TO: Joint Committee on Biosafety Cabinetry

FROM: Robert W. Powitz, Chairperson of the Joint Committee

DATE: November 14, 2023

SUBJECT: Proposed revision to NSF/ANSI 49 – *Biosafety Cabinetry: Design, Construction, Performance and Field Certification* (49i176r2)

Revision 2 of NSF/ANSI 49 issue 176 is being forwarded to the Joint Committee for balloting. Please review the changes proposed to this standard and **submit your ballot by December 7, 2023** via the NSF Online Workspace <www.standards.nsf.org>.

When adding comments, please identify the section number/name for your comment and add all comments under one comment number where possible. If you need additional space, please upload a word or pdf version of your comments online via the browse function.

Purpose

The purpose of this ballot is to affirm revised language related to the verification of the Secondary Inflow Method in Normative Annex 1 and 5.

Background

Issue paper **BSC-2023-01 – Secondary Inflow Method** highlighted the long-tested fact that very rarely and likely coincidentally does the data gathered using the secondary inflow method match that of the primary method. Nevertheless, as pointed out by the issue proponent, Standard 49 requires that a successful reproduction of the method shall take place prior to certification. This issue proponent suggested matching data with that of the manufacture cannot happen in most cases and therefore revising the language in this case will allow for the secondary method to be unverifiable. This issue was sent directly to JC Approval Ballot and yielded a vote of **Vote - 7 : 6 : 3 (Affirmative : Negative : Abstain)** and 8 comments.

With the extent of comments and concerns, the issue proponent submitted a new issue paper replacing the first. This included the recommendation of creating a task group to discuss further. Since that time, the Task Group met 3 times, discussed the language with respect to the comments and voted on R1 language. This vote yielded a tally of **7 : 1 : 0 (Affirmative : Negative : Abstain)** and 3 comments.

The issue proponent agreed with the comments, discussed with the negative voter, and created this Revision 2 ballot which is now offered here for your consideration.

Public Health Impact

The proposed changes have no negative impact on public health.

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If you have any questions about the technical content of the ballot, you may contact me in care of:

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[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 *red italics* and only used to add clarity; these statements will NOT be in the finished publication.]

NSF/ANSI International Standard for Biosafety Cabinetry —

Biosafety Cabinetry: Design, Construction, Performance, and Field Certification

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Normative Annex 1
(formerly Annex A)

Performance tests

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N-1.9.3.1 General

The nominal set point average inflow velocity shall be determined by a direct inflow reading instrument measurement. ~~After the nominal set point is determined by a direct inflow reading instrument measurement, readings shall be taken by the appropriate alternate calculated or measured method recommended by the manufacturer. Both of these set point values shall meet the requirements of Section N-1.9.4.~~

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N-1.9.3.4 Alternate inflow measurement methods

These methods, approved by the testing organization, shall be validated and provided by the manufacturer and shall be subject to review by the testing organization. ~~Manufacturer validation procedures shall contain no fewer than ten replicate tests.~~ The testing organization's approval shall be based on ~~review of data and~~ successful reproduction of test results. The following methods have been found to be acceptable on some cabinets:

N-1.9.3.4.1 Method for Type A1 and A2, and C1 cabinets that use a thermal anemometer to measure exhaust velocity to determine inflow velocity

a) Take air velocity measurements at multiple points across the exhaust filter face as described by the manufacturer on a grid no larger than 4 × 4 in (100 × 100 mm), with the grid starting points and height above the filter validated by the testing organization (see Figure 22). A clear 12 in (300 mm) of space is required above the exhaust HEPA filter face for valid thermal anemometer measurements. The air measurement probe shall be held rigidly in a freestanding fixture that permits accurate positioning and does not distort the airflow pattern.

This includes a ring-stand and clamp or manufacturer supplied probe holder. The anemometer probe shall not be hand held.

b) The effective open area of the exhaust HEPA/ULPA filter or exhaust port shall be determined and supplied by the manufacturer and validated by the testing organization. Cabinets in which the exhaust filter is not accessible or exhaust port flow is nonuniform, such as caused by a damper or exhaust filter housing design, shall be tested as approved by the testing organization.

c) To obtain the exhaust flow volume rate in ft^3/min (m^3/s), multiply the average exhaust air velocity in ft/min (m/s) by the exhaust area in ft^2 (m^2).

d) Calculate the average inflow velocity in ft/min (m/s) by dividing the average exhaust volume rate in ft^3/min (m^3/s) by the work access opening area in ft^2 (m^2).

e) Include the following in the reported data: individual exhaust velocity readings, average exhaust velocity, exhaust volume rate, exhaust opening dimensions and area, work access opening dimensions and area, calculated average inflow velocity, and the method used to determine them.

N-1.9.3.4.2 Method for Type A1, A2, B1, B2 and C1 cabinets using a thermal anemometer to measure velocity through a constricted access opening to determine average inflow velocity

a) Restrict the access opening as specified by the testing organization.

b) Air velocity measurements shall be taken at multiple points across the restricted opening as specified on the data plate. No fewer than two readings per 1 ft (0.3 m) of access opening width shall be taken. The air measurement probe shall be held rigidly in a freestanding fixture provided by the manufacturer that permits accurate positioning and does not distort the airflow pattern. ~~This includes a ring-stand and clamp or manufacturer supplied probe holder, or if specified by the BSC manufacturer, taping the probe to the inside or outside of the sash. The anemometer probe shall not be hand held~~.

c) Average the air velocity measurements. Multiply the average by the listed correction factor to obtain average inflow velocity.

d) Include the following in the reported data: height of restriction, individual velocity readings, average velocity, the listed correction factor, calculated inflow velocity, and methods used to determine them.

N-1.9.3.4.3 Method for Type B1 cabinets using a thermal anemometer to measure velocity through the access opening to determine average inflow velocity

a) Turn off blower(s) that recirculate air in the cabinet, if specified in the manufacturer's instructions.

b) Set the sash to manufacturer's recommended operating height.

c) Take two rows of air velocity measurements with an anemometer at multiple points in the plane of the access opening. Take one row at a distance below the top of the access opening equal to 25% of the opening height. Take the second row at a distance below the top of the access opening equal to 75% of the opening height (see Figure 23). The air measurement probe shall be held rigidly in a freestanding fixture that permits accurate positioning and does not distort the airflow pattern. This includes a ring-stand and clamp or manufacturer supplied probe holder, or if specified by the BSC manufacturer, taping the probe to the inside or outside of the sash. The anemometer probe shall not be hand held.

d) Take the indicated velocity measurements every 4 in (100 mm) across the width of the front work access opening but no closer than 4 in (100 mm) from sides of the work opening. The average of all measurements represents the inflow velocity.

e) Include individual inflow velocity readings, average inflow velocity, and the methods used to determine them in the reported data.

N-1.9.3.4.4 Calculated method for Type B2 cabinets using an anemometer and pitot tube, if applicable

a) Turn on the cabinet downflow blower and exhaust system blower.

b) Set the sash at manufacturer's recommended operating height.

c) Measure and calculate exhaust volume in accordance with the testing organization's verified methodology or with ASHRAE[7] standards for air velocity measurements, in round or rectangular ducts or with the *Industrial Ventilation Manual*.[3]

d) Measure the supply air velocity on an approximate 4 × 4 in (100 × 100 mm) grid in a horizontal plane 6 in (150 mm) below the face of the downflow diffuser, starting 2 in (50 mm) from each perimeter wall. The air measurement probe shall be held rigidly in a freestanding fixture (ring-stand and clamp) that permits accurate positioning and does not distort airflow pattern (see Figure 24). The anemometer probe shall not be hand held. Average the velocity readings and multiply the average by the area in ft^2 (m^2) of the plane in which the velocities were measured to determine the total filtered air supply in ft^3/min (m^3/s).

e) Subtract the supply air volume rate in ft^3/min (m^3/s) from the total exhaust volume rate in ft^3/min (m^3/s); the difference represents the calculated inflow volume rate in ft^3/min (m^3/s).

f) Divide the calculated inflow volume rate by the area of the access opening in ft^2 (m^2) to determine

the average inflow velocity in ft/min (m/s).

g) Reported the individual exhaust velocity readings, calculated average exhaust velocity, exhaust duct area, calculated exhaust volume, individual supply velocity readings, average supply velocity, effective supply area, calculated supply air volume, area of the work access opening, calculated inflow air volume, calculated access opening average inflow velocity, and the methods used to determine them.

N-1.9.3.4.5 Alternate method Acceptance

Acceptance criteria of the alternate method shall be based on inflow determined by the direct measurement. The fully corrected alternate method inflow velocity shall be within ± 5 ft/min (± 0.025 m/s) of the direct measurement results when both measurements are completed on the same day.

N-1.9.4 Acceptance

Acceptance criteria shall be based on inflow determined by the direct measurement. Subsequent production cabinets of the initial model and size may also qualify as meeting Section N-1.6 when the directly measured inflow velocities are provided within ± 5 ft/min (± 0.025 m/s) of the nominal set point velocities.

The minimum inflow velocity of Type A1 cabinets shall be 75 ft/min (0.38 m/s). The minimum inflow volume shall be 45 ft^3/min (76 m^3/h) per 1 ft (0.3 m) of total work area width (see Sections N-1.6 and N-1.8).

The minimum inflow velocity of Type A2, B1, ~~and~~ B2, and C1 cabinets shall be 100 ft/min (0.51 m/s). The minimum inflow volume shall be 65 ft^3/min (110 m^3/h) per 1 ft (0.3 m) of total work area width (see Sections N-1.6 and N-1.8).

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Normative Annex 5

(formerly Annex F)

Field tests

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N-5.3.3 Methods

One of these methods was validated per cabinet model and provided by the manufacturer, which was reviewed and approved by the testing organization. ~~Manufacturer validation procedures contained no fewer than ten replicate tests. The testing organization's approval will be based on review of data and successful reproduction of test results. The validated alternate method is on the manufacturer's data plate.~~

~~**N-5.3.3.1 General**~~

~~When the testing organization has determined the nominal set point on a given model and size of cabinet using a DIM device, and an appropriate alternative method has been validated for that cabinet by the testing organization, this alternate method may be used to establish the set point on the same model and size of cabinet in the field.~~