Summary of Substantive Changes
between the 2019 and the 2020 editions of

NSF/ANSI/CAN 50 "Equipment and Chemicals for Swimming Pools, Spas, Hot Tubs, and other Recreational Water Facilities"

Presented to the IAPMO Standards Review Committee on October 18, 2021

General: The changes to this standard may have an impact on currently listed products. The substantive changes are:

- Relocating swimming pool treatment chemicals requirements to Section 27, and also moved all informative language to Annex R (see Section 27, and Annex R)
- Expanding the scope to include Stainless Steel type 304 and 316 to piping materials (see Section 4.5)
- Expanding the scope to include cryptosporidium parvum oocyst reduction filters (see Section 6.1.10, and Annex N-2.9)
- Adding requirements to accommodate pumps that provide a flow rate output such as a visual flow rate in LPM/GPM or other manner (see Sections 7.6.3, 7.7.3, and 7.9.1)
- Adding requirements to accommodate UV systems utilizing low pressure (LP) lamps (see Section 15.18.1)
- Revising turbidity reduction test method and performance requirements (see Annex N-2.5)

Section ,3 Definitions: The following definition was added:
3.59 high capacity cartridge filter*: A cartridge-type filter designed for use at filtration rates ≤ 0.375 gpm/ft^2*

Section 4, Swimming pool water contact materials: Relocated swimming pool treatment chemicals requirements to Section 27, and also moved all informative language to Annex R as follows:
4 Swimming pool water contact materials ~~***and swimming pool treatment chemicals***~~
4.1 Materials
....
~~***4.2.1***~~ ***27.3 Formulation submission***
The manufacturer shall submit, at a minimum, the following information for each swimming pool treatment chemical:
— a proposed maximum dose rate for the product;
— complete formulation information, which includes the following:
— the composition of the formulation (in percent or parts by weight for each chemical in the formulation);
— the reaction mixture used to manufacture the chemical, if applicable;
— Chemical Abstracts Registry Number (CASRN), chemical name, and supplier for each chemical present in the formulation; and
— a list of known suspected impurities within the treatment chemical formulation and the maximum percent or parts by weight of each impurity;
— a description or classification of the process in which the treatment chemical is manufactured, handled and packaged.

~~4.2.2~~ 27.3.1 Formulation review

The formulation information provided by the manufacturer shall be reviewed and this review shall determine the formulation-dependent chemical constituents required to be evaluated in accordance with Annex N-12.

For those swimming pool treatment chemicals that have regulatory approval for use in pools by the US EPA under the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA),20 such regulatory approval may be used to exempt the swimming pool treatment chemical constituents from evaluation against the requirements of Annex N-12; however, contaminant testing and evaluation shall still be required as set forth under Section 5.2.3.

~~4.2.3~~ 27.4 Contaminant testing

Swimming pool treatment chemicals shall be tested according to the test methodologies in NSF/ANSI/CAN 60, Annex N-1, and analyzed for contaminants per the requirements of NSF/ANSI/CAN 60, Sections 3, 4, 5, 6, and 7 regarding minimum test batteries and formulation dependent analytes. Any identified contaminants shall not exceed criteria ~~developed using Annex N-12~~ in Sections 27.5 and 27.7.

Section 4.5, Piping materials: Expanded the scope to include Stainless Steel type 304 and 316 to piping materials as follows:

4.5 Piping materials

4.5.1 *Galvanized steel pipe and galvanized iron pipe with cast or malleable iron fittings and bronze or iron-bodied bronze fitted valves are acceptable for use without a protective coating. If such materials have a steel housing, then no insulating fittings are required. Otherwise, all metal pipe with a dissimilar metal housing shall have insulated fittings.*

4.5.2 *Piping intended for use in water applications with conductivity greater than or equal to 600 ppm aqueous solution of sodium chloride shall be made from one of the following materials:*

— aluminum brass (UNS C68700);
— copper-nickel, 10% (UNS C70600);
— copper-nickel, 30% (UNS C71500);
— nickel-copper alloy – Monel 400 (UNS N04400);
— stainless steel Type 304 (passivated) (UNS S30400);
— stainless steel Type 316 (passivated) (UNS S 31600); or
— thermoplastics or thermoset pipes conforming to the applicable sections of NSF/ANSI 14.

Section 6, Filters: Expanded the scope to include cryptosporidium parvum oocyst reduction filters as follows:

6.1 General

The requirements in this subsection apply to diatomite-type, sand-type, cartridge-type, and high-permeability-type filters.

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6.1.10 Cryptosporidium parvum oocyst reduction

6.1.10.1 *A filter manufacturer may make a C. parvum log reduction claim up to a maximum of 1.0 log. A filter claimed by the manufacturer to reduce C. parvum shall be tested in accordance with Section N-2.9. The verified C. parvum log reduction determined in accordance with Section N-2.9 shall be noted on the data plate.*

***6.1.10.2** Polystyrene latex microspheres, as referenced in the test method for bag and cartridge filter systems in NSF/ANSI 419: Public Drinking Water Equipment Performance – Filtration, shall be an acceptable surrogate for live C. parvum oocyst.*

***6.1.10.3** The polystyrene latex microspheres shall have 95% of particles in the range of 3.00 ± 0.15 µm. The size variation of the polystyrene microspheres shall be confirmed by electron microscopy. The spheres shall have a surface charge content of less than 2 µeq/g. The microspheres shall contain a fluorescein isothiocyanate (FITC) dye or equivalent.*

***6.1.10.4** The maximum feed concentration shall be 10,000/L, to prevent overseeding that will lead to artificially high log removals performance.*

***6.1.10.5** Detection and enumeration of polystyrene microspheres shall be done in accordance with Annex A of NSF/ANSI 419.*

***6.1.10.6** If a filter has been validated for a reduction of C. parvum in accordance with Section 6.1.10 and Section N-2.9, the installation and operating instructions shall contain the following information:*

— the validated log reduction, shall be indicated via the following statement:

"This filter has demonstrated the ability to provide a 1.0 log reduction of Cryptosporidium parvum at a flow rate of XXX gpm when tested with 3-µm polystyrene microspheres."

— cleaning instructions, including but not limited to any backwash, rinse, filter to drain, or auxiliary recirculation steps. Minimum and maximum flow rates and times shall be included for each step;

— remediation instructions specific to the handling of waste, rinse, and/or backwash water that may contain C. parvum. These instructions must include a statement that all waste, rinse and backwash water generated by this filter must be directed to a sanitary sewer; and

— the allowable range of pressure drop through the filter, what pressure drop, or flow reduction indicates cleaning is required, and the terminal pressure drop requiring changeout of the media.

***6.1.10.7** If a filter has been validated for a reduction of C. parvum in accordance with Section 6.1.9.2 and Section N-2.9, the data plate shall contain the following information:*

— the validated log reduction shall be indicated on the data plate via the following statement:

"This filter has demonstrated the ability to provide a 1.0 log reduction of Cryptosporidium parvum when tested with 3-µm polystyrene microspheres."

— name and grade of media used during the validation testing of C. parvum reduction and a statement that use of any other media invalidates the C. parvum reduction claim of the filter; and

— the data plate shall also include the following statement:

"Follow the cleaning and remediation instructions provided in the operating manual for safe handling of filter cleaning and wastewater. All waste, rinse, and/or backwash water generated by this filter must be directed to a sanitary sewer."

Section 7, Centrifugal pumps: Added requirements to accommodate pumps that provide a flow rate output (such as a visual flow rate in LPM/GPM or other manner) as follows:

7.6 Pump performance curve

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***7.6.3** For pumps that provide a flow rate output (such as a visual flow rate in LPM/GPM or other manner), the pump may be tested in accordance with the following flow meter requirements of Section 24 of this standard:*

−Section 24.8: Flow rate measurement accuracy;

−Section 24.9: Flow metering device testing and accuracy levels; and

−Section 24.12: Life testing.

7.7 Operation and installation instructions
7.7.3 *For pumps that provide a flow rate output, the instruction manual shall either state the accuracy level of flow metering performance, (e.g., Level 1 or L1) or shall include the statement: "Displayed flow rate has not been evaluated to the flow meter requirements of NSF/ANSI/CAN 50."*

7.9 Data plate
7.9.1 *A pump shall have a data plate that is permanent; easy to read; and securely attached, cast, or stamped into the pump at a location readily accessible after installation. The data plate shall contain the following information:*
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— if applicable, accuracy level of flow metering performance, (e.g., Level 1 or L1).

Section 15, Ultraviolet (UV) light process equipment: Added requirements to accommodate UV systems utilizing low pressure (LP) lamps as follows:
15.18 UV Cryptosporidium inactivation and dose determination
....
15.18.1 Sample selection
When validating a range of aquatic or recreational water use UV systems for inactivation of cysts such as C. parvum, each of the following variables shall be used to determine which UV reactor / systems and components shall be tested within the range of product. Select at least two worst-case models from the range of products based upon all of the following variables.
— test the unit representative of the worst-case reactor hydraulics and UV dose delivery as determined by computational fluid dynamics modeling, including intensity and flow modeling;
— test the unit with the lowest power to highest flow rate;
— test one unit of each configuration (if family range contains U and S reactors, test each);
— test one unit of each UV lamp type (if alternate lamp types or suppliers, test each);
— in the case where the UV system utilizes low pressure (LP) lamps, it is sufficient to provide a data sheet of the lamp that includes the expected lamp life. In addition, the following characteristics of the lamp must be the same:
— lamp length, the length of the lamp from base face to base face, ± 0.5 in;
— the arc length, the lit length, ± 0.5 in;
— the diameter, ± 10%;
— the quartz material, fused silica, synthetic quartz, deep UV blocking;
— electrode current, ± 0.2 A;
— lamp wattage, ± 5 W;
— output, 185/254 nm or 254 nm;
— mercury source, elemental, spot amalgam, pocket amalgam; and
— connections, single ended, double ended.
— test one unit of each UV sensor type (if alternate UV sensor types or suppliers, test each).
NOTE — The above variables require that multiple UV systems are tested in order to validate a range of products.

Normative Annex 2: Revised turbidity reduction test method and performance requirements as follows:

N-2.5 Turbidity reduction test

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N-2.5.4 Turbidity reduction test method

a) *Determine the volume of water needed to achieve a turnover ~~rate of no greater than 30 min~~ time according to the equation below when the filter is operated at the maximum design flow rate. Fill the test tank with the required volume of water.*

$$\text{turnover time (minutes)} = \left(\frac{8}{\sqrt{U}} + 8\right), \pm 5\%, \text{ maximum } 30$$

where:

$$U = \text{filtration rate}, \left(\frac{\text{gpm}}{\text{ft}^2}\right) = \frac{\text{maximum design flow rate (gpm)}}{\text{effective filtration area } (\text{ft}^2)}$$

$$\text{Volume (gallons)} = \text{turnover time (minutes)} \times \text{maximum design flow rate (gpm)}$$

If the prescribed turnover time requires a test volume greater than 10,000 gallons, the turnover time may be shortened to limit the test volume to 10,000 gallons.

b) *Sample the water in the tank and determine the turbidity level (TB1) in NTU. Add a sufficient quantity of silica #140 to obtain a turbidity level (TB2) of 45 ± 5 NTU.*
c) *Install and condition the filter according to the manufacturer's instructions. Operate the filter at the maximum design flow rate.*
d) *After operating the filter for the time required to filter one tank volume, draw a sample from the filter effluent and measure the turbidity (TB3). Repeat for the next four tank volumes.*
e) *Calculate the turbidity remaining (TR) ratio at each tank volume using the following equation:*
TR = (TB3 – TB1) / (TB2 – TB1)
f) *If the filter reaches the manufacturers recommended condition for cleaning prior to completing five tank turnovers, draw a sample from the filter effluent at the time the filter reaches the manufacturer's recommended condition for cleaning, and measure the turbidity (TB3).*
g) *High capacity cartridge filters only (as defined in Section 2): if the TR ratio is > 0.30 after five tank turnover times has elapsed and the filter has not reached the manufacturer's recommended condition for cleaning, a second turbidity reduction test may be performed, steps (a) through (f), without cleaning the filter. Prior to this second test, the water from the test tank and the filter housing shall be drained. The water used for the second test shall meet the requirements of Section N-2.5.3. The acceptance criteria shall be applied to the TR ratio from this second test.*

N-2.5.5 Acceptance criteria

After the fifth tank volume, the TR ratio shall be ≤ 0.30. This is equivalent to a 70% or greater reduction in turbidity.
Filters that reach the manufacturer's recommended condition for cleaning prior to completing five turnovers, shall have TR ratio ≤ 0.30 at the time the filter reaches the manufacturer's recommended condition for cleaning.

N-2.9 Test method for Cryptosporidium parvum oocyst reduction

N-2.9.1 Cartridge and bag type filters

Cartridge and Bag Filters shall be evaluated according to NSF/ANSI 419: Public Drinking Water Equipment Performance – Filtration (Section 5).

As specified in Section C.3.2 of NSF/ANSI 419, the log reduction value assigned to a filter shall be the minimum value obtained from all test conditions.

The manufacturer of the filter may claim a 1.0 log reduction of C. parvum; the claim shall not exceed the minimum observed $LRV_{condition}$.

N-2.9.2 Precoat media type filters

N-2.9.2.1 Apparatus

– flow meter (required accuracy is ± 1 GPM [± 4 LPM] or ± 3% of reading, whichever is greater);

– pressure-recording device (required accuracy is ± 0.5 psi of the smallest division used in the manufacturer's claimed pressure loss);

– turbidimeter (required accuracy from 0 to 10 NTU is ± 0.5 NTU; required accuracy above 10 NTU is ± 5% of the reading or ± 1 NTU, whichever is greater);

– temperature-indicating device (required accuracy is ± 2 °F [± 1 °C]);

– water tank and pump system capable of delivering water at the design flow rate through the filter;

– pressure measurement taps sized to the filter's inlet and outlet; and

– polystyrene latex microspheres

N-2.9.2.2 Challenge water

pH	7.2 to 7.6
alkalinity	≥20 mg/L as $CaCO_3$
hardness	200 to 400 mg/L as $CaCO_3$
temperature	50 to 81°F
turbidity	≤0.3 NTU
total / free available chlorine	0 ppm
iron	≤0.3 mg/L
manganese	≤0.3 mg/L

N-2.9.2.3 Test dust

Test dust is used to load the filter to create a pressure drop across the filter. Test dust shall be added to the general test water as specified in the following procedure to achieve a maximum turbidity of 10 NTU. The test dust shall be ISO 12103-1 A3 Medium Arizona Test Dust.

N-2.9.2.4 Procedure

a) Fill a test tank and condition to water parameters specified above.

b) Static mixers shall be installed three pipe diameters upstream of the filter influent and effluent collection taps. Influent and effluent sample taps shall extend into the center of the piping.

c) Install precoat media and condition the filter according to the manufacturer's instructions.

d) Begin filter operation at the manufacturer's maximum claimed flow rate. The filter effluent shall be recirculated to the test tank.

e) A negative control sample shall be collected from the influent and effluent sample taps and analyzed for microspheres.

f) Begin injection of the challenge microsphere suspension to obtain a maximum feed concentration of 10,000/L. Influent and effluent samples shall be collected after three void volumes of water containing the challenge have passed through the test filter. Test sample taps shall be flushed before each sample collection.

g) After sample collection is complete, challenge suspension injection shall be stopped, and filter operation shall continue.

h) Begin injection of the test dust and operate the filter until the pressure drop across the filter reaches 50 ± 5% of the backwash pressure differential as specified by manufacturer. The water in the tank shall then be recirculated without test dust or microsphere additions until the tank turbidity has dropped to ≤ 2 NTU.

i) Ensure that the pressure drop across the filter is still 50 ± 5% of the backwash pressure differential as specified by manufacturer and begin injection of the microsphere suspension to obtain a maximum feed concentration of 10,000/L and collect influent and effluent samples after three void volumes of water containing the challenge have passed through the test filter. Test sample taps shall be flushed before each sample collection.

j) After sample collection is complete, challenge suspension injection shall be stopped, and filter operation shall continue.

k) Begin injection of the test dust and operate the filter until the pressure drop across the filter reaches 100 ± 5% of the backwash pressure differential as specified by manufacturer. The water in the tank shall then be recirculated without test dust or microsphere additions until the tank turbidity has dropped to ≤ 2 NTU.

l) Ensure that the pressure drop across the filter is still 100 ± 5% of the backwash pressure differential as specified by manufacturer and begin injection of the microsphere suspension to obtain a maximum feed concentration of 10,000/L and collect influent and effluent samples after three void volumes of water containing the challenge have passed through the test filter. Test sample taps shall be flushed before each sample collection.

m After sample collection is complete, challenge suspension injection shall be stopped, and filter shall be cleaned in accordance with the manufacturer's instructions.

n) After cleaning, install precoat media and condition the filter according to the manufacturer's instructions.

o) Restart filtration and injection of the microsphere suspension to obtain a maximum feed concentration of 10,000/L and collect influent and effluent samples immediately after restarting the flow, after one, two and three void volumes of water containing the challenge have passed through the test filter, and after 5 min of operation. Test sample taps shall be flushed before each sample collection. As the test is being performed with recirculation of filtration effluent, measured feed concentrations of up to 5.0 × 104 shall be considered as conforming to the method. However, for the purpose of calculating observed log reductions values, the influent concentration shall be capped at 1.0 × 104.

N-2.9.2.5 Analytical methods

Detection and enumeration of microspheres in each sample shall be analyzed in triplicate and in accordance with Annex A of NSF/ANSI 419.

N-2.9.2.6 Acceptance criteria

The geometric means of the triplicate analyses of the microsphere test samples shall be log transformed to calculate the log removal value of each of the conditions tested, $LRV_{condition}$:

−initial startup of filter;

−50 ± 5% of pressure differential;

−90 ± 5% of pressure differential;

−immediately after cleaning;

−1 void volume after cleaning;
−2 void volumes after cleaning;
−3 void volumes after cleaning; and
−5 min of operation after cleaning.

The manufacturer of the filter may claim a 1.0 log reduction of C. parvum not exceeding the minimum observed $LRV_{condition}$.

N-2.9.3 Sand type filters

N-2.9.3.1 Apparatus

−flow meter (required accuracy is ± 1 GPM [± 4 LPM] or ± 3% of reading, whichever is greater);
−pressure-recording device (required accuracy is ± 0.5 psi of the smallest division used in the manufacturer's claimed pressure loss);
−turbidimeter (required accuracy from 0 to 10 NTU is ± 0.5 NTU; required accuracy above 10 NTU is ± 5% of the reading or ± 1 NTU, whichever is greater);
−temperature-indicating device (required accuracy is ± 2 °F [± 1 °C]);
−water tank and pump system capable of delivering water at the design flow rate through the filter;
−pressure measurement taps sized to the filter's inlet and outlet; and
−polystyrene latex microspheres.

N-2.9.3.2 Challenge water

pH	7.2 to 7.6
Alkalinity	≥20 mg/L as $CaCO_3$
Hardness	200 to 400 mg/L as $CaCO_3$
temperature	50 to 81°F
Turbidity	≤0.3 NTU
total / free available chlorine	0 ppm
Iron	≤0.3 mg/L
manganese	≤0.3 mg/L

N-2.9.3.3 Test dust

Test dust is used to load the filter to create a pressure drop across the filter. Test dust shall be added to the general test water as specified in the following procedure to achieve a maximum turbidity of 10 NTU. The test dust shall be ISO 12103-1 A3 Medium Arizona Test Dust.

N-2.9.3.4 Procedure

a) Fill a test tank and condition to water parameters specified above.
b) Static mixers shall be installed three pipe diameters upstream of the filter influent and effluent collection taps. Influent and effluent sample taps shall extend into the center of the piping.
c) Install media and condition the filter according to the manufacturer's instructions, including any backwash and filter to drain operations specified.
d) Begin filter operation at the manufacturer's maximum claimed flow rate. The filter effluent shall be recirculated to the test tank.
e) A negative control sample shall be collected from the influent and effluent sample taps and analyzed for microspheres.
f) Begin injection of the challenge microsphere suspension to obtain a maximum feed concentration of 10,000/L. Influent and effluent samples shall be collected after three void volumes of water containing

the challenge have passed through the test filter. Test sample taps shall be flushed before each sample collection.

g) After sample collection is complete, challenge suspension injection shall be stopped, and filter operation shall continue.

h) Begin injection of the test dust and operate the filter until the pressure drop across the filter reaches 50 ± 5% of the backwash pressure differential as specified by manufacturer. The water in the tank shall then be recirculated without test dust or microsphere additions until the tank turbidity has dropped to ≤2 NTU.

i) Ensure that the pressure drop across the filter is still 50 ± 5% of the backwash pressure differential as specified by manufacturer and begin injection of the microsphere suspension to obtain a maximum feed concentration of 10,000/L and collect influent and effluent samples after three void volumes of water containing the challenge have passed through the test filter. Test sample taps shall be flushed before each sample collection.

j) After sample collection is complete, challenge suspension injection shall be stopped, and filter operation shall continue

k) Begin injection of the test dust and operate the filter until the pressure drop across the filter reaches 100 ± 5% of the backwash pressure differential as specified by manufacturer. The water in the tank shall then be recirculated without test dust or microsphere additions until the tank turbidity has dropped to ≤2 NTU.

l) Ensure that the pressure drop across the filter is still 100 ± 5% of the backwash pressure differential as specified by manufacturer and begin injection of the microsphere suspension to obtain a maximum feed concentration of 10,000/L and collect influent and effluent samples after three void volumes of water containing the challenge have passed through the test filter. Test sample taps shall be flushed before each sample collection.

m) After sample collection is complete, challenge suspension injection shall be stopped, and filter shall be cleaned in accordance with the manufacturer's instructions.

n) After cleaning, restart filtration and injection of the microsphere suspension to obtain a maximum feed concentration of 10,000/L and collect influent and effluent samples immediately after restarting the flow, after one, two and three void volumes of water containing the challenge have passed through the test filter, and after 5 minutes of operation. Test sample taps shall be flushed before each sample collection. As the test is being performed with recirculation of filtration effluent, measured feed concentrations of up to 5.0 × 104 shall be considered as conforming to the method. However, for the purpose of calculating observed log reductions values, the influent concentration shall be capped at 1.0 × 104.

N-2.9.3.5 Analytical methods

Detection and enumeration of microspheres in each sample shall be analyzed in triplicate and in accordance with Annex A of NSF/ANSI 419.

N-2.9.3.6 Acceptance criteria

The geometric means of the triplicate analyses of the microsphere test samples shall be log transformed to calculate the log removal value of each of the conditions tested, $LRV_{condition}$:

−initial startup of filter;

−50 ± 5% of pressure differential;

−90 ± 5% of pressure differential;

−immediately after cleaning;

−1 void volume after cleaning;

−2 void volumes after cleaning;

−3 void volumes after cleaning; and
−5 min of operation after cleaning.
The manufacturer of the filter may claim a 1.0 log reduction of C. parvum; the claim shall not exceed the minimum observed $LRV_{condition}$.

27 Treatment chemicals used in recreational water and facilities

27.1 Scope

27.1.1 Products included in scope

Treatment chemicals requiring a health effects evaluation includes those directly added to the waters of pools and spas. These treatment chemicals shall not impart undesirable levels of either chemical constituents or contaminants to the water.

~~**4.2 Swimming pool treatment chemicals**~~

~~Swimming pool treatment chemicals shall be evaluated in accordance with the requirements of Annex N-12 and shall not impart undesirable levels of either chemical constituents or contaminants to the water~~

Swimming pool treatment chemical~~s~~ constituents evaluated under this Standard shall ~~be~~ include:
— the swimming pool treatment chemical constituents;
— the product-specific contaminants identified in the formulation review or by testing; and
— other constituents as identified in the formulation review or by testing.

Excluded from the scope of this evaluation procedure are contaminants produced as by-products through reaction of the treatment chemical with a constituent of the treated water. Also excluded from the scope of this evaluation procedure are the potential effects of the accumulation of pool treatment chemicals in the pool water based on multiple dosages over time. The rationale for these exclusions is based on the variability of pool-specific parameters that may influence such determinations which include, but are not limited to, water chemistry, variability in recirculation, different filtration rates/types, water replacement rates, and splash-out rates.

27.1.2 Products excluded from scope

Excluded from health effects evaluations are any chemicals not added directly to the water that only have incidental contact.

NOTE — The excluded treatment chemicals are not diluted in the recreational water, thus a health effects assessment must consider user exposure to the concentrated chemical under different circumstances. This exposure is best evaluated using a different hazard assessment than the framework outlined in Annex N-12.

~~N-12.2~~27.2 Definitions:

All definitions in Annex N have been relocated to Section 27.2