Q1: DOES ASHRAE HAVE ANY RECOMMENDATIONS FOR BUILDING OWNERS FOR HOW TO "MOTHBALL" THEIR BUILDINGS FOR AN UNDETERMINED AMOUNT OF TIME AND HOW TO OPERATE THE HVAC SYSTEMS DURING THE SHUTDOWN?

A: General recommendations:

1. Notify relevant people of the need to shut down or partially occupy the building. Include exact dates and times the building will be shut down.
2. Backups and Data Protection–Backup all necessary computer data, e.g. building control systems and servers to local and/or cloud-based backup services and media.
   a. If there are tenants that need to use the building during lockdown, they should refer to the Commercial Building Guide as the building may not be able to be shut down.

3. Check important remote or offsite access connections to the Building Management System and Building Automation System (BMS includes more than the HVAC controls in the BAS) to make sure they are functioning properly and can be logged into, if any. For example, remote observation via the security and access platforms, such as security cameras, locks, alarms and more can help monitor the building for emergencies remotely.
4. Operators should ensure that they have electronic copies of their building plans, past test and balance reports, operation and maintenance (O&M) manuals, systems manual and other pertinent information to operating the building.
5. If someone does visit the building to check, they could also be tasked with watering any of the plants.

Heating, Ventilating and Air-Conditioning:

1. In buildings equipped with a Building Automation Systems (BAS):
   a. It is not recommended to completely shut off HVAC systems in a building that is being temporarily shut down or unoccupied for an undetermined amount of time during an emergency.
   b. Operate or place the HVAC systems in the Unoccupied Mode using the BAS. For example, if the system is normally controlled to a 70°F heating with 40% RH and 75°F cooling setpoint at about 55% RH when the building is occupied, then having the limits in heating at set back to 65°F, 40% RH and cooling limits up to (80°F, 60% RH) is reasonable. If the limits are exceeded while in the Unoccupied Mode, the systems should be enabled and allowed to operate, with the OA dampers at minimum and exhaust fans off, until the space returns the Unoccupied Setpoint conditions. The intent is to maintain the building within a reasonable range of temperature and humidity conditions to help avoid developing poor indoor conditions while reducing energy consumption during the shutdown.

c. If occupants are going to be allowed to use the building on a partial or limited basis during a shutdown, it may be desirable to program an override into the BAS to allow the systems to be returned to normal Occupied modes of operations for temporary length of time, such as for two hours. After the override period expires, the system should automatically return to the Unoccupied setpoints.
d. Check if all the setbacks and setup modes are working.

2. A building without a BAS may require more set-up time to have the building be shuttered and may require more direct monitoring on site during the shutdown.
a. Recommend that the HVAC systems should not be completely shut down in any building where the building is being unoccupied for any length of time if the intent is to re-occupy the building in the future.
b. In addition, we do not recommend extreme setbacks for heating thermostat setpoints or extreme setup for cooling thermostat setpoints. The intent is to set the individual controls on the equipment to do the following–maintain a cooling space setpoint of 80°F and less than 60% RH in cooling and 65°F and minimum 40% RH in heating.
c. Any outside air dampers should be set to their minimum position. The exhaust fans other than those in restrooms should be turned off.
i. If the OA dampers are closed, all exhaust fans shall be turned off.
d. Monitor the building regularly to ensure that no unexpected consequences are occurring such as condensation, moisture or fungal growth on HVAC system components or building surfaces and finishes.

3. Boilers and distributed hot water:
a. If the building has more than one boiler, reduce the number of operating boilers to bare minimum needed. If the building is going to be offline for more than 60 days, dry storage is recommended via desiccants or inert gas blanketing. If using inert gas, follow OSHA safety protocols.
b. For boilers less than 300 hp, a heat source (light bulb) with a fan may be sufficient. Warm wet storage is acceptable; oxygen scavenger residuals in the boiler should be 500% of normal (i.e. if you normally run 20 to 40 ppm of sodium sulfite, maintain 100-200 ppm during mothball period.
c. Maintain 400-600 ppm P-alkalinity during wet storage.
d. Boilers should fire and circulate once per week for minimum of 1 hour.
e. Cold wet storage is discouraged! Equipment could suffer significant corrosion damage.
f. If the boilers are offline, drain all deaerators, feed water tanks, surge/condensate receivers, superheaters and economizers. If you can't drain them, make sure they are fully flooded and oxygen scavenger levels are at 500% of normal.
g. If steam lines are idle, make sure all steam traps and condensate receivers are empty. Be prepared to dump condensate for several days upon restart due to flash rusting developing on the interior surfaces of the lines.

4. Cooling towers, chillers and chilled water distribution piping:
a. Many facilities have a water risk management plan such as an ANSI/ASHRAE Standard 188-2018, to provide guidance and protocols to minimize the risk of water borne

pathogens, such as legionella pneumophila in their utility water systems. If you have a plan and it addresses shut down and restarts of this magnitude, follow it. If you do not have a plan:

  i. Keeping systems running keeps the equipment in the best shape. Set the BAS to unoccupied temperature and humidity setbacks and monitor and adjust to preserve IAQ and building elements.
  ii. With all mechanical systems, if you don't use it, nature takes it back. If you are taking chilled water systems down for an extended period of time, completely drain the cooling towers, chillers, heat exchangers and associated piping. Leaving the system with stagnant water can result in severe corrosion, biofouling and contribute to transmission of Legionnaires' disease. Be prepared for rust and biological incursions when bringing branch lines back into service. Do a complete system flush to restore design water parameters and clean strainers throughout. Consider adding side stream filtration at this time.
  iii. Try to maintain circulation in main chilled water loops, the larger the loop the greater the importance.
  iv. If operating at reduced capacities for extended duration, for HVAC hydronic loops, increase the frequency of testing and adjusting of biological control regimen by your water treatment provider.

Plumbing Systems:

1. Many facilities have a water risk management plan such as ANSI/ASHRAE Standard 188 to provide guidance and protocols to minimize the risk of waterborne pathogens such as legionella pneumophila in their utility water systems.
2. Regularly turn on the water and run the drinking fountains, lavatories, urinals, water closets and sinks. Do this once a week to avoid issues with stagnant water.
3. Make sure all plumbing P and U-traps are wet (filled with water) and check them routinely during the unoccupied times.
4. Water features should be shut down and properly drained. This should be part of the water risk management plan.
5. Distributed domestic hot water systems–if possible, keep distributed domestic hot water systems circulating, if possible.. Keep water above 140°F to avoid microbial incursion. Do not let it drop below 120°F. If circulation must stop, try to circulate once every two weeks for two hours at temperature. If the hot water recirculating system goes down for extended duration, do a high temperature flush and pull the strainers before going back online.

Electrical Systems:

1. Unplug or disconnect non-essential appliances wherever possible - unplug any and all appliances that don't need to stay powered on to avoid "Vampire or Phantom Appliances". These include but are not limited to:
   a. Computers

b. Routers
c. Modems
d. Televisions
e. Printers
f. Chargers
g. Microwaves
h. Vending machines (remove food that may spoil before disconnecting vending machines that store food and perishables)
i. Things that turn on with a remote control

2. It is important to work with your IT department because some computers and monitors will need to remain powered on to facilitate remote desktop functions for remote working employees.

Special Systems:

1. Check on fire alarms and other equipment with battery backup power supplies. Consider having an electrical technician come and check that everything is working properly.
2. Check on the battery backup power supplies for IT and IOT devices, especially the ones that are mission critical. These items include but are not limited to servers, BAS, communication systems, lighting control systems and security systems.
3. If the building is equipped with an emergency or backup generator, arrange to have it tested regularly as required by codes, local jurisdictions and the manufacturer's recommendations.