COVID-19 and the Impacts to Workplace Facilities

Course # - BalaAIA021

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Course Description

The COVID-19 Virus has forever changed our perspective on cleanliness, personal interaction and our environment. The thought of a post-pandemic state brings us hope. But what does a post pandemic environment look like and how does it operate? From filters and air changes in HVAC systems to sanitization and touchless toilet fixtures as well as technology integrations for access control and bio-scanning, there are short and long-term strategies building owners can implement to increase the safety of their building. This session will provide research developed by Bala, healthcare, and industry professionals that takes an in depth look at building systems strategies, coupled with architectural elements, and will provide guidance and recommendations to reduce the risk of exposure within the workplace.

Learning Objectives

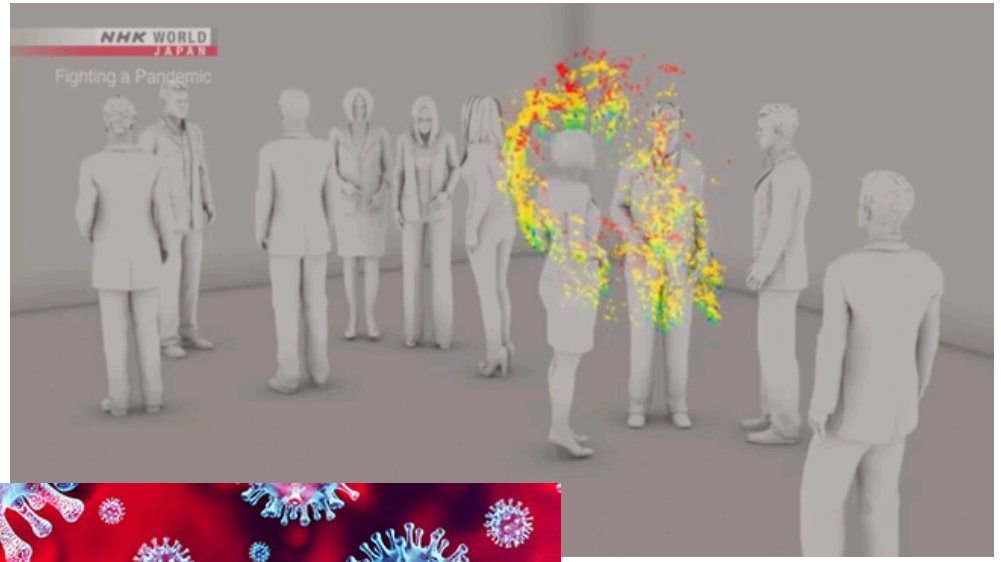
- Participants will learn how to apply protective measures to new and existing HVAC systems such as filtration, bi-polar ionization, UVC light, pressurization and air flow, humidification, sanitization, and air purification.
- Participants will learn about recommended plumbing solutions to protect against respiratory, touch, and fecal-oral transmission with special attention on restrooms.
- Participants will learn about the technological measures such as thermographic screening, remote collaboration, and Wi-Fi capabilities to keep the workplace a safe environment to be in.
- Participants will learn about controlled access solutions for people entering the workplace, such as de-densification, employee PPE, and the importance of disinfecting all surfaces.

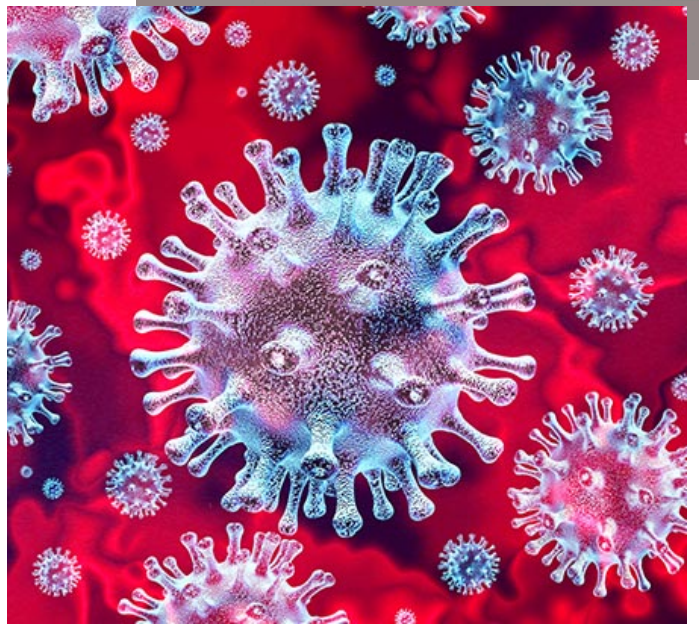
Overview

- The Virus
- HVAC Solutions
- Plumbing Solutions
- Electrical Solutions
- Technology Solutions
- Facility 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





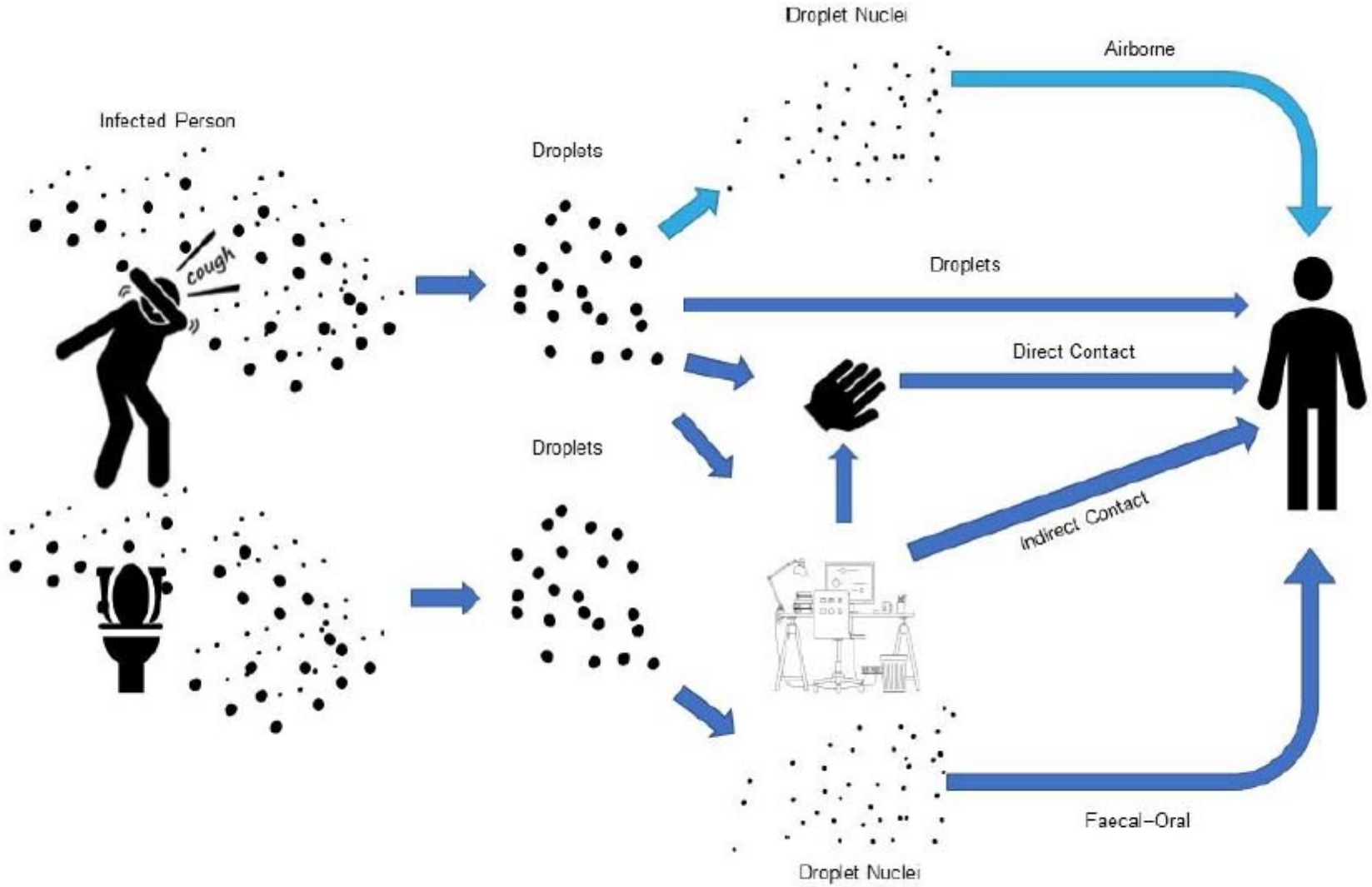


Figure 1. WHO reported exposure mechanisms of COVID-19 SARS-CoV-2 droplets (dark blue colour). Light blue colour: airborne mechanism that is known from SARS-CoV-1 and other flu, currently there is no reported evidence specifically for SARS-CoV-2 (figure: courtesy Francesco Franchimon).

HVAC Solutions

Effective Measures

- Install filtration, bi-polar ionization and UV light within HVAC systems
- 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
- Use portable air purifiers to clean and increase ACPH
- Portable UVC light for disinfection

HVAC Solutions

Filtration

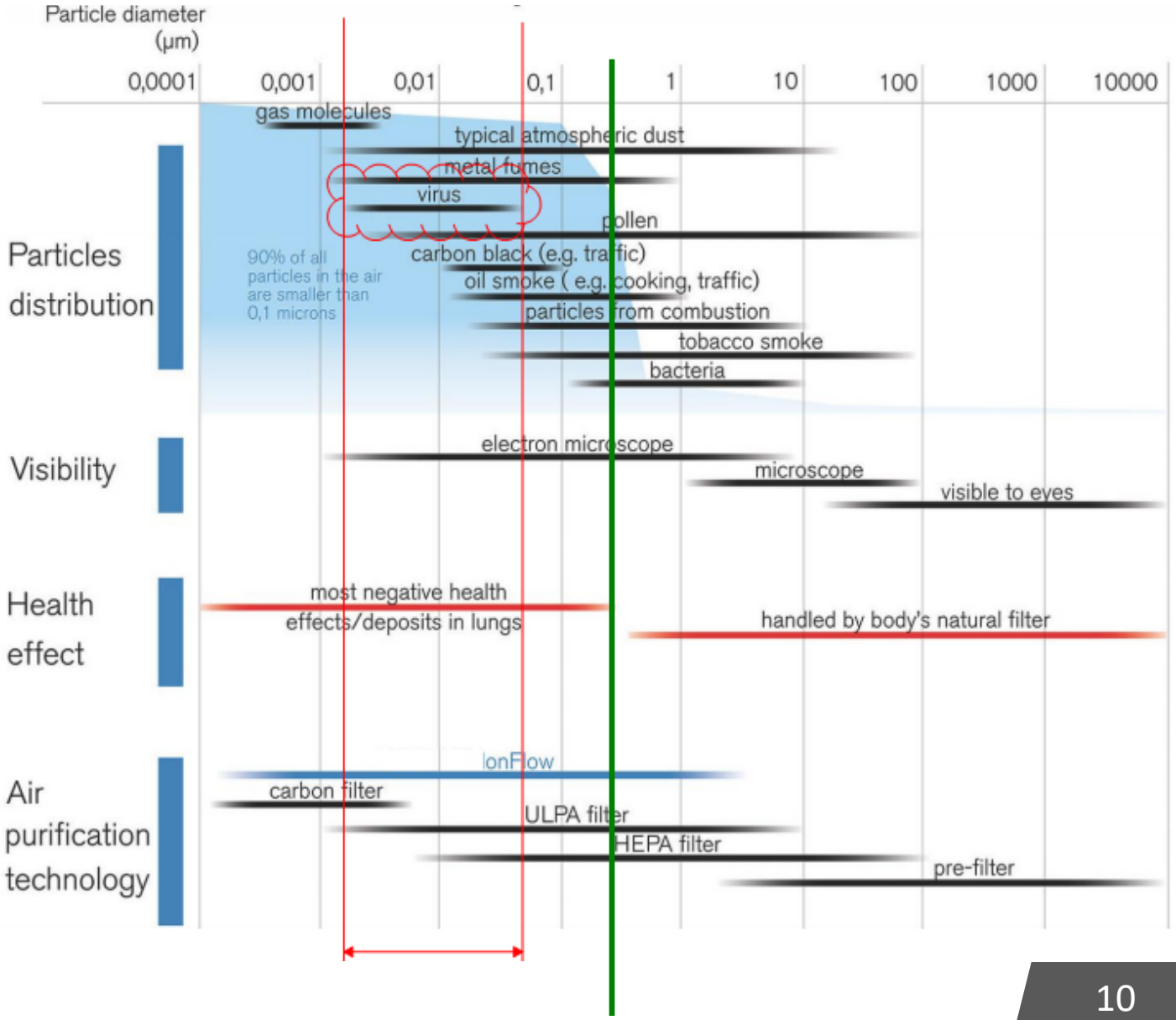
- Viruses are very small and can pass through filters - *if independently suspended in air*
- The coronavirus often attaches to airborne particulate (dust & vapor droplets) which can be captured by high efficiency filters
- HEPA filters rated at 0.3 micron particulate
  - Will capture smaller particulate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

Advantage

- High Percentage of virus captured

Disadvantages

- A percentage still passes through
- Increased pressure drop



HVAC Solutions

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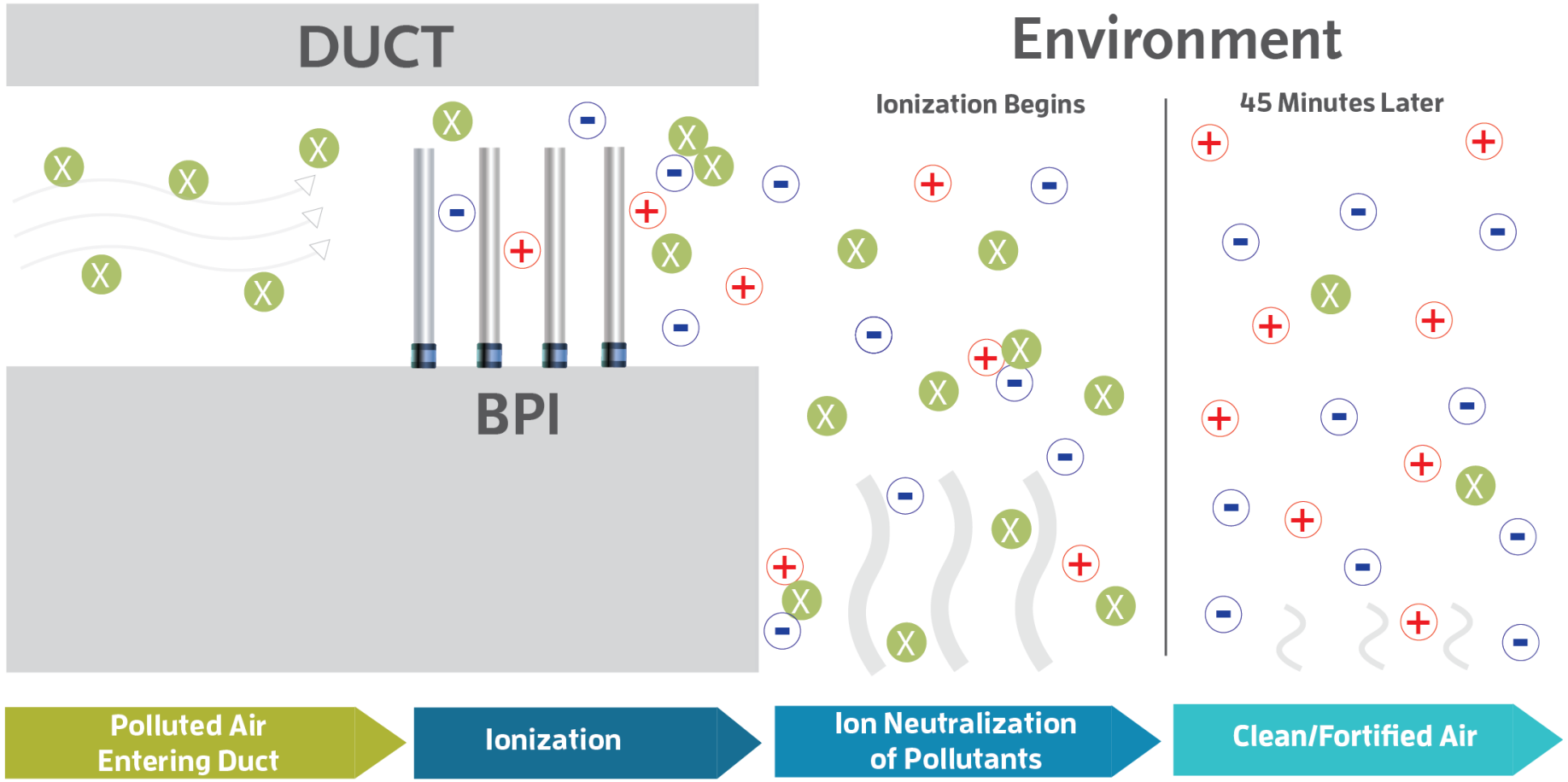
Bi-Polar Ionization



HVAC Solutions

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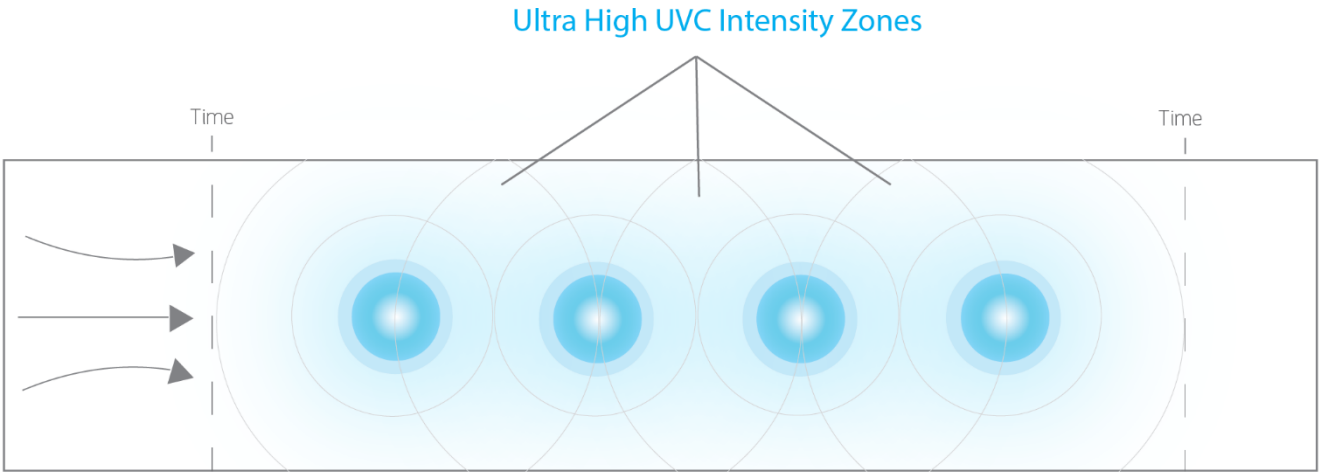
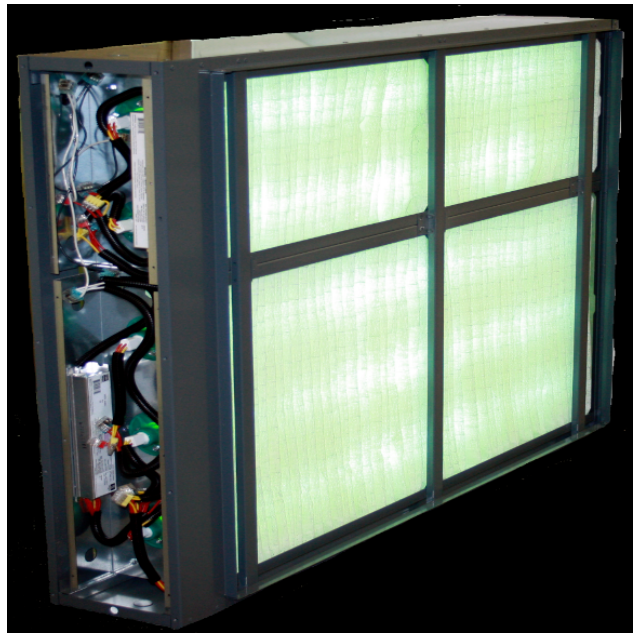
UVC Light



Photocatalytic Oxidation

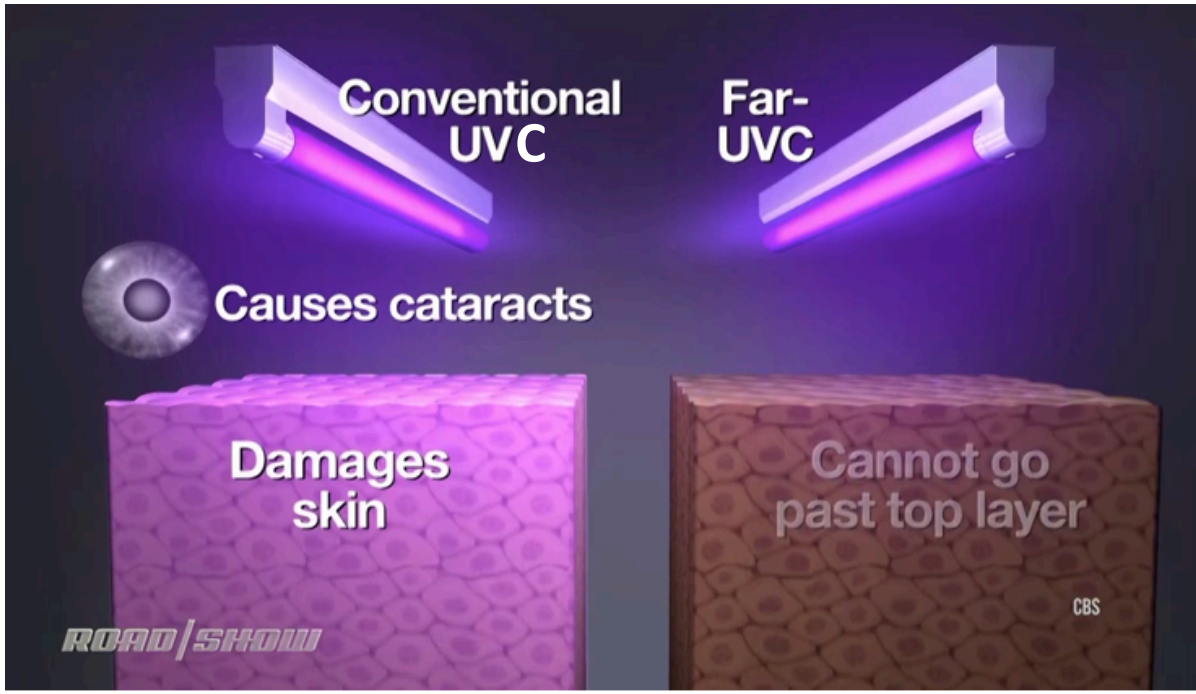


Note: Due to exposure time required, UVC lights are most practical at the coils, filters, sound attenuators, etc.

HVAC Solutions

Far-UVC Light (207-222 nm)

- UVC light sources can be carcinogenic and cataractogenic
- Far-UVC inactivates bacteria and viruses without harm to human skin when proper filters are applied to prohibit standard UVC light release
- Inactivates viral, bacterial, and fungal cells in minutes with correct intensity
- Far-UVC lamps do not contain mercury



HVAC Solutions – Workplace

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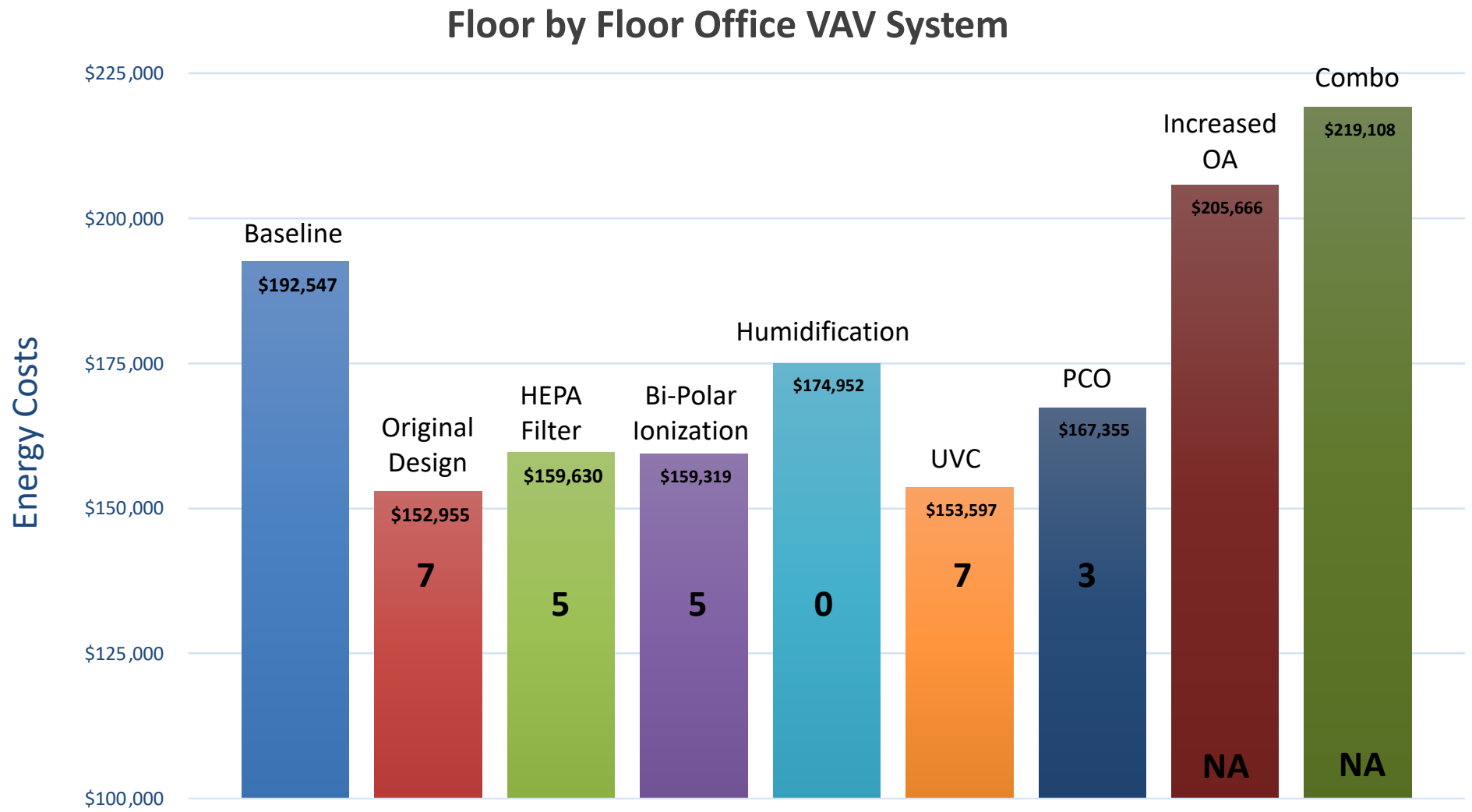
System Applications

Systems to Apply Solutions	Filtration	UVC Lights/ PCO	Bi Polar Ionization	Portable Purifiers	Humidification	Increase Outside Air
Cost Estimates	**$**	**$$**	**$$**	**$**	**$$$$**	**$**
Centralized VAV System	Yes	Yes	Yes	As needed	Yes	Yes
Systems that recirculate air locally	Yes	Yes	Yes	As needed	Maybe	Maybe
Chilled Beams DOAS	Yes	Yes	Yes	As needed	Yes – on DOAS	Yes
PTAC and VTAC (ducted)	No	Yes	Yes - VTAC	Yes	Yes - VTAC	N/A
Induction Units DOAS	Yes	Yes	Yes	As needed	Yes – On DOAS	Maybe
Baseboard Heating	No	No	No	Yes	No	N/A

HVAC Solutions – Education Facilities

SPACE TYPE	SYSTEM(S)	UVC IN HVAC	UVC IN ROOM	ENHANCED FILTRATION	BI-POLAR IONIZATION	PRESSURIZATION & AIRFLOW	HUMIDIFICATION	COMMENTS
Classroom	AHU/RTU	Yes	Yes - Upper Room	In AHU	Yes	Neutral	Central	Can be Single Zone or Multi-Zone VAV
	Unit Ventilator	N/A	Yes - Upper Room	Portable	Portable	N/A	Local or Portable	
	VRF/HP/FCU	Yes	Yes - Upper Room	Portable	Yes	Neutral	Central, Local or Portable	
Theater	AHU/RTU	Yes	No	In AHU	Yes	Negative	Central	
Gym	AHU/RTU/H&V	Yes	No	In AHU	Yes	Negative	Central	
Kitchen	AHU/RTU/H&V	Yes	No	Unnecessary	Yes	Negative	Central	
Cafeteria	AHU/RTU/H&V	Yes	No	Yes	Yes	Positive to kitchen	Central	
Faculty/ Admin.	AHU/RTU	Yes	Yes - Upper Room	In AHU	Yes	Negative	Central	Can be Single Zone or Multi-Zone VAV
	VRF/HP/FCU	Yes	Yes - Upper Room	Portable	Yes	Negative	Central, Local or Portable	
	Unit Ventilator	N/A	Yes - Upper Room	Portable	Portable	N/A	Local or Portable	
Nurse	AHU/RTU	Yes	Yes - Upper Room	In AHU	Yes	Negative	Central, Local or Portable	Can be Single Zone or Multi-Zone VAV
	VRF/HP/FCU	Yes	Yes - Upper Room	Portable	Yes	Negative	Central or Portable	
Public, Private, Shared Restrooms/ Showers	Exhaust	N/A	Yes - Surfaces	N/A	N/A	Negative	N/A	

Energy Impacts



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
- Re-entry strategies and guidelines (CDC)

Note: Research findings indicate COVID-19 is not found in water supplies

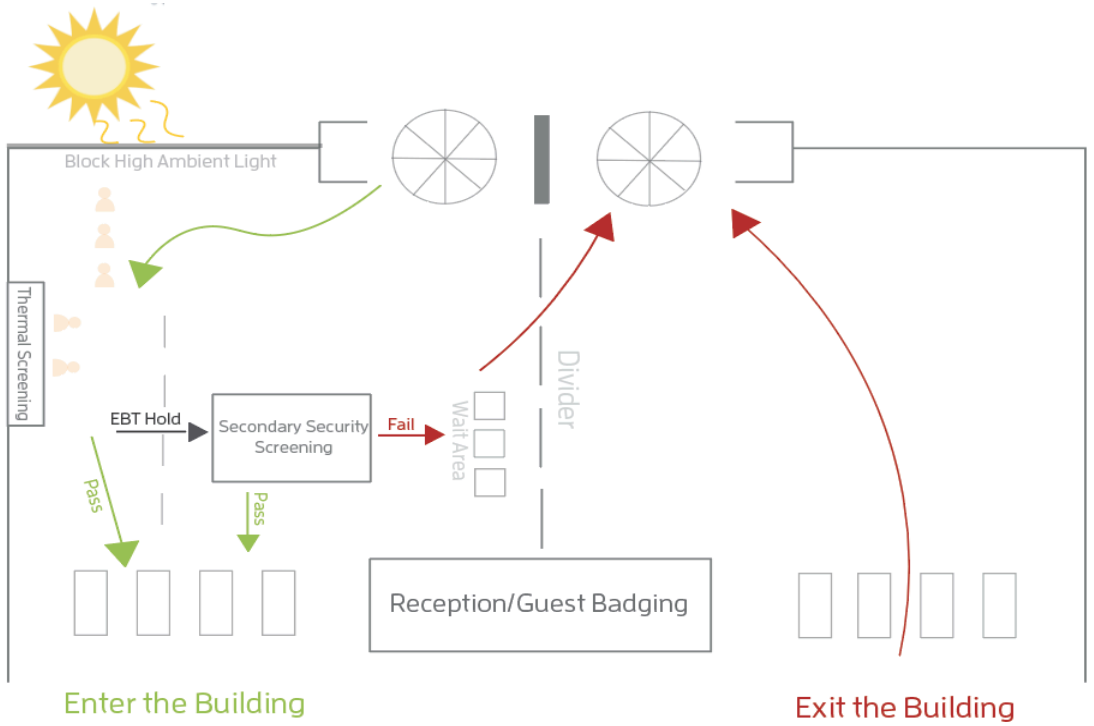
Entrance Solutions

Barrier/Controlled Access

- Multiple controlled access points for personnel and public entry
- Independent controlled access for materials
- Contained area and procedure for receiving of packages prior to entering the facility
- Pressurization
- Disinfectant Misting vs. Wipe Down
- Limit entry of service providers

Entrance Solutions

Staff and Guest Screening



- Body Temperature screening via non-contact systems
- Technology for speed, people for final determination
- Creation of a safety threshold and ability to reaffirm safety commitments.

Screening Rings

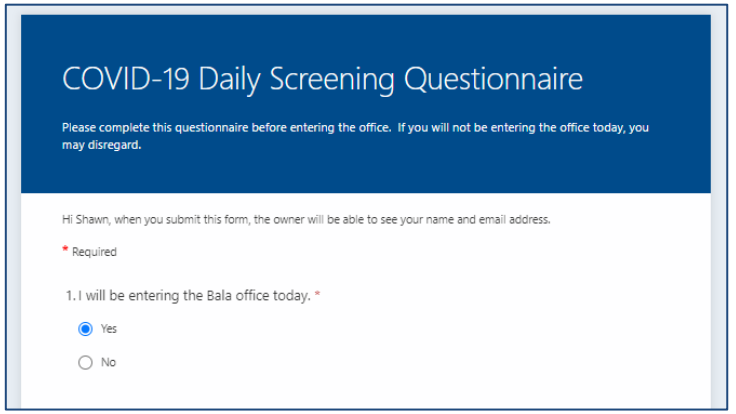
Near Term Technology Solutions

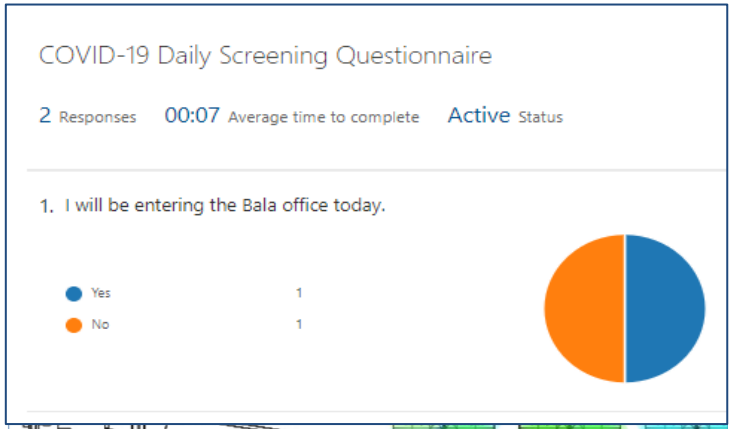
Planning while technology systems and supply chains catch-up

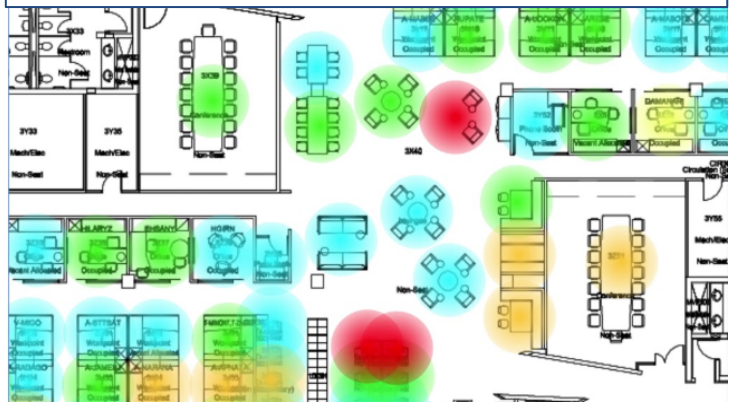
- Roll out changes and improvement in stages and evaluate impact
- Pair technology with policy to evaluate total impact
- KISS – keep it simple…..

Address Immediate Mitigation Opportunities

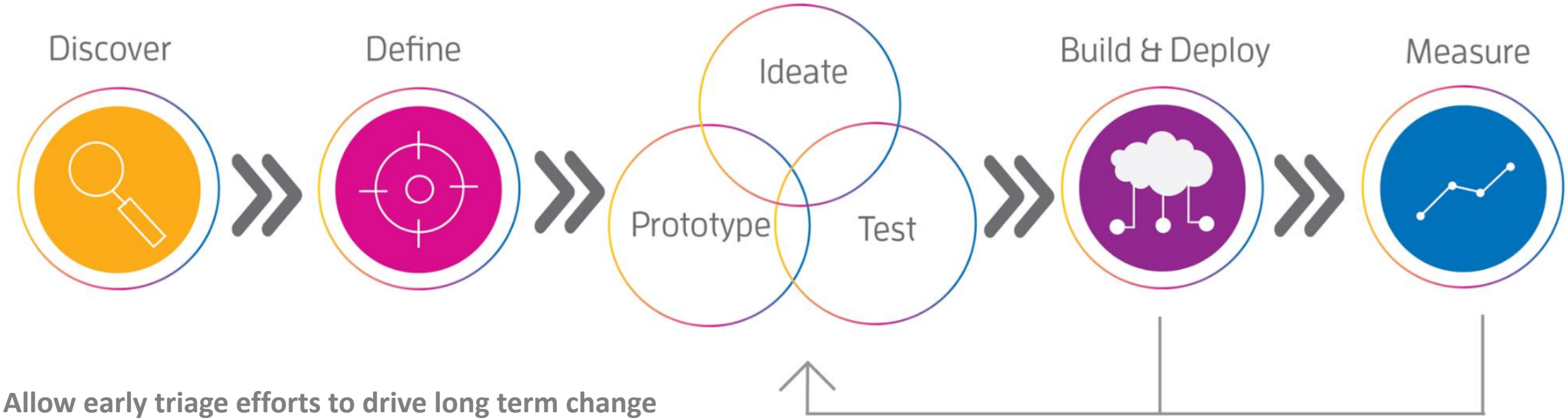
- Implement a digital check-in and contact tracing program
- Reduce technology touch interfaces or shared technology use
- Address hybrid meeting experiences and remote working conditions
- Consolidate communications platforms – shift to the platforms most used during the WFH period







Next Step User Experience



Allow early triage efforts to drive long term change

- Evaluate your digital workplace readiness (employee apps, digital culture, communications plans)
- Shift away from location-based platforms
- Merge security and employee experience – address mobile credentialing, contact-less access controls and space monitoring in relation to impact to user experience
- Untether your staff - explore automation opportunities to focus on core business tasks

Environment Solutions

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

Cleaning

- Sanitize all surfaces
- Frequent cleaning of communal spaces
- Disinfect restrooms
- Utilize UV systems to clean overnight
- Sanitizing mister at entrances

Solutions

Short Term Measures

Strategy	Objective
De-Densification - Shift Work - Working From Home	Reduce people in workplace
Control Access to Space	Restrict staff, visitors and materials
Walk Off Mats	Barrier control
PPE	Staff and Maintenance Workers
Frequent Cleaning	Clean spaces and materials entering
Increase Ventilation *(with existing HVAC)*	Introduce more fresh air
Add Flush Cycles	Staggered periods of increased outside air to accommodate increased cleaning
Alter Space Pressurization *(with existing HVAC)*	Increase Negative - Restrooms Negative - Communal spaces
Deploy Portable Purifiers	Locate throughout spaces
Hands Free Fixtures	Restrooms and Communal spaces
Technology	Support Hybrid Environments

Long Term Measures

Strategy	Objective
UVC Lamps in HVAC Systems	Sanitize the equipment
UVC Lamps in Unoccupied Space	Sanitize surfaces
Humidification	Achieve 40-60% humidity
Bi-Polar Ionization	Deactivate virus particles in the space
Increased Ventilation	Provide additional fresh air
Increased Filtration	Remove particles from the air
Alter Space Pressurization	Minimize risk of outside contamination
Controls Upgrade	Automate sequence of operation to reduce maintenance demands
UVC Lamps in Restrooms	Sanitize stalls and fixtures

COVID-19 Sustainability Impacts

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	Social	Technological	Environmental	Economic	Political
Positives	• Cleaner indoor air quality • Better remote connection • Education on safety measures • Changes in social structure caused by social distancing	• Cleaner air in buildings with newer technology using UVC, far-UVC, and higher efficiency filters • More frequent air filter changes • Automation innovation	• Increased climate issue awareness • Reduced emissions and pollution • WFH successful • Higher value on nature	• Allow the economy to expand again • Technology business will grow • Continued materialism – but online • Emergency preparedness changes • Job creation	• Major disruption across the board. • Healthcare and emergency preparedness may change • Address equity among citizens
Negatives	• 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	• Maintaining air pressure • Treating a greater volume of air • Cleaning more frequently • Increasing filtration may not capture all of the virus	• HVAC filters reduce energy efficiency (more CO_2) • Increased chemical use for cleaning • Increased material solid waste (filters, PPE, etc.) • Increased online shopping, increased shipping • Supply chain management	• Reduced efficiency = higher operating costs • Capital cost for new systems • Increased maintenance & cleaning costs • High unemployment and job loss • Added expenses to buy PPE	• Major disruption across the board • Impacts on civil liberties • Enforcement of new standards • Prioritizing buildings

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COVID-19 Impacts to the Facilities

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Conclusions

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

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This concludes The American Institute of Architects
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