



COVID-19 *Transit Operations*

PUBLIC TRANSIT RESPONSES TO CORONAVIRUS SITUATION

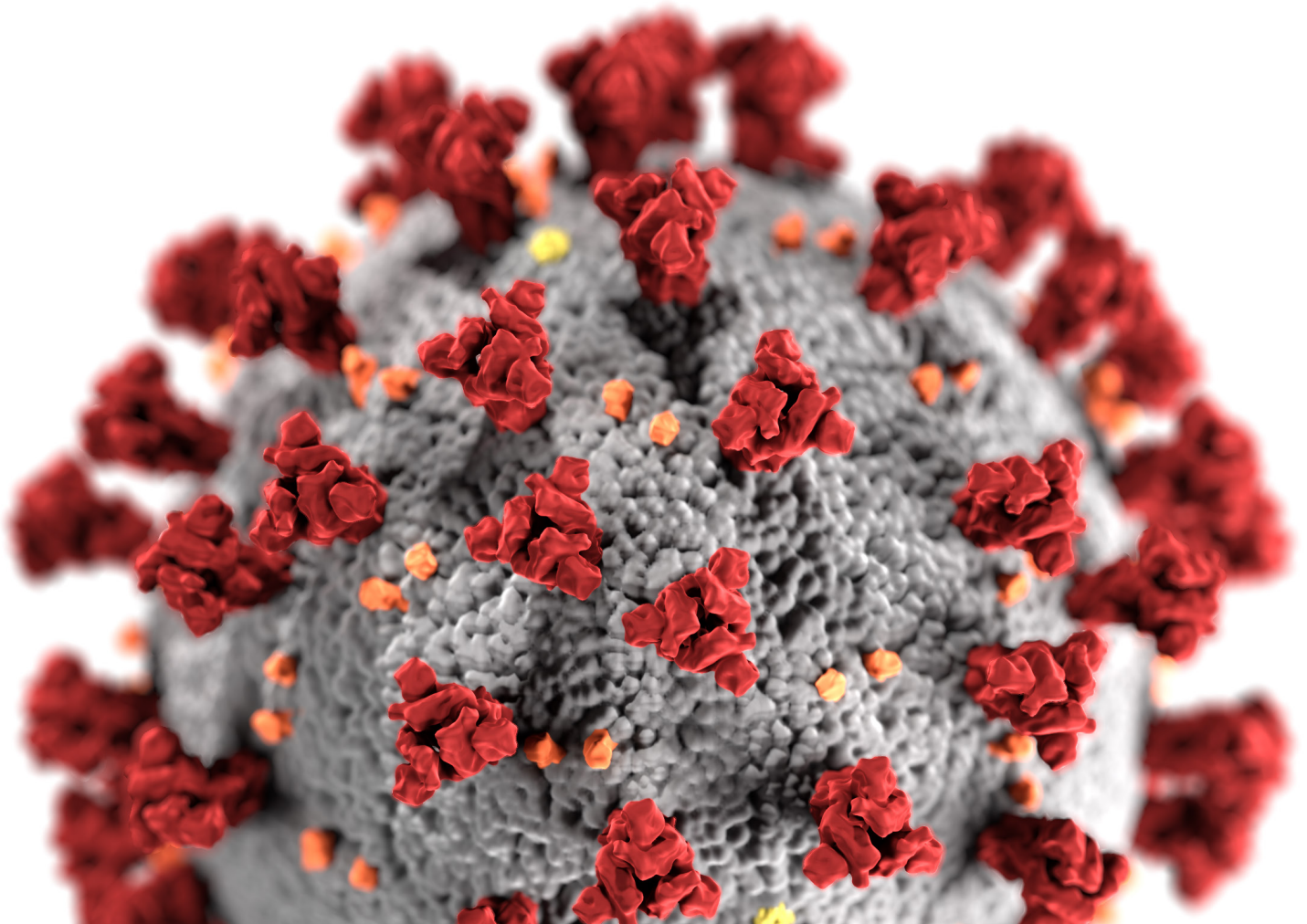


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1. INTRODUCTION

In the face of an unprecedented outbreak, the objective of this whitepaper is to provide a summary of the ongoing global pandemic of COVID-19 and its impact on public transit agencies, with a detailed focus on transit bus operations. For the purposes of this review, WSP has refrained from referring to specific agencies' protocols and instead elected to focus on providing an overview of current practices as being adopted by transit agencies in North America. Since the risk of spreading the virus emerged, many agencies are reporting large decreases in transit ridership. This can be expected as residents follow protocols recommended by their governments such as self-isolation, quarantine, physical distancing, working from home, along with the cancellation of public events. This paper will provide a summary of practices as recommended by current transit operators.

COVID-19 BACKGROUND AND CONTEXT

COVID-19 is an infectious disease that is caused by the novel coronavirus strain of Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). This disease was initially identified in December 2019 in Wuhan, China and has since spread globally (in over 180 countries) in the beginning of 2020. The World Health Organization (WHO) declared the spread of COVID-19 as a pandemic on March 11, 2020. There have been two previous coronaviruses that have proliferated from animals to humans resulting in illness in humans: Severe Acute Respiratory Syndrome coronavirus (SARS CoV) & Middle East Respiratory Syndrome coronavirus (MERS CoV).

- COVID-19 symptoms can appear to be similar to the common cold or flu. Reported illnesses have ranged from mild symptoms to severe illness and death. These symptoms may appear 2-14 days after exposure. Symptoms include fever, cough, shortness of breath and possibility of pneumonia in both lungs.

- The virus is thought to spread mainly from person to person between people who are in close contact with one another (within about 6 feet) through respiratory droplets produced when an infected person coughs or sneezes. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs.
- COVID-19 transmission continues to proliferate with a rapid global increase in the reported number of cases.
- Current mitigation strategies that are being employed by global governments include: quarantine of infected patients, self-isolation if possible exposure to COVID-19, physical distancing, wearing masks and gloves, improved hygiene associated with cleaning frequently touched surfaces and utilizing approved disinfectants.

PUBLIC TRANSIT AGENCY IMPACTS

Public transportation systems are considered a high-risk environment for the spread of COVID-19 due to:

- Large volume of individuals confined to shared common space for extended periods, with limited ventilation
- The elderly and individuals with mobility impairments and other medical conditions who rely on conventional and specialized transit are at high risk

- Common surfaces to touch (stanchions, handrails, doors, buttons, straps, farebox, ticket kiosks, etc.)
- No control or method of pre-screening individuals before boarding a transit system operation

As continuation of transit service is important for mobility, transportation providers need to consider methods of containing and preventing the spread of the virus, manage their workforce impacts effectively and safely, and have transparent communication with their customers.

HIGHLIGHTS OF CURRENT PRACTICES BEING EMPLOYED BY TRANSIT AGENCIES

The following provides an overview of some of the key actions of transit agencies to control and reduce the risk associated with COVID-19:

- **Increased cleaning and disinfecting:** Bus facilities and terminals are being disinfected daily, with increased cleaning schedules during peak hours operations. Some transit agencies are cleaning their vehicles twice daily. Operators are being provided with hand sanitizer (at least 70% alcohol) and disinfectant wipes for cleaning their work environment. Agencies are providing daily cleaning of high-touch surfaces with disinfectants (details on disinfectants are outlined later in this whitepaper).
- **Transit route and service modifications:** Changes in service patterns based on local considerations, including reductions in service hours, routes (addressing ridership decrease), and increases in service during peak hours to assist in physical distancing.
- **Modification of seating protocols:** Removing seating immediately behind operators to assist in physical distancing, deploying operator shields for protection through physical barriers, rear-door boarding to minimize contact with operators, and screening questions during the booking process for paratransit and specialized transit passengers.
- **Regular communications with staff and customers:** Regularly informing staff about personal risk management and proper hygiene, regular updates with regards to local COVID-19 situations, utilization of communication screens, posters, announcements to remind passengers about methods of reducing infection transmission and maintaining safe physical distancing while on transit, transparent communications with regards to COVID-19 transmission in transit service.
- **Identifying risks to supply chain and essential protection equipment:** Reviewing current availability of essential protection and

cleaning disinfectants and supplies, amending plans for review of operational necessities such as fuel, lubricants and spare parts, preliminary investigation of alternative suppliers if possible.

- **Identify and establish continuity plans:** Transit agencies are reviewing their continuity plans and

emergency action plans to ensure that front-line staff, maintenance and other support functions have redundancy and operations can continue. Management strategies for oversight and leadership back up are also devised.

2. MODIFICATIONS TO SERVICE

It is evident that the global pandemic of COVID-19 has brought unprecedented challenges to public transit systems around the world as they continue to operate as a crucial service, enabling people to access essentials such as groceries and pharmacies in a time of crisis. Therefore, it is paramount that a focus is placed on protecting not only transit riders but also operators and workers on the front line.

Transit agencies are enacting several measures for pre- and post-trip vehicle sanitation and quarantine. However, there are additional precautions and measures being put in place during revenue service. The goal of this section is to share information on how leaders in the transit industry are responding and their practices to help inform other transit agencies of what precautions should be considered.

Transit agencies are implementing various strategies to improve customer and employee morale, such as suspending fare evasion enforcement, providing free service and encouraging rear boarding protocols.

Staff on the front lines include drivers/operators, station attendants and ticketing personnel. As the outbreak continues, it is vital to protect these workers to mitigate the impact of staff illness and absence which can put a strain on the transit service as well as the health-care system. The following sections detail some precautionary measures that can be practiced by staff working in transit stations exposed to the public, as well as operators and transit riders.



TRANSIT FACILITIES, STATIONS, STOPS AND TERMINALS

These are some of the actions and proactive measures which station attendants and ticketing personnel are enacting regarding stations, bus stops and terminals:

- Encourage the use of ticketing machines and contactless payment (i.e. credit card, Presto card, debit card, online reload) to minimize the level of personal interaction.
- Regular cleaning of fare payment terminals including touch-screen surfaces and credit/debit card PIN keypads.
- Frequent employee hand washing and use of hand sanitizer (at least 70% alcohol).
- Regular cleaning and sanitation of bus stops and terminals.

VEHICLES & OPERATOR AREA

In subway and light rail transit (LRT) vehicles, the operator cabin is typically isolated from the passenger areas. However, on-board city buses there is an increased risk of exposure between the driver and passengers. Transit agencies are attempting to better isolate drivers from potential exposure by:

- Using vehicles with driver cabin shields (plexiglass dividers installed) as well as providing drivers with personal protective equipment (PPE) including face masks and gloves which can be disposed of at the end of every trip. Disinfectant wipes are also being provided so drivers can wipe down their steering wheel and other frequent touch points as an added precaution to pre-trip vehicle cleaning.
- Providing hand sanitizer (at least 70% alcohol) dispensers on vehicles and creating awareness among passengers to use hand sanitizer (at least 70% alcohol) before touching anything on the vehicles.
- Where possible, encouraging the practice of rear door entry/exit only. This helps to distance passengers and the driver.
- Creating a driver safe area leaving three (3) to five (5) rows of passenger seating vacant behind the driver's cabin area. This area can be cordoned off with signage and marking tape.
- Making frequent in vehicle radio announcements about precautionary measures from the transit agency. This also includes informing passengers of any COVID-19 reported cases on transit vehicles, with the date, time and quarantined vehicle ID so that potentially exposed passengers can reach out to public health authorities for guidance.
- As part of announcements, transit agencies could promote among passengers the habit of maintaining a log of their transit trips. The log can include essential information such as time of trip, bus number, route, seating position, number of riders and anything unusual.

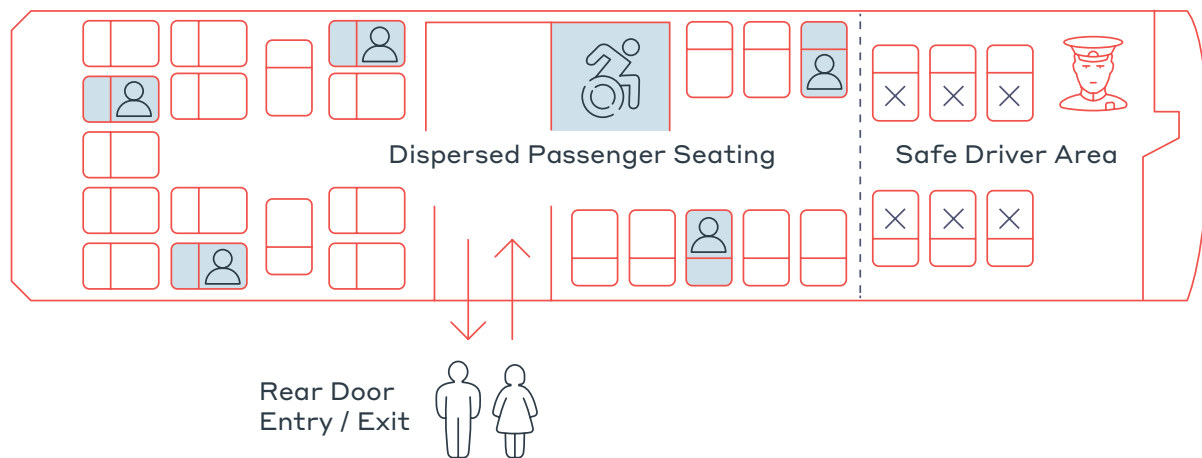
TRANSIT PASSENGERS

Passengers can play an equally important role in assisting transit systems through this pandemic. First and foremost, this means staying at home when sick or displaying any flu-like symptoms. Other precautionary measures include the following:

- Sanitize hands prior to boarding and touching vehicle stanchions, grab straps and other surfaces inside the vehicle. If possible, transit agencies can provide alcoholic hand sanitizer (at least 70% alcohol) mounted on stanchions on-board the vehicle.

- Practicing physical distancing by only operating vehicles up to 50% passenger capacity and encouraging passengers to practice physical distancing via dispersed seating (i.e. more than 6ft apart).

The following figure depicts a typical floor plan of a public transit bus with key areas and best practices marked on how best to reduce potential exposure and implement physical distancing.



Passengers are encouraged to be patient while boarding/departing a vehicle to keep personal distancing top of mind. As a result of working from home and other physical distancing measures being put in place, from both the federal and provincial levels, transit ridership is down approximately 60%-90%, which can further support physical distancing on-board transit vehicles for those needing to use them.

Most importantly, everyone can help play their part by staying home and only venturing out for essentials when needed. This can help reduce the likelihood of spreading COVID-19 and manage the burden on our health care system. The following section dives into some of the current practices from transit agencies on cleaning procedures to help ensure the sanitation of public transit vehicles.

3. CLEANING PROCEDURES

Transit agencies have used various methods and cleaning intervals from daily, monthly and yearly cleaning protocols to ensure a hygienic environment for passengers. This section lays out the changes in cleaning methods as a result of the current climate of COVID-19. This section will highlight the various methods deployed by transit agencies to clean their buses. This section will also highlight the use of appropriate disinfectants and Personal Protection Equipment (PPE) for cleaning personnel to mitigate the exposure and spread of COVID-19.

The first scenario involves maintaining a level of hygiene on the bus where there has been no infected passenger on the bus. The second scenario involves maintaining a level of hygiene on the bus where there has been confirmed exposure to COVID-19 on the bus. The first scenario identifies best practices in the pre-cleaning inspection phase, the active cleaning stage and the post-cleaning inspection phase. In the case of the second scenario, it is best to consult health experts regarding how to minimize the risk of exposure to the virus.

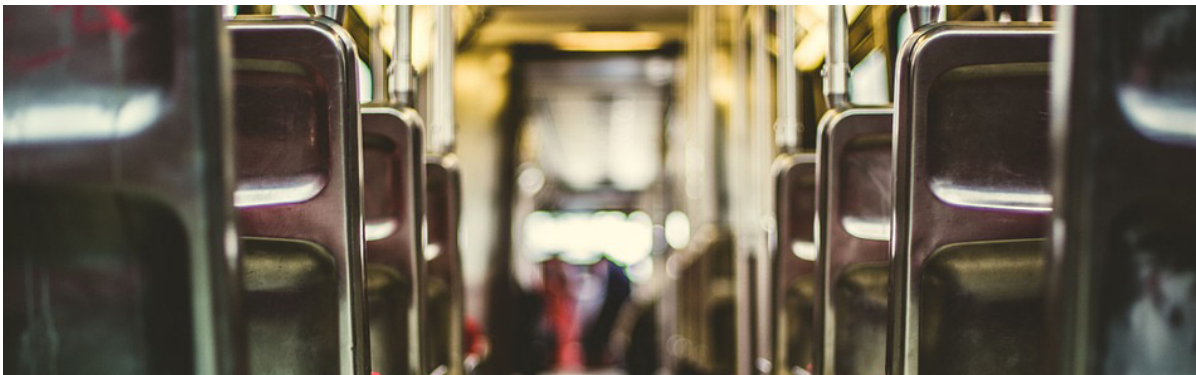
DISINFECTANTS FOR COVID-19

While there are quite a few disinfectants that can be used against COVID-19, the disinfectant product used by most transit agencies has hydrogen peroxide as the common active ingredient.

The United States Environmental Protection Agency (EPA) continuously updates products with emerging pathogen claims. SARS-CoV-2 is a novel virus, and is commercially not available for laboratory testing. EPA's list of disinfectants with emerging viral pathogen claim can be found on its website¹. These products have not been tested against the SARS-CoV-2 virus, but are expected to

be effective based on demonstrated efficacy against a harder-to-kill virus² (i.e. another human coronavirus similar to SARS-CoV-2).

The disinfection products come with manufacturers' guidelines for methods of application (ready-to-use, diluted, wipe etc.), contact time and use of personal protective equipment (PPE) during application. The contact time is the amount of time the surface should be visibly wet to be effective against pathogens. It is very important that these guidelines from manufacturers are followed to minimize spread of the COVID-19 infection.



¹ <https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>

² <https://www.epa.gov/pesticide-registration/frequently-asked-questions-about-list-n-disinfectants-use-against-sars-cov-2>

The most common disinfectants were identified based on input from transit agencies. The disinfectants, their active ingredients and contact time were found from the respective safety data sheets, and can be found in the table shown below.

| Disinfectant Product Name | Active Ingredients | Application Method | Contact Time |
|---------------------------|--|--------------------|--------------|
| ES65H (5-10%) | Hydrogen Peroxide | Sprayer/Fogger | 10 minutes |
| Oxivir Wipes | Potassium Hydroxide (0.1-1%) | Wipe | 1 minute |
| Oxivir 5 | Hydrogen Peroxide & Phosphoric Acid (1-5%) | Dilutable | 5 minutes |
| Virox 5 | Hydrogen Peroxide (0.1-1.5%) | Wipe | 5 minutes |
| Decon 30 | Thymol (0.05%) | Ready-to-use | 10 minutes |

Other disinfectants used by transit agencies include Decon 7, Flexo Patriot 30, DR200, EP50 and Swish Miracle.

Based on researching EPA's list of approved disinfectants, it was found that sodium hypochlorite (bleach) is one of the disinfectants with a minimal contact time of 30 seconds. The use of bleach can be explored by transit agencies to improve the effectiveness of disinfectants.

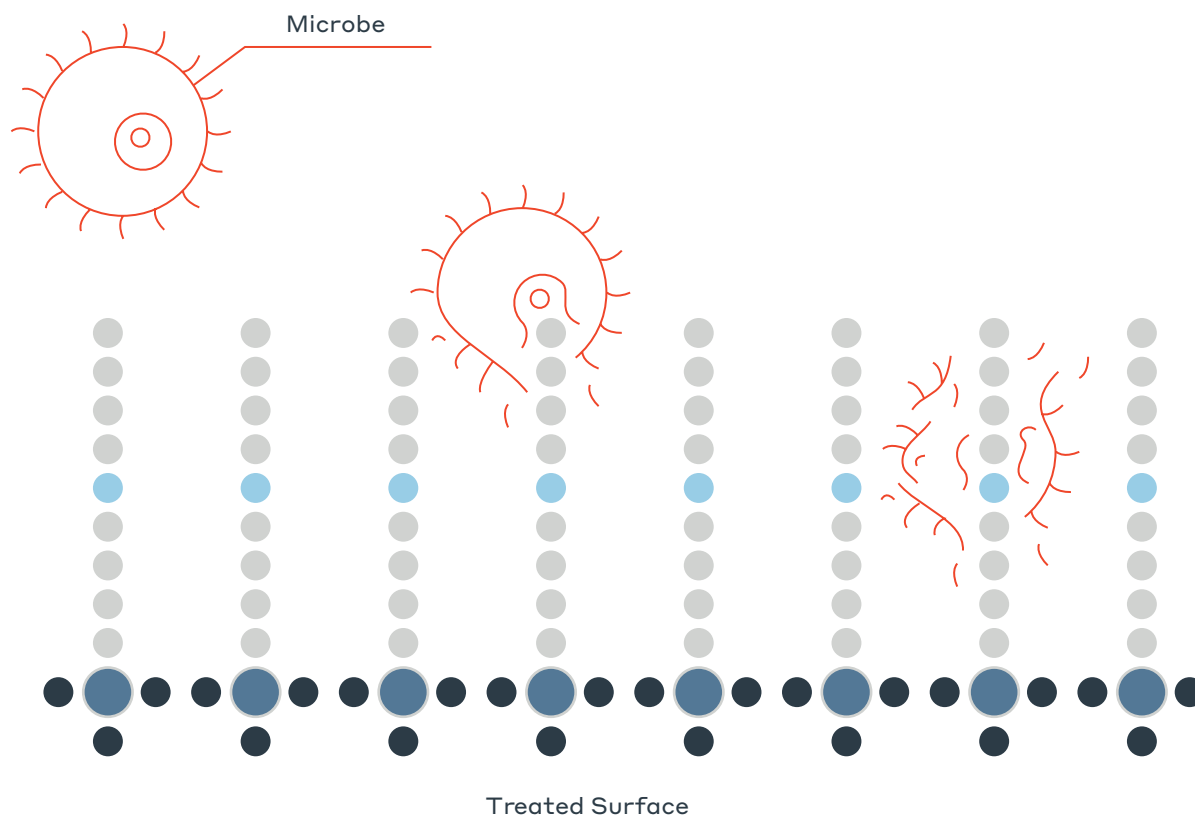
AEGIS MICROBE SHIELD

AEGIS Microbe Shield³ is a liquid antimicrobial that forms a protective coating that can molecularly bond with surfaces. Microorganisms are attracted to the coating's positive charge and quickly die upon coming into contact with the surface. AEGIS shield inhibits the growth of microbes on surfaces by neutralizing the microbes' natural cell wall protection.

It was found that a few transit agencies had been using the AEGIS Microbe Shield on their transit vehicles even before the COVID-19 outbreak. The AEGIS product is now increasingly being used by several other transit agencies.

Unlike disinfectant products which kill pathogens during the wet contact time, the AEGIS product is claimed to be effective for a period of one year. It is an antimicrobial formulated to permanently bond to surfaces it is applied to. The antimicrobial treatment creates a bed of spikes that can puncture the cell wall of pathogens deposited via air or touch. This protective layer can destroy the outer membrane of pathogens like SARS-CoV-2 which can result in killing the pathogens.

³ <https://www.microban.com/antimicrobial-solutions/technologies/aegis-microbe-shield>



Conventional disinfectant products can kill pathogens only during application, and have high possibilities of surfaces being contaminated again when touched by an infected person. Also, as mentioned, sanitizing using disinfectants is effective only when the proper method and contact time is followed. The AEGIS shield is not a conventional disinfectant, but it can compliment the effectiveness of existing cleaning and disinfection methods. It is proven to be effective against any microorganism with outer cell membranes.

The AEGIS product can be easily applied to both hard and soft surfaces by spraying and letting it dry. Currently, transit agencies are treating all

internal surfaces with this AEGIS product. AEGIS recommends PPE such as the N95 mask, safety goggles and nitrile gloves for personnel applying the microbial agent.

Like the other disinfectants with emerging viral pathogen claim, this product is also perceived to kill the COVID-19 causing virus. But there is no approval or any form of testing done so far to prove the effectiveness of this antimicrobial agent. Moreover, the manufacturer has released a statement on its website on the effectiveness⁴.

⁴ <http://microban.com/message-about-covid-19>

EXPANDED CLEANING PROTOCOL

Transit agencies have already started expanding their regular cleaning protocol to reduce the spread of COVID-19. This includes transit facilities, workspaces, bus stops and vehicles.

Transit agencies have made it a top priority to disinfect high frequency touch points in both their facilities and vehicles. The high frequency touch points have been listed below.

DRIVER'S AREA

- | | | |
|---------------------|------------------------|---------------------------------------|
| • Steering Wheel | • All Knobs | • Overhead Console Buttons |
| • Horn Switch | • All Column Levers | • Driver's Compartment Door and Latch |
| • Shift Selector | • Door Air-Dump Valves | • Emergency Buttons |
| • Parking Brake | • Microphones | • Fresh/Recirculation Air Plunger |
| • Seat Switches | • Communication Radio | • Hot/Cold Plunger |
| • Seat Knobs | • Farebox Unit | |
| • Seat Belt Ends | • CAD AVL Unit | |
| • All Dash Switches | • Visors | |

PASSENGER'S AREA

- | | | |
|----------------|-----------------|-------------------------|
| • Door Handles | • Seat Armrests | • Stop Buttons |
| • Stanchions | • Windows | • Seats |
| • Farebox Unit | • Window Ledges | • Overhead Grab Handles |

The above list provides common high frequency touch points based on inputs from transit agencies. The list can be more extensive to create a safer environment for employees and passengers.

Transit agencies are performing a daily wipe down of these high frequency touch points. Some transit agencies are performing twice a day. One transit agency is planning to complete this cleaning once every 4 hours during service hours, which can be highly challenging.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

The use of PPE while cleaning and disinfecting highly depends on the cleaning products being used. PPE use to prevent the spread of infection might not be sufficient during the cleaning process due to the harmful effects of chemicals. The use of appropriate PPE for the commonly used hydrogen peroxide along with bleach is provided in this section.

SODIUM HYPOCHLORITE⁵

Eye Protection:

- Wear splash resistant safety goggles with a face-shield.
- Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection:

- Wear chemical resistant clothing and rubber boots when potential for contact with the material exists.
- Contaminated clothing should be removed, then discarded or laundered.

Hand Protection:

- Wear appropriate chemical resistant gloves. Protective Material Types: Natural rubber, Neoprene, Nitrile, Polyvinyl chloride (PVC).

Respiratory Protection:

- A NIOSH approved respirator with N95 (dust, fume, mist) cartridges may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits, or when symptoms have been observed that are indicative of overexposure.
- Acid gas cartridges may be required if decomposition products are present.
- A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant the use of a respirator.

HYDROGEN PEROXIDE

Eye Protection:

- Close-fitting, splash-proof chemical mono-goggles at all times.

Skin and Body Protection:

- Clothing that has come in contact with hydrogen peroxide should be washed thoroughly and immediately, to avoid the potential of a delayed ignition.

Hand Protection:

- Neoprene or butyl rubber gloves, loose fitting for ease of removal.

Respiratory Protection:

- It is recommended to ventilate areas as soon as possible and to not return until odors have dissipated.

⁵ Manufacturer recommendations was gathered from OXY: Occidental Chemical Corporation Safety Data Sheet for Sodium Hypochlorite (EPA) and Allied Universal Corporation Material Safety Data Sheet for Sodium Hypochlorite.

Transit agencies have already modified their cleaning policies and Standard Operating Procedures (SOPs) as a response to the current COVID-19 situation. Transit agencies should ensure that cleaning personnel are properly trained for the use of PPE and display graphical guides that can help to properly wear/remove PPE (ex. gloves, mask etc.). The documentation on PPE should include important elements such as frequency of PPE sterilization/replacement, proper fit for PPE and alternative suppliers.

METHODS OF DISINFECTANT APPLICATION

Based on research and input from transit agencies, the most commonly used methods of application of disinfectant is listed here below.

1. Diluted/Ready-to-use disinfectants:

- Spraying diluted/ready-to-use products
- Electrostatic sprayer/fogging
- Spray and wipe

2. Ready-to-use wipes

Transit agencies around the world are under pressure to prevent the spread of COVID-19 and some of them have turned to technology to keep their vehicles clean. One such example is the use of ultraviolet (UV) light to disinfect buses.

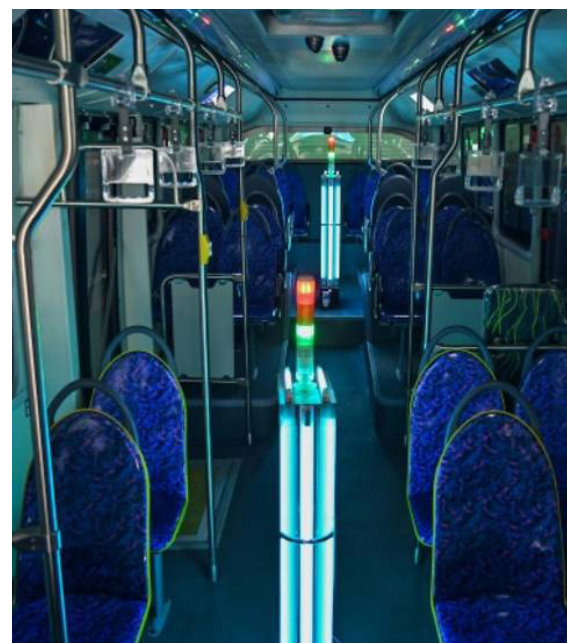
Shanghai public transport firm Yanggao has recently converted its conventional cleaning room into a UV light disinfection chamber for its buses.

This innovation has cut down the usual 40-minute process to just 5 minutes. The regular cleaning process generally required the full attention of two cleaning personnel for spraying disinfectant on surfaces and then wiping down.

Yanggao felt that the disinfectants might not reach all corners and to tackle this issue it partnered with a technology supplier to set up UV cleaning rooms equipped with 210 UV tubes. Yanggao has converted two cleaning rooms, each of which can disinfect up to 250 buses a day. The UV chambers are closed off and activated by staff outside with no manual intervention as UV tradition can cause skin irritation.

Similarly, transit agencies are adopting various methods of fogging and mist systems to disinfect their vehicles.

Transit bus being disinfected with UV rays in Shanghai (Photo: AFP/Hector Retamal)



CLEANING PROCEDURES & AUDITS

Transit agencies usually have different levels of cleaning based on frequency (daily, weekly, monthly etc.). Given the COVID-19 situation, transit agencies have expanded their cleaning policies to include daily cleaning of high frequency touch points, and in some cases even cleaning multiple times in a day. In general, transit agencies have three levels of cleaning:

1. **Light cleaning (daily)**
2. **Deep cleaning (quarterly)**
3. **Biological hazard cleaning (as required)**

Deep cleaning usually has protocols/procedures related to use of disinfectants in all interior components in transit vehicles. These protocols/procedures are now being done on a daily basis. Likewise, transit agencies have developed new Standard Operating Procedures (SOPs) using protocols/procedures from the usual cleaning procedures with increased frequency and also adding new protocols/procedures based on guidelines from local health authorities.

A post-cleaning inspection process is done to ensure a proper cleaning. Consider the following:

- **Last Cleaned Date:** Documentation of last cleaning date and time of transit vehicle
- **Completed Checklist:** Ensuring that all critical touch points and items have been cleaned and marked on the checklist
- **Staff Sign-Off:** Documentation regarding sign-off of staff responsible for cleaning activities
- **Confirmation:** Documentation of post-cleaning inspector

Cleaning/disinfecting vehicles has become a top priority for transit agencies. Transit agencies are following multiple types/frequencies of cleaning and must ensure that no vehicle will be skipped.

Hence, it is crucial that the cleaning schedules are properly planned and tracking systems are established to ensure that cleaning schedules are met. This tracking can be integrated into existing maintenance management systems. Some transit agencies are also performing regular audits of these cleaning/disinfecting procedures to ensure that the new protocols are being strictly followed by employees/contractors.

Other measures that transit agencies can take include:

- Make sure that cleaning staff have their own changing areas to minimize contact with other staff
- Enforce quality gates to make sure that vehicles don't get back into revenue service without completing cleaning/disinfection
- Pro-actively look for alternative suppliers for essential supplies, third-party cleaning contractors, innovation in cleaning such as UV light cleaning
- Be prepared for frequent revisions in SOPs and training procedures to accommodate changes in equipment, disinfectant products, PPE, staff shortages due to infections etc.

4. GARAGE SCREENING PROCEDURES

While all possible precautions are being taken to keep the buses clean and prevent the spread of infection, transit agencies are still anticipating the possibility of having passengers with COVID-19. To be prepared for this scenario, transit agencies have established a system to efficiently track buses, drivers and other passengers who might have been in contact with the infected passengers.

Transit agencies are setting up screening procedures at bus garages/storage facilities where buses are returning after operations. Modified duty drivers and other transit employees are being positioned at gates with a non-revenue vehicle.

- Transit agencies are developing a questionnaire and SOPs for entry checkpoint screening and other responses (quarantine, cleaning/disinfecting) to situation where COVID-19 passenger(s) travel history is discovered.
- Drivers are questioned at the entry gate checkpoint to identify history of any passengers suspected to have symptoms of COVID-19 (cough, shortness of breath, fever etc.).
- If COVID-19 passenger(s) are suspected, the bus and/or driver must be quarantined, then other co-passengers suspected to have been present around the COVID-19 infected passenger(s) must be informed to self-isolate and health authorities must be informed to initiate other procedures.
- Quarantine parking zones are being designated at each garage facility.

Standard procedures are being developed to quickly identify co-passengers who might have been exposed to the COVID-19 infected passenger(s) and communication protocols about the situation. In the case that a vehicle is determined to be quarantined, dispatch must be notified immediately and the following actions should be taken:

- License plate removed
 - Use your current lockdown procedures when placing a bus out of service to ensure no one can enter or exit bus
 - Barricades/pylons/caution tape being put around the vehicle
 - Windshield marked clearly with caution signs and "DO NOT ENTER" warning
 - Vehicles quarantined for a minimum of nine days to a maximum of 19 days based on the contamination level i.e. criticality of infected passenger(s)
- The quarantined vehicles are being carefully cleaned/disinfected as per a newly created SOP:
- Appropriate PPE such as full-body suit must be used by personnel cleaning/disinfecting the quarantined vehicles
 - It is important that transit agencies use disinfectants that have been approved by authorities such as the EPA to be effective in killing the COVID-19 causing SARS-CoV-2 virus
 - It is also crucial that the SOPs and PPE be developed appropriate to the disinfectants and as per the manufacturer's application guidelines (contact time, method of application, etc.)

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