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Ventilation to Reduce COVID-19 Spread in Enclosed Work Areas During Cold Weather: A Survey of Construction Contractors

December 2020

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Overview

Construction projects that are winterized to protect workers and work from cold temperatures need to address ventilation in enclosed work and rest areas. Steps taken under normal conditions (e.g., tenting, using large heaters with blowers) may increase the spread of COVID-19. The Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), and other health organizations acknowledge the importance of good ventilation in enclosed areas to prevent the spread of COVID-19 and have issued general guidance; however, this guidance may not be applicable or detailed enough for the varied and often unpredictable ventilation challenges found on construction sites.

CPWR-The Center for Construction Research and Training (CPWR) and the National Institute for Occupational Safety and Health (NIOSH) NORA Construction Sector Council's COVID-19 Work Group have developed preliminary guidance for the construction industry on how to prevent the build-up of viral particles by improving ventilation and air quality in enclosed work areas. From December 11 to 18, 2020, CPWR conducted a brief, confidential online survey of industry decision-makers (e.g., construction contractors, owners, safety and health professionals) on behalf of the Work Group to collect information on the ventilation challenges facing the construction industry and steps being taken or planned to increase ventilation in enclosed work areas on job sites.*

The survey results have been and are continuing to be used to inform guidance developed by the Work Group, including the CPWR "[Quick Tips to Increase Ventilation at Indoor Construction Sites Without Operating HVAC Systems](#)". As new information becomes available on how to effectively ventilate work areas to prevent the spread of COVID-19, guidance from CPWR, the NORA Work Group, CDC/NIOSH, OSHA, and other organizations is being updated and included in the CPWR COVID-19 Construction Clearinghouse (covid.elcosh.org).

Key Findings

- More than half (56%) of the 105 participants self-identified as a construction safety and health director/manager, 30% as a construction contractor/employer, 10% as a construction safety and health consultant, and 3% as a project owner.
- Just under half (47%) of the participants reported using OSHA's ventilation guidance, 30% CDC/NIOSH guidance, and 25% said they were not using guidance from any of the organizations listed in the survey (OSHA, CDC/NIOSH, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), American Industrial Hygiene Association (AIHA)).
- Only one-fourth of the participants were setting up temporary structures to keep workers warm on construction sites. The types of structures included trailers, tented/tarped/plastic wrapped areas, c-cans, Conex boxes (large steel storage/shipping containers), arched steel (Quonset-style) huts, shanties, and vehicles. Only a few of these participants provided information on how the temporary structures were being ventilated. The ventilation measures shared included openings (e.g., rollup side walls, open ends), fans, and negative air machines/scrubbers. Some participants said they were using or planned to use social distancing and to limit the number of workers in the structures.

* The survey is included as Appendix A.

- Fifty-six percent of participants had projects underway or planned between December and May 2021 that would require enclosing work areas. Most provided information on the types of work areas, although the level of detail varied. In general, the types of work areas and the ventilation measures used there included:
 - Interior areas in structures – no ventilation, negative air machines, HVAC with filtering, and social distancing
 - Partial outdoor/indoor areas – window and HVAC openings, air monitoring using gas meters/ CO₂ monitors, heaters that draw fresh air from outside, and use of masks and gloves if working within 6 feet of another individual
 - Trailers/temporary structures – window air units and natural ventilation
 - Scaffolds – air leaks in tenting through openings
 - Vehicles – hand sanitizer, masks, and gloves

Some of these participants did not specify the type of enclosure, but provided information on ventilation, including using loose fitting tarps or other barriers that allow air to pass through, negative air machines, portable fans with MERV 13, scrubber machines, HEPA filtration, or TSI Dust Trak™ DXR aerosol instruments to assess PM1 with telemetry, and using CO₂ monitors with Bluetooth dataloggers to determine efficacy and provide actionable points.

- Forty-eight of the participants had projects planned or underway in **structures with existing HVAC systems**. When given a list of control measures, the ones most frequently reported as being used or planned to be used included 1) providing face coverings, 2) opening windows or using other sources of fresh air, 3) local exhaust ventilation, 4) making sure unit ventilators are clean, and 5) providing employees with N-95s or other respirators. The measures they reported as least likely to be used or planned to be used included 1) air cleaning technologies such as Ultraviolet Germicidal Irradiation (UVGI), 2) portable room air cleaners, 3) providing maximum ventilation rates before and after shifts, and 4) taking steps to maintain humidity of 40%-60% in the work area.
- Forty of the of the participants had projects underway or planned **in structures that did not or would not have HVAC systems in place**. The control measures most frequently reported as being used or planned to be used included 1) providing face coverings/masks, 2) opening windows or using other sources of fresh air, 3) adjusting work schedules to limit workers in a particular area, 4) using local exhaust ventilation, and 5) using fans and making sure they are blowing away from workers. The measures they reported as least likely to be used included air cleaning technologies such as UVGI and portable room air cleaners.
- **For both structures with and without HVAC systems, face coverings, open windows, and LEV were among the top control measures participants reported they were using or planned to use, and air cleaning technologies such as UVGI and portable room air cleaners were among the control measures least likely to be used.**
- Roughly 67% of all participants raised other challenges (including ventilation) related to preventing the spread of COVID-19. Some touched on ventilation issues, such as maintaining adequate air flow, but many raised issues the industry has been grappling with since the pandemic began, including how to: maintain social distancing; ensure face coverings are worn and worn properly; deal with workers who come to work sick and their employers on multi-employer sites; and respond given the lack of a standard and enforcement mechanisms. There were also a few comments that indicated continued confusion about the disease (e.g.,

once you've had COVID-19 you can't get it again) or resistance to accepting the seriousness of this pandemic.

- Thirty of the participants agreed to share additional information and provided their contact information.

Response

The survey was sent to a convenience sample of roughly 1,400 individuals who identified as a construction contractor/employer, project owner, construction safety and health consultant, or construction safety and health director/manager in CPWR's outreach database. A total of 105 or (roughly 7.5%) of those contacted completed the survey. More than half of participants (56%) self-identified as a construction safety and health director/manager, 30% as a construction contractor/employer, 10% as a construction safety and health consultant, and 3% as a project owner.

Participants represented a cross-section of the industry in terms of the segment of the industry in which they work, area of the country where they perform most of their work, and company size.

- When asked to select the segment or segments of the industry they work in, the majority selected commercial and institutional construction (85%), followed by industrial (41%), heavy and civil (21%), residential (15% multi-family and 7% single family), highway, streets and bridges (12%), and "other" (8% - electrical utility, government, schools, etc.).
- Just under half (49%) reported performing most of their work in the Northeast, followed by the Midwest (29%), the Southwest (9%), the Southeast (8%), and the West (7%).
- More than half (53%) said they work for large companies with 100 or more employees, 20% for companies with 50 to 100 employees, 16% for companies with 20 to 49 employees, and 11% for companies with fewer than 20 employees.

Sources of Ventilation Guidance (n=102)

When asked which ventilation guidance (available at the time of the survey) they use, OSHA's guidance was used most (47%), followed by guidance provided by the CDC/NIOSH (30%), ASHRAE (14%), and AIHA (10%). A small number identified "Other" sources of guidance including Harvard University Public Health Professionals, Rhode Island Department of Health, and the Mechanical & Service Contractors Association. Twenty-five percent said they had not used guidance from any of the organizations.

Use of Temporary Structures on Job Sites (n=105)

Only 24% of the participants said their company was setting up temporary structures for workers to use to warm up on construction sites. When asked to describe the structures and how they were being heated and ventilated, 20 participants provided some level of detail in their comments.

Most (18) participants identified the types of structures:

Table 1. Types of Temporary Structures Used for Warming on Job Sites

Types of temporary structures	Times mentioned (Note: Some participants mentioned more than one type of structure)
Trailers	7
Tented/tarped/plastic wrapped areas	7
C-cans, Conex boxes, arched steel (Quonset-style) huts	6
Open/partially enclosed structures under construction	3
Shanties	2
Vehicles	1

Only eight comments provided some description of how the temporary structures would be ventilated (seven of these comments also addressed heating and one comment only described the ventilation). Ventilation descriptions included openings, fans, and negative air machines/air scrubbers, as noted in the following comments:

- *Job site with structures under construction ... If heating is provided with propane heaters (direct heating), CO detectors, and ventilation with the proper air exchange is maintained*
- *Tents with roll upside walls, forced air heating and ventilation*
- *...Shanties...electric heater [and]... openings in at least two panels that will allow for cross ventilation*
- *Tented/tarped work areas with individual space heaters (electric) open on each end*
- *Arched steel (Quonset style) open ended with radiant ceiling heaters (propane fueled)*
- *C-cans, tents, temp buildings. HVAC, fans, filter systems*
- *Heated with propane or electric heaters. Air monitors are stationed inside of the enclosures. As well as negative air machines/air scrubbers for enclosures*
- *Plastic wrap and exhaust fans some interior jobs*

Nine comments described how the area would be heated:

- *Tarped in under decks, gas-fired heaters, CO monitors and temperature monitors in heated space.*
- *Job Trailers with electric heat*
- *Job site with structures under construction with indirect heating units*
- *Trailers with forced air or baseboard heating*
- *Temporary enclosure of the building with shrink wrap and poly sheeting - heated with natural gas heaters*
- *Mobile structures, such as tents, are more likely to have a salamander style heater or other similar device*
- *Tents with electric heaters*
- *Field office ... Heating will be accomplished with electric heaters*
- *Tarped in floor under working deck with multiple 1,000,000 btu heaters*

Three comments described use of social distancing or limiting capacity:

- *Only large spaces to allow at least 6 feet separation*
- *Conex boxes with maximum capacities posted*
- *Using job shacks with limited occupancy*

Projects Underway or Planned That Require Enclosed Work Areas (N=102)

Participants were also asked about their projects that were underway or planned between December and May 2021. More than half (57, or 56%) said they had projects underway or planned during this period that would require enclosing work areas. Most (72%) provided some level of detail on the types of enclosed work areas, but many did not include information on ventilation challenges or solutions, and a few noted they were relying on the CDC's guidance (social distancing, use of masks). The following are the comments provided broken down by type of enclosed work area and ventilation when available.

Interior areas in structures:

- *Interior finish work...building is enclosed and has permanent or temporary heat. size can be 5,000sf to 1,000,000sf*
- *Renovation to life science / pharmaceutical manufacturing facilities*
- *Work being performed is inside an existing building or one that's under construction; multiple trades are many times working in the same area; various types of heating and exhaust ventilation are being used depending on the specific jobsite. Many of the sites would be considered medium to large jobs.*
- *Working in interior gang bathrooms - no ventilation*
- *Electrical/mechanical rooms and interstitial spaces*
- *Renovation, soft demolition of Government facilities - ventilation systems will be completely removed of system upgraded*
- *Closed in building*
- *Enclosed areas are floors to be built out that do not have glazing or wall partitions complete - HVAC systems are not installed or functional at this phase*
- *Confined space work, breakrooms, basements*
- *Indoor construction operations tasks such as wiring, terminating, piping, etc.*
- *Office buildings use central systems, but the office buildings are leased facilities - we do not control the building systems*
- *Construction barriers in hallways - plywood, Masonite or in some cases plastic that will create a physical barrier between us and tenants*
- *We have limited scope in residential buildings including hallways and inside occupied residential units*
- *Small electric/data rooms, to large scale data centers or industrial facilities; ventilation really isn't of major concern to our company as our people have been instructed not to crowd into enclosed areas, especially with people that aren't working on our crews; if there is to be work done in these smaller enclosed areas (with or without good ventilation) our people are to wear CDC recommended masks and limit this type of work exposure as much as possible.*
- *New 3 story building without heat - using 1 large heater to heat the building*
- *Welding Hooches and confined spaces*
- *2 main projects are either in progress or will start after the first of the year - one: 10,000 square feet of medical research labs, Issue is this project is a complete redo and installation of new HVAC; two: 6,000 square feet of Medical clinics; issue is this is 2 clinics in an operating medical clinic building and maintaining the operation of areas adjacent to the construction site.*
- *Commercial building spaces without central air*
- *Warehouse buildings that have plywood on openings where there will eventually be windows and doors; work areas that are with concrete floors that have poly enclosures -- mostly these areas are used as break areas with physical distancing--with negative air machines present*
- *Existing office space under renovation - potential use of existing HVAC; new construction, ability to utilize new HVAC with filtering*
- *New construction - temporary heat via NG fired heaters - winter is here, buildings are primarily enclosed for finishes, etc.*
- *Break rooms, large in size with a rotating cleaning schedule shared by all who use it*

Partial outdoor/indoor areas:

- *Many of our projects are outdoors but the indoor projects we have going on are very open areas such as a manufacturing plant; if any of our workers are working within 6 feet of any other co-worker or even another contractor, they are required to wear masks and gloves*
- *Full demolition of existing warehouse spaces*
- *Multi story hotels with window and HVAC openings*
- *10,000 square feet decks are tarped in and 10 - 12 1,000,000 btu heaters run day and night to cure concrete; air quality is monitored by safety managers using 4 gas meters. CO2 monitors are also in the heated area all the time - heaters draw fresh air from outside of the tarp.*
- *Adding a new floor to an existing building*

Trailers/temporary structures:

- *40x60 ft enclosed temp building - making sure the cold stays out*
- *Trailers and Conexes use wall or window mounted units*
- *Trailers with window air units*
- *Quonset-style - will be used for fabrication and repair - 10x20 typical size - natural ventilation.*

Scaffolds:

- *FRACO enclosure to install blocking*
- *Tenting in scaffold - there is typically enough air leaks for good ventilation*
- *Enclosed scaffolding to install masonry*

Vehicles:

- *All our trucks are equipped with hand sanitizer, masks, and gloves*

Ventilation solutions provided without information on type of work area:

- *Tarps are loosely secured to allow air to pass through space - constraint is to combat freezing temperatures with allowing ventilation at the same time.*
- *Fresh air exchange, no return air*
- *Tenting with plastic*
- *Loose fitting fabric or other barriers*
- *Plastic zip walls and negative air machines*
- *We are using CO₂ to determine ACH [air changes per hour]. We are augmenting conditions with portable fans with MERV13 filters. These have been evaluated using a flow-hood and amp meter. We are also using TSI Dust Trak DXR aerosol instruments to assess PMI with telemetry, CO₂ monitors with Bluetooth dataloggers to determine efficacy and provide actionable points for our team. The HSPH developed a formula for assessing steady state CO₂ level in room. The RI Department of Health is promoting this. We have used CO₂ generation for 50-60-year-old man standing and talking for CO₂ generation value.*
- *Scrubber machines, HEPA filtration*

Ventilation challenges not tied to a specific work area:

- *Heating the area and bringing in fresh make up air*

Work practices not linked to a specific work area:

- *If any of our workers are working within 6 feet of any other coworker or even another contractor, they are required to wear masks and gloves*

Projects Underway or Planned with Enclosed Areas with or without HVAC Systems (N=57)

The 57 participants who said they had projects underway or planned between December and May 2021 were also asked to provide information about projects taking place in structures with existing HVAC systems and those without HVAC systems.

Projects in Structures with Existing HVAC Systems

The majority (84%, or 48 participants) said they had projects underway or planned in structures with existing HVAC systems. All but one of these participants responded to the follow-up question asking about their use of selected control measures. As shown in the following table, the control measures participants were most frequently using or planned to use included 1) providing face coverings/masks (95%), 2) opening windows or using other sources of fresh air (78%), 3) using local exhaust ventilation (72%), 4) making sure unit ventilators are clean (72%), and 5) providing employees with N-95s or other respirators (64%). The measures they were least likely to be using or planning to use included 1) air cleaning technologies such as UVGI, 2) portable room air cleaners, 3) providing maximum ventilation rates before and after shifts, and 4) taking steps to maintain humidity of 40%-60% in the work area.

Table 2. Control Measures in Structures with Existing HVAC Systems

Control Measures – HVAC present (bold type most using or planned to use, gray highlight least using or planned to use)	Currently Using	Plan to Use	Are Not/ Will Not Use	Not Sure
Increase the HVAC system’s outdoor air intake. Disable demand-controlled ventilation to bring in more outside air and reduce recirculation of air.	43%	11%	19%	28%
Make sure unit ventilators are clean (72%)	51%	21%	11%	17%
Use HVAC system filters with a Minimum Efficiency Reporting Value (MERV) rating of 13 or higher	43%	13%	15%	30%
Use local exhaust ventilation (72%)	51%	21%	17%	11%
Maintain humidity in the work area of 40-60%	23%	15%	28%	34%
Open windows or other sources of fresh air (78%)	49%	28%	11%	13%
Increase air changes per hour	28%	17%	19%	36%
Use portable room air cleaners	30%	9%	34%	28%
Use portable high-efficiency particulate air (HEPA) fan/filtration systems	36%	19%	23%	21%
Use other air cleaning technologies, such as Ultraviolet Germicidal Irradiation (UVGI), Effective Static Pressure (ESP), etc.	9%	6%	47%	38%
Provide face coverings/masks (95%)	89%	6%	0.00%	4%
Provide employees with N-95 or other respirators (64%)	51%	13%	19%	17%
Provide maximum ventilation rates before and after shifts	19%	17%	28%	36%

Other control measures

When asked to provide information on other control measures they were using or planned to use to increase ventilation and air quality in structures with HVAC systems, 32% provided additional detail, suggestions, or comments on the challenges:

- *We have zero control measures - we are the subcontractor and the means and methods are under the control by the GC/CM - I think the GC should always leave windows out for fresh air, get rid of propane heaters which are very high humidity, and put a UV light chamber on the heat system. They also should give special badges to those who already survived COVID since they can't get it again and can't give it to anyone else.*
- *Circulate air in from outside of our construction space - have mechanical contractor hook up vents to provide ventilation*
- *Jobsites that are considered "inside", we are using portable fans and keeping as many doors open depending on the weather - we are not depending on existing HVAC systems for any ventilation issues*
- *Increase the number of fans; larger fans, bigger units; fans left on overnight with windows opened*
- *To comply with Cal/OSHA we are having our Safety Consult company evaluate all work sites to insure we are in compliance*
- *Keep areas unenclosed for as long as possible*
- *Negative air machines with HEPA filtration*
- *We are also using fresh air Fridays at office - using 48-inch barrel fans and two open exterior doors to change air*
- *Control dust mitigation by using HEPA wet/dry vacuums and sweeping compound as needed*
- *Dust control*
- *Regular cleaning and disinfecting of spaces*

Projects in Structures Without Existing HVAC Systems

Forty of the participants (71%) said they had projects underway or planned in structures without existing HVAC systems. All but one of these participants responded to the follow up question asking about their use of selected control measures. As shown in the following table, the control measures participants were most frequently using or planned to use when HVAC systems are not present included 1) providing face coverings/masks (98%), 2) opening windows or using other sources of fresh air (84%), 3) adjusting work schedules to limit workers in a particular area (82%), 4) using local exhaust ventilation (64%), and 5) using fans and making sure they are blowing away from workers (61%). The measures they were least likely to use included air cleaning technologies such as UVGI and portable room air cleaners.

Table 3. Control Measures in Structures without Existing HVAC Systems

Control Measures – No HVAC (bold type most using or planned to use, gray highlight least used or planned to use)	Currently Using	Plan to Use	Are Not/ Will Not Use	Not Sure
Provide employees with N-95 or other respirators	49%	10%	31%	10%
Provide face coverings/masks (98%)	90%	8%	3%	0%
Use local exhaust ventilation (64%)	46%	18%	21%	15%
Increase air changes per hour	21%	13%	21%	46%
Use portable high-efficiency particulate air (HEPA) fan/filtration systems	28%	13%	32%	28%
Use portable room air cleaners	13%	10%	52%	26%
Use other air cleaning technologies, such as Ultraviolet Germicidal Irradiation (UVGI), Effective Static Pressure (ESP), etc.	5%	3%	54%	38%
Open windows, doors or other sources of fresh air (84%)	69%	15%	10%	5%
Adjust work schedules to limit the number of workers in the work area at a given time (82%)	72%	10%	10%	8%
Use fans to increase air flow from windows or openings and make sure they blow away from the workers (61%)	46%	15%	21%	18%

It is noteworthy that for both structures with and without HVAC systems, face coverings, open windows, and LEV were among the top control measures participants were using or planned to use, and air cleaning technologies such as UVGI and portable room air cleaners were among the control measures least likely to be used.

Other control measures

When asked to provide information about other control measures they were using or planned to use to increase ventilation and air quality in structures with HVAC systems, 20% provided the following additional detail, suggestions, or comments. Two mentioned ventilation – use of fans and keeping areas open for outside air. Four mentioned other CDC recommendations to prevent the spread of disease (social distancing, hygiene, limiting individuals in a space), and one discussed use of dust controls:

- *We have portable fans available for area's that need to have increased ventilation as work progresses on the jobsite*
- *Keep areas open to the outside air as long as possible*
- *6 feet distance, wipe down tools if being shared, gloves*
- *Social distancing, increased sanitation, and hygiene*
- *Procure plans to increase the distance of each employee from one-another (i.e., greater than 6 feet).*
- *[Our] main administrative controls rely on pre-planning work to avoid multiple craft workers in any particular area at a time*
- *Misting with germicidal/virucidal chemical after shifts, dust control - most of the above is for Silica not Wuhan virus*

Other Challenges

All participants were also provided the opportunity to share other challenges (including other ventilation challenges) they were currently facing or anticipated in the months ahead in their efforts to prevent the spread of COVID-19 on their job sites. Most (roughly 67%) responded to this open-ended question. As described in the following comments, the challenges included maintaining adequate air flow and ventilation (the focus of this survey), but many raised issues the industry has been grappling with since the pandemic began, including how to: maintain social distancing; ensure face coverings are worn and worn properly; deal with workers that come to work sick and their employers on multi-employer sites; and respond given the lack of a standard and enforcement mechanism. There were also a few comments that indicated there was still confusion about the disease (e.g., once you've had COVID-19 you can't get it again) or resistance to accepting the seriousness of this pandemic.

Ventilating areas – maintaining adequate air flow:

- *Large buildings under construction - ventilation not always an option due to curtainwall installations or other enclosed areas*
- *In hot weather it is difficult to get airflow and keep heat in the area*
- *Some buildings not having HVAC systems and engineering temporary controls*
- *Working at a major airport, concerns with the ability to increase ventilation and mitigation efforts with international flights*
- *Very few contractor clients utilize mechanical ventilation as dictated by environment*
- *We are in the process of turning over our building/finalizing commissioning as the owner is starting to occupy the building, ivy league public health professionals have required CFM per person that is impossible for our new, energy efficient, state of the art building, the project simply cannot achieve this because the building is 100% outside air - I think there is a disconnect with ventilation/public health solutions and current MEP/HVAC engineering designs implemented in newer buildings*
- *Office spaces for project management team is normally not fully finished and the HVAC is not fully effective*
- *No heat in building*
- *Warming areas up and bringing in fresh air*
- *Although heating is primary concern, the greatest challenge is ensuring the air is circulated out of areas, filtered, or conditioned in a manner to promote cleaner air quality*
- *Most of the work we do is renovation of public buildings with existing HVAC systems - owners have not provided for any additional/upgraded ways to ventilate the spaces, and we are limited in ventilation improvements for two main reasons: 1) we can't design or modify any changes to permanent HVAC systems, and 2) to remain competitive in a low-bid marketplace with shallow margins, we have to be very cautious about portable ventilation equipment (and temporary heating) costs. Lastly, we mainly work in climates that are very cold during the Winter, so opening windows is not always a very practical option.*
- *Access to equipment and providing warm areas along with fresh air in our colder climates.*
- *Maintaining heat for construction quality while increasing air changes over the winter*
- *As buildings get closer to completion, ventilation becomes more difficult, and workers closer together*
- *Work to be performed in areas that are currently occupied by residents*

Issues with face coverings, social distancing, sanitation, screening workers

Social distancing:

- *Trailer rental and owners -- having enough space for the need of renting additional trailers due to spacing employees out while taking breaks*
- *Challenges include interior fit-out workspaces and hospital infrastructure work, limited spacing for social distancing and requiring more than one person to handle the material at one time -- pre-planning is critical and morning huddles and schedule reviews are critical -- opting to run 2 shifts to spread people out*
- *Maintaining positive safety climate will be our biggest challenge for our regular, FT crews -- assuring new hires/temporary hires (for outages & shutdowns) understand and are compliant with our protocols.*
- *Multiple workers in a crew truck*
- *Union contracts require a break room instead of allowing the workers to take their lunch in their vehicles*
- *Congested spaces: elevators, stairways*
- *Achieving 6' distances during various activities*
- *Multiple trades working in the same areas - staggering employee shift schedules may need to be implemented to reduce the number of workers in any given area during "normal" workday hours*
- *Crew members seek a warm place to take breaks and eat lunch. This time of year, they normally congregate in sea boxes and office trailers. We are trying to find an alternative with better ventilation.*
- *Maintaining distance on more crowded sites. Limiting access to company employees only to curb additional exposures.*
- *Cold weather and close quarter spaces.*
- *Occupancy of break trailers continues to be higher than we would like, due to space limitations.*
- *Enforcing the use of physical distancing and adherence to wearing masks if we do decide to enclose in any work areas. Juggling work schedules with multiple companies to limit the number of people in these areas to limit exposure.*
- *Workers commuting to/from jobsite in same vehicle*

Face coverings and other safety measures:

- *Face coverings are mostly cloth and often fall below the nose, requiring constant touching by workers; Also, safety glasses fog up so workers are choosing one over the other. Use is sporadic and I feel unstated peer pressure is influencing use, which is less than ideal, but is showing slight signs of improvement.*
- *Worker compliance with mask usage and social distancing*
- *The biggest challenge is to keep people from getting complacent in wearing their masks. Many times, everyone wears masks on the jobsites, but with hop in a vehicle with another employee and remove their masks. For our company, our biggest exposures aren't the actual jobsites, but the break areas or other areas where not wearing a mask is somewhat accepted. Really its maintaining attention to detail and making sure people understand that other than when you are truly alone and away from other people, you need to be wearing your mask and practicing social distancing whenever possible.*
- *Ensure workers use face covers*
- *Workers not properly wearing face coverings - working in close quarters - asymptomatic workers that can / do / will spread COVID -19*
- *Some workers resistance to wearing face covers and glasses fogging. We do provide fog resistant glasses*
- *People not wearing masks, and those who still believe it's not "real" - other contractors not following the COVID rules and putting our staff at risk*
- *availability of sanitation and safety gear*
- *Face covering compliance with cold weather that results in fogging glasses.*
- *Wearing mask in hot weather*

- *We also wear respirators because of dust and organic vapor hazards so our workers are protected (if they wear respirators correctly)*
- *As a GC it is hard to regulate adherence from 100% of our Subs. We are always looking for ways to share what info we have with them.*
- *Personal responsibility from sub-contractors, vendors and visitors to the job site to wear face covering properly or at all*

Screening:

- *Maintaining consistent room temperature in pre-COVID Temperature check-in room - cold air causes fluctuations with the digital electronic thermometer*
- *Housekeeping, cleaning, disinfecting, screening/questionnaires before shifts and entering the project, contact tracing*
- *Other company's workers coming to work sick*
- *Employees reporting to work with symptoms or symptomatic family members*
- *Policing and implementation of all the new measures is challenging. How do we know when people are a symptomatic? How do we know when they went out for beers last night? Add that to an already full workload, and stress of pandemic. We're worried about it all. Trying to simplify as much as humanly possible.*
- *Unreported international travel and unreported symptoms are the two most significant concerns.*

Lack of a standard:

- *The need for clear and concise standard*
- *Regulatory guidance, NIOSH recognition of the effectiveness of technologies like CIMR tech creating H₂O₂ disinfection to disinfect at 0.02 pp. while workers are present; 50 times less than the PE; should be not only on every construction site but every school, business, bus, plane, hotel room etc.*
- *There are usually other subcontractors on the job - some of these subcontractors have little to no regulation, which puts us at risk when we're on the same job - it should be enforced by the contractors, with OSHA stepping in to fine the contractors, to make sure that their subs are doing their part - it would encourage all of the other subcontractors to comply.*
- *Changing guidelines and regulations*

Other comments that reflect a continued lack of awareness of the seriousness of COVID-19

- *It's is totally cost prohibitive to add any ventilation. It has to either be the buildings permanent HVAC system or nothing. What we DONT need is OSHA coming in at the 11th hour any making changed due to COVID when a vaccine is rolling out. All you will do is shut down construction and make the workers unemployed, viral spread at construction sites has been minimal. Don't mess things up by adding another layer of red tape with rules hastily thrown together because someone got in panic mode.*
- *... stop the panic that's what needs to happen*
- *It's cold as hell outside so air exchanges are unrealistic in the Northeast it's time to realize that this global panic attack needs to end, COVID is real but the death rate is comparable to the flu, so stop acting like we are all going to die.*
- *Convincing craft workers that the hazard is real and the safeguards are effective*
- *Misconceptions and misinformation seem to take hold immediately, while factual information and instructions are met with a plethora of objections and rebuttals*

Willingness to share additional information

At the end of the survey, participants were asked if they would be willing to share additional information on control measures and challenges. Thirty (30) participants said "Yes" and shared their contact information to be used by CPWR only for this purpose.

Appendix

Working in Confined Spaces and Other Enclosed Areas During the COVID-19 Pandemic Survey

CPWR and the NORA Construction Sector Council's COVID-19 Workgroup are in the process of developing guidance for the construction industry on how to prevent the build-up of viral particles by improving ventilation and air quality in enclosed work areas. As a first step, CPWR is conducting this brief confidential online survey on behalf of the Workgroup to collect information on the ventilation challenges facing the industry and steps currently being taken or planned to prevent the spread of COVID-19 in enclosed work areas on jobsites.

Your participation in this online survey is completely voluntary and your responses will be anonymous unless you choose to share your contact information at the end of the survey. If you share your contact information, your responses will remain confidential. Your contact information will only be used by CPWR to follow up with you to gather additional information on ventilation controls and challenges related to COVID-19. Your name and company name will not appear in the analysis of the survey results or be used without your permission.

The survey should take less than 15 minutes to complete.

Thank you in advance for your help.

Page Break

Please select the category that most closely reflects your current role in the construction industry:

- Construction Contractor/Employer (1)
 - Project Owner (2)
 - Construction Safety & Health Consultant (3)
 - Construction Safety & Health Director/Manager (4)
 - Other (please specify): (5) _____
-

In which segment of the construction industry do you work? (Check all that apply)

- Commercial & Institutional (1)
 - Heavy & Civil (2)
 - Highway, Streets & Bridges (3)
 - Residential - Multifamily (4)
 - Residential - Single Family (5)
 - Industrial (6)
 - Other (please specify): (7) _____
-

What is the size of your company?

- Less than 20 employees (1)
 - 20 - 49 employees (2)
 - 50 - 100 employees (3)
 - More than 100 employees (4)
-

In what region of the country do you perform most of your work?

- Northeast (1)
 - Southeast (2)
 - Midwest (3)
 - Southwest (4)
 - West (5)
-

Is your company setting up temporary structures for workers to use to warm up on construction sites?

- Yes (1)
- No (2)

Skip To: Q8 If Is your company setting up temporary structures for workers to use to warm up on construction sites? = No

Please briefly describe the temporary structures and how they are being heated and ventilated:

Is your company using the ventilation guidance provided by any of the following organizations?
(Check all that apply)

- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) (1)
- American Industrial Hygiene Association (AIHA) (2)
- Occupational Safety and Health Administration (OSHA) (3)
- Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (CDC/NIOSH) (4)
- Other (please specify): (5)
-
- Not sure (6)
- My company is not using ventilation guidance from any of these organizations (7)

Do you have projects underway or planned that will require enclosing work areas between now and May 2021?

- Yes (1)
- No (2)

Skip To: Q12 If Do you have projects underway or planned that will require enclosing work areas between now and M... = No

For the projects underway or planned, please briefly describe the most common type of enclosed work area and the ventilation challenges: (Please provide as much detail as possible regarding size of area, type of work, type of ventilation, etc.)

Do you currently or will you have one or more projects in structures with existing HVAC systems?

- Yes (1)
- No (2)

Skip To: Q11 If Do you currently or will you have one or more projects in structures with existing HVAC systems? = No

Please indicate the use of the following control measures by your organization:

	Currently Using (1)	Plan to Use (2)	Are Not/ Will Not Use (3)	Not Sure (4)
Increase the HVAC system's outdoor air intake. Disable demand-controlled ventilation to bring in more outside air and reduce recirculation of air. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make sure unit ventilators are clean (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use HVAC system filters with a Minimum Efficiency Reporting Value (MERV) rating of 13 or higher (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use local exhaust ventilation (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintain humidity in the work area of 40-60% (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open windows or other sources of fresh air (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increase air changes per hour (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use portable room air cleaners (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use portable high-efficiency particulate air (HEPA) fan/filtration systems (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Use other air cleaning technologies, such as Ultraviolet Germicidal Irradiation (UVGI), Effective Static Pressure (ESP), etc. (10)

Provide face coverings/masks (11)

Provide employees with N-95 or other respirators (12)

Provide maximum ventilation rates before and after shifts (13)

Please briefly describe **other control measures** you are using or plan to use to increase ventilation and air quality for projects in structures with existing HVAC systems:

Do you currently or will you have one or more projects in structures that **do not** have existing HVAC systems?

- Yes (1)
- No (2)

Skip To: Q12 If Do you currently or will you have one or more projects in structures that do not have existing HV... = No

Please indicate the use of the following control measures by your organization:

	Currently Using (1)	Plan to Use (2)	Are Not/ Will Not Use (3)	Not Sure (4)
Provide employees with N-95 or other respirators (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provide face coverings/masks (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use local exhaust ventilation (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increase air changes per hour (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use portable high-efficiency particulate air (HEPA) fan/filtration systems (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use portable room air cleaners (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use other air cleaning technologies, such as Ultraviolet Germicidal Irradiation (UVGI), Effective Static Pressure (ESP), etc. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open windows, doors or other sources of fresh air (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adjust work schedules to limit the number of workers in the work area at a given time (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use fans to increase air flow from windows or openings and make sure they blow away from the workers (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please briefly describe **other control measures** you are using or plan to use to increase ventilation and air quality for projects in structures that do not have an existing HVAC system:

Please briefly describe **challenges (ventilation and others)** you are currently facing or anticipate in the months ahead in your efforts to prevent the spread of COVID-19 on your construction projects:

Would you be willing to be contacted by CPWR, if needed, to share additional information about or photos of the COVID-19 related control measures you are using and the challenges you are facing? Please be assured, your contact information will only be used for this purpose and we will not use your name or the name of your company/organization when reporting on information that you may provide.

- Yes (1)
- No (2)

Skip To: End of Survey If Would you be willing to be contacted by CPWR, if needed, to share additional information about or... = No

Skip To: Q14 If Would you be willing to be contacted by CPWR, if needed, to share additional information about or... = Yes

Thank you for being willing to be contacted if needed to share additional information on controls and challenges. Please use the space below to provide your contact information:

Your Name _____

Company/Organization _____

Email Address _____

Phone number _____

End of Block: Default Question Block
