



How To Manage Indoor Air Quality in Arenas - Webinar

*Saskatchewan Parks and Recreation
Association (SPRA)*

January 17, 2024

Thank You for Participating!

How To Manage Indoor Air Quality in Arenas

- Host – Tim Hanna
- SPRA Support – Ryan Monks and Kristy Wilson
- Maximum time will be 1.5 hours (11:30am)
- Session will be recorded and available after the webinar
- Some of the information presented today will be available to the participants in a follow up email



Thank You for Participating!

How To Manage Indoor Air Quality in Arenas

- Format = 4-person panel presentations + Q&A at the end
- Questions can be submitted by raising your hand (unmuting), through the chat feature in Go To Meeting
- Welcome to leave your video on



SPRA

Who we are... www.spra.sk.ca

Vision: We envision a Saskatchewan in which all people have equitable access to recreation experiences that contribute to their health and wellbeing; result in connected and engaged community members; and provide connection and attachment to the natural environment.

Mission: We provide leadership, support and services that contribute to recreations' impact on the quality of life for people in Saskatchewan.

Our programs, services and support reaches lands covered by Treaties 2, 4, 5, 6, 8 and 10, the traditional territories of the Cree, Dakota, Dene, Lakota, Nakota, and Saulteaux peoples, and homeland of the Metis.



SPRA

Thank you to

Sask Lotteries for their financial support to Saskatchewan Parks and Recreation

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Indoor Air Quality (IAQ)

Why is it an important topic?

- Many reasons...Occupational Health and Safety, & Public Health
- Several occurrences of IAQ issues in arenas this season
- Incidents of bad IAQ are very **newsworthy**
- Owner/Operator – you are legally responsible for ensuring a safe facility



Indoor Air Quality (IAQ)

Learning Outcomes

- What the standards are
- How to maintain IAQ standards through best practices
- How mechanical air handling and ventilation can help achieve those standards
- How to monitor your IAQ using today's technology
- Practical solutions that can be incorporated immediately
- Where to go for help



Indoor Air Quality (IAQ)

Roadblocks... yes there are some

- Old facility – IAQ was not a design concern back in the '60's, or '70's or '80's
- We have some ventilation/circulation systems (e.g. large exhaust fan at the top of rink wall) is that enough?
- Don't have the financial resources to make any changes
- How can I manage ice quality when I need to ventilate and circulate air?
- Ventilating/circulating air adds cost to the arena operation
- Mindset – we have been doing things the same way for 40 years and never had a problem

- Today's presentation will help you on a path to help make positive changes to ensure your IAQ is acceptable in your arena



Panelists

Ted Cooke, P.Eng
HDA Engineering

Mechanical Designer / Partner

Ryan Philipation, CPHI, ABCP
Saskatchewan Health Authority

Sr. Public Health Inspector – Public Health Office - Melfort

Warren Thiele and Jason Lewandoski,
DMA Applied Controls

Project Engineer and Service Manager

Tim Hanna,
Saskatchewan Parks & Recreation Association

Facilities & Training Consultant





*INDOOR AIR
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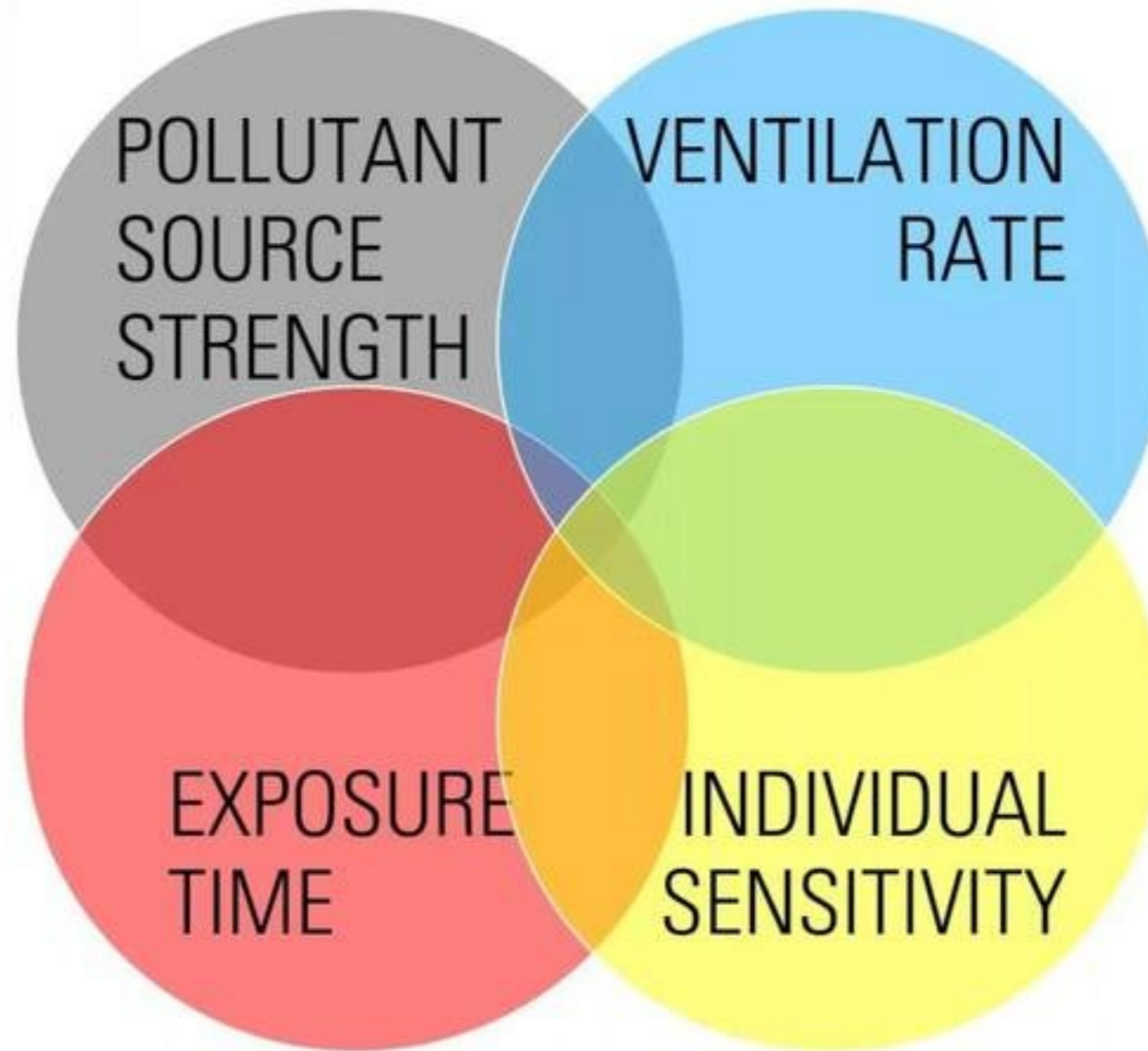
WHAT IS IAQ

To define Indoor Air Quality,
we need to understand:

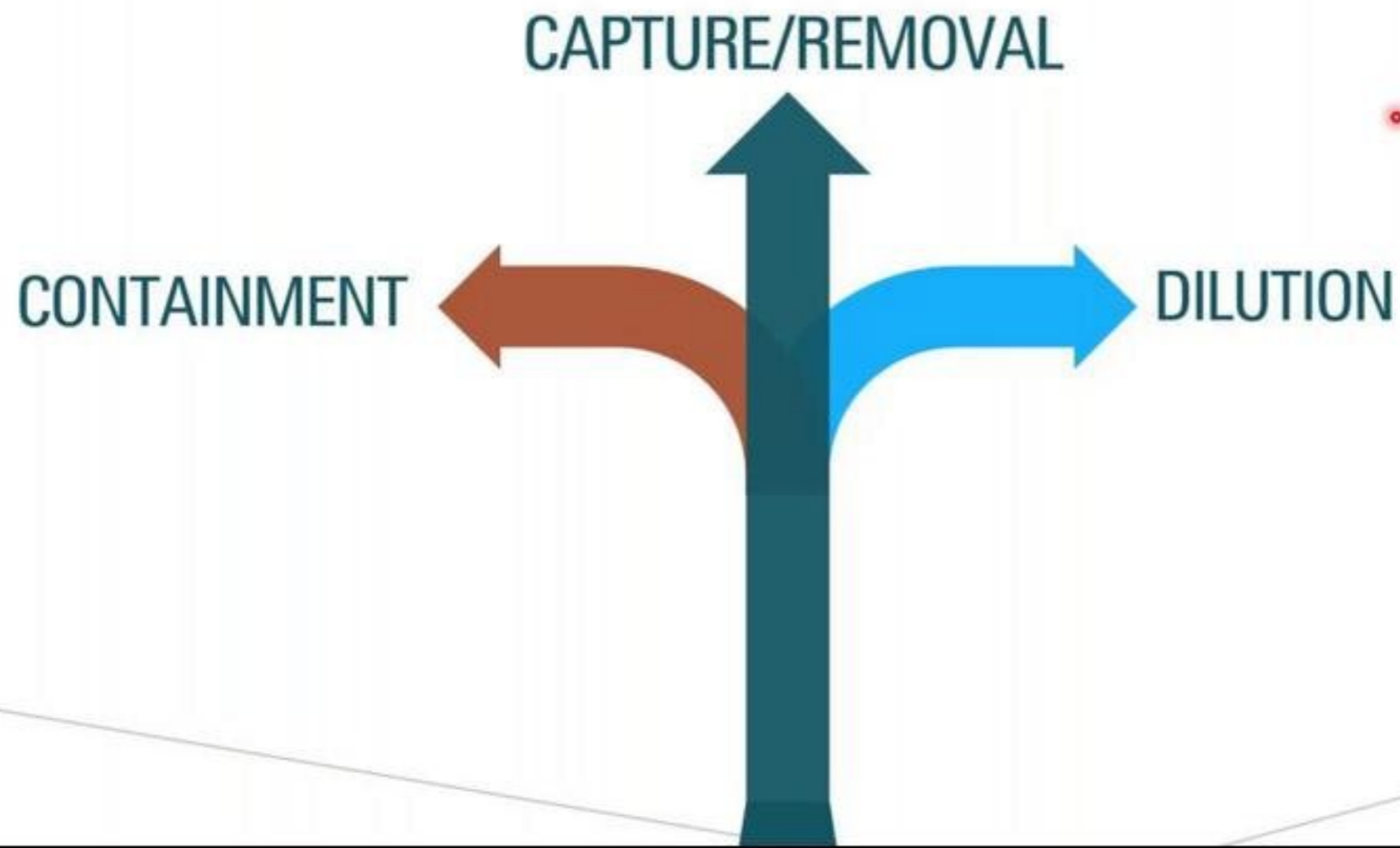
- A. All air has contaminants
- B. Human health is only impacted when contaminant concentrations exceed safe exposure levels
- C. Everyone has different tolerance levels when exposed to irritants

IAQ is maintaining acceptable levels of contaminants within occupied spaces to facilitate human comfort and reduce risk of adverse health effects.

FACTORS EFFECTING IAQ?



HOW DO WE ACHIEVE GOOD IAQ



CONTAINMENT

CONTAIN POLLUTION SOURCES FROM OCCUPANTS

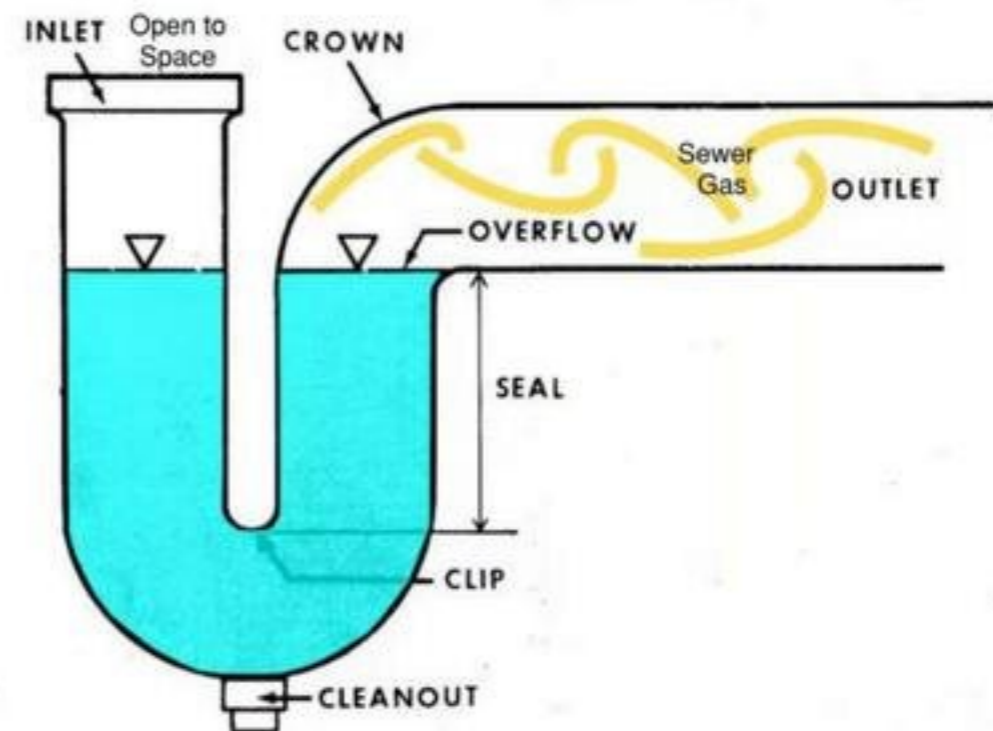
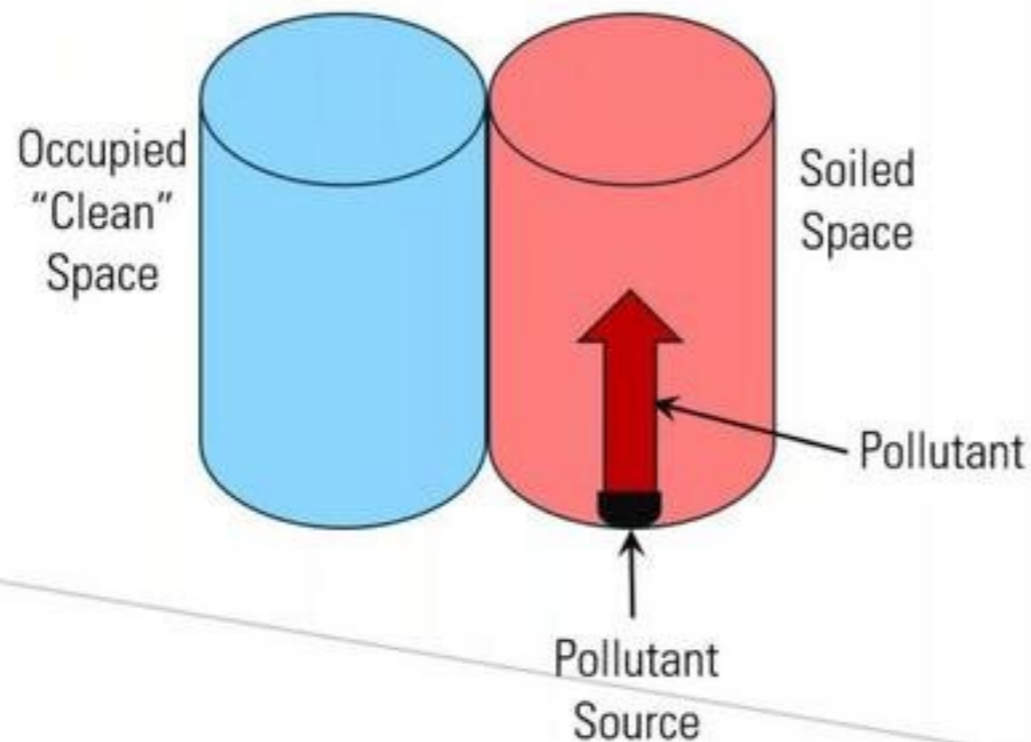
- SEPARATION BARRIERS
- GARBAGE CONTAINMENT
- RECYCLING CONTAINMENT



CONTAINMENT

ISOLATE POLLUTION SOURCES FROM OCCUPIED SPACES

- DESIGNATED ROOMS SEPARATED FROM OCCUPIED SPACES (washrooms, change rooms, janitor rooms, garbage rooms, kitchens ETC)
- PLUMBING TRAPS CONTAIN SEWERS GASSES FROM THE OCCUPIED SPACE



CAPTURE AND REMOVAL

REMOVAL

- REGULARLY REMOVE POLLUTANT SOURCES ONCE CONTAINED (GARBAGE, RECYCLING, ETC.)

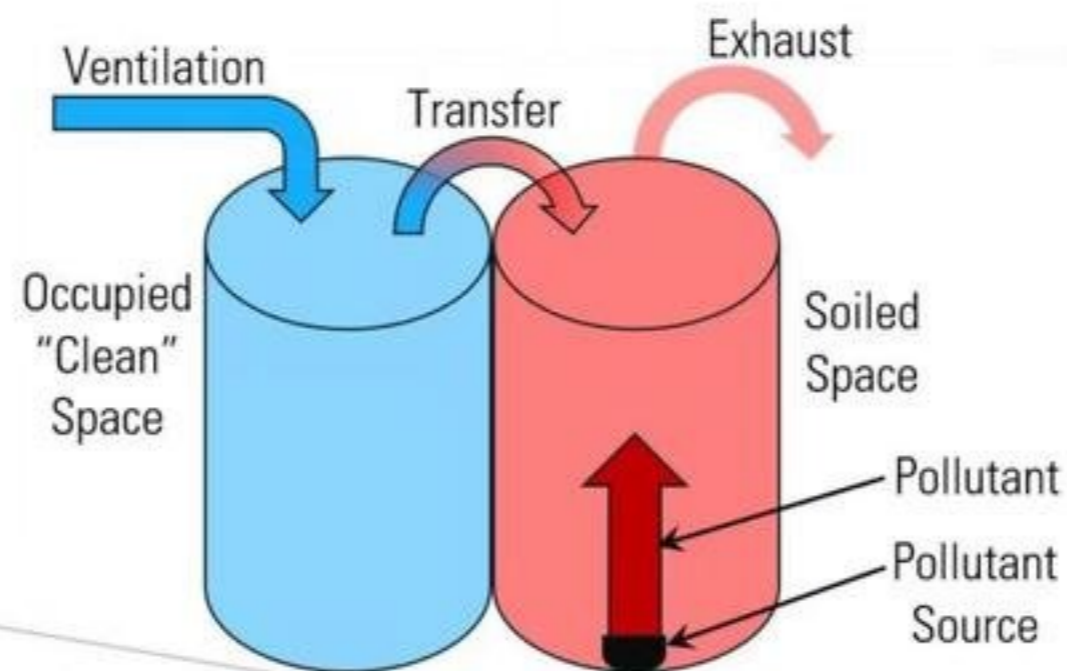
FILTRATION

- FILTER AIR (RECIRCULATED OR FRESH) TO CAPTURE AND REMOVE CONTAMINANTS, REDUCES CONTAMINANT CONCENTRATIONS
- CAN USE HIGH VOLUME RECIRCULATION FILTRATION SYSTEMS (AIR PURIFIERS) FOR CONTAMINATED SPACES

CAPTURE AND REMOVAL

EXHAUST

- CRITICAL TO EXHAUST THE DESIGNATED SOILED SPACES THAT CONTAIN POLLUTANTS (washrooms, changerooms, rooms with vehicles, kitchens)
- WHERE POSSIBLE, CAPTURE EXHAUST SYSTEMS SHOULD BE USED (vehicle exhaust pipes, kitchen hoods)
- ENSURE AIRFLOW ALWAYS MOVES FROM CLEAN SPACES TO DIRTY SPACES



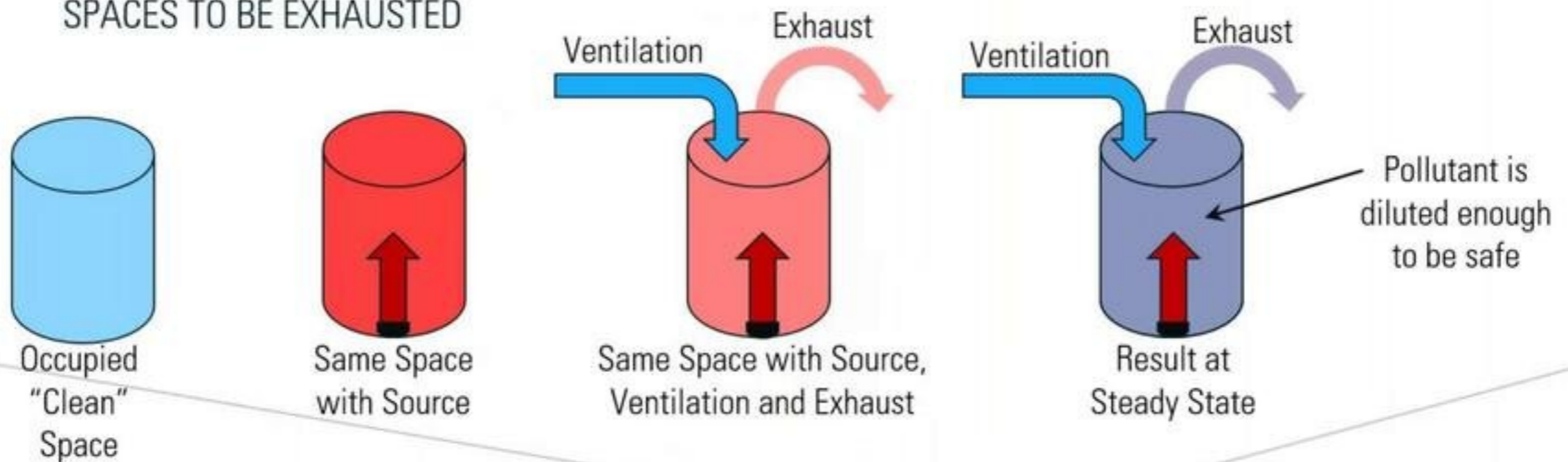
DILUTION

VENTILATION

- INTRODUCE CLEAN FRESH AIR TO THE BUILDING TO DILUTE CONTAMINANTS
- EXHAUST SPACES THAT HAVE POLLUTION SOURCES

TRANSFER AIR

- USING AIR FROM CLEAN OCCUPIED SPACES TO TRANSFER THROUGH SOILED SPACES TO BE EXHAUSTED



IAQ IN RINKS

HUMAN COMFORT (IRRITANTS)

- Human bioeffluent
- Volatile organic compounds (VOCs)
- Particulates
- Allergens
- Odours
- Sewer Gas

HEALTH AND SAFETY

- CO/NO₂ FROM VEHICLE EXHAUST
- MOULD, FUNGUS AND BACTERIA
- RADON
- VIRUSES

ADDRESSING HUMAN COMFORT

WHY ADDRESS IAQ FOR HUMAN COMFORT

- Not addressing can lead to headaches, malaise, nausea, eye and throat irritation.
- Can lead to Sick Building Syndrome.
- Can become a health risk.

CONTAINMENT (VERY IMPORTANT)

- Ensure polluting sources are being contained (stored in designated exhausted soiled rooms).
- Verify designated soiled rooms are reasonably separated from occupied spaces.
- Ensure exhausts are running and air moves from clean to dirty
- Verify plumbing traps are not dry.

ADDRESSING HUMAN COMFORT IAQ

VENTILATION

- Proper ventilation should address Human Comfort IAQ in most cases
- Proper ventilation is legally mandated (NBC cites ASHRAE 62.1)

WHAT VENTILATION IS REQUIRED

- Must introduce sufficient Outside Air to address human bioeffluent
 - Based on function and Occupant load
- Must introduce sufficient Outside Air to address VOCs etc.
 - Based on space function
- Must exhaust soiled spaces (according to function).
- Total outside air must be the greater of Ventilation or Make-Up Air for Exhaust

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ADDRESSING HUMAN COMFORT IAQ

FILTRATION

- Removes contaminants from air to reduce contaminant loading
- Should be installed on all air delivery systems.
- Higher the rating – better results (Merv 13 versus Merv 8)
- Must properly maintain filtration or it does not work



ADDRESSING HEALTH (CO/NO₂)

SOURCES

- Combustion engine vehicles (ice resurfacers, car shows, telehandler moving material).
- Gas fired appliances for HVAC (boilers, furnaces, radiant tube heaters, dehumidifiers etc.).
- Gas sources increase CO; Diesel sources increase NO₂.

ADDITIONAL ISSUES WITH RINKS

- NO₂ is heavier than air and can be trapped over playing surface due to rink boards.
- Increased ventilation and air movement can lead to poor ice without proper dehumidification



ADDRESSING HEALTH (CO/NO₂)

EXPOSURE LEVELS

- Defined by Occupational Health and Safety
- Permitted concentration level over an exposure period
- CO (Carbon Monoxide):
 - 8 hour exposure limit = 25 ppm, •
 - 15 minute exposure limit = 190 ppm
- NO₂ (Nitrogen dioxide):
 - 8 hour exposure limit = 3 ppm,
 - 15 minute exposure limit = 5 ppm

ADDRESSING HEALTH (CO/NO₂)

ADDRESSING CO/NO₂

- Must keep concentration levels below exposure limits.
- Usually done with ventilation and exhaust purge cycle.
- Can use recirculating filtration systems designed to remove CO/NO₂.
- Must monitor levels in occupied spaces and alarm when high limits are breached.
- Alarm must be local and inform people they should leave the space.
- Can use high volume low velocity fans to stir air within rink boards.
- When using resurfacer, keep end boards open to help release heavier fumes

ADDRESSING HEALTH (OTHER)

MOULD, BACTERIA AND FUNGUS

- Keep spaces dry – moisture propagates the contaminants.
- Ensure organic material is removed and disposed of properly (boxes, paper, organic waste)
- Exhaust is used in wet spaces to remove air borne moisture – must be working
- Exhausts will not address standing water, must ensure drainage is working, pipe leaks addressed quickly
- Dehumidification

RADON

- An invisible, odourless, tasteless radioactive gas that comes from the radioactive decay of elements like Uranium and Radium in the ground.
- Proper ventilation will address Radon in Commercial Buildings.
- Ensure ventilation operates before building is occupied (30 minutes).
- If concerned, you can test for Radon using long term do-it-yourself test kits

SUMMARY

ENSURE ALL OCCUPIED SPACES ARE PROPERLY VENTILATED

ENSURE SOILED SPACES ARE EXHAUSTED

ENSURE PLUMBING TRAPS HAVE WATER IN THEM

ENSURE RINK VENTILATION KEEPS CO/NO₂ CONCENTRATIONS BELOW LIMITS AT ALL TIMES

ENSURE PATHWAY FOR HEAVIER FUMES TO ESCAPE RINK BOARDS WHEN RESURFACING

MONITOR CO/NO₂ COMPLETE WITH LOCAL ALARMS

ENSURE PROPER DEHUMIDIFICATION



Saskatchewan
Health Authority

How to Manage Indoor Air Quality Webinar

Presented on January 17, 2024

Ryan Philipation, Saskatchewan Health Authority

Healthy People, Healthy Saskatchewan

The Saskatchewan Health Authority works in the spirit of truth and reconciliation, acknowledging Saskatchewan as the traditional territory of First Nations and Métis People.



www.saskhealthauthority.ca

DISCLAIMER

SASKATCHEWAN HEALTH AUTHORITY IS CURRENTLY UPDATING THE ARENA GUIDANCE AND INFORMATION SHEETS. INFORMATION PRESENTED TODAY IS SUBJECT TO CHANGE.

■ AGENDA

- INTRODUCTION
- CARBON MONOXIDE and NITROGEN DIOXIDE REVIEW
- ARENA AIR QUALITY PROGRAM
- ABATEMENT
- KEY POINTS
- QUESTIONS

INTRODUCTION

The indoor skating arena is a major hub of social activity in almost every community in Saskatchewan. However, if not maintained properly, they can create a health hazard.

The exhaust from fossil fuel powered equipment operating at indoor arenas can make people ill.

Inadequate ventilation may allow combustion gases (exhaust) to collect at the ice surface.

INTRODUCTION

Fossil fuels include:

- Propane
- CNG
- Diesel
- Gasoline

Equipment that use fossil fuels include:

- Ice resurfacers (Zamboni, Olympia)
- Ice edgers
- Lift trucks
- Gas-fired radiant heaters
- Special events equipment (monster trucks, dirt bikes ect).
- Vehicles idling too close to a fresh-air intake can cause exhaust gases to be drawn into the facility



INDOOR AIR QUALITY

The exhaust from fossil fuel powered equipment can contain harmful gases, including:

- Carbon monoxide (CO) - Colourless, odourless and tasteless gas.

Interferes with oxygen getting into the blood. Children are more susceptible to CO poisoning

- Nitrogen dioxide (NO₂) - Brownish gas with an irritating, pungent odour. At levels normally associated with arenas, essentially colourless and odourless. Irritates lungs, air passages and nose. People with pre-existing respiratory ailments (Asthma, COPD, Chronic bronchitis) can be more sensitive to NO₂ exposures

INDOOR AIR QUALITY

SYMPTOMS FOR CO POISONING INCLUDE:

Headache, Itchy or watery eyes, Nausea, Weakness, Dizziness, Rapid breathing, Fatigue, Dulled senses, Incoherent thoughts and speech, Convulsions, Unconsciousness, Death

SYMPTOMS FOR NO₂ POISONING INCLUDE:

Coughing, Irregular heart beat, Nausea, Fatigue, Rapid breathing, Chest pain, Flu-like symptoms, Pneumonia, Pulmonary edema (fluid in lungs), Death

INDOOR AIR QUALITY – RECOMMENDED GUIDANCE

During every hour that the ice is used by the public:

CO - The average Carbon monoxide (CO) level is not to exceed 25 ppm.

NO₂ - The average Nitrogen dioxide (NO₂) level is not to exceed 1 ppm.

The main sources of CO and NO₂ in arenas are:

- Ice resurfacing equipment
- Edger's

INDOOR AIR QUALITY PROGRAM

An effective Air Quality Standards Program helps the operators to:

- Control Emissions at the source, and
- Control the indoor Environment

Arena operators can create and implement a two-part air-quality standards program, comprising of both a:

- Written Program, and
- Monitoring Program



INDOOR AIR QUALITY PROGRAM – WRITTEN PROGRAM

A Written Program should detail:

- The types of internal combustion equipment
- Last tune-up and maintenance frequency
- Equipment mod's to reduce build-up of combustion gases
- Sketch or schematic of arena ventilation
- Time Lags, if necessary

INDOOR AIR QUALITY PROGRAM – MONITORING PROGRAM

A Monitoring Program should have the arena operator:

- Test and record CO and NO₂ levels weekly and during periods of heavy use.
- CO (Carbon monoxide): < than 25ppm
- NO₂ (Nitrogen dioxide): < than 1ppm

Monitoring recommendations include:

- Test at breathing height – 30 minutes after maintenance. If air quality does not meet standards, test every 15 minutes until standards are met.
- Record results (log sheet)
- Determine and implement corrective actions (equipment review, increase ventilation, review operational procedures).

AIR TESTING RECORD

Use this testing record to determine if carbon monoxide (CO) and nitrogen dioxide (NO₂) levels are too high. If levels are too high or levels are consistently increasing, consult your local public health inspector.

ARENA: _____

DATE (day/month/year)	TIME (am/pm)	LOCATION/CONDITIONS	CO LEVEL (ppm)	NO ₂ LEVEL (ppm)	INITIALS of TESTER

Air testing records are to be kept on site for review.

AIR TESTING RECORD

Use this testing record to determine if carbon monoxide (CO) and nitrogen dioxide (NO₂) levels are too high. If levels are too high or levels are consistently increasing, consult your local public health inspector.

ARENA: _____

DATE (day/month/year)	TIME (am/pm)	LOCATION/CONDITIONS	CO LEVEL (ppm)	NO ₂ LEVEL (ppm)	INITIALS of TESTER
Nov. 15	11 AM		8	0	BS
Nov. 16	2 PM		7	0	BS
Nov. 17	2 PM		6	0	BS
Nov. 18	11 AM		8	0	BS
Nov. 19	4 PM	Arena Tootney	13	0	BS
Nov. 20	4 PM		6	0	BS
Nov. 21	11 AM		5	0	BS
Nov. 22	2 PM	V. cold	11	0	BS
Nov. 23	2 PM	V. cold	17	0	BS
Nov. 24	11 AM		16	0	BS
Nov. 25	2 PM		19	0	BS
Nov. 26	2 PM	TOURNAMENT	23	0	BS
Nov. 27	11 AM		23	0	BS

Air testing records are to be kept on site for review.

INDOOR AIR QUALITY PROGRAM

What To Do If You Suspect a Problem

If someone has symptoms of CO and/or NO₂ poisoning:

- Vacate the ice and other areas of the arena.
- Immediately take ill person(s) to the closest hospital or health centre. Explain that you were at an arena and describe the symptoms.
- Increase ventilation in the arena.
- Call your nearest Public Health office.

ABATEMENT

Arena operators are better able to control arena air quality by:

- ensuring proper equipment operation and maintenance,
- monitoring indoor air levels, and
- maintaining adequate ventilation.

Fossil fuel-powered equipment such as edgers should be used only when the ventilation system can be run long enough to reduce CO and NO₂ to acceptable standards.



ABATEMENT

Recommended practices for fossil fuel-powered equipment such as ice resurfacers:

- Extend exhaust pipe.
- Keep rink gates open during resurfacing.
- Install catalytic converters.
- Tune-up engine seasonally
- Fuel mix too lean – increased NO₂
- Fuel mix too rich – increased CO.
- Warm-up the resurfacer.
- Ventilate the rink.



KEY POINTS

IMPLEMENT AN INDOOR AIR QUALITY PROGRAM AT YOUR ARENA

ENSURE TESTING EQUIPMENT IS CALIBRATED

ARENA VENTILATION IS CRUCIAL TO GOOD INDOOR AIR QUALITY

ANNUAL EQUIPMENT MAINTENANCE IS A MUST

OH&S MUST BE CONSIDERED AT ALL TIMES



QUESTIONS?

Honeywell Analytics

E3Point and 301C

E3Point - Standalone or Networked



- CO, NO₂, H₂S, O₂, H₂, CH₄ (methane), C₃H₈ (propane)
- Visual and Audible Alarm
- Standalone
 - DualGas, 2 relay outputs, 1 analog output
- Networked
 - 1 Relay, Modbus, BACnet MS/TP
- Sensor cell can be replaced / swapped
- Rated to -40degC, CO rated to -20degC
- 50ft Coverage radius
- Annual recalibration



Installation Height

Detected Gas		Relative Density	Installation Height
		(air = 1)	
CO	Carbon monoxide	0.968	1–1.5 m (3–5 ft.) from floor
H ₂ S	Hydrogen sulfide	1.19	30 cm (1 ft.) from floor
*NO ₂	Nitrogen dioxide	1.58 (cold)	30 cm–1 m (1–3 ft.) from ceiling
O ₂	Oxygen	1.43	1–1.5 m (3–5 ft.) from floor
COMB	Most combustibles are heavier than air, with the exception of methane, hydrogen, ethylene and acetylene. Sensors for gases that are heavier than air should be installed approximately 30 cm (1 ft) from the floor. For combustibles that are lighter than air, sensors should be installed 30 cm (1 ft) from the ceiling, close to the potential leak source.		

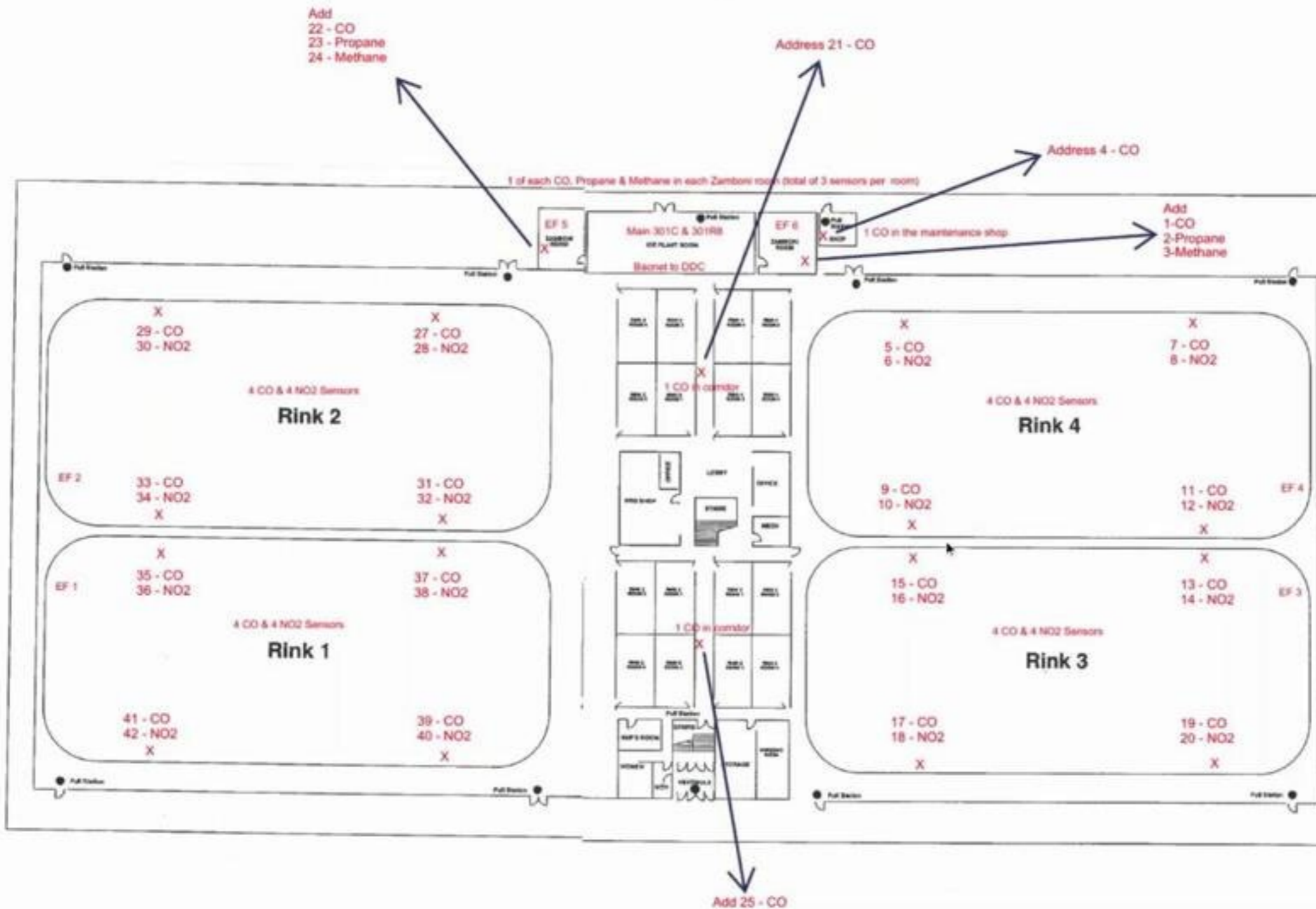
* May differ in certain applications. Hot NO₂ from exhaust systems is lighter than ambient air.



301C Control Module

- Up to 126 programmable zones
- BACnet optional
- Relay Outputs for equipment control
- Data logging
- Optional Remote Visual and Audible alarms
- Sensors available for refrigerant detection





Honeywell



OPERA
Gas Detectors



ac *armstrong*
MONITORING

QEL QUATROSENSE
ENVIRONMENTAL
LTD.



SPRA Fact Sheet

Arena Indoor Air Quality (IAQ)

- Resource – originally developed in January 2019 on account of some IAQ incidents
- Updated December 2023
- Link to the Fact Sheet – included in the webinar reminder
- Purpose of the Fact Sheet – provide some informative and some practical solutions



SPRA Fact Sheet

December 2023

- Managing IAQ is not as identifiable as measuring ice thickness and documenting that practice
- Do you have a process in place and proper monitoring equipment for IAQ – **really lacking in our industry**
- 2 major toxic gases – do you know the symptoms as it could be a matter of life or death in severe cases



SPRA Fact Sheet

December 2023

- Typical sources of CO and NO₂ are ice resurfacers, and edgers (internal combustion engines)
- Recognize there are other sources like boilers, hot water heaters, spectator heaters (radiant tube), etc.
- IAQ can be negatively impacted by other things too like cooking equipment, mold, mildew, fumes from chemicals, etc. – different type of contaminants



SPRA Fact Sheet

December 2023

- Owner/operator has a legal responsibility to manage IAQ
- Owner/operator has a responsibility to train their Facility Operators
- Trained Facility Operators have the responsibility follow established practices/procedures, and be aware of potential symptoms; and how to respond in case of an emergency
- All need to understand how to monitor the IAQ and record results



SPRA Fact Sheet

December 2023

- How do you know the level of toxic gases without monitoring? You don't! How to monitor?
- Personal and/or fixed monitors are available
- Prefer personal monitors – affordable, and portable (check out other locations in building like boiler room)
- Remember residential equipment does not equal commercial equipment
- Commercial equipment needs to work effectively and quickly in low temperature, high humidity conditions
- Multiple monitors provide maximum coverage



SPRA Fact Sheet

December 2023

- Important point to remember – programming within your facility can negatively impact your IAQ
- Full day of ice rentals and continuous flooding on a Saturday can be worse than Wednesday night due to the higher number of floods – adapt accordingly
- Summer events like indoor tractor pulls, car shows, etc.
- Remember – IAQ is not just a winter issue



SPRA Fact Sheet

Best Practices – page 2

- Learn more about IAQ and how it relates to your facility – no 2 arenas are the same
- Get to know your local Public Health Inspector – great resource
- Have a plan in place to deal with IAQ emergency and evacuation procedure – practice it at least once a year
- Annual servicing/testing of ice resurfacer and edger – document – partner with arenas in your area to reduce costs
- Consider switching to electric edger – better than sliced bread
- Consider switching to Natural Gas from propane/gasoline when purchasing a new ice resurfacer – electric ice resurfacers are expensive



SPRA Fact Sheet

Best Practices

- Ventilation and air circulation are 2 key considerations for proper IAQ
- Run ventilation systems at least 5 minutes before your flood and 10-15 minutes afterwards
- Training – make sure Facility Operator has been trained and they follow established procedures – don't take shortcuts
- Invested in a monitoring system and log IAQ
- Extend the exhaust pipe of the ice resurfacer so it is above the glass – rink boards and high glass create a bowl for emissions like NO₂ to stay in



SPRA Fact Sheet

Best Practices

- Catalytic converter is installed/functioning on ice resurfacer, and warmup the engine for at least 5 minutes
- During warmups, vent the ice resurfacer exhaust to the outside and/or use mechanical means to assist – residential box fan doesn't work
- Watch for and prohibit vehicles (e.g. buses) idling close to entrance/exit doors and fresh air sources – this can create a significant issue in a short amount of time



SPRA Fact Sheet

Conclusion

- Owner/Operator has a legal responsibility to manage IAQ from both an Occupational Health and Safety, and Public Safety perspectives
- Boils down to recognizing the standards and creating a plan to deal with the issue
- IAQ Plan may require an investment in new mechanical systems and/or improved mechanical systems
- IAQ Plan may require an investment in monitoring systems
- IAQ Plan may require adopting some new procedures, and/or making some simple changes to operations to help minimize the potential impact



Resources

More information out there...

- Federal Government document
- Ontario Recreation Facilities Association
- Government of Manitoba
<https://www.gov.mb.ca/health/publichealth/environmentalhealth/protection/aaq.html>
- WorkSafe BC document
- WorkSafe SK document
- State of Wisconsin
- Much more...



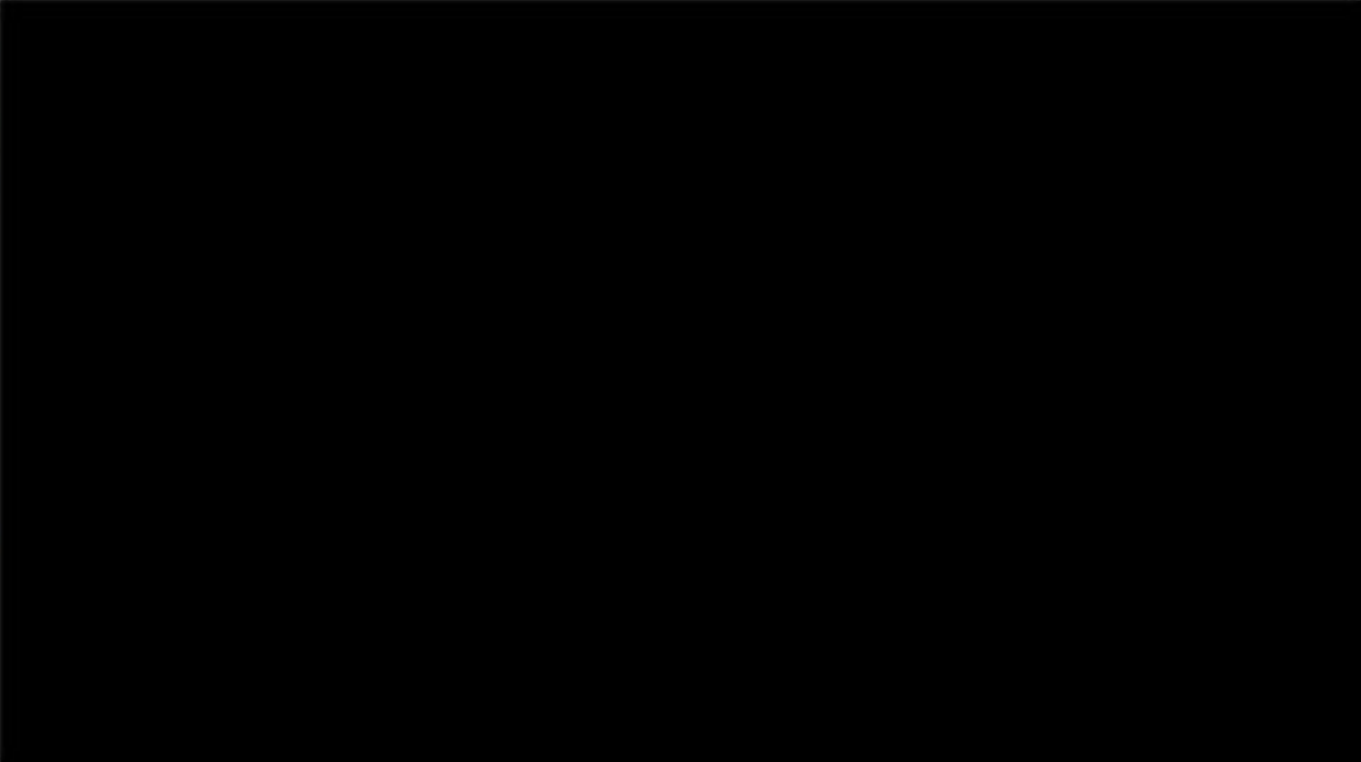
Questions & Answers

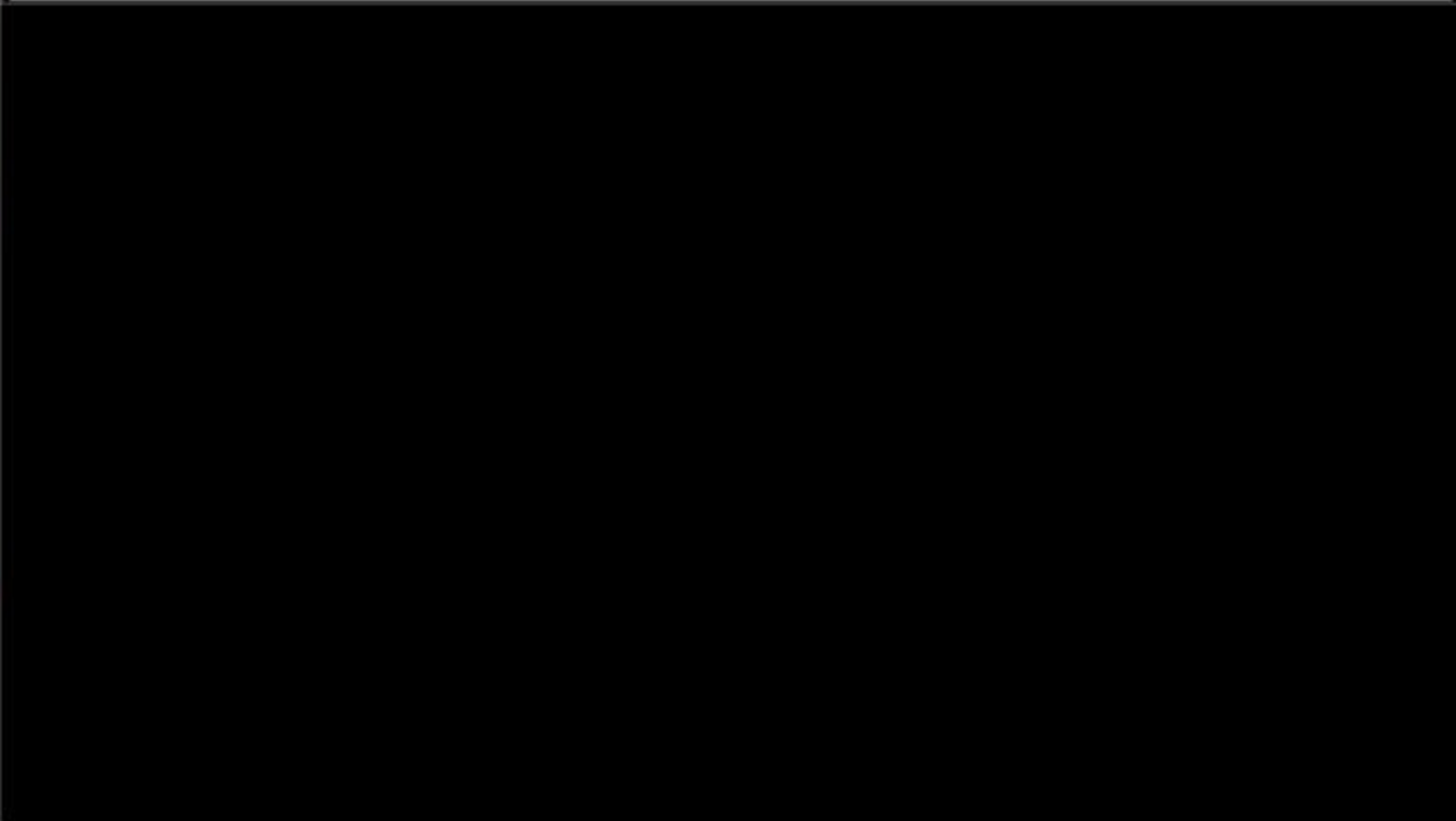
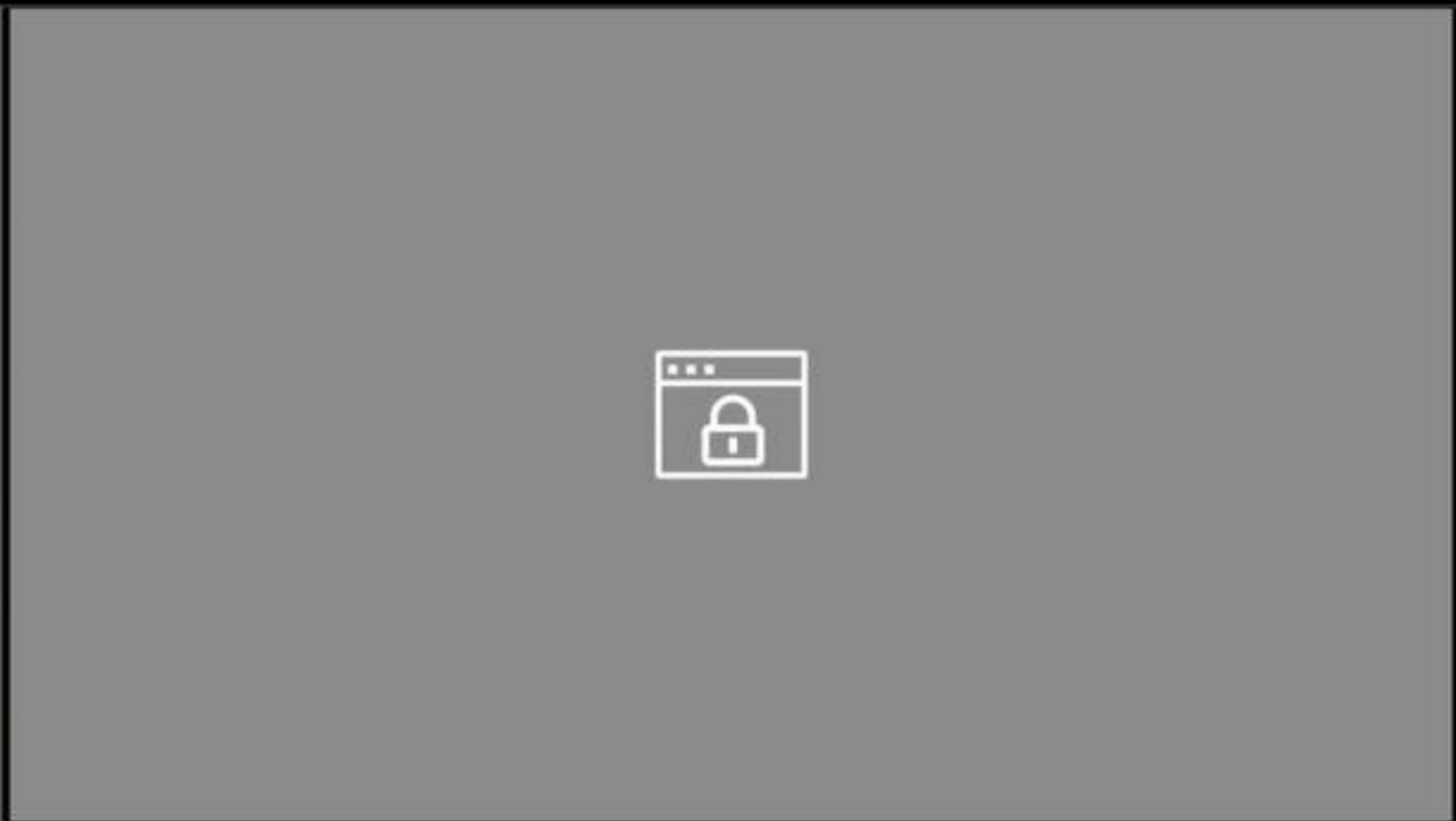
Can we engage you in the conversation?

- Questions can be submitted by raising your hand (unmuting) and asking, use the chat function
- Webinar will conclude at 11:30am









Thank You!

IAQ Webinar

- Presenters for their time and expertise on this matter
- Participants for recognizing the importance of IAQ
- SPRA team for assistance in coordinating the webinar

- More information, please contact me – contact information will be shared in the post webinar emailer

