Waterworks Standards - Concrete Used for Drinking Water Systems
May 2015

This is guidance on meeting the Waterworks Standards for project owners who specify use of concrete materials for drinking water system components in California. It includes background on the standards, ways to comply with NSF/ANSI 61 for concrete, common situations encountered, and a specification template.

Background

Concrete and other materials used in drinking water systems are required to meet the NSF International/American National Standard Institute (NSF/ANSI) Standard 61 under the California Waterworks Standards adopted under the California Safe Drinking Water Act. California adopted the NSF/ANSI 61 standard into its Waterworks Standards that became effective in March 2008.

The California Safe Drinking Water Act is administered by the Division of Drinking Water (DDW) at the State Water Resources Control Board, and its 24 district offices and local county health departments in certain counties. Public water system operators (both public and privately owned) must comply with Waterworks Standards. For most projects that involve new or modifications to drinking water sources, distribution system reservoirs or treatment facilities, construction plans and specifications must be reviewed and approved by one of the 24 district offices or the local county health department prior to construction. Conformance with the Waterworks Standards, including NSF/ANSI 61, is verified as part of the review.

Concrete that comes in contact with drinking water during "production, treatment or distribution" would fall under Section 64591 "Indirect Additives." Some examples of water system facilities built with concrete include wells, treatment plants, potable water storage tanks, potable water mains and potable water distribution pipes.

DDW has provided guidance that for surface water treatment plants, NSF/ANSI 61 applicability should start at the inlet (flash mix) of the treatment plant.

Accredited Laboratories for Certification

There are at least 5 approved laboratories for certifying products and components under NSF/ANSI 61. These include Canadian Standards Association, IAPMO, Water Quality Association, Underwriters Laboratory, and NSF International.

Showing Compliance of Concrete

There are five general ways to show compliance of concrete to NSF/ANSI 61 requirements:

1. Approved Components Certification Method – When all components (cement, admixtures, aggregates, etc.) of the concrete mixture are certified by an ANSI accredited laboratory, no additional testing is required to certify the concrete mixture. For this method typically NSF/ANSI 61 certified cement and admixtures are already available and the aggregate will be soak tested for regulated metals and gross alpha radionuclides by an ANSI-accredited laboratory. Lists of approved components such as cement and admixtures can be found at the following web sites:

    a. http://info.nsf.org/Certified/PwsComponents/
    b. https://www.wqa.org/Find-Products

c. http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html
d. http://pld.iapmo.org/default.aspx
e. http://www.csagroup.org/us/en/services/testing-and-certification/certified-product-listing

2. Concrete Site Mix Evaluation Method – A project specific method where a concrete mixture is tested for NSF/ANSI 61 compliance even if one or more of the individual components is not certified, such as cement or flyash. Samples of the hardened concrete, with proper chains-of-custody are analyzed by an ANSI-accredited laboratory to determine if the mixture meets the requirements of the analytes provided under NSF/ANSI 61 Table 3.1 – Portland and Hydraulic Cements. There are additional analytes to be tested for under Portland and hydraulic cements as opposed to those listed for concrete in Table 3.1.

3. Facility Certification Method – A batching facility can be certified to produce NSF/ANSI 61 approved mixtures. This method is typically more expensive than the other methods but allows the facility to supply the approved mixture to any project so long as the facility maintains their certification (1-5 years depending on the certification company). The process for certification is as follows:

   a. Company submits an application.
   b. Provide product formulation, toxicology and product use information.
   c. Toxicology department reviews formulations.
   d. Plant audit and sample collection.
   e. Laboratory conducts testing.
   f. Final toxicology evaluation.
   g. Certification issued for compliant products.

4. Coating - Small Project or Short Amount of Time -- For some projects, the cost of testing, or time available to get testing completed, is not feasible. In this circumstance the public water system may elect to use an NSF/ANSI 61 certified coating on the interior of concrete structure.

5. Alternative Method - The law allows public water systems to propose an alternative method of compliance to the DDW. The proposed alternative will need to provide the same level of protection to public health and the public water system must obtain written approval from the DDW.

   a. Water systems that want to propose and use an Environmental Laboratory Accreditation Program (ELAP) certified laboratory instead of an ANSI-accredited certification laboratory to perform NSF/ANSI 61 related testing will need to make the proposal to and receive approval from DDW prior to implementation.

Common Situations

No Aggregate Certification -- In general, many cements and admixtures have already been certified to meet NSF/ANSI 61 requirements. However, aggregate sources are often not certified. Recently, some of the ANSI accredited laboratories have developed a relatively quick test for evaluating of the aggregates, called the aggregate soak test. Aggregates are tested for regulated metals and gross alpha radionuclides. With the aggregates evaluated for the project,

a water system may then show compliance by the *Approved Components Certification Method*. Note: This test must be performed by an ANSI-accredited laboratory.

No Cement Certification -- If the concrete supplier does not have NSF/ANSI 61 certified cement then the *Concrete Site Mix Evaluation Method* may be utilized. For this, hardened concrete specimens of the concrete mix are sent to an ANSI-accredited laboratory for soak testing. Soak testing will evaluate for a larger battery of analytes which are listed under NSF/ANSI 61 Table 3.1 – Portland and Hydraulic Cements. This battery of analytes is larger than those listed required by concrete soak testing. If the concrete mix passes requirements, then it does not matter what the constituent components are in it.

No Fly Ash Certification -- At this time there is not a NSF/ANSI 61 certified fly ash. The option is either to use a modified concrete mix that does not use fly ash, or have the concrete mix tested using the *Concrete Site Mix Evaluation Method*. For this hardened concrete specimens of the concrete mix are sent to an ANSI-accredited laboratory for soak testing. Soak testing will evaluate for a larger battery of analytes which are listed under NSF/ANSI 61 Table 3.1 – Portland and Hydraulic Cements. If the concrete mix passes requirements, then it does not matter what the constituent components are in it.

If there are multiple concrete structures it is recommended to normalize the results to the smallest structure with the least amount of surface area. This will allow the results to be utilized for larger structures.

If Method 1, Method 2, or Method 3 of the attached sample specification is utilized for the project and the testing passes, then this information does not need to be submitted to DDW unless specifically requested by the District Engineer.

Contact Suppliers In Advance

While there are a number of options and situations to demonstrate compliance by testing the concrete or using components that comply with NSF/ANSI 61 standards, there are also situations where the required components are not locally available and require a long lead time. As such, it is recommended that project owners and contractors contact materials suppliers as far in advance as possible to determine the options and availability of qualified concrete or components. Materials suppliers can work with project owners and contractors to identify the best options to show compliance.

Questions. For questions, project owners should contact the local DDW District Engineer for further assistance. General questions may be directed to the DDW Water Treatment Technical Specialist, Eugene Leung.

Attachments. Sample specification, Applicable state law sections, and List of 24 district offices.

Sample Specification

CONCRETE IN DIRECT CONTACT WITH POTABLE WATER SHALL
BE TESTED BY ONE OF THE FOLLOWING METHODS:

METHOD 1: Constituent Verification – Confirmation the components of the concrete are certified or tested using the following parameters. Concrete mixes using flyash may not be tested with Method 1.

1. Cement shall be NSF/ANSI 61 certified.
2. Admixtures shall be NSF/ANSI 61 certified.
3. Aggregates shall be tested and approved by one of the following methods:
   a. Soak Testing: Aggregates shall be supplied to an ANSI accredited lab, accompanied by the appropriate chains-of-custody and tested for regulated metals and gross alpha radionuclides. Testing shall be conducted by an ANSI accredited product certification body for Drinking Water Quality.
   b. Hardened Concrete Specimen Testing: Provide hardened concrete specimens using the proposed mix designs for the concrete that come in direct contact with potable water to an ANSI accredited lab, accompanied by the appropriate chains-of-custody. Concrete specimens shall be soak tested for regulated metals and radionuclides.

METHOD 2: Mix Design Verification through Concrete Specimen Testing:
If NSF/ANSI 61 certified cement and admixtures are not available or flyash is utilized within the concrete mix design, the following testing procedure can be utilized:

1. Provide hardened concrete specimens for each mix design that will come in direct contact with potable water with the appropriate chains-of-custody to an ANSI accredited lab. Concrete specimens shall be tested for the items listed in NSF/ANSI 61 Table 3.1 – Portland and Hydraulic Cements.

METHOD 3: Coating:

1. Coat the interior concrete surface with a NSF/ ANSI 61 certified coating.

METHOD 4: Request a waiver:

Propose an alternative to Division of Drinking Water (DDW) District Engineer per section 64551.100. The alternative will need to provide at least the same level of protection to public health. The Public Water System must receive written approval from DDW prior to implementation of this testing alternative.

CHAPTER 16. CALIFORNIA WATERWORKS STANDARDS

Article 1.5. Waivers and Alternatives

§64551.100. Waivers and Alternatives.

(a) A water system that proposes to use an alternative to a requirement in this chapter shall:

(1) Demonstrate to the Department that the proposed alternative would provide at least the same level of protection to public health; and

(2) Obtain written approval from the Department prior to implementation of the alternative.

Article 7. Additives

§64590. Direct Additives.

No chemical or product shall be added to drinking water by a water supplier unless the chemical or product is certified as meeting the specifications of NSF International/American National Standard Institute (NSF/ANSI) 60-2005 (Drinking Water Treatment Chemicals—Health Effects), which is hereby incorporated by reference. Certification shall be from an ANSI accredited product certification organization whose certification system includes, as a minimum, the following criteria for ensuring the chemical or product meets NSF/ANSI Standard 60.

(a) Annual product testing,

(b) Annual facility inspections,

(c) Annual quality assurance and quality control review,

(d) Annual manufacturing practice reviews, and

(e) Annual chemical stock inspections.

§64591. Indirect Additives.

(a) Except as provided in Section 64593 or where a more stringent statutory requirement exists, after March 9, 2008, a water system shall not use any chemical, material, lubricant, or product in the production, treatment or distribution of drinking water that will result in its contact with the drinking water including process media (carbon, sand), protective materials (coatings, linings, liners), joining and sealing materials (solvent cements, welding materials, gaskets, lubricating oils), pipes and related products (pipes, tanks, fittings), and mechanical devices used in treatment/transmission/distribution systems (valves, chlorinators, separation membranes) that has not been tested and certified as meeting the specifications of NSF International/American National Standard Institute (NSF/ANSI) 61-2005 / Addendum 1.0-2005 (Drinking Water System Components—Health Effects), which is hereby incorporated by reference. This requirement

shall be met under testing conducted by a product certification organization accredited for this purpose by the American National Standards Institute.

(b) If a treatment chemical is generated on site,

(1) No equipment used in the generation process shall be in contact with a drinking water, or a chemical to be applied to drinking water, after March 9, 2008, unless the equipment has been tested and certified as meeting the specifications of NSF International/American National Standard Institute (NSF/ANSI) Standard 61-2005/Addendum 1.0-2005 (Drinking Water System Components—Health Effects). This requirement shall be met under testing conducted by a product certification organization accredited for this purpose by the American National Standards Institute; and

(2) No input chemical used in the generation process shall be in contact with a drinking water after March 9, 2008, unless the chemical meets the requirements of section 64590.

(c) Any chemical used to clean on-line or off-line drinking water treatment facilities that may subsequently come into contact with drinking water to be distributed to the public shall meet the requirements of section 64590.

(d) Any contract for the purchase of chemicals, materials, or products that was signed by a public water system and effective prior to March 9, 2008, shall be exempt from the provisions of subsections (a) and (b) until March 9, 2009.

§64593. Use of Uncertified Chemicals, Materials or Products.

(a) A water supplier may use a chemical, material or product that has not been certified pursuant to sections 64590 or 64591 if the chemical, material or product is in the process of being tested and certified and there are no certified alternatives.

(b) Prior to use of an uncertified chemical, material or product, the water supplier shall provide the Department with an explanation of the need for the chemical, material or product; the date that the chemical, material or product was submitted for testing; the name of the accredited product certification organization conducting the testing; and a statement that certified alternatives are not available.

(c) Unless directed otherwise by the Department to ensure a pure and wholesome drinking water supply, a water supplier may use the following chemicals, materials, or products that have not been and are not in the process of being certified pursuant to section 64590 or 64591:

(1) a material or product previously approved by the Department for use or installation on or before March 9, 2008.

(2) a material or product constructed of components meeting the requirements of sections 64590 and 64591;

(3) chemical by-products necessary for meeting drinking water standards, such as sodium hypochlorite for disinfection, generated by chemicals certified pursuant to section 64590 or 64591; and

(4) atmospheric air and small parts, such as probes, sensors, wires, nuts, bolts, and tubing for which there are no certified alternatives.

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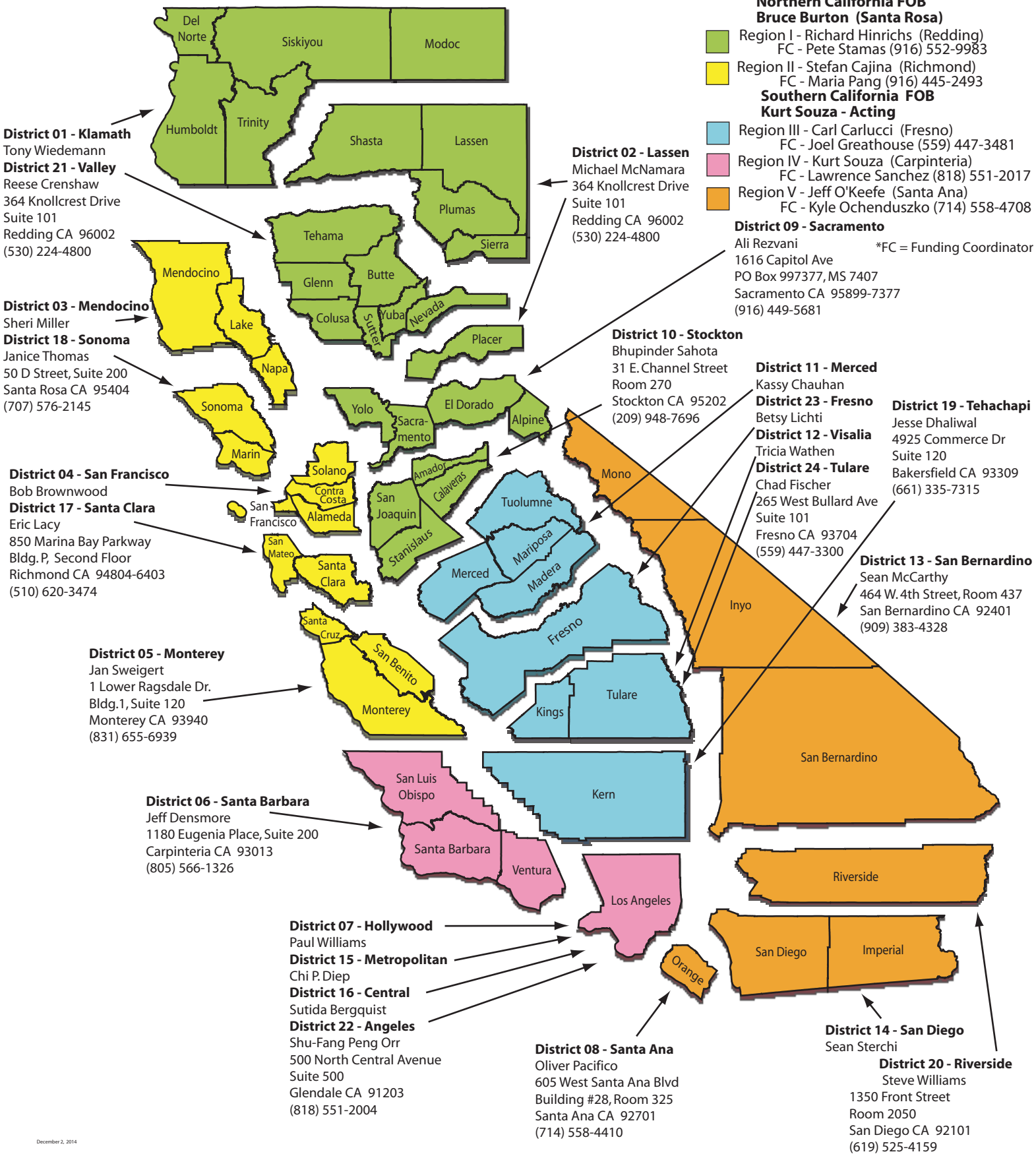

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