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The NSF 61 Standard and it's effect on drinking water storage tanks:

Condensed and Updated.

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Introduction:

This report assumes the reader has little knowledge of NSF International, its Standard 61, and limited knowledge of water storage tanks and paint coatings. It will attempt to introduce NSF International, describe its Standard 61, review the impact of Standard 61 on drinking water storage tanks constructed of both welded steel and concrete, and suggest action(s) the Steel Tank Institute may consider adopting in response to such impact. Much information in this update is gathered from what is available in the public domain. For example, the information found in this update is derived from NSF International (www.nsf.org), the American National Standards Institute (www.ansi.org), the Association of State Drinking Water Administrators (www.asdwa.org), Underwriters Laboratories (www.ul.com), the US Environmental Protection Agency (www.epa.gov) and other sources.

Discussions regarding "concrete versus steel" in this report assume identical structures in type and size: reservoirs (aka: "flat-bottomed" tanks).

NSF International

First established in 1944, and celebrating its 75th anniversary recently in Ann Arbor, Michigan, the name NSF International was coined in the 1990's to reflect the merging of the National Sanitation Foundation and the NSF Testing Labs.

From its website, www.nsf.org, one discovers that it "develops public health standards and certification programs that help protect the world's food, water, consumer products and environment." Its mission is to protect and improve global human health. It is an independent, accredited organization, whose standards group facilitates the development of standards, and whose service groups test and certify products and systems. In addition, NSF offers "timely and pertinent" training for the global water and wastewater industry.

Further, NSF International considers itself "The Public Health and Safety Company", and includes "over 2,700 global employees, including microbiologists, toxicologists, chemists, engineers, and environmental and public health professionals."

NSF International World Headquarters is located at 789 Dixboro Road, Ann Arbor, MI 48105, USA. Phone (734) 827-6817 or (800) NSF-MARK for more information.

The NSF / ANSI 61 Standard:

"NSF/ANSI 61 is a performance-based standard that evaluates the amount of contaminants that leach from the products into drinking water, rather than setting prescriptive limits on content. This differs from U.S. Food and Drug Administration requirements and some international standards that are based only on prescriptive content requirements."

"NSF/ANSI 61 requires analysis for any chemicals that leach from a material into drinking water and a toxicological evaluation of concentrations leached to ensure that they are below levels that may cause potential adverse human health effects. The toxicological evaluation criteria are based on lifetime exposure to the concentration of contaminants in drinking water."

History: “Prior to 1988, the U.S. Environmental Protection Agency’s Additives Advisory Program for drinking water system components provided the regulatory framework and approval processes for inclusion of products and components into the water distribution systems across the United States. In 1984, the U.S. EPA published an RFP for the purpose of privatizing the processes. A consortium led by NSF International and including the American Water Works Association Research Foundation, the Association of State Drinking Water Administrators, the Conference of State Health and Environmental Managers, and the American Water Works Association was awarded the contract to develop the standard.”

“Based on the cooperative work of this consortium, NSF/ANSI 61: Drinking Water System Components — Health Effects was published in 1988 to establish ***minimum requirements for the control of potential adverse human health effects from products that contact drinking water*** [author’s italics]. The standard has been updated regularly since then to add testing criteria for additional contaminants and product types.”

NSF/ANSI Standard 61: *Drinking Water System Components -- Health Effects* has an impact on drinking water storage tanks. This Standard is the nationally recognized health effects standard for all materials which contact drinking water. It is this Standard, NSF/ANSI 61, which has relevance to water storage tanks since the interior surfaces of such tanks are in contact with drinking water.

Certified products, used to protect the interior surfaces of drinking water storage tanks, appear in NSF’s online listings which are updated daily and available at *http://www.nsf.org/certified-products-systems*.

Certification Requirements: “NSF/ANSI 61 requires a complete formulation disclosure from product manufacturers and their component, material and ingredient suppliers. The standard requires a formulation review of all ingredients in each water contact material and development of a test battery to detect any chemical that may leach from water contact materials. The standard specifies formulated exposure waters of pH 5, 6.5, 8 and 10. Products are tested with the formulated test waters for various periods of time from 1 hour for water treatment process media to 19 days for faucets. Exposure water samples are then analyzed for all potential chemical contaminants that were identified in the formulation review. The chemical analyses include broad-based scans for metallic and organic chemicals which have the ability to identify trace quantities of contaminants or reaction by-products that may not be in the formulations of the materials.”

The impact of NSF 61 Standard on Welded Steel Water Tanks:

In simple terms, the effect of this Standard is to require all surfaces in contact with drinking water (aka: "finished" water or "potable" water) to be NSF 61 certified. Since steel plate in contact with drinking water will corrode, thereby leaching corrosion byproducts into the stored drinking water, a coating - certified to meet the requirements of the NSF 61 Standard - is required to be applied to interior steel plate surfaces. This is done prior to the tank being placed "in-service" and used to store drinking water.

Update: NSF/ANSI/CAN 61: Forty-nine states have legislation, regulations or policies requiring drinking water system components to comply with or be certified to NSF/ANSI/CAN 61.
[ASDWA, April 2019. Author's emphasis]

The examples below, in reverse alphabetical order, illustrate an exact copy of an NSF listing of Standard 61 certified products. This listing includes the manufacturer's name, headquarters address and location of the plant where the certified product is made, the certified product number(s), color(s), number of coats, maximum dry film thickness (DFT) in mils, the product cure time, and any special comments. NSF International also provides information regarding the capacity restriction of the tank, the temperature of the stored water, and the generic classification of the certified coating.

Tnemec Company, Inc.
6800 Corporate Drive
Kansas City, MO 64120-1372
United States
816-474-3400
Coatings - Tank

22 Epoxoline[1]	>= 3000 gal.	CLD 23	EPOXY
Series 20 Pota-Pox[8]	>= 6000 gal.	CLD 23	EPOXY
Series 406 Elastoshield[7]	>= 50,000 gal.	CLD 23	PUR
Series 91-H2O™ Hydro-Zinc™[2]	>= 8000 gal.	CLD 23	PUR
Series 94-H2O Hydro Zinc[9]	>= 500 gal.	CLD 23	PUR
Series F020HS[4]	>= 300 gal.	CLD 23	EPOXY
Series FC20 Pota-Pox (Fast Cure)[10]	>= 6000 gal.	CLD 23	EPOXY
Series FC20HS[4]	>= 300 gal.	CLD 23	EPOXY
Series N140 Pota-Pox Plus[11]	>= 1,000 gal.	CLD 23	EPOXY
Series N140F Pota-Pox Plus Fast Cure[12]	>= 1,000 gal.	CLD 23	EPOXY

Sherwin-Williams Company
101 Prospect Avenue
Cleveland, OH 44115
United States
773-821-3420
Coatings - Tank

COROTHANE® I GALVAPAC 2K 100 Two Pack[8]		CLD 23	ZINC
Zinc Primer[7]			
Corothane I Galvapac Zinc Primer[9]	[10]	CLD 23	ZINC
Dura-Plate 235 PW[1]	>= 5000 gal.	CLD 23	EPOXY
Dura-Plate UHS[2]	>= 1000 gal.	CLD 23	EPOXY
MACROPOXY® 5500 LT	[11]	CLD 23	EPOXY
MACROPOXY® 5500 PRIMER (RED) LT	[11]	CLD 23	EPOXY
SherPlate PW[3]	>= 100 gal.[4]	CLD 23	EPOXY
Tank Clad HS Epoxy[12]	>= 60,000 gal.	CLD 23	EPOXY
Tank Clad HS Epoxy Low Temp Hardener[6]	>= 1000 gal.	CLD 23	EPOXY
Zinc Plate Ultra II PCP[13]	[14]	CLD 23	ZINC

Induron Protective Coatings, Birmingham, AL
Induron Protective Coatings, and other manufacturers, may select Underwriters Laboratories (UL) to perform product testing in order to achieve certification in accordance with NSF/ANSI/CAN 61. For the purposes of this report, only coatings found on http://www.nsf.org/certified-products-systems are cited.

The impact of NSF 61 Standard on Concrete Water Tanks:

"Drinking water contaminants can come from many sources, including … water storage. Concrete used in large storage tanks is usually a combination of cement, admixtures, curing compound, sand and gravel. It can also contain fly ash and other additives to strengthen the concrete and increase its durability. However, any of these additives can have contaminants that cause compliance problems for the utility and present potential health risks to the consumer."

"To help minimize the risk of contaminants, NSF certifies concrete ingredients to the requirements of NSF / ANSI / CAN 61: *Drinking Water System Components – Health Effects*. Our Concrete Site Mix Design Evaluation Program provides a one-time evaluation that certifies concrete consisting of non-certified cement or other ingredients against this same standard."

"NSF/ANSI/CAN 61 testing covers all products with drinking water contact from source to tap and determines what contaminants may migrate or leach from your product into drinking water. It also confirms if they are below the maximum levels allowed to be considered safe."

For information regarding Concrete Site Mix Evaluation, visit http://www.nsf.org/services/by-industry/water-wastewater/municipal-water-treatment/concrete-site-mix-evaluation.

Update: NSF/ANSI/CAN 61: Forty-nine states have legislation, regulations or policies requiring drinking water system components to comply with or be certified to NSF/ANSI/CAN 61.
[ASDWA, April 2019. Author's emphasis]

Most concrete water tank makers coat the exterior surfaces of their newly constructed tanks, often with a coating made from or with acrylic or vinyl-acrylic resins. Over time, these organic coatings deteriorate due to weathering and exposure to ultraviolet (UV) light. They are subsequently and easily repainted using coatings of the same generic type. Makers of concrete water storage tanks may suggest to their prospects that concrete water tanks are maintenance-free.

Because concrete drinking water storage tanks do not corrode, makers of such tanks present this water storage alternative to engineers and water providers as one that does not require an interior protective coating. But stored water characteristics can, and often do, "corrode" the interiors of concrete water storage tanks.

In general, there are five ways a concrete water tank maker can achieve the protection demanded by policy or regulation. Two acceptable methods are "painting" the interior surfaces with an NSF Standard 61 certified coating or, alternately, using NSF Standard 61 certified ingredients in the construction of their tanks. As early as 1999, NSF International has addressed the need to certify Portland Cement (used in the construction of concrete water tanks) in its WaterWORKS publication (*see WaterWORKS 99-1 issue at www.nsf.org*). In the Summer 2001 issue, certification of concrete water storage structures was the focus as NSF launched its Concrete Site Mix Design Evaluation program (see *WaterWORKS*, Summer 2001 issue). Perhaps as a way to include material suppliers as well as to educate engineers and water providers, certification of cement materials was again included in the Summer 2004 NSF *WaterWORKS* publication.

Consequently, if a concrete water storage tank is consturcted of non-NSF certified Portland cement, aggregate, and / or admixtures, interior surfaces must be “painted” with a coating certified to meet the requirements of Standard 61 with the following exceptions as examples:

a) on uncoated concrete water storage tank interiors of 350,000 gallons or larger
b) on uncoated concrete water storage tank interiors with a diluted surface area-to-volume ration less than or equal to 0.8 in2/L for static conditions or 0.08 in2/L for flowing conditions.

The following commentary is beyond the scope of this document but is nevertheless, noteworthy: uncoated concrete water storage tank interior surfaces, exempt as stated above are not smooth. They are very rough and, with time, have been known to harbor organisms that may impact water quality and, perhaps, safety. Lining the concrete tank with an NSF / ANSI / CAN 61 certified coating will limit the attachment of harmful constituents to interior tank surfaces. **“*The porosity and unevenness of uncoated concrete surfaces enhances bacterial attachment and biofilm growth…can lead to water quality compliance problems, nitrification risks … disinfectant residual loss and formation of disinfection by-products…*” - STI / SPFA Steel Facts No. 7**

The information listed below, taken from the current, 2016 revision of the *NSF International Standard/American National Standard for Drinking Water Additives* specifically identifies “constituents of concrete and cement-mortar (e. g., Portland and blended hydraulic cements, admixtures, sealers, and mold release agents)” as ingedients requiring NSF 61 certification.

5 Barrier materials

5.1 Scope

The requirements of this section apply to products and materials intended to form a barrier providing containment of drinking water or to prevent drinking water contact with another surface. The products and materials that are covered include, but are not limited to: non-residential storage tanks, coatings, paints, linings and liners, bladders, diaphragms, and constituents of concrete and cement-mortar (e. g., Portland and blended hydraulic cements, admixtures, sealers, and mold release agents). These products and materials can be field-applied, factory-applied, precast, or cast in place.

The AWWA, the ASDWA, and the EPA:

The ASDWA:

The Association of State Drinking Water Administrators (ASDWA) published their revised survey in April 2019. As seen before, they state: “***Forty-nine states have legislation, regulations or policies requiring drinking water system components to comply with or be certified to NSF/ANSI/CAN 61.”***

Within the 2019 ASDWA revised survey is a listing of each State, whether it has adopted legislation, the State Citation for such adotion, the date of the regualtion and its effective date.

Example:

ADDENDUM A:

ASDWA Member Survey on State Adoption of NSF/ANSI/CAN 60 and 61

State	Adopted Legislation or Regulations	State Citation	ANSI-Accredited Certifier Required	Effective Date of Regulation and Latest Update	
				NSF/ANSI/CAN 60	NSF/ANSI/CAN 61
Alabama	Yes	335-7-6.12/8.04	Yes (NSF/ANSI/CAN 60)	November 9, 1992	November 9, 1992
Alaska	Yes	18 AAC 80.030	Yes	May 18, 1994	May 18, 1994
Arizona	Yes [1]	AAC R18-4-213	Yes	January 1, 1993	January 1, 1993
Arkansas	Yes	PWS Reg. VII.F	Yes (policy)	October 1, 1994	October 1, 1994
California	Yes [2]	CCR Title 22: 64590/64591	Yes [2]	January 1, 1994	March 9, 2008
Colorado	Policy		Yes (policy)		
Connecticut	Policy	Guidelines IV.D.5	Yes		

The AWWA:
In the words of Vincent E. Sagan and Michael L. Brainerd, quoting from the November 2004 American Water Works Association (AWWA) *Journal*, an article entitled *Evaluation and Rehabilitation of Older, Circular Prestressed Concrete Tanks,* "If there is doubt about whether a product is certified, apply an NSF 61 certified coating."

The EPA:
The Environmental Protection Agency (EPA) provides information related to drinking water laws and regulations in the 10 EPA regions (see *www.epa.gov/water/region.html*). Whereas each State in the 10 EPA regions may operate differently, each has an Office or Bureau involved, in some way, with water quality or water management. Generally, it is within these Offices or Bureaus that information related to NSF Standard 61 can be found.

Limited EPA enforcement of State requirements that concrete tanks meet NSF Standard 61 may provide a misperception that concrete water storage tanks need not comply.

The impact of NSF 61 Standard on The Steel Tank Institute:

Several welded steel water tank fabricators are members of the Steel Tank Institute (STI) and compete with and against makers of concrete water storage tanks. These members state that water providers often choose concrete tanks in lieu of welded steel tanks. Two reasons are often given. First, the misperception that concrete tanks require no maintenance; and, second, that these tanks are not required to meet NSF Standard 61. The requirement that construction of concrete tanks with NSF Standard 61 certified materials is often unmentioned in marketing literature.

To the question, "how can I assure that NSF Standard 61 ingredients are being used on the new concrete tanks I am intending to construct?" the answer is simple: have NSF Standard 61 ingredients specified by the design engineer, review construction submittals by the award-winner to assure that these ingredients will be used, contract the services of a full-time inspector to assure that these materials are used … or, simply "paint" the interior of the concrete tank with an NSF 61 certified coating.