Evaluating Professional Cleaning of the Commercial Built Environment for COVID-19

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EMSL Analytical, Inc. is one of the leading testing laboratories with 46 locations throughout the United States and Canada.
Topics

- Introduction
- Environmental Sampling Considerations
- ATP Testing
- Bacteria/Fungi Screening
- qPCR Testing
- Current Research Findings
COVID-19

Origin
The disease caused by SARS-CoV-2 virus.

Spread
A respiratory illness that can spread from person-to-person.
Transmission and Surface Contamination

- Main infection route is between people who are in close contact (within about 6 feet).
- Through respiratory droplets produced when an infected person coughs or sneezes.
- Currently, transmission from surfaces is not thought to be the main way the virus spread, however the CDC’s April 13th update remarked: "COVID-19 is a new disease and we are still learning about how it spreads and the severity of illness it causes."
- Possible by touching a surface or object that has the virus on it, and then touching the mouth, nose, or eyes.
Environmental Surfaces

- May remain infective on surfaces for hours to days
- Dependent on the surface material type (fabric, tile, steel, paper, etc.)
- Thorough cleaning and disinfection of frequently touched surfaces are recommended by the CDC and believed to be essential in preventing the spread of infection
Potential High Risk Areas to Sample

- Telephones, Keyboards
- Chairs, Tables, Light Switch
- Hand Soap Dispenser
- Garbage Bin
- Office Equipment, Panels
- Doorknobs
- Railings, banisters
- Faucet Handles
- Toilet Handles
- Air Returns, Ventilation Exits
ATP Testing

- Adenosine Triphosphate – the energy molecule used by living cells
- Measured by luminometer (RLUs) onsite
- Commonly used in food processing
- Indicator of cleanliness (all cellular ATP)
  - food residues, blood spillages, fecal matter, dust, shed skin squama
- Not produced or stored by viruses
- Not a direct measure of viral presence
- Follow manufacture recommendation on sampling
Microbial Screening

- Swab surfaces for bacteria/fungi as indicators of cleaning efficacy
- Assumes an EPA-registered virucide was included in the cleaning protocol and used according to labeling
- If results are free of bacteria and fungi then those surfaces have been properly cleaned

https://www.worldbioproducts.com/purblue.html
Microbial Screening

- Wait until disinfectant has dried
- Must use swab with neutralizing buffer
- Fungal plate counts, 5 day TAT
- Bacterial plate counts, 2 day TAT
- Ship swabs on ice packs

https://www.worldbioproducts.com/purblue.html
SARS-CoV-2 PCR Testing

- Presence or absence of the viral genetic material on environmental surfaces
- RT-qPCR targets the SARS-CoV-2-nucleocapsid N gene
- Two indicators: 2019-nCoV_N1 & 2019-nCoV_N2
- Same method as specified by the CDC and authorized by the FDA for clinical COVID-19 diagnostics
- Human RNAse P gene is not analyzed
- Not for processing patient SARS-CoV-2 specimens
SARS-CoV-2 PCR Testing cont.

- Environmental samples frequently contain qPCR inhibiting substances found in dirt, soil, and dust.
- Additional nucleic acid (NA) extraction method (clean-up) for environmental samples.
- 'Detected' for either indicator can be interpreted with confidence that the area swabbed contained SARS-CoV-2 coronavirus particles that could be deemed as potentially infectious.
- Test includes five controls: positive N1, positive N2, negative N1, negative N2, and qPCR inhibition control.
SARS-CoV-2 PCR Results

- Test is currently P/A results but may be quantitative in future
- Limit of detection (LOD) 1 RNA copy per microliter of transport medium
- The test is specific only to SARS-CoV-2
- There is no known cross-reaction to any other viruses
- Rapid TATs available: same day to 5 day typically offered by commercial labs
Sampling Protocol

- Wear appropriate PPE during sampling
- Swab surface areas of interest (25 cm² is commonly used)
- Moderate pressure while moving in at least two different directions and rotating the swab
- Avoid letting the swab dry completely
Sampling Protocol (cont.)

- Place back in labeled transport container
- Wipe with disinfectant
- Place all swabs in Ziplock bag, wipe bag
- Double bag and wipe outside of second bag
- Place COC in separate Ziplock bag
Shipping Samples

- Pack well so samples are not damaged during shipping
- Samples must be wrapped with and shipped with an ice-pack
- Recommend shipping samples on the same day as collected
- Samples may be refrigerated up to 72 hours per WHO guidelines
Stability of SARS-CoV-2 in Different Environmental Conditions

- Virus is highly stable at 4°C (14 days), but sensitive to heat
- Temperature increased to 70°C, the time for virus inactivation was reduced to 5 mins
- No infectious virus could be recovered from printing and tissue papers after a 3-hour incubation
- Day 2 treated wood and cloth
- Day 4 glass and banknote
- Day 7 stainless steel and plastic
- Surgical mask on day 7

https://doi.org/10.1016/S2666-5247(20)30003-3
## Disinfectants Studied

<table>
<thead>
<tr>
<th>Disinfectant (Working concentration)</th>
<th>Virus titre (Log TCID$_{50}$/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 mins</td>
</tr>
<tr>
<td>Household bleach (1:49)</td>
<td>U</td>
</tr>
<tr>
<td>Household bleach (1:99)</td>
<td>U</td>
</tr>
<tr>
<td>Hand soap solution (1:49)</td>
<td>3.6#</td>
</tr>
<tr>
<td>Ethanol (70%)</td>
<td>U</td>
</tr>
<tr>
<td>Povidone-iodine (7.5%)</td>
<td>U</td>
</tr>
<tr>
<td>Chloroxylenol (0.05%)</td>
<td>U</td>
</tr>
<tr>
<td>Chlorhexidine (0.05%)</td>
<td>U</td>
</tr>
<tr>
<td>Benzalkonium chloride (0.1%)</td>
<td>U</td>
</tr>
</tbody>
</table>
COVID-19 in Wastewater

**Tempe COVID-19 Wastewater Results**

**Average Weekly Results COVID-19 Genome Copies per Liter of Wastewater by Collection Area**

**Testing Results: Weekly Average (log scale)**

- 4/6-4/12/2020: 743.1k
- 4/13-4/19/2020: 27.1k
- 4/20-4/26/2020: 7.9k
- 04/27-05/03/2020: 5k

Minimum testing level: 5k

**Collection Areas by Week**

- Area 1
- Area 2
- Area 3
- Area 4
- Area 5

A logarithmic scale (or log scale) is a compact way of showing numerical data over a very wide range of values.

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Cleaning Standard in Development

- **BSR/IICRC S410, Standard for Infection Control During Professional Cleaning and Maintenance of the Commercial Built Environment**

- This standard will provide a specific set of practical principles, methods, and processes to clean, sanitize and evaluate the cleaning of the built environment where verifiable, hygienic cleaning is required.

- The S410 Consensus Body Chair is Graham Dick and Vice Chair is Mark Drozdov
CEICC

Council-certified Environmental Infection Control Consultant by ACAC (ACAC.org)

- To raise the standards of those engaged in infection control consulting in healthcare and other environmental settings.

- To identify persons with acceptable knowledge of environmental infection control and the standards and regulations affecting Council-certified Environmental Infection Control Consultants.

- To award special recognition to those environmental infection control professionals who have demonstrated verifiable field experience.
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