HEAPY

PLANNING FOR THE "NEW NORMAL"

MAY 2020
JULY 2020 UPDATE

REAL **COLLABORATION**
REAL **PERFORMANCE**
REAL **INSPIRATION**

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JULY 2020 UPDATE

22 **SUMMARY**

This document is a dedicated **"THANK YOU!"** to all the medical workers,

healthcare facility personnel, and support staff on the frontlines

who work tirelessly, **SERVING THEIR COMMUNITIES**

and risking their own health and wellbeing to do so.

PLANNING FOR THE NEW NORMAL

Considerations

In Planning for the NEW NORMAL, we must provide ways to make the built environment safe and healthy.

PLANNING CONSIDERATIONS SHOULD INCLUDE:

For the Built Environment

- Physical Access Protocols
- Interior Personnel Movement and Spacing
- At Risk Colleague Considerations
- PPE and General Area Disinfection Plan

For Building Infrastructure

- Documentation of infrastructure
- Pro-active System Analysis and Retro-fits
- Mechanical/Electrical Resiliency Fitness Testing
- Telecommunications Tenacity

For Hospitals / Healthcare

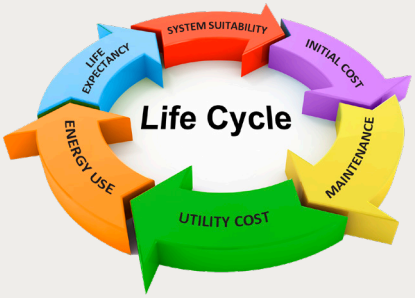
- Travel paths for infected patients from site entry to treatment space
- Pandemic units
- Remote communication with an infected patient
- Telehealth
- Addressing specialty and/or high-risk areas (Operating Rooms, Maternity, Cancer Care, etc.)

For Higher Education, Corporate, Cultural, Civic Spaces (traditional people-centric spaces)

- General building layout / traffic flow design
- Awareness of social distancing, ventilation, access, etc.
- Leverage system capabilities and technologies.
- Addressing “common” areas
- Specific application for Dorms, Classrooms, Rec Centers, Conference areas, etc.

For Community / Campus Resource Collaboration

- Overall cohesive plan to effectively utilize all available resources.
- Minimize redundancies in capital assets and prioritize the strategic future.



Our **PLANNING TEAM** is available to help guide your Organization’s critical next steps in addressing **RESILIENCY**, **SUSTAINABILITY**, and our **“NEW NORMAL”.**

PLANNING FOR THE NEW NORMAL
COVID-19

This white paper explains proven and practical options available to Building Owners and Operators to be used to reduce the transmission of airborne disease within their buildings. **However, the larger matter to contend with is "What's Next?"**

What **Strategic Operations Planning** is necessary to ensure your Organization and its facilities, equipment, and people are prepared for the "What's Next?"

1

What is thought to be the **primary means of "COVID-19 transmission** is… mainly through close contact from person-to-person in respiratory droplets from someone who is infected."[2]

- Close contact is considered when two or more individuals are within about 6 feet of each other, with a common means of transmission from when an infected person coughs, sneezes, or talks with and generates respiratory droplets.
- The primary measure of protecting against this means of transmission is **maintaining a social** distance from other individuals of about 6 ft as well as infected **people wearing masks** to contain respiratory droplets when they cough, sneeze, or talk.

2

A **second means of transmission** is **airborne** from aerosolized particles, which can be spread beyond the 6 feet ***and stay suspended in air currents long enough to travel for considerable distances***. It is important to distinguish this means of transmission from what is stated above:

- Many particles from a cough or sneeze are respiratory droplets, which largely consist of water and because of their size and gravity, fall to the ground or surface quickly[3].
- There are other smaller particles (aerosolized particles, or droplet nuclei), generated from a cough or sneeze that **because of their small size can stay suspended in the air, sometimes for days at a time**[4].
- Droplet nuclei containing viruses and bacteria are of concern because they are small enough in diameter and have been shown to reach the alveolar region of the lungs[5] bypassing some of the body's natural defenses.
- An additional path, (beyond coughing or sneezing), for generation of respiratory droplets and aerosolized particles is **when toilets are flushed**[6,7].
- The CDC has acknowledged the concern of aerosolized transmission of the disease by the use of airborne precautions by medical personnel and the use of airborne infection isolation rooms (AIIR) during certain aerosol generating procedures such as intubation.[8] There are studies done by multiple research teams supporting airborne spread at a restaurant in China. [25,26]

3

A **third means of transmission** is from contact with contaminated surfaces or objects. This path of transmission could be from respiratory droplets quickly settling on a surface or from an infected person touching their mouth or nose with their hands then transferring some viral cells to a surface that someone later touches.

- The primary means of preventing catching COVID from this means of transmission is **washing your hands** with soap and water or with the use of alcohol-based hand sanitizer[2].

Building Systems Summary of

METHODS TO DEAL WITH AIRBORNE PARTICLES

HVAC systems provide conditions for human comfort in buildings through cooling, heating, dehumidification, humidification, and cleaning of air. Contaminants are constantly introduced into building air in various forms such as viruses, bacteria, dust, pollen and off-gassing of chemicals from the people, building furnishings, and outdoor ("fresh") air required to maintain indoor air quality.

For most non-healthcare buildings, acceptable levels of indoor air quality are determined by complying with ANSI/ASHRAE Standard 62.1. This Standard sets minimum standards for "cleaning" the air by providing a minimum quantity of outdoor air and sets minimum levels of filtration[10].

HVAC systems "clean" indoor air by two different methods, dilution and filtration. Additional means are with the use of ultraviolet light and air particle ionization.

DILUTION

The greater amount of outdoor air that can be provided the cleaner the air will be in the building[a].

FILTRATION

Removes particles from the air by the air passing through a porous material (filter), which removes particles from the airflow. There are filter efficiency levels in terms of effectiveness at removing particles of different sizes.

ULTRAVIOLET LIGHT & AIR PARTICLE IONIZATION

These devices function by "inactivating" viruses or killing bacteria and mold spores with the use of ultraviolet light or ionizing air particles.

GOOSENECK FAUCETS

Remove aerators on faucets. Replacing aerated faucets with a gooseneck type that has a plain end and a laminar flow controller in the base of the spout minimizes splashing.

AUTOMATIC / TOUCHLESS

Install or modify all plumbing fixtures to be automatic / touchless to minimize the possibility of surface contaminant transmission.

RESTROOM EXHAUST

Increase Restroom exhaust levels to improve removal of aerosol type contaminates.

Due to the "particle" size of viruses, **commercial buildings meeting the filtration requirements of Standard 62.1** have very little ability to remove viruses from the air. Healthcare facilities, however, are designed to meet generally more stringent air filtration levels as well as require higher amounts of outdoor air for **greater dilution to provide for a cleaner environment**.

STEPS TO INCREASE

BUILDING SYSTEMS EFFECTIVENESS

HEAPY

Steps to Increase

BUILDING SYSTEMS EFFECTIVENESS

HVAC SYSTEM CONSIDERATIONS

The following are a few simple steps to take in preparing your Building Systems to reduce Airborne transmission of disease and other indoor pollutants:

1 Perform System Assessment / Retro-Commissioning

For most buildings, after initial building opening / equipment startup, the systems are rarely checked whether they are operating within their original design parameters. While routine maintenance is performed (replace filters, check fan belts., etc.), over time equipment operation (especially building controls) begins to significantly vary from the original design requirements.

According to research from Texas A&M University and the Lawrence Berkeley National Laboratory, critical ventilation and temperature controls systems can vary from original design parameters as much as 10-30 percent over a one to two-year period.

- A Building Assessment, (also referred to as Retro-Commissioning) is the first step to employ prior to prepping your building to address COVID transmission. This involves performing a Systems Assessment (HVAC, Plumbing, Electrical, Technology, other) to determine a baseline of current system performance and potential opportunities for improvement.

Once the Commissioning Assessment is completed, your Engineer will present a Report of strategies that would be most effective to lower the risk of airborne disease transmission.

IN SUMMARY... VENTILATION STRATEGIES

- Increase outdoor air ventilation (use caution in highly polluted areas)
  - With lower occupancy in buildings, the dilution ventilation per person is increased.
- Disable demand-controlled ventilation (DCV).
  - This prevents stagnant air to accumulate in buildings due to low occupancy
- Open minimum outdoor air dampers to as high as 100%
  - This eliminates recirculation
  - During Spring and Fall this may not negatively affect the Utility bill much
  - During Winter and Summer months overall impact can be costly / high and perhaps not functionally operable(capacity of coils, filters, etc.)
- Extend run times for HVAC systems - This will increase the effectiveness of all the above.
- Decentralized Systems (need to focus on inactivation and / or alternate filter technologies)
- Increase Restroom exhaust levels to improve removal of aerosol type contaminates

Steps to Increase

BUILDING SYSTEMS EFFECTIVENESS CONT.

2 Increase Ventilation \ Dilution

Increasing the quantity of outdoor air introduced to a building via the HVAC Systems will provide more dilution and removal of viruses, etc. from the building compared to baseline system performance.

- Most HVAC systems are designed to deliver code minimum amounts of outdoor air. An analysis of equipment capabilities or modification of different building operating temperatures, (such as increasing room temperature from 72 F to 75 F), would allow for increasing outdoor air quantities.
- One drawback to many of these strategies will be increased utility/energy cost due to additional heating or cooling loads from treating additional quantities of unconditioned outside air.

Your Engineer can provide guidance in determining the capability / limits of your installed building equipment that would allow for any potential to increase the amount of outdoor air supplied. Some specific examples to consider:

- Building systems typically are shut down overnight (unoccupied mode) to conserve energy. **Extending building HVAC system operation several hours after the building is unoccupied, the system can remove nearly 99% of all airborne contaminants.**

*Refer to **Table 1**[11] for time required to remove airborne contaminants from the space.*

- Airside economizers are system and control strategies employed to reduce building cooling energy requirements.

TABLE 1

Air Changes/hour (ACH) and time required for airborne-containment removal by efficiency		
ACH*	Time (mins.) required for removal 99% efficiency	Time (mins.) required for removal 99.9% efficiency
2	138	207
4	69	104
6	46	69
8	35	52
10	28	41
12	23	35
15	18	28

*Values apply to an empty room with no aerosol-generating source. With a person present and generatating aerosol, this table would not apply. Other equations are available that include a constant generating source. However, certain diseases (e.g. infectious tuberculosis are not likely to be aerosolized at a constant rate. The times given assume perfect mixing of the air within the space (i.e. mixing factor = 1). However, perfect mixing usually does not occur. Removal times will be longer in rooms or areas with imperfect mixing or air stagnation. Caution should be exercised in using this table in such situations. For booths or other local ventilation enclosures, manufacturers' instructions should be considered.

Since HVAC systems are designed to deal with annual extremes in weather, it may be possible to increase outdoor air quantities by extending the operational temperature range of the economizer controls sequence.

- Should your building system use a Demand Control Ventilation control strategy, this too may be disabled / turned off to ensure at least the minimum designed quantity of outdoor air is always delivered throughout the building to provide better dilution ventilation.
- Energy Recovery Systems may need to be addressed as some of these technologies use rotating equipment that oscillates between the contaminated airstream and the outdoor air stream – thus a potential route of transferring viruses and bacteria back into the building.

Steps to Increase

BUILDING SYSTEMS EFFECTIVENESS CONT.

3 Improve Filtration

Providing higher efficiency filters can increase the removal effectiveness of airborne contaminants via building air systems. Filter efficiencies are rated on a MERV scale, (Minimum Efficiency Rating Value - rated from 1 to 16 with MERV 16 the most efficient at removing smaller particles).

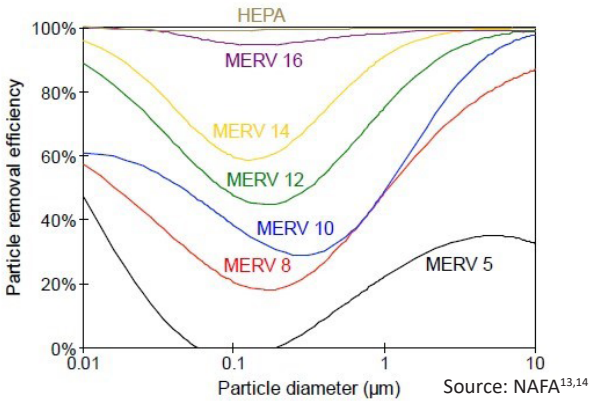
- MERV 8 is the current minimum requirement in ASHRAE Standard 62.1 (Ventilation for Acceptable Indoor Air Quality)[10,12]. Research shows most aerosols created from coughing and breathing range in size from 0.3-2 µm[15].

  MERV 8 filters are intended to pick up larger particles such as dust and mold, but could be less than 5% efficient at removing aerosol viruses due to the small size of the particle; refer to Figure 1[13,14] , and Figure 2[15]. (NOTE: Using MERV-A filters is recommended as they tend to have higher mechanical filter efficiencies, thus likely to increase small particle capture).

- Increasing the filter MERV rating typically increases system static pressure. Therefore, an assessment of the existing fan system as well as the existing filter installation would be required to determine the maximum MERV rating the system can handle. Ideally a MERV-A 14 filter or better can be provided.

- Another critical element to address is the filter frame seal. When the installation permits air to bypass around the filter, the higher level of filtration is rendered useless. Options are available for more robust filter assemblies and should be evaluated by your Engineer for their applicability.

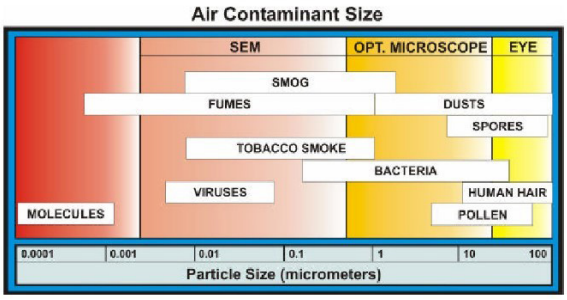
FIGURE 1



Source: NAFA[13,14]

- When existing equipment is unable to provide the desired filtration efficiency, an alternative is to use in-room filter units, which can accomplish a similar level of air "cleanliness". These in-room units could use HEPA filters, which are not on the MERV efficiency scale, but are rated to be more than 99.9% efficient at removing smaller airborne particles associated with viruses, or a MERV 16 filter which are rated to be 95% or more efficient.

FIGURE 2



Source: CDC/NIOSH[15]

IN SUMMARY... FILTRATION STRATEGIES

- Modify Air Handler filter racks to accept higher capacity / effective filters (HEPA, etc.)
  - Improve edge seals on filter racks to reduce bypass air
- Use portable HEPA filter room air cleaners.

Steps to Increase

BUILDING SYSTEMS EFFECTIVENESS CONT.

4 Employ Virus Inactivation Technologies

Viruses have a natural decay rate that causes them to inactivate overtime and become noninfectious in most instances. Several technologies have shown to accelerate the decay rate of viruses. Ultraviolet (UV) lamps and lamp systems have been utilized to disinfect surfaces, room air, and air streams since the early 1900's.

- **Ultraviolet (UV) Lamp Systems** Most UV lamp systems utilize UV-C energy to disrupt the DNA of a wide range of microorganisms such as viruses and bacteria, and if installed with enough intensity can inactivate a virus in several minutes.
    - UV lamp output degrades over time making them less effective, requiring replacement every 1-2 years, depending on the type of lamp installed. It is recommended installation/replacement be done in the late summer/early fall so the UV system is at its strongest when viruses seem most prevalent. The following paragraphs describe a number of UV system types:

IN SUMMARY... INACTIVATION STRATEGIES

- Use UVGI (ultraviolet germicidal irradiation)
    - Targeting critical people areas (waiting rooms, etc.)
    - Install in Ductwork and in Spaces

- **Ultraviolet germicidal irradiation (UVGI)** UV systems are installed in ductwork or air handling units. If designed to irradiate a heating or cooling coil, it will also help keep the coil clean from algae/mold, maintaining coil performance over time. To inactivate a virus in the air as the airstream quickly passes through an air handling unit, the UVGI System must have a high enough output intensity to impact the virus within a second or fraction of a second.

  While UVGI systems could be designed to inactivate 100% of all viruses on a single pass, this is nearly cost prohibitive due to the number of UV lamps needed to deliver the UV intensity required. Therefore, systems are typically selected at a lower UV intensity, inactivating only a percentage of viruses in the airstream with each pass. The percentage of inactivation is dependent on the virus strain, with influenza being relatively more difficult to inactivate than smallpox or TB[16].

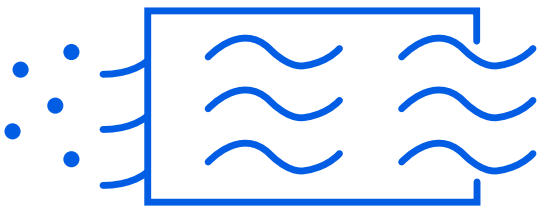
  Additional passes of the building air through the air handling unit further reduce active virus particles. System efficiency for virus removal is calculated accounting for outdoor air percentage, filter efficiency and UV system efficiency. (Please note this UV system type does not provide any surface disinfection in the occupied spaces).

- **Room UV Systems** UV lamp fixtures installed near the ceiling to create a UV field in the upper portion of a room to inactivate viruses or bacteria that enter the UV field. These UV-C lights are harmful to people because the wavelength used is selected to be most effective against viruses and bacteria but can also damage human skin and eyes. Therefore, UV generation levels must be kept below a certain amount to not risk exposing people to excessive amounts of UV light.

Steps to Increase

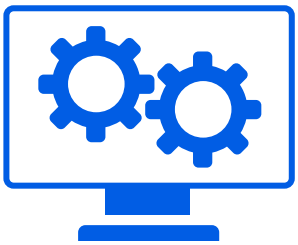
BUILDING SYSTEMS EFFECTIVENESS CONT.

- **Bipolar Ionization (BPI).** BPI devices are installed in the air handling unit and through the use of an electronic charge to generate a plasma field filled with concentrations of positive and negative ions. As ions are distributed throughout the HVAC system they attach to particles, viruses, bacteria, and gases through a process called agglomeration to create larger particles that will either settle more quickly onto surfaces or be easier to capture through filtration.



  - The BPI generated negative and positive ions also accelerate the inactivation of viruses by robbing them of hydrogen, in many instances within hours instead of their natural inactivation rate of several days.
    - Unlike UV systems which only kill viruses in the air, the BPI generated negative and positive ions sent to the occupied space can attach to viruses and bacteria that are surface contaminants, accelerating their inactivation period. Therefore, this technology will reduce both airborne and surface contaminants.
  - Historically, a concern with BPI has been the associated ozone generation, but the more recently developed BPI technology has greatly reduced the ozone production.

- **Photo-catalytic Oxidation (PCO).** PCO systems are combined with high levels of filtration (minimum MERV 13) and a UVGI system. The PCO process works with the energy source (UVGI system) to react with a Titanium Dioxide (TiO2) mesh installed just downstream of the UV array to create hydroxyl radicals (OH-). These oxidize airborne biologicals such as viruses and bacteria or combine with other airborne contaminants, such as volatile organic compounds (VOCs), and convert them to simpler chemicals, ideally carbon dioxide and water.[17]



REMOTE MONITORING

Increased remote monitoring / control capability of various systems to allow more detailed building status items to be viewed without going into the building / spaces.

Steps to Increase

BUILDING SYSTEMS EFFECTIVENESS CONT.

PLUMBING SYSTEM CONSIDERATIONS

Restrooms are a space deserving additional focus for ventilation due to the possibility of generating aerosol droplet nuclei of SARS-CoV-2 viruses when toilets are flushed.

Multiple research papers have determined the SARS-CoV-2 virus is detectable in stool samples for a percentage of recovered patients even after testing negative for the virus in respiratory swabs. In some instances, stool samples would continue to be positive for SARS-CoV-2 for as many as 18 days after the negative respiratory tract test[18, 19].

Therefore, a person "recovered" from COVID-19 could continue to generate SARS-CoV-2 aerosols via toilet flushing for weeks after testing negative via a respiratory tract test.

IN SUMMARY... PLUMBING STRATEGIES

- Develop Water Management Strategies
  - Flush stagnant water out of building systems when unoccupied for more than a week
- Modify Plumbing Fixtures.
  - Remove aerators on faucets
  - Replace aerated faucets with laminar flow gooseneck type to minimize splashing
- Install Toilet Lids
  - Provide training materials on importance of flushing only when lid is down
- Remove air blower type hand dryers

The following strategies will help reduce the potential of someone contracting COVID-19 in a restroom:

- Ensure the restroom always has greater amounts of exhaust than supply air to create negative pressure to the adjoining space to make it less likely for any aerosol particle to leave the restroom.
- Clean the restroom more often than normal to remove potential surface contaminants.
- Current restroom minimum exhaust levels are based on maintaining acceptable odors levels and not removing aerosol particles.
- Flush stagnant water out of building systems that have been unoccupied for more than a week. Stagnant water slowly loses the chlorine disinfectant level, therefore promoting growth of bacteria in the system. Periodic flushing of all fixtures replenishes the chlorine level supplied by municipality[20,21,22].
- Install toilet lids and provide training materials in each stall or private restroom on the importance of flushing only after the lid is down to minimize aerosolizing bacteria and viruses.
- Remove air blower type hand dryers to prevent aerosolized bacteria and viruses from being transferred to clean hands.

Steps to Increase

BUILDING SYSTEMS EFFECTIVENESS CONT.

ELECTRICAL SYSTEM CONSIDERATIONS

Whether your technology infrastructure is housed in the "cloud" or within your internal building data centers, serious analysis is needed to verify the robustness, redundancy and especially the cyber-security of your systems.

A thorough Assessment not only of network hardware, software, electrical and cooling systems, which as an Owner you may have direct control over, but also a more in-depth evaluation of the overall resiliency of your telecommunication service provider(s).

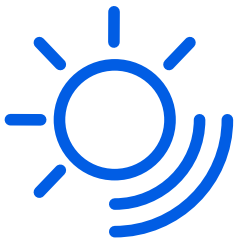
While it's difficult to track how prevalent the spread of disease is through indirect contact of hard surfaces, today's technologies can help reduce or eliminate the need to come in contact with these surfaces.

- Utilize phone apps to allow users to sign in and out of doctor and business offices or place orders at fast food restaurants and grocery stores without the need to come in contact with common-use touch-screen kiosks.

- Provide hands-free auto-doors throughout buildings to reduce the amount of contact with door handles / push plates.

OCCUPANCY SENSOR

Utilize occupancy sensors or phone app / voice control lighting in lieu of manual light switches. Where necessary, tap switches that can be easily wiped down and disinfected could be provided.



IN SUMMARY... ELECTRICAL STRATEGIES

- Use more cameras throughout spaces to perform tasks / equipment monitoring remotely.
- Provide more visual displays throughout buildings (flat panel displays) showing number of people in various spaces, visual status of air flow in a room, etc.
- Asset Management - Keep track of equipment and people via wireless sensors.
    - Possibly via phone apps, sensors, company access fob or ID card
- More hands-free control of entry access and interior spaces – voice, phone app, sensors, to minimize touching surfaces.
    - Switch vacancy sensors to occupancy sensors so no unnecessary touches
- Use more anti-bacterial wiring devices – switches and receptacles.
- Use thermal scanning devices at entrances and key building areas to alert of high personnel temps.
- Verify redundancies in power systems and telecommunication systems, (including suppliers)
- Focus on "modular design / construction" – to reduce costs and minimize on-site installation time of external workers inside buildings

Steps to Increase

BUILDING SYSTEMS EFFECTIVENESS CONT.

By reducing the growth of harmful bacteria, molds, mildew and fungi, antimicrobial cover plates and wiring devices can improve public health by greatly reducing the risk of infection. Lab tests show anti-microbial wiring devices can reduce bacteria that causes E. Coli, Salmonella, Staphylococcus, and Listeria by over 99%.[24]

Existing electrical infrastructure will need to be carefully reviewed. If additional chillers or electric heat are required to accommodate 100% outdoor air, is the electrical system sized appropriately to accommodate the additional electrical load?

Colleagues will want to **make use of sensors** to understand the number of people in a space prior to entering and other wireless technologies to monitor not only individual thermal health but also the **"building's health".**

- Encourage employees to go "paperless" where possible to reduce waste and use of common equipment.

Increased control of physical access into the building and visual confirmation of the building's status will be necessary to assuage occupants comfort levels. Displays of selected building and occupant data dashboards will assist in monitoring individual and corporate workflows during this transition to a new and sustainable normal.

TECHNOLOGY SYSTEM CONSIDERATIONS

Asset management and contact tracing is an important part of helping to control the spread of viruses and avoiding future outbreaks. Being able to identify where equipment has been and who has had it will help reduce the time needed to collect contact data.

- Add RFID or GPS tracking devices to equipment.
- Provide software to electronically sign equipment in and out.

The following concepts will assist in adapting electrical and technology systems in conjunction with other efforts to minimize transmission:

- Have a clear and simple process for employees to access workstations or machine remotely. All processes should have a "how to" set up document.
- Assess ability to continue or improve remote colleague work access, particularly for At Risk Colleagues.
- Provide an easily accessible digital "help center" for employees to contact when they are having software issues. This could include a telephone number to call or a website that does not rely on a local server.
- Analyze and plan for resilient connectivity, bandwidth and wireless resources.
- Upgrade and deploy high performance networks for remote work, communication and learning platforms.
- Develop infrastructure plans to eliminate single points of failure in power and mechanical systems.
- Aggregate sensors for big data capture and analytics as precursor to building artificial intelligence (AI) applications.
- Perform strategic master planning for smart integrated healthy building systems which will cost effectively intertwine with your new normal business model.

OPERATING DURING SHUTDOWNS

HEAPY

/MINIMAL FACILITY USE

REMOTE BUILDING SYSTEMS MONITORING TIPS

In the current climate with COVID-19, and at any other similar time when social distancing is necessary, the following occurs:

- An unprecedented number of colleagues work from home, leaving their places of work primarily empty
- Facility Managers, Maintenance personnel, and IT Professionals also work remotely

Therefore, below are proven strategies (best practice Tips) Facility Managers can use to lower their facility's energy use, provide ongoing monitoring management of their building systems while maintaining healthy and resilient facilities:

TIP #1

The following items should be considered before you go about setting the entire facility, or areas, to "unoccupied" mode.

- Are alarms on high/low room or zone temperature setup?
- Is there an unoccupied high humidity alarm?
- Do systems enable to maintain an unoccupied humidity set point?

TIP #2

Adjust schedules for equipment to match expected use (system level or terminal zone level) by utilizing a special event, rather than overriding the status or adjusting the Master schedules.

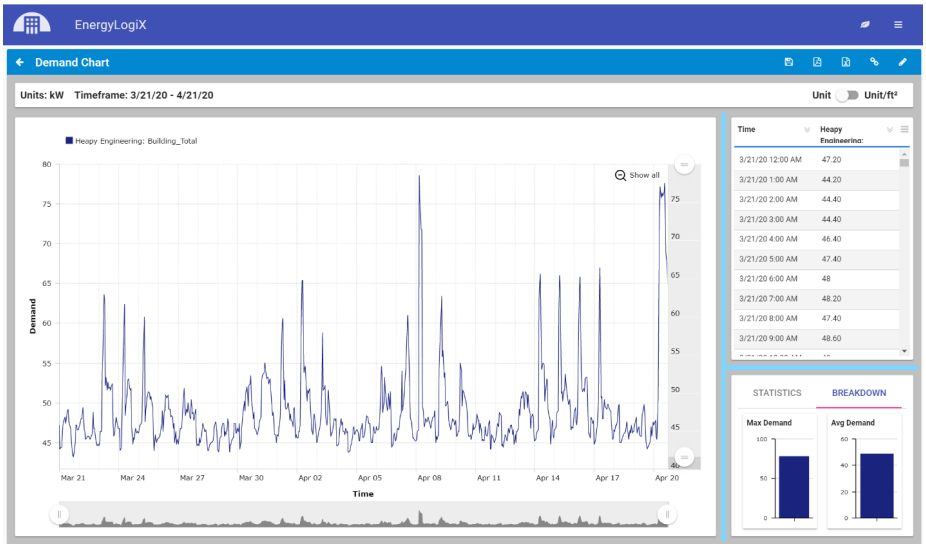
/MINIMAL FACILITY USE

REMOTE BUILDING SYSTEMS MONITORING TIPS

TIP #3
If you cannot fully shut off equipment, relax setpoints or enable a stand-by mode in non-critical locations with these parameters.

TIP #4
Be sure to monitor humidity at the room level or at the air handling unit return air sensor. Turning off equipment without regard for indoor humidity can create health concerns and/or lead to building damage (ie: mold growth, etc.).

TIP #5
Utilize an energy management information system (EMIS) or BMS trend data, monitoring building energy meters, to learn about the facility energy use.



TIP #6
Upon reopening your facility, here are a few additional items to consider.

- Release any occupancy overrides, or revise to original schedule, 1-2 days before occupants return to allow the proper ventilation and additional circulation within the facility.
- With energy cost avoidance typically returning the investment in less than 1 year, Retro-Commissioning is a two-fold benefit: reviewing existing system performance related to proper ventilation and airflow while maximizing system energy performance.

PLUMBING SYSTEMS

RE-OCCUPANCY & ONGOING OPERATIONS

JULY 2020 UPDATE

HEAPY

Building Re-Occupancy and Ongoing Operations

PLUMBING SYSTEM SAFETY

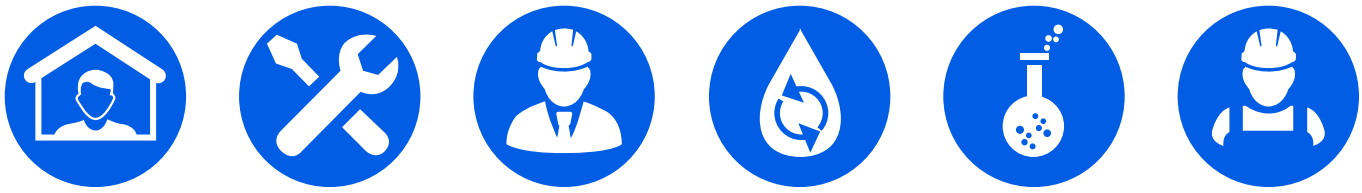
To maximize the health and safety of building occupants, successful re-occupancy and ongoing operations will require well thought out **TESTING**, **DISINFECTION** and **FLUSHING** of the Plumbing Systems and the creation of a comprehensive **WATER MANAGEMENT PLAN**.

- **Each building's plumbing and drainage systems have their own distinctive characteristics**. These include water flow rates and profiles, piping system arrangements, source equipment, use points, distribution and drainage system materials and treatment systems.

- There is a myriad of resources available for information regarding re-occupying facilities (that have undergone a period of low to no use), including from the following: USEPA, CDC, ASHRAE, ICC, IAPMO, State Code Authorities, Universities, and CTI.

  - ***However, this information is general in nature and simply cannot address the uniquely specific aspects of every building's plumbing systems.***

- A **COLLABORATIVE EFFORT** that includes the Building Owner, Maintenance Staff, Trusted Engineers, Water Treatment Specialists, Qualified Laboratories and Quality Contractors will be necessary to develop the Building Re-Occupancy Plan that will properly address water safety.



The KEY elements of a Building Plumbing Systems Re-Occupancy Plan should include:

TESTING

Flushing, and even shock temperature and chemical disinfection, is a good first step and may be adequate for small buildings with less complicated systems. However, it is recommended for large buildings with complicated plumbing distribution systems and buildings with susceptible populations to be tested to confirm control of Legionella and other biofilm-associated bacteria.

- Stagnant water, due to its loss of disinfectant residual and loss or gain of temperature, promotes the growth of Legionella and other biofilm-associated bacteria.

- As part of the **Building Re-Occupancy Plan**, a well thought out Testing Approach is necessary as the results of the testing dictate necessary next steps such as additional flushing, disinfection and re-testing.

- Testing can also confirm that pipe corrosion constituents, (lead and disinfectant byproducts), potentially brought on by flushing and shock disinfection procedures are still under control.

PLUMBING SYSTEM SAFETY

DISINFECTION

As a result of testing or based on system size and duration of building shut-down, shock chemical or thermal disinfection might be necessary to control fecal coliform, Legionella or other biofilm-associated bacteria that may reside in the plumbing system.

- Disinfecting requirements, set by building codes and AWWA guidelines, are well established for new building projects, renovation projects, and municipal distribution systems. However, these requirements do not directly address re-occupancy of low-use buildings.

- The Disinfection Approach must consider building occupant safety, size and configuration of the system, distribution piping and gasket materials, connected equipment, potential connection points, time available for the procedure, municipal supply disinfectants, and drainage piping material and equipment.

NOTE: SYSTEM (LEAK) INSPECTION: Flushing, equipment adjustments and disinfection of the piping system can dislodge pipe corrosion and scale. A system inspection should be conducted to identify and repair any leaks resulting from this process.

FLUSHING

Successfully flushing a building's water systems requires understanding the water distribution system from the municipal service connection to every end use point. The general approach is:

1. An **ESTIMATE** of the entire system's volume must be made (to figure out how much fresh treated water will be necessary).

2. An **INVENTORY** of fixture and equipment types (flowrates and usage patterns) as well as source and treatment equipment, will be necessary to develop a proper flushing sequence to progressively replace stagnant water with fresh treated water.

3. Water heaters and other tanks should be **DRAINED**, and **SEDIMENT REMOVED**.

4. An **UNDERSTANDING** of the drainage system design and its capacities will minimize potential overflows during the flushing process.

EQUIPMENT / SYSTEM RE-START

Identify idle or low use system equipment and develop and implement an equipment cleaning, adjustment, and startup plan. Commission the system to ensure proper equipment operation to reduce the potential for Legionella and other biofilm-associated bacteria growth, this will include addressing:

- Water softeners need to be checked for media contamination, and the media backwashed or replaced, as necessary.
- Water heater and mixing valve setpoints should be verified.
- Domestic hot water recirculation loops should be checked for proper flow rates and adjusted to maintain design temperatures throughout the system.
- Filter cartridges should be replaced or backwashed with fresh water to remove potential contamination and ensure proper operation.
- Backflow Preventers and Vacuum Breakers need to be inspected and tested for proper operation.
- Aerators, shower heads and hoses should be removed and disinfected, or replaced, to minimize the potential of aerosolizing bacteria.
- Other end-use equipment supplied from the domestic water systems should be cleaned and adjusted as recommended by the equipment manufacturer's instructions.

ONGOING OPERATIONS... DEVELOP A WATER MANAGEMENT PLAN

Based on building type, occupancy, and/or size, consideration should be given to the development of a building Water Management Plan (WMP).

- Some jurisdictions and certification agencies require WMPs for specific buildings and/or systems.
- WMPs are specific to the building for which they are developed and are intended to establish minimum risk for building occupants from Legionella and other water-borne bacteria found in domestic water systems, evaporative cooling towers, water-based humidifiers, pools, spas, decorative water fountains and similar equipment.
- WMPs are developed based on ANSI/ASHRAE Standard 188 Legionellosis: Risk Management Building Water Systems, or other agency specific guidelines.
- WMPs consist of a Program Team, Water System Flow Diagrams, an Analysis of the Building Water Systems, establishment of Control Measures, Monitoring and Corrective Actions, Confirmation of Program Implementation, and Documentation.
- A certified WMP consultant, working with the facility staff and a qualified engineer, can develop an appropriate WMP that matches the unique characteristics of the building type, building occupancy, distribution systems, and system equipment.

/IN SUMMARY

While there is an abundance of technology available, prudent overall **Planning is Critically Necessary** to not only meet strategic needs in a cost-effective manner but to also alleviate colleague concerns to return to a productive level. The old adage of "the only constant is change" is abundantly clear today, since **Everything Has Changed**.

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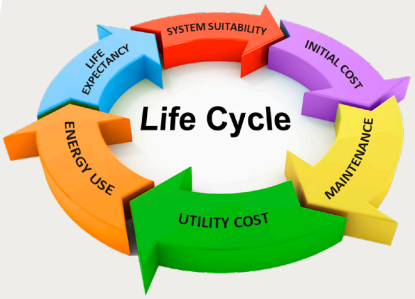
Please Note: Although there is considerable industry research behind the concepts presented in this document, some may, and some may not, be suitable for use in your specific buildings and the types of systems present. Please contact HEAPY (info@heapy.com) to help you develop the appropriate application of these concepts for your operations.



Our **PLANNING TEAM** is available to help guide your Organization's critical next steps in addressing **RESILIENCY**, **SUSTAINABILITY**, and our **"NEW NORMAL".**

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Planning for the New Normal
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