PENNSYLVANIA

- **Reference Guide for Inspecting Public Water Systems**

REFERENCE GUIDE FOR INSPECTING PUBLIC WATER SYSTEMS

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Reference Guide For Inspecting
Public Water Systems

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FOREWARD

This reference guide was developed for the purpose of assisting Safe Drinking Water Program staff in the Pennsylvania Department of Environmental Resources. With the increasing complexity of federal regulations and the varieties of treatment needed for compliance, a guide was necessary to ensure consistent, detailed assessment of source, treatment and distribution facilities. While no reference guide contains all components of a public water system, this guide includes some of the most common inquiries into physical conditions, operation, maintenance and administration. While using the guide, the facility inspector needs to keep two questions in mind:

1) Is the problem (or potential problem) resulting in a real impact on the performance of the water system, and thus compromising public health protection?

2) Is the problem a violation of the Pennsylvania Safe Drinking Water Regulations (which would again entail public health protection)?

Every public water system will have some problems that, in an ideal world, should be corrected. However, in recognition of time constraints and limited resources of the water system and the facility inspector, those problems resulting in a "YES" to either of these questions will increase the priority schedule for correction. Nevertheless, it is anticipated that priorities will shift due to new or modified regulations and changing time constraints, thus initiating frequent revisions of this reference guide.

Reference Guide for Inspecting Public Water Systems

A. Source Water and Facilities

1. *Watershed Characteristics*

Are all of the following items (a - f) documented in records, and do any of them adversely impact water quality or quantity of the source water?

a. Area of watershed or recharge area

b. Stream flow

c. Land uses (e.g. forested, agriculture, rural housing, recreation, commercial, industrial, etc.)

d. Degree of public access to the watershed or recharge area

e. Terrain, soil type, and geology

f. Types of vegetation and extent of cover

2. *Contamination and Adverse Activities*

Do any of the following items (a - q) in the watershed or recharge area adversely impact (actual and potential) water quality or quantity of the source water?

a. Point discharges of sewage, stormwater or other wastewater

b. Single and multiple family sewage disposal systems

c. Recreation (swimming, boating, fishing, hunting, etc.)

d. Human habitation

e. Pesticide/herbicide/fertilizer application

f. Logging

g. Commercial, industrial or manufacturing activity

h. Solid waste or other disposal facilities, including landfills, hazardous waste, waste tailings, etc.

i. Materials storage, transport or transfer, including hazardous materials storage, road salt stockpiles, road/rail/barge transport with spill potential, transfer stations, manure pits, etc.

j. Above and below ground storage tanks and pipelines

k. Mining operations and discharges

l. Injection and productions wells (oil, gas, water, etc.)

m. Livestock and other concentrated domestic animal activity

n. Agricultural activities such as grazing, tillage (erosion), concentrated manure areas, chemical applications, etc.

o. Turbidity fluctuations from precipitation

p. Inorganic contaminants from parent materials (e.g. asbestos fibers)

q. Algae blooms

3. ***Watershed Management and Source Protection***

a. Surface and Ground Water

1) If the public water system does not own the entire watershed or recharge area, have written agreements been made with other land owners to satisfactorily control the land uses?

2) Is the public water system making efforts to obtain as complete ownership of the watershed or recharge area as possible? Is effort directed to control critical adverse impacts on the source?

3) Where access is limited, is the watershed or recharge area regularly inspected for new potential and actual sources of contamination?

4) Does the water system employ adequately qualified personnel to identify watershed and water quality problems? Who is given responsibility to correct these problems?

5) Are raw water quality records kept to assess trends and to assess the impact of different activities and contaminant control techniques in the watershed or recharge area?

6) Has the water system responded adequately to concerns expressed about the source or watershed/recharge area in past inspections and sanitary surveys?

7) Has the water system identified problems in its yearly watershed control reports, and if so, what progress has been made in solving these problems?

8) Does the water system actively interact with other

agencies that have control or jurisdiction in the watershed or recharge area? Are their policies or activities consistent with the water system's goal of maintaining high raw water quality?

9) Does the water system actively initiate corrective measures to improve raw water quality (e.g. copper sulfate treatment to control aquatic growth, vegetation control around reservoir shorelines, etc.)?

b. Ground Water

1) In addition to the above management practices and protective measures (items 1 - 9), has the water system formally delineated a wellhead protection area for each well? Is it being implemented?

2) Is a protective radius of 100 feet established around each well? How is it controlled?

3) Are any contaminant sources within a zone of 100 feet?

4) Is the source protected from rapid shifts in water quality characteristics during heavy precipitation events? Is infiltration occurring from a nearby surface source?

5) Do any man-made features (e.g. abandoned wells, roadcuts, etc.) within 200 feet of the source expose the aquifer to direct surface water infiltration? Does the topography, or depth of weathering, within 200 feet expose the source?

6) Is the well located in a carbonate aquifer and does it have a static water level of 50 feet or less? If in an unconfined aquifer, does the well have a static water level of 100 feet or less? If in a confined aquifer, does it have a static water level of 50 feet or less?

7) During a pump test, is the well's recharge boundary within 200 feet of a surface water body?

4. ***Source Construction***

a. Surface Intakes

1) Is the source adequate in quantity?

2) Is the best quality source, or location of the source, in use?

3) Is the intake protected from icing problems?

4) Can intake levels be varied to obtain the best water quality?

5) Is the intake screened to prevent entry of debris, and are the screens maintained?

6) Is animal activity controlled within the immediate vicinity of the intake?

7) Is a raw water tap available for routine monitoring?

b. Wells

1) Is the source adequate in quantity?

2) Is the well properly cased and grouted? Is the casing capped and locked?

3) Is a well construction diagram available?

4) Is a raw water tap available for routine monitoring?

c. Springs, Infiltration Galleries, and Collectors

1) Is the source adequate in quantity?

2) Is the immediate source area adequately protected (fencing and locks), and is the area within 200 feet controlled?

3) Is the best construction used to capture the flow?

4) Are drains available to divert surface water from the vicinity of the source?

5) Is the collection structure of sound construction with no leaks or cracks?

6) Are the vents, overflow, and drain pipes screened?

7) Is the supply intake located above the floor and screened?

8) Is a raw water tap available for routine monitoring?

5. ***Source Equipment***

a. Are all intake pumps, booster pumps, and other pumps of sufficient capacity?

b. Does the design of the intake structure result in excessive clogging of screens, a buildup of silt, or passage of solids that damages downstream processes?

c. Are all pumps and controls operational and maintained properly?

d. Does the existence of high volume constant speed pumps cause undesirable hydraulic loadings on downstream unit processes?

e. Are check valves, blow-off valves, master meters, and other appurtenances operated and maintained properly?

f. Is emergency power backup with automatic start-up provided and is it checked regularly to ensure good working order?

g. Are underground compartments and suction wells waterproof?

h. Is the interior and exterior of the pumphouse in good structural condition and properly maintained?

i. Are there any safety hazards (electrical or mechanical) in the pumphouse?

j. Is the pumphouse locked and otherwise protected against vandalism?

k. Are water production records maintained at the pumphouse?

l. SOURCE EQUIPMENT MAINTENANCE PROGRAM (refer to Maintenance, Section E)

6. ***Sampling, Monitoring and Records***

(refer to Sampling, Monitoring and Records under Treatment, Section B)

B. Treatment

1. *Overall Facilities*

   a. Does the excessive age or poor physical condition of facilities adversely affect water quality delivered to consumers?

   b. Is hourly production within the design flow capacity of the treatment facilities?

   c. Do one or more of the following raw water quality characteristics (items 1 - 3) exceed what the facilities were designed for, or exceed what is thought to be tolerable, and degrade process performance?

      1) THM Precursors

      2) Turbidity

      3) Seasonal Variation

         Do seasonal variations such as change in temperature or high turbidity during spring runoff exist?

   d. FACILITY MAINTENANCE PROGRAM (refer to Maintenance, Section E)

2. *Presedimentation Basin*

   Does a deficient design cause poor sedimentation that results in poor plant performance (e.g. inlet configuration, size, type, or depth of the basin; or placement or length of the weirs)?

3. *Chemical Pretreatment*

   a. Are the appropriate type and amount of chemicals added?

   b. How does the operator determine proper chemical doses (e.g. jar tests, process monitoring results, streaming current monitor or zeta meter, visual observation of floc, historical performance data, etc.)?

   c. Are pH levels properly maintained after the coagulant is added (e.g. pH at 6.7 to 7.2 after alum addition or pH at 7.0 to 8.8 after ferric chloride/sulfate addition)?

   d. Are sufficient alkalinity levels maintained after the coagulant is added (generally greater than 20 mg/l)?

   e. Do chemical feed facilities have various feed points to optimize treatment (e.g. feed coagulants and cationic

polymers at rapid mix, feed non-ionic or anionic polymers at points where mixing is gentle)?

f. Do facilities exist to feed the types of chemicals required to produce a high quality stable finished water (e.g. coagulant aids, flocculant aids, filter aids, stabilization chemicals)?

g. Do chemical feed facilities provide adjustable feed ranges that are easily set for operation at all required dosages?

h. Do chemical feed controls remain set once adjusted or do they vary?

i. Are chemical feed rates easily measured, and are chemical feed facilities calibrated at least once every six months?

4. ***Rapid Mix***

Does a lack of mixing or inadequate mixing result in excessive chemical use or insufficient coagulation to the extent that it impacts plant performance?

5. ***Flocculation***

a. Does the performance of the flocculation unit process contribute to problems in downstream unit processes and eventually degrade plant performance?

b. Does a lack of flocculation time or flocculation stages with variable energy input result in poor floc formation and degrade plant performance?

c. Is a floc formed and does it settle at an appropriate location?

6. ***Sedimentation***

a. Does a deficient design cause poor sedimentation that results in poor filter performance (e.g. inlet configuration, size, type, or depth of the basin; or placement or length of the weirs)?

b. Do design problems or other problems (e.g. high flow rates) lead to short-circuiting?

c. Is sludge removed often enough to prevent short-circuiting?

d. Does the type or capacity of sludge disposal and treatment processes cause process operation problems that degrade plant performance? Are sludge facilities of sufficient size and type to ensure that poor plant performance does not occur, or that applicable permits regulating the discharge are not violated?

7. *Filtration*

a. Does excessive filter run time between backwashes lead to a degradation in filter effluent quality?

b. What criteria (e.g. headloss, time or turbidity, or all three) is used to determine when to backwash a filter?

c. Is the backwash time long enough and backwash rate (usually 15 gpm/sq ft) high enough to adequately clean the media? Are mudballs and mud accumulation apparent?

d. Is the backwash even throughout the filter bed (e.g. no media boils or dead spots)?

e. Are the surface wash and backwash facilities adequate to maintain a clean filter bed?

f. How severe are post-backwash turbidity spikes? Does the lack of filter-to-waste (rewash) facilities, or lack of use, result in high on-line turbidity spikes?

g. How quickly does the filter effluent return to the pre-backwash turbidity levels?

h. Does the size of filter, or the type, depth and effective size of filter media hinder its ability to adequately treat water?

i. Have the underdrains or support gravels been damaged or disturbed to the extent that filter performance is compromised?

j. Does the lack of functional filter appurtenances (e.g. headloss gauges, rate-of-flow controllers, etc.) result in degraded filter effluent quality?

k. Are the backwash waste facilities and disposal area of sufficient size and type to ensure that poor plant performance does not occur, or that applicable permits regulating the discharge are not violated?

8. *Disinfection*

a. Is the disinfection equipment appropriate for the application (e.g. correct equipment for chloramines, liquid or gas chlorine, ozone, chlorine dioxide)?

b. Are back-up units available in case of failure, and are they operational?

c. Is auxiliary power available with automatic start-up in case of power outage? Is it tested and operated on a regular basis, both with and without load?

d. Is an adequate quantity of disinfectant on hand and is it properly stored?

e. In the case of hypochlorinators, does an excessive amount of scale buildup on feeder valves result in a failure to properly feed the solution?

f. In the case of gaseous chlorine, is automatic switch-over equipment available when cylinders expire?

g. Are scales available and operational?

h. Are chlorine cylinders properly labeled and chained?

i. Are critical spare parts on hand to repair disinfection equipment?

j. Is disinfectant feed proportional to the water flow?

k. Are daily records kept of disinfectant residual near the first customer from which to calculate CT values?

l. Are production records maintained to determine CT values?

m. Are year-round CTs acceptable based on the level of treatment provided?

n. Does prechlorination cause excessive finished water disinfection by-products?

o. Is the proper disinfectant residual maintained at the entry point and in the distribution system, and are records kept of daily or continuous measurements?

p. Is the system in compliance with all disinfectant and disinfectant by-products monitoring requirements?

q. If gas chlorine is used, are the following safety precautions (items 1 - 5) being followed to ensure the safety of both the public and employees in the event of a chlorine leak?

    1) Is the exhaust fan operational, and is an intake located within six inches of the floor?

    2) Is a self-contained breathing apparatus available, and is it regularly tested?

    3) Is regular safety training provided to employees?

    4) Are automatic chlorine leak detectors available, or ammonia bottles?

    5) Are windows provided to view the chlorine room's interior?

9. *Fluoridation*

   a. Are the minimum and maximum fluoride doses based on the proper annual average of the maximum daily air temperatures?

   b. Do excessive natural fluoride levels in the raw water lead to high finished water fluoride levels?

   c. Does the lack of chemical feeder calibration, lack of flow-paced feed, or lack of a means to check feeder output lead to improper fluoride doses?

   d. Does the lack of continuous monitoring equipment and alarms result in excessive finished water fluoride levels?

   e. Do improper sodium fluoride bed depths (i.e. typically 6 to 10 inches is proper) in the saturator cause improper treatment?

   f. Does excessive hardness (i.e. over 75 mg/l) of the dilution water result in scaling in the equipment and feed lines?

   g. Does the lack of routine cleaning and maintenance result in equipment failure?

   h. Is the system in compliance with all fluoride monitoring requirements?

   i. Is safety equipment available, including goggles or face shield, gloves, apron, respirator, eye wash station, safety shower, exhaust fan/dust collector?

10. *Phosphate Treatment*

   a. In the case of sequestration, do iron and manganese levels (i.e. more than 0.1 mg/l and 0.3 mg/l, respectively) limit the phosphate's ability to adequately sequester these metals?

   b. For sequestration, is chlorine added <u>after</u> (downstream of) the addition of the phosphate?

   c. Are phosphate solutions used within 48 hours?

   d. Is enough free chlorine (i.e. 0.2 mg/l) maintained throughout the distribution system to prevent growth of iron bacteria?

   e. Does the phosphate treatment result in phosphorous levels that lead to excessive bacterial growths in the distribution system?

   f. Do phosphorous levels cause the wastewater treatment plant to violate the discharge limit?

11. *Ion Exchange*

a. Synthetic Zeolites

1) Does the source water contain any dissolved oxygen that can foul the resins with insoluble iron, rust or manganese dioxide?

2) Does infrequent regeneration with brine solution lead to occasional breakthrough of contaminants?

3) Do high concentrations of raw water contaminants prevent full removal by regeneration?

4) Do high raw water concentrations of hardness (e.g. over 350 mg/l) or total dissolved solids (e.g. over 500 mg/l) lead to excessive leakage into the finished water?

5) Is the backwash of sufficient duration and flow to adequately expand media (e.g. 75 to 100%) for solids and contaminant removal?

6) Do inadequate brine concentrations (e.g. less than 10% sodium chloride solution) lead to excessively long contact times for successful regeneration? Do high brine concentrations (e.g. 15 to 26%) result in osmotic shock on the ion exchange resin?

7) Do inadequate rinse cycles lead to noticeable salty tastes when the unit is returned to service?

8) Does the overall ion exchange process lead to excessive levels of sodium in the finished water?

9) Is the brine solution disposed of in an approved manner?

b. Greensand Zeolite

1) Do the source water contaminant concentrations limit the efficiency of the greensand filters?

2) Do upstream processes (i.e. reaction basins) provide sufficient detention time for chemicals to react?

3) Does infrequent filter media regeneration with potassium permanganate lead to iron and manganese breakthrough?

4) Does the lack of process control testing (i.e. jar tests) result in incorrect doses of chlorine, potassium permanganate, alkalis, etc.?

12. *Aeration*

a. Dispersers, Cascade

1) Are the source water contaminant concentrations too high for aeration to work properly?

2) Does the lack of alkali addition (i.e. lime, sodium hydroxide, etc.) result in a reaction time that is too slow for oxidation to occur?

3) Are flow rates too high to allow enough time for oxidation reactions to occur?

4) Do insufficient disinfectant levels lead to excessive slime growths?

5) Do problems with freezing prevent the year-round practice of aeration?

6) Does the lack of covered units or unscreened vents lead to contamination from rain, stormwater runoff, rodents and insects? Are air gaps present to prevent backflow?

b. Counter-Current (Packed) Towers

13. *Reverse Osmosis (Membrane Filtration)*

a. Does improper feedwater quality adversely affect the reverse osmosis system and its accessory equipment?

1) Are excessive turbidity levels and suspended solids concentrations removed with cartridge filters?

2) Are pH values adjusted to proper ranges?

3) Are precipitating compounds (e.g. calcium carbonate, calcium sulfate, etc.) sequestered with sodium hexameta-phosphate to prevent scaling or fouling of the membrane?

4) If necessary, is the proper chlorine dose used to prevent excessive biological fouling?

b. Are differential pressures across the unit routinely checked to prevent possible damage to the reverse osmosis modules? Are pressures within the manufacturer's acceptable limits?

c. Does inadequate cleaning frequency, or improper use of cleaning solutions, hinder the performance of the membrane?

d. Do malfunctioning automatic controls and shutdown alarms lead to unacceptable operating conditions?

e. Is the reject stream disposed of in an approved manner?

14. *Sampling, Monitoring and Records*

a. Does the operator frequently measure and record the appropriate water quality parameters throughout the source, treatment, and distribution processes to determine and/or verify proper chemical treatment?

b. Is the operator performing the necessary testing for all water quality parameters?

c. Are samples collected as close to the sample sources as possible to prevent contamination from sample lines?

d. Are sample taps opened slowly and thoroughly flushed to prevent dislodged scale and other material from contaminating the sample?

e. Are samples preserved/fixed with the proper chemicals? Are analysis for metals completed within 48 hours, or otherwise acidified to a pH level of 2?

f. Does the absence or wrong type of process control testing cause improper operational control decisions to be made?

g. Does the operator correctly interpret and apply the monitoring results?

h. Are monitoring tests truly representative of performance?

i. Is the analytical equipment adequate and are the instruments properly and regularly calibrated? Is the shelf life of reagents expired?

j. Is the system in compliance with all treatment techniques and monitoring requirements for the source, treatment, and distribution processes?

k. Are records of water test results and water quality compliance results maintained?

15. ***Miscellaneous***

The "miscellaneous" category covers areas of inadequacy (mostly design oriented) that are not specified in the previous treatment categories.

a. Process Controllability

1) Do the existing process control features provide adequate adjustment and measurement of plant flow rate, backwash flow rate, and filtration rate?

2) Does the lack of needed automated monitoring or control devices (streaming current monitor, continuous

recording turbidimeters, etc.) cause excessive operator time for process control and monitoring? Does the automatic operation of critical unit processes degrade plant performance during start-up and shutdown?

b. Lack of Standby Units for Key Equipment

Does the lack of standby units for key equipment cause degraded process performance during breakdown or during necessary preventive maintenance activities (e.g. backwash pumps and chemical feeders, etc.)?

c. Flow Proportioning Units

Does inadequate flow proportioning or flow splitting to duplicate units cause problems or partial unit overloads that degrade effluent quality or hinder achievement of optimum process performance?

d. Alarm Systems

Does the absence or inadequacy of an alarm system for critical pieces of equipment or processes cause degraded process performance (e.g. raw or finished water turbidity)?

e. Alternate Power Source

Does the absence of an alternate power source cause problems in reliability of plant operation leading to degraded plant performance?

f. Laboratory Space and Equipment

Does the absence of an adequately equipped laboratory limit plant performance?

g. Sample Taps

Does a lack of sample taps on key process flow streams (e.g. individual filters, sedimentation basin solids, backwash recycle streams) for sampling prevent needed information from being obtained?

h. Plant Inoperability Due to Weather

Are certain units in the plant externally vulnerable to weather changes and, as such, do not operate at all or do not operate as efficiently as necessary to achieve the required performance? Do poor roads leading into the plant cause it to be inaccessible during certain periods of the year for chemical or equipment delivery or for routine operation?

i. Waste Recycle

Does excessive volume and/or a highly turbid return process flow stream (e.g. backwash waste water recycle flow) cause adverse effects on process performance, equipment problems, etc.? Does the inability to measure or sample these streams degrade plant performance?

C. Distribution System

1. *Storage*

a. Gravity

1) Are storage reservoirs covered and otherwise constructed to prevent contamination?

2) Are all overflow lines, vents, drain lines, or cleanout pipes turned downward and screened?

3) Are reservoirs inspected regularly?

4) Is the storage capacity adequate for the system, including fire fighting demands?

5) Do the reservoirs provide sufficient pressure throughout the system (e.g. no less than 20 psi)?

6) Are surface coatings within the reservoirs in good repair and acceptable for potable water contact?

7) Is the hatch cover for the tanks watertight and locked?

8) Can each reservoir be isolated from the system?

9) Is adequate safety equipment (e.g. caged ladder, OSHA approved safety belts, etc.) in place for climbing tanks?

10) Is the site fenced, locked or otherwise protected against vandalism?

11) Are storage reservoirs disinfected after undergoing repairs?

12) What is the scheduled cleaning program for removing sediments or slime growths on the floor and side walls?

13) Are provisions made for potential service interruptions resulting from power supply, equipment, or structural failures?

b. Hydropneumatic

1) Is the storage capacity adequate for the system, including fire fighting demands?

2) Are instruments, controls, and equipment adequate, operational and well maintained?

3) Are the interior and exterior surfaces of the pressure tank in good condition?

4) Are tank supports structurally sound?

5) Does the low pressure start-up provide adequate pressure throughout the entire system (e.g. no less than 20 psi)?

6) Is the pump cycle rate acceptable (not more than 15 cycles per hour)?

7) Are provisions made for potential service interruptions resulting from power supply, equipment or structural failures?

2. ***Pipes and Meters***

a. Do all construction materials meet AWWA or equivalent standards?

b. Is the appropriate pipe size and type used for the system conditions?

c. Are proper pressures and flows maintained at all times of the year?

d. Are all services metered and are meters read?

e. Are maps for the distribution system available and current?

f. Does the distribution system have an adequate maintenance program?

1) Is leakage evident in the system?

2) Is there a pressure testing program?

3) Is there a regular line flushing program?

4) Are valves and hydrants regularly exercised and maintained?

5) Are AWWA standards for disinfection followed after all repairs?

6) Are specific bacteriological criteria and limits prescribed for new line acceptance or following line repairs?

7) Is the system interconnected with other systems?

3. *Corrosion Control Program/Lead and Copper Rule*

a. Corrosion Control Program

1) Have customer complaint records been examined to evaluate distribution areas of discolored water, stained plumbing fixtures, pressure loss from scale build-up, or deterioration of household pipes/hot water heaters?

2) Have accurate corrosion indices (e.g. Langelier Saturation Index, Aggressive Index, etc.) been developed to predict corrosion?

3) Has an accurate, representative sampling plan been developed for a thorough corrosion monitoring program? Has the program isolated problem sections in the distribution system due to differences in pipe materials, pipe/tank linings, or water quality characteristics?

4) Is the best corrosion control treatment or combination of treatments in use (e.g. alkalinity and pH adjustment, calcium and hardness adjustment, or phosphate/silicate based corrosion inhibitor)?

5) Has the water system developed a means to evaluate an optimum corrosion control treatment plan (e.g. desk top evaluation, pipe rig/loop tests, metal coupon tests, partial system tests, etc.)?

b. Lead and Copper Rule

1) Has an accurate, representative sampling plan been developed for lead and copper monitoring?

2) Has the water system exceeded any action levels for lead and copper? If so, have the correct target public audiences received minimum education materials that are consistent with mandatory language?

3) Has the water system identified areas of lead pipe and lead service lines, and areas of lead solder used?

4) Is the system in compliance with all Lead and Copper Rule monitoring requirements?

4. *Cross-Connection Control*

a. Legal Authority

1) Has the water system adopted an ordinance that contains the necessary provisions and authority for eliminating and preventing cross-connections, including penalty provisions for non-compliance?

2) Have all municipalities served by the water system adopted an ordinance relating to cross-connections?

3) Where appropriate, has the PUC approved the ordinance?

4) Does the ordinance include the following items?

- purpose and general policy statement outlining the need for the program
- definitions of terminology used in the program
- technical requirements (materials specs, sizes, etc.)
- responsibilities of each party (customer, water system, testers, etc.)
- acceptable backflow prevention devices and their uses depending on degree of hazard
- requirements for testing/retesting installed devices
- qualifications for persons who install, test, and repair backflow prevention devices
- authority to enter premises to conduct inspections
- provisions on penalties or termination of service

b. Plumbing Standards

Has the water system adopted a nationally recognized plumbing code or developed its own plumbing standards that establish minimum requirements?

c. System Surveys and Plan Reviews

1) Has the water system implemented a program to survey existing customers and to approve new construction for determining the type of backflow prevention devices required?

2) Has the system surveyed and classified customers by degree of hazard?

3) Has the system established installation deadlines based on the degree of hazard?

4) Are plans for new service connections to the system under review for approval?

d. Installation Requirements

Has the water system established standards on acceptable cross-connection control procedures and how each device or

assembly is to be installed in the distribution system, including the following?:

- information on devices or assemblies acceptable to or required by the water system
- criteria on the type of devices required for each type or degree of hazard
- guidelines on the required installation procedures for each type of device
- minimum and maximum acceptable performance standards for each type of device
- guidelines on the required installation testing requirements
- qualifications standards for installers of devices

e. Testing and Maintenance

1) Has the water system adopted requirements covering the routine testing of each device?

2) Do these requirements clearly indicate who is responsible for the device's testing, repair or replacement?

3) Are testing and inspection procedures documented?

f. Record Keeping

Has the water system developed a system for maintaining records on the installation, repair and replacement of backflow prevention devices, including the following:?

- each customer's name, address, telephone number, and emergency contact person(s)
- each customer's commercial activities and types of potential water contaminants
- devices installed, size, make, model, and serial number(s)
- installation and testing dates and testing results
- name, address, and certification number of the person testing the device
- correspondences or notices sent to customers

g. Training

1) Has the water system established a training program for

system personnel, including concepts of backflow and backsiphonage, identification of cross-connections, and the measures to eliminate them?

2) How many persons have been assigned to administer the program?

3) Does the water system refer plumbers/customers to a tester certification program?

h. Public Information

1) Has the water system established program requirements for disseminating information to those affected?

2) Can the system provide copies of relevant state, federal and local regulations that apply to cross-connection?

3) Does the water system provide information on the precautions that should be considered when installing devices (e.g. thermal expansion, pressure differentials, and changes in flow, etc.)?

4) Is the system prepared to provide comments on the installation of fire suppression systems, irrigation systems, auxiliary sources, swimming pools, and other hazards?

i. Accident Response

Does the water system have an emergency response plan that includes the necessary guidance on how to respond to the contamination of the distribution system due to backflow or backsiphonage?

5. ***Total Coliform Rule Sampling***

a. Is an accurate, representative sampling plan available to meet requirements of the Total Coliform Rule?

1) Where in the distribution system are samples collected? Do the locations adequately represent the distribution system? Do they include the first service connection (or equivalent) and dead ends?

2) Who is collecting the samples?

3) When are samples collected?

4) Are the correct number of samples collected?

6. ***Sampling, Monitoring and Records***

(refer to Sampling, Monitoring and Records under Treatment, Section B)

D. Administration and Management

1. *Water System Administrators*

a. Policies

Do operating staff members have authority to make required decisions involving operation (e.g. adjust chemical feed), maintenance (e.g. hire electrician), and/or administration (e.g. purchase critical piece of equipment), or do policies cause critical decisions to be delayed, which in turn affects water system performance and reliability? Does any established administrative policy limit system performance (e.g. non-support of training, or system funding too low because of emphasis to avoid rate increases)?

b. Familiarity with Water System Needs

Do administrators have a first-hand knowledge of needs through water system visits or discussions with operators? Are they adequately trained, educated and/or certified? If not, has this been a cause of poor system performance and reliability through poor budget decisions, poor staff morale, or limited support for system modifications?

c. Supervision

Do management styles, organizational capabilities, budgeting skills, or communication practices at any management level adversely impact the water system to the extent that performance is affected?

d. Planning

1) Do administrators regularly summarize both current and long-term problems in the water system and define how they intend to solve the problems? Is their planning mechanism effective and do they follow through with plans?

2) Does lack of long-range plans for facility replacement, alternative source waters, emergency response, etc. adversely impact system performance?

e. Violations

Does the long-term inability of the system to comply with all applicable MCLs or monitoring requirements result in extra burdens on water system personnel?

f. Water Demand

Does excessive water use caused by a declining rate structure, concessions to industry, or high unaccounted-for use exceed the capability of treatment unit processes and, therefore, degrade system performance?

g. Safety

Have administrators instituted a safety training and education program regarding specific work environments, tools and equipment, and is it reinforced with regular meetings, literature and supervisor oversight?

2. ***Water System Staff***

a. Manpower

1) Number

Does a limit to the number of people employed have a detrimental effect on water system operations or maintenance (e.g. not getting the necessary work done)?

2) Insufficient Time on Job

Does the short time on the job and associated unfamiliarity with water system needs result in the absence of adjustments or in improper adjustments being made (e.g. opening or closing a wrong valve, turning on or off a wrong chemical feed pump, backwashing a filter incorrectly, etc.)?

3) System Coverage

Is water system coverage adequate to accomplish necessary operational activities? Can appropriate adjustments be made during the evenings, weekends or holidays? For example, is staff available to respond to changing raw water quality characteristics or emergencies during periods of operation?

4) Workload Distribution

Does the improper distribution of adequate manpower (e.g. a higher priority on maintenance tasks) prevent process adjustments from being made or cause them to be made at inappropriate times, resulting in poor water system performance?

5) Personnel Turnover

Does a high personnel turnover rate cause operation and/or maintenance problems that affect process performance or reliability?

b. Morale

1) Motivation

Does the water system staff want to do a good job because they are motivated by self-satisfaction?

2) Pay

Does a low pay scale or benefit package discourage more highly qualified persons from applying for operator positions or cause operators to leave after they are trained?

3) Work Environment

Does a poor work environment and/or numerous safety concerns create a condition for more "sloppy work habits" and lower operator morale?

c. Staff Qualifications/Certification

1) Aptitude

Does the lack of capacity for learning or understanding new ideas of critical staff members cause improper operation and maintenance decisions leading to poor system performance or reliability?

2) Level of Education

Does a low level of education result in poor operation and maintenance decisions? Does a high level of education cause staff to believe that needed training is unnecessary?

3) Water Treatment Understanding

Is the operator's lack of basic understanding of water treatment (e.g. limited exposure to terminology, lack of understanding of the function of unit processes, etc.) a factor in poor operational decisions and poor system performance or reliability?

4) Application of Concepts

Is the staff deficient in the application of their knowledge of water treatment and interpretation of process control testing such that improper process control adjustments are made?

5) Certification

Does the lack of adequately certified personnel result in poor operation and maintenance decisions?

6) Training and Technical Guidance

Does inattendance at available training programs result in poor process control decisions by the water system staff or administrators?

Does inappropriate operational information received from a technical resource (e.g. design engineer, equipment representative, state trainer or inspector) cause improper operational decisions to be implemented or continued?

3. ***Financial***

a. Insufficient Funding

Does the lack of available funds (e.g. inadequate rate structure) cause poor salary schedules, insufficient spare parts inventories that result in delays in equipment repair, insufficient capital outlays for improvements or replacement, lack of required chemicals or chemical feed equipment, etc.?

b. Unnecessary Expenditures

Does the manner in which available funds are utilized cause problems in obtaining needed equipment, staff, etc.? Are funds spent on lower priority items while more necessary, higher priority items are unfunded?

c. Bond Indebtedness

Does the annual bond debt payment limit the amount of funds available for other needed items such as equipment, staff, etc.?

4. ***O&M Manual/Procedures***

a. Adequacy

Does the Operation and Maintenance Manual contain at least the following (items 1 - 11):?

1) A description of the facilities.

2) An explanation of startup and normal operation procedures.

3) A routine maintenance program.

4) Records and reporting system.

5) Sampling and analyses program.

6) Staffing and training.

7) Sanitary survey program.

8) Safety program.

9) Emergency plan and operating procedures.

10) Manufacturer's manuals.

11) An interconnect, valve and blowoff exercise and testing program.

b. Use

Does the operator's failure to utilize a good O&M Manual/Procedures cause poor process control and poor treatment that could have been avoided?

Does inappropriate guidance provided by the O&M Manual/Procedures result in poor or improper operation decisions?

c. Productivity

Does the water system staff conduct the daily operation and maintenance tasks in an efficient manner? Is time used efficiently?

5. ***Consumer Complaints***

a. Have administrators developed a policy for responding to and recording consumer complaints? Does the lack of adequate response adversely affect morale of water system personnel?

b. Does the lack of records lead to inadequate follow-up procedures and inability to determine trends?

c. Have administrators developed informational brochures, utility bill inserts, and other educational tools to inform consumers and avoid future complaints?

6. ***Emergency Response***

a. Is a comprehensive emergency plan of action available that includes response to equipment breakdown, loss of power, pipe/storage tank breaks or failures, vandalism, toxic spills, employee strikes, and natural disasters?

b. Do provisions include the following (items 1 - 7):?

1) Alternative sources of supply and reserve finished water storage capacity.

2) A list of organizational personnel and detailed descriptions of their responsibilities.

3) A plan for recovery operation.

4) Training programs for operators to carry out the plan.

5) A plan for local and regional coordination such as state agencies, police, and fire departments.

6) Communications procedures.

7) Protection for personnel, plant equipment, records, and maps.

c. Is the plan reviewed and updated at least annually?

E. Maintenance

1. *Preventive*

   a. Lack of Program

      Does the absence or lack of an effective scheduling and recording procedure cause unnecessary equipment failures or excessive downtime that results in water system performance or reliability problems?

   b. Spare Parts Inventory

      Does a critically low or nonexistent spare parts inventory cause unnecessary long delays in equipment repairs that result in degraded system performance?

2. *Corrective*

   a. Procedures

      Are procedures available to initiate maintenance activities on observed equipment operating irregularities (e.g. work order system)? Does the lack of emergency response procedures result in activities that fail to protect process needs during breakdowns of critical equipment (e.g. maintaining disinfectant or chemical feeds during equipment breakdowns)?

   b. Critical Parts Procurement

      Do delays in getting replacement parts caused by procurement procedure result in extended periods of equipment downtime?

3. *General*

   a. Housekeeping

      Does a lack of good housekeeping procedures (e.g. unkempt, untidy, or cluttered working environment) cause an excessive equipment failure rate?

   b. References Available

      Does the absence or lack of good equipment reference sources (maintenance portion of O&M Manual, equipment catalogs, etc.) result in unnecessary equipment failure and/or downtime for repairs?

c. Staff Expertise

Does the water system staff have the necessary expertise to keep the equipment operating and to make equipment repairs when necessary?

d. Technical Guidance (Maintenance)

Does inappropriate guidance for repairing, maintaining, or installing equipment from a technical resource (e.g. equipment supplier or contract service) result in equipment downtime that adversely affects performance? If technical guidance is necessary to decrease equipment downtime, is it available and retained?

e. Equipment Age

Does the age or outdatedness of critical pieces of equipment cause excessive equipment downtime and/or inefficient system performance and reliability (due to unavailability of replacement parts)?

4. ***O&M Manual/Procedures***

(refer to O&M Manual/Procedures under Administration and Management, Section D)

REFERENCES

Substantial portions of the preceding reference guide were obtained from the following documents:

Renner, R.C., B.A. Hegg, J.H. Bender, E.M. Bissonette, Handbook - Optimizing Water Treatment Plant Performance Using the Composite Correction Program, EPA 625/6-91/027, U.S. EPA, Cincinnati, Ohio, February 1991.

Water Treatment Plant Operation, Vol. II, California State University, Sacramento, California, 1991.

Guidance Manual For Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources, Appendix K, U.S. EPA, Office of Drinking Water, Washington, D.C., March 1991.

APPENDIX B:

Guidance Table for Using Surveillance Forms

Department Activities	Forms		
	Inspection	Narrative	Inventory
*Full Inspection	x		?
New Violations Identified	x		
Follow-up/Progress Evaluation		x	
Inventory Update			x
Complaint Investigation		x	
On-site Consultation		x	
Office (phone contact, etc.)		x	
Emergency Response (no violations)		x	
Permit Related		x	

*use Water Supply Inspection Checklist as mnemonic tool

SECTION II

INSPECTIONS

Introduction

Under the requirements of Chapter 109, Safe Drinking Water Regulations (SDWR), the Department must conduct a first-time sanitary survey at all community water systems by June 29, 1994, followed by a sanitary survey frequency of once every three years. Department staff will conduct more frequent surveys or consultations if problems have been identified in the system. In years between surveys, staff should review the community water system's annual survey that is attached to the annual water supply report as a tool in assessing conditions of source, treatment and distribution facilities. At noncommunity water systems, the Department must conduct a first-time sanitary survey by June 29, 1999, followed by a sanitary survey frequency of once every ten years for protected groundwater systems and once every five years for all other noncommunity systems. For the purposes of the SDWR, the Department's inspection format as outlined in this strategy satisfies all sanitary survey requirements. Accordingly, inspection dates must be transferred into the Model State Information System to satisfy the Primacy agreement with the Environmental Protection Agency for sanitary survey frequency.

During the inspections, staff should review source, treatment and distribution facility conditions and operational control, focus on current and proposed regulatory information, and refer the water system to helpful organizations, groups, assistance programs and other public water systems. Staff should also determine if the water system's inventory forms require updating; the appropriate inventory forms should be on hand during inspections. Two inspection formats, one a routine inspection and the other a narrative report, are outlined below.

Inspection

Staff should conduct an inspection jointly with the facility operator and use a checklist (**Attachment 2A**) of specific items to review during the on-site assessment. The checklist serves as a mechanism to maintain consistency in the review process of facilities, but not as an inventory mechanism. Checklist items include an evaluation of surface and groundwater sources and their watersheds to substantiate possible reduced monitoring requirements and to maximize "use" and "susceptibility" waivers. The checklist also includes treatment facilities, along with finished water storage facilities and the distribution system. Other items to examine include operation and complaint records as well as support documents (emergency response plans, cross connection control plans, etc.). An inspection should

also entail on-site measurements of water quality parameters to verify proper facility operation, compliance with regulations, or to cross-check facility monitoring equipment.

Staff should refer to the document, "Reference Guide for Inspecting Public Water Systems" when inspecting water systems. The following references may also serve as useful tools for conducting an inspection:

a. Permit
b. Prior Department inspection reports or inventory forms
c. Filter plant performance evaluation report
d. Small systems outreach report
e. Annual water supply report
f. Annual public water system sanitary survey (in the annual water supply report)
g. Complaint reports
h. Emergency response plan
i. Cross connection control plan
j. Water quality analysis results
k. Water system distribution map
l. MSIS inventory and reports
m. Brief description form
n. Correspondences
o. Other reports or studies

In addition to documenting the review of a water system, the inspection form (**Attachment 2B**) also documents violations or problems that have been identified, and any necessary corrective actions. This documentation is especially critical to assist Field Operations staff in selecting a water system for more intensive surveillance efforts (see "Comprehensive Evaluations", Section III) or for additional follow-up activities. Staff should discuss an overview of inspection findings and violations with the water system operator prior to leaving the facility. Staff should complete the inspection form only in conjunction with a <u>full</u> inspection (i.e. review of source, treatment and distribution facilities) or when documenting new violations.

FREQUENCY: At community water systems, the Department must conduct an inspection at least once every three years. At noncommunity water systems, the Department must conduct an inspection at least once every ten years for protected groundwater systems and once every five years for all other noncommunity systems. More frequent inspections may be necessary at public water systems presenting a health risk to consumers.

DISTRIBUTION: The original inspection form is retained in the district office, and copies are provided to (1) the public water system and (2) the regional office (or county environmental health director). The completed checklist form is retained in the district office.

Narrative Report

A narrative report form (**Attachment 2C**) serves as a means to record other Department activities associated with a public water system. The goal of the narrative report is to demonstrate the water system's progress in resolving specific problems, especially violations or problems previously requiring enforcement action. Field Operations staff should include in the report any on-site consultations that were initiated as a result of problems previously identified in an inventory survey, inspection or comprehensive evaluation. Other items may include partial inspections, responses to consumer complaints, emergency response, the supplier's completion and updating of the annual water supply report and annual sanitary survey, transfer of regulatory information, training associated with the supplier, permitting activities such as source siting, pump tests and progress of construction, and office activities such as telephone consultations. The reason the narrative was completed should be clearly stated at the beginning of the form.

FREQUENCY: Staff should use discretion when deciding when or if an on-site follow-up consultation is necessary. However, staff should document all activities associated with a public water system by using a narrative report. The report should seek qualitative results (as opposed to a quantitative orientation), and should serve as a tool to achieve progress in correcting problems at a public water system.

DISTRIBUTION: The original is retained in the district office, and if necessary, copies are provided to the public water system.

PWS _____ DATE _____

WATER SUPPLY INSPECTION CHECKLIST

SURFACE WATER FILTRATION

SURFACE & GROUNDWATER SOURCES

01 Watershed/recharge area characteristics & changes
02 Contamination/adverse activities & changes
03 Watershed management/ wellhead protection efforts
04 Source construction & quantity satisfactory? Y N
05 Source equipment operational & maintained? Y N
*06 Date of last watershed survey by PWS? _____

OVERALL FACILITIES & MAINTENANCE

*10 Max. production rate _____GPM
Total production _____GPD
Operating time _____hours
Design capacity _____GPD/GPM
11 Are all facilities operational & in good physical condition? Y N
12 Maintenance program? Y N

DISINFECTION

20 Back-up units/parts available? Y N
21 Auxiliary power available? Y N
22 Stored quantity/proper storage of disinfectant? Y N
23 Auto switchover equipment? Y N
24 Flow proportioned feed? Y N
*25 Entry point residual/CTs maintained? Y N
26 Gas chlorine facilities & safety equipment adequate? Y N

OTHER TREATMENT

30 Chemical doses/solutions proper, equipment operational, monitoring adequate? Y N
31 Zeolite adequate for source water quality? Y N
32 Zeolite regeneration, backwash & rinse sufficient? Y N
33 Aeration adequate for source water quality? Y N
34 Flows/chemicals optimal for aeration? Y N
35 Reverse osmosis feedwater optimized? Y N
36 Reverse osmosis pressures proper? Y N

DISTRIBUTION SYSTEM

*50 Storage reservoirs protected? Y N
51 Storage reservoirs maintained? Y N
*52 Storage capacity adequate? Y N
*53 Pressure problems? Y N
*54 Distribution maps current? Y N
55 Adequate distribution system leak detection/flushing/ maintenance programs? Y N
*56 Lead & copper site sampling plan? Y N
57 Corrosion control inhibitor? _____
*58 Cross connection control plan? Y N
*59 TCR site sampling plan? Y N
*60 Adequate disinfection residuals maintained? Y N

MONITORING & RECORDS

*70 All monitoring requirements fulfilled? Y N
71 Proper sample collection procedures? Y N
72 Approved/appropriate analytical tests performed? Y N
73 Adequate/calibrated analytical equipment? Y N
75 Outdated reagents/ chemicals? Y N
74 Are results recorded properly? Y N

ADMINISTRATION & MANAGEMENT

*80 O&M plan & records updated? Y N
*81 Complaint records? Y N
*82 Emergency response plan? Y N
*83 Certified operator? Y N

MISCELLANEOUS

90 Corrective action(s)from previous surveys? Y N
91 Inventory update needed (list items)

CHEMICAL PRETREATMENT

100 Coagulant dose (mg/L) _____
Polymer dose (mg/L) _____
Pre-Cl_2 dose (mg/L) _____
Others? _____
101 How does the operator determi proper chemical doses? (jar test process monitoring, etc.)
102 Proper pH/alkalinity ranges? Y
103 Chemical feeders operational, ir good condition, & easily adjustable? Y N
104 Date of last chemical equipment calibration _____

FLOCCULATION & SEDIMENTATION

110 Flocculation time & facilities adequate? Y N
111 Floc formation & settling adequate? Y N
112 Short circuiting evident? Y N
113 Sludge disposed properly & ofte enough? Y N
114 Turbidity of settled water _

FILTRATION

120 Filtration rate (GPM/Ft^2) _____
121 Excessive filter run time? Y N
122 Criteria used to initiate backwas (time, turbidity, headloss)
123 Backwash rate & time adequate? Y N
124 Backwash uniform? Y N
125 Filter-to-waste after wash? Y N
*126 Turbidity when filter is put on lir _____
127 Filter media size, depth & condition adequate? Y N
128 Filter appurtenances functional? Y N
129 Backwash waste facilities adequate/permitted? Y N

* Potential Violations of 25 Pennsylvania Co Chapter 109

NOTE: Some problems may indicate the need for a specific water quality analysis (attach results)

WATER SUPPLY INSPECTION CHECKLIST

Check List #	Notes

Attachment 2B

COMMONWEALTH OF PENNSYLVANIA — DEPARTMENT OF ENVIRONMENTAL RESOURCES

WATER SUPPLY INSPECTION

FACILITY NAME	PWS ID #	COUNTY	MUNICIPALITY	INSPECTION DATE

CERTIFIED OPERATOR'S NAME	TELEPHONE NO	RESPONSIBLE OFFICIAL'S NAME	TYPE SYSTEM	POPULATION

FACILITY LOCATION/ADDRESS

FIELD ORDER # _____ ISSUE DATE _____

VIOLATIONS

A1.	Response to emergency		C1.	Design/construction standards	
A2.	Continuous disinfection		C2.	Performance monitoring	
A3.	Response to an acute violation		C3.	Failure to treat as permitted	
B1.	Inadequate supply		C4.	Operate and maintain PWS	
B2.	Minimum disinfection residual		C5.	Certified operator	
B3.	PMCL trt. technique violation		C6.	Improper interruption/repair	
B4.	Public notice for PMCL		D1.	Reports/Records/Maps	
B5.	Noncompliance with Order		D2.	Operation and maintenance plan	
B6.	Failure to obtain permit		E1.	Other	

INSPECTION TIME

START _____

STOP _____

NARRATIVE

WATER QUALITY SAMPLING POINT LOCATION	SAMPLE NUMBER	pH	CHLORINE		TURBIDITY				
			F	T	R	F			

RECEIVED BY (SIGNATURE AND DATE) | INVESTIGATOR (SIGNATURE AND DATE) | MSIS UPDATED | SUPV INITIALS

	VIOLATION	REGULATION REFERENCE
A1.	Failure to act in an emergency situation (includes: disease outbreaks, spills, unregulated contaminants).	109.4, .402
A2.	Failure to provide continuous disinfection (Disinfection must be done continuously; any breakdown is an imminent threat).	109.4 .202(c)(1) and (2)
A3.	Failure to respond to an acute violation (includes reporting to DER, public notification, investigation of cause and corrective measures for the following acute violations: nitrate MCL, turbidity exceeding 5 NTU, and MCL for total coliform with fecal coliforms present).	109.4, .401-.403
B1.	Failure to provide an adequate supply of water (includes: source, storage and distribution system inadequacies).	109.602, .603
B2.	Failure to provide acceptable minimum disinfection residual throughout the system.	109.710
B3.	PMCL or treatment technique violation (includes: filtration/turbidity violations).	109.202
B4.	Failure to issue public notice for a PMCL violation.	109.401, .403, .701(a)(4)
B5.	Failure to comply with an Order issued by the Department.	Section 13.(a) of Act 43 (SDWA)
B6.	Failure to obtain a permit, experimental permit, major permit amendment, or emergency permit.	109.501-.507
C1.	Failure to meet design and construction standards (additive for multiple violations).	109.602-.609, .611-.612
C2.	Failure to conduct performance monitoring for surface water systems.	109.301(1) and (2)
C3.	Failure to provide level of treatment as designed and permitted, failure to filter to waste.	109.703
C4.	Failure to operate and maintain the water system or implement O&M Plan.	109.4, .702
C5.	No certified operator or certified back-up.	109.701
C6.	Improper interruption and repairs, failure to disinfect facilities.	109.708, .711
D1.	Failure to maintain/submit: daily plant records, sample siting plan, water supplier complaint log.	109.701
	water supplier sanitary surveys.	109.705
	distribution map.	109.706
	emergency response plan.	109.707
D2.	No operation and maintenance plan.	109.702
E1.	Violations of other Safe Drinking Water Regulations (examples: SMCLs, unregulated contaminants, special monitoring, etc.)	

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REPORT SHEET
(Consultation, Narrative, etc.)

Attachment 2C

COMMONWEALTH OF PENNSYLVANIA — DEPARTMENT OF ENVIRONMENTAL RESOURCES

Facility Name	Prog. Code	Date	PWS No.	Permit/Lic. No.
Address		City, Boro, Twp.		County

Item No.

Received By (Signature and Date)

Investigator (Signature and Date)

Supervisor's Initials