Responses to Questions Posed during TURI's 5/28/20 "Cleaning and Disinfection" Webinar

The following are questions posed during TURI's May 28 webinar entitled "Guidelines to Safely Clean and Disinfect," designed to aid businesses reopening in Massachusetts after the initial COVID-19 closure. Answers are provided by Dr. Jason Marshall, Director of the Toxics Use Reduction Institute's Cleaning Laboratory, and his colleague Alicia McCarthy, the TURI Cleaning Lab Specialist, who were the webinar presenters.

Questions about disinfectants

1) What are your thoughts on bleach as a disinfectant?

- Bleach (sodium hypochlorite, NaOCl) is a commonly used, inexpensive disinfecting product with a long shelf life. It is listed on the EPA List N of products with emerging viral pathogens AND human coronavirus claims for use against SARS-CoV-2.
- Bleach is a skin, eye and respiratory irritant, is corrosive (pH greater than 11) and can generate toxic fumes when accidentally mixed with acidic products (such as ammonia or vinegar).
- Chlorine gas (generated by bleach solutions in use) and sodium hypochlorite are designated by The Association of Occupational and Environmental Clinics (AOEC) as sensitizer-induced asthmagens.
- TURI does not recognize bleach as a safer active ingredient for these reasons.

2) Is hypochlorous acid safer than bleach?

- Like bleach, hypochlorous acid (HOCl) is present on the EPA List N as a recognized active agent effective in disinfecting the SARS-CoV-2 coronavirus.
- Both HOCl and bleach are oxidizers, corrosive and hazardous to the environment. Bleach has additional hazards due to the high pH and is more irritating and corrosive when used in similar concentration solutions.
- When comparing airborne chlorine gas exposures, TURI laboratory analyses showed that NaOCl (bleach) solutions resulted in higher average and peak chlorine exposures as well as more recordings at or above the limit of detection (0.1 ppm) than HOCl solutions with similar free available chlorine concentrations. The highest airborne chlorine gas exposure recording for any HOCl solution in the lab tests was 0.1 ppm, whereas for bleach it was 0.7 ppm. Therefore, while the hypochlorous acid solution still produces some airborne chlorine exposure, it is less than for similar-strength bleach solutions. These tests were performed using sodium dichloroisocyanurate (NaDCC) tablets to generate the HOCl solution. (Source: TURI's fact sheet on sodium dichloroisocyanurate.)

- Hypochlorous acid is available in stabilized liquid solutions. These solutions have not been evaluated for efficacy or the amount of chlorine gas generated during use.
- Hypochlorous acid can be generated by dissolving NaDCC tablets in water, and by electrolyzed water systems, which use salt and, in some instances, vinegar in water that is electrolyzed using small home units. Both NaDCC and electrolyzed water systems have been evaluated by the TURI Lab for cleaning efficacy but not for disinfection efficacy. No large liquid chemical manufacturing, packaging or distribution is required with either the NaDCC or electrolyzed water systems.
- Hypochlorous acid has a short shelf life and a slightly acidic pH between 4.5 and 6.0.
- The science tells us that hypochlorous acid is more effective at disinfecting than bleach, which means that you should be able to use a lower FAC (free available chlorine) concentration HOCl solution for the same result, although TURI has not yet tested this in the Lab. When using a solution at a pH between 4 and 6.5 (the range typically maintained for HOCl solutions), the only chlorine species in solution is HOCl. Hypochlorous acid has a relatively low molecular weight, which makes it better able than other chlorine-based active ingredients to penetrate the cell walls. It also oxidizes organic matter (e.g., microbial cells) more rapidly than other chlorine-based disinfectants. Unlike the hypochlorite ion which predominates solutions made from bleach, HOCl is not repelled from the surface of the organisms.
- In short, if you are looking for a chlorine-based disinfectant, HOCl is a better choice than bleach.

3) What about electrostatic sprayer systems or foggers?

- Electrostatic sprayer systems are an efficient method for applying a disinfectant to surfaces. The unit applies a small charge to the solution when sprayed. When the solution comes in contact with a surface, the charged solution is attracted to the oppositely charged surface and clings to the surface. This allows for hard-to-reach areas to be exposed to the solution, increasing the delivery efficiency.
- Foggers deliver the solution in a mist that settles onto a surface. Hard-to-reach areas may not be exposed to the solution. Extra solution may be needed to work effectively.
- Both may be used with a variety of disinfecting alternatives. Whenever possible use these types of equipment with safer disinfectants.
- For both systems, proper ventilation and PPE should be used. You must follow the manufacturer's directions.

4) Is there a concern about products that combine hydrogen peroxide and acetic acid?

- Hydrogen peroxide is one of the active ingredients TURI identified as safer. When combined with acetic acid, however, it produces a mixture identified by the AOEC as an asthmagen and respiratory sensitizer. Therefore, we do not consider this combination as safer.

5) How did the Lab determine which active ingredients are safer?

- The selection was based on the work from the Massachusetts Toxics Reduction Task Force (the "Task Force"), which is composed of staff from multiple Massachusetts government offices that provide health, environmental and labor support, including the Toxics Use Reduction Institute.
- The Task Force developed a list of products that can be used for disinfecting as part of its input into the development of the Commonwealth's Environmentally Preferable Products (EPP) list. To do this, the following endpoints were used to screen products:
  i) Known or suspected carcinogen
  ii) Known or suspected reproductive toxin
  iii) Respiratory irritant or asthmagen as determined by the AOEC.
  iv) Causes dermal or eye irritation (or is only associated with mild effects)
  v) Corrosive
  vi) Evidence of aquatic toxicity
  vii) Is expected to bioaccumulate
  viii) Evidence of persistence
  ix) Contains phosphorous or phosphoric acid (known to cause eutrophication in surface waters)
- After reviewing products in this way, products that have been shown to be effective were identified by the Task Force as "preferred." Further screening looked to eliminate products that were described as both cleaner and disinfectant (which goes against our strong recommendation that you clean *before* disinfecting).
- It should be noted that none of the active ingredients associated with "preferred" products contain carcinogens or reproductive toxicants.

6) How can you clean and disinfect leather furniture without damaging the leather?

- As is the case for many sensitive materials, the first step is checking with the manufacturer on the best practices for cleaning/disinfecting. Studies have shown that use of a good cleaner and microfiber towel may be enough to remove microbes (see this video). But if you wanted to disinfect, there are some hypochlorous acid systems that have been shown to not affect the integrity of leather. This has not been validated by the TURI Lab at this time.

7) How do you verify that your choice of disinfectant is effective?

- Unfortunately, there is no easy way to verify that a product is effective in the field. The process would require plate sampling of the surface you cleaned, and sending it to a lab to have the sample analyzed to see if microorganisms were present. The process can take a couple of days to get results. It's not practical when you need an answer right away.
- In reality, the requirements to ensure a product is effective are to document that the manufacturer's recommended operating conditions are being met. This would include the microorganism to kill, concentration, pH, contact time and surface being cleaned. The concept is

that when the product is used as directed, it has been found to be effective at killing specific organisms.

8) How long does the novel coronavirus remain infectious on porous surfaces?
   - Studies have been conducted on the length of time the SARS-CoV-2 virus can be detected on a number of surfaces; note that this is not an indication of the length of time that the virus may continue to be viable. This article provides a good summary of their findings, which we've included below.
     i) Cloth: 2 days
     ii) Cardboard: 1 day
     iii) Wood: 2 days
     iv) Latex: 4-7 days
     v) Surgical masks: 4-7 days
   - The EPA is currently also researching this issue.

Questions about reopening practices

1) What do we (manufacturers in Massachusetts) need to document? The reopening guidelines specify that we must maintain records of cleaning. How detailed do these need to be?
   - The TURI Lab has created templates based on the documentation we are maintaining. The templates can be accessed here – they demonstrate the level of detail used by our Lab for an overall cleaning and disinfecting checklist and log. In general, you must log the date, time and scope of cleaning conducted by location.
   - High-touch areas such as doorknobs, drawer handles, chair backs and arms, containers, switch plates, keyboards and touchpads should be cleaned and disinfected more frequently.
   - Remember: ALWAYS clean before you disinfect!

2) Do you have guidance on hiring a cleaning company to clean and disinfect?
   - Going beyond the obvious things like getting references and such, the questions I would ask would be:
     i) What chemicals do you use to clean?
     ii) What chemicals do you use to disinfect?
     iii) Do you provide training to your staff on the difference between cleaning and disinfecting?