**RWF Task Group on UV**
**Straw Ballot**
**February 11, 2021**



## Purpose

This straw ballot will add language regarding chloramine reduction to NSF/ANSI/CAN 50.

## Background

When free chlorine reacts with ammonia and nitrogen in the water, it can form chloramines, which is often referred to as "combined chlorine". Not only does a chloramine lose some disinfection strength, they often will form a gas at the surface that can result in respiratory health effects. Health departments are requiring pool operators to test for combined chlorine at a frequency to maintain combined chlorine at a concentration below 0.4ppm. Section 25 (Water Conditioning Devices) of NSF/ANSI/CAN 50 was developed in part to address technologies designed in reduction of chloramines (combined chlorine). Two technologies, ozone and UV radiation, are also technologies that can reduce combined chlorines. Both technologies should be evaluated using the same method as those technologies covered under the scope of Section 25.

An r1 version of this ballot drew comments, and the RWF Task Group on UV met 4 times, reviewing and revising language based on the comments. R4 language was again sent to straw ballot in September, and that ballot received 1 comment regarding whether or not the testing should be mandatory. The Task Group met once to discuss the comment, and an r5 ballot was sent to the group. That ballot received comments advising addition of UVT language, clarification of language about whether the testing is required, and suggesting the ozone testing be written separately. The RWF Task group on UV met on 1/28/21 to discuss those comments, and the r6 language presented for approval here is the result of those discussions.

This straw ballot will last two weeks.

The grey highlighted portions of the language are proposed additions to the language of the standard.
The ~~strikeout~~ portions of the language are proposed deletions to the language of the standard.

An affirmative (yes) vote on this straw ballot means you agree with the revised language as submitted.

A negative (no) vote on this straw ballot means you disagree with the revised language as submitted. A negative vote must include an explanation of why you disagree with the revised draft.

**[Note – the recommended changes to the standard which include the current text of the relevant section(s) indicate deletions by use of ~~strikeout~~ and additions by grey highlighting. Rationale Statements are in *italics* and only used to add clarity; these statements will NOT be in the finished publication.]**

NSF/ANSI Standard
for Recreational Water Facilities —

# Equipment and Chemicals for Swimming Pools, Spas, Hot Tubs, and other Recreational Water Facilities

Evaluation criteria for materials, components, products, equipment, and systems for use at recreational water facilities

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## 14 Ozone generation process equipment

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### 14.24 Performance criteria for the certification of combined chlorine reduction

Ozone generation systems that make a combined chlorine reduction claim may have this perormance claim verified by testing. Manufacturers choosing to have this claim verfied shall be tested in accordance with this section.

#### 14.24.1 Test method for performance certification

##### 14.24.1.1 Purpose

The purpose of this test is to determine the effect of an ozone generator system on the reduction of combined chlorine levels in recreational water.

##### 14.24.1.2 Apparatus

— a test tank capable of holding a volume of 10,000 gallons;

— an environment free from direct air currents on the tank surface and with a temperature of 75 ± 10 °F;

— circulation piping constructed of PVC, sized to match the unit under test;

— a dosing pump equipped to inject hydrochloric acid into the circulation system for pH control;

— a dosing pump equipped to inject sodium hypochlorite into the circulation system for chlorine control separated by a minimum of two feet from the hydrochloric acid injection point; and

— a dosing pump equipped to introduce to the test tank the synthetic bather load.

#### 14.24.1.3 Reagents and test kits

— 0.1 to 0.2M Hydrochloric acid, HCl, reagent grade;

— sodium bicarbonate, $NaHCO_3$, > 99%;

— 3 to 4% sodium hypochlorite, NaOCl. If household bleach is used, documentation shall be provided that no other additives were present in the bleach (dyes, fragrances, etc.);

— calcium chloride (anhydrous or hydrated), $CaCl_2$, > 99%;

— calibration chemicals as specified by the chemical controller manufacturer; and

— hardness (*Standard Methods*[Error! Bookmark not defined.] 2340) and alkalinity (*Standard Methods*[Error! Bookmark not defined.] 2320B; Hach/US EPA 8221)[Error! Bookmark not defined.] test kits.

**Table 14.1**
**Synthetic bather load insult**
**stock solution preparation**

| Chemical | Concentration (g/L) |
|---|---|
| urea | 25.1 |
| albumin | 3.9 |
| creatinine | 1.7 |
| lactic acid | 1.33 mL/L |
| uric acid | 0.619 mL/L |
| glucoronic acid | 0.470 mL/L |
| sodium chloride | 8.873 |
| sodium sulfate | 14.2 |
| ammonium chloride | 2.8 |
| sodium bicarbonate | 2.7 |
| potassium hydrogen phosphate | 4.6 |
| potassium sulfate | 4.1 |
| suntan lotion | 4.0 mL/L |

#### 14.24.1.4 Instrumentation

— inline flow meter(s), minimum accuracy of ± 3%

— scale accurate to ± 0.05

— stopwatch accurate to ± 1% over the test duration;

— a data acquisition system capable of measuring and logging flow rate at a period not to exceed 2 min; and

— water chemistry controller, certified to NSF/ANSI/CAN 50:

— calibrated using the manufacturer's recommended calibration procedure;

— accuracy of the pH and chlorine sensors shall be verified twice daily against a method accurate to ± 0.05 mg/L for chlorine and ± 0.1 for pH;

— the sampling port must be located upstream of the chlorine and pH adjustment feed locations; and

— capable of measuring and logging the following at a period not to exceed 2 min:

— pH;
— free available chlorine;
— total chlorine; and
— temperature (minimum accuracy of ± 2 °F).

**14.24.1.5 Initial water characteristics**

| | |
|---|---|
| temperature | 82 ± 5 °F |
| pH | 7.60 ± 0.10 |
| free chlorine | 2.10 ± 0.05 mg/L |
| turbidity | ≤ 2.0 NTU |
| alkalinity | 100 ± 10 mg/L as $CaCO_3$ |
| hardness | 250 ± 10 mg/L as $CaCO_3$ |

**14.24.1.6 Method**

a) Install the unit under test in accordance with the manufacturer's instructions, but also include the necessary valving and circulation piping to be able to direct the water flow to bypass the unit under test.

b) Fill the test tank with water to a volume of 10,000 gallons, conditioned to the parameters specified in Section 14.24.1.5. Makeup water shall be added to the tank if more than 5% of the volume is lost during testing. Makeup water added to the tank during testing shall also meet the specifications of Section 25.3.

c) Measure the following at the initiation of testing and once daily thereafter:

— turbidity, mass and free chlorine concentration of the sodium hypochlorite stock solution. This data shall be used to calculate consumption of chlorine; and

— total hardness and total alkalinity of the test tank water.

Turbidity, hardness and alkalinity are not adjusted if they fall outside the initial range specified in Section 14.24.1.5.

d) Isolate the unit under test from the water circulation path, and start the circulation and mixing pumps. The flow rate of the circulation system shall be the maximum claimed operating flow rate of the unit under test ±3%.

e) Start the automatic controller and data acquisition system with measurement and data logging at a period not to exceed two minutes.

1. pH adjustments shall be made using an on/off control strategy that initiates the addition of acid upon the measured pH rising to a value between 7.55 and 7.70, and turning off upon the measured pH falling to a value between 7.45 and 7.60.

2. Free chlorine adjustments shall be made using an on/off control strategy that initiates the addition of the sodium hypochlorite stock solution upon the measured free chlorine falling to 2.0 mg/L and turning off upon the measured free chlorine rising to 2.1 mg/L.

f) Initiate continuous dosing of synthetic bather load into the test tank.

1. Prepare the bather load with the ingredients and concentrations shown in Table 14.1.
2. Dilute the bather load with 2 parts deionized water and 1 part bather load
3. Inject into the test tank at a rate of 16.7 ml/min

g) Monitor the combined chlorine level of the test tank, and adjust the dosing rate of the synthetic bather load as necessary to achieve a steady state combined chlorine concentration of 1.0 ± 0.2 mg/L. A steady state combined chlorine concentration is achieved when ten successive 10 minute averages, taken at intervals equivalent to one tank turnover time at the flow rate of the unit under test or 4 hours, whichever is longer, are within 0.15 mg/L of their average. The average of the ten successive 10 minute averages is the steady state combined chlorine concentration

h) Once a steady state has beeen achieved, introduce the circulation flow to the unit under test, and turn on the unit under test. Maintain a constant rate of synthetic bather load addition for the remainder of the test.

i) Continue to run until a steady state combined chlorine concentration is achieved. A steady state combined chlorine concentration is achieved when ten successive 10 minute averages, taken at intervals equivalent to one tank turnover time at the flow rate of the unit under test or 4 hours, whichever is longer, are within 0.15 mg/L of their average. The average of the ten successive 10 minute averages, taken at intervals equivalent to one tank turnover time at the flow rate of the unit under test or 4 hours, whichever is longer, is the steady state combined chlorine concentration observed when the unit under test is operational

#### 14.24.1.6 Acceptance criteria

For devices claiming a reduction in combined chlorine, the steady state combined chlorine concentration observed when the unit under test is operational shall be ≤ 0.4 mg/L.

### 14.24.2 Listing and manual requirements

#### 14.24.2.1 Listing notes

Ozone generation systems that meet the acceptance criteria in Section 14.24.1.6 shall be shown with the following statement on the listing:

*"When tested in accordance with NSF/ANSI/CAN 50, this device was shown to reduce combined chlorine concentrations to < 0.4 mg/L when operated at a maximum flow rate of ___ gpm."*

Ozone generation systems that have not been tested or meet the acceptance criteria of Section 14.24.1.6 shall be shown with the following statement on the listings:

*"Product has not been tested for the reduction of combined chlorine."*

**14.24.2.2 Operation/Installation instructions**

**14.24.2.2.1 Combined chlorine claim**

Ozone generation systems that meet the acceptance criteria in Section 14.24.1.6 shall be shown with the following statement on the listing and in the product manual:

*"When tested in accordance with NSF/ANSI/CAN 50, this device was shown to reduce combined chlorine concentrations to < 0.4 mg/L when operated at a maximum flow rate of ___ gpm."*

Ozone generation systems that have not been tested or meet the acceptance criteria of Section 14.24.1.6 shall be shown with the following statement in the operation/installation instructions:

*"This device has not been tested for the reduction of combined chlorine."*

**14.24.2.2.2 Sodium hypochlorite consumpion**

For ozone generations systems that meet the acceptance criteria in Section 14.24.1.6 but also increase the sodium hypochlorite consumption rate by 25% over the baseline period, the following statement shall be required in the product operation/installation instructions:

*"The conditions under which this system demonstrated a reduction in combined chloramine also resulted in an increase in consumption of sodium hypochlorite."*

**14.24.2.3 Labeling**

For ozone generation systems that meet the acceptance criteria in Section 14.24.1.6, a performance verification label that is permanent and readily accessible, is required with the following statement:

*"When tested in accordance with NSF/ANSI/CAN 50, this device was shown to reduce combined chlorine concentrations to < 0.4 mg/L when operated at a maximum flow rate of ___ gpm."*

***Rationale**: NSF/ANSI/CAN 50 defines "readily accessible" as "Fabricated to be exposed for cleaning and inspection without using tools".*

# 15 Ultraviolet (UV) light process equipment

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### 15.19 Performance criteria for the certification of combined chlorine reduction

UV light equipment that makes a combined chlorine reduction claim may have this performance claim verified by testing. Manufacturers choosing to have this claim verified shall be tested to this section.

#### 15.19.1 Test method for performance certification

##### 15.19.1.1 Purpose

The purpose of this test is to determine the effect of a UV light equipment on the reduction of combined chlorine levels in recreational water.

##### 15.19.1.2 Apparatus

— a test tank capable of holding a volume of 10,000 gallons;

— an environment free from direct air currents on the tank surface and with a temperature of 75 ± 10 °F;

— circulation piping constructed of PVC, sized to match the unit under test;

— a dosing pump equipped to inject hydrochloric acid into the circulation system for pH control;

— a dosing pump equipped to inject sodium hypochlorite into the circulation system for chlorine control separated by a minimum of two feet from the hydrochloric acid injection point;

— a dosing pump equipped to introduce to the test tank the synthetic bather load.

##### 15.19.1.3 Reagents and test kits

— 0.1 to 0.2M Hydrochloric acid, HCl, reagent grade;

— sodium bicarbonate, $NaHCO_3$, > 99%;

— 3 to 4% sodium hypochlorite, NaOCl. If household bleach is used, documentation shall be provided that no other additives were present in the bleach (dyes, fragrances, etc.);

— calcium chloride (anhydrous or hydrated), $CaCl_2$, > 99%;

— calibration chemicals as specified by the chemical controller manufacturer; and

— hardness (*Standard Methods*[Error! Bookmark not defined.] 2340) and alkalinity (*Standard Methods*[Error! Bookmark not defined.] 2320B; Hach/US EPA 8221)[Error! Bookmark not defined.] test kits.

**Table 15.1**
**Synthetic bather load insult**
**stock solution preparation**

| Chemical | Concentration (g/L) |
|---|---|
| urea | 25.1 |
| albumin | 3.9 |
| creatinine | 1.7 |
| lactic acid | 1.33 mL/L |
| uric acid | 0.619 mL/L |
| glucoronic acid | 0.470 mL/L |
| sodium chloride | 8.873 |
| sodium sulfate | 14.2 |
| ammonium chloride | 2.8 |
| sodium bicarbonate | 2.7 |
| potassium hydrogen phosphate | 4.6 |
| potassium sulfate | 4.1 |
| sunscreen | 4.0 mL/L |

**15.19.1.4 Instrumentation**

— inline flow meter(s), minimum accuracy of ± 3%

— scale accurate to ± 0.05

— stopwatch accurate to ± 1% over the test duration;

— a data acquisition system capable of measuring and logging flow rate at a period not to exceed 2 min; and

— water chemistry controller, certified to NSF/ANSI/CAN 50:

— calibrated using the manufacturer's recommended calibration procedure;

— accuracy of the pH and chlorine sensors shall be verified twice daily against a method accurate to ± 0.05 mg/L for chlorine and ± 0.1 for pH;

— the sampling port must be located upstream of the chlorine and pH adjustment feed locations; and

— capable of measuring and logging the following at a period not to exceed 2 min:

— pH;
— free available chlorine;
— total chlorine; and
— temperature (minimum accuracy of ± 2 °F).

### 15.19.1.5 Initial water characteristics

| | |
|---|---|
| temperature | 82 ± 5 °F |
| pH | 7.60 ± 0.10 |
| free chlorine | 2.10 ± 0.05 mg/L |
| turbidity | ≤ 2.0 NTU |
| alkalinity | 100 ± 10 mg/L as $CaCO_3$ |
| hardness | 250 ± 10 mg/L as $CaCO_3$ |
| $UVT_{1\ cm}$ | 94.0±0.5% |

### 15.19.1.6 Method

a) Install the unit under test in accordance with the manufacturer's instructions, but also include the necessary valving and circulation piping to be able to direct the water flow to bypass the unit under test.

b) Fill the test tank with water to a volume of 10,000 gallons, conditioned to the parameters specified in Section 15.19.1.5. Makeup water shall be added to the tank if more than 5% of the volume is lost during testing. Makeup water added to the tank during testing shall also meet the specifications of Section 25.3:

— if necessary, initial UVT adjustments shall be made with SuperHume

c) Measure the following at the initiation of testing and once daily thereafter:

— turbidity, UVT, mass and free chlorine concentration of the sodium hypochlorite stock solution. This data shall be used to calculate consumption of chlorine; and

— total hardness and total alkalinity of the test tank water.

Turbidity, UVT, hardness and alkalinity are not adjusted if they fall outside the initial range specified in Section 15.19.1.5.

d) Isolate the unit under test from the water circulation path, and start the circulation and mixing pumps. The flow rate of the circulation system shall be the maximum claimed operating flow rate of the unit under test ±3%.

e) Start the automatic controller and data acquisition system with measurement and data logging at a period not to exceed two minutes.

1) pH adjustments shall be made using an on/off control strategy that initiates the addition of acid upon the measured pH rising to a value between 7.55 and 7.70, and turning off upon the measured pH falling to a value between 7.45 and 7.60.

2) Free chlorine adjustments shall be made using an on/off control strategy that initiates the addition of the sodium hypochlorite stock solution upon the measured free chlorine falling to 2.0 mg/L and turning off upon the measured free chlorine rising to 2.1 mg/L.

f) Initiate continuous dosing of synthetic bather load into the test tank.

1) Prepare the bather load with the ingredients and concentrations shown in Table 15.1.
2) Dilute the bather load with 2 parts de-ionized water and 1 part bather load.
3) Inject into the test tank at a rate of 16.7 mL/min.

g) Monitor the combined chlorine level of the test tank, and adjust the dosing rate of the synthetic bather load as necessary to achieve a steady state combined chlorine concentration of 1.0 ± 0.2 mg/L. A steady state combined chlorine concentration is achieved when ten successive 10 minute averages, taken at intervals equivalent to one tank turnover time at the flow rate of the unit under test or 4 hours, whichever is longer, are within 0.15 mg/L of their average. The average of the ten successive 10 minute averages is the steady state combined chlorine concentration

h) Once a steady state has beeen achieved, introduce the circulation flow to the unit under test, and turn on the unit under test. Maintain a constant rate of synthetic bather load addition for the remainder of the test.

i) Continue to run until a steady state combined chlorine concentration is achieved. A steady state combined chlorine concentration is achieved when ten successive 10 minute averages, taken at intervals equivalent to one tank turnover time at the flow rate of the unit under test or 4 hours, whichever is longer, are within 0.15 mg/L of their average. The average of the ten successive 10 minute averages, taken at intervals equivalent to one tank turnover time at the flow rate of the unit under test or 4 hours, whichever is longer, is the steady state combined chlorine concentration observed when the unit under test is operational.

#### 15.19.1.6 Acceptance criteria

For UV light equipment claiming a reduction in combined chlorine, the steady state combined chlorine concentration observed when the unit under test is operational shall be ≤ 0.4 mg/L.

### 15.19.2 Listing and manual requirements

#### 15.19.2.1 Combine chlorine claim

UV light equipment that meet the acceptance criteria in Section 15.19.1.6 shall be shown with the following statement on the listing and in the product manual:

*"When tested in accordance with NSF/ANSI/CAN 50, this device was shown to reduce combined chlorine concentrations to < 0.4 mg/L when operated at a maximum flow rate of ___ gpm with 94% UVT."*

UV light equipment that have not been tested or meet the acceptance criteria of Section 15.19.1.6 shall be shown with the following statement in the operation/installation instructions:

*"This device has not been tested for the reduction of combined chlorine."*

#### 15.19.2.2 Sodium hypochlorite consumpion

For UV light eqipment that meet the acceptance criteria in Section 15.19.1.6 but also increase the sodium hypochlorite consumption rate by 25% over the baseline period, the following statement shall be required in the product operation/installation instructions:

*"The conditions under which this system demonstrated a reduction in combined chloramine also resulted in an increase in consumption of sodium hypochlorite."*

**15.19.2.3 Labeling**

For UV light equipment that meet the acceptance criteria in Section 15.19.1.6, a performance verification label that is permanent and readily accessible, is required with the following statement:

*"When tested in accordance with NSF/ANSI/CAN 50, this device was shown to reduce combined chlorine concentrations to < 0.4 mg/L when operated at a maximum flow rate of ___ gpm with 94% UVT."*

***Rationale**: NSF/ANSI/CAN 50 defines "readily accessible" as "Fabricated to be exposed for cleaning and inspection without using tools".*