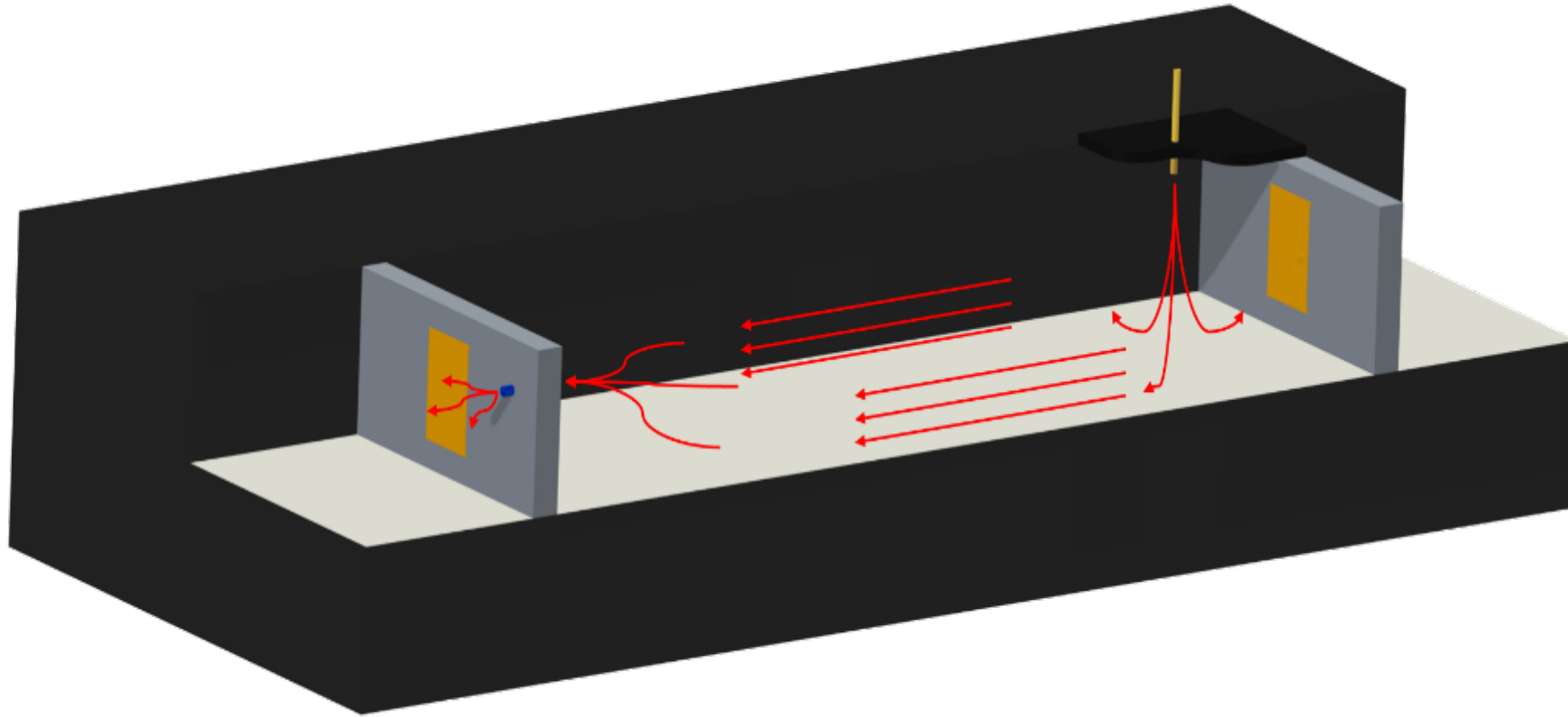
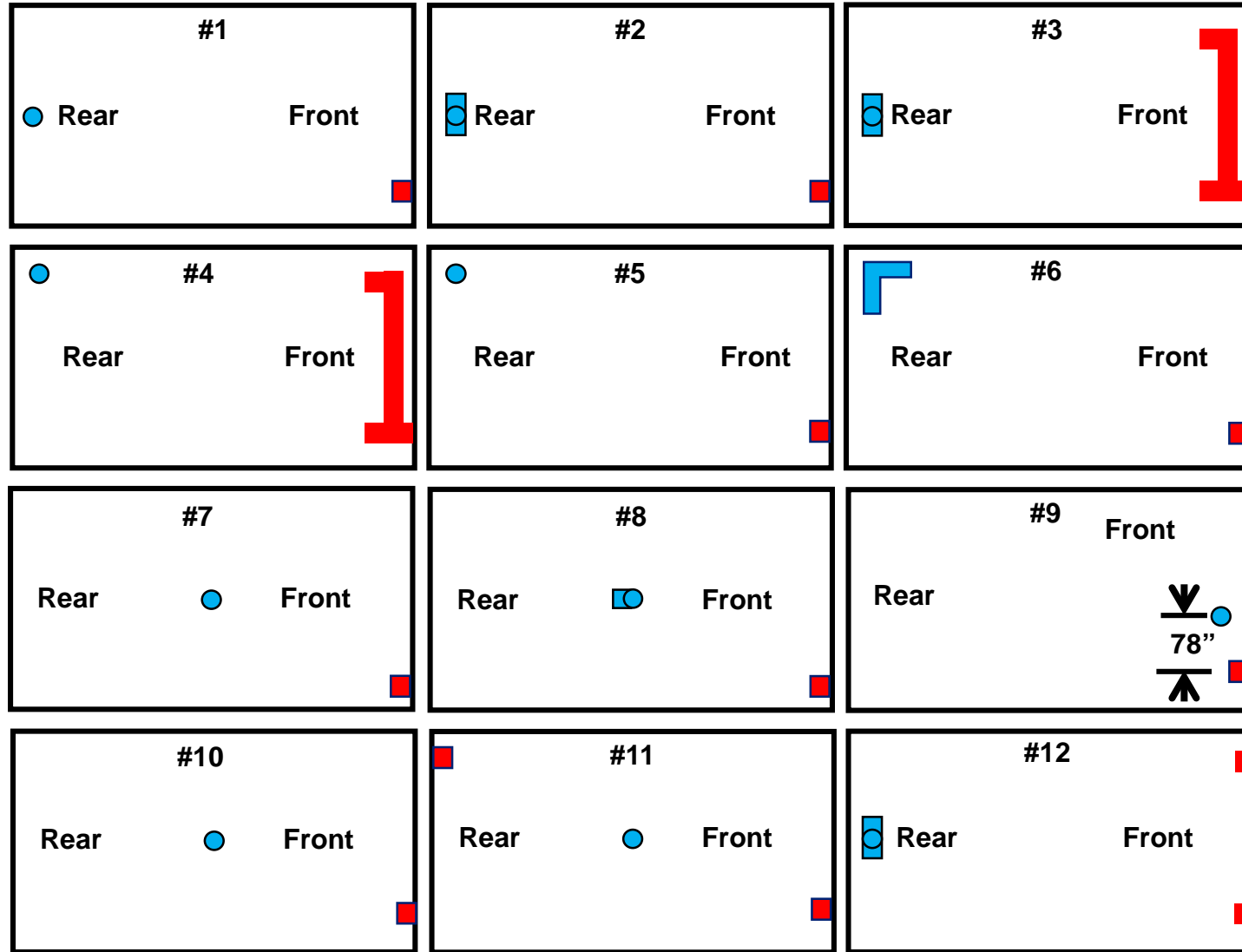


NIOSH is conducting research on contamination purging to ensure that BIP RAs can provide a breathable environment

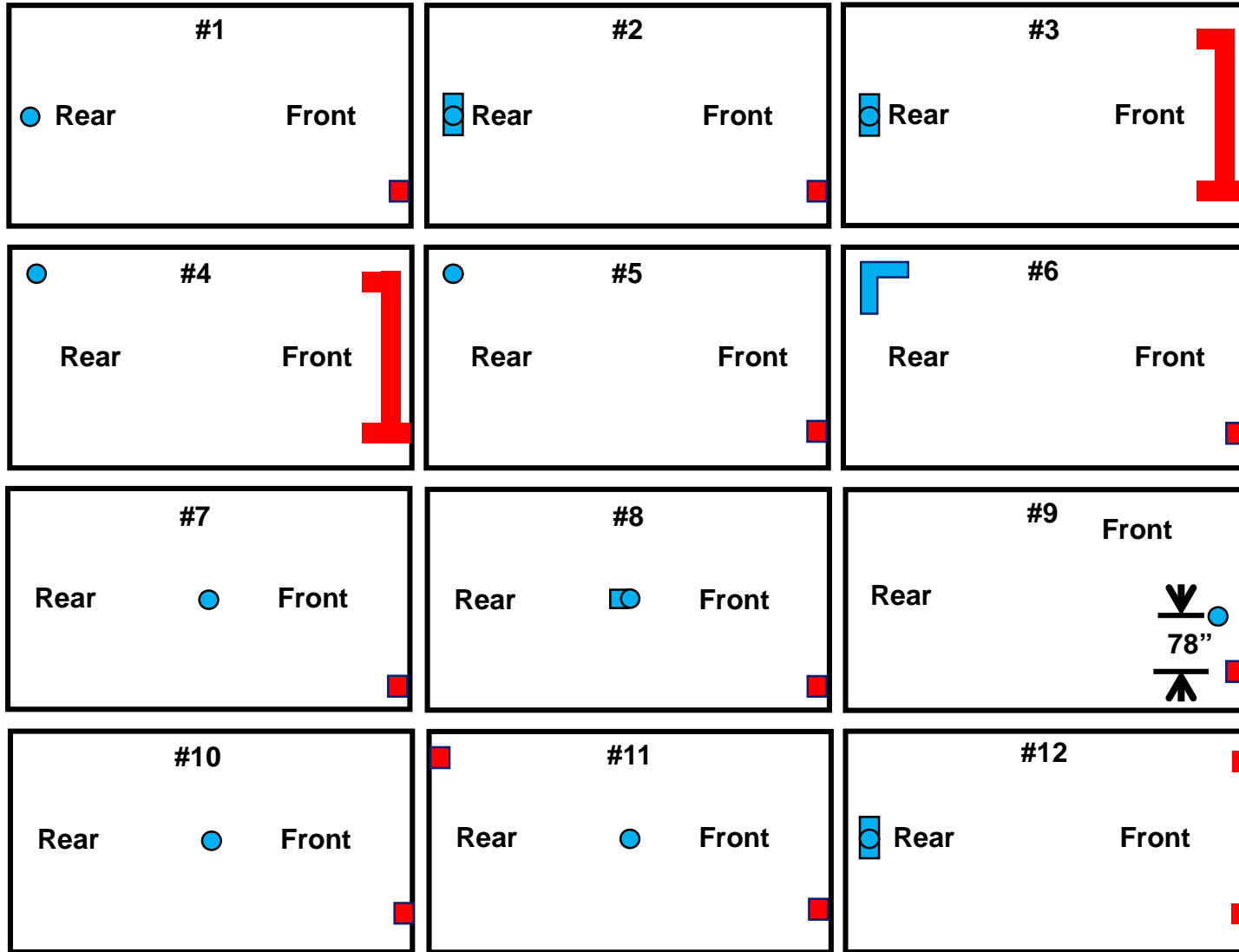


# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



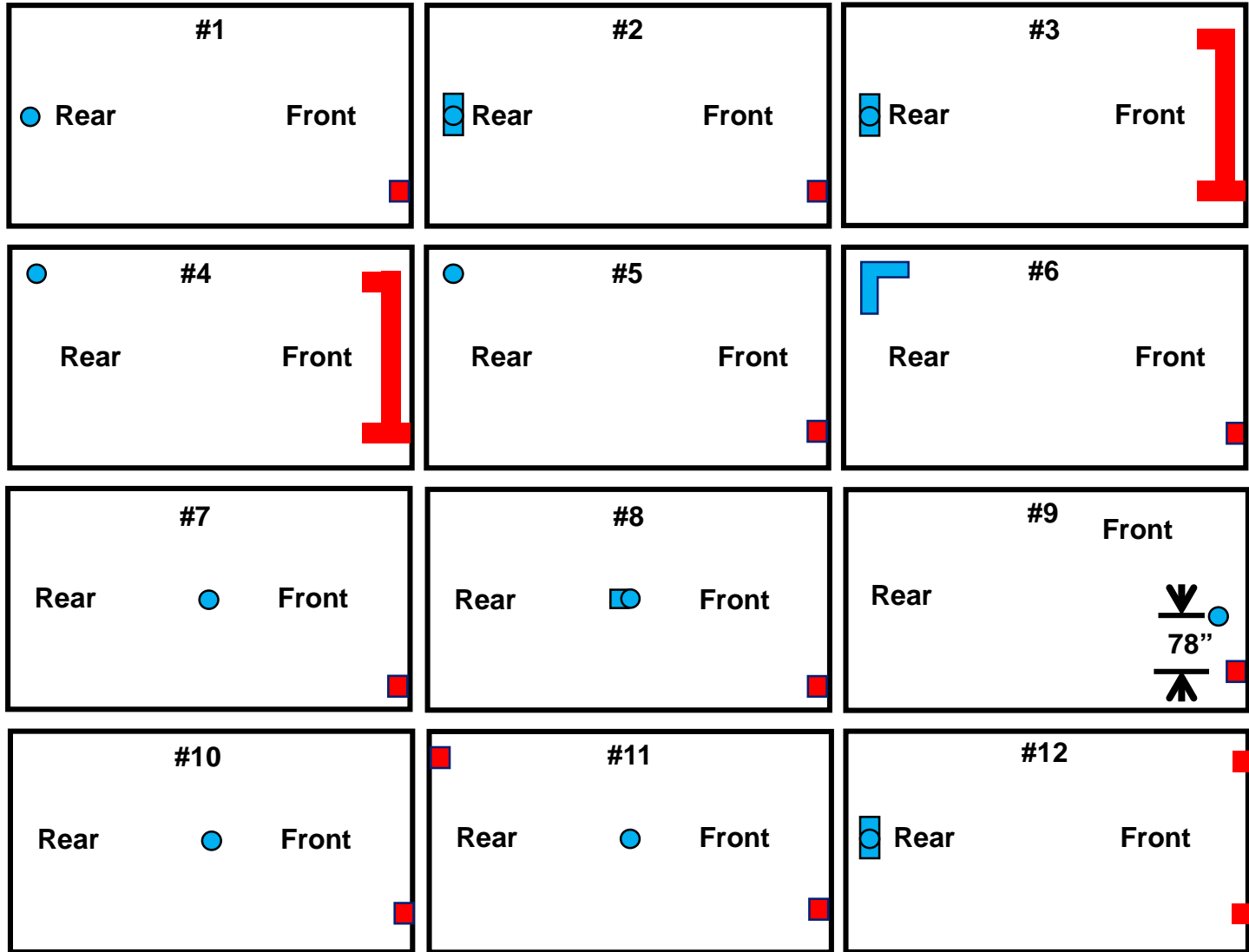
- Air inlet: geometric shapes in blue
- Air outlet: the geometric shapes in red

# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



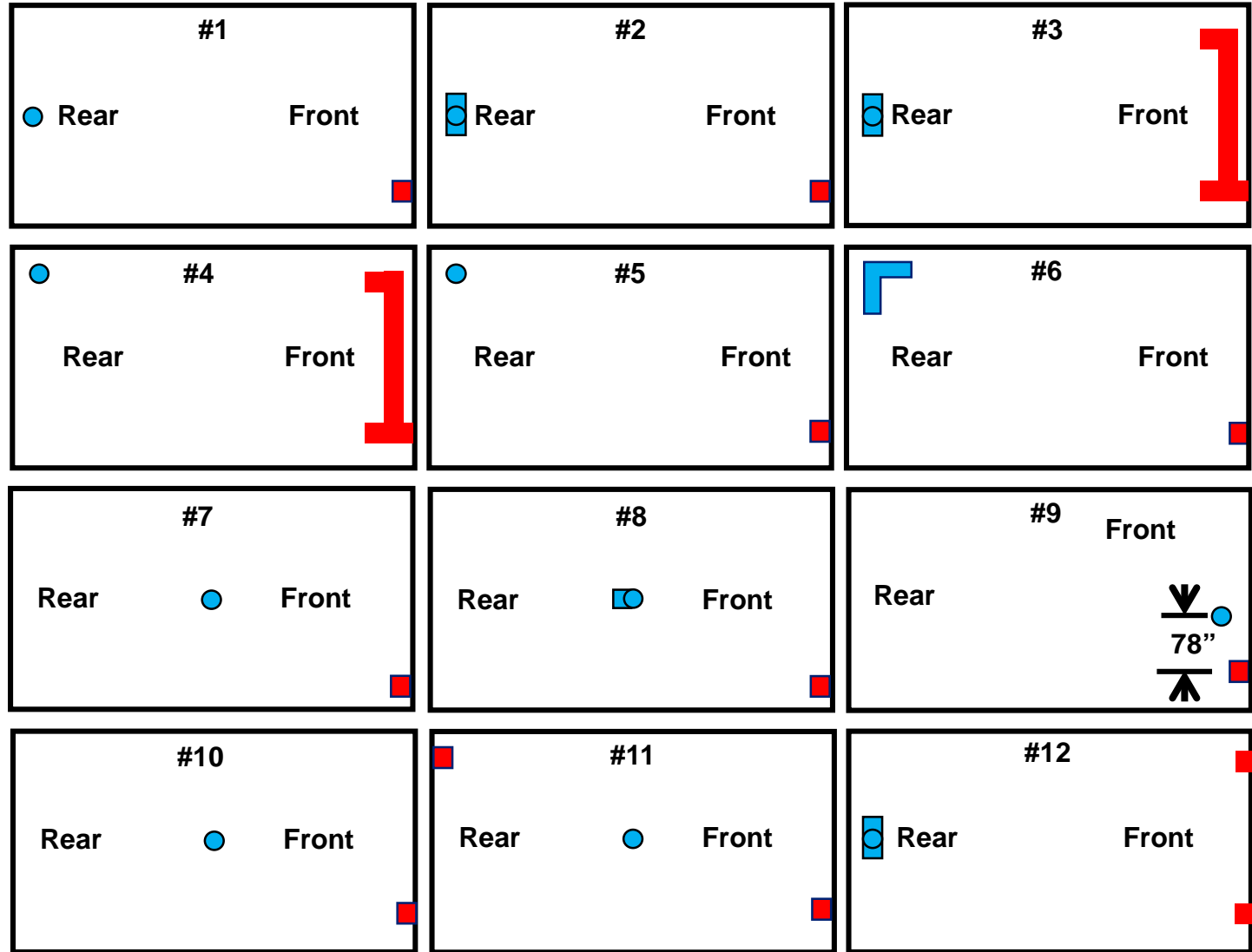
Air inlet for VSC #1

# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



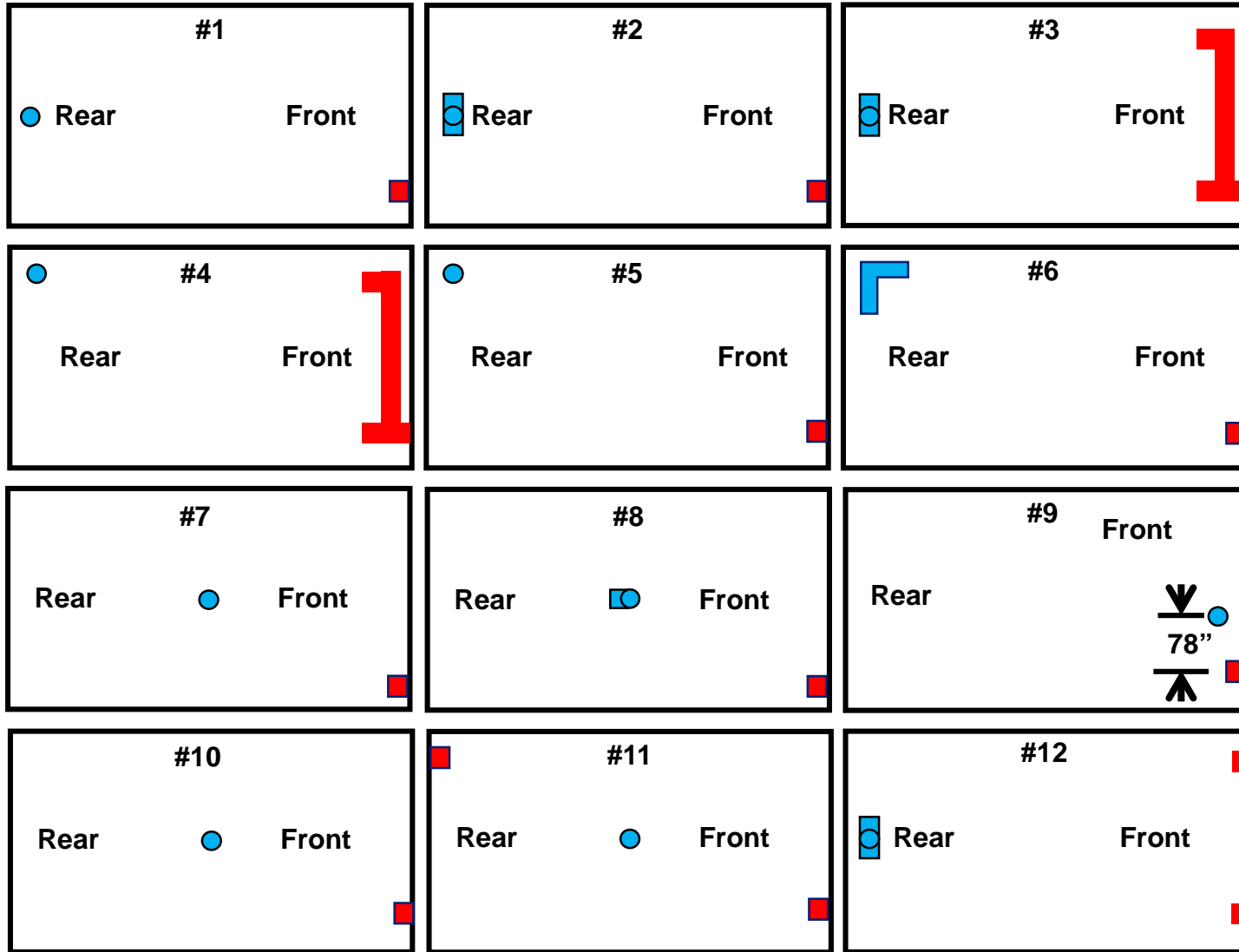
**Air outlet for VSC #1, 2, 5, 6, 7, 8, 9, 10, 11, 12**

# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



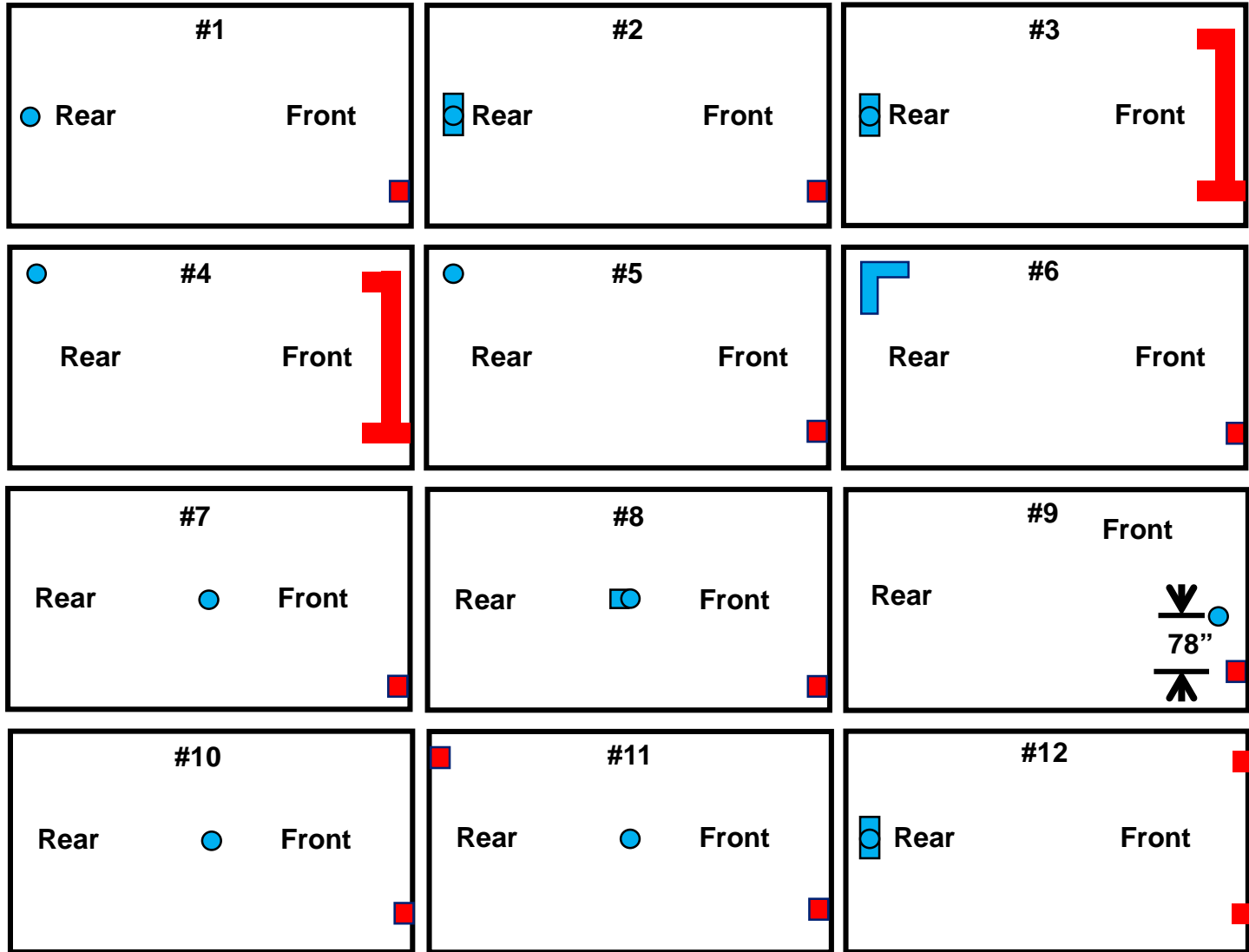
Air inlet for VSC #2, 3, 12

# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



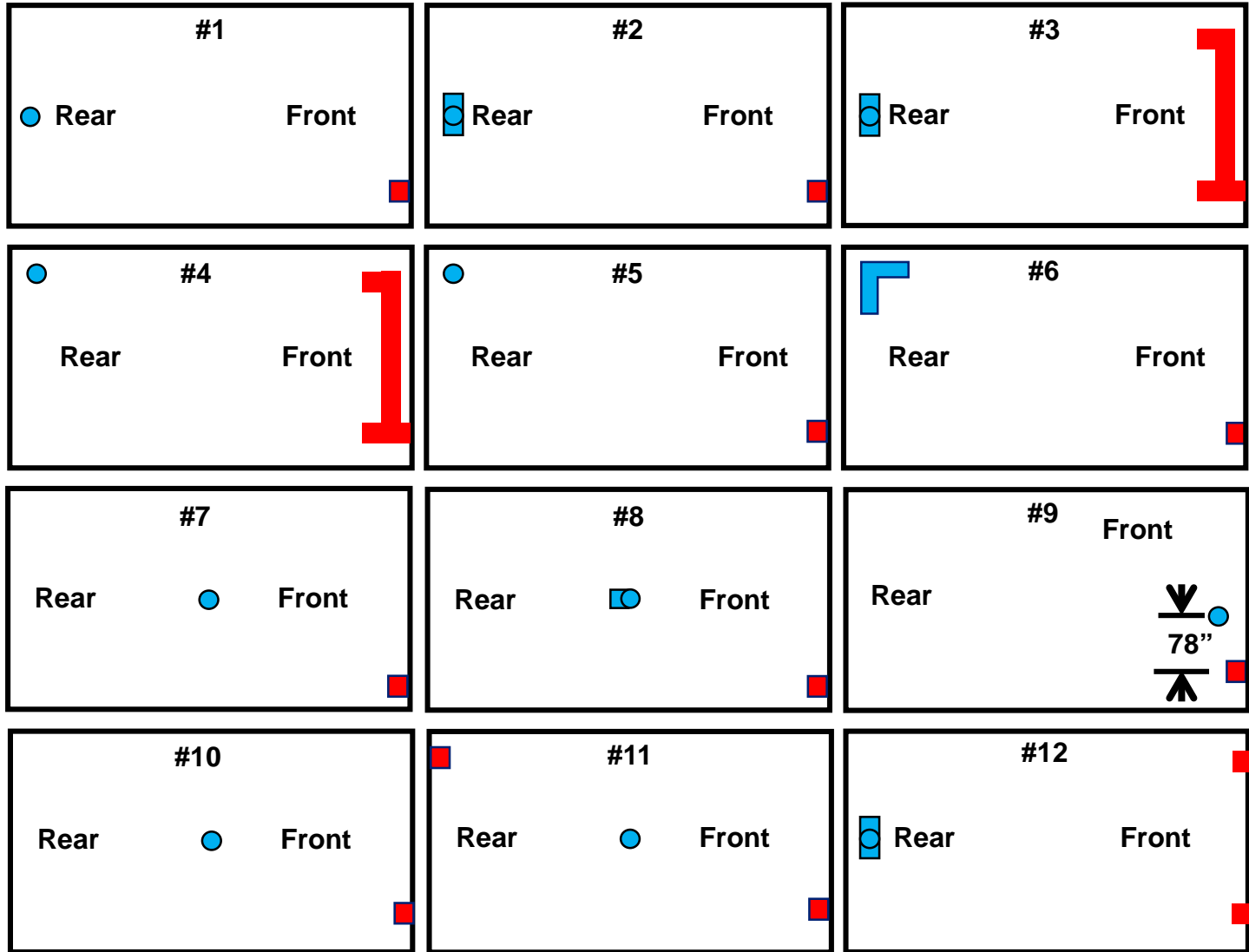
Y-shaped air outlet for VSC #3, 4

# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



Air inlet for VSC #4, 5

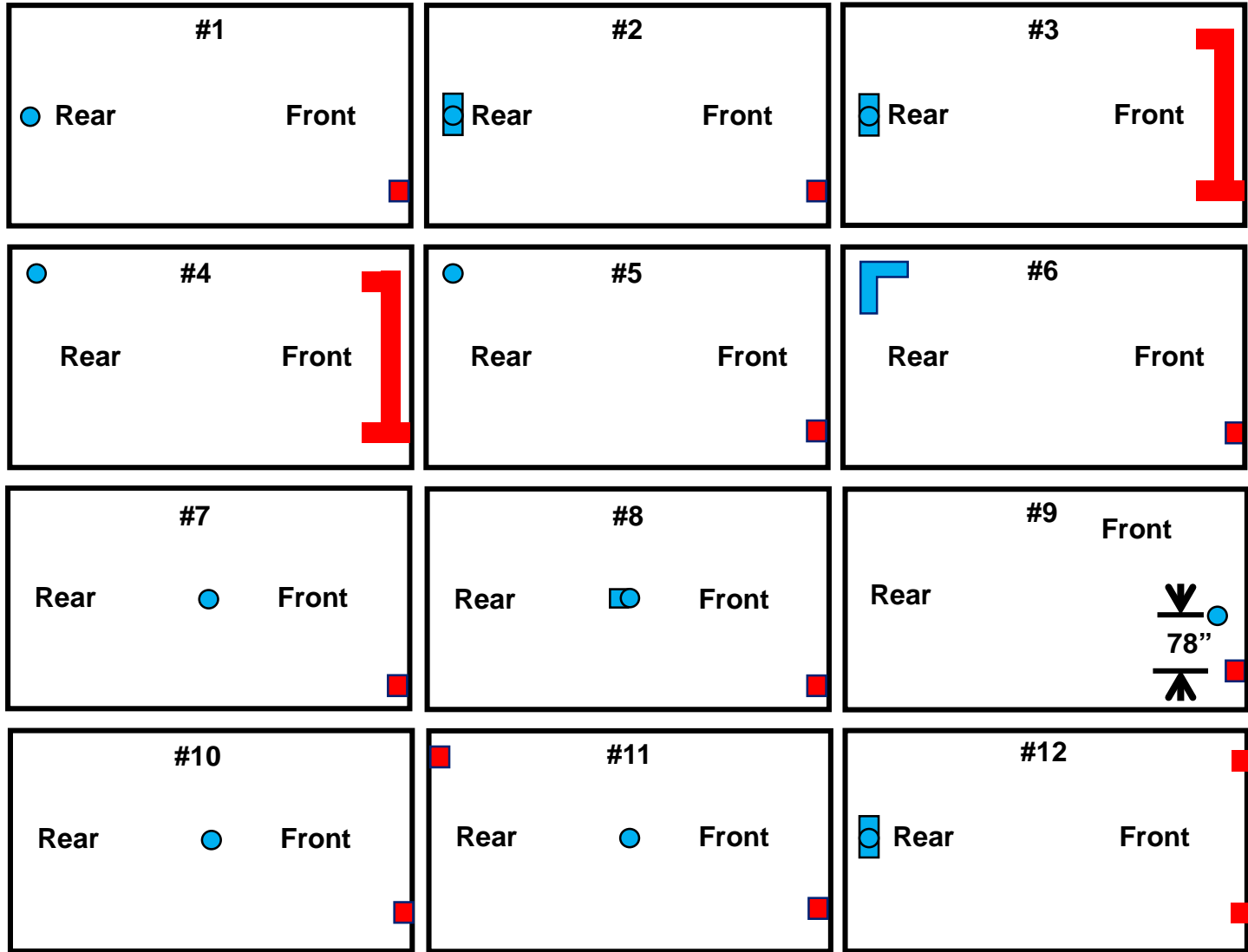
# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



**L-shaped air inlet for VSC #6**

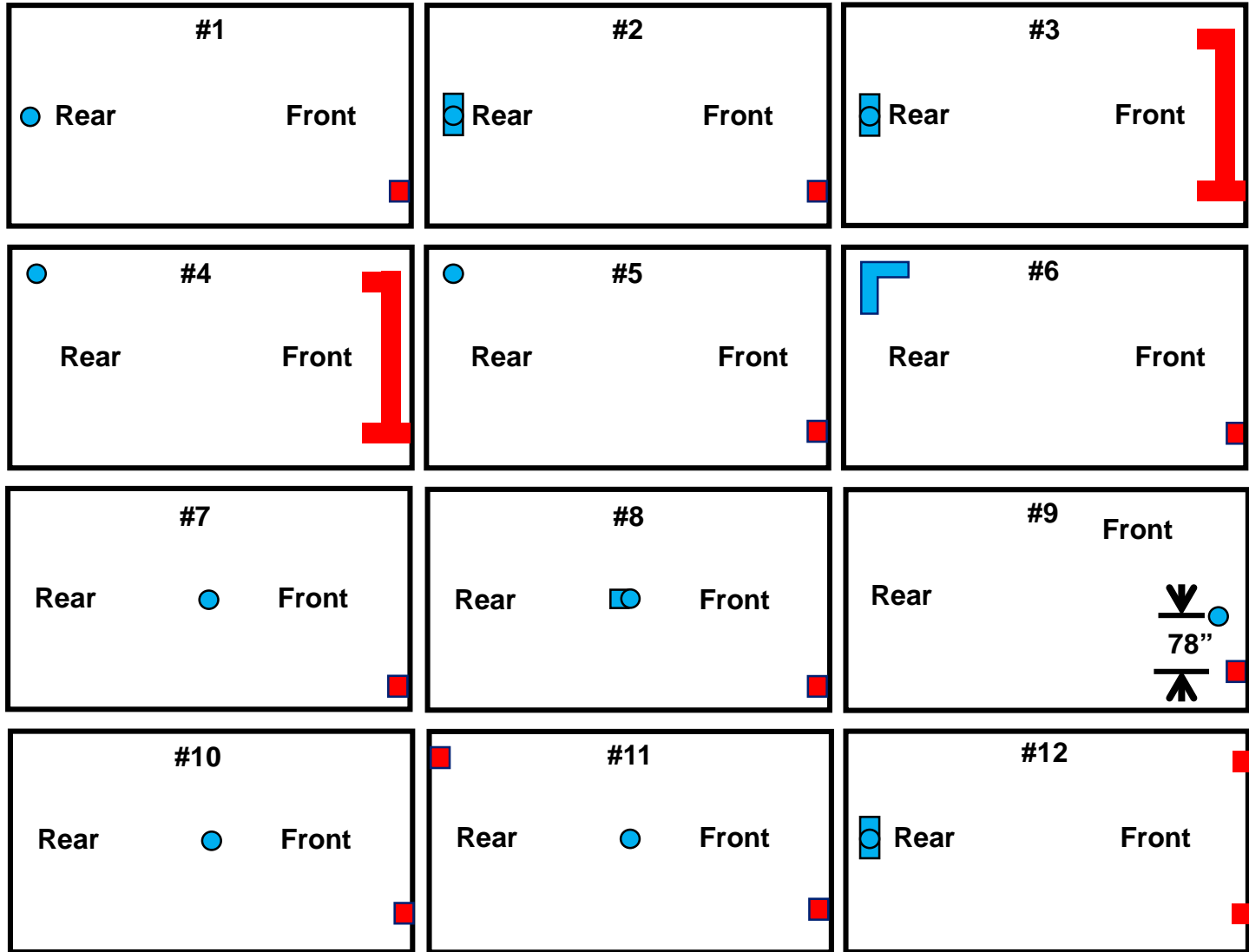


# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



Air inlet for VSC #7, 10, 11

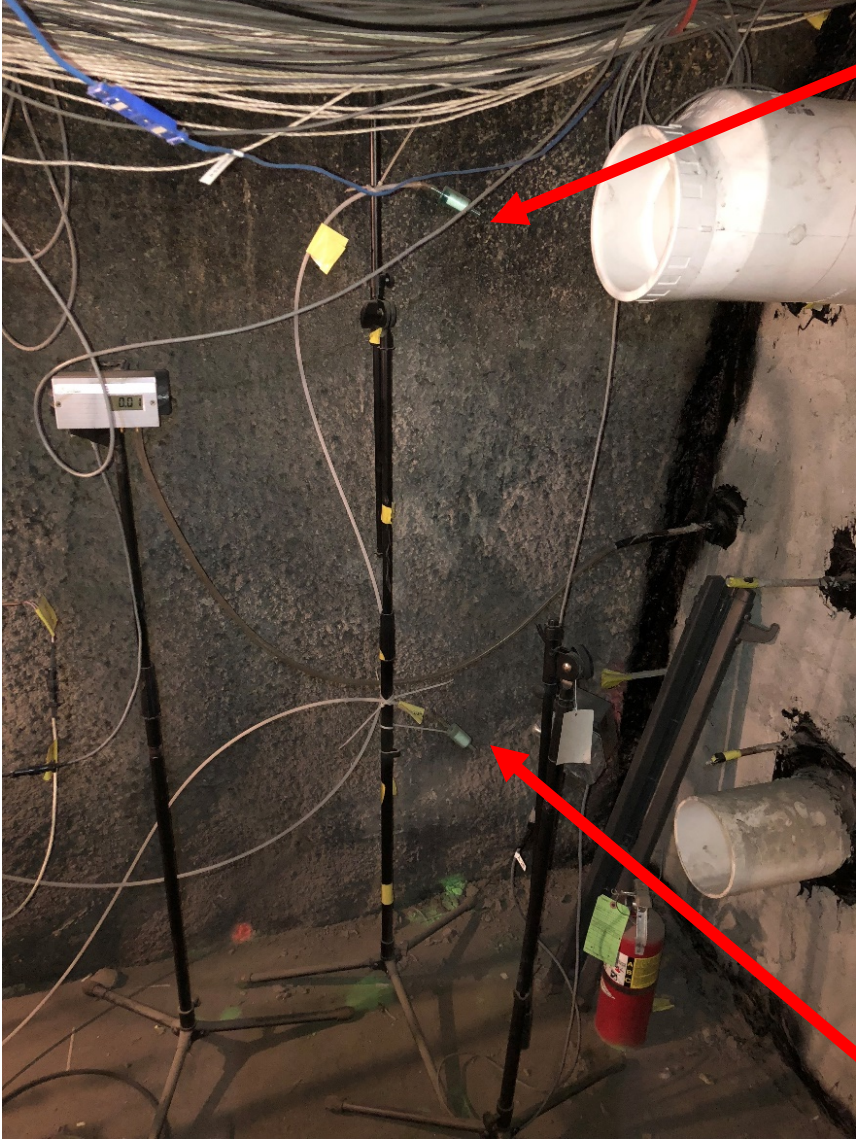
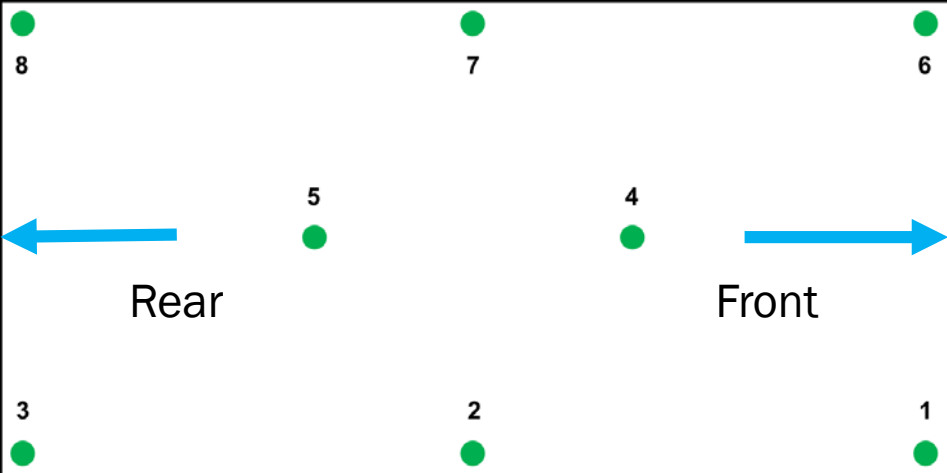
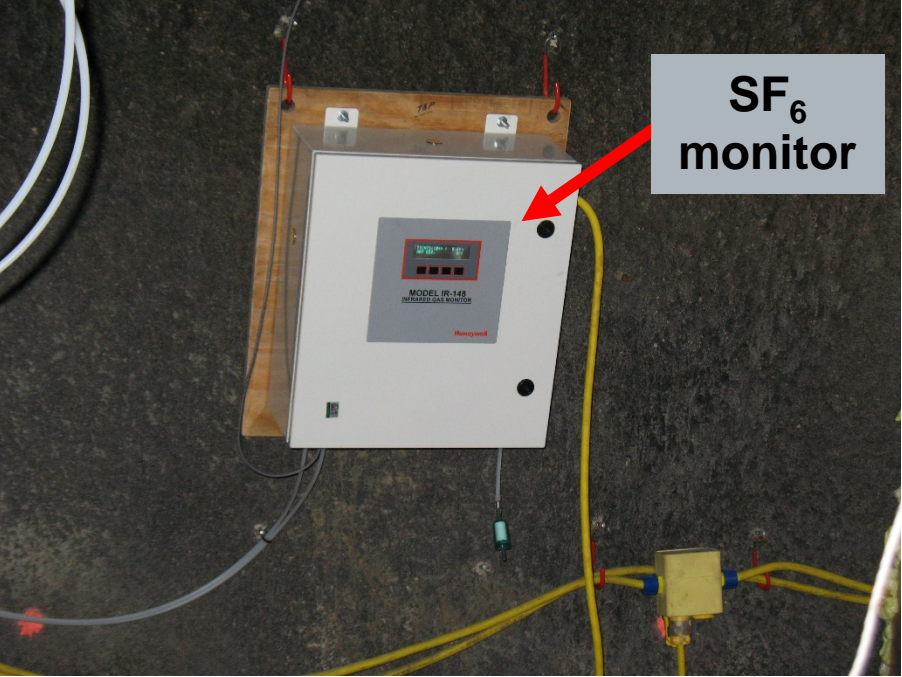
# Purging research was conducted on 12 ventilation system configurations (VSCs) to examine the variation in purge time and presence of stagnant areas



Air inlet for VSC #8

# Eight SF<sub>6</sub> monitors were used to read the concentration level at 16 locations

*Note: For safety purposes, SF<sub>6</sub> tracer gas was used as a surrogate for CO*

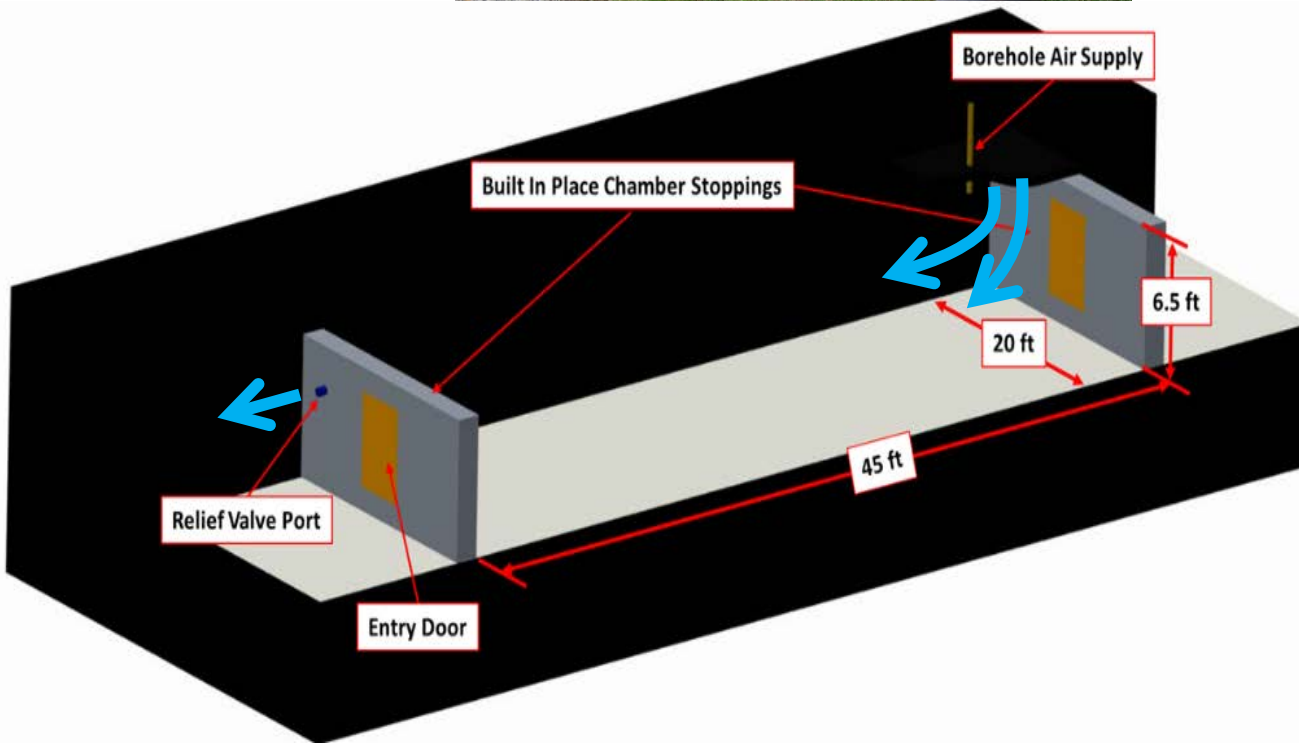


# A borehole air supply was used to provide flow rates of 750 SCFM and 1,000 SCFM

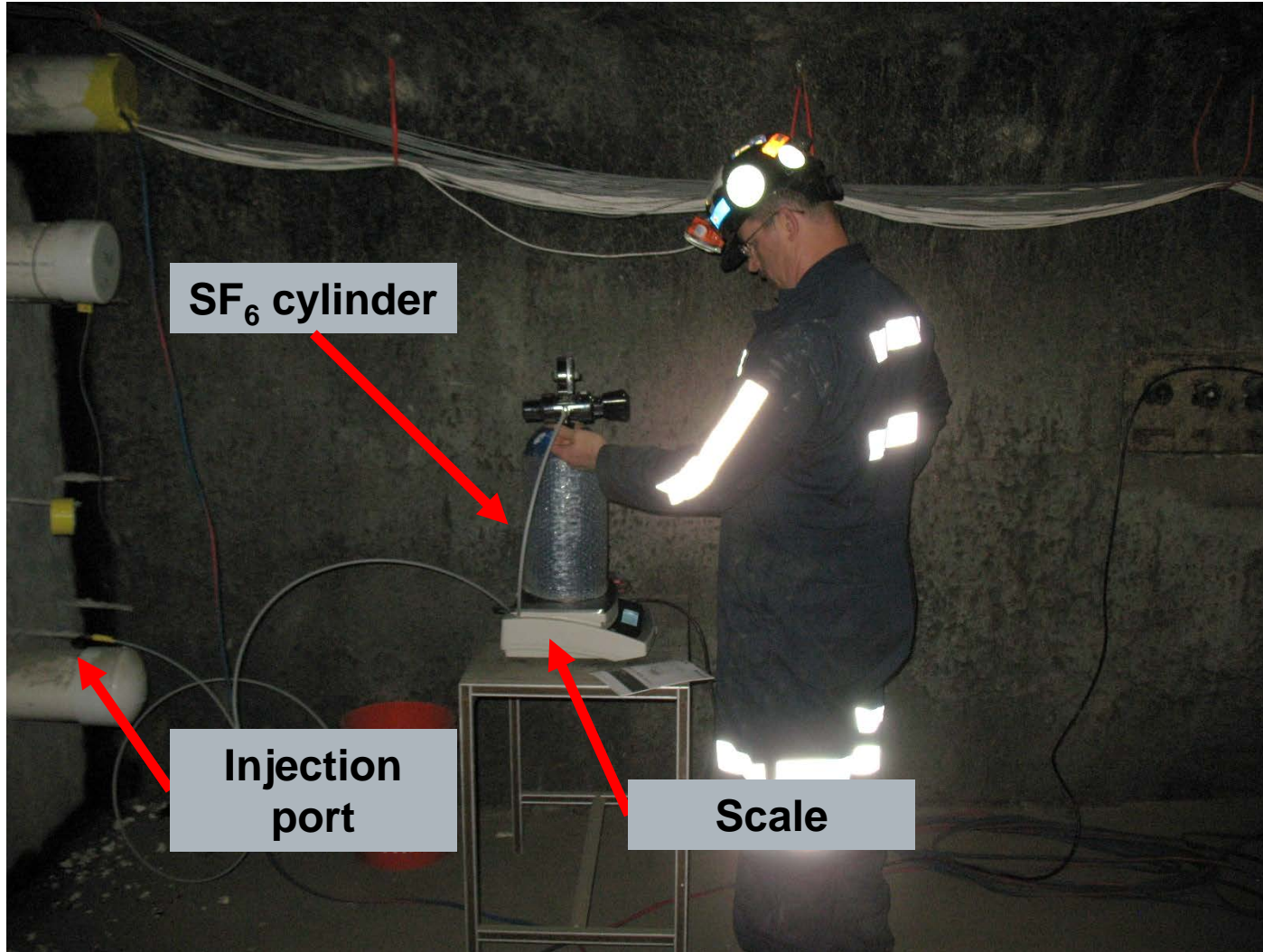


## Airflow

- 750 SCFM based on 12.5 SCFM per miner requirement
- 1,000 SCFM is the maximum capacity of the borehole air supply



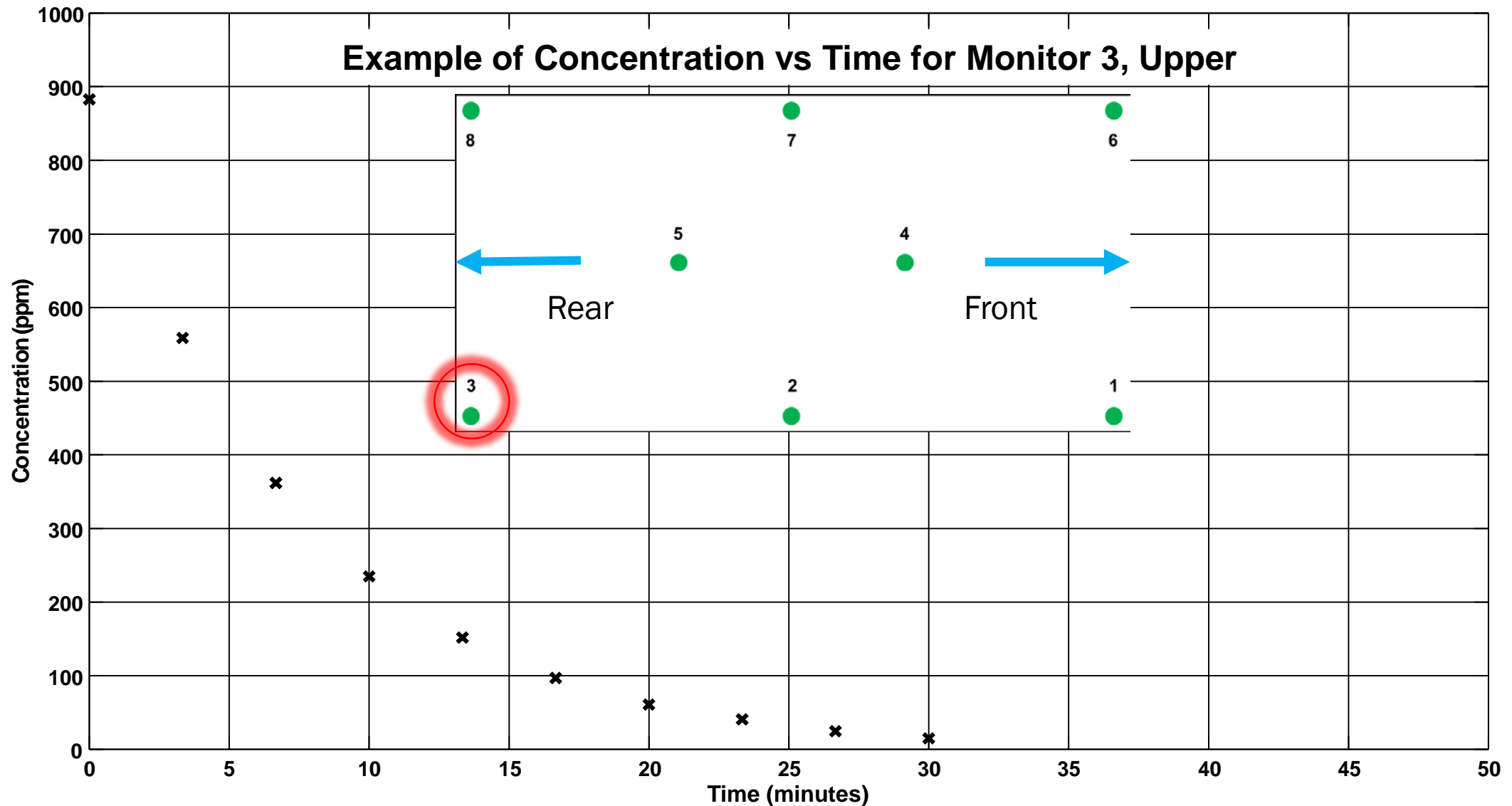
## 2.2 lbs. of SF<sub>6</sub> were injected to achieve an initial concentration of 1,000 ppm



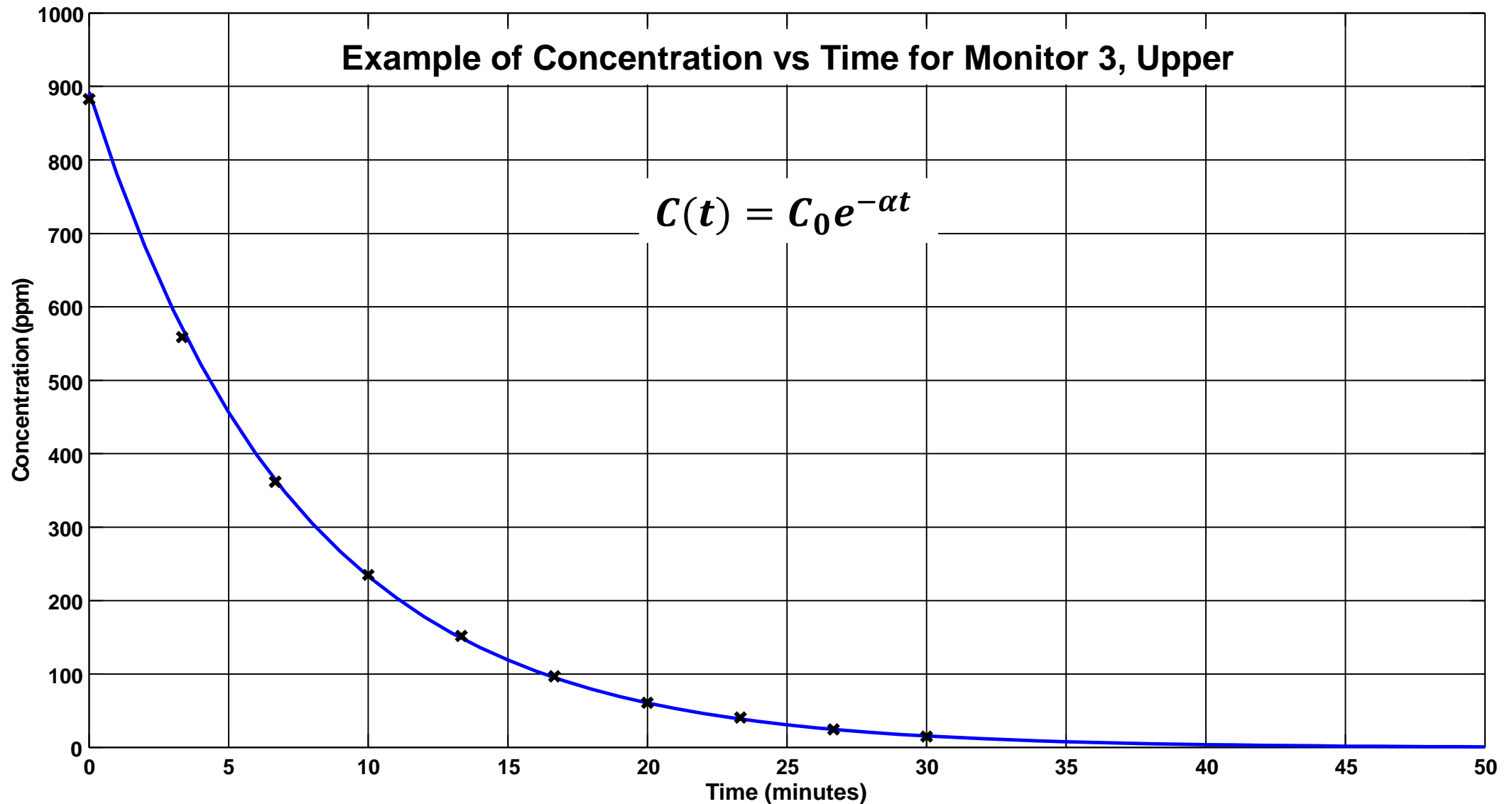
### Procedure

- Inject SF<sub>6</sub>
- Turn on the mixing fans
- Start recording
- Wait 5 minutes
- Turn off the mixing fans
- Turn on the borehole air supply
- Stop recording when all sampling locations are below 5 ppm

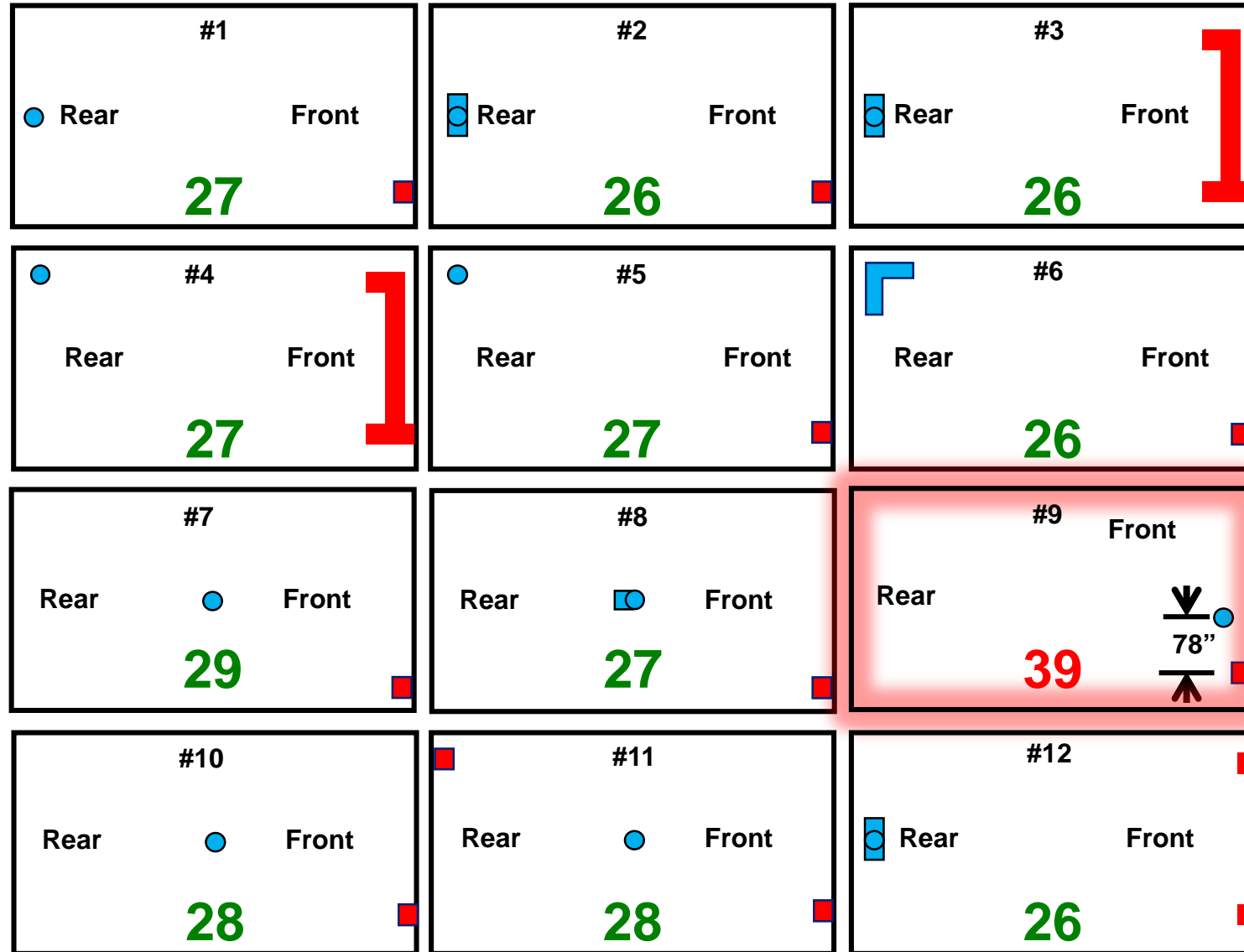
# The data were curve fit and the results were used to calculate purge time from 1000 ppm to 25 ppm



# The data were curve fit and the results were used to calculate purge time from 1000 ppm to 25 ppm

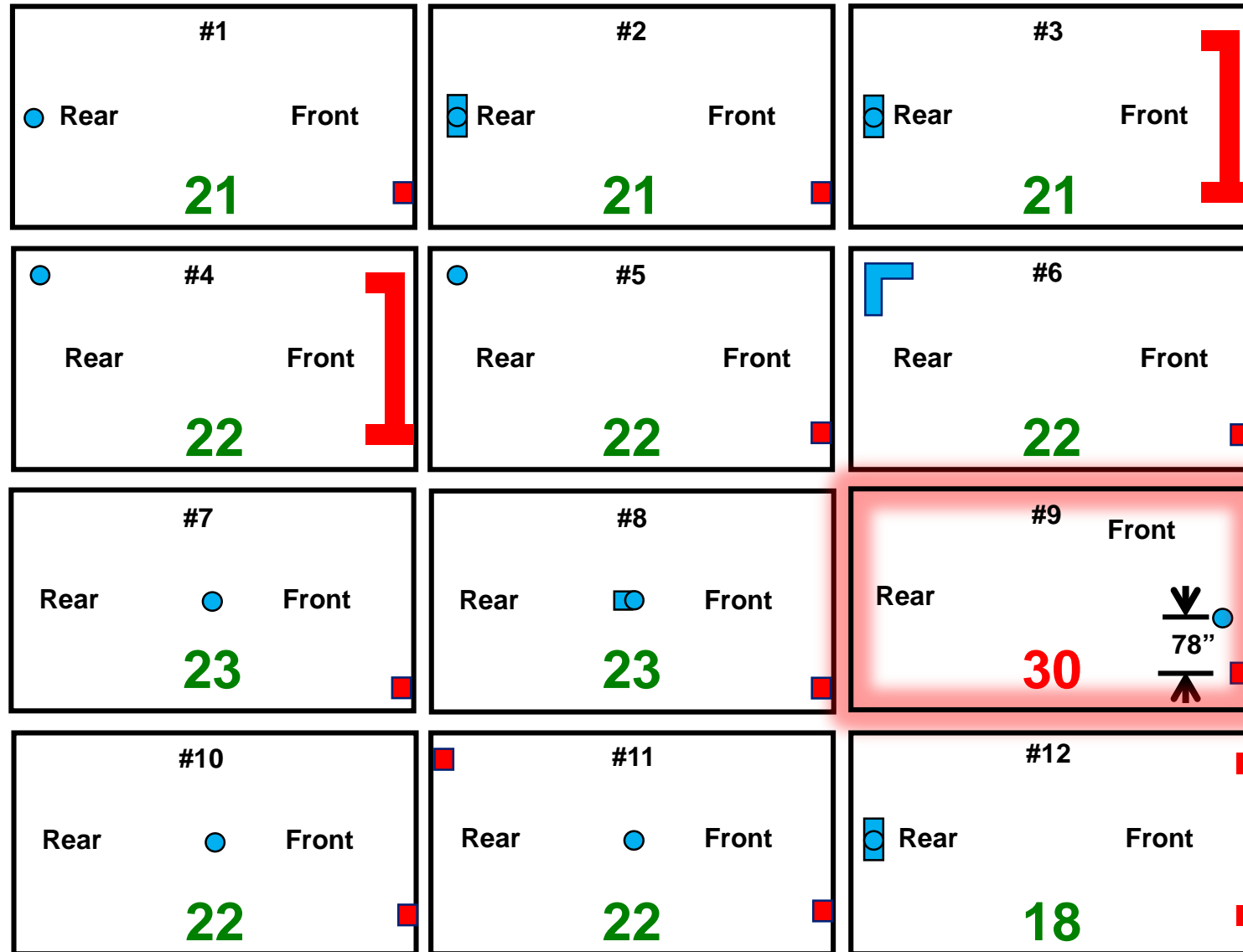


# With the exception of VSC #9, the average purge times ranged from 26 - 29 minutes at 750 SCFM



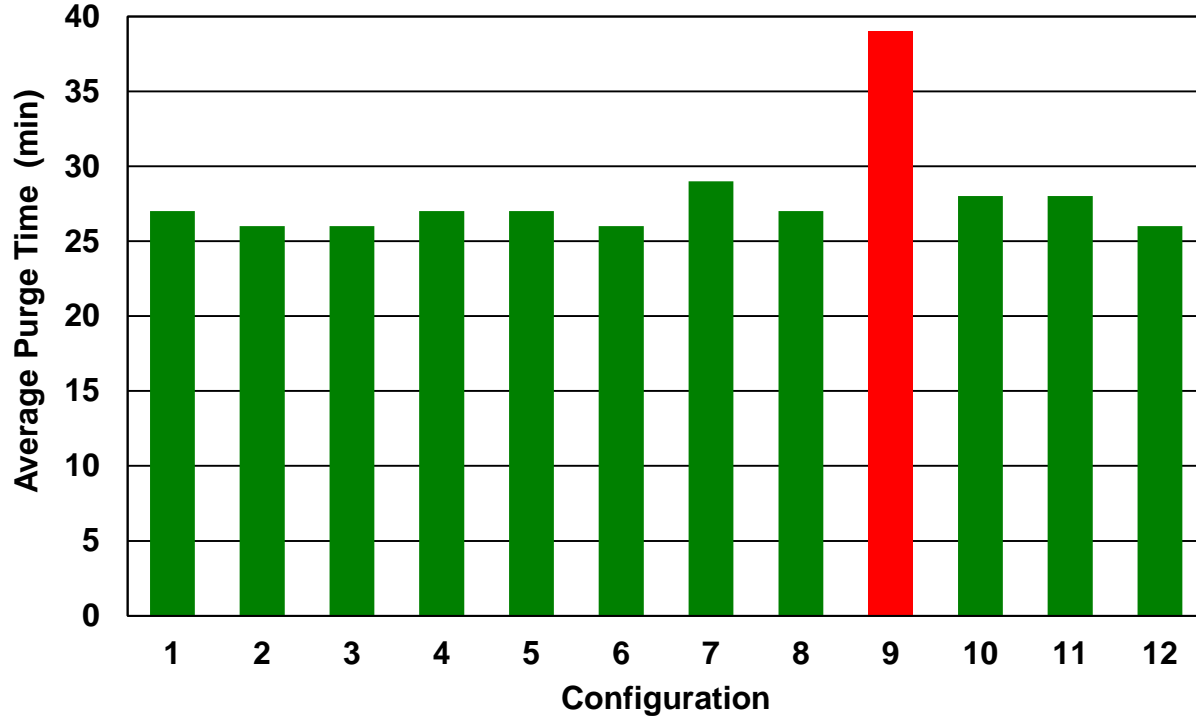


# With the exception of VSC #9, the average purge times ranged from 18 - 23 minutes at 1,000 SCFM

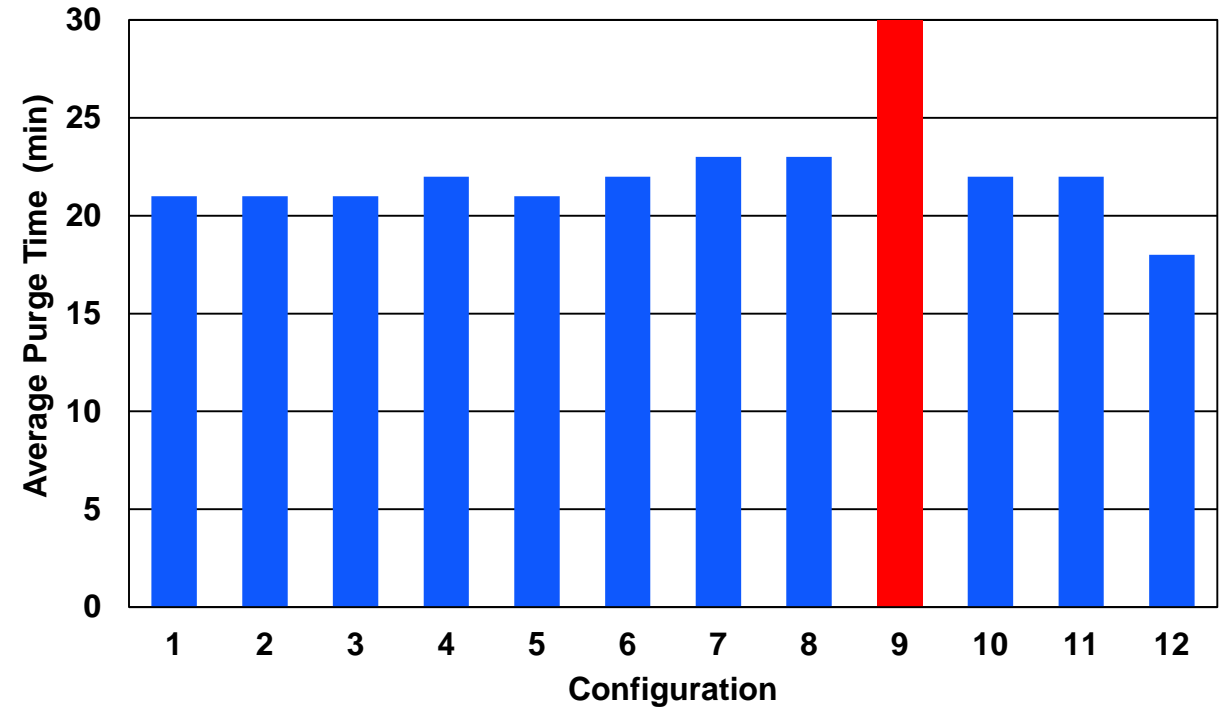


# VSC #9 was more than 9 minutes slower than the next slowest VSC for both airflows

### Average Purge Times at 750 SCFM

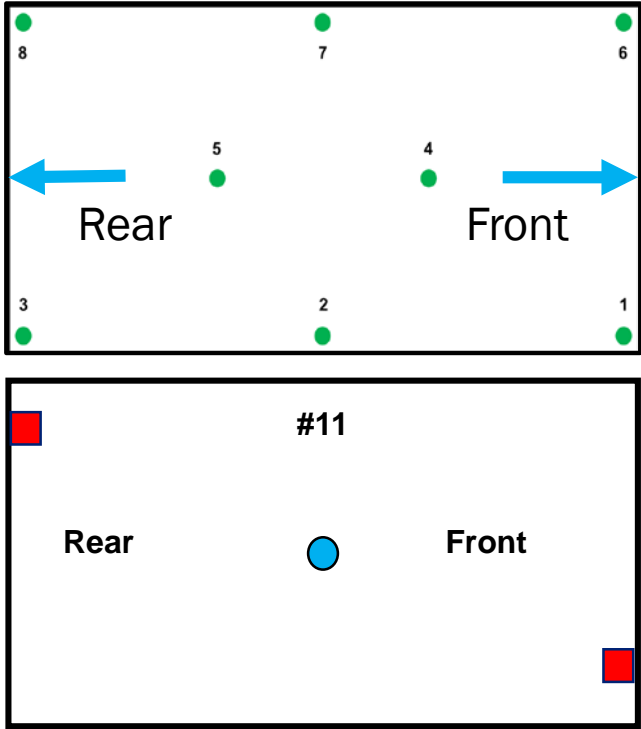
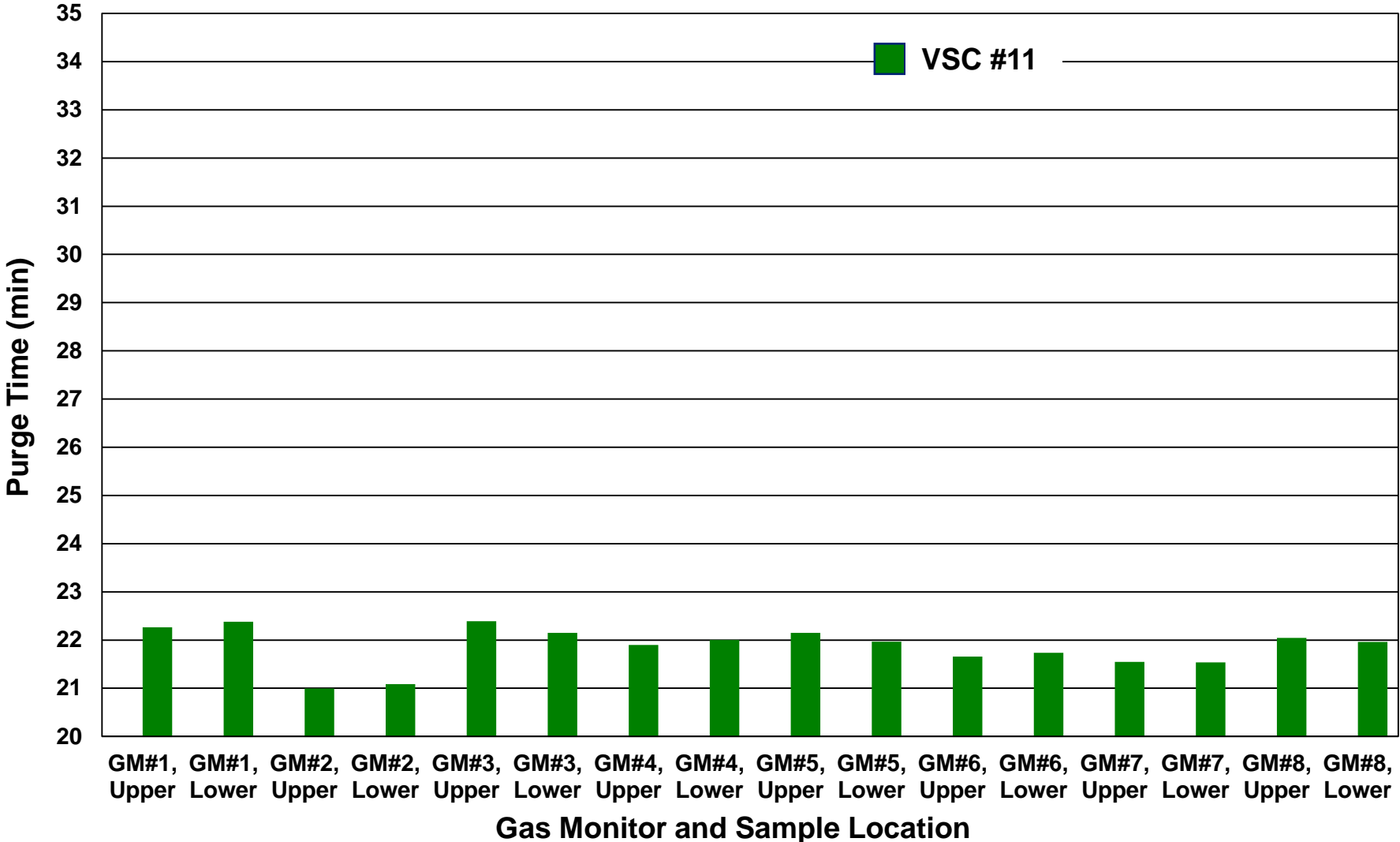


### Average Purge Times at 1,000 SCFM



# Except for VSC#9, the variation in purge time from sample location to sample location was small

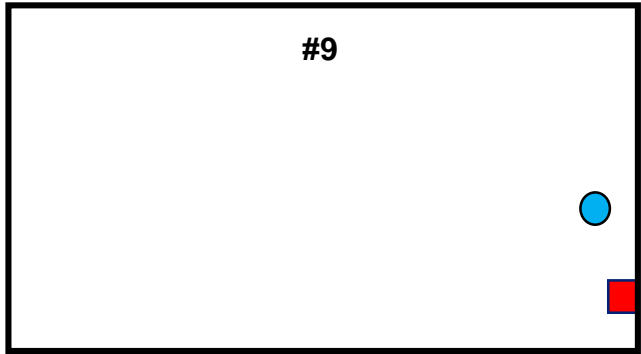
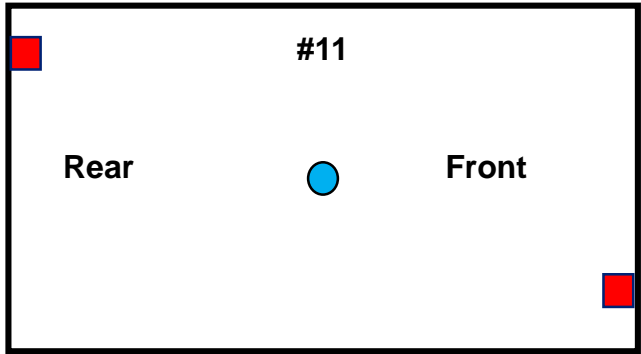
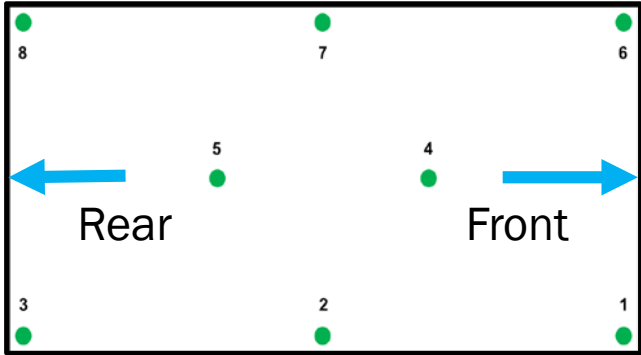
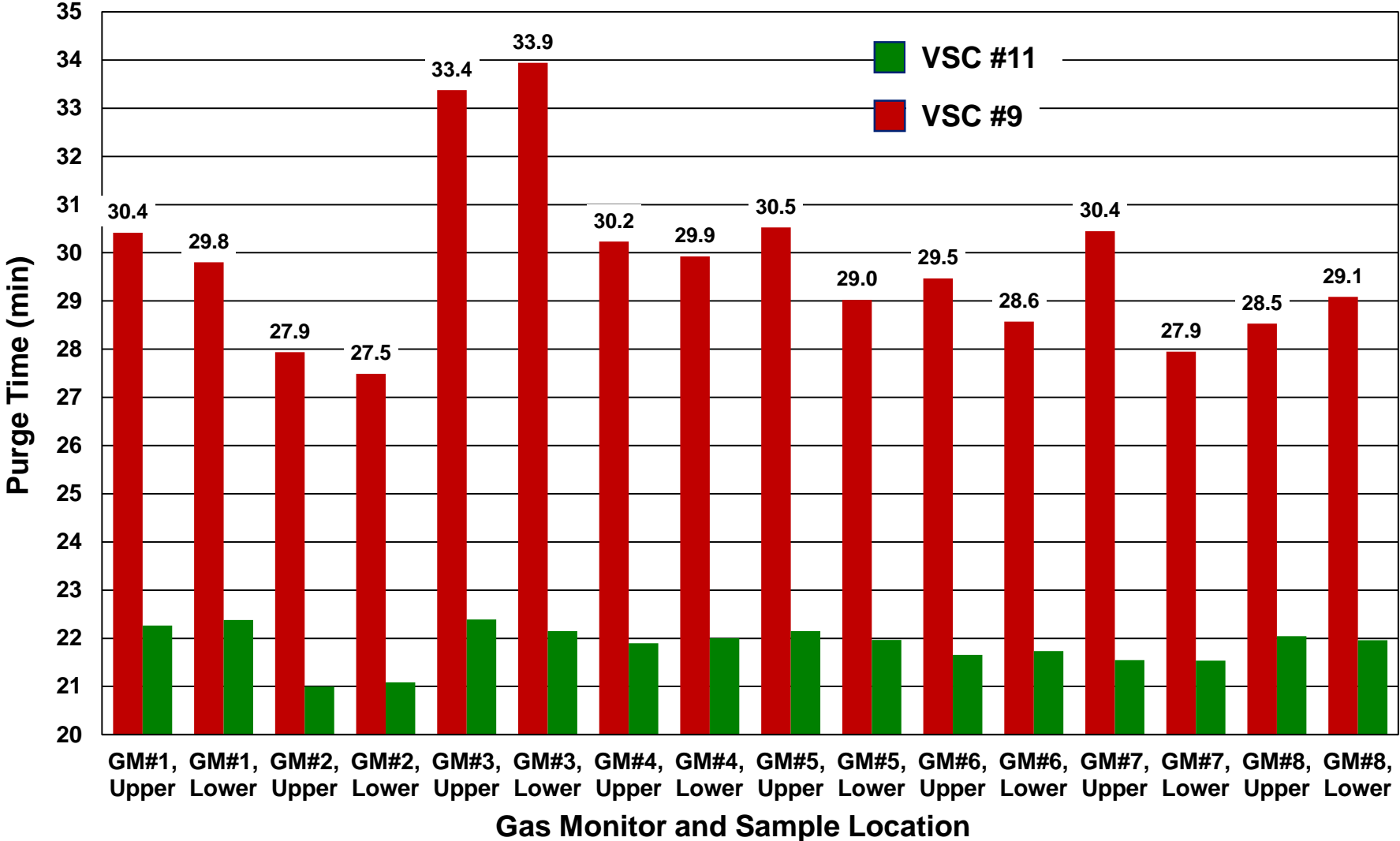
Purge Time Variation for VSC #9 and VSC #11 at 1000 SCFM



*“This information is distributed solely for the purpose of pre dissemination peer review under applicable information quality guidelines. It has not been formally disseminated by the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention. It does not represent and should not be construed to represent any agency determination or policy.”*

# Except for VSC#9, the variation in purge time from sample location to sample location was small

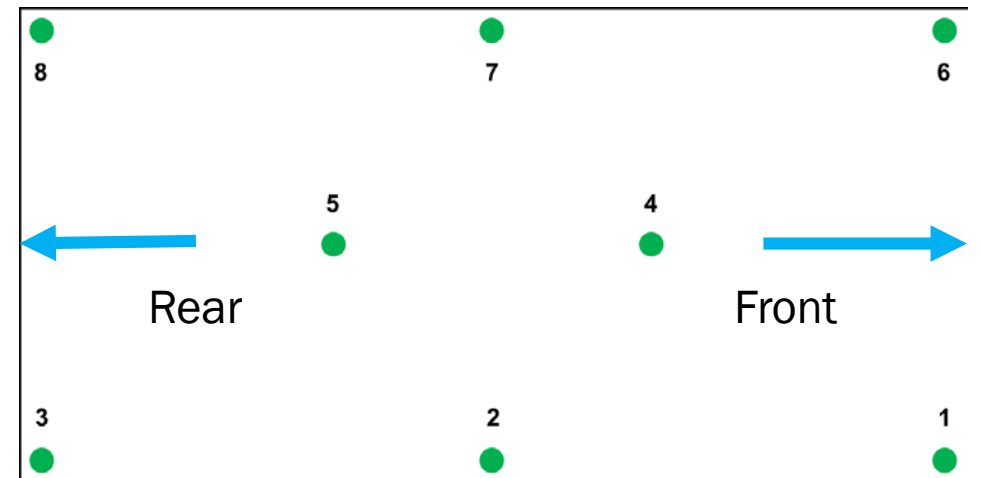
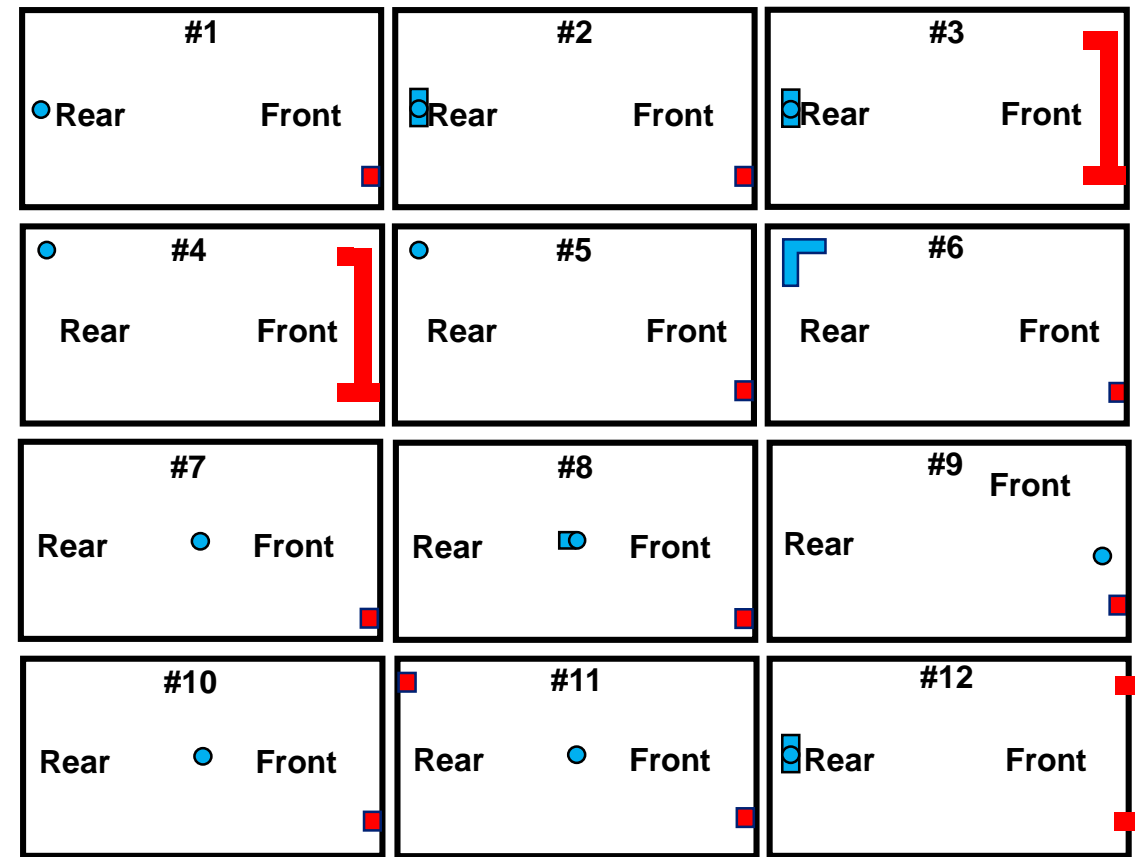
Purge Time Variation for VSC #9 and VSC #11 at 1000 SCFM



*"This information is distributed solely for the purpose of pre dissemination peer review under applicable information quality guidelines. It has not been formally disseminated by the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention. It does not represent and should not be construed to represent any agency determination or policy."*

# In Summary

- Excluding VSC #9, there was little variation among the purge times
- Excluding VSC #9, the purge time variation across the sample locations was small
- To reduce purge time
  - Do not place the air inlet close to the air outlet
  - Increase the airflow

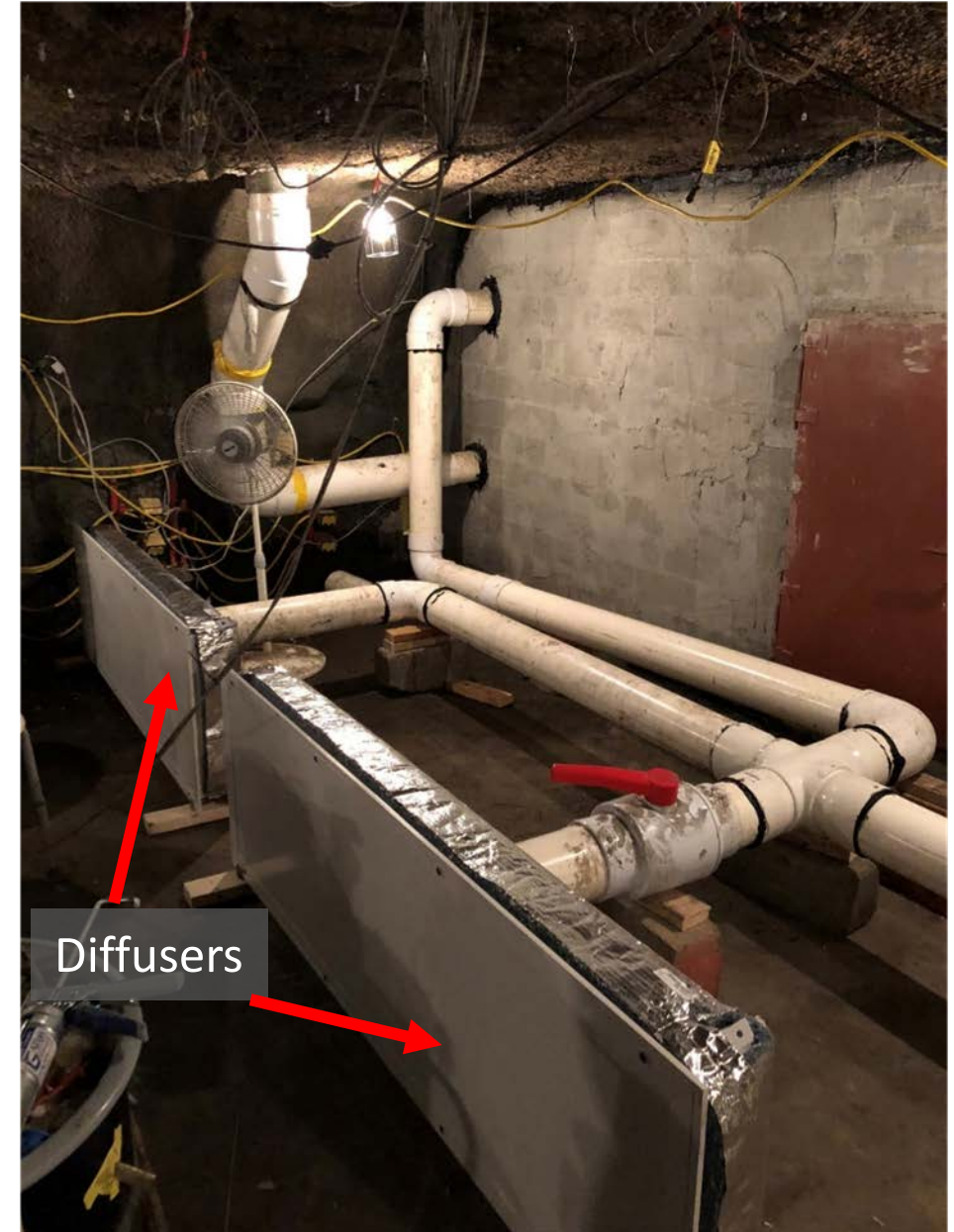


# NIOSH is testing a thermal displacement ventilation (TDV) system

Same objectives

Concept

- Low velocity air supply (diffusers)
- Buoyancy forces (heated simulated miners)
- Stratification



Questions?

Thank you!

Joseph Bickson  
[Jbickson@cdc.gov](mailto:Jbickson@cdc.gov)  
412-386-5935



**NIOSH Mining Program**  
[www.cdc.gov/niosh/mining](http://www.cdc.gov/niosh/mining)

