



COVID-19 and the Impacts to the Workplace

Bala | Meta Consulting Engineers

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Overview

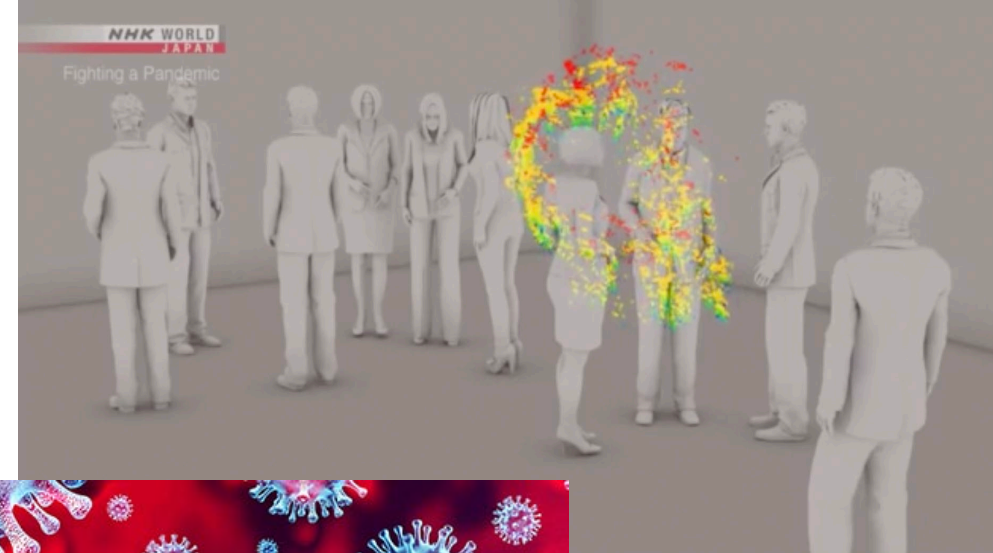
BALA

- The Virus
- HVAC Solutions
- Plumbing Solutions
- Electrical Solutions
- Technology Solutions
- Workplace Environment Solutions



The Virus – Fast Facts

- COVID-19 is caused by the SARS-Cov-2 virus
- Highly Contagious
- How it's spread:
 - Humans
 - Surfaces
 - Airborne Water Droplets/Dust Particles
- Presence:
 - Aerosol = Up to 3 hours
 - Copper = Up to 4 hours
 - Cardboard = Up to 24 hours
 - Plastic = Up to 3-4 days
 - Stainless Steel = Up to 3-4 days



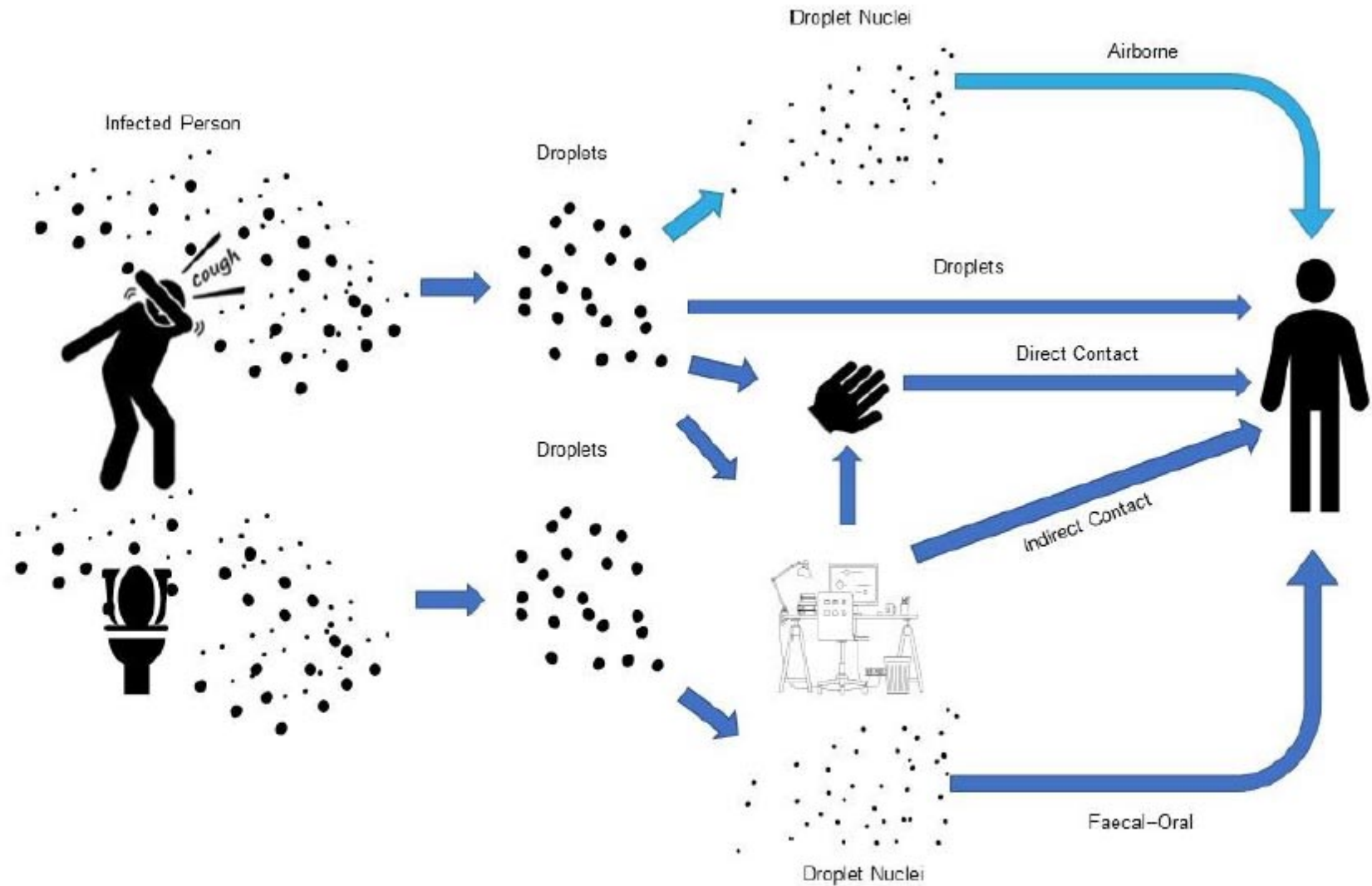


Figure 1. WHO reported exposure mechanisms of COVID-19 SARS-CoV-2 droplets (dark blue colour). Light blue colour: airborne mechanism that is known from SARS-CoV-1 and other flu, currently there is no reported evidence specifically for SARS-CoV-2 (figure: courtesy Francesco Franchimon).

High Risk

- Older adults, with risk increasing by age
- People who serious chronic medical conditions:
 - Heart Disease
 - Diabetes
 - Lung Disease
 - Compromised Immune System
 - Asthma

Precautionary Steps

- Personal Protection Equipment (PPE)
- Isolation – Maintaining safe distances between people and contaminated surfaces.
- Cleaning/Disinfection

Effective Measures

- Install filtration, bi-polar ionization and UV light within ductwork
- Implement pressurization control and/or enhance current practices
- Increase outside airflow
- Deactivate demand control ventilation system
- Operate systems longer and with higher outside air content to flush spaces (at night purge)
- Operate exhaust systems serving communal spaces continuously
- Maintain minimum humidity levels (between 40-60% RH)
- Sanitize ductwork with aerosol sprays or UV light
- Use portable air purifiers to clean and increase ACPH

HVAC Inspiration

Clean Rooms

- Barriers/Airlocks
- Positive pressure
- Full gowning
- Extremely high and laminar airflow
- High supply and low return
- HEPA filtration
- Critical work performed in isolators

Bio-Safety Level (BSL) Research Facilities

- Same as clean rooms
- Negative pressure
- Local exhaust near contamination sources
- 100% outside air for BSL-3 & 4

Infectious Disease Rooms

- Elevated airflow (2 ACPH outside air/12 ACPH room air)
- Negative pressure
- Highly infectious rooms similar to BSL

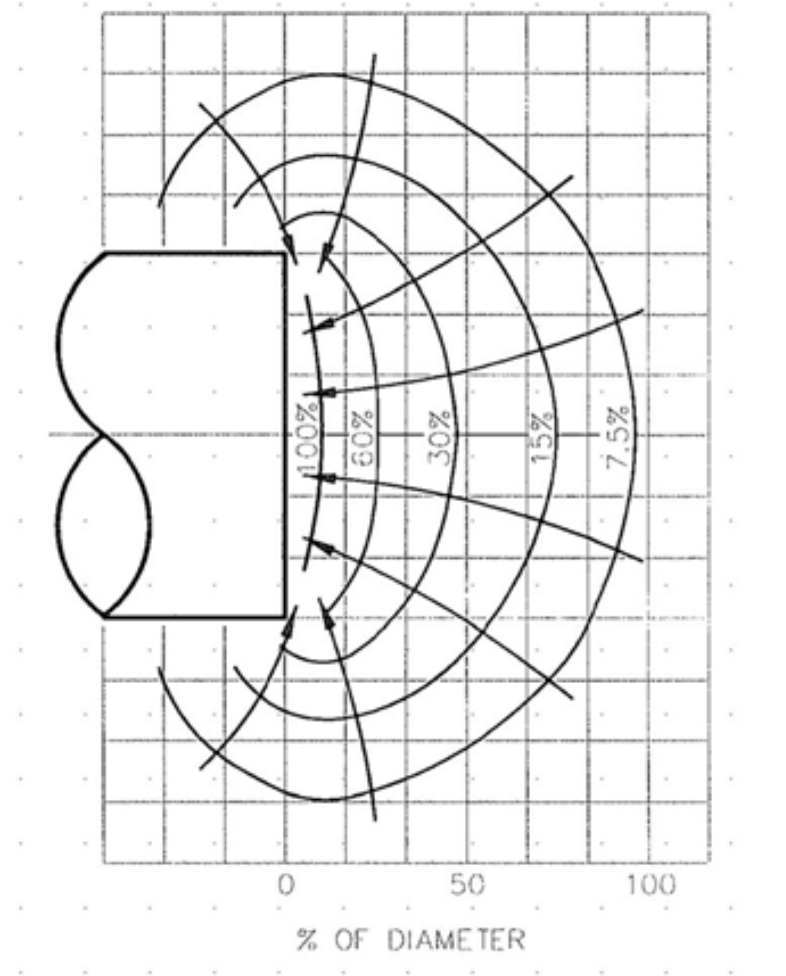


FIGURE 3-6. Velocity contours — plain circular opening — % of opening velocity

HVAC Solutions

Filtration

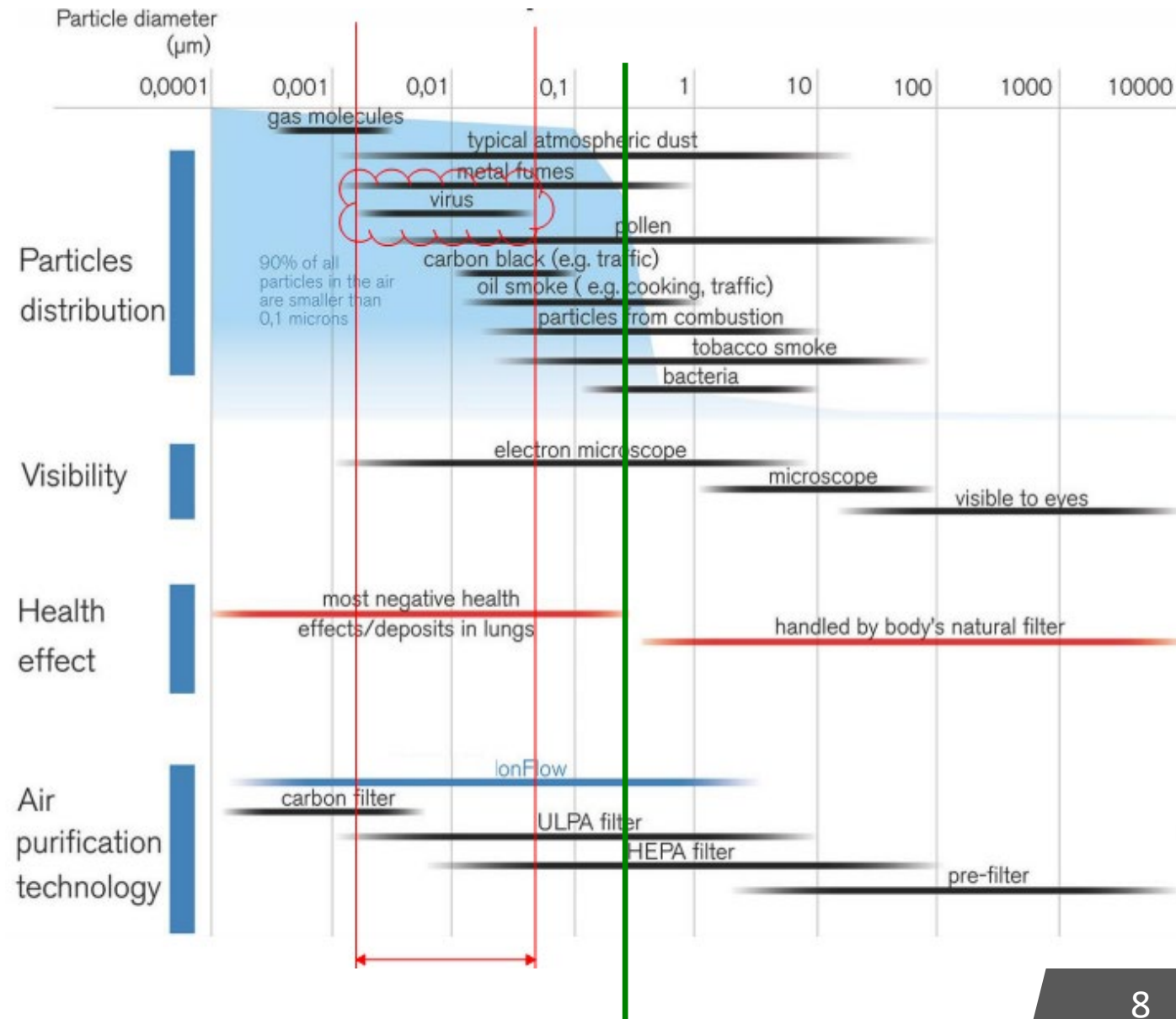
- Viruses are very small and can pass through filters - if independently suspended in air
- The coronavirus often attaches to airborne particulate (dust & vapor droplets) which can be captured by high efficiency filters
- HEPA filters rated at 0.3 micron particulate
 - Will capture smaller particulate
 - Capture improves with loading
 - ULPA has higher efficiencies

Advantage

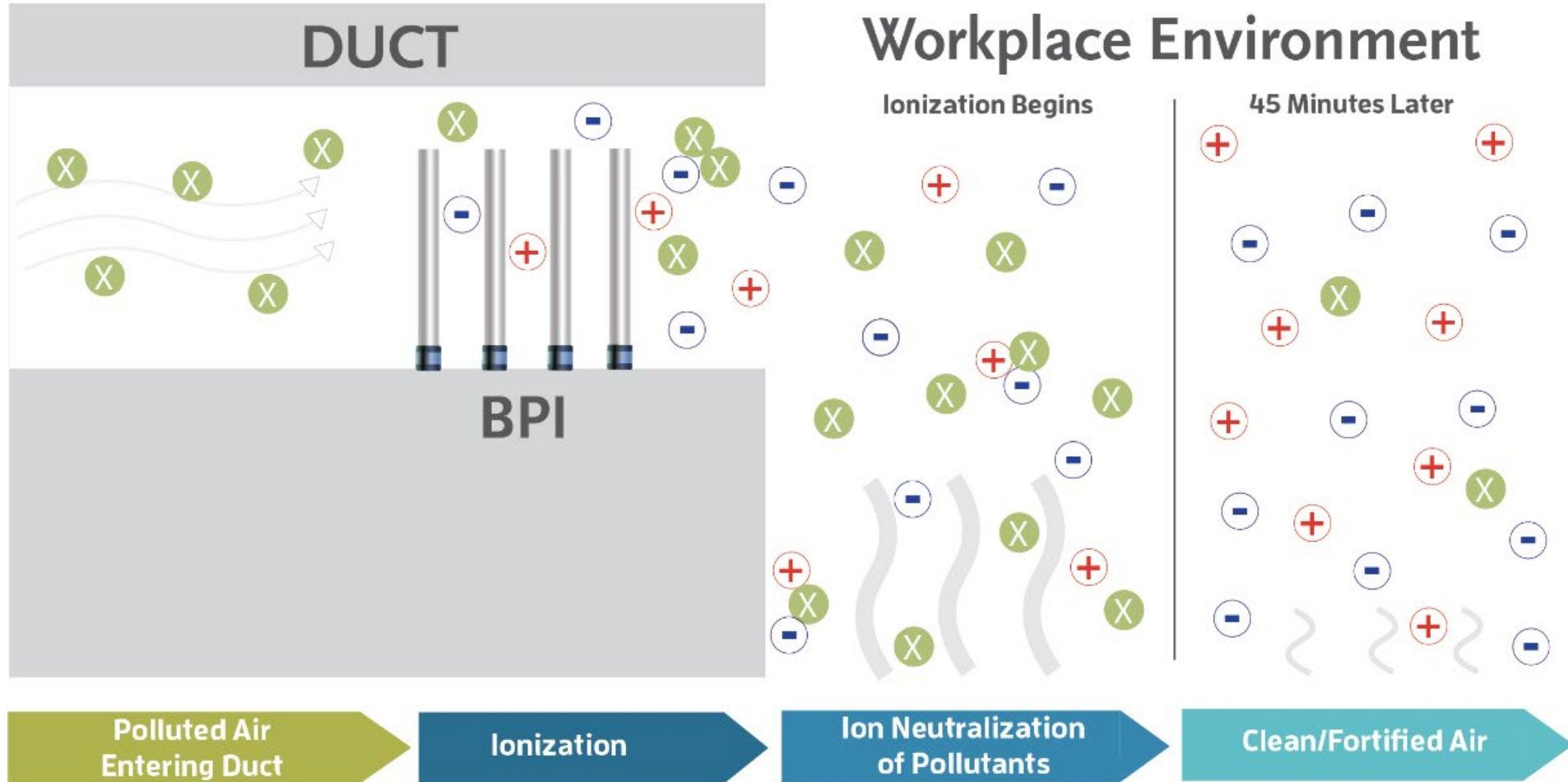
- High Percentage of virus captured

Disadvantages

- A percentage still passes through
- Increased pressure drop



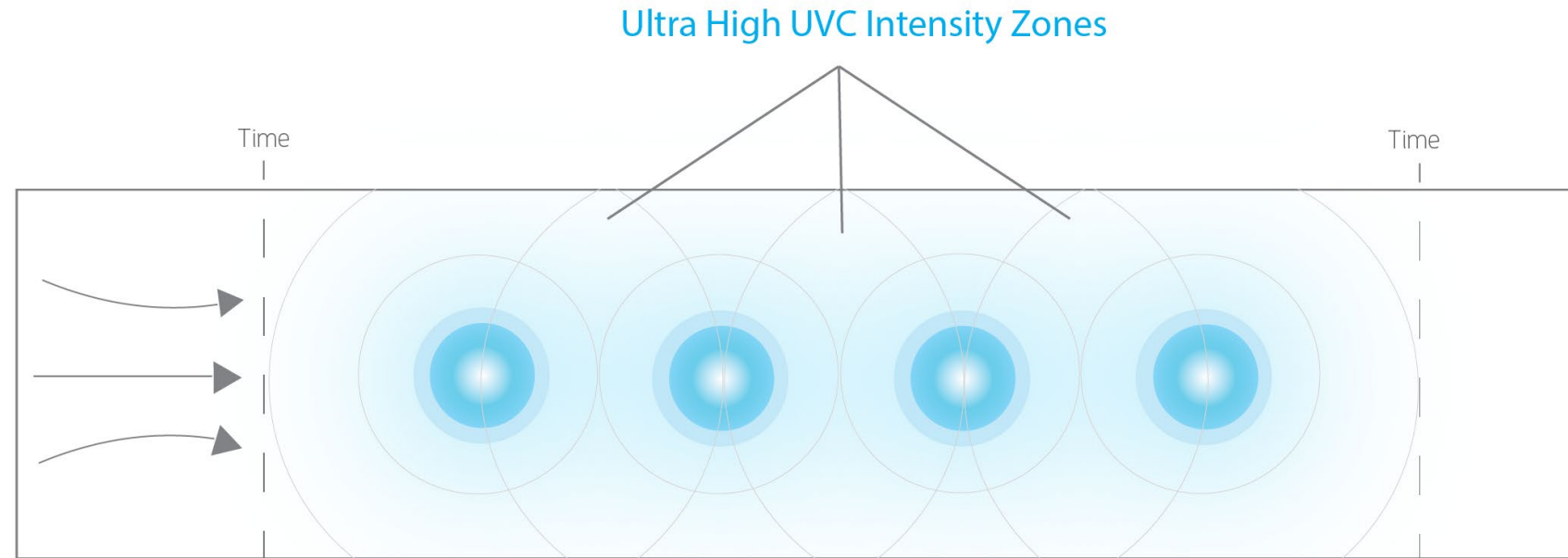
Bi-Polar Ionization



UVC Light

Possible Lamp Placement

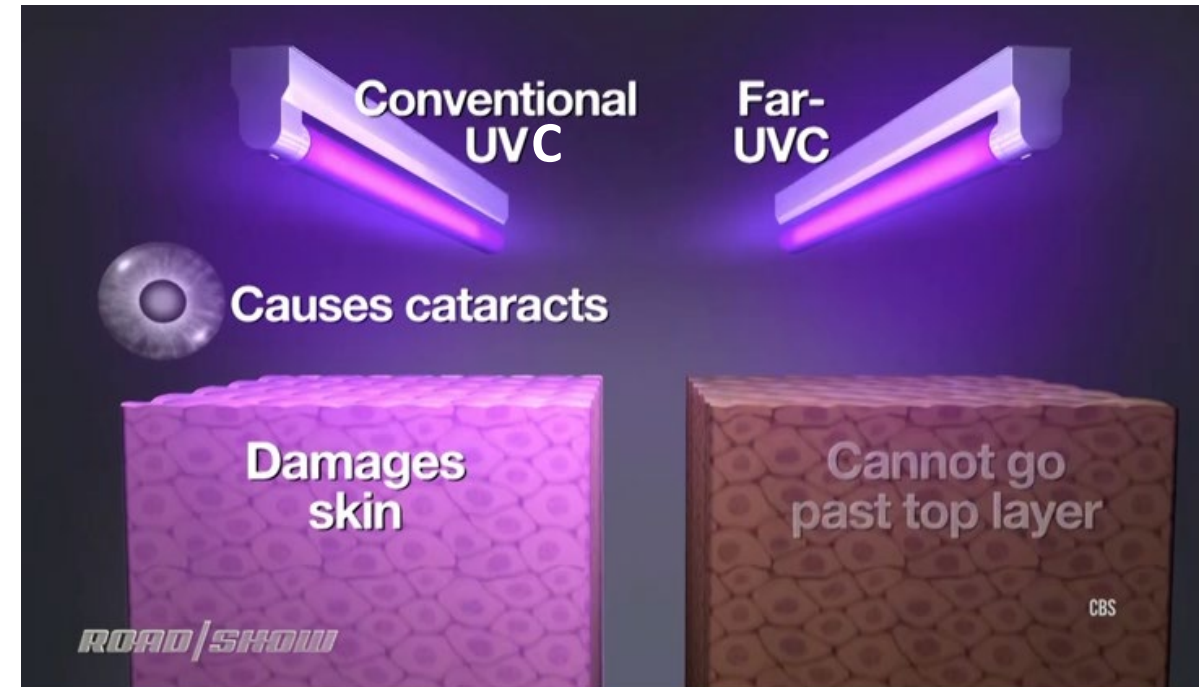
- Attenuators
- Filters
- Energy Recovery wheels
- Coils
- Fans



Note: Manufacturers recommend 10 second exposure to the UVC bulb, with lamps being 6-12” apart.

Far-UVC Light (207-222 nm)

- UVC Light is carcinogenic and cataractogenic
- Far-UVC inactivates bacteria and viruses without harm to human skin
- Inactivates viral, bacterial, and fungal cells in seconds
- Faster than UVC light



UVC Disinfection Process



Source: AFP



System Applications

Systems to Apply Solutions	Filtration	UVC Lights	Bi Polar Ionization	Portable Purifiers
Centralized VAV System	Yes	Yes	Yes	As needed
Systems that recirculate air locally	Yes	Yes	Yes	As needed
Chilled Beams DOS	Yes	Yes	Yes	As needed
PTAC and VTAC (ducted)	No	Yes	Yes	Yes
Induction Units DOS	Yes	Yes	Yes	As needed
Baseboard Heating	No	No	No	Yes

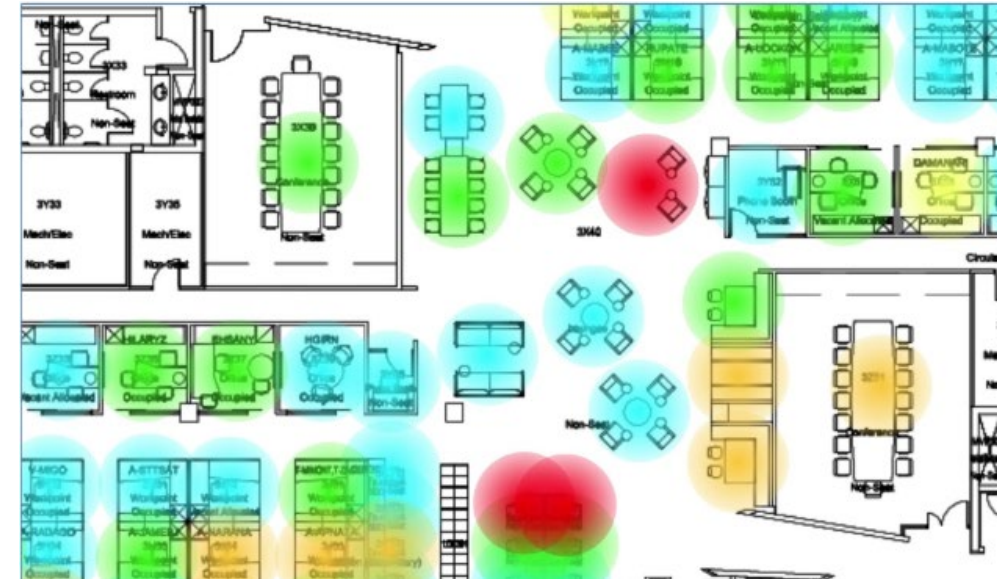
Plumbing Solutions

- Far-UVC or UVC lamps under lids of water closets. For water closets without lids, lids would need to be added.
- Spray disinfectant to bowl of water during and after each flush
- Far-UVC or UVC lamp to disinfect stall after use
- Hands free toilet fixtures
- Limit use of stalls with adjacent occupancy
- Close lids when flushing toilets
- Far-UVC or UVC lamps in lids of waste bins
- Bathroom attendant to wipe down



Technology Solutions

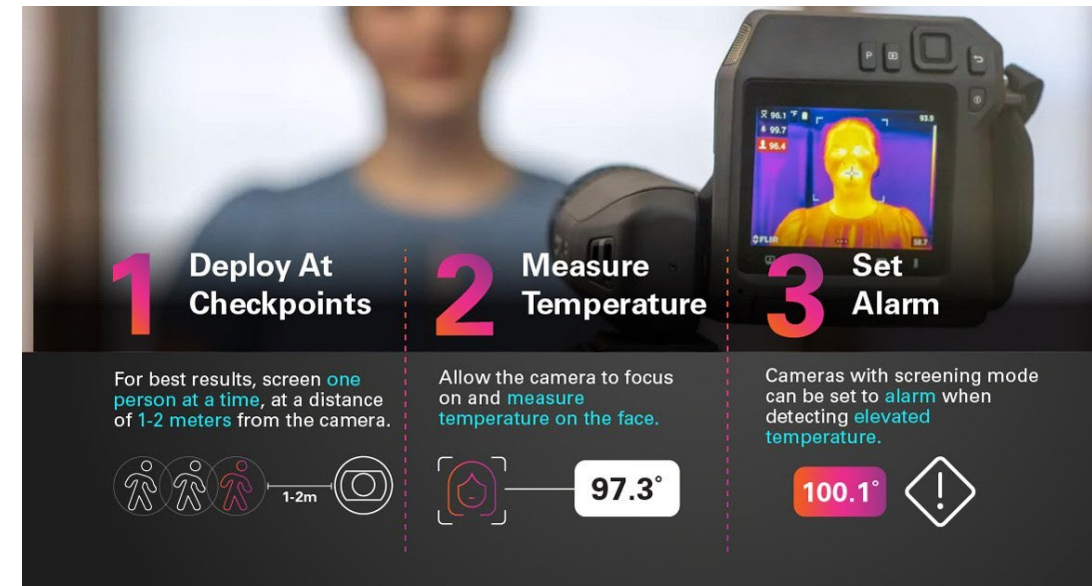
- **Touch** – Identify opportunities to reduce use of community technology devices
 - Enable mobile credentialing for door access
 - Disable touch on room schedulers and other shared devices
 - Move to app-based AV control in conference spaces
 - Reduce printing workflows and improve digital display capabilities
- **Collaboration** – Use technology to limit staff movement and the need to meet together
 - Anticipate reduced meeting space use and improve the user desk collaboration experience
 - Meetings spaces should connect to collaboration platforms adopted during remote work period
 - Prepare for and manage increased Wi-Fi use
 - Ensure ability to quickly transition back to WFH mode
- **Detection** – Focus on mitigating risk over avoiding it
 - Heat mapping of staff traffic patterns to inform cleaning teams
- **Future Resilience** – Move away from location-based file & asset storage, optimize for remote working long term



Workplace Environment Solutions

Barrier/Controlled Access

- Single controlled access point for personnel and public entry
- Independent controlled access for materials
- Airlock
- Air Shower – not practical, low effectiveness
- Walk-Off Mats
- Disinfectant Misting vs. Wipe Down
- Pressurization
- Body Temperature screening – local vs mass



Source: FLIR

Workplace Environment Solutions

Workplace Separation

Minimize risk

- De-densify – shift work, spread out seating, work remote
- One-way movement
- Employ mandatory PPE
- Limit points of congestion
- Reconsider the use of conference rooms

Personal Protective Equipment

- Gloves
- Sanitizer Stations/Wipes
- Face masks
- Respirator



Workplace Environment Solutions

Cleaning the Workplace



Recommended Actions

- Sanitize all surfaces
- Wipe down desks and workspaces
- Wipe all packages and mail
- Wipe all door handles
- Frequent cleaning of communal spaces
- Disinfect restrooms
- Utilize UV systems to clean overnight
- Sanitizing mister at entrances

COVID-19 Sustainability Impacts

	Social	Technological	Environmental	Economic	Political
Positives	<ul style="list-style-type: none"> • Cleaner indoor air quality • Better remote connection • Education on safety measures • Changes in social structure caused by social distancing 	<ul style="list-style-type: none"> • Cleaner air in buildings with newer technology using UVC, far-UVC, and higher efficiency filters • More frequent air filter changes • Automation innovation 	<ul style="list-style-type: none"> • Increased climate issue awareness • Reduced emissions and pollution • WFH successful • Higher value on nature 	<ul style="list-style-type: none"> • Allow the economy to expand again • Technology business will grow • Continued materialism – but online • Emergency preparedness changes • Job creation 	<ul style="list-style-type: none"> • Major disruption across the board. • Healthcare and emergency preparedness may change • Address equity among citizens
Negatives	<ul style="list-style-type: none"> • Continued social distancing enforced • Adjust to wearing PPE • Work hours may shift • If children are still at home, workers will need to stay home • New forms of unsafe waste • Employee stress concerns 	<ul style="list-style-type: none"> • Maintaining air pressure • Treating a greater volume of air • Cleaning more frequently • Increasing filtration may not capture all of the virus 	<ul style="list-style-type: none"> • HVAC filters reduce energy efficiency (more CO₂) • Increased chemical use for cleaning • Increased material solid waste (filters, PPE, etc.) • Increased online shopping, increased shipping • Supply chain management 	<ul style="list-style-type: none"> • Reduced efficiency = higher operating costs • Capital cost for new systems • Increased maintenance & cleaning costs • High unemployment and job loss • Added expenses to buy PPE 	<ul style="list-style-type: none"> • Major disruption across the board • Impacts on civil liberties • Enforcement of new standards • Prioritizing buildings

COVID-19 Impacts to the Workplace

Conclusions



- It's a multi-faceted approach
- Research changes daily
- Future mechanical systems will incorporate these strategies
- The new workplace
- Next Steps



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