# School Bus Disinfection Efficacy Results

Build With Robots
Turquoise Trail Charter School
August 17, 2022

# Synopsis


Build With Robots (BWR), a GBAC Advocate, partnered with Turquoise Trail Charter School (TTCS) in their mission to serve a diverse community of students and families in a safe and supportive environment. Breezy Blue Response provides a robust, consistent, and quick disinfection solution and can be easily implemented in locations that have limited accessibility.

Two Class C school busses were fogged using one Breezy Blue Response, testing two different fogging methods. These methods were compared to determine which would provide greater efficacy.

# Testing Protocol

*The correlation curve linking measured hydrogen peroxide concentration to pathogen kill rate shows:*
*≥ 97 mg/L : > 99.9% pathogen elimination rate*

- Location: Turquoise Trail Charter School, Santa Fe, NM
- Disinfectant: Breezy Biocare RTU
- Disinfectant Equipment: One Breezy Blue Response
- School Bus Type Tested:
  1. Bus #1 – Class C, regular row seating
  2. Bus #2 – Class C, lift area in back
- $H_2O_2$ test strips were placed throughout the school bus.
- Bus #1 was fogged from two different locations for 15 seconds. After fogging the back door was closed.
- Dwell time: 15 minutes.
- $H_2O_2$ test strips were examined for concentration of Hydrogen Peroxide that reached 11 independent locations in each school bus.
- After the results from Bus #1, it was decided to fog three different locations for 10 seconds each for Bus #2.

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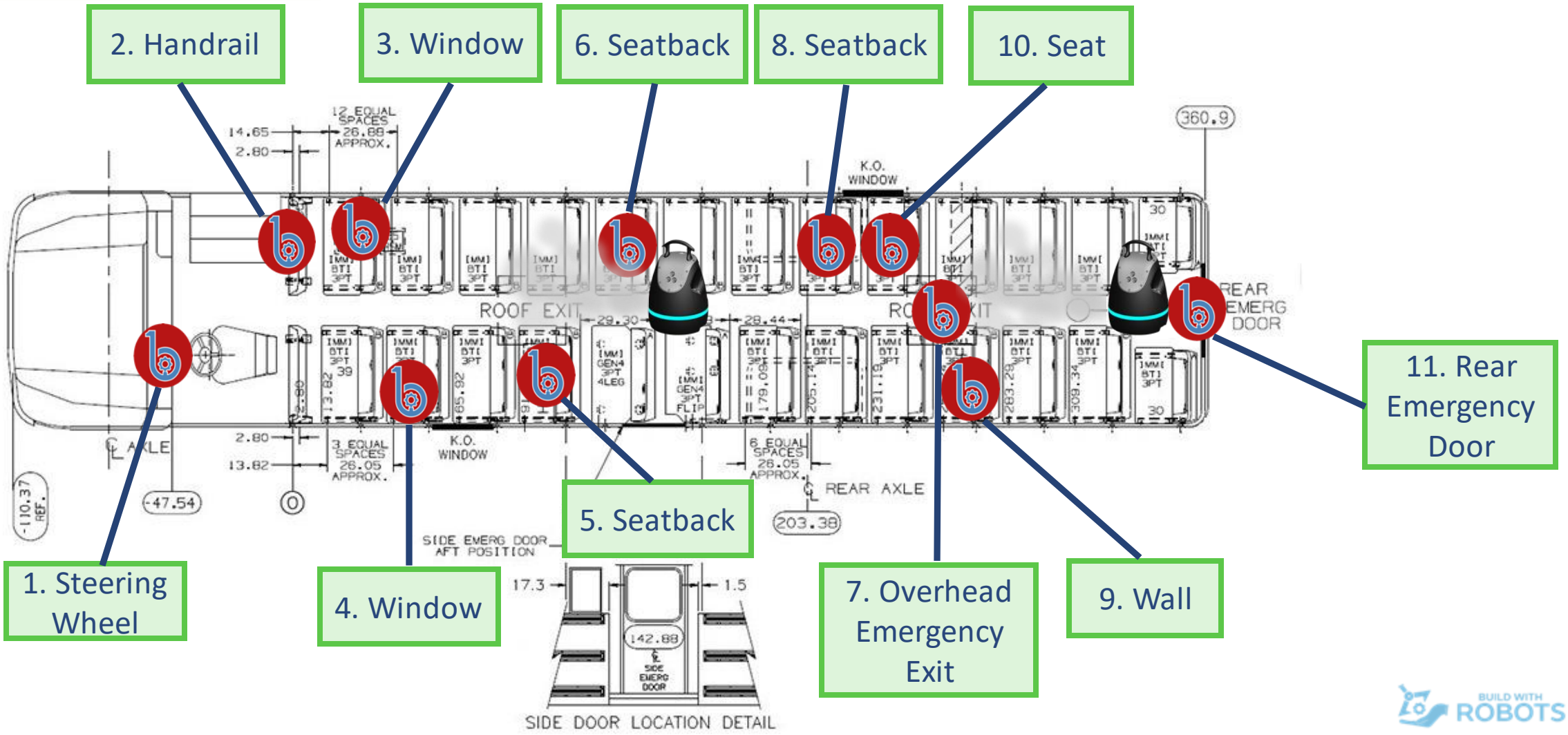
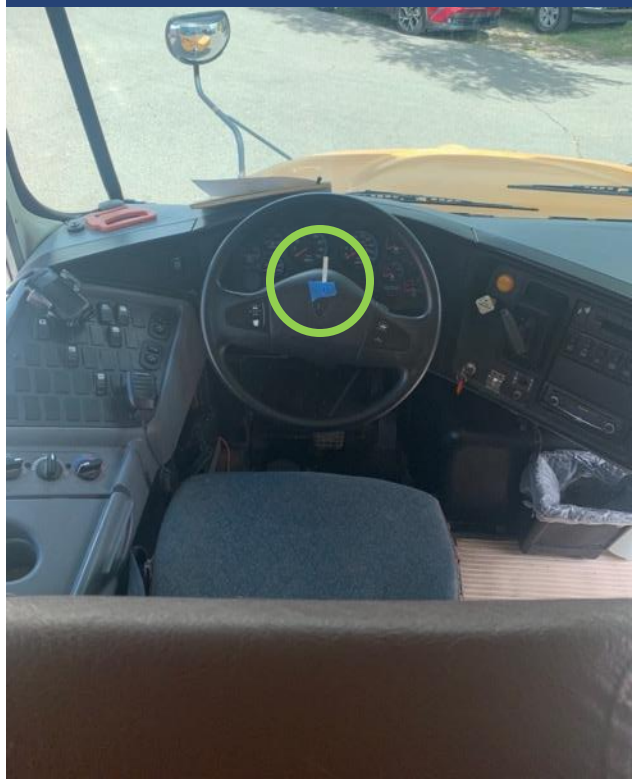
# School Bus Test #1

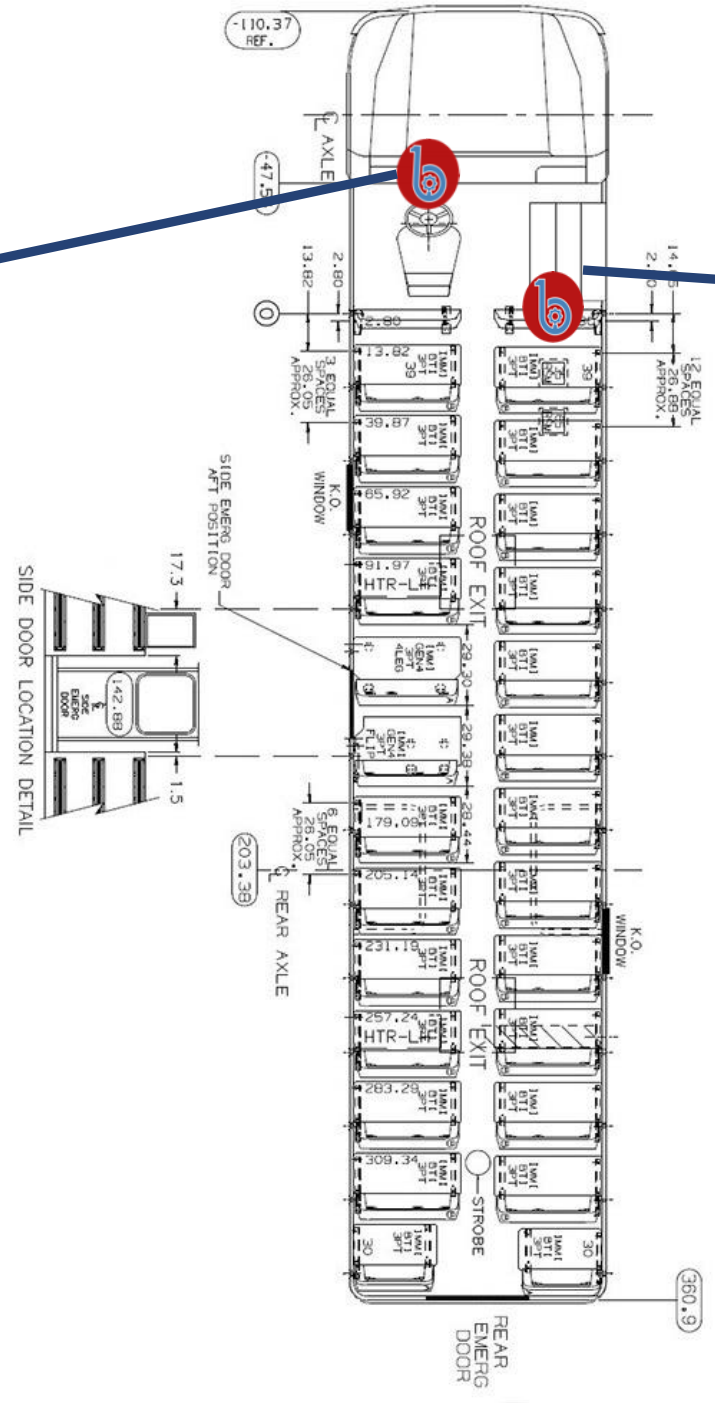
= Fogging Locations and Direction

= Test Strip Locations



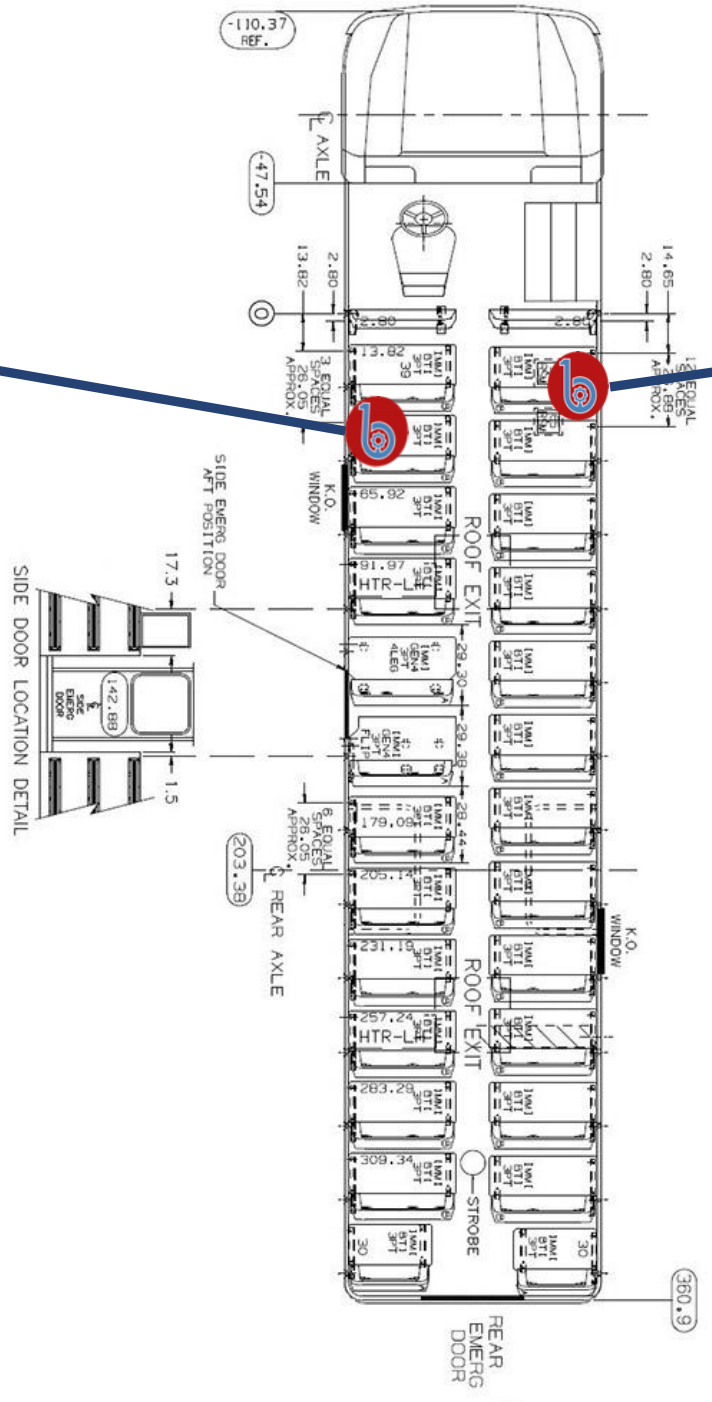
## 1. Steering Wheel
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination



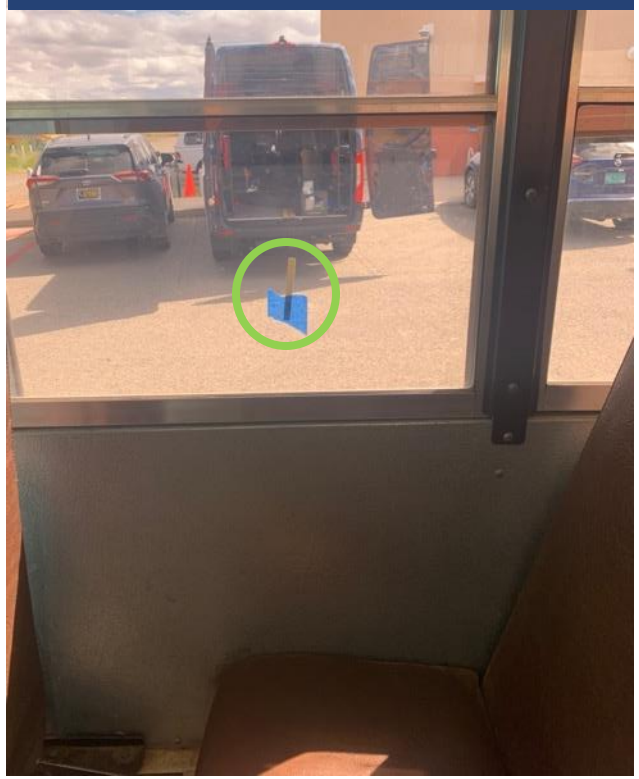



## 2. Handrail
84.0 mg/L $H_2O_2$
**97.6%** Pathogen Elimination

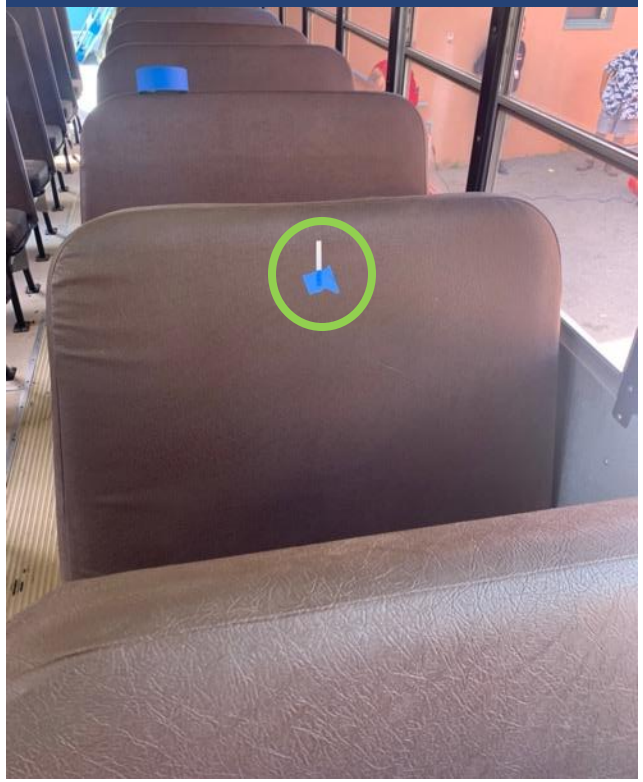
## 4. Window
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination

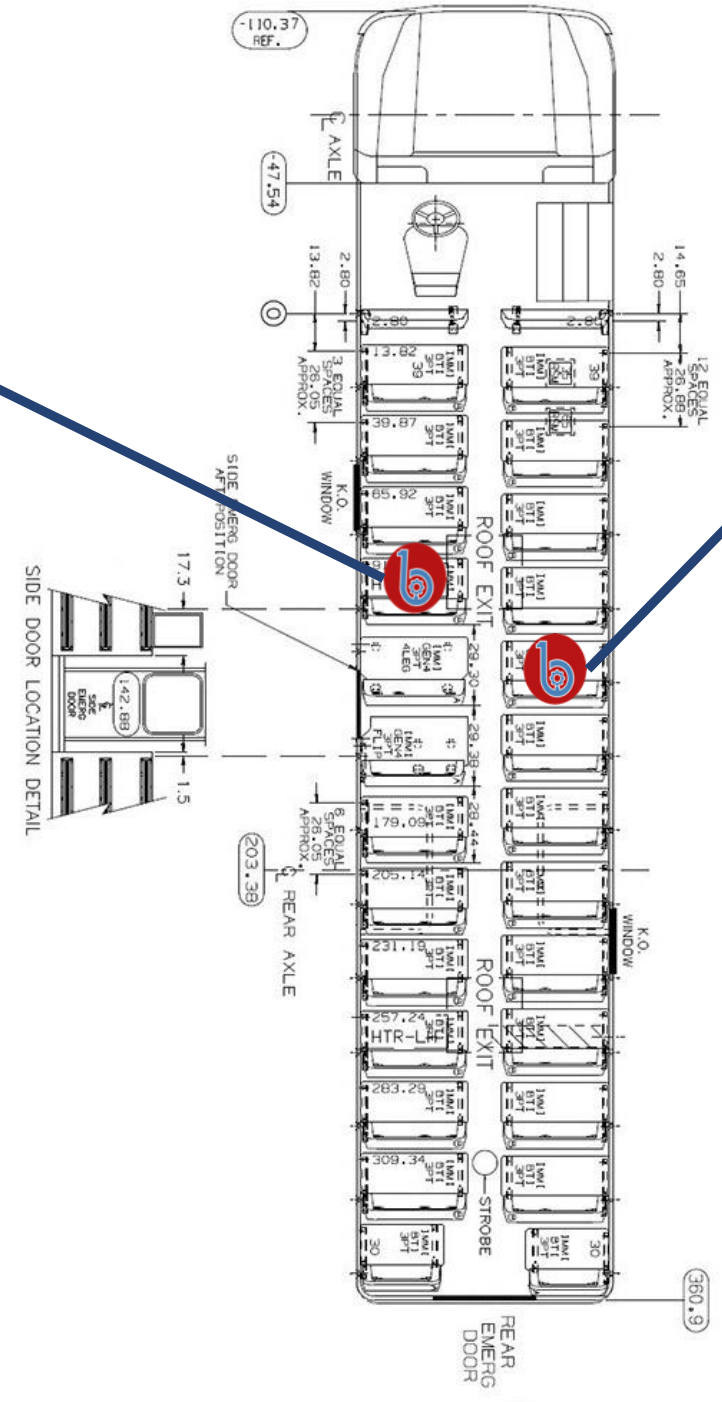



## 3. Window
82.5 mg/L $H_2O_2$
**97.5%** Pathogen Elimination



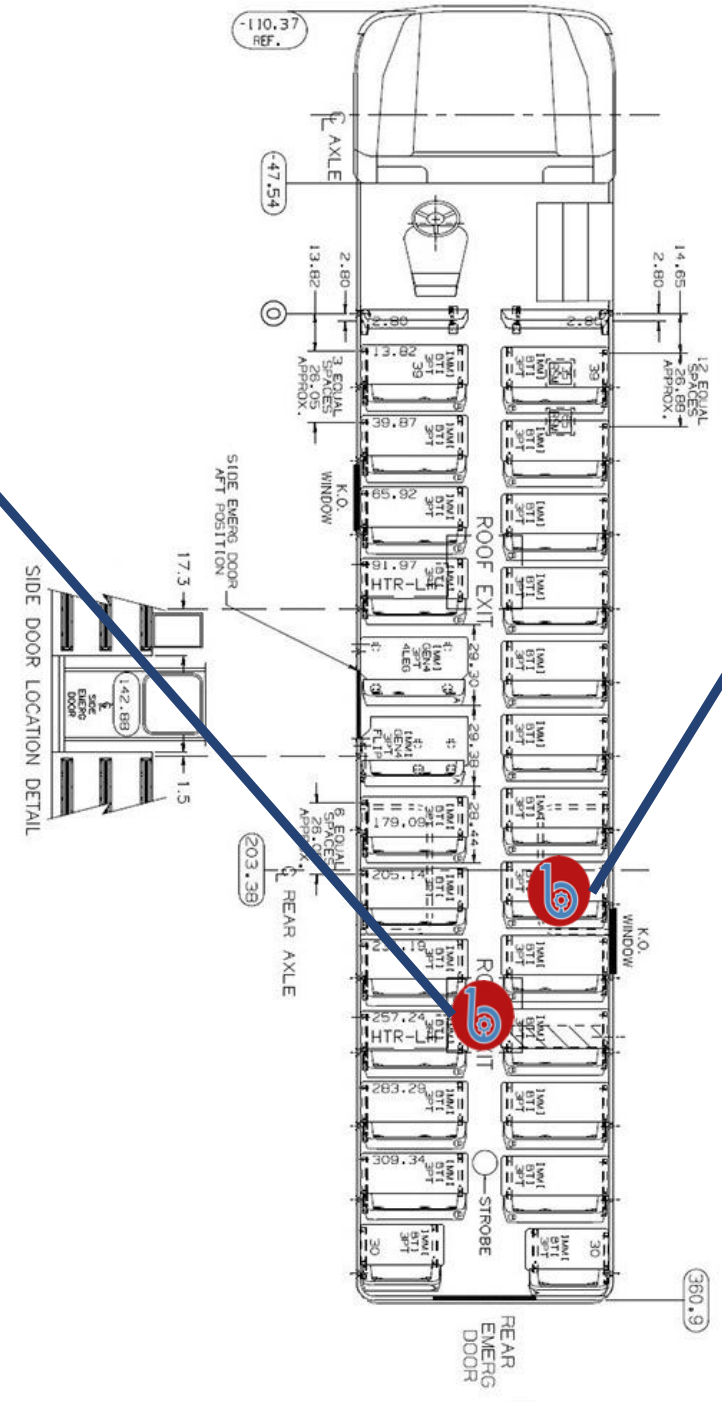
## 5. Seatback
28.8 mg/L $H_2O_2$
**86.4%** Pathogen Elimination



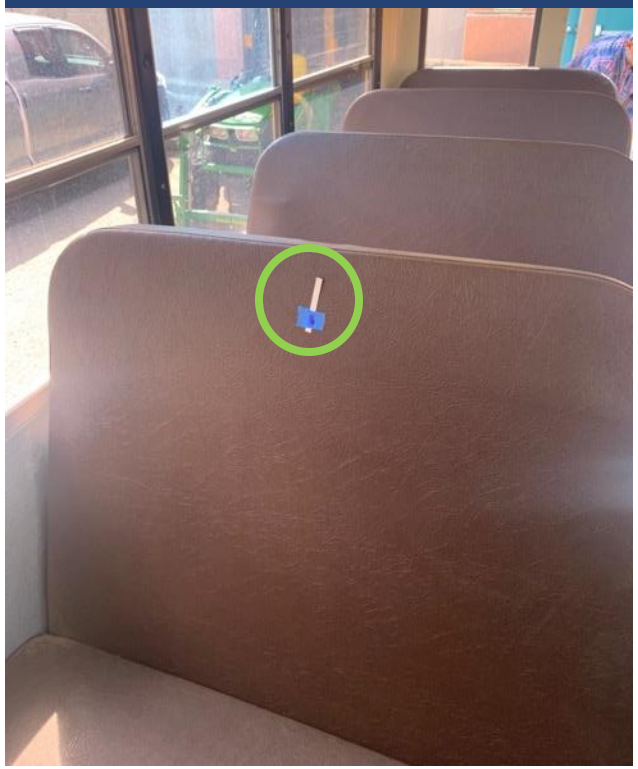



## 6. Seatback
92.7 mg/L $H_2O_2$
**98.7%** Pathogen Elimination

7. Overhead Emergency Exit
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination



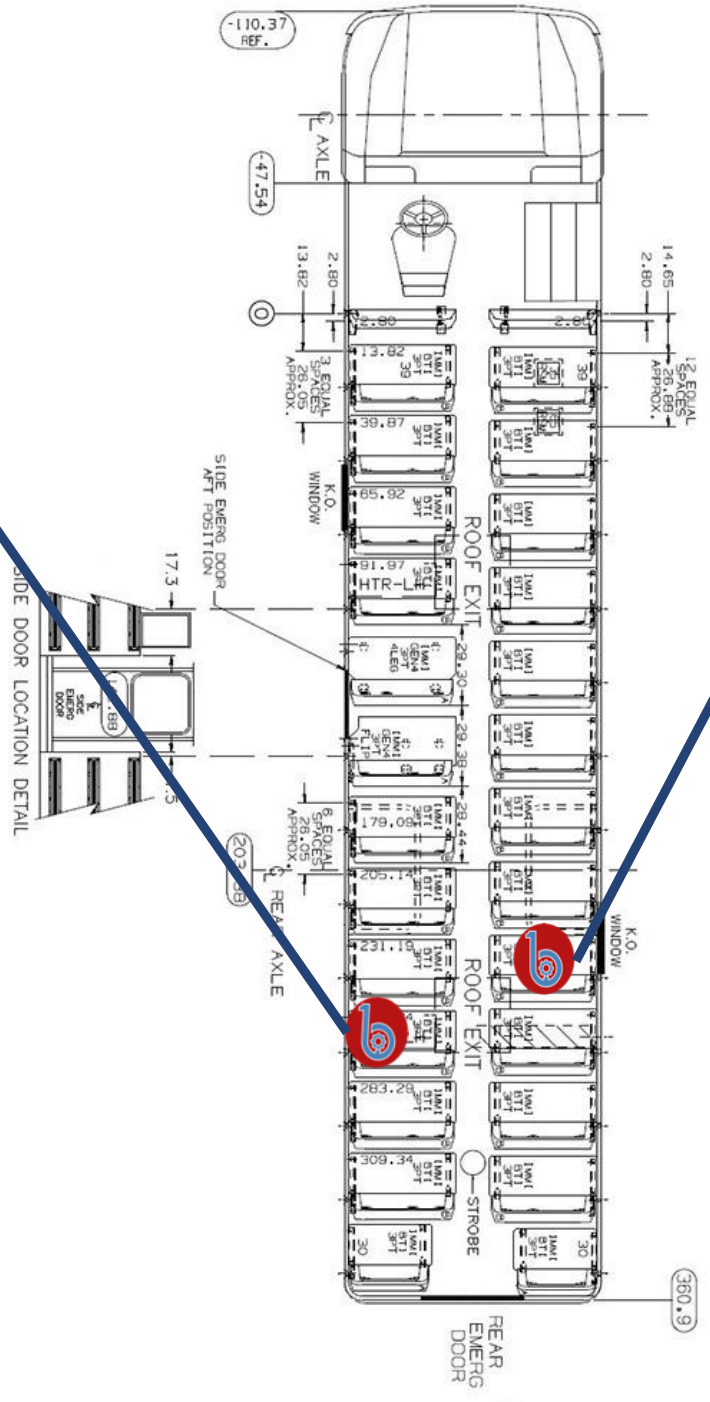

8. Seatback
56.1 mg/L $H_2O_2$
**93.4%** Pathogen Elimination



## 9. Wall

> 99.9 mg/L $H_2O_2$

**99.9%** Pathogen Elimination

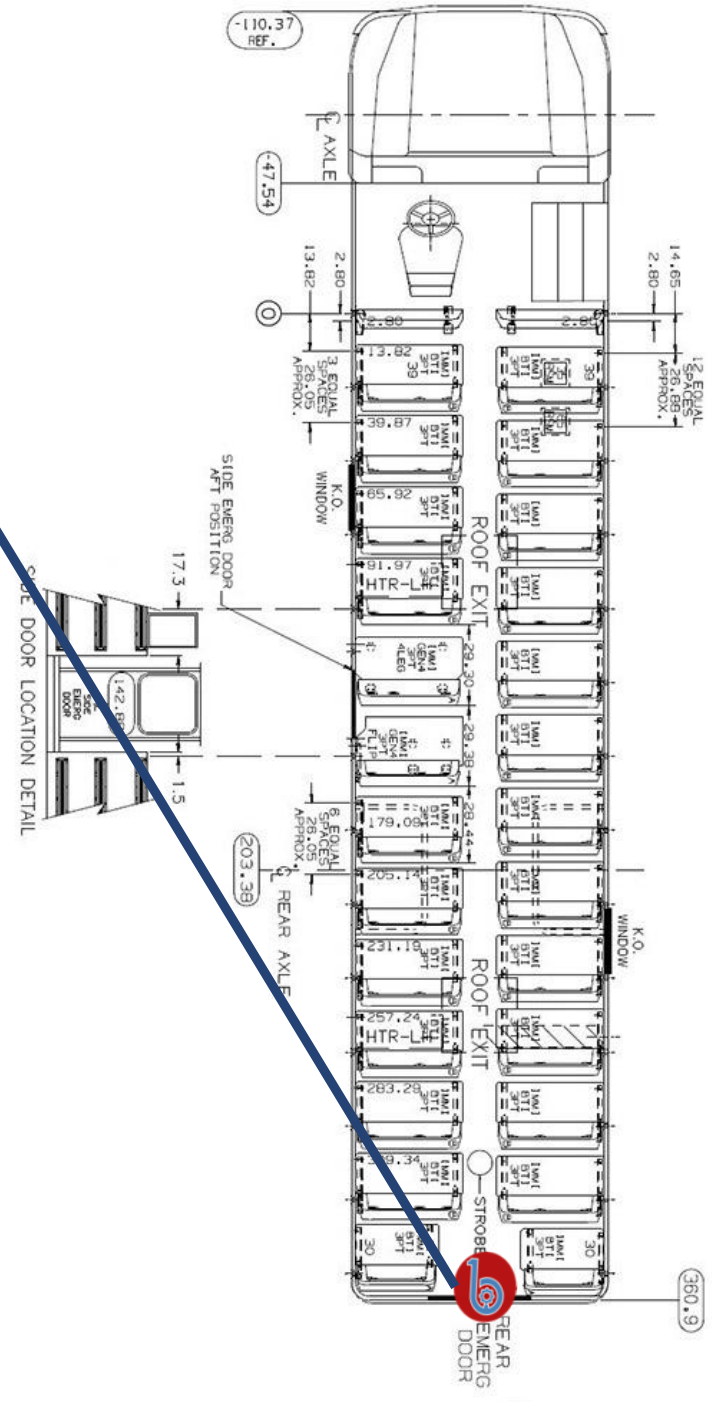



## 10. Seat

65.6 mg/L $H_2O_2$

**95.0%** Pathogen Elimination

## 11. Wall
34.8 mg/L $H_2O_2$
**88.4%** Pathogen Elimination

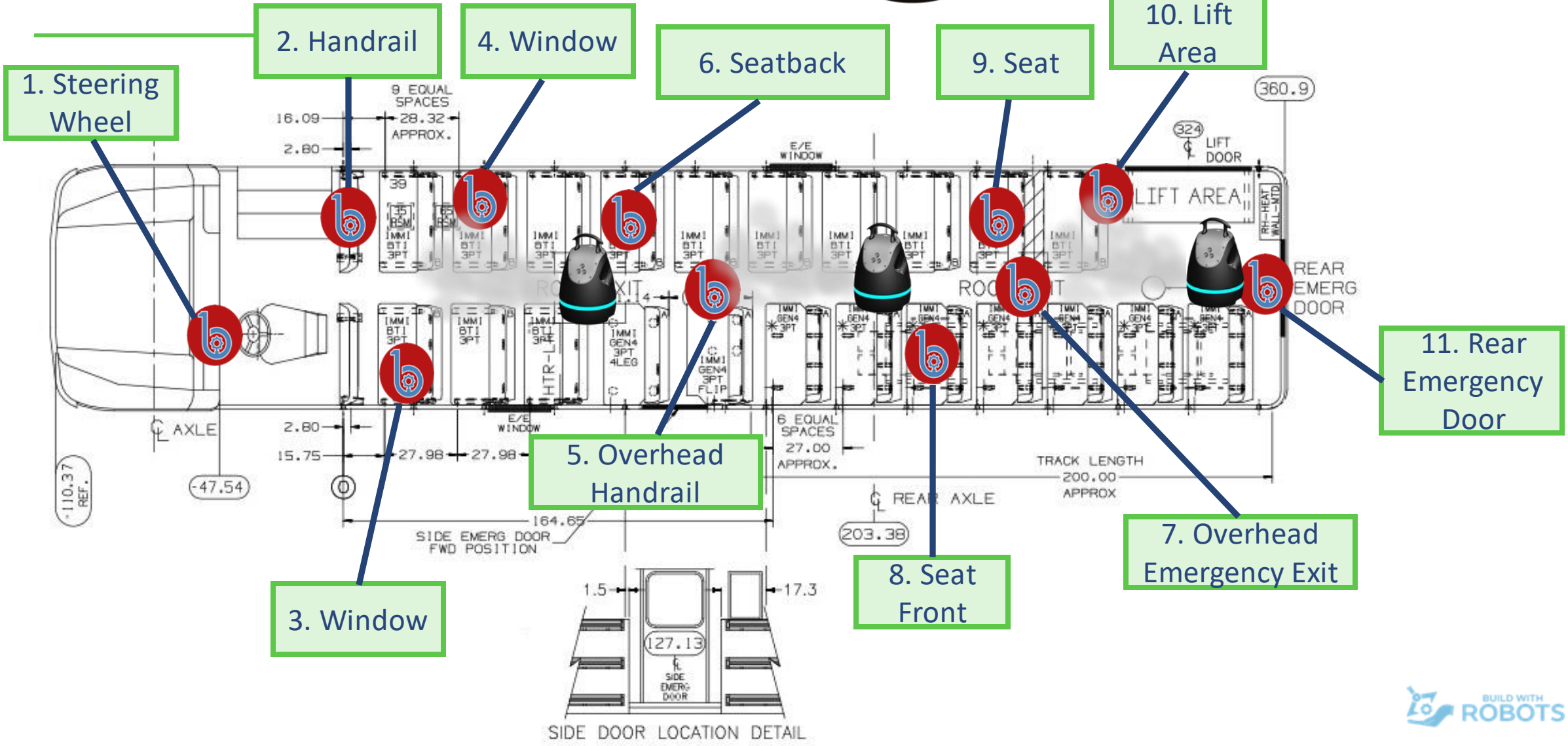

## 12. Control*
< 20 mg/L $H_2O_2$
$H_2O_2$ detection out of range

* A control test strip was used as a benchmark for the remaining test strips. It was placed outside of the bus and fogging area at the same time as the test strips in the bus being fogged. It is expected that the control strip should not show any presence of disinfectant.

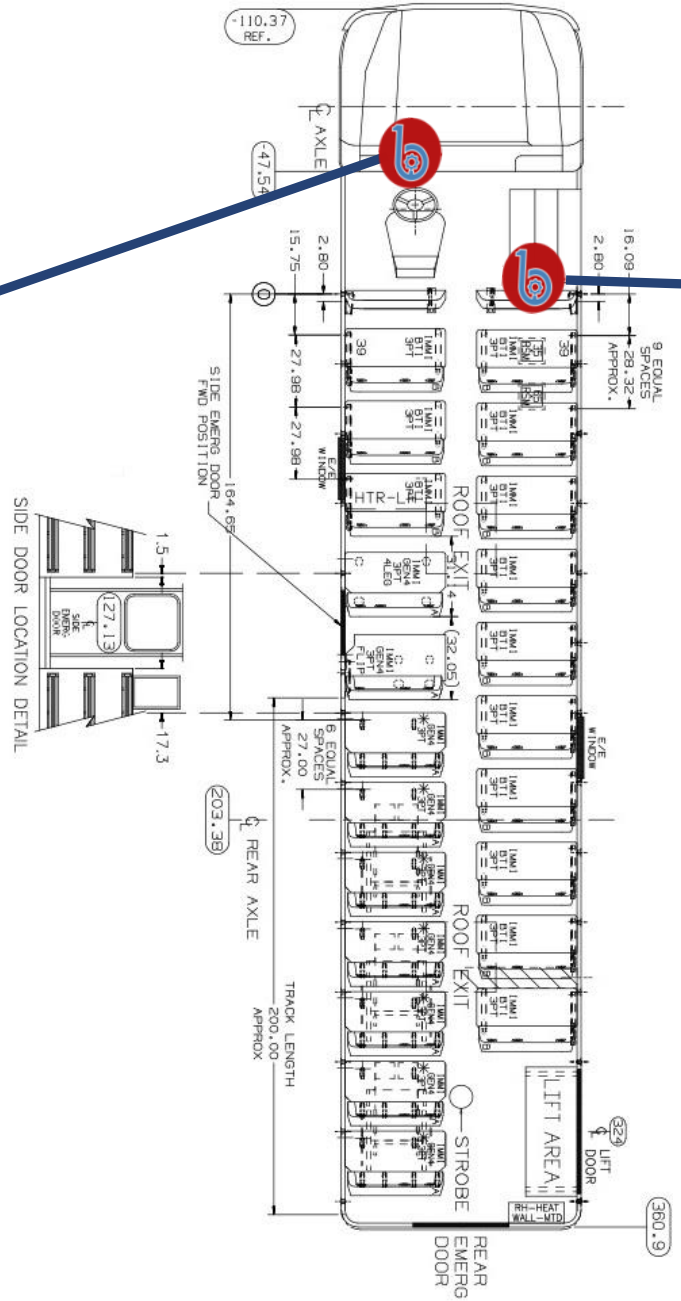
# School Bus Test #2

= Fogging Locations and Direction

= Test Strip Locations

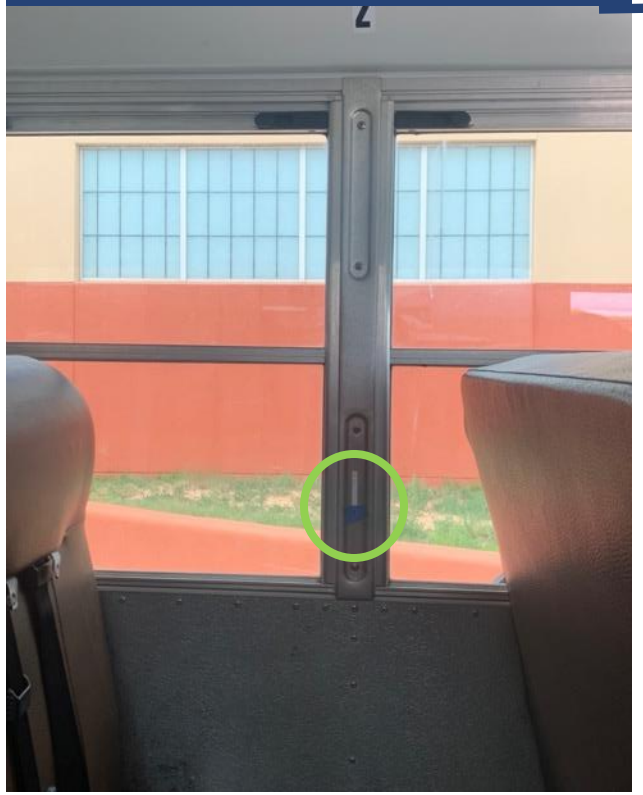


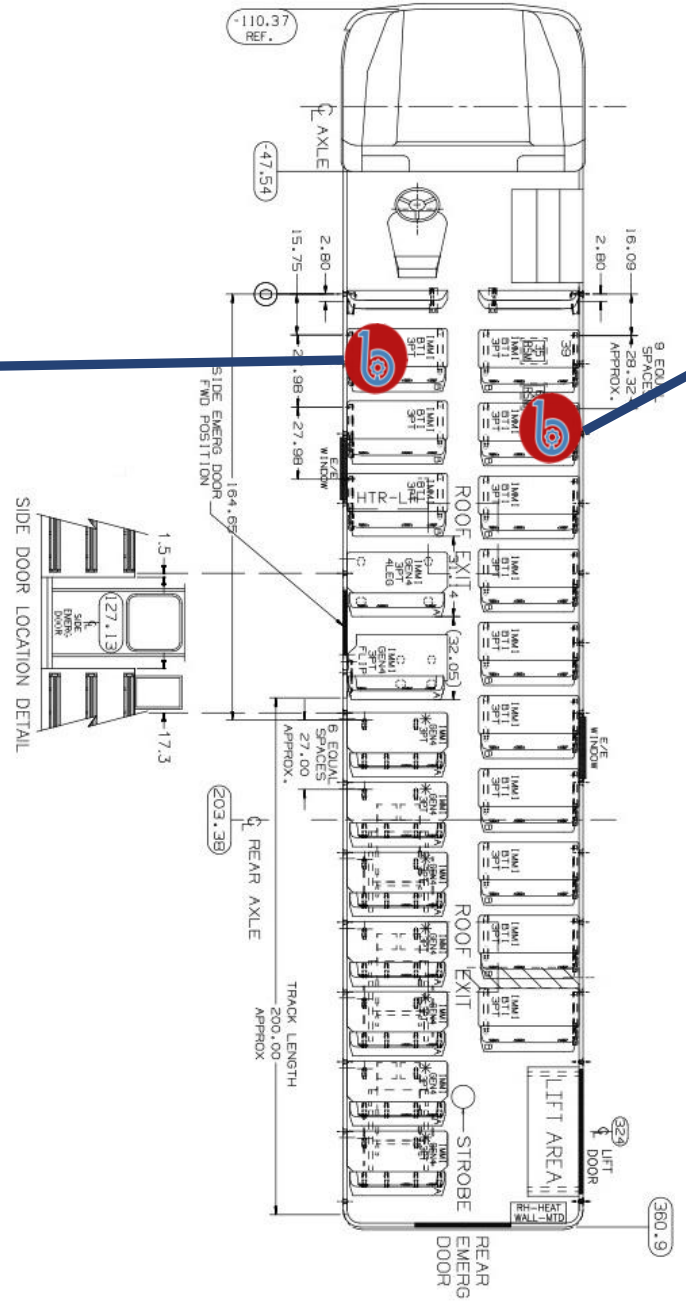
## 1. Steering Wheel
42.4 mg/L $H_2O_2$
**90.5%** Pathogen Elimination




## 2. Handrail
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination

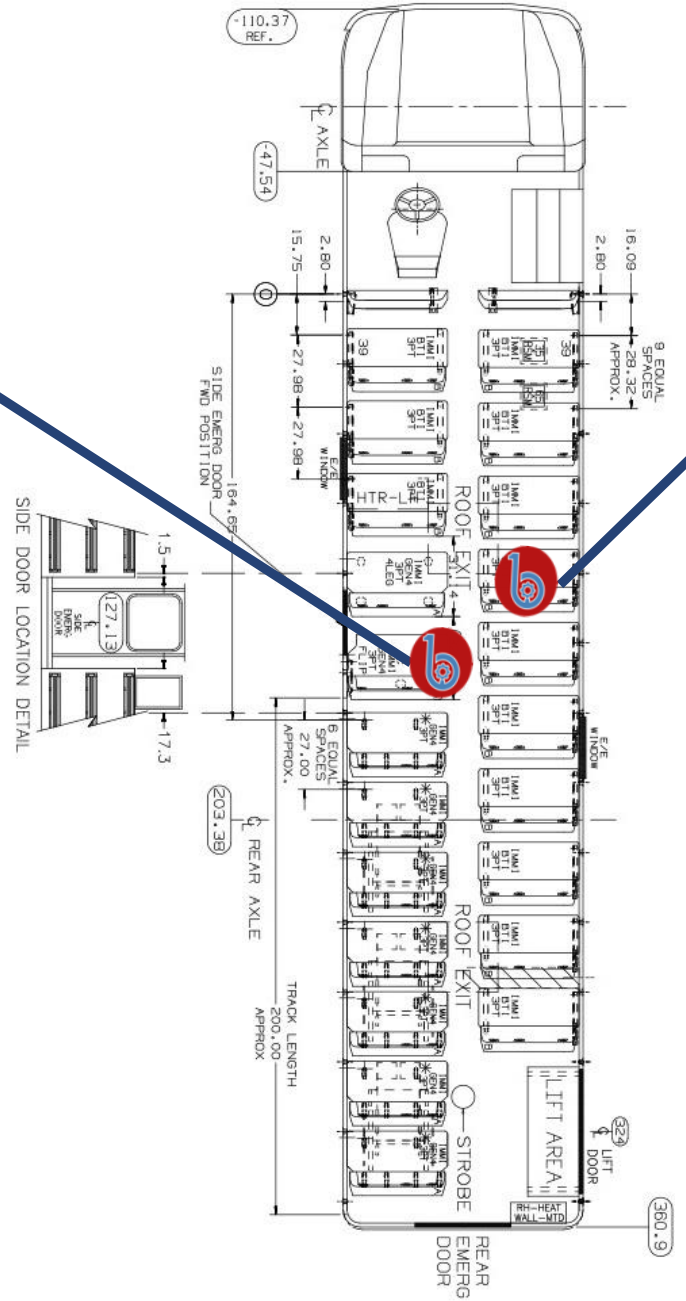
## 3. Window
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination



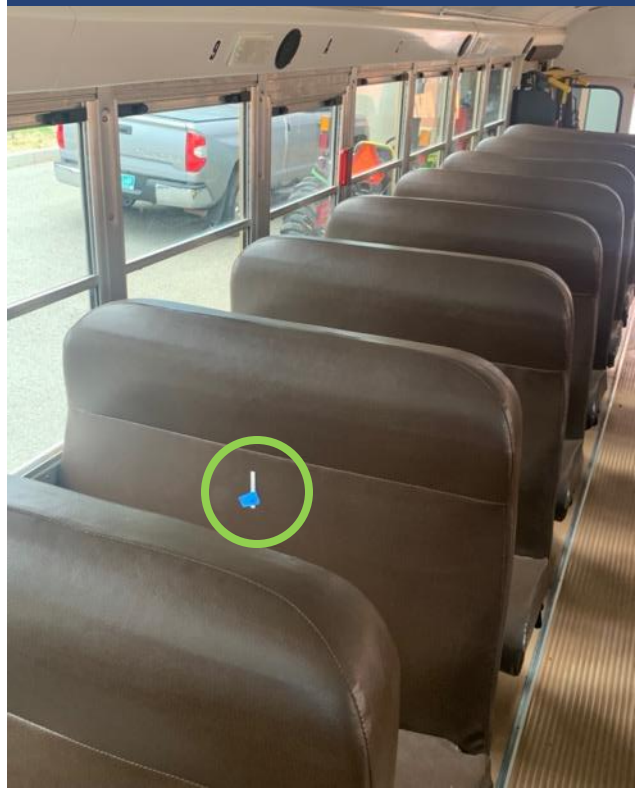



## 4. Window
94.5 mg/L $H_2O_2$
**98.9%** Pathogen Elimination

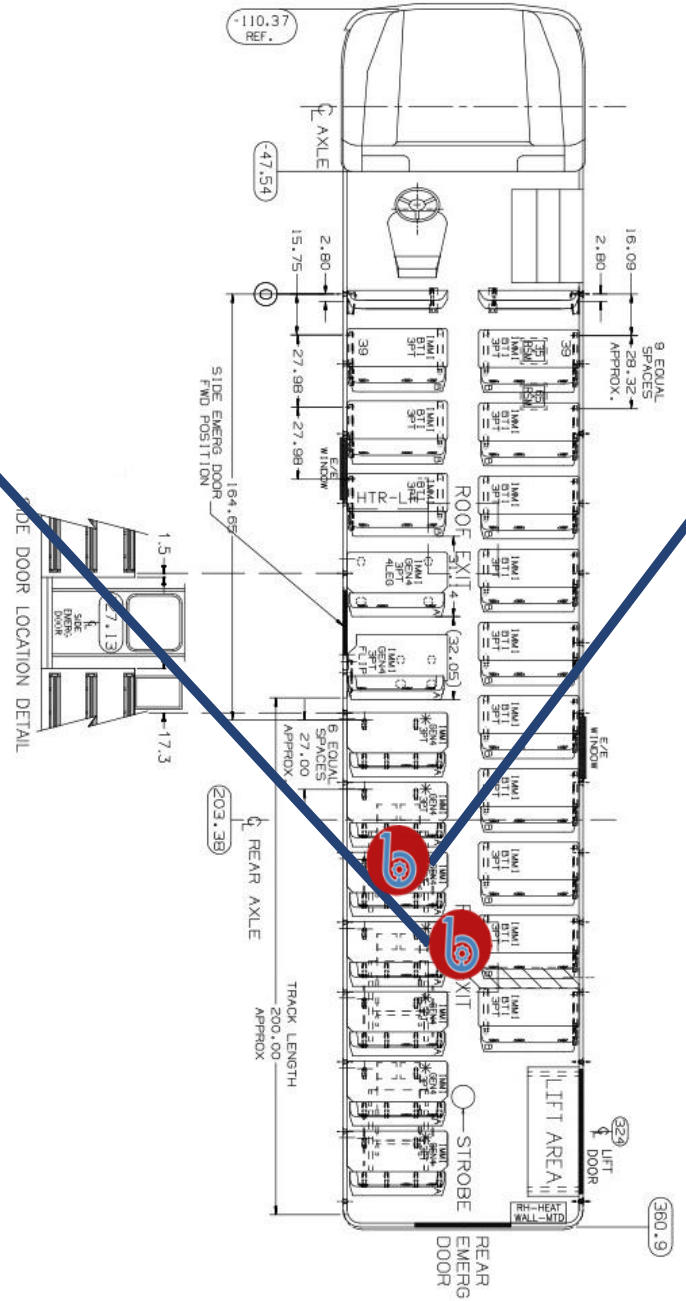
## 5. Overhead Handrail
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination




## 6. Seatback
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination



## 7. Overhead Emergency Exit
94.1 mg/L $H_2O_2$
**98.8%** Pathogen Elimination


## 8. Seat Front
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination

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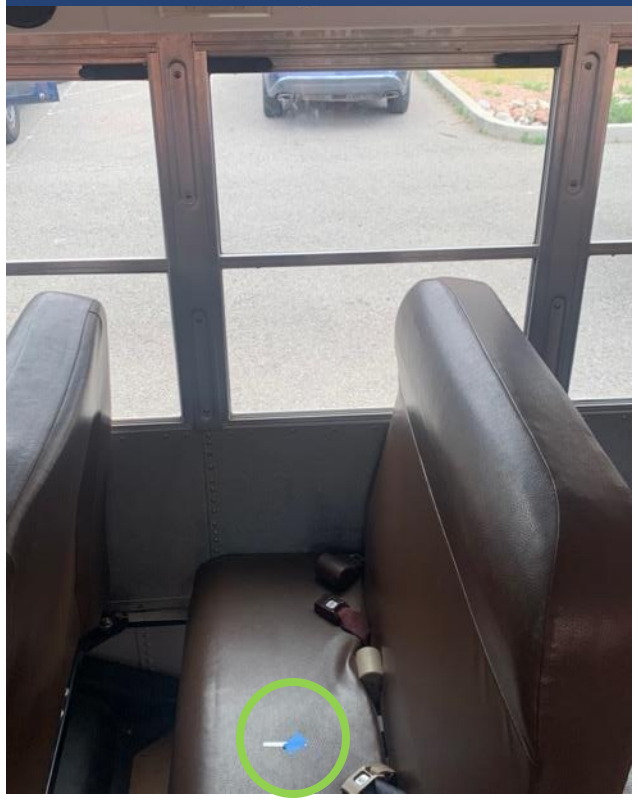
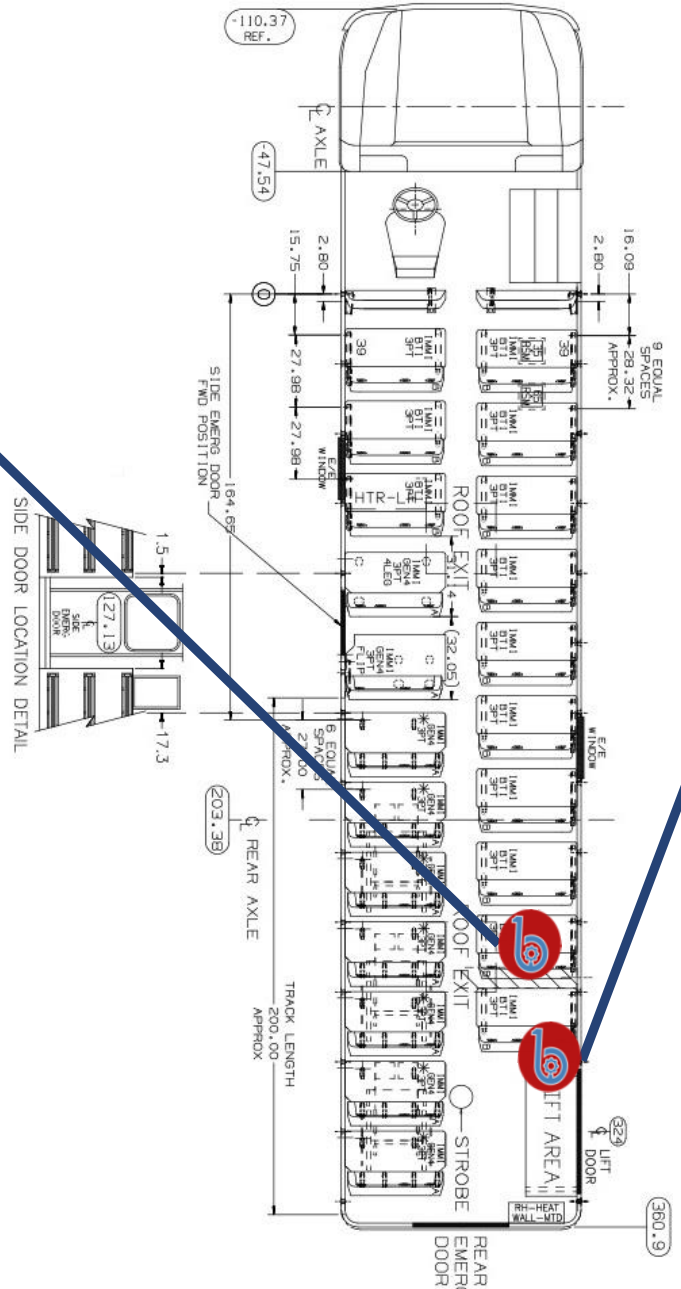
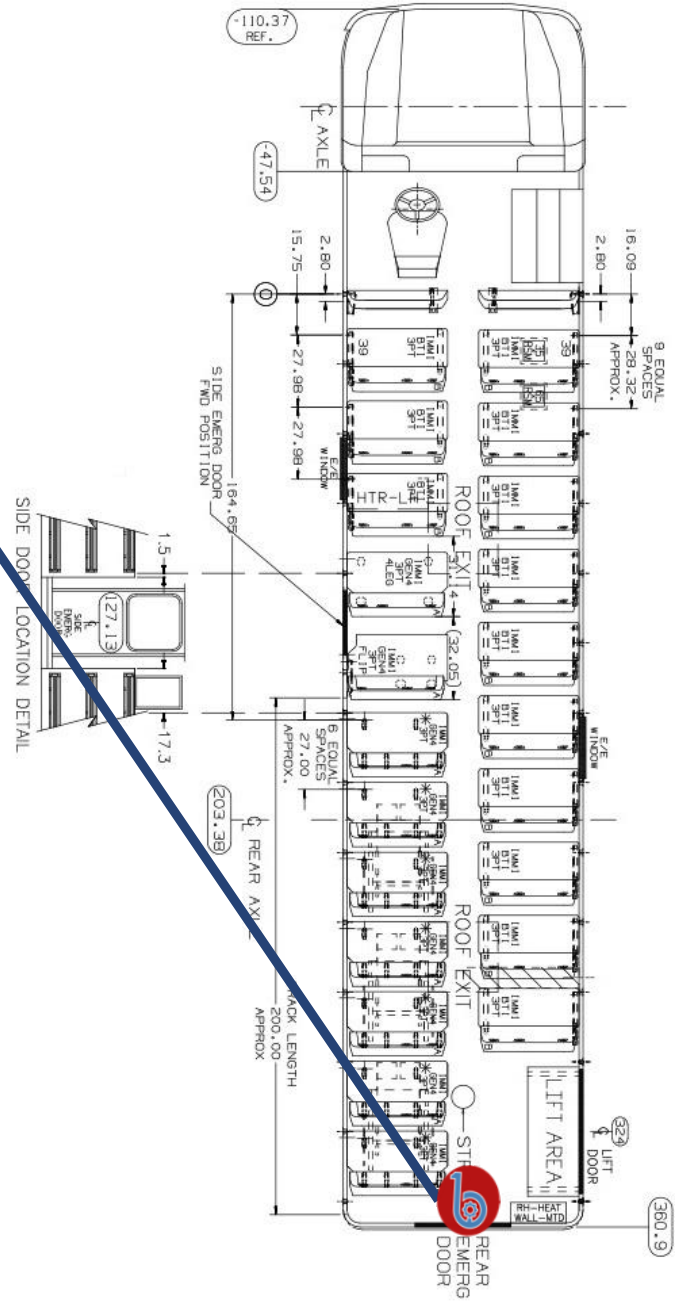
## 9. Seat
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination






## 10. Lift Area
> 99.9 mg/L $H_2O_2$
**99.9%** Pathogen Elimination

## 11. Rear Emergency Door
96.9 mg/L $H_2O_2$
**99.2%** Pathogen Elimination


## 12. Control*
< 20 mg/L $H_2O_2$
$H_2O_2$ detection out of range

* A control test strip was used as a benchmark for the remaining test strips. It was placed outside of the bus and fogging area at the same time as the test strips in the bus being fogged. It is expected that the control strip should not show any presence of disinfectant.

# Conclusions

It is recommended that to ensure 99.9% efficacy throughout the school bus, fogging should be done from three locations within the bus for 10 seconds each (1/3 of the way back, 2/3rds of the way back, and from the back of the bus). In addition, we recommend that the front of the school bus be fogged for 10 seconds through the front door and towards the driver's compartment. For 40 seconds of total fogging time, you have 99.9% efficacy throughout the school bus.

# Laboratory Testing Summary
# EPA Registration No. 90748-1

Breezy BioCare™ RTU can be found on EPA List N and List Q of disinfectants and is Green Clean Certified.*

Tested method: AOAC Germicidal Spray conducted in a Good Laboratory Practice (GLP) facility.
Recommended method: Fogging

| PATHOGEN | SOIL / LOAD CONTACT TIME | CONCLUSION |
|---|---|---|
| **Staphylococcus aureus** (Blood infections, sepsis) | 5% Soil Load / 2 minutes | ✓ Successful Disinfection |
| **Pseudomonas aeruginosa** (Blood and lung infections) | 5% Soil Load / 2 minutes | ✓ Successful Disinfection |
| **Salmonella enterica** (Salmonella) | 5% Soil Load / 2 minutes | ✓ Successful Disinfection |
| **Trichophyton mentagrophytes** (Fungi causing ringworm) | 5% Soil Load / 2 minutes | ✓ Successful Disinfection |
| **Listeria monocytes** (Infection to bloodstream, sepsis) | 5% Soil Load / 2 minutes | ✓ Successful Disinfection |
| **Methicillin-resistant Staphylococcus aureus** (MRSA) | 5% Soil Load / 5 minutes | ✓ Successful Disinfection |
| **Respiratory Syncytial Virus** (RSV) | 5% Soil Load / 5 minutes | ✓ Successful Disinfection |
| **Escherichia coli** (E. coli) | 5% Soil Load / 5 minutes | ✓ Successful Disinfection |
| **H1N1** (Swine flu) | 5% Soil Load / 5 minutes | ✓ Successful Disinfection |
| **Human Coronavirus** (COVID-19) | 5% Soil Load / 5 minutes | ✓ Successful Disinfection |
| **Rhinovirus** (Common cold) | 5% Soil Load / 10 minutes | ✓ Successful Disinfection |
| **Feline calicivirus/Human norovirus** (Gastrointestinal bug) | 5% Soil Load / 10 minutes | ✓ Successful Disinfection |

**Breezy BioCare™ RTU appears on these lists under its EPA registration number (#90748-1).*



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