(THIS POLICY DOES NOT HAVE THE FORCE OF LAW)

Ohio Environmental Protection Agency
Division of Drinking and Ground Waters

Guidelines for Obtaining Approval of Backflow Prevention Methods in Drinking Water Treatment Plants

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This document was developed in consultation with Ohio Section AWWA – Technology Committee to provide technical guidance to the regulated community and consultants concerning backflow prevention requirements within *Recommended Standards for Water Works, 2012 Edition* (RSWW). RSWW is incorporated by reference in Ohio Administrative Code (OAC) Rule 3745-91-08. This policy is not intended to create any new requirement but is merely a suggested approach for facilities to comply with backflow prevention requirements of RSWW. Nothing within this document should stop other strategies from being considered to complying with these requirements.

I. PURPOSE

The purpose of this policy is to set guidelines for water treatment plant backflow prevention plan approval, including raw and finished water pumps. The successful application of these guidelines should result in the design of treatment systems that will provide adequate protection against contamination caused by backflow as water flows through the treatment plant.

II. BACKGROUND AND OBJECTIVES

The complex piping configurations found at most drinking water treatment plants presents many opportunities to unintentionally introduce contaminants into the treatment train. Chemical feed lines, makeup water lines, sanitary waste lines, process waste lines, hose connections, drain lines and sludge lines can all be potential sources of contamination if adequate backflow prevention measures are not included in the design of a water treatment plant. The objective of this document is to help the regulated community and design engineers with some of the acceptable methods to reduce the risk of contamination via backflow during the water treatment plant design.

The following sections of RSWW require backflow prevention: 4.1.1.b.3, 4.2.4.j, 4.2.5.8, 4.2.6.e, 4.3.1.4.g, 4.3.1.4.o, 4.3.1.8.b, 4.3.1.10.a.4, 4.3.1.11.i, 4.3.2.3.k.,4.3.3.10.a.6, 4.3.4.9.d,

4.3.5.5.a.4, 4.4.5.1, 4.4.7.3.c 4.5.2.9, 4.5.2.13, 4.6.9, 5.0.2.f, 5.1.6.a, 5.1.6.c, 5.1.8.d, 5.1.10.i, 5.4.3.c.5, 5.4.5.3.e, 5.4.7.b.1., 5.4.7.b.2, 5.4.7.b.9, 5.4.7.b.11, 6.3.2, 6.4.c., 6.6.4, 7.0.5, 7.0.7, 8.13, 9.0 and 9.5.3.

This document presents several common design features with potential for backflow and acceptable solutions.

III. Applicable Regulations
OAC Rule 3745-91 incorporates the RSWW by reference.

IV. APPLICABLE GUIDANCE
Recommended Standards for Water Works, 2012 Edition
Ohio EPA Backflow Prevention and Cross-Connection Control Manual, 4th Edition
American Water Works Association Manual M14, 3rd edition
USEPA Cross Connection Control Manual EPA 816-R-03-002

V. POLICY

Air Gaps
An air gap is the unobstructed vertical distance through free atmosphere between the lowest opening of a discharge pipe and the flood level rim of the receiving receptacle.

When an air gap is specified, the following is acceptable for air gap vertical distance requirements:

1. Free fall discharge equal to two pipe diameters but no less one (1.0) inch; or,

2. Air gaps may be determined using the following weir formula. A one (1.0) inch safety factor will be added to the result:

$$Q = 1495 \times L \times H^{1.5}*$$

H = rise of water, ft.
L = weir length,
Q = flow in gpm

*Source: Douglas M. Grant, *Isco Open Channel Flow Measurement Flow Measurement Handbook, Third Edition.*

Converting all length units to inches and solving for H results in the following revised formula:

$$H = (Q/(3.0 \times L))^{2/3}$$

H = rise of water, in.
L = weir length, in.
Q = flow in gpm

Example: Q = 900 gpm, L = 72 in. (a 1.5-foot square sump – total weir length = 72 in.)

$H = (900/(3.0 \times 72))^{2/3}$
H = 2.59 in.
Air gap = 2.59 + 1 in.
Air gap = 3.59 in.
Air gap ≥ 3.6 in.

Air gaps for filter drains using the weir formula are calculated by using the maximum projected flow of backwash water for the largest filter with the addition of one filter-to-waste flow stream.

Design Features Where Air Gaps Are Required

In general, air gaps must be provided to meet the requirements of RSWW 9.0 for all design features listed below:

- All treatment process waste pipes that drain into storm or sanitary sewers (i.e., basin drains, blow-off outlets and overflows, supernatant, waste filter wash water, spent brine, membrane concentrate, etc.)
- All filter-to-waste lines
- All filter red water waste to red water sand filters
- All discharges to lagoons.

The following exceptions to applying the air gap as defined above apply, if all conditions are met:

1. For waste filter wash water drains, on gravity filters only, discharging to lagoons:
   a. The bottom of the waste wash water collection gullet must be at least 12” above the flood rim of the receiving lagoon or the 100-year flood elevation, whichever

is higher. The hydraulics of the system must allow for complete drain down of the gullet at the highest operating level set for the lagoon.

b. In lieu of using the flood rim of the lagoon, as specified in 1.a above, the 12-inch separation can be achieved as follows:
   i. The system is set up with a maximum operating level (as set by level controls, under the flood rim) for the lagoon that is controlled by level indicators and pump operation.
   ii. The system must be equipped with an alarm on the pumps to indicate failure. Furthermore, all basin, tanks, etc. that use this feature must meet this condition.
   iii. The flood level rim of the lagoon must be higher than the 100-year flood elevation.

2. A shroud with at least a one-inch annular space can be used to minimize splashing.

Filter Surface or Subsurface Wash and Backwash Supply(See RSWW Section 4.3.1.8, 4.3.1.11.i and 4.3.2.3.k)

A connection to a filtered or finished water supply line, to provide for filter surface or subsurface wash, must be protected with a reduced pressure principle backflow preventer (RP) for surface water plants and ground water plants treating for a health-based contaminant and at least a double check valve assembly for all other ground water plants.

A connection to a finished water supply for backwash must be protected with a RP.

Chemical Feed Systems (See RSWW Sections 5.1.5 and 5.1.6)

1. Dilution and make-up water lines to chemical storage tanks must be protected with either an air gap or a reduced pressure principle backflow preventer (RP). An air gap may be required for certain chemicals (i.e. fluoride feed systems) that pose a greater risk should the chemical be siphoned into the water supply.
2. Carrier water lines originating from treated or finished water must be equipped with a RP.
3. Feed lines must be designed to prevent siphoning. Typical methods include installation of an anti-siphon device in the discharge line or use of peristaltic feed pumps. Also, RSWW 5.4.7.b. specifies additional protection required for fluoride feed systems.
4. A chemical feed system designed with multiple feed points at a surface water treatment plant or a ground water treatment plant treating for health-related contaminants must include backflow protection so that no backflow can occur from the unfiltered water to the filtered water. Some acceptable methods to accomplish this include:
   a. Completely separate feed systems.

b. A common day tank may be used if peristaltic feed pumps are used.
c. Separate day tanks.

5. Tank drains and overflows must terminate at least six inches or two pipe diameters, whichever is greater, above the overflow of a receiving basin.

   Exception: Chemical Storage and day tank drains may terminate below the flood rim of the secondary containment vessel, provided:

   a. The secondary containment vessel has no discharge and no other processes (including floor runoff or floor drains) draining into it.
   b. Design shall allow for visible inspection of leaks or overflows from storage vessels, if they occur.

Treatment Basin Drains

1. Drains from treatment basins must not be directly connected to sewers as required by RSWW 5.1.6.c.
2. Drains common to treatment basins in different treatment processes must be designed to eliminate the potential to bypass treatment.

Process Water Lines

Process water lines (i.e. flushing lines and wash-down hoses) require isolation via RPs as required by OAC 3745-95.

Clearwells

If a freefall overflow is required, it must have an air gap of 12 to 24 inches as required by RSWW 7.0.7.

Water Loading Stations

Water loading stations should be a top-load design and must be protected by an air gap separation equal to at least six inches or two times the discharge pipe diameter, whichever is greater, and as required by RSWW 8.13.