is the depth of the casing?
7. What is the depth of grouting?
8. Does the casing extend at least 18 inches above the floor or ground?
9. Is the well properly sealed?
10. Does the well vent terminate 18 inches above ground/floor level or above maximum flood level with return bend facing downward and screened
11. Does the well have a suitable raw water sampling tap?



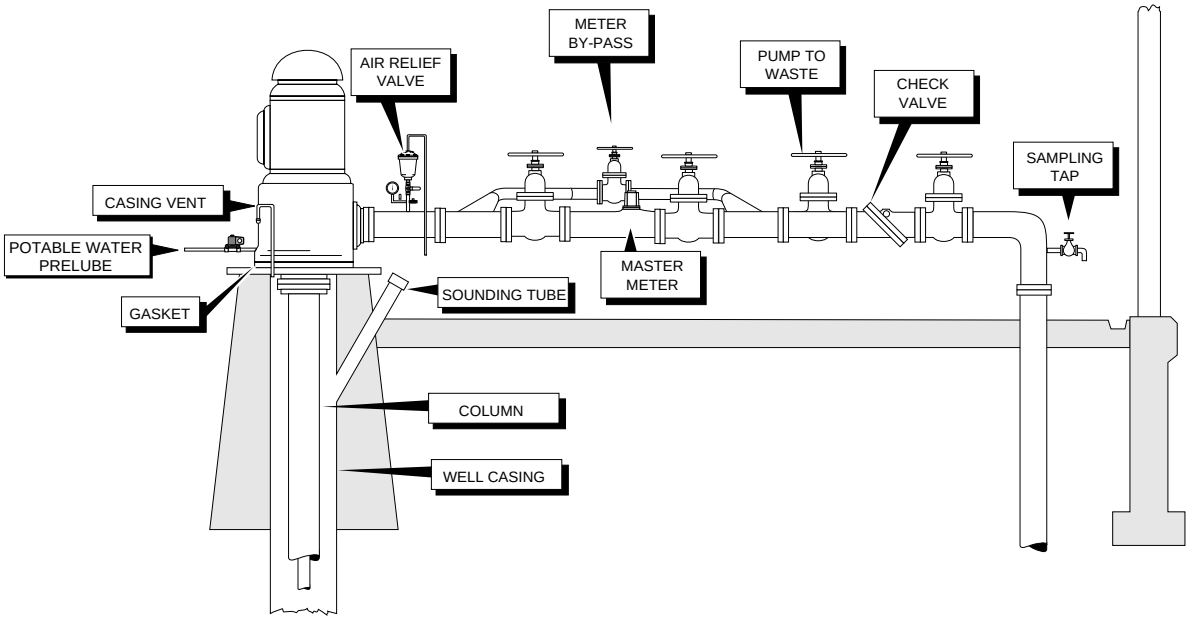

II-3

Groundwater

1. Is the well in a confined or unconfined aquifer?
2. Is the site subject to flooding?
3. Is the well located in the proximity of any potential sources of pollution?
4. What is the depth of the well?
5. Is drawdown measured?
6. What is the depth of the casing?
7. What is the depth of grouting?
8. Does the casing extend at least 18 inches above the floor or ground?
9. Is the well properly sealed?
10. Does the well vent terminate 18 inches above ground/floor level or above maximum flood level with return bend facing downward and screened
11. Does the well have a suitable raw water sampling tap?

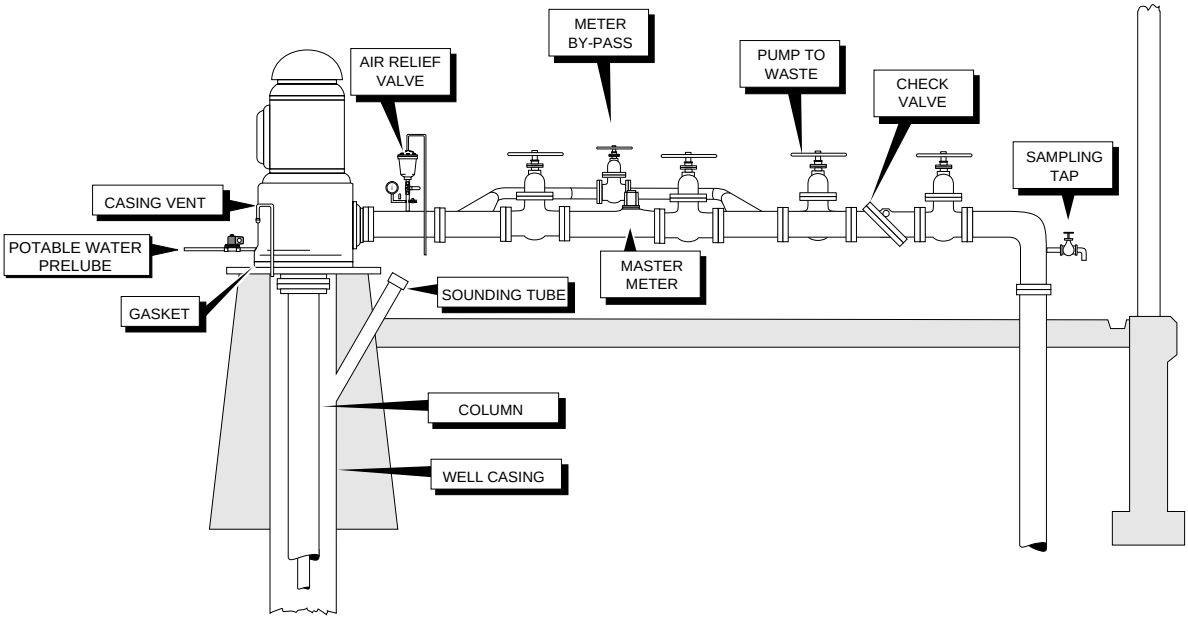


12. Are check valves, blow-off valves, and water meters maintained and operated properly?
13. Is the upper termination of the well protected?
14. Is lightning protection provided?

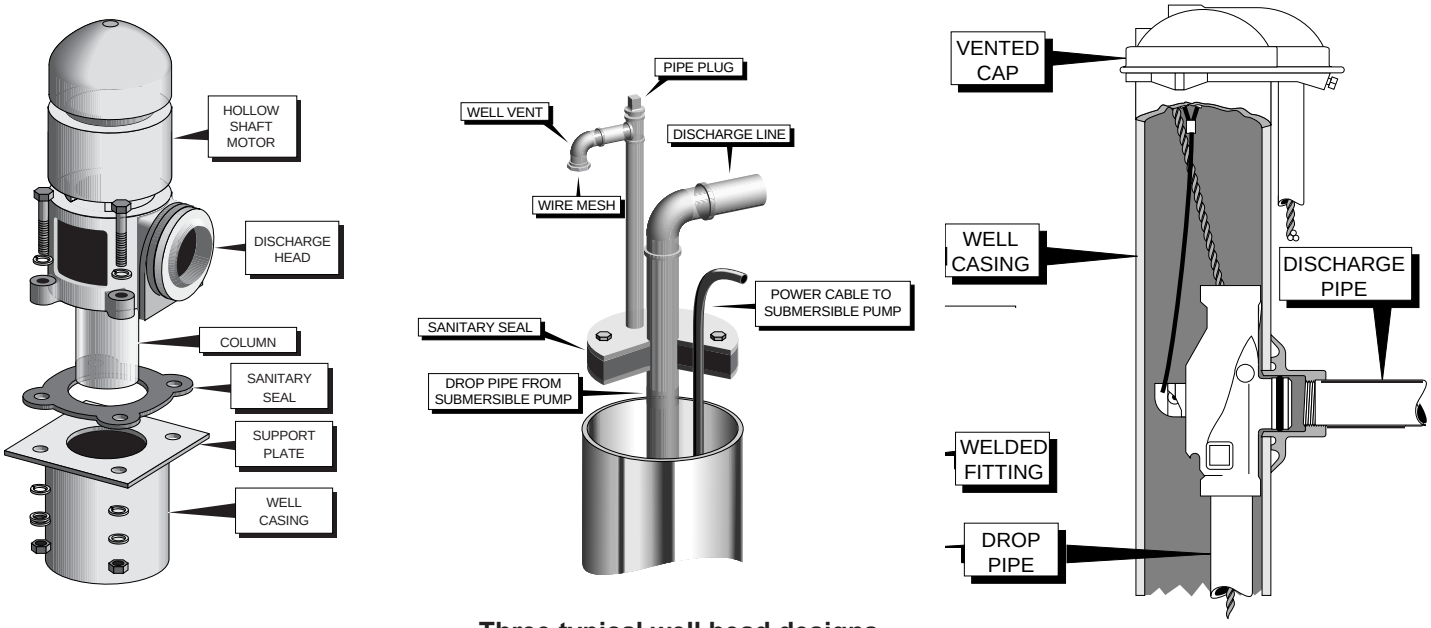





12. Are check valves, blow-off valves, and water meters maintained and operated properly?
13. Is the upper termination of the well protected?
14. Is lightning protection provided?

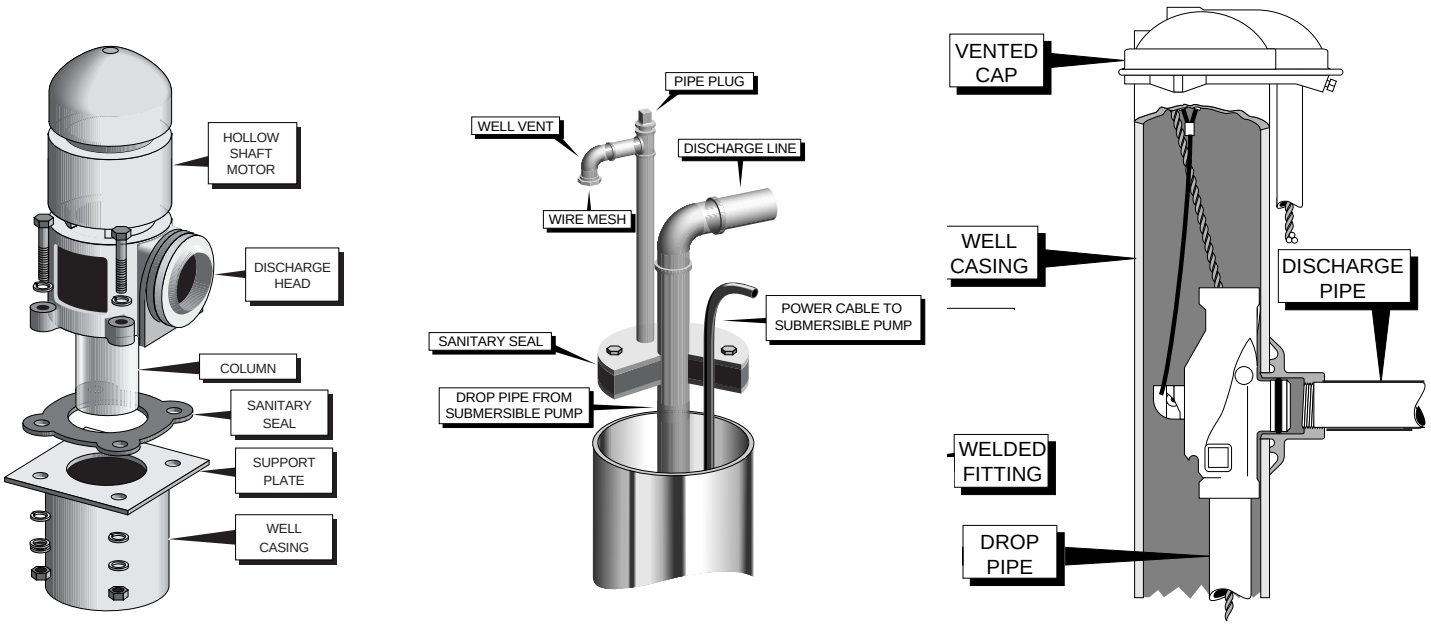



II-4




**Three typical well head designs**

II-5




**Three typical well head designs**

15. Is pump intake located below maximum drawdown?
16. Are foot valves and/or check valves accessible for cleaning?

## Table 3-2: Sample Minimum Distances Between Wells and Pollution Sources

| Source | Feet from Well | Remarks |
|---|---|---|
| Watertight Sewers | 50 | |
| Other Sewers | 100 | Consult the state |
| Septic Tanks | 100 | regulatory agency |
| Sewage Field, Bed, or Pit | 200 | for special local |
| Animal Pens and Yards | 200 | requirements. |



15. Is pump intake located below maximum drawdown?
16. Are foot valves and/or check valves accessible for cleaning?

## Table 3-2: Sample Minimum Distances Between Wells and Pollution Sources

| Source | Feet from Well | Remarks |
|---|---|---|
| Watertight Sewers | 50 | |
| Other Sewers | 100 | Consult the state |
| Septic Tanks | 100 | regulatory agency |
| Sewage Field, Bed, or Pit | 200 | for special local |
| Animal Pens and Yards | 200 | requirements. |

II-6

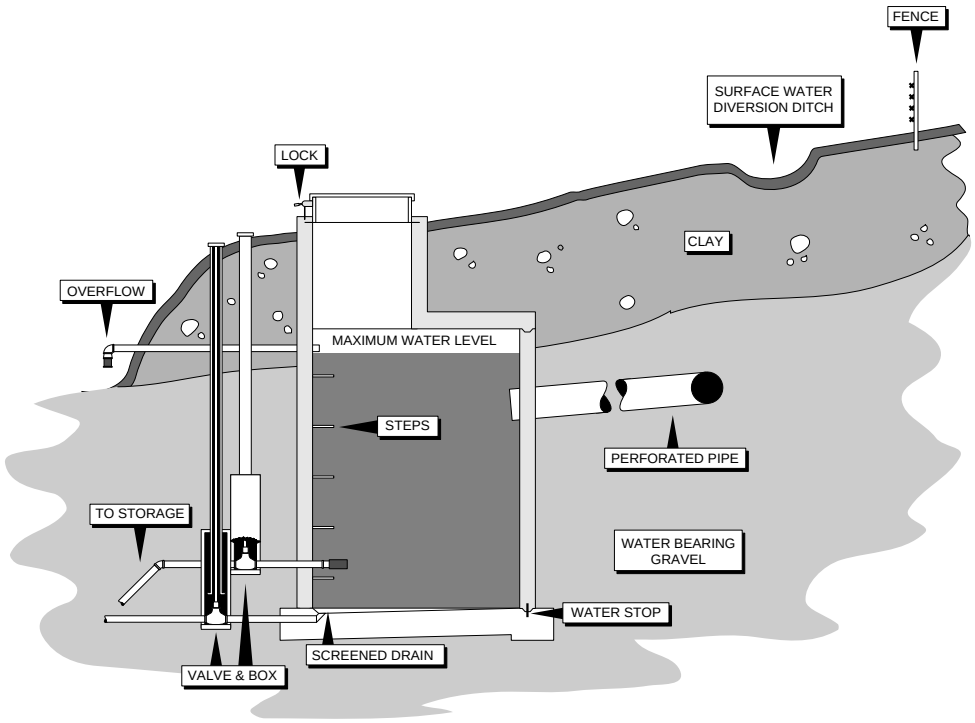
## Springs

1. Is the recharge area protected?
2. What is the nature of the recharge area?
3. Is the site subject to flooding?
4. Is the supply intake adequate?
5. Is the site adequately protected?
6. Is the collection chamber properly constructed?
7. What conditions cause changes to the quality of the water?

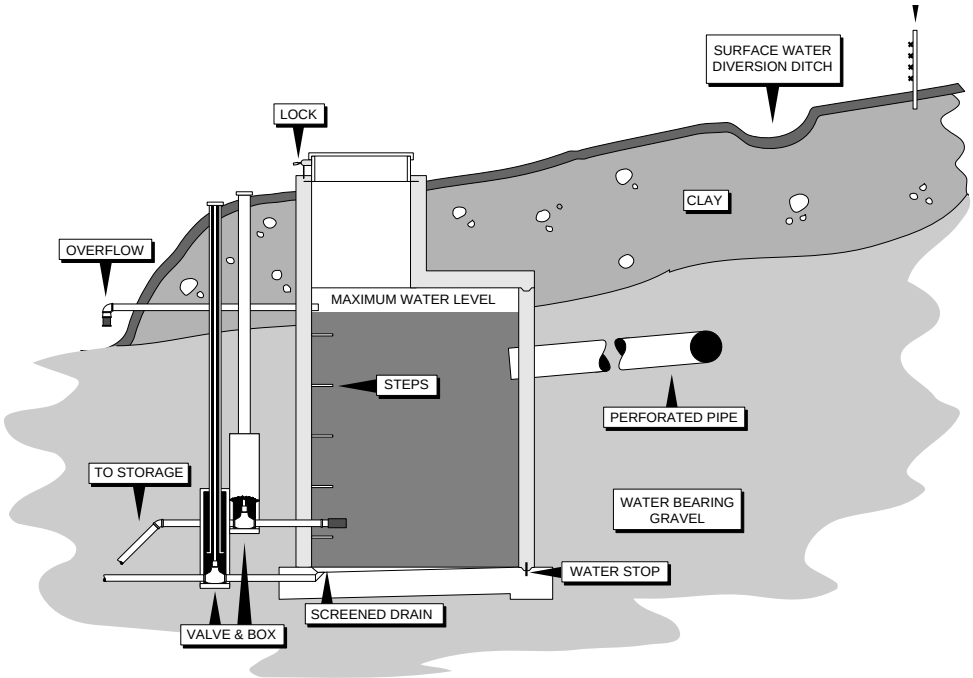
II-7

## Springs

1. Is the recharge area protected?
2. What is the nature of the recharge area?
3. Is the site subject to flooding?
4. Is the supply intake adequate?
5. Is the site adequately protected?
6. Is the collection chamber properly constructed?
7. What conditions cause changes to the quality of the water?


FENCE
SURFACE WATER
DIVERSION DITCH
LOCK
CLAY
OVERFLOW
MAXIMUM WATER LEVEL
STEPS
PERFORATED PIPE
TO STORAGE
WATER BEARING
GRAVEL
WATER STOP
SCREENED DRAIN
VALVE & BOX




SURFACE WATER
DIVERSION DITCH
LOCK
CLAY
OVERFLOW
MAXIMUM WATER LEVEL
STEPS
PERFORATED PIPE
TO STORAGE
WATER BEARING
GRAVEL
WATER STOP
SCREENED DRAIN
VALVE & BOX

II-8

# Groundwater Treatment

## Chemical Feed Systems

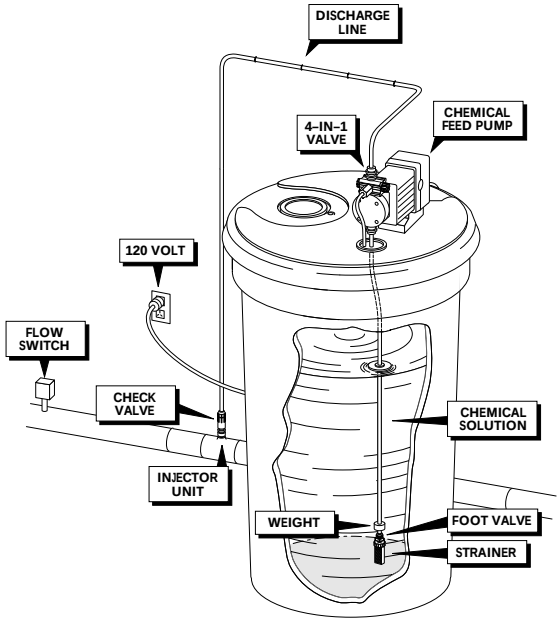
1. What chemicals are used?
2. What is the amount used?
3. Where are the application points of all the chemicals used?
4. Does the system have adequate laboratory facilities?
5. What is the condition of the chemical feed equipment?
6. Is the chemical feed equipment calibrated?
7. Are instrumentation and controls for the process adequate, operational, and utilized?
8. Is chemical storage adequate and safe?
9. Do daily operating records reflect chemical dosages and total quantities used?
10. Is the chemical feed system tied to flow (e.g. flow paced)?
11. Is there an operating 4-in-1 valve or equivalent on each feed pump?
12. Is there a Hazard Communication Program in place?
13. Is there appropriate safety equipment (e.g. cartridge respirator for calcium hypochlorite) and PPE (e.g. goggles, gloves, etc.) available and in use? Have operators been trained to use the safety equipment?
14. Is the building clean and as dry as possible?

III-1

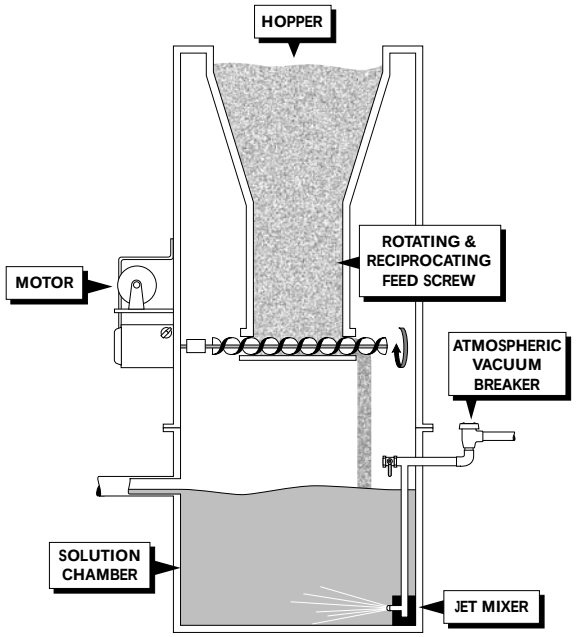
# Groundwater Treatment

## Chemical Feed Systems

1. What chemicals are used?
2. What is the amount used?
3. Where are the application points of all the chemicals used?
4. Does the system have adequate laboratory facilities?
5. What is the condition of the chemical feed equipment?
6. Is the chemical feed equipment calibrated?
7. Are instrumentation and controls for the process adequate, operational, and utilized?
8. Is chemical storage adequate and safe?
9. Do daily operating records reflect chemical dosages and total quantities used?
10. Is the chemical feed system tied to flow (e.g. flow paced)?
11. Is there an operating 4-in-1 valve or equivalent on each feed pump?
12. Is there a Hazard Communication Program in place?
13. Is there appropriate safety equipment (e.g. cartridge respirator for calcium hypochlorite) and PPE (e.g. goggles, gloves, etc.) available and in use? Have operators been trained to use the safety equipment?
14. Is the building clean and as dry as possible?

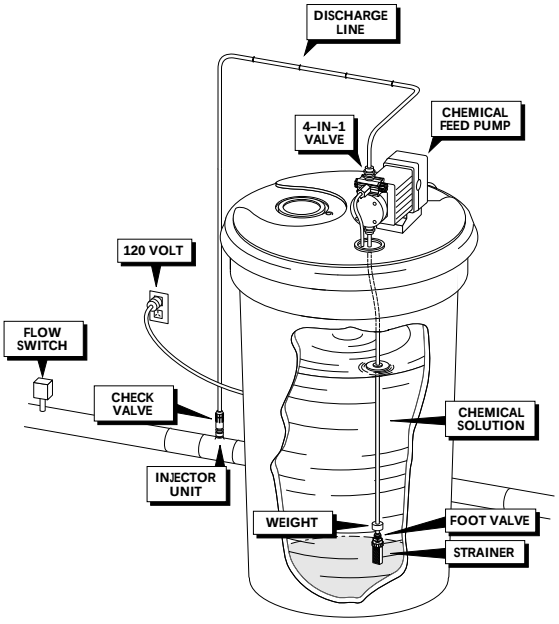



**Liquid Feeder**

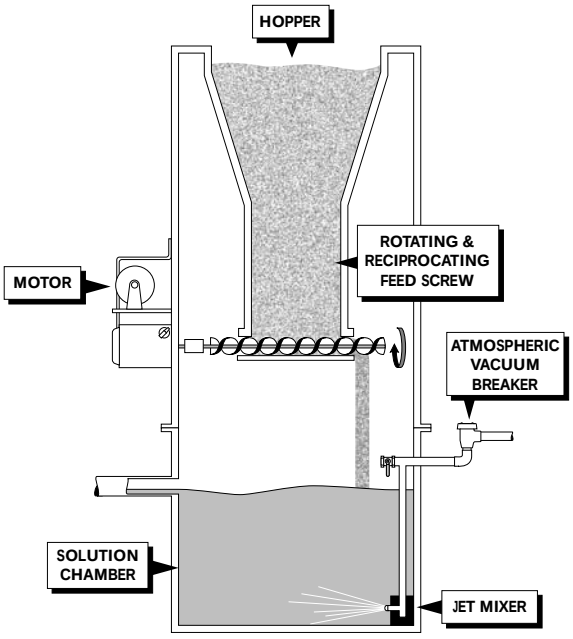



**Dry Feeder**






**Liquid Feeder**

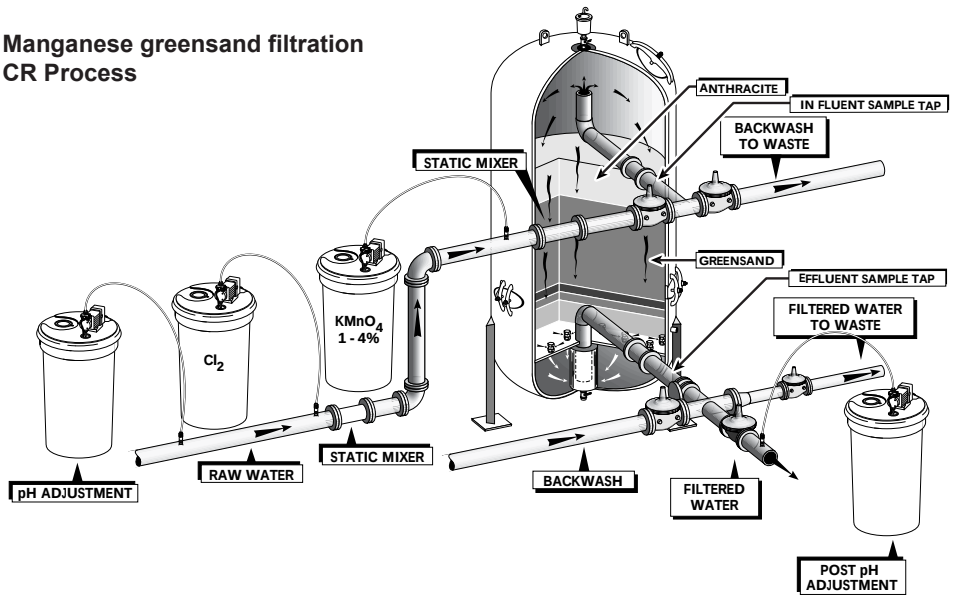



**Dry Feeder**

## Iron and Manganese Removal

1. What treatment process is being used?
2. Is process performing adequately based on visual observation?
3. What chemicals are used and in what amounts?
4. Where are the chemicals applied?

**Manganese greensand filtration CR Process**

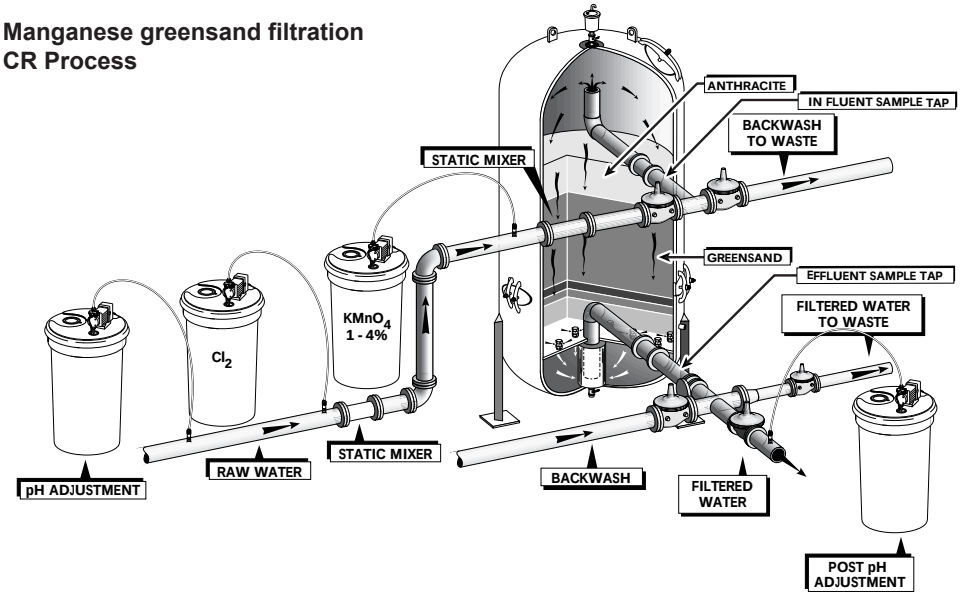



## Iron and Manganese Removal

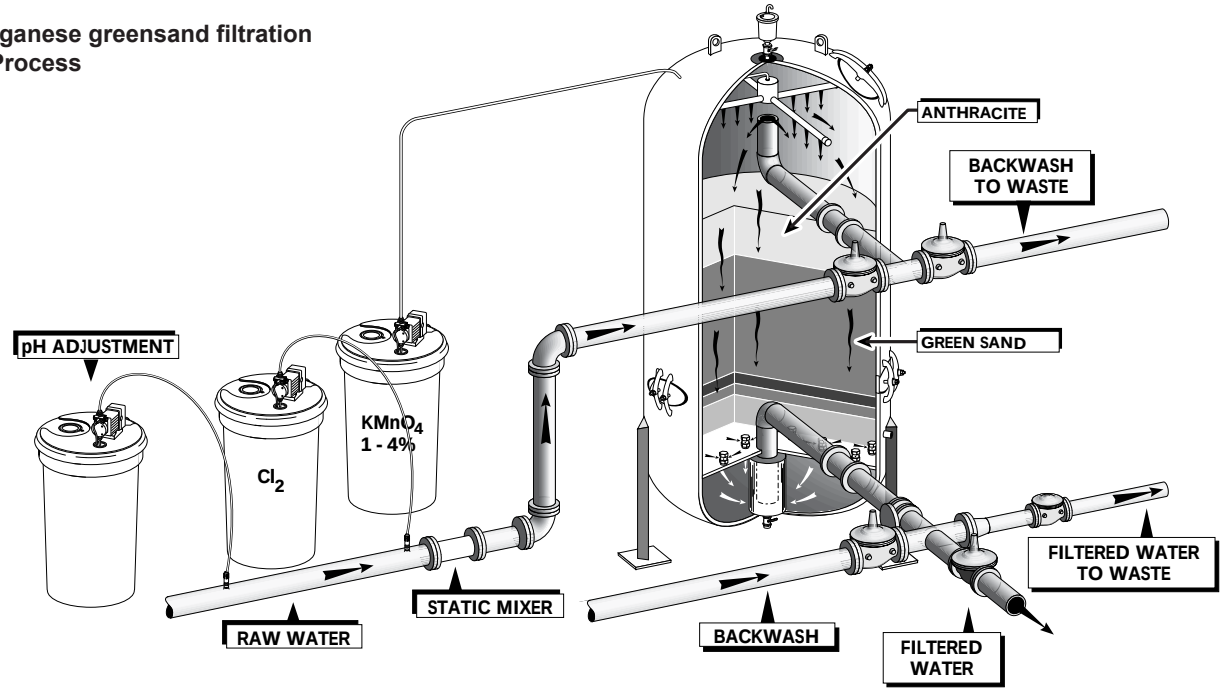
III-3

1. What treatment process is being used?
2. Is process performing adequately based on visual observation?
3. What chemicals are used and in what amounts?
4. Where are the chemicals applied?

**Manganese greensand filtration CR Process**

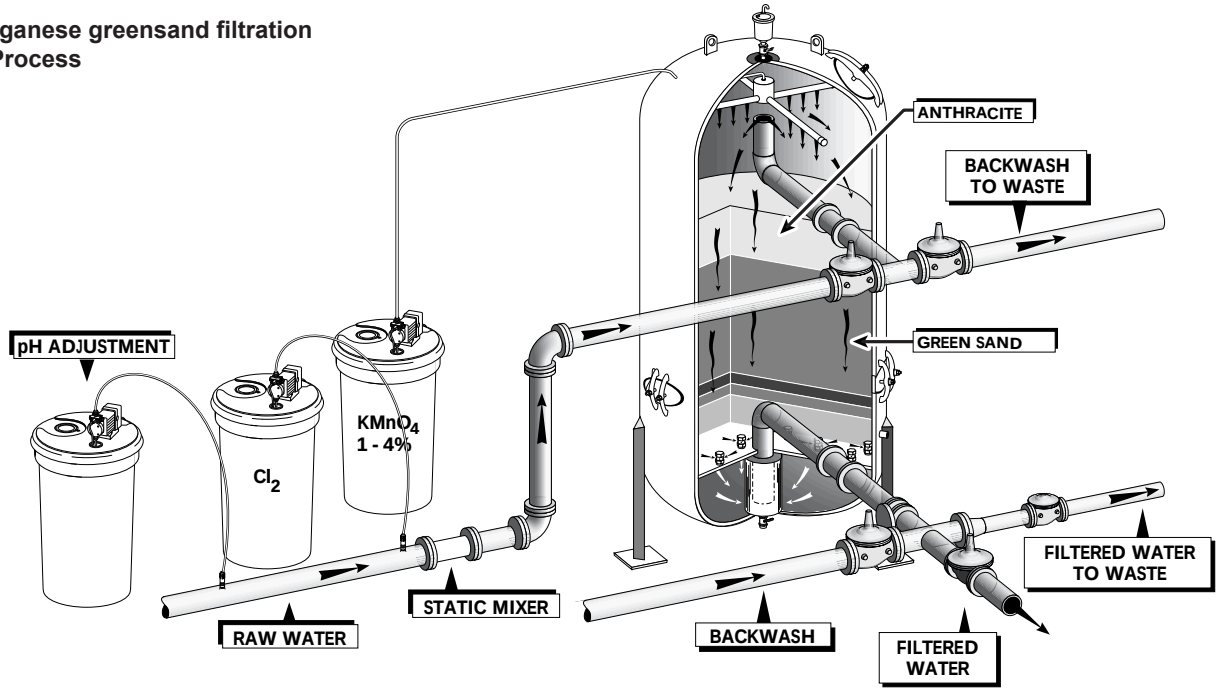


**Manganese greensand filtration**
**IR Process**




III-4

**Manganese greensand filtration**
**IR Process**




III-4

## Softening

**Lime Soda Process**

1. What are the treatment goals?
2. Is the facility performing adequate process control testing?
3. Is the facility tracking the chemicals used?

**Ion Exchange**

1. What are the treatment goals?
2. What is the condition of the equipment?
3. What is the operator's knowledge of the softening process?

III-5

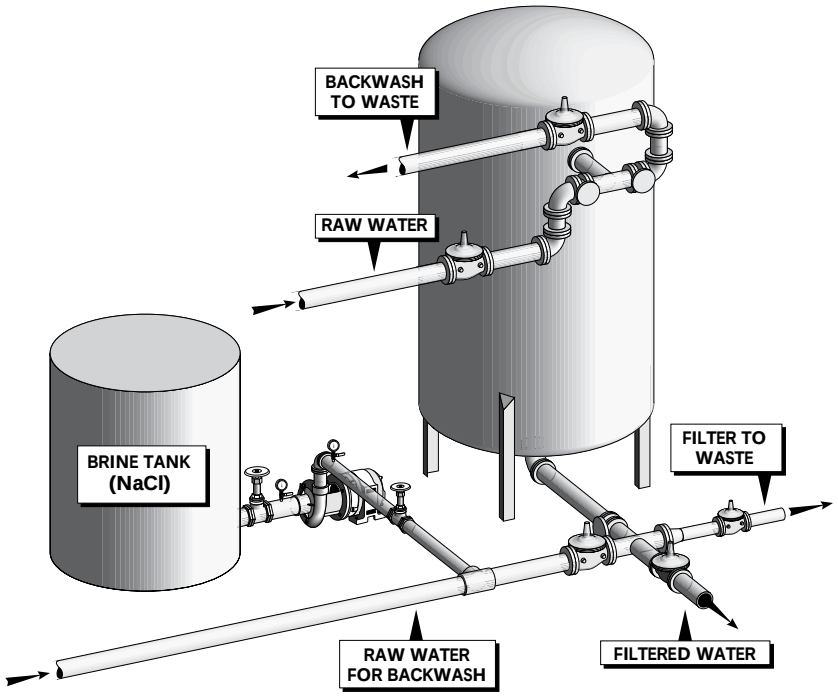
## Softening

**Lime Soda Process**

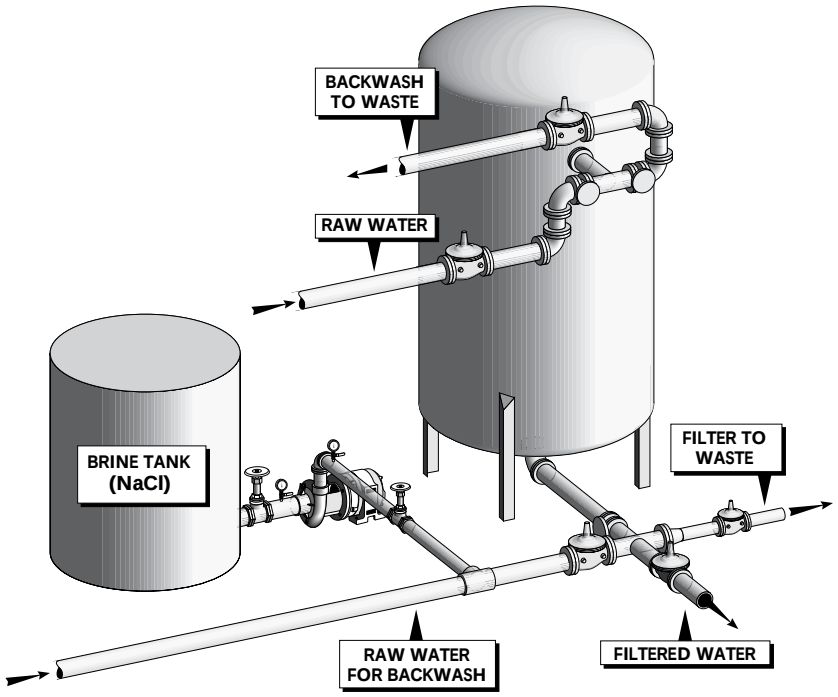
1. What are the treatment goals?
2. Is the facility performing adequate process control testing?
3. Is the facility tracking the chemicals used?

**Ion Exchange**

1. What are the treatment goals?
2. What is the condition of the equipment?
3. What is the operator's knowledge of the softening process?


BACKWASH
TO WASTE
RAW WATER
BRINE TANK
(NaCl)
FILTER TO
WASTE
RAW WATER
FOR BACKWASH
FILTERED WATER





BACKWASH
TO WASTE
RAW WATER
BRINE TANK
(NaCl)
FILTER TO
WASTE
RAW WATER
FOR BACKWASH
FILTERED WATER

III-6

## Corrosion Control

1. What are the results of current lead and copper sampling?
2. What are the characteristics of the water entering and leaving the treatment plant?
3. What sampling is conducted in the distribution system as part of the corrosion control program?
4. Is the test equipment to monitor the data appropriate and in good working order?

## Aeration

1. What type of aeration system is used?
2. What parameters are monitored to evaluate the performance of the process?
3. What types of contaminants are in the vicinity that could be pulled into the air supply?
4. What types of operations problems has the facility experienced that could contribute to low performance of aeration device?
5. After treatment in the aerator, is the effluent disinfected adequately before it is introduced into the water distribution system?
6. What is the condition of the aerator, both inside and out?

III-7

## Corrosion Control

1. What are the results of current lead and copper sampling?
2. What are the characteristics of the water entering and leaving the treatment plant?
3. What sampling is conducted in the distribution system as part of the corrosion control program?
4. Is the test equipment to monitor the data appropriate and in good working order?

## Aeration

1. What type of aeration system is used?
2. What parameters are monitored to evaluate the performance of the process?
3. What types of contaminants are in the vicinity that could be pulled into the air supply?
4. What types of operations problems has the facility experienced that could contribute to low performance of aeration device?
5. After treatment in the aerator, is the effluent disinfected adequately before it is introduced into the water distribution system?
6. What is the condition of the aerator, both inside and out?

## Disinfection - Dosages and Residuals

1. Can the operator answer basic questions about the disinfection process, including what is done, as well as when and why?
2. Have there been any interruptions in disinfection? If so, why?
3. Is there a proper residual entering the distribution system at all times?
4. What disinfectant residual is maintained?
5. Is the contact time between the point of disinfection and the first customer adequate?
6. Are the temperature and pH of the water at the point of chlorine application measured and recorded daily?



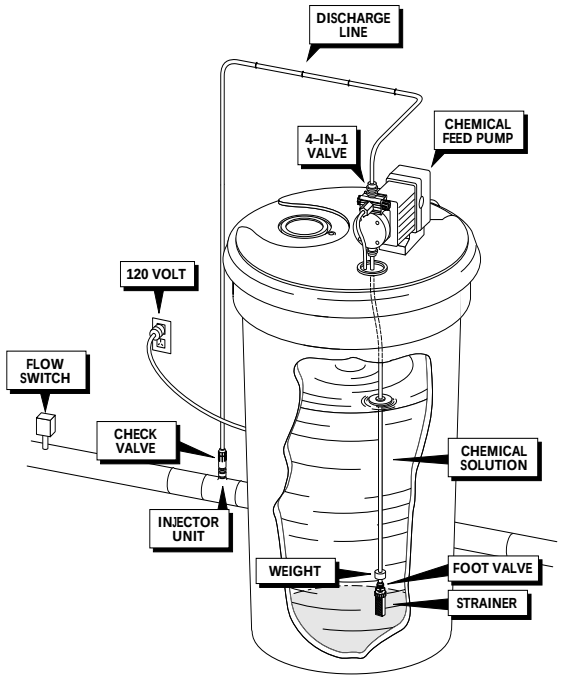
## Disinfection - Dosages and Residuals

1. Can the operator answer basic questions about the disinfection process, including what is done, as well as when and why?
2. Have there been any interruptions in disinfection? If so, why?
3. Is there a proper residual entering the distribution system at all times?
4. What disinfectant residual is maintained?
5. Is the contact time between the point of disinfection and the first customer adequate?
6. Are the temperature and pH of the water at the point of chlorine application measured and recorded daily?

III-8

## Hypochlorination Systems

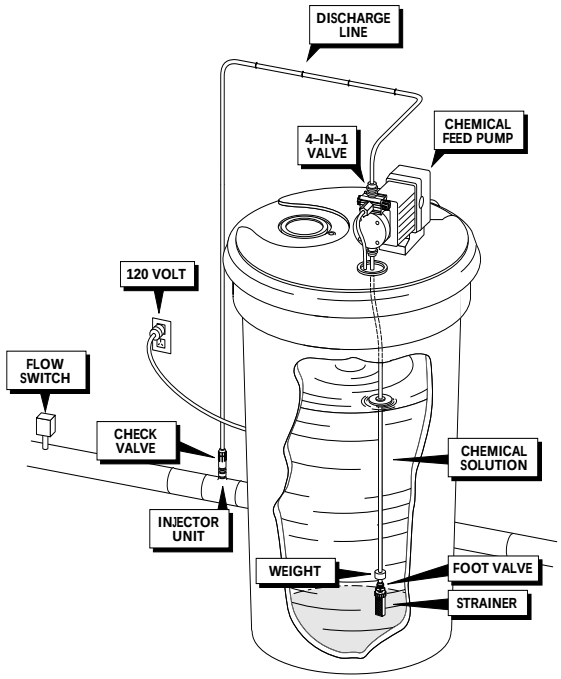
1. What kind of hypochlorite is used (e.g. calcium, sodium or others)?
2. Is the solution tank covered to minimize corrosive vapors?
3. Are there adequate spill containment provisions?
4. Are safe practices followed during chemical handling and mixing?




III-9

## Hypochlorination Systems

1. What kind of hypochlorite is used (e.g. calcium, sodium or others)?
2. Is the solution tank covered to minimize corrosive vapors?
3. Are there adequate spill containment provisions?
4. Are safe practices followed during chemical handling and mixing?



## Gas Chlorination Systems

1. Are there means for leak detection? Have automatic detectors been tested recently and at what detection concentration are they set?
2. Is the sensor tube for the automatic detector near the floor level and is it screened?
3. Is the chlorination equipment properly contained?
4. Is the chlorination room vented at floor level with adequate make up air supply coming from the ceiling across the room? Is the vent switch located outside and by the door?
5. Does the door in the chlorination room open out and have a panic bar and a window?
6. Are there any cross-connections in the chlorine feed makeup water or injection points?
7. Is there an alarm tied to interruptions in the chlorine feed?
8. Does the system use automation, pace with flow, chlorine residual analyzer or other system to adjust feed rates?

   Does it work?
9. Is there more than one cylinder, and are they manifolded with an automatic switch-over to prevent running out of chlorine?
10. Are the cylinders on a working scale?
11. Are the tanks in use a quarter turn open with a wrench in place for quick turnoff??



## Gas Chlorination Systems

1. Are there means for leak detection? Have automatic detectors been tested recently and at what detection concentration are they set?
2. Is the sensor tube for the automatic detector near the floor level and is it screened?
3. Is the chlorination equipment properly contained?
4. Is the chlorination room vented at floor level with adequate make up air supply coming from the ceiling across the room? Is the vent switch located outside and by the door?
5. Does the door in the chlorination room open out and have a panic bar and a window?
6. Are there any cross-connections in the chlorine feed makeup water or injection points?
7. Is there an alarm tied to interruptions in the chlorine feed?
8. Does the system use automation, pace with flow, chlorine residual analyzer or other system to adjust feed rates?

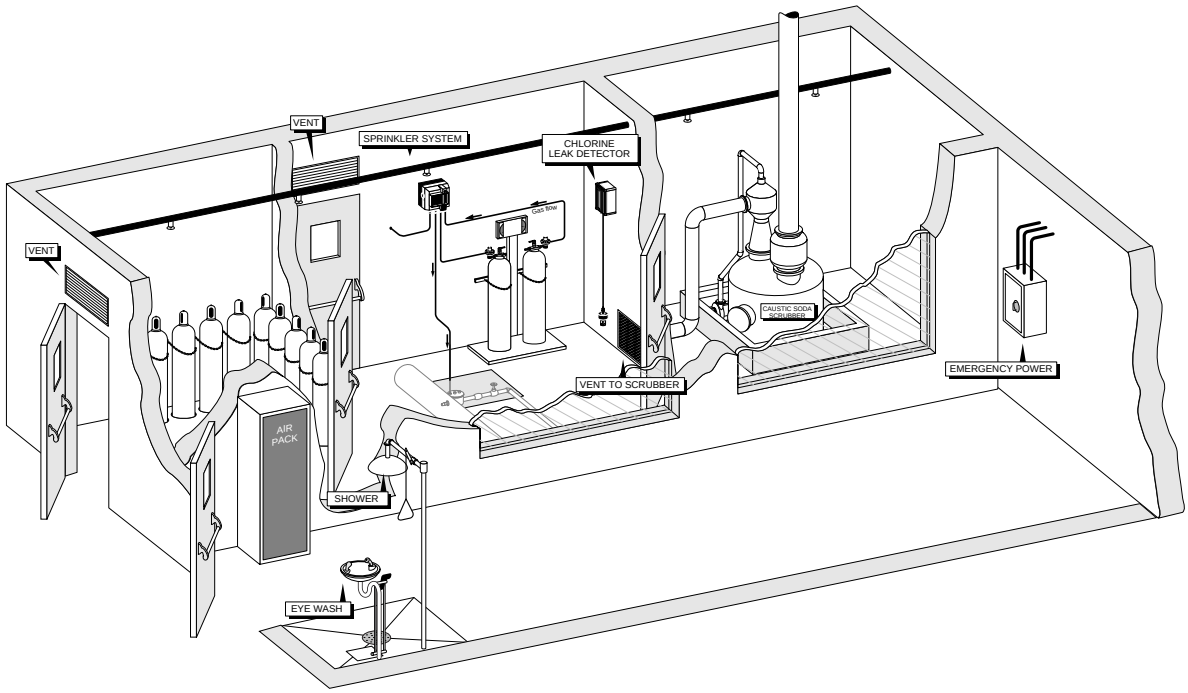
   Does it work?
9. Is there more than one cylinder, and are they manifolded with an automatic switch-over to prevent running out of chlorine?
10. Are the cylinders on a working scale?
11. Are the tanks in use a quarter turn open with a wrench in place for quick turnoff??

III-10

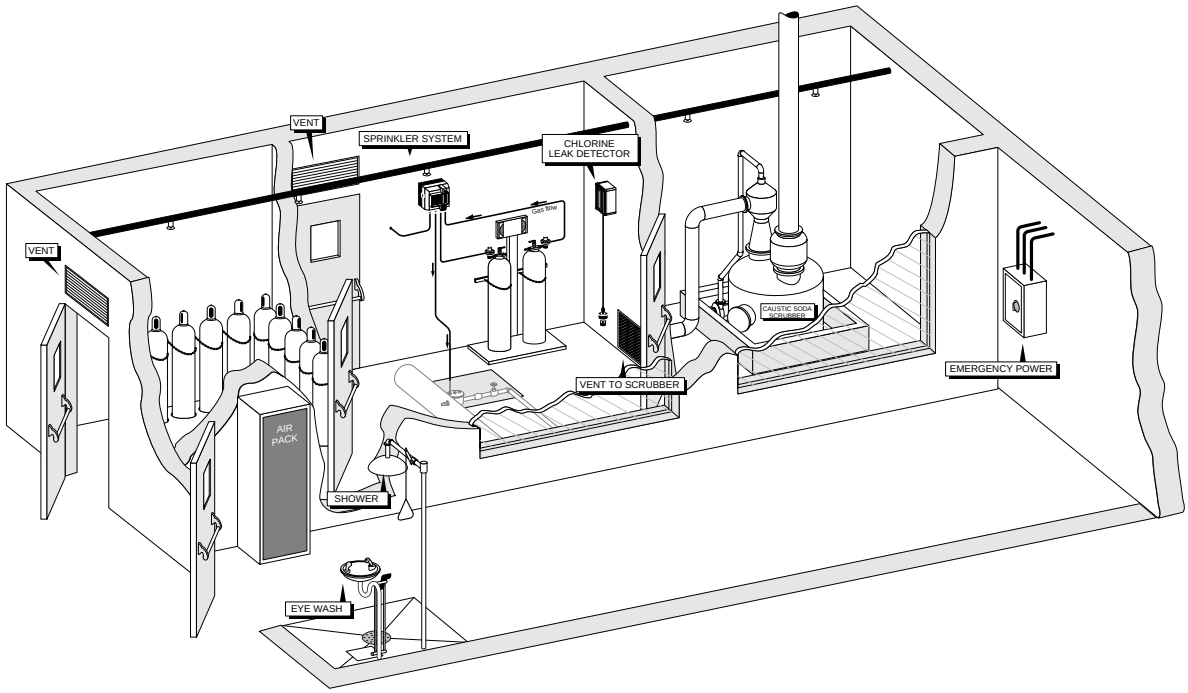
12. Are all cylinders properly marked and restrained to prevent falling?
13. Does the facility transport gas chlorine cylinders? If s,are the requirements of 49 CFR parts 171 and 172 followed?
14. Is the proper concentration of ammonia available for testing for leaks?
15. Are there adequate leak containment provisions?
16. Are safe practices followed during cylinder changes and maintenance?
17. How many individuals are present when the chlorine cylinders are changed?
18. What type of respiratory protection is used?
19. Is there an emergency plan and when was it last practiced?
20. What is the operating condition of the chlorinator?
21. Is redundant back-up equipment available, and are there adequate spare parts?
22. Are the appropriate lighting, guards and railings, etc. in place, and are there safety concerns such as electrical hazards?

III-11

12. Are all cylinders properly marked and restrained to prevent falling?
13. Does the facility transport gas chlorine cylinders? If s,are the requirements of 49 CFR parts 171 and 172 followed?
14. Is the proper concentration of ammonia available for testing for leaks?
15. Are there adequate leak containment provisions?
16. Are safe practices followed during cylinder changes and maintenance?
17. How many individuals are present when the chlorine cylinders are changed?
18. What type of respiratory protection is used?
19. Is there an emergency plan and when was it last practiced?
20. What is the operating condition of the chlorinator?
21. Is redundant back-up equipment available, and are there adequate spare parts?
22. Are the appropriate lighting, guards and railings, etc. in place, and are there safety concerns such as electrical hazards?


VENT
SPRINKLER SYSTEM
CHLORINE
LEAK DETECTOR
VENT
Gas flow
CAUSTIC SODA
SCRUBBER
EMERGENCY POWER
VENT TO SCRUBBER
AIR
PACK
SHOWER
EYE WASH




VENT
SPRINKLER SYSTEM
CHLORINE
LEAK DETECTOR
VENT
Gas flow
CAUSTIC SODA
SCRUBBER
EMERGENCY POWER
VENT TO SCRUBBER
AIR
PACK
SHOWER
EYE WASH

III-12

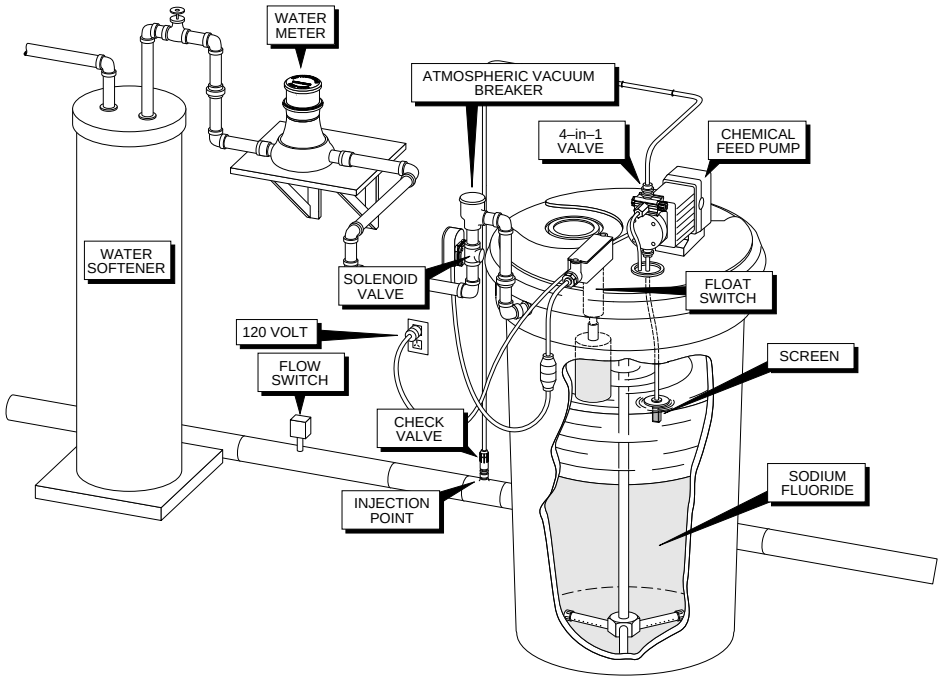
## Fluoridation

1. Can the operator answer basic questions about the fluoridation process, including what is done, as well as when and why it is done?
2. Is there a proper concentration in the distribution system at all times?
3. Are fluoride concentrations tested in the system daily?
4. Does the fluoride concentration vary from day to day?
5. Is the testing procured performed correctly?
6. When was the last time the testing instrument was calibrated?
7. Is there a water meter on the inlet line when using a saturator?
8. How often is the saturator tank cleaned?
9. What is the level of fluoride crystals in the tank?
10 What method is used to dispose of old fluoride crystals?
11. Is there a scale for weighing the solution tank for a liquid acid system?
12. How often are the scales calibrated?
13. Does the electrical system wired with fail safe?

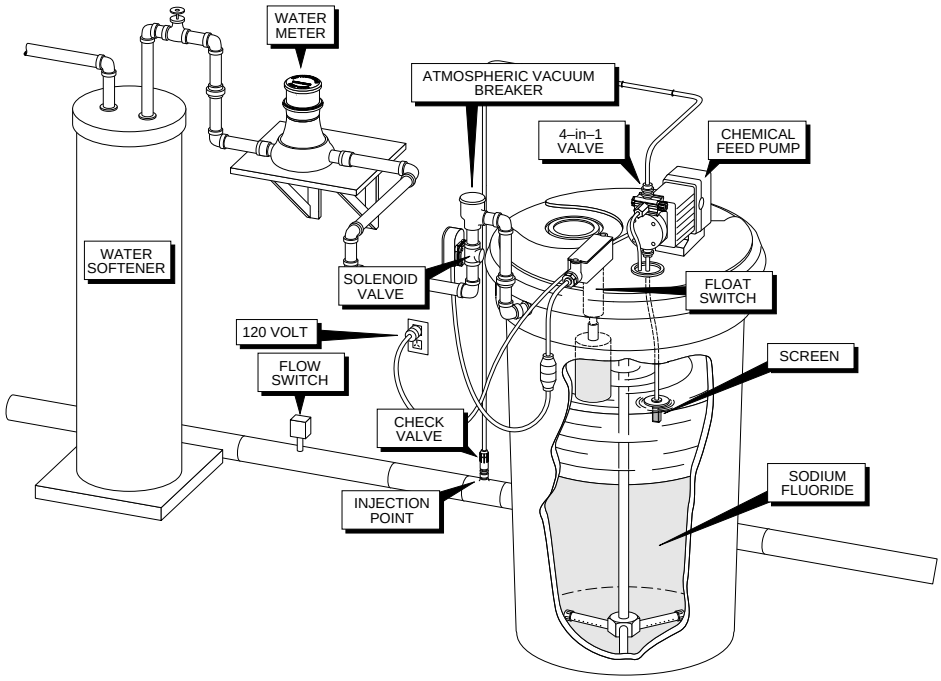
III-13

## Fluoridation

1. Can the operator answer basic questions about the fluoridation process, including what is done, as well as when and why it is done?
2. Is there a proper concentration in the distribution system at all times?
3. Are fluoride concentrations tested in the system daily?
4. Does the fluoride concentration vary from day to day?
5. Is the testing procured performed correctly?
6. When was the last time the testing instrument was calibrated?
7. Is there a water meter on the inlet line when using a saturator?
8. How often is the saturator tank cleaned?
9. What is the level of fluoride crystals in the tank?
10 What method is used to dispose of old fluoride crystals?
11. Is there a scale for weighing the solution tank for a liquid acid system?
12. How often are the scales calibrated?
13. Does the electrical system wired with fail safe?


WATER METER
ATMOSPHERIC VACUUM BREAKER
4–in–1 VALVE
CHEMICAL FEED PUMP
WATER SOFTENER
SOLENOID VALVE
FLOAT SWITCH
120 VOLT
FLOW SWITCH
SCREEN
CHECK VALVE
SODIUM FLUORIDE
INJECTION POINT





WATER METER
ATMOSPHERIC VACUUM BREAKER
4–in–1 VALVE
CHEMICAL FEED PUMP
WATER SOFTENER
SOLENOID VALVE
FLOAT SWITCH
120 VOLT
FLOW SWITCH
SCREEN
CHECK VALVE
SODIUM FLUORIDE
INJECTION POINT

III-14

# Distribution Systems

## Piping Materials

1. What kind of piping materials are in the distribution system?

## Material Standards

1. What standards are used to select materials?
2. Are all materials used in the system manufactured according to AWWA Standards?
3. Are all materials ANSI/NSF certified?
4. Is there a set of construction standards used by the utility?
5. Does the System have its own construction standards, or have they adopted some from another agency?
6. Do the construction standards meet the state requirements?
7. Are in-house staff and contractors required to use the same standards?
8. Are standards actually followed?

IV-1

# Distribution Systems

## Piping Materials

1. What kind of piping materials are in the distribution system?

## Material Standards

1. What standards are used to select materials?
2. Are all materials used in the system manufactured according to AWWA Standards?
3. Are all materials ANSI/NSF certified?
4. Is there a set of construction standards used by the utility?
5. Does the System have its own construction standards, or have they adopted some from another agency?
6. Do the construction standards meet the state requirements?
7. Are in-house staff and contractors required to use the same standards?
8. Are standards actually followed?

## Water Quality

1. Is there any point in the system where pressure drops below 20 psi during peak demand or fire response?
2. If the valves are in a vault, can the operator observe pressures without entering the vault?
3. If there is a vault, is there a sign identifying it as a confined space? Does the operator have and use gas monitoring equipment and follow a confined space entry procedure?
4. If there are pressure zones controlled by automatic Pressure Reducing Valves (PRVs), do they work properly?
5. If there are PRVs, can the operator describe how they work and what they do?
6. If a PRV should fail, how would the utility be notified?
7. Is the system designed with dead-end lines?
8. Are there several low places in the system piping?
9. Do reservoirs turn over at least once every 14 days?
10. If there is a model, has it been compared to actual conditions? When was it updated last? Does it show any low pressure conditions?
11. Are the backflow prevention devices installed and tested at each commercial site where backflow could cause a reduction in water quality?
12. Does the discharge piping on all air valves extend a proper distance above ground and flood level?



## Water Quality

1. Is there any point in the system where pressure drops below 20 psi during peak demand or fire response?
2. If the valves are in a vault, can the operator observe pressures without entering the vault?
3. If there is a vault, is there a sign identifying it as a confined space? Does the operator have and use gas monitoring equipment and follow a confined space entry procedure?
4. If there are pressure zones controlled by automatic Pressure Reducing Valves (PRVs), do they work properly?
5. If there are PRVs, can the operator describe how they work and what they do?
6. If a PRV should fail, how would the utility be notified?
7. Is the system designed with dead-end lines?
8. Are there several low places in the system piping?
9. Do reservoirs turn over at least once every 14 days?
10. If there is a model, has it been compared to actual conditions? When was it updated last? Does it show any low pressure conditions?
11. Are the backflow prevention devices installed and tested at each commercial site where backflow could cause a reduction in water quality?
12. Does the discharge piping on all air valves extend a proper distance above ground and flood level?

IV-2

13. Are distribution system problem areas identified on a system map?

## Maps/Drawings & Planning

1. Are as-built drawings available?
2. How often are maps updated?
3. Do maps and as-builds contain the proper information?
4. Is there a master plan showing proposed construction and or replacement of lines?

## Distribution System Monitoring

1. Are chlorine residuals tested in the system daily?
2. Is the residual at least 0.2 mg/L prior to the first customer?
3. Is a trace of residual maintained at all points in the system?
4. Are there an adequate number of sample sites and do they provide a representative sample of system conditions?
5. Is the correct reagent used for testing free residual?
6. Are they waiting the correct length of time before reading the residual?
7. When was the last time the testing instrument was calibrated?

IV-3

13. Are distribution system problem areas identified on a system map?

## Maps/Drawings & Planning

1. Are as-built drawings available?
2. How often are maps updated?
3. Do maps and as-builds contain the proper information?
4. Is there a master plan showing proposed construction and or replacement of lines?

## Distribution System Monitoring

1. Are chlorine residuals tested in the system daily?
2. Is the residual at least 0.2 mg/L prior to the first customer?
3. Is a trace of residual maintained at all points in the system?
4. Are there an adequate number of sample sites and do they provide a representative sample of system conditions?
5. Is the correct reagent used for testing free residual?
6. Are they waiting the correct length of time before reading the residual?
7. When was the last time the testing instrument was calibrated?

8. Is system pressure monitored at high and low elevations? Is this information recorded?
9. Are customer water quality complaints recorded?
10. What is the percentage of unaccounted for water?

## System Operation and Maintenance

1. What is the frequency of main breaks?
2. Are the breaks primarily in one area? What type of pipe is involved?
3. Is there a line flushing program? Is a systematic unidirectional process used? Are records maintained of frequency, location and amount of time required?
4. Is there a valve inspection and exercising program?
5. Is there a fire hydrant flushing program, separate from the line flushing program?
6. Does the utility have a backhoe? If not, how long would it take a contractor or rental company to provide one if needed? Can they obtain this equipment late at night?
7. How often are pressure readings taken in the distribution system? Are they representative of the system?
8. Are adequate repair materials on hand?
9. Are there written procedures for isolation of portions of the system and for making main repairs?



8. Is system pressure monitored at high and low elevations? Is this information recorded?
9. Are customer water quality complaints recorded?
10. What is the percentage of unaccounted for water?

## System Operation and Maintenance

1. What is the frequency of main breaks?
2. Are the breaks primarily in one area? What type of pipe is involved?
3. Is there a line flushing program? Is a systematic unidirectional process used? Are records maintained of frequency, location and amount of time required?
4. Is there a valve inspection and exercising program?
5. Is there a fire hydrant flushing program, separate from the line flushing program?
6. Does the utility have a backhoe? If not, how long would it take a contractor or rental company to provide one if needed? Can they obtain this equipment late at night?
7. How often are pressure readings taken in the distribution system? Are they representative of the system?
8. Are adequate repair materials on hand?
9. Are there written procedures for isolation of portions of the system and for making main repairs?

IV-4

10. Does the utility maintain an updated list of critical customers?
11. Does the utility have a corrosion control program?

## Safety Considerations

1. Dose the utility use proper safety procedures for handling line disinfection chemicals?
2. Is there a trained “Competent Person” on the staff?
3. Does the “Competent Person” evaluate soil and work site hazards at each excavation?
4. Are excavation hazard evaluations documented?
5. Does the utility have and use cave-in protection equipment?
6. Does the utility have and do they use proper traffic control equipment?
7. Have all field workers been trained in the use of traffic control equipment?
8. Are all employees who operate industrial trucks required to have a Commercial Drivers License (CDL)?

## Disinfection Procedures

1. What disinfection procedure is used for new lines?
2. Does this procedure meet the AWWA C-601 Standard?

IV-5

10. Does the utility maintain an updated list of critical customers?
11. Does the utility have a corrosion control program?

## Safety Considerations

1. Dose the utility use proper safety procedures for handling line disinfection chemicals?
2. Is there a trained “Competent Person” on the staff?
3. Does the “Competent Person” evaluate soil and work site hazards at each excavation?
4. Are excavation hazard evaluations documented?
5. Does the utility have and use cave-in protection equipment?
6. Does the utility have and do they use proper traffic control equipment?
7. Have all field workers been trained in the use of traffic control equipment?
8. Are all employees who operate industrial trucks required to have a Commercial Drivers License (CDL)?

## Disinfection Procedures

1. What disinfection procedure is used for new lines?
2. Does this procedure meet the AWWA C-601 Standard?

3. What disinfection procedure is used during repairs of broken lines?

## Design & Operational Constraints on Water Quality

1. Are all water lines looped or are there dead ends?
2. Are there any bottle necks in the piping system? (A small diameter pipe connected on both ends by large diameter pipe)
3. Are blow offs connected to sanitary or storm sewers or do they exit below flood level in ditches or streams?

## Design & Operational Constraints on Reliability

1. Is the system interconnected with any other water systems?
2. Does the system have adequate valves?

## Construction Considerations

1. Are concrete thrust blocks or restraining fittings used at all elbows, tees and dead ends?
2. Are proper bedding and backfill procedures used with new or repaired pipes?
3. Are pressure and/or leak tests performed on all new pipe construction?
4. Are cast iron and steel pipe protected from external corrosion?



3. What disinfection procedure is used during repairs of broken lines?

## Design & Operational Constraints on Water Quality

1. Are all water lines looped or are there dead ends?
2. Are there any bottle necks in the piping system? (A small diameter pipe connected on both ends by large diameter pipe)
3. Are blow offs connected to sanitary or storm sewers or do they exit below flood level in ditches or streams?

## Design & Operational Constraints on Reliability

1. Is the system interconnected with any other water systems?
2. Does the system have adequate valves?

## Construction Considerations

1. Are concrete thrust blocks or restraining fittings used at all elbows, tees and dead ends?
2. Are proper bedding and backfill procedures used with new or repaired pipes?
3. Are pressure and/or leak tests performed on all new pipe construction?
4. Are cast iron and steel pipe protected from external corrosion?

IV-6

# Finished Water Storage

## Gravity Storage Tanks

1. Is the storage system designed for “direct pumping” or “floating” on the distribution system?
2. Is the storage capacity adequate?
3. Is the storage over designed?
4. Is the pumping capacity adequate?
5. Is the elevation of the tank sufficient to maintain distribution pressure throughout the system?
6. Is there a need to provide for separate pressure zones?
7. Does the operator understand the controls?
8. Is there adequate minimum rise and fall distance?
9. Are control systems reliable and properly protected?
10. Is water level indicator accurate?
11. Is there a maintenance program?

V-1

# Finished Water Storage

## Gravity Storage Tanks

1. Is the storage system designed for “direct pumping” or “floating” on the distribution system?
2. Is the storage capacity adequate?
3. Is the storage over designed?
4. Is the pumping capacity adequate?
5. Is the elevation of the tank sufficient to maintain distribution pressure throughout the system?
6. Is there a need to provide for separate pressure zones?
7. Does the operator understand the controls?
8. Is there adequate minimum rise and fall distance?
9. Are control systems reliable and properly protected?
10. Is water level indicator accurate?
11. Is there a maintenance program?

## Direct Contamination Concerns

1. Is all treated water storage covered?
2. Are overflow pipes:
   - Terminated 12 to 24 inches above the ground?
   - Screened?
   - Splash pad provided?
3. Are Air vents:
   - Turned downward or covered from rain?
   - Terminated at a minimum of 3 diameters above the surface of storage tank roof?
   - Screened?
4. Are the cathodic protection access plates watertight?
5. Is the top access hatch designed correctly and closes tight?
6. Are access hatches locked?
7. Is there a roof penetration for a water level indicator cable?
8. Are there other roof penetrations?
9. Are there sewer lines within 50 feet of an in-ground storage tank?
10. Are there cracks in the walls or covers of the in-ground concrete storage tanks?
11. Is there protection from flooding?



## Direct Contamination Concerns

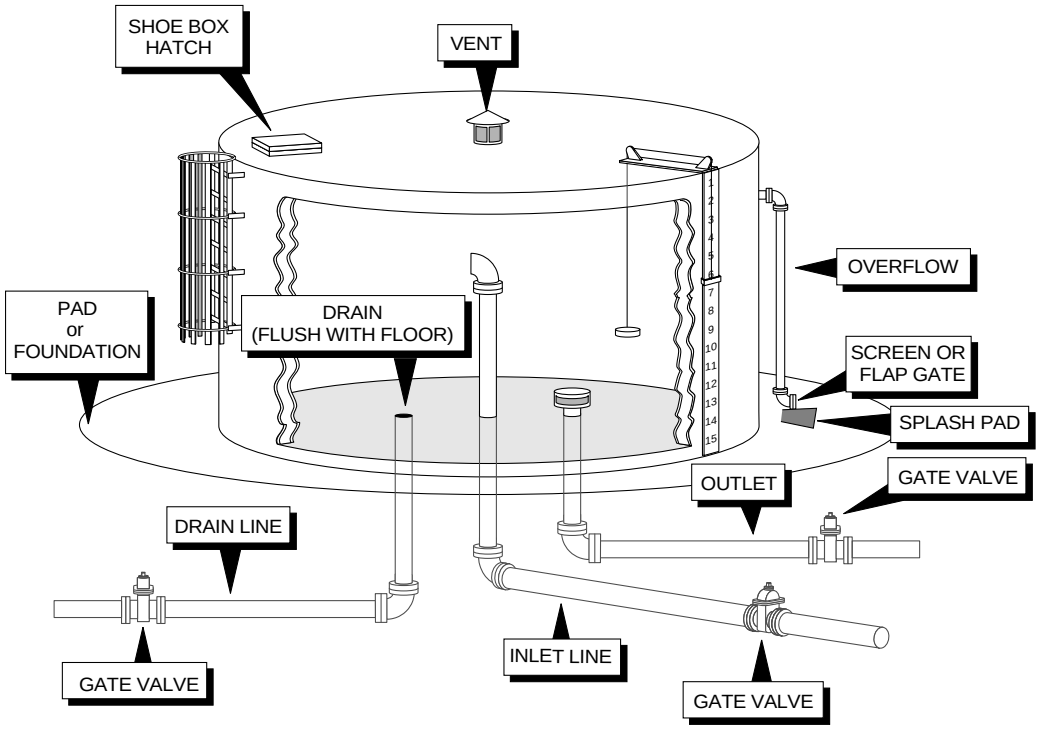
1. Is all treated water storage covered?
2. Are overflow pipes:
   - Terminated 12 to 24 inches above the ground?
   - Screened?
   - Splash pad provided?
3. Are Air vents:
   - Turned downward or covered from rain?
   - Terminated at a minimum of 3 diameters above the surface of storage tank roof?
   - Screened?
4. Are the cathodic protection access plates watertight?
5. Is the top access hatch designed correctly and closes tight?
6. Are access hatches locked?
7. Is there a roof penetration for a water level indicator cable?
8. Are there other roof penetrations?
9. Are there sewer lines within 50 feet of an in-ground storage tank?
10. Are there cracks in the walls or covers of the in-ground concrete storage tanks?
11. Is there protection from flooding?

V-2

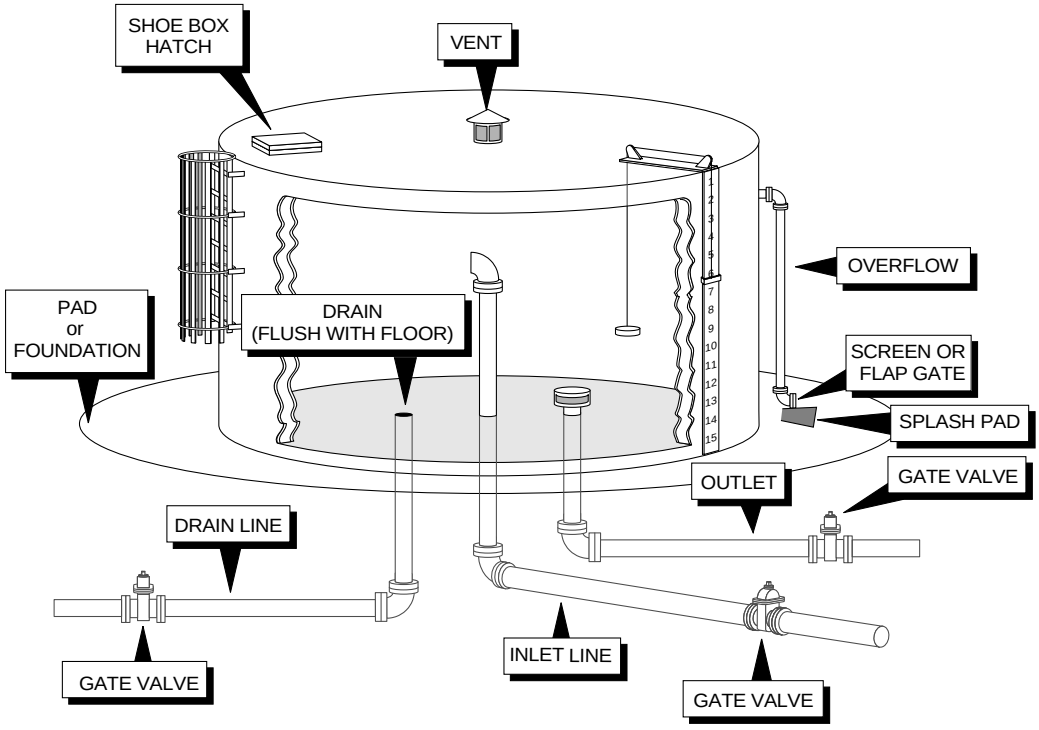
12. Can tank be isolated from the system?
13. Is the site protected against vandalism?
14. Are interior surface coatings approved?
15. Is VOC sampling performed after painting?
16. Is the tank protected against icing?
17. Are there indications that the tank may not be structurally sound?
18. Is the tank protected against corrosion?
19. What is the frequency of general inspection and cleaning?
20. What is the frequency and method of structural/coating inspections?
21. Are storage tanks disinfected following interior maintenance?
22. Are there provisions established for maintaining the water supply when the storage tank is out of service for maintenance?
23. Are there emergency procedures established?
24. Are safety precautions followed?
25. If the tank is a wooden tank, is it operated in a manner to minimize an increase in bacterial count?

V-3

12. Can tank be isolated from the system?
13. Is the site protected against vandalism?
14. Are interior surface coatings approved?
15. Is VOC sampling performed after painting?
16. Is the tank protected against icing?
17. Are there indications that the tank may not be structurally sound?
18. Is the tank protected against corrosion?
19. What is the frequency of general inspection and cleaning?
20. What is the frequency and method of structural/coating inspections?
21. Are storage tanks disinfected following interior maintenance?
22. Are there provisions established for maintaining the water supply when the storage tank is out of service for maintenance?
23. Are there emergency procedures established?
24. Are safety precautions followed?
25. If the tank is a wooden tank, is it operated in a manner to minimize an increase in bacterial count?


SHOE BOX HATCH
VENT
OVERFLOW
PAD or FOUNDATION
DRAIN (FLUSH WITH FLOOR)
SCREEN OR FLAP GATE
SPLASH PAD
OUTLET
GATE VALVE
DRAIN LINE
GATE VALVE
INLET LINE
GATE VALVE

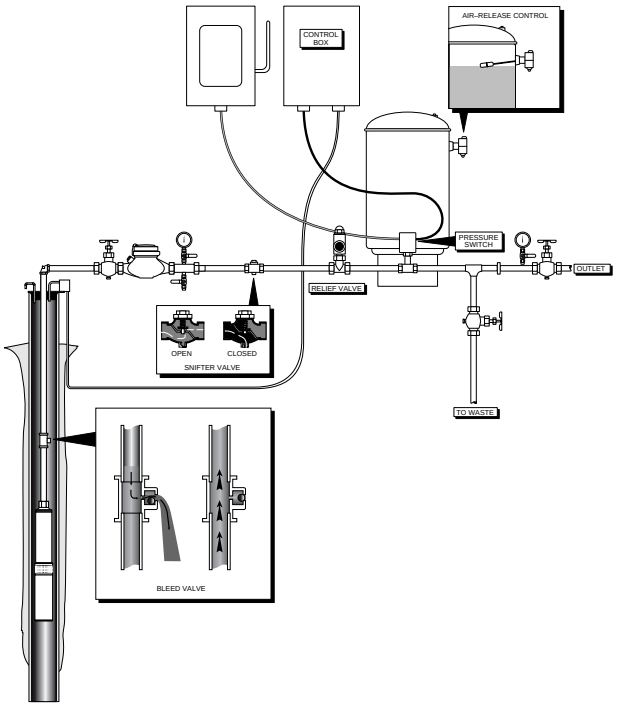



SHOE BOX HATCH
VENT
OVERFLOW
PAD or FOUNDATION
DRAIN (FLUSH WITH FLOOR)
SCREEN OR FLAP GATE
SPLASH PAD
OUTLET
GATE VALVE
DRAIN LINE
GATE VALVE
INLET LINE
GATE VALVE

V-4

## Hydropneumatic Storage Tanks

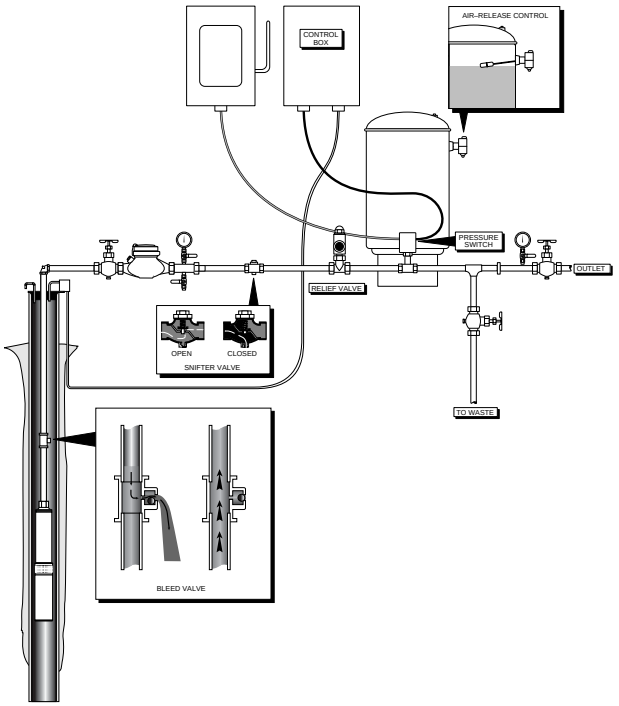
1. Is tank capacity adequate?
2. Does low pressure level provide adequate distribution system
3. Are instruments and controls adequate and operational? Are they being utilized and maintained?
4. What is the cycle rate and air to water ratio?
5. Are the tank and controls properly protected?
6. Are emergency procedures established?
7. Are back-up systems provided?
8. Are the interior and exterior surfaces in good condition?
9. Are tank supports structurally sound?
10. Is the recharge air free of pollutants such as oil from an air compressor?
11. What is the physical condition of the outside hatch?



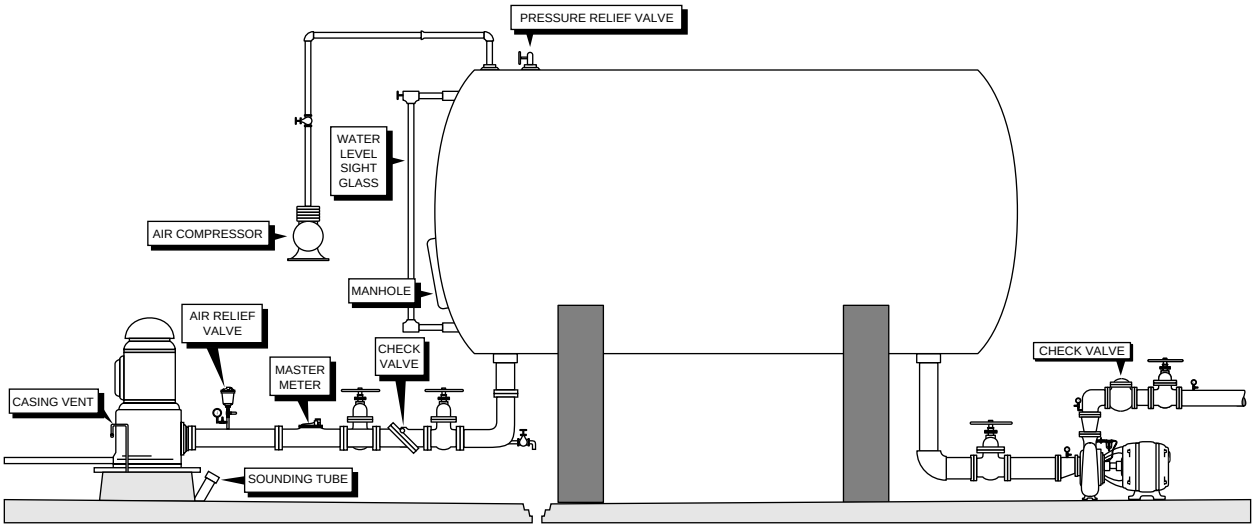

V-5

## Hydropneumatic Storage Tanks

1. Is tank capacity adequate?
2. Does low pressure level provide adequate distribution system
3. Are instruments and controls adequate and operational? Are they being utilized and maintained?
4. What is the cycle rate and air to water ratio?
5. Are the tank and controls properly protected?
6. Are emergency procedures established?
7. Are back-up systems provided?
8. Are the interior and exterior surfaces in good condition?
9. Are tank supports structurally sound?
10. Is the recharge air free of pollutants such as oil from an air compressor?
11. What is the physical condition of the outside hatch?

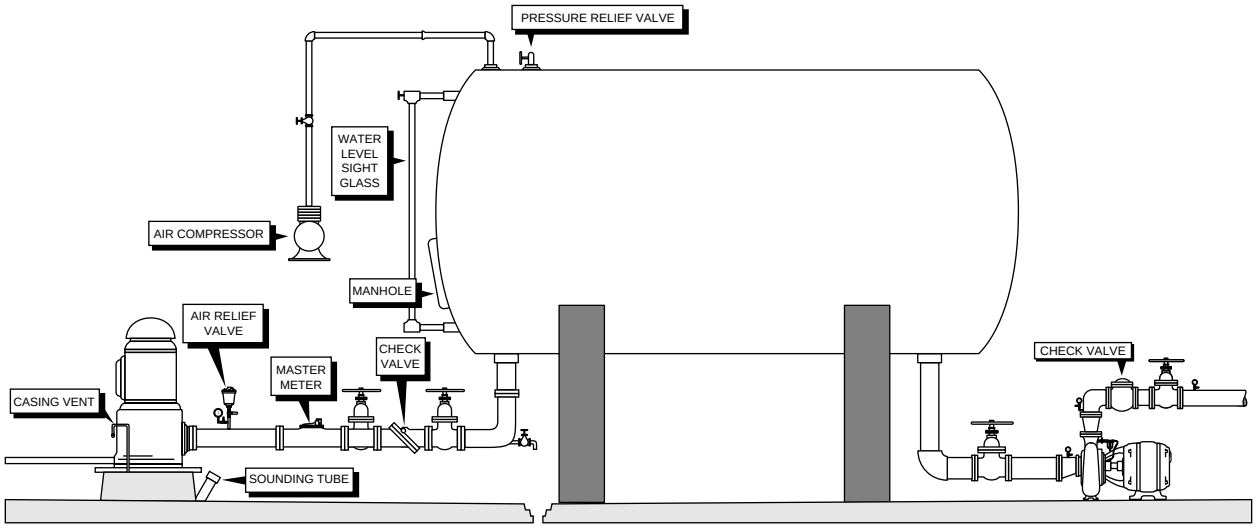


12. Is the tank support adequate?




V-6

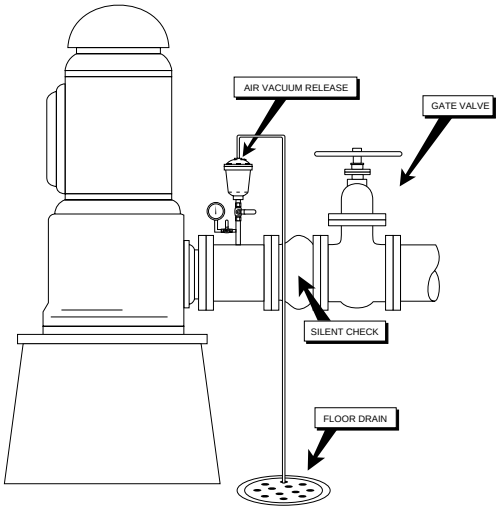
12. Is the tank support adequate?




V-6

# Cross-connection

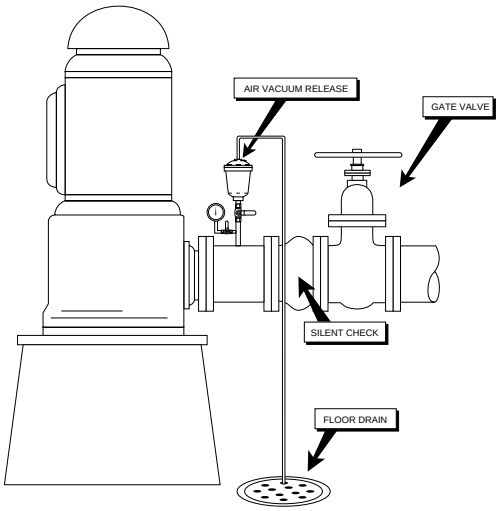
1. Does the water system have a written cross-connection control program?
2. Is the program active and effective in controlling cross-connections?
3. Are cross-connections present at the water treatment plant?
4. Are backflow preventers at treatment plants and other facilities owned by the water system tested?
5. Are cross-connections present in pumping stations?
6. Are there cross-connections in the distribution systems which are owned or controlled by the water system?
7. Does the water system have a program to control the use of fire hydrants?

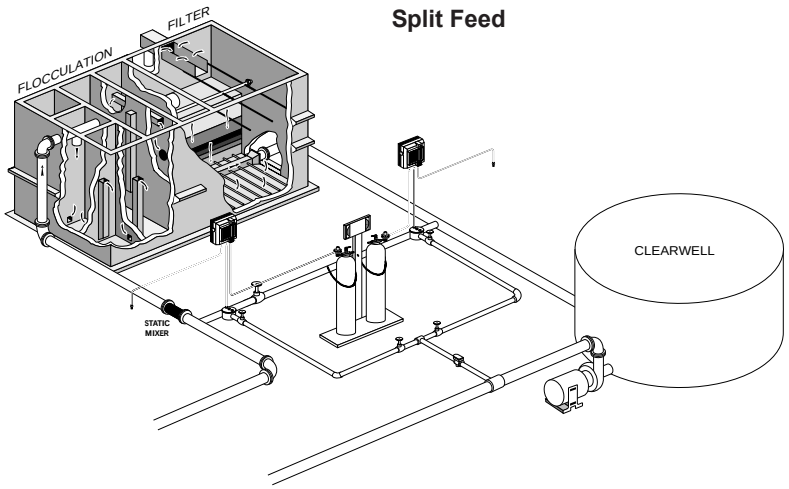



VI-1

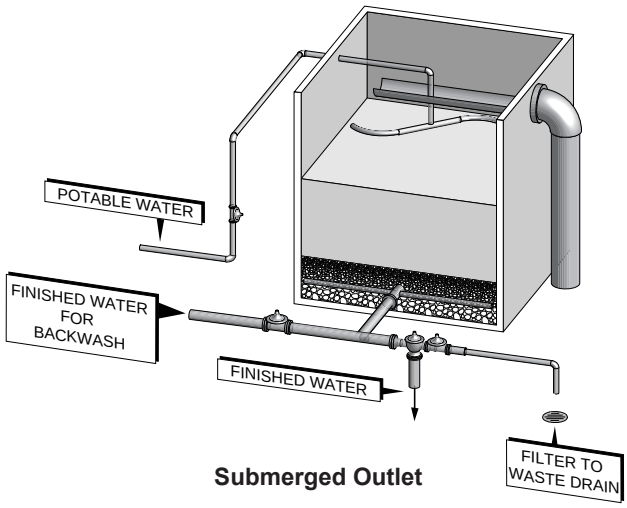
# Cross-connection

1. Does the water system have a written cross-connection control program?
2. Is the program active and effective in controlling cross-connections?
3. Are cross-connections present at the water treatment plant?
4. Are backflow preventers at treatment plants and other facilities owned by the water system tested?
5. Are cross-connections present in pumping stations?
6. Are there cross-connections in the distribution systems which are owned or controlled by the water system?
7. Does the water system have a program to control the use of fire hydrants?



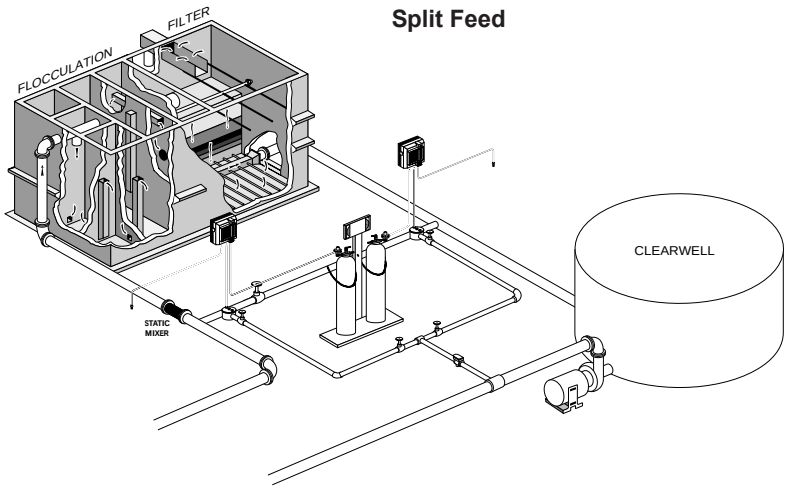



**Split Feed**

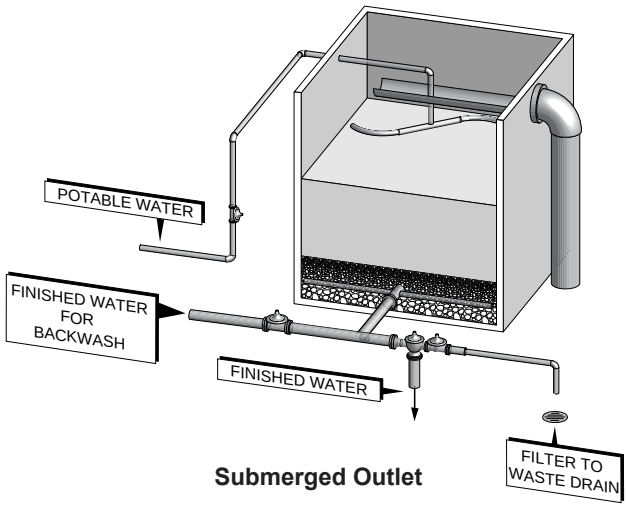



**Submerged Outlet**

VI-2




**Split Feed**




**Submerged Outlet**

VI-2

# Pumps - Pump Facilities and Controls

## The Pumping Station/Well House

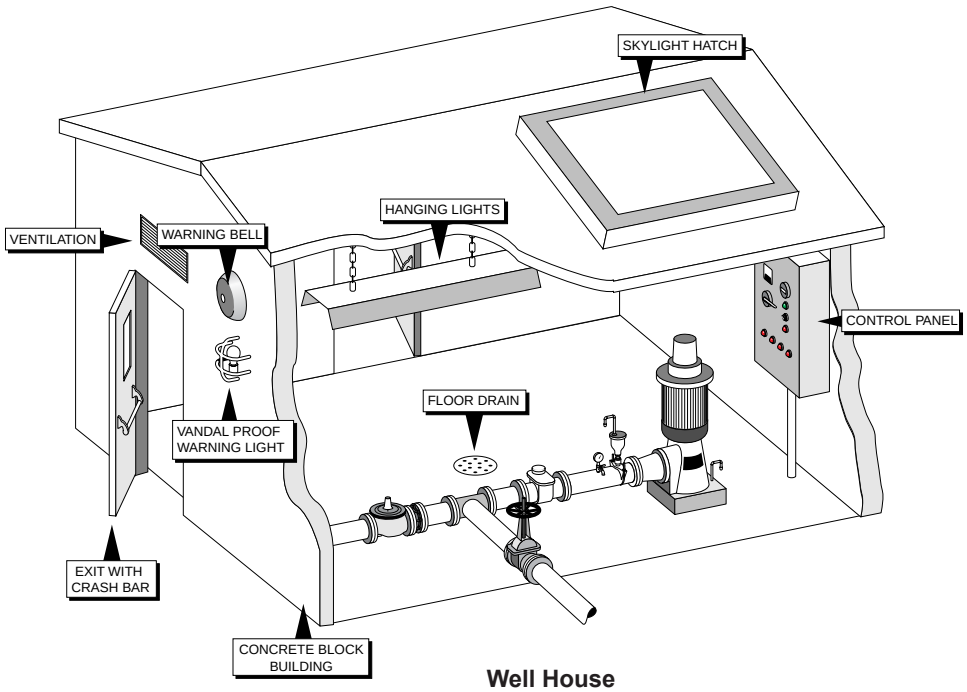
1. Is security adequate?
2. Is the building and equipment protected from flooding?
3. What is the structural condition of the building?
4. Is heating, ventilation, and lighting adequate?
5. Can equipment be accessed for maintenance and removal from the building?
6. Is the building orderly and clean?
7. Is the pumping station also used for storage?
8. Is safety equipment adequate?

VII-1

# Pumps - Pump Facilities and Controls

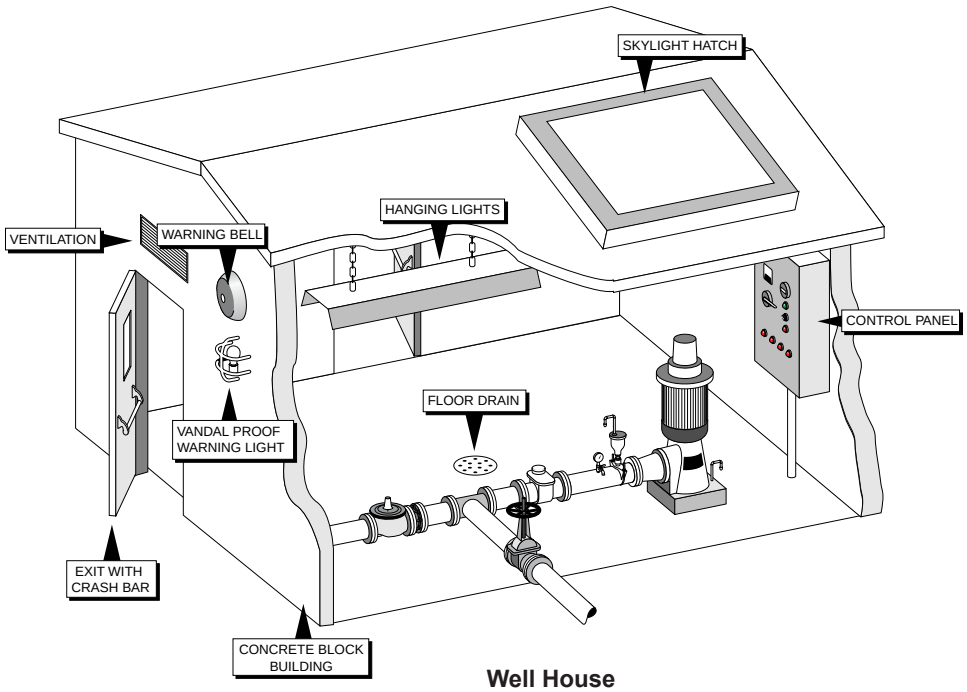
## The Pumping Station/Well House

1. Is security adequate?
2. Is the building and equipment protected from flooding?
3. What is the structural condition of the building?
4. Is heating, ventilation, and lighting adequate?
5. Can equipment be accessed for maintenance and removal from the building?
6. Is the building orderly and clean?
7. Is the pumping station also used for storage?
8. Is safety equipment adequate?




**Well House**






**Well House**

VII-2

## Pumps and Motors

1. What is the number (including reserves), location and type of pumps?
2. Is the actual capacity of the pumping facility adequate to meet the demand?
3. When and how is pump capacity determined?
   - Drawdown Measurements
4. What is the condition of the equipment?
   - ALL units operable
   - Excessive noise/vibration/heat/odors
   - Leaking water
   - Dirt / grime
   - Leaking lubricant
5. Are the correct types of lubricant used?
6. Is the frequency & amount of lubrication adequate?

VII-3

## Pumps and Motors

1. What is the number (including reserves), location and type of pumps?
2. Is the actual capacity of the pumping facility adequate to meet the demand?
3. When and how is pump capacity determined?
   - Drawdown Measurements
4. What is the condition of the equipment?
   - ALL units operable
   - Excessive noise/vibration/heat/odors
   - Leaking water
   - Dirt / grime
   - Leaking lubricant
5. Are the correct types of lubricant used?
6. Is the frequency & amount of lubrication adequate?

## Appurtenances

1. Are the pumping systems equipped with:

   a. check valves?

   b. isolation valves?

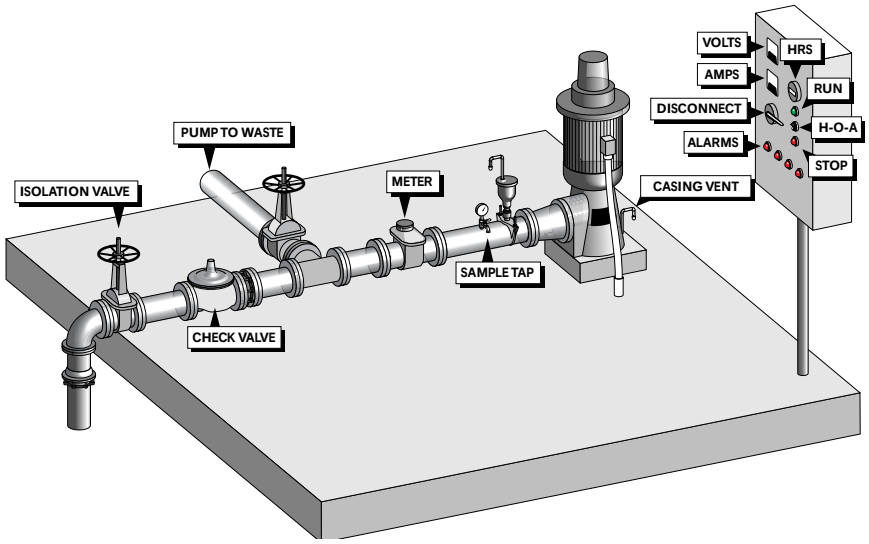
   c. pressure gauges?

   d. flow meter?

   e. blow-off line

   f. air/vacuum relief valve?

2. Are there any cross-connections present?




## Controls

1. Are the motor control systems...

   a. adequately designed and reliable?

   b. equipped with adequate failure alarm system?

   c. equipped with fail-safe devices?



## Appurtenances

1. Are the pumping systems equipped with:

   a. check valves?

   b. isolation valves?

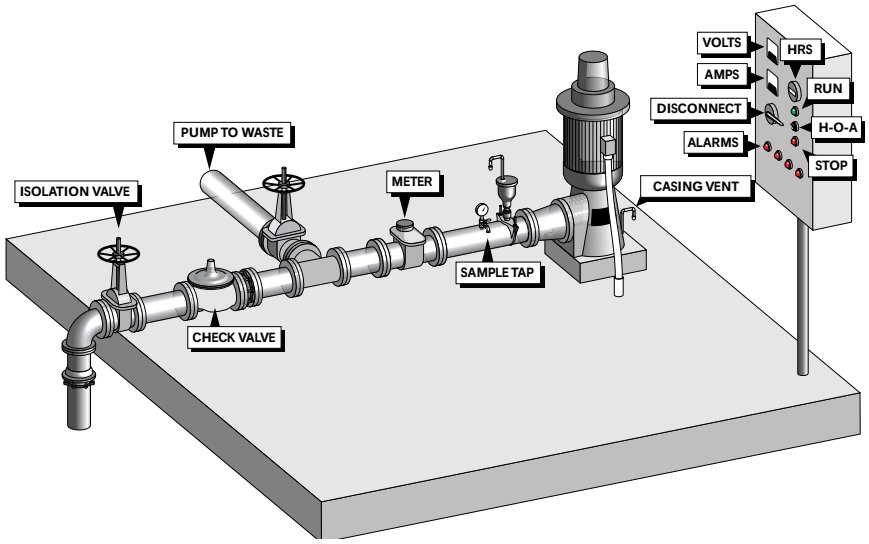
   c. pressure gauges?

   d. flow meter?

   e. blow-off line

   f. air/vacuum relief valve?

2. Are there any cross-connections present?




## Controls

1. Are the motor control systems...

   a. adequately designed and reliable?

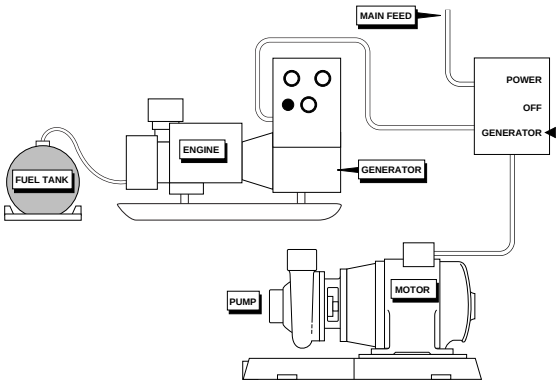
   b. equipped with adequate failure alarm system?

   c. equipped with fail-safe devices?

d. equipped with elapsed time meters (ETMs)

e. adequately protected?

f. adequately maintained?




## Safety

1. Is rotating and electrical equipment provided with protective guards

   (Note: While conducting the sanitary survey, the inspector should not wear loose clothing or neckties.)

## Auxiliary Power

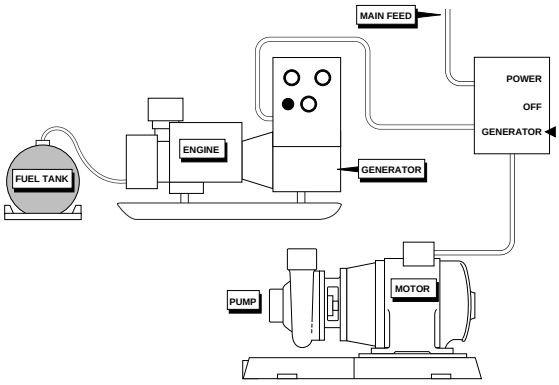
1. Is auxiliary power needed and if so, is it provided?
2. What type of auxiliary power is provided and how is it activated?
3. Does the auxiliary power unit supply <u>all</u> electrical systems at the pumping station?
4. Where is the fuel tank located?
5. Is the auxiliary power unit exercised, tested regularly and properly?
6. Is the auxiliary power unit maintained, in good condition, and secure?
7. Are there any cross connections between the auxiliary power and potable water?

VII-5

d. equipped with elapsed time meters (ETMs)

e. adequately protected?

f. adequately maintained?




## Safety

1. Is rotating and electrical equipment provided with protective guards

   (Note: While conducting the sanitary survey, the inspector should not wear loose clothing or neckties.)

## Auxiliary Power

1. Is auxiliary power needed and if so, is it provided?
2. What type of auxiliary power is provided and how is it activated?
3. Does the auxiliary power unit supply <u>all</u> electrical systems at the pumping station?
4. Where is the fuel tank located?
5. Is the auxiliary power unit exercised, tested regularly and properly?
6. Is the auxiliary power unit maintained, in good condition, and secure?
7. Are there any cross connections between the auxiliary power and potable water?

## Operation and Maintenance

1. Is the number and skill level of the staff adequate for operating and maintaining the pumping facilities?
2. Are adequate operational records maintained for pumping facilities?
3. Are written standard operating procedures available and followed?
4. Is there an established and documented preventative maintenance (PM) program?



## Operation and Maintenance

1. Is the number and skill level of the staff adequate for operating and maintaining the pumping facilities?
2. Are adequate operational records maintained for pumping facilities?
3. Are written standard operating procedures available and followed?
4. Is there an established and documented preventative maintenance (PM) program?

VII-6

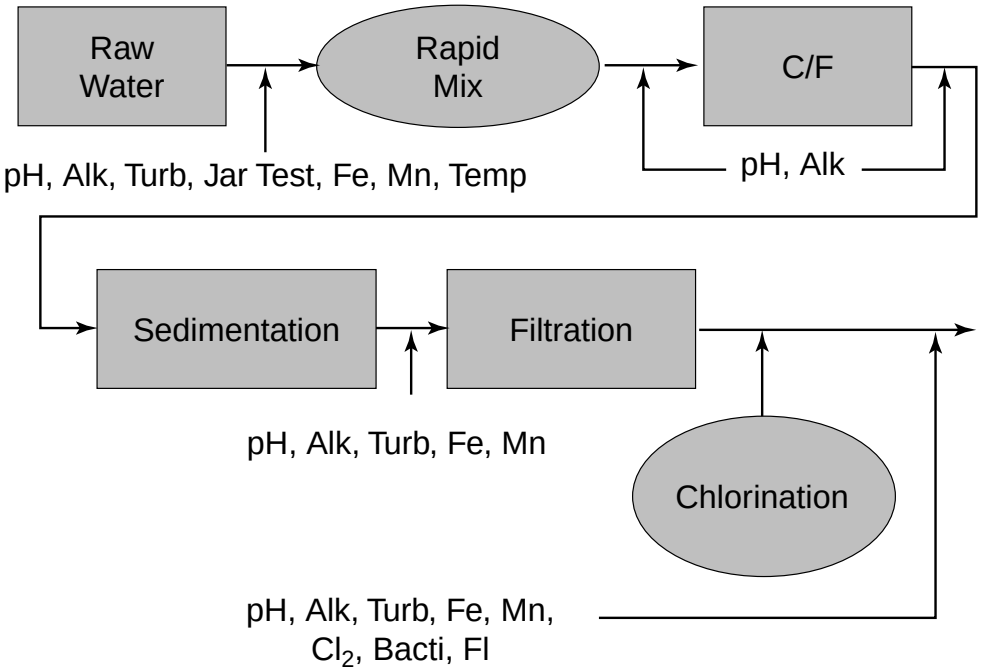
# Monitoring & Lab Testing

1. Is adequate monitoring in place?
2. Is the operator following proper procedures?
3. Are testing facilities and equipment adequate?
4. Are records of the monitoring program adequately maintained?
5. Does the operator chart the results?
6. Are treatment adjustments made based on lab results?
7. Are certified laboratories utilized when required?

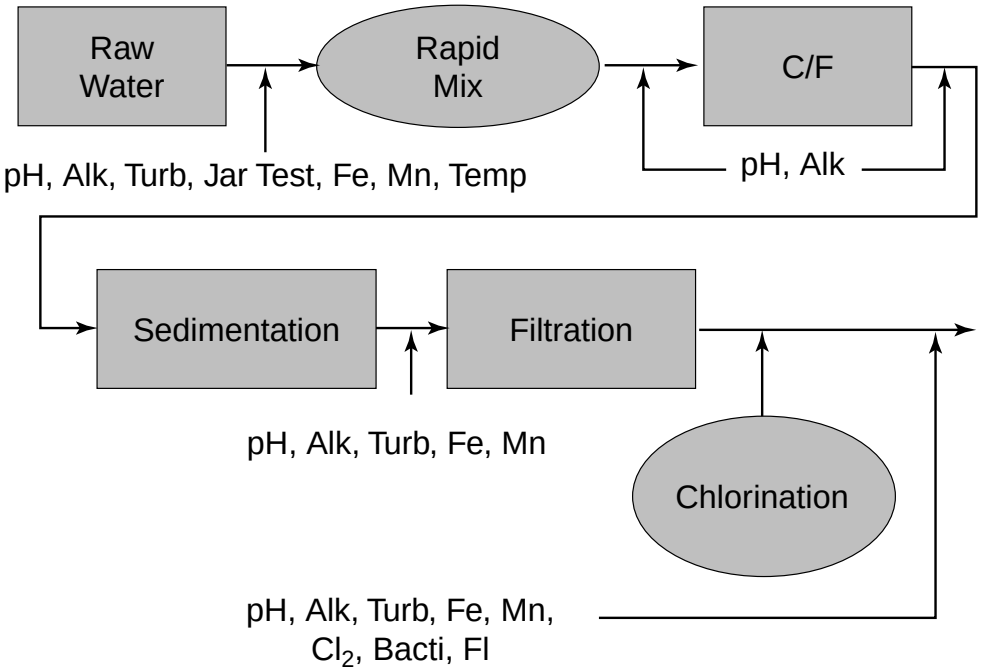
VIII1


# Monitoring & Lab Testing

1. Is adequate monitoring in place?
2. Is the operator following proper procedures?
3. Are testing facilities and equipment adequate?
4. Are records of the monitoring program adequately maintained?
5. Does the operator chart the results?
6. Are treatment adjustments made based on lab results?
7. Are certified laboratories utilized when required?


Raw Water
Rapid Mix
C/F
pH, Alk, Turb, Jar Test, Fe, Mn, Temp
pH, Alk
Sedimentation
Filtration
pH, Alk, Turb, Fe, Mn
Chlorination
pH, Alk, Turb, Fe, Mn,
$Cl_2$, Bacti, Fl

VIII2


Raw Water
Rapid Mix
C/F
pH, Alk, Turb, Jar Test, Fe, Mn, Temp
pH, Alk
Sedimentation
Filtration
pH, Alk, Turb, Fe, Mn
Chlorination
pH, Alk, Turb, Fe, Mn,
$Cl_2$, Bacti, Fl

VIII2

# Management

## Organization

### Administration

1. Is there a formal organizational chart?
2. Do operating staff have authority to make required operation, maintenance, and/or administrative decisions affecting plant performance and reliability?
3. Are administrators familiar with SDWA requirements and system needs?
4. Is there a formal and adequate planning process?

### Information Management

1. Does the utility manage its information?
2. Does the utility track and identify typical operating parameters such as:Unaccounted for water, Cost per unit of production of water.
3. Does the utility track finances, operational data and maintenance practices on a computer?

IX-1

# Management

## Organization

### Administration

1. Is there a formal organizational chart?
2. Do operating staff have authority to make required operation, maintenance, and/or administrative decisions affecting plant performance and reliability?
3. Are administrators familiar with SDWA requirements and system needs?
4. Is there a formal and adequate planning process?

### Information Management

1. Does the utility manage its information?
2. Does the utility track and identify typical operating parameters such as:Unaccounted for water, Cost per unit of production of water.
3. Does the utility track finances, operational data and maintenance practices on a computer?

### Communication

1. Is there effective communication between key management staff, operations staff and the state enforcement agency?
2. What is the level of cooperation between the system and other agencies and organizations?
3. What is the level of cooperation between the system and the local fire department?

## Planning

### Emergency/Contingency Planning

1. Is an emergency plan available and workable?
2. Are written, workable plans available for the areas listed below?
   - Source Protection
   - Sampling & Monitoring
   - Emergency/Contingency
   - Cross Connection Control
   - Repair, Replacement & Future Expansion



### Communication

1. Is there effective communication between key management staff, operations staff and the state enforcement agency?
2. What is the level of cooperation between the system and other agencies and organizations?
3. What is the level of cooperation between the system and the local fire department?

## Planning

### Emergency/Contingency Planning

1. Is an emergency plan available and workable?
2. Are written, workable plans available for the areas listed below?
   - Source Protection
   - Sampling & Monitoring
   - Emergency/Contingency
   - Cross Connection Control
   - Repair, Replacement & Future Expansion

# Personnel

## Staffing

1. Are there sufficient personnel?
2. Is the staff qualified?
3. Are personnel adequately trained?

# Safety Program

1. Have the operators been adequately trained in safety procedures and equipment?
2. Has the utility complied with the safety requirements as proscribed by OSHA?
3. Does the utility have a good safety record?

IX-3

Personnel

Staffing

1. Are there sufficient personnel?
2. Is the staff qualified?
3. Are personnel adequately trained?

Safety Program

1. Have the operators been adequately trained in safety procedures and equipment?
2. Has the utility complied with the safety requirements as proscribed by OSHA?
3. Does the utility have a good safety record?

## Operations

### Operating Procedures

1. Is there an overall operations and maintenance (O&M) manual for the facility?
2. Has a program of standard operating procedures (SOPs) been implemented at the facility?

### Facilities & Equipment

1. Are there sufficient facilities to store parts inventory, equipment, vehicles, traffic control devices and supplies?
2. Are there adequate facilities for the personnel of the system?
3. Are the facilities and equipment of the system adequate?

## Finance

1. Are the financing and budget satisfactory?
2. Are funds focused in the correct direction?
3. Are there sufficient funds for staff training?
4. Does the system have a water conservation policy or program?



## Operations

### Operating Procedures

1. Is there an overall operations and maintenance (O&M) manual for the facility?
2. Has a program of standard operating procedures (SOPs) been implemented at the facility?

### Facilities & Equipment

1. Are there sufficient facilities to store parts inventory, equipment, vehicles, traffic control devices and supplies?
2. Are there adequate facilities for the personnel of the system?
3. Are the facilities and equipment of the system adequate?

## Finance

1. Are the financing and budget satisfactory?
2. Are funds focused in the correct direction?
3. Are there sufficient funds for staff training?
4. Does the system have a water conservation policy or program?