



**ARENA RESTART PROTOCOLS 2020/21**





***MECHANICAL / HVAC-R  
SYSTEMS POLICY***

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# MECHANICAL / HVAC-R SYSTEMS POLICY



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# MECHANICAL / HVAC-R SYSTEMS POLICY



## INTRODUCTION

The NHL recognizes the importance of indoor environmental quality (IEQ) in arenas and the optimization of **Heating, Ventilation, Air Conditioning and Refrigeration (HVAC-R)** systems in NHL Arenas and Practice Facilities to mitigate viral exposure from aerosolized particles. The American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) position statement<sup>1</sup> on SARS-CoV-2 and the operation of HVAC-R systems in response to the COVID-19 pandemic states:

**Ventilation and filtration provided by heating, ventilating, and air-conditioning systems can reduce the airborne concentration of SARS-CoV-2 and thus the risk of transmission through the air.**

No intervention to prevent the transmission of COVID-19 is 100% effective, but risk levels are reduced when ventilation rates are increased<sup>2</sup>, air filtration (central and local) is enhanced and inactivation technologies are deployed<sup>3</sup>. In conjunction with third party experts, the NHL has established **requirements and recommendations** for mechanical and HVAC-R systems intended to mitigate the risk of transmission of COVID-19 in facilities. All facilities hosting NHL games or team practices during the NHL's 2020/21 season are to adhere to **requirements** of all applicable local regulations and building codes, including any further restrictions or direction (if any) by local, state, provincial, and federal health authorities.

## CRITERIA FOR TEMPERATURE AND RELATIVE HUMIDITY

At all times during NHL Game play, NHL Arenas' HVAC-R system and operations should have the ability to, and are **required** to, achieve and maintain temperature parameters at ice level between 60°F - 64°F and RH (Relative Humidity) levels of 40% to 45% during games.

## HVAC-R SYSTEM EVALUATION FOR NHL VENUES

**Mechanical/HVAC-R Systems Evaluation<sup>4</sup>:** The NHL recognizes that all NHL Arenas and Practice Facilities (hereafter "Venues") differ based on various factors such as building vintage, type of HVAC-R systems currently installed, region-specific climatic considerations, and even day-specific outdoor temperature and humidity conditions particularly during "shoulder-month" periods (typically late spring and early fall times of the year when daily temperatures can vary between about 45°F and 65°F). The League further acknowledges that facilities where Clubs practice range from older community rinks to newer, state-of-the-art facilities.

Given the multitude of considerations, the NHL recommends Venues to undergo an HVAC-R system review prior to hosting NHL games or team practices, where feasible, to understand current HVAC-R system configuration and operations, and to inform proposed upgrades, retrofits or enhancements to reduce risk of airborne viral transmission.

While the above is recommended, each Club is **required** to perform an independent ventilation analysis and air balance report (air handling unit-level Testing Adjusting Balancing (TAB) report) for all occupied spaces, which will confirm supply, outdoor air and exhaust ventilation rates by a certified TAB contractor, and establish whether the existing system is performing to the basis of its

<sup>1</sup> ASHRAE Statement Regarding Transmission of SARS-CoV-2 (Resources to Address COVID-19)  
<sup>2</sup> ASHRAE Position Document on Infectious Aerosols, April 14, 2020. Section 3.2 Varying Approached for Facility Type, page 6  
<sup>3</sup> ASHRAE Position Document on Infectious Aerosols, April 14, 2020. Section 3.2 Ventilation and Air-Cleaning Strategies, page 6 & 7, 10  
<sup>4</sup> ASHRAE Guidance for Re-Opening Buildings

design. For clarity, the testing of individual VAV boxes and distribution ductwork in occupied spaces is not a requirement.

In addition, please be advised of the following recommendations:

- All areas planned for occupancy should be analyzed to determine total Air Changes per Hour (ACH) and Outdoor Air Changes per Hour (OACH), and an air change rate table for each occupied space should be developed to indicate the current rates for analysis. Expected occupancy counts for these areas should be provided as part of this overall review.
- Review central and local air filtration including Minimum Efficiency Reporting Values (MERV) ratings on existing filters to ensure they are within service life and appropriately installed. Review filter maintenance and replacement schedule as indicated in filter manufacturer's published operations manual.
- Consider independent review of supply and exhaust systems and controls including exhaust fan inspections by a mechanical contractor or commissioning agent.

Venue operators both of **NHL Arenas and Club Practice Facilities** are encouraged to use a professional engineer to do an overall evaluation of the above considerations. The analysis of each venue may take between 2-4 weeks, or longer, based on industry demand and scope of work.

## AIRFLOW MANAGEMENT: VENTILATION AND FILTRATION

The NHL recommends improving airflow (demonstrated by increasing ACH as compared to existing performance levels) and increasing outdoor air flow rates to all occupied spaces, based on an analysis of the venue's existing configuration of the HVAC-R system and current air balance report with analysis by a professional engineer.

### Recommendations:

- Calibrate HVAC-R system controls and airflow measurement devices to coordinate with increased outdoor airflow rates, particularly in areas such as team spaces (visiting and home) back-of-house staff areas, and the main bowl area.
- Any mechanical system allowing for potentially contaminated exhaust air to bypass into the incoming outdoor air stream is not recommended and should be disabled. Proper separation of exhaust sources and intakes should be maintained, and energy recovery should be carefully controlled to limit any bypass airflow<sup>5</sup>.
- Venues should consider disabling automatic demand-controlled ventilation (DCV) system configurations.
- CO<sub>2</sub> Monitoring: Venues should consider monitoring CO<sub>2</sub> levels in occupied spaces to account for any air pollution (parts per million) due to the increased outside air intake<sup>6</sup>.
  - A note on CO<sub>2</sub> Sensor Applications: Venues are encouraged to establish baseline CO<sub>2</sub> concentrations by monitoring each space, while unoccupied, prior to planned occupancy. If possible, simulate event occupancy of each space and chart CO<sub>2</sub> levels at different occupancy counts. Establish maximum occupancy count such that CO<sub>2</sub> levels are maintained below 1,000

<sup>5</sup> ASHRAE Position Document on Infectious Aerosols, April 14, 2020 Section 4.1

<sup>6</sup> ASHRAE Technical Resources: Filtration / Disinfection

<sup>7</sup> ASHRAE 62.1 2016 Ventilation for Acceptable Indoor Air Quality Appendix D

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ppm and implement procedures for reducing occupancy count in the event CO2 levels exceed 1,000 ppm (Ref. ASHRAE 62.1-2016, Appendix D<sup>7</sup>) . During occupied periods, monitor CO2 levels in occupied spaces and track whether ventilation systems are operating properly. If currently installed, CO2 sensors in return air systems serving occupied spaces may be utilized in lieu of sensors in the occupied space level, in addition to any permanently mounted individual sensors, or handheld portable sensors.

- Install duct- or air-handling-unit-mounted UVGI, upper-room UVGI (with possible in-room fans) or portable UVGI air treatment technology to treat the supply air flow, in order to inactivate airborne viruses particularly in high occupancy spaces, team spaces, back of house staff areas or mission-critical operations areas like Security and Command Center-type rooms. See section: Viral Inactivation Technologies below for further information.
- In elevators, implement local treatment such as UVGI technology or HEPA filtration where direct ventilation is not present or not practical, due to the inability to ventilate the elevator cab. Venues are encouraged to obtain industrial hygienist and medical guidance for further consideration on elevator ventilation concerns, and to implement appropriate occupancy count limits as may be recommended.
- In all restrooms, locker rooms, wet areas and showers, engage exhaust systems to run continuously during occupancy<sup>8</sup>. If the HVAC-R system cycles on/off with a thermostat, run the fan constantly during occupied hours.

## **PURGE CYCLES AND OUTDOOR AIR FLOW** //////////////////////////////////////

In addition to the airflow management guidance above, per ASHRAE general guidance<sup>9</sup>, pre- and post-occupancy purge cycles are outlined below for Team Spaces, and Other Occupied Spaces (Non Team Spaces) in NHL Venues:

### **Team Spaces**

- Prior to each occupancy by Players and staff (e.g., Groups 1 and 2A-C), the NHL **requires** flushing all home and visiting Team Spaces with outdoor air for a time required to achieve three air changes of outdoor air<sup>10</sup> (3 OAC). Such team spaces include, without limitation, changing rooms, locker areas, weight rooms, training rooms, medical rooms, coaches room, equipment room, strength and conditioning areas, rehabilitation areas and eating or recreation lounge-type spaces areas.
- For HVAC-R systems serving such occupied spaces that are unable to achieve 3 OAC, the venue must attempt to achieve six air changes per hour<sup>11</sup> (6 ACHs). Venues shall seek assistance from a professional engineer, infectious disease specialist or industrial hygienist to assess their specific needs for this evaluation.
- Post-occupancy, the NHL recommends the continued operation of the HVAC-R ventilation system for approximately 1 hour<sup>12</sup> to achieve 6 ACHs. In facilities with nighttime setback

<sup>8</sup> ASHRAE Guidance for Polling Place HVAC-R Systems page 2

<sup>9</sup> ASHRAE Technical Resources/Building Readiness Guide; Section: Pre- or Post-Occupancy Flushing Strategy

<sup>10</sup> ASHRAE Guidance for Reopening Buildings; Section: Pre- or Post-Occupancy Flushing Strategy

<sup>11</sup> CDC Ventilation requirements for areas affecting patient care in hospitals and outpatient facilities Appendix B. Air - Section 4 Table B-2

<sup>12</sup> CDC Ventilation requirements for areas affecting patient care in hospitals and outpatient facilities Appendix B. Air Section 1 Table B-1



modes, the NHL recommends disabling those settings or at a minimum overriding them to allow for the system flush after occupied periods.

## Other Occupied Spaces (Non-Team Spaces)

- The NHL recommends flushing all Other Occupied Spaces with outdoor air for a time required to achieve three air changes of outdoor air<sup>13</sup> (3 OAC) prior to significant occupancy of the arena and between consecutive spectator events.
- For HVAC-R systems serving occupied spaces that may not be able to achieve 3 OAC, or in situations where the arena bowl ventilation system may not have the capacity to condition outdoor air per the recommendation above while maintaining NHL criteria for temperature and relative humidity for ice conditions, the venue may consider an equivalent of 3 OAC which may include effect of outdoor air, particulate filtration and air cleaners<sup>14</sup> (see below section: Viral Inactivation Technologies). Venues are encouraged to seek assistance from a professional engineer to assess their specific needs for this evaluation.

## AIR FILTRATION AND AIR CLEANING //////////////////////////////////////

Per ASHRAE Position Document on Filtration and Air Cleaning (January 2015)<sup>15</sup>, filtration and air cleaning can be used to improve indoor air quality and to mitigate airborne viral transmission.

The NHL recommends improving central air and other local HVAC-R filtration above code minimums to MERV-13 (ASHRAE 2017b) or the highest level achievable, without impacting system air flow and pressure based on existing HVAC-R system configuration. Consult with a professional engineer or qualified professional to determine the appropriate scope of this work. Venues should review filter maintenance and replacement schedules; filter replacements should be achieved as indicated in filter manufacturer’s published operations manual.

For enhanced air cleaning, particularly in areas with low air flow, in high occupancy spaces, back of house staff areas or mission-critical operations areas like Security and Command Center-type rooms, Venues should consider deploying additional portable room air cleaners with HEPA or high-MERV filters with due consideration to the Clean Air Delivery Rate (CADR)<sup>16</sup> (AHAM 2015)<sup>17</sup>.

## VIRAL INACTIVATION TECHNOLOGIES

There are numerous technologies that may actively kill or inactivate organics, including viruses, in airstreams and/or on surfaces. There are HVAC unit-mounted options, products installed in central air handlers, and in-space options for use in occupied rooms or in guest-accessible spaces. The following technologies are deployed in varying capacities in sports and entertainment venues and are worth considering, particularly in occupied spaces with lower air change rates. At this time, neither ASHRAE nor the CDC specifically recommend nor warn against their use.

Additionally, the NHL continues to monitor guidance from both ASHRAE and CDC as well as other industry experts and authorities on appropriate guidance regarding COVID-mitigating technologies and their efficacy in real-world applications.

<sup>13</sup> ASHRAE Guidance for Reopening Buildings; Section: Pre- or Post-Occupancy Flushing Strategy  
<sup>14</sup> ASHRAE Guidance for Reopening Buildings; Section: Pre- or Post-Occupancy Flushing Strategy  
<sup>15</sup> ASHRAE Position Document on Filtration and Air Cleaning (January 2015)  
<sup>16</sup> ASHRAE Position Document on Infectious Aerosols (April 2020) Section 4.1  
<sup>17</sup> Association of Home Appliance Manufacturers AHAM AC-1-2015 Method for Measuring Performance of Portable Household Electric Room Air Cleaners



- 1. Ultra-Violet (UV) Germicidal Irradiation.** Such technologies include unit mounted UV, in-duct UV, and Upper-Air UV. Unit mounted UV has proven to be effective at reducing organics on unit components such as cooling coils. The use of in-duct UV systems for airstream applications requires careful review of air velocities, which must be kept low for the UV to be effective. Upper-Air UV has long been considered effective against infectious aerosols within occupied spaces but requires careful design to prevent occupants from being exposed to the UV source. Manufacturers offer UV at multiple wavelengths with varying degrees of potential danger to occupants. We recommend consulting both the manufacturers and experienced professional engineers when evaluating which options may be appropriate in a specific venue.
- 2. Photo-Catalytic Oxidation (PCO).** This technology uses UV lamps along with a photo catalyst surface to create hydroxyl radicals which oxidize contaminants onto the catalytic surface. This equipment is effective at removing contaminants within the targeted airstream but has limited effectiveness in occupied spaces.
- 3. Bi-Polar Ionization (BPI).** This technology utilizes energy to produce positive and negative ions, which then react with particles and contaminants to remove them from the air and ultimately to improve air quality. Some manufacturers claim the ions also deactivate viruses although limited industry testing is available to independently validate these claims. Manufacturers indicate independent testing procedures are under development. These products may produce ozone which can be harmful to occupants. When considering BPI technology ensure the equipment carries a UL 2998 listing as “zero ozone emission.”
- 4. Photo-Hydro Ionization (PHI).** Like PCO, this technology utilizes UV lamps along with a catalytic target to create hydroxyl radicals which oxidize contaminants. However, PHI produces hydroxyl radicals in gaseous form, and this “gaseous hydrogen peroxide” travels with the airstream into the occupied spaces. Some manufacturers produce PHI equipment meant for direct installation in the occupied space, and this equipment may prove useful in targeted locations within a particular venue. Testing suggests PHI is effective at killing viruses within an occupied zone, but there is limited independent research available and currently no industry standard to measure efficacy. Manufacturers suggest such standards are currently under development. Like Bi-Polar ionization, PHI equipment should carry a UL 2998 listing as “zero ozone emission.”
- 5. Dry Hydrogen Peroxide (DHP).** DHP is very similar to PHI, with patented variations in the combination of UV and catalyst material. This technology is often deployed through equipment installed at, or near, the occupied space. Like PHI, manufacturers indicate testing and efficacy standards are under development. DHP equipment, if used, should carry a UL 2998 listing as “zero ozone emission.”

Limited testing and lack of industry standards or consensus throughout the HVAC-R industry makes it impossible to specifically recommend the technologies noted above. Because of this, the NHL recommends consulting engineering professionals to evaluate options specific to each venue.

For more up-to-date information and guidance on these technologies, please visit **ASHRAE Technical Resources: Filtration and Disinfection:** <https://www.ashrae.org/technical-resources/filtration-disinfection#mechanical>

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## COMPLIANCE

On or before February 15, 2021, each NHL Arena and Practice Facility shall submit to [REDACTED] and [REDACTED] a certification that:

1. An independent ventilation analysis and air balance report (air handling unit-level Testing Adjusting Balancing (TAB) report) has been conducted for all occupied spaces, which will confirm supply, outdoor air and exhaust ventilation rates by a certified TAB contractor, and establish whether the existing system is performing to the basis of its design. For clarity, the testing of individual VAV boxes and distribution ductwork in occupied spaces is not a requirement.
2. The following requirement set forth in this policy has been met:
  - a. In Team Spaces, prior to each occupancy by Players and staff (e.g., Groups 1 and 2A-C), flushing all home and visiting Team Spaces with outdoor air for a time **required** to achieve three air changes of outdoor air<sup>18</sup> (3 OAC).
    - i. For HVAC-R systems serving such occupied spaces that are unable to achieve 3 OAC, the venue must attempt to achieve six air changes per hour<sup>19</sup> (6 ACHs). Venues shall seek assistance from a professional engineer, infectious disease specialist or industrial hygienist to assess their specific needs for this evaluation.
3. If the above points 1 and/or 2 have not been met, provide an explanation of when they are expected to be met, or if they cannot be met.
4. The recommendations to
  - a. review and increase airflow (ACH) and outdoor air flow rates to all occupied spaces based on an analysis of the venue's existing configuration of the HVAC-R system and the current air balance report and
  - b. improve central air and other local HVAC-R filtration above code minimums to MERV-13 (ASHRAE 2017b) or the highest level achievable, without impacting system air flow and pressure based on existing HVAC-R system configurationhave been reviewed and met, where practicable.

Compliance forms will be provided for this purpose.

<sup>18</sup> ASHRAE Guidance for Reopening Buildings; Section: Pre- or Post-Occupancy Flushing Strategy

<sup>19</sup> CDC Ventilation requirements for areas affecting patient care in hospitals and outpatient facilities Appendix B. Air - Section 4 Table B-2



# ***MECHANICAL HVAC-R SYSTEM POLICY CERTIFICATION***

# FORM 1 CERTIFICATION



## ARENA RESTART PROTOCOLS 2020/21 SEASON MECHANICAL HVAC-R SYSTEM POLICY CERTIFICATION

Please return via email to \_\_\_\_\_ and \_\_\_\_\_ )  
on or before February 15, 2021.

I hereby certify that \_\_\_\_\_ has completed the following  
[Game Arena or Practice Facility Name]  
actions below as required by the NHL Mechanical / HVAC-R Systems Policy:

Please note that this certification must be submitted for the Game Arena **and**  
Practice Facility.

- [ ] 1 An independent ventilation analysis and air balance report (air handling unit-level Testing Adjusting Balancing (TAB) report) has been conducted for all occupied spaces, which will confirm supply, outdoor air and exhaust ventilation rates by a certified TAB contractor, and establish whether the existing system is performing to the basis of its design. For clarity, the testing of individual VAV boxes and distribution ductwork in occupied spaces is not a requirement.
  
- [ ] 2 The following requirement set forth in this policy has been met:
  - a. In Team Spaces, prior to each occupancy by Players and staff (e.g., Groups 1 and 2A-C), flushing all home and visiting Team Spaces with outdoor air for a time required to achieve three air changes of outdoor air (3 OAC).
    - i. For HVAC-R systems serving such occupied spaces that are unable to achieve 3 OAC, the venue must attempt to achieve six air changes per hour (6 ACHs). Venues shall seek assistance from a professional engineer, infectious disease specialist or industrial hygienist to assess their specific needs for this evaluation.
  
- [ ] 3 If the above points 1 and/or 2 have not been met, provide an explanation of when they are expected to be met, or if they cannot be met here:

Explanation: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# FORM 1 CERTIFICATION



- [ ] 4 The recommendations to
- a. review and increase airflow (ACH) and outdoor air flow rates to all occupied spaces based on an analysis of the venue's existing configuration of the HVAC-R system and the current air balance report and
  - b. improve central air and other local HVAC-R filtration above code minimums to MERV-13 (ASHRAE 2017b) or the highest level achievable, without impacting system air flow and pressure based on existing HVAC-R system configuration
- have been reviewed and met, where practicable.

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Signature

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Print Name

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Title

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Date