PUBLIC WATER SUPPLIES: PROPOSED NEW 35 ILL. ADM. CODE 604 R2018-017 (RULEMAKING – WATER)

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... following ...

SECOND HEARING, THURSDAY, NOVEMBER 16, 2017 AT 9:00 A.M.
CHICAGO AND SPRINGFIELD BY VIDEOCONFERENCE
IPCB SPRINGFIELD HEARING ROOM
CONFERENCE ROOM 1244 N, 1ST FLOOR
1021 N. GRAND AVE. E.
NORTH ENTRANCE

POST 2nd HEARING COMMENTS
RESPECTFULLY SUBMITTED BY: _____

Capt. Michael D. Curry, PE.
As an individual
803 South Paul Street
Nashville, IL 62263
Work Ph. 618-327-8841
mcurry@curryassociates.com

SUBMITTAL DATE: 6 Dec 2017

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Curry Post 2nd Hearing Comment No. 1

At 604.900(c)(3), respectfully recommend revise to read as follows:

3) Iron, Steel and Concrete

A) Calculated Calcium Carbonate Precipitation Potential (CCPP) as referenced in 2330**B** Standard Methods for Examination of Water and Wastewater, 22nd edition incorporated by reference in 35 Ill. Admin Code 611.102;

B) For water containing phosphates:

1) The Alkalinity Difference Technique ~~("Marble Test") as described in 2330D~~ 2330B.3.b and 2230.C.2.b Standard Methods for Examination of Water and Wastewater, 22nd edition. The Calcium Carbonate Precipitation Potential (CCPP) is the difference between the initial and equilibrated water's alkalinity (or calcium) values, when expressed as $CaCO_3$.

2) The Marble Test as described in 2330C.2.c Standard Methods for Examination of Water and Wastewater, 22nd edition. The Marble Test is similar to the Alkalinity Difference Technique. The Calcium Carbonate Precipitation Potential (CCPP) equals the change in alkalinity (or calcium) values during equilibration, when expressed as $CaCO_3$.

At 604.900(d), respectfully recommend revise to read as follows:

d) The following may be used to determine deposition of excess calcium carbonate (CaCO3) scale:

A) Calculated Calcium Carbonate Precipitation Potential (CCPP) as referenced in 2330**B** Standard Methods for Examination of Water and Wastewater, 22nd edition incorporated by reference in 35 Ill. Admin Code 611.102;

B) For water containing phosphates:

1) The Alkalinity Difference Technique ~~("Marble Test") as described in 2330D~~ 2330B.3.b and 2230.C.2.b Standard Methods for Examination of Water and Wastewater, 22nd edition. The Calcium Carbonate Precipitation Potential (CCPP) is the difference between the initial and equilibrated water's alkalinity (or calcium) values, when expressed as $CaCO_3$.

2) The Marble Test as described in 2330C.2.c Standard Methods for Examination of Water and Wastewater, 22nd edition. The Marble Test is similar to the Alkalinity Difference Technique. The Calcium Carbonate Precipitation Potential (CCPP) equals the change in alkalinity (or calcium) values during equilibration, when expressed as $CaCO_3$.

Curry note:

Why the "Marble Test" and "Alkalinity Difference Technique" Are Applicable to Water Containing Phosphates

"The relative state of saturation with respect to calcium carbonate has also been determined empirically by physical means for many years, through the use of what is commonly called the *marble test*. Though often considered crude and obsolete, this physical testing approach is often advantageous. When there are complex-forming ligands in the water, such as polyphosphates, or there are other water constituents (such as phosphates, sulfate, magnesium, NOM, and certain trace metals) that tend to alter or inhibit the nucleation, crystal growth, rate of precipitation, solubility, or crystal structure of calcium carbonate that could form, the numerical methods are largely inappropriate. **Thus, the empirical test is the only accurate indicator of scaling potential." *(… when phosphates are present … emphasis added).*** *(Schock and Lytle, 2011)*

> *"Numerical methods" refer to calculation procedures to estimate CCPP …Calcium Carbonate Precipitation Potential, such as Trussell Technologies and TetraTech (RTW) Model computer spreadsheets.*
>
> *Schock, Michael; Lytle, Darren A. (2011); "Chapter 20. Internal Corrosion and Deposition Control", Water Quality & Treatment, A Handbook on Drinking Water, 6th ed., James K. Edzwald, Editor; American Water Works Association.*

Curry additional note:

Both the Marble Test and "Alkalinity Difference Technique" are *"actual tests of water"*, where $CaCO_3$ content is measured before and after in-place treatment by addition of $CaCO_3$.

If phosphates are present, a portion of the $CaCO_3$ may be sequestered … which could physically affect the measurement of the tendency to precipitate and/or dissolve scale. Phosphate treatment for sequestration of calcium has been practiced in boilers … dating back to the days of steam-driven locomotives. The City of Springfield water treatment plant and other lime softening plants add a small amount of hexametaphosphate prior to filtration to sequester calcium and prevent deposition of calcium carbonate scale on the filter media. The company "CALGON" (from "calcium gone") initiated sales of phosphates to sequester calcium circa 1920. (Personal communication, Russ Lane (deceased), former Head – Chemistry Section, Illinois State Water Survey).

Curry Post 2nd Hearing Comment No. 2

Curry respectfully requests … please can the following be included as a "Board note" in order to facilitate public access to the "free" computer software for calculating CCPP?

Following 604.900(d)(B), proposed note:

Calcium Carbonate Precipitation Potential (CCPP) can be calculated using computer software that is in the public domain, and there is not any cost for downloading and using the software.

Access to TT (Trussell Technologies) Software
www.trusselltech.com/downloads?category=6

(CCPP is not applicable to protection or corrosion of lead and copper plumbing materials, and is not applicable for water containing phosphates. The Marble Test and "Alkalinity Difference Technique" are applicable to water containing phosphates.)
(Schock, Michael; Lytle, Darren A. (2011); "Chapter 20. Internal Corrosion and Deposition Control", Water Quality & Treatment, A Handbook on Drinking Water, 6th ed., James K. Edzwald, Editor; American Water Works Association.)

Curry note to reviewer:

Software contains programs for …

- *$CaCO_3$ Indices Modeling Spreadsheet (2017)* — *Includes CCPP and can model chemical addition.*
- *Mineral Analysis Spreadsheet (2015)*
- *TT Blending Worksheet (2015)*

Ref: R. Rhodes Trussell, John D. Kenny, and David R. Hokanson (Nov. 2017) "Technical Note: Common Water Treatment Chemicals and Calcium Carbonate Saturation", Journal AWWA 109:11, November 2017. Corresponding author: John D. Kenny: johnk@trusselltech.com

Vernon Snoeyink, Professor Emeritus Environmental Engineering, University of Illinois at Champaign-Urbana stated confidence in the Trussell Technologies software and equilibrium constants used in computing CCPP. (Personal communication with Curry.)

Curry Post 2nd Hearing Comment No. 3

Curry respectfully requests … please can the following be included as a "Board note" in order to facilitate Water Operator access to the AWWA simplified laboratory procedure for determining "Calcium Carbonate Saturation"? *If the Board needs a copy of referenced AWWA M12, Curry volunteers to submit a copy to the Board.*

Following 604.900(d)(B), proposed note:

The basic procedure for estimating Calcium Carbonate Precipitation Potential (CCPP) using the Alkalinity Difference Technique and using the Marble Test, both referenced in Standard Methods for Examination of Water and Wastewater, 22nd edition, is described as:

> **"Calcium Carbonate Saturation", contained in Simplified Procedures for Water Examination, Manual of Water Supply Practices M12 (Fifth Edition, 2002), American Water Works Association.**

Based on results of the "Calcium Carbonate Saturation" test, CCPP can be calculated as follows:

CCPP = Final mg/L alkalinity (as $CaCO_3$) - Initial mg/L alkalinity (as $CaCO_3$)

Water is unsaturated with respect to calcium carbonate and may be corrosive if the final alkalinity result is greater than the initial alkalinity result, a positive value in the above equation. (If there is alkalinity gain in the final alkalinity test, it indicates tendency to dissolve calcium carbonate scale.)

Water is oversaturated with calcium carbonate scale and may deposit calcium carbonate coating in the water mains if the final alkalinity result is less than the initial alkalinity result, a negative value in the above equation. (If there is alkalinity loss in the final alkalinity test, it indicates tendency to precipitate calcium carbonate scale.)

If the final and initial alkalinity values are the same, the water is stable and in equilibrium with calcium carbonate.

(CCPP is not applicable to protection or corrosion of lead and copper plumbing materials.)

Caution: Recommend verifying the alkalinity titration endpoint by using a pH meter to verify the pH of the titrated alkalinity sample, since titration endpoint visual color change may be individually variable. If uncertain, consider pH 4.50 to represent the endpoint. See "Alkalinity Test" in Standard Methods for Examination of Water and Wastewater, 22nd edition.

Curry Post 2nd Hearing Comment No. 4

Curry note:

Larson-Skold Index is referenced at 604.900(c)(2) as follows:

(1) Larson-Skold Index, calculated as follows:

$$\text{L-SI} = (Cl + SO_4) \ / \ \text{Alkalinity}$$

All parameters expressed as mg/L of equivalent $CaCO_3$.

Curry respectfully requests … please can the following be included as a "Board note" in order to simplify the calculation procedure for use by Water Operators not familiar with converting Cl and SO_4 concentrations to equivalent $CaCO_3$?

Following 604.900(c)(2), proposed note:

Simplified procedure for calculating LS-I

$$\text{LS-I} = \frac{(1.41)(\text{mg/L } Cl^-) + (1.04)(\text{mg/L } SO_4^{-2})}{\text{mg/L alkalinity (as } CaCO_3)}$$

Cl^- expressed as mg/L Chloride
SO_4^{-2} expressed as mg/L Sulfate

****

Curry's calculations for conversion of Cl^- and SO_4^{-2} to equivalent $CaCO_3$ are as follows:

Definition: *Equivalent weight = atomic wt./valence*

Molecular weight of $CaCO_3$ = 40.078 + 12.011 + 3 (15.999) = 100.086

Equivalent weight of $CaCO_3$ = (100.086)/2 = 50.043

Convert Cl^- to $CaCO_3$ equivalent:

Molecular weight of Cl^{-1} = 35.453

Equivalent wt. of Cl^{-1} = 35.453/1 = 35.453

$$\text{mg/L } Cl^{-1} \text{ expressed as } CaCO_3 = (\text{mg/L } Cl^{-1}) \frac{(\text{eq. wt. } CaCO_3)}{(\text{eq. wt. } Cl^{-1})}$$

Exchanging units:

$$\text{mg/L } Cl^{-1} \text{ expressed as } CaCO_3 = \frac{(50.043 \text{ mg/L } CaCO_3)}{(35.453 \text{ mg/L } Cl^{-1})} = 1.4115 \times \text{mg/L } Cl^{-1}$$

say 1.41 x mg/L Cl^{-1}

Convert SO_4^{-2} to $CaCO_3$ equivalent:

Molecular wt. of SO_4^{-2} = 32.066 + 4 (15.999) = 96.062

Equivalent wt. of SO_4^{-2} = 96.062/2 = 48.031

$$mg/L\ SO_4^{-2}\ expressed\ as\ CaCO_3 = (mg/L\ SO_4^{-2})\ \frac{(eq.\ wt.\ CaCO_3)}{(eq.\ wt.\ SO_4^{-2})}$$

Exchanging units:

$$mg/L\ SO_4^{-2}\ expressed\ as\ CaCO_3 = (mg/L\ SO_4^{-2})\ \frac{(50.043\ mg/L\ CaCO_3)}{(48.031\ SO_4^{-2})} = 1.0419 \times mg/L\ SO_4^{-2}$$

say 1.04 x mg/L SO_4^{-2}

- end calculations -

Curry Post 2nd Hearing Comment No. 5

Respectfully recommend revise 604.900(e)(5) to read as follows:

a. hydrated lime
b. sodium carbonate
c. sodium bicarbonate
d. sodium hydroxide

Curry note: Sodium hydroxide (also known as "caustic soda") is commonly fed after filtration to adjust (increase) pH and alkalinity. Curry inadvertently did not include this in a prior comment.

Curry Post 2nd Hearing Comment No. 6

In Curry's original pre-filed testimony (dated 14 October 2017), Curry's comment 49 requested additions to (604.110(b)) pertaining to deluge shower and eye/face wash device … colloquially referred to as "safety shower".

On 1 November 2017, the Agency responded to Curry's pre-filed testimony for this item, as follows:

> "Agency Response: With proposed Section 604.1110, the Illinois EPA acknowledges the need for workplace safety with a general provision. However, the Agency must defer to the appropriate state and federal agencies that have the proper expertise for the development specific regulations on this matter. For additional background, proper construction and water tempering for deluge showers has been a contentious point between the regulated community, Agency, and Illinois Department of Public Health (Department). To avoid confusion these plumbing appurtenances must be addressed by Department in the Illinois Plumbing Code in a more complete and appropriate fashion."

Curry followup inquiry: After listening to the testimony of Justin DeWitt, P.E., LEED AP, Chief of General Engineering, Division of Environmental Health, Illinois Department of Public Health, at the 2nd Hearing on 16 November 2017, Curry reviewed the contents of 77 IAC 890 ("The Illinois Plumbing Code"), and found several provisions that appear to pertain to "safety showers". On 19 November 2017, Curry submitted an email inquiry to Mr. Dewitt at the IDPH. Mr. Dewitt indicated concurrence with Curry's conclusion that 77 IAC 890 ("The Illinois Plumbing Code") contains provisions for a proper "safety shower" installation. A copy of Curry's email and the 20

November 2017 response from Justin Dewitt is submitted herewith as "Curry Post Second Hearing Attachment #PSH-1".

Respectfully, it is Curry's opinion that regulatory guidance governing water supply for "safety showers" is contained at 77 IAC 890. (Specifically at 890.690(b), 890.800(a), 890.800(b), 890.1230, and 890.1240.)

Curry recommendation:
In the interest of encouraging adequate safety provisions for Water Plant Operators, Curry respectfully requests that 604.1110 be revised to read as follows:

Section 604.1110 Protective Equipment

a) Personal protective equipment shall be provided consistent with the requirements of the CWS safety plan developed pursuant to Section 604.160.

b) A deluge shower and eye washing device shall be installed where strong acids and alkalis are used and stored. The deluge shower and eye washing device, and water supply to those devices, shall comply with applicable provisions of 77 IAC 890 ("The Illinois Plumbing Code").

end

Curry
Post Second Hearing Attachment # PSH-1

PUBLIC WATER SUPPLIES: PROPOSED NEW 35 ILL. ADM. CODE 604 R2018-017 (RULEMAKING – WATER)

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… FOLLOWING …

SECOND HEARING, THURSDAY, NOVEMBER 16, 2017 AT 9:00 A.M.
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POST HEARING COMMENTS
(FOLLOWING HEARING NO. 2)
RESPECTFULLY SUBMITTED BY: _____

Capt. Michael D. Curry, PE.
As an individual
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Work Ph. 618-327-8841
mcurry@curryassociates.com

SUBMITTAL DATE: 6 Dec 2017

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Email communications between Curry and Justin DeWitt, P.E., LEED, AP, Chief of General Engineering, Division of Environmental Health, Illinois Department of Public Health, in support of **Curry Post 2nd Hearing Comment No. 6**, pertaining to proposed 35 IAC 604.1110.

20 November 2017, Mr. DeWitt's email to Curry.
19 November 2017, Curry's email to Mr. DeWitt.
(total 2 pages of email communications)

Mike Curry

From: DeWitt, Justin <Justin.Dewitt@Illinois.gov>
Sent: Monday, November 20, 2017 11:28 AM
To: Mike Curry
Cc: McMillan, Dave; Andy Curry; Cox, Brian
Subject: RE: "Safety Showers"

Mike,

Your assessment seems to include all of the relevant requirements of the Plumbing Code. I might add that I made it clear in my testimony that installation of such equipment, as well as, the rest of the "plumbing" inside a water treatment facility, regardless of purpose, is to be performed by a registered plumbing contractor. In my time at IDPH, I find that most water utilities fail to follow the Plumbing Code requirements for the construction of such facilities and that they use unlicensed people to complete the work, perhaps under some notion that the IEPA permit trumps those requirements. Interestingly, I have had many vigorous discussions with design engineers and architects claiming that very fiction. Whether 10 States or AWWA guidance, the notion that a stagnant tank at ambient temperature would in any way be suitable supply for an emergency shower (required to deliver 20GPM of tepid water for 15 minutes) is irresponsible and perhaps approaches negligence.

As you mentioned and as I testified, including a requirement that entities subject to the 604 regulations follow the IL Plumbing Code, as applicable, is a fine addition to the regulations and provides regulatory clarity.

Please let me know of any additional questions.

Justin DeWitt, P.E., LEED AP
Chief of General Engineering
Division of Environmental Health
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Visit our website at:
http://www.idph.state.il.us/envhealth/ehhome.htm

From: Mike Curry [mailto:mcurry@curryassociates.com]
Sent: Sunday, November 19, 2017 11:56 AM
To: DeWitt, Justin

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Cc: McMillan, Dave; Andy Curry
Subject: [External] "Safety Showers"

Dear Justin,

As followup to your testimony at the Board hearing last week, it is my understanding that "safety showers" (or "deluge showers" as referenced by IEPA) are to comply with 77 IAC 890. **Please, at your convenience, would you confirm my interpretation of specific requirements contained in 77 IAC 890. My purpose in seeking your input is solely to guide me in recommending "correct" installations:**

At 890.690(b) ... I interpret that a (potable) cold water source and a separate hot water source are to be supplied through an automatic safety mixing device complying with ASSE 1016/ASME A112.1016/CDA B125.16, etc.

At 890.800 ... I interpret that emergency showers and eye wash stations must comply with (a) and (b) of 890.800. (890.800(a)) requires potable water for emergency showers and eye wash stations.

At 890.1230 ... I interpret that the equipment for heating or storing hot water shall be provided with the required relief valve or valves to protect against excessive or unsafe temperature and pressure in accord with (a), (b), (c), (d), (e), (f), and (g).

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At 80.1240 ... the hot water storage tank must be equipped with a drain cock.

Subject to your input guidance, I believe that the Plumbing Code furnishes adequate guidance for "safety showers" ... and I regret to say that in the past I have not paid sufficient attention to the Plumbing Code requirements. Several years ago, the AWWA publication OPFLOW contained an article that recommended using an indoor storage tank where potable water would enter the tank and be retained long enough to reach room temperature before being discharged by activation of the safety shower. I have recommended a similar installation in the past. Now, in hindsight, I feel that use of that arrangement is not satisfactory because (1) it does not comply with the Illinois Plumbing Code, (2) prolonged storage of water in an enclosed tank at room temperature would result in depletion of the chlorine residual and the water quality could (most likely) not be of acceptable bacteriological quality.

I suspect that there are other safety showers at water plants that are supplied only from the potable supply cold water piping, which could deliver very cold water to the safety shower during winter months. I recall hearing about an Operator that was "in shock" after being "sprayed" with caustic soda from a broken pipe ... and the Operator died of cardiac arrest soon after being exposed to extremely cold water from the safety shower.

While ANSI Z358.1-2014 addresses many aspects of safety showers, it does not appear to assure delivery of bacteriologically acceptable water quality to the safety shower? I understand that ANSI standards are not the responsibility of IDPH or IEPA.

It is my understanding that IEPA prefers to not include IDPH code requirements for "deluge showers" in the new 35 IAC 604 regulations. During the public comment/IEPA response period for 35 IAC 604, the Agency expressed interest in calling attention to "safety" issues. Respectfully, it is my opinion that requiring "safety shower" installations that comply with the Illinois Plumbing Code would be a significant step in improving safety conditions for Water Plant Operators. After you have had a chance to determine if I am "on the right track" regarding the requirements for safety showers, perhaps "post hearing testimony" might be submitted for review by the Pollution Control Board?

Thanks.

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