**Section 900.40 Water System Design**

a) Siting Requirements. Construction, alteration or expansion of a public water system shall be accomplished so as to:

1) Avoid locating any or all of the facility at a site that is subject to undue risk from earthquakes, floods, or other disasters.

2) Except for the intake structures, avoid locating any or all of the facility within the floodplain of a 100-year flood.

3) Sources of pollution shall be located no closer to wells and finished water storage facilities than indicated in Table A. Beginning January 1, 1988, no new non-community water system well may be located within 200 feet of any potential primary or potential secondary source or any potential route, unless specifically allowed in Table A. When the owner of a potable well is the same owner of a potential primary source, potential secondary source, or a potential route, the Department may allow a variance to the minimum separation distances required in this Part provided the owner complies with the variance provisions of Section 920.30(c) of the Water Well Construction Code.

b) Existing Water System. The sanitary quality of an existing water system shall be determined by a survey of facilities and laboratory analyses of water samples. Defects in facilities or contamination shown present by laboratory analyses shall be considered sufficient grounds for requiring repairs, chlorination or other treatment, or termination of the use of the system. All repairs, modifications, and alterations to existing wells and pump equipment shall be in accordance with the Water Well Construction Code, the Illinois Plumbing Code, and the Illinois Water Well Pump Installation Code. Treatment will not be considered a substitute for location and construction in accordance with the Water Well Construction Code. Wells terminating in pits shall not be allowed. Existing pits shall be eliminated and the floor or one wall of the pit shall be broken or removed, the pit shall be filled with compacted earth, and the casing shall be extended to terminate 8 inches above grade.

c) New Well Construction. All new wells shall be constructed in accordance with the Water Well Construction Code.

d) New Pumping Equipment. All new well pumps shall be installed in conformance with the Illinois Water Well Pump Installation Code.

e) Surface Water. Gravity filtration and disinfection shall be provided as the minimum treatment facilities for all supplies obtained from ponds, lakes, streams, rivers, groundwater under the influence of surface water, and other surface collectors of water. Surface water supply treatment facilities shall be designed, constructed, operated, and maintained as described in the Surface Source Water Treatment Code or in accordance with the Ten States' Standards. Where average turbidity, based upon 30 daily samples, of the source exceeds 50 nephelometric turbidity units, complete treatment must be provided in accordance with the Ten States' Standards. All systems that use surface water, in whole or in part shall be operated by personnel who have taken a water treatment course approved by the Department and have received a certificate or other evidence that the course has been completed satisfactorily (such as a letter from the school), or shall be operated by personnel that have received certification from the Illinois Environmental Protection Agency as a Class A or Class B public water supply operator. The Department will approve a course if the course is given by an accredited college or university, is at least equivalent to .7 continuing education units, and addresses water filtration, disinfection, water supply, and the measurement of disinfectant residual and turbidity. The Department will make available a list of approved courses upon request.

f) Springs. Spring water supplies shall not be allowed except where it is impossible to develop a well that meets the water quality and capacity standards of this Part. Where springs are used for potable water, they shall be protected from entry of surface water, housed in a permanent structure, and chlorinated in accordance with subsection (n). Spring water supplies located in an area with sink-holes or outcropping rock, with a history of periodic discolored discharge, or subject to fecal contamination, as demonstrated by laboratory analysis, shall not be approved unless provided with treatment consistent with that required for surface water.

g) Cisterns. Cisterns shall not be used for public water supply except where groundwater resources will not produce the quantity of water needed for the population to be served. Cistern water shall receive treatment consistent with that required for surface water (see subsection (e)).

h) Design Capacity. The design capacity for a non-community public water system shall be determined based on the estimated peak demand or the average daily consumption rate obtained from Table B.

i) Hydropneumatic Storage. The minimum requirements for designing a hydropneumatic storage system are as follows:

1) Well and Pump Sizing. The capacity of the wells and pumps in a hydropneumatic system shall be at least eight times the average daily consumption rate or shall be sufficient to meet the estimated peak demand, whichever is greater. (Calculate the average daily consumption rate from Table B). If it can be shown that a specified amount of water is more appropriate, or if the Department can be shown that the storage requirements are excessive, the Department will permit other sizing alternatives dependent upon, but not limited to, water demand at the facility in question or water usage reports from a similar facility.

2) Pressure Tank Sizing. The minimum capacity of the pressure storage tank shall be calculated by the following formula:

Q = Qm(3)/Pf

Where:

QM = Pump capacity (g.p.m.)

Pf = Pressure factor obtained from TABLE C.

3) Precharged Pressure Tanks. The capacity of a precharge pressure storage tank shall be calculated by the following formula:

Qp = 1.50m/Pf

Where:

Qp = Precharged pressure tank volume, gal.

4) Existing Hydropneumatic Storage. An existing undersized pressure storage system may be allowed provided a history of adequate water supply exists. Major alterations shall comply with all requirements of subsection (i).

j) Storage Reservoir. All nonpressure underground reservoirs shall be constructed of permanently watertight material and shall be provided with a watertight insect-proof cover. Examples of permanently watertight materials are steel, plastic, concrete or fiberglass. On new water system installations, all nonpressure storage reservoirs in or on the ground shall be located in such a manner that surface water will flow away from the structure. When the bottom of any such reservoir is located below the ground surface, the reservoir shall be located with respect to sources of pollution as outlined in Table A. Where manholes are necessary, they shall have a raised curb and be provided with a cover of the overhanging type. Vents and openings shall be insect-proof and shall be installed so there is no hazard to the sanitary quality of the water supply. Piping shall enter the reservoir through the top of underground tanks or through the exposed vertical extension of the manhole opening. Points of entry must be sealed in a watertight manner. No suction lines may enter the reservoir underground unless protected by an external pipe enclosure maintained at system pressure.

k) Water Distribution Lines. The system shall be designed to maintain a minimum positive pressure of 20 p.s.i. in all parts of the system at all times. Water pipe shall conform to applicable specifications and standards of the Illinois Plumbing Code for the type of pipe to be used. The following shall govern the separation of water lines from possible sources of pollution:

1) Whenever possible, a water line shall be laid at least 10 feet horizontally from any existing or proposed sewer line.

2) Whenever water lines must cross sewers, the water line shall be laid at such an elevation that the bottom of the water line is 18 inches above the top of the sewer. This vertical separation shall be maintained for that portion of the water line located within 10 feet horizontally of any sewer or drain it crosses, with the 10 feet to be measured as the normal distance from the water line to the drain or sewer. The sewer shall be constructed of cast iron pipe, type K copper, or Drain, Waste and Vent (DWV) plastic pipe (Schedule 40) with water-tight joints for a distance of 10 feet from each side of the water line. All crossings shall be made at right angles.

3) Where conditions prevent the minimum horizontal and/or vertical separation specified in subsections (k)(1) and (2), special consultation shall be obtained from the Department to determine other routes of water piping. In all cases, construction shall meet the applicable provisions of Section 1150 of the Illinois Plumbing Code.

4) No water line shall pass through, or come into contact with, any part of a sewer manhole.

5) There shall be no physical connection between a community water system and a non-community or private water system, unless the non-community or private water system is in compliance with cross-connection requirements in subsection (l).

6) Lines for potable water shall be laid at least 25 feet horizontally from any underground sewage seepage field.

1) Plumbing Fixture Backflow Protection. The water supply lines shall have no physical connection with nonpotable water supplies. All plumbing shall be in accord with the Illinois Plumbing Code. All plumbing fixtures and other equipment connected to the water system shall be constructed and installed to safeguard the water system from the possibility of contamination through cross-connections or backsiphonage. Laundry units and equipment shall be so constructed and installed to prevent the contamination of the contents by the backflow of sewage. When required by the Illinois Plumbing Code, the fixture or appliance shall be connected indirectly with the drainage system by means of an open, funnel-type fitting with a suitable air gap.

m) Drinking Fountains. All outlets established for the provision of drinking water shall consist of drinking fountains in accordance with requirements contained in the Illinois Plumbing Code, or a supply of single service drinking cups shall be provided. Common drinking cups are prohibited.

n) Disinfection. Disinfection may be accomplished with calcium or sodium hypochlorites or gas chlorine. Other disinfecting agents will be considered, providing reliable application equipment is available, and testing procedures for residual are recognized in "Standard Methods for the Examination of Water and Wastewater". Proposals for use of disinfecting agents must be approved by the Department prior to preparation of final plans and specifications. Approval will be given only when the information shows that the chemical to be used as a disinfecting agent will not jeopardize the health of the user and that the chemical will eliminate bacteria from the water supply. Disinfection is required at all surface, spring, and cistern water supplies; and at any groundwater supplies that are of questionable sanitary quality or where any treatment that exposes the water to the atmosphere is provided. Disinfection shall not be a substitute for proper well location and construction.

1) Chlorination Equipment. The chlorinator shall be designed to provide a free chlorine residual of at least 2 milligrams per liter in the water after contact time of at least 30 minutes at maximum flow rates. The equipment shall be of such design that it will operate accurately over the desired feeding range. Where flow is uniform, actuation of a constant volume feeder by the pump circuit is required. Where flow is variable, automatic flow proportioning is required.

2) Contact Time and Point of Application. Chlorine shall be applied at a point that will provide the maximum contact time. At facilities treating surface water, chlorine shall be applied to the water after filtration. At facilities chlorinating groundwater, provisions should be made for applying chlorine to the detention basin inlet. When chlorination is required, minimum free chlorine residual at distant points in a water distribution system shall be at least 0.1 milligram per liter, except that systems utilizing surface water as a source shall have a minimum free chlorine residual of 0.2 mg/l maintained at all distant points in the distribution system and a minimum free chlorine residual of 0.4 mg/l shall maintained in the water storage tank. Those systems utilizing surface water as a source and groundwater under the influence of surface water shall be designed in accordance with the Surface Water Treatment Code and shall meet disinfection requirements and CT values of 40 CFR 141.

3) Testing Equipment. Chlorine residual test equipment capable of measuring free chlorine residual shall be provided and should be capable of measuring residuals to the nearest 0.1 mg/1 in the range below 0.5 mg/1, to the nearest 0.3 mg./1 between 0.5 and 1.0 mg/1, and to the nearest 0.5 mg/1 between 1.0 mg/1 and 2.0 mg/1. Systems utilizing surface water as a source shall test the chlorine residual in the distribution system daily and keep a record of the results. Whenever the chlorine residual falls below the values specified in subsection (n)(2), the supplier of water shall notify the Department as soon as possible but no later than the end of the next business day.

4) Hypochlorinator. Positive displacement pumps shall be provided to inject hypochlorite solution. The pump shall be of variable flow type and shall be of sufficient capacity to feed the required amount of disinfectant. If calcium hypochlorite is used, the concentration of calcium hypochlorite in the solution shall not exceed 5 percent. The solution container shall have a minimum capacity equal to the volume of solution required per day. The hypochlorinator shall be interlocked with the pump so that both will start and stop together.

5) Gas Chlorinators

A) The chlorine supply and gas feeding equipment shall be in a separate, air-tight room. The room shall be provided with an exhaust system that takes its suction not more than 8 inches from the floor and discharges out-of-doors in a direction to minimize exposure to toxic fumes. The fan shall be capable of producing one air change per minute. Means for introducing a fresh air supply to the enclosure shall be provided through appropriate openings, such as filters, grill openings, etc., at a high point opposite the exhaust fan intake. The room shall have a window at least 18 inches square and artificial illumination so that the chlorinator equipment is visible from the operating area outside the room. Electrical switches for lighting and ventilation shall be outside the room and adjacent to the door. Scales for weighing chlorine cylinders in service shall be provided and should have the platform at floor level.

B) All chlorine cylinders, both full and empty, shall be anchored to prevent their falling over.

C) The chlorine feeding device shall be designed so that, during interruptions of the flow of the water supply, gas feed is automatically terminated. Chlorinator vent lines shall terminate out-of-doors.

D) The gas feed equipment shall be solution feed type capable of delivering chlorine at its maximum rate without releasing chlorine gas to the atmosphere.

E) The water supply for the gas feeding equipment shall produce the flow rate and pressure required according to the manufacturer's specifications for proper operation of the equipment. The release of chlorine shall be automatically terminated when the pump is shut off. The water supply line to the chlorine injector shall be equipped with an electric shut-off valve interlocked with the pump and shall be equipped with a suitable backflow preventer.

F) Gas chlorinators shall be repaired and operated only in accordance with the manufacturer's directions. The owner/operator shall determine the appropriate emergency personnel to contact in the event of a chlorine gas emergency and have the telephone number of emergency personnel conspicuously posted within view of operating personnel.

6) General. The chlorinator water supply piping shall be designed to prevent contamination of the treated water supply by sources of questionable water that may be contaminated. Housing must be provided for the chlorination equipment and for storing the chlorine.

o) Hauled Water. When it is necessary to use hauled water as a source of public supply, the water shall be obtained only from a regulated public water system.

1) Transport Equipment. Equipment used for hauling water, including tank trucks or trailers, hoses, etc., shall be used only for handling potable water. In an emergency, equipment used for handling other potable materials, such as milk, syrup, etc., may be used after cleaning and disinfection with not less than 100 ppm of free chlorine.

2) Storage Facilities. Equipment used for the storage of hauled water shall be used only for that purpose and shall be constructed in accordance with subsection (j). A minimum free chlorine residual of 0.4 mg/l shall be maintained in the water storage tank.

p) Vending Machines. Vending machines that serve water to the public shall meet the following conditions:

1) The source of water to a vending machine shall be obtained from a community water system or a supply that meets the construction and location requirements of this Part.

2) A dual check backflow device approved in accordance with the Illinois Plumbing Code shall be installed in the water supply pipe between the vending machine and the source of water.

3) An air gap shall be provided between the water dispensing spout and the water container that is at least equal to 4 times the diameter of the water dispensing supply pipe.

4) The machine shall be kept in an area that is free of dirt and debris. The area shall be maintained to prevent insect and rodent harborage.

5) Any overflow or discharge of water from the vending machine shall be indirectly connected to a sewer or to waste in accordance with the Illinois Plumbing Code.

q) Sample Siting Plan. All non-community supplies shall designate sampling points from which to collect all required samples. If a kitchen tap is available, one sample shall be taken from this location.

(Source: Amended at 44 Ill. Reg. 15785, effective September 1, 2020)