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CFD Modeling of Agent Concentration in an Empty MPS Test Chamber



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Boeing MPS Test Site

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MPS Verdagent[®] Discharge Performance Test

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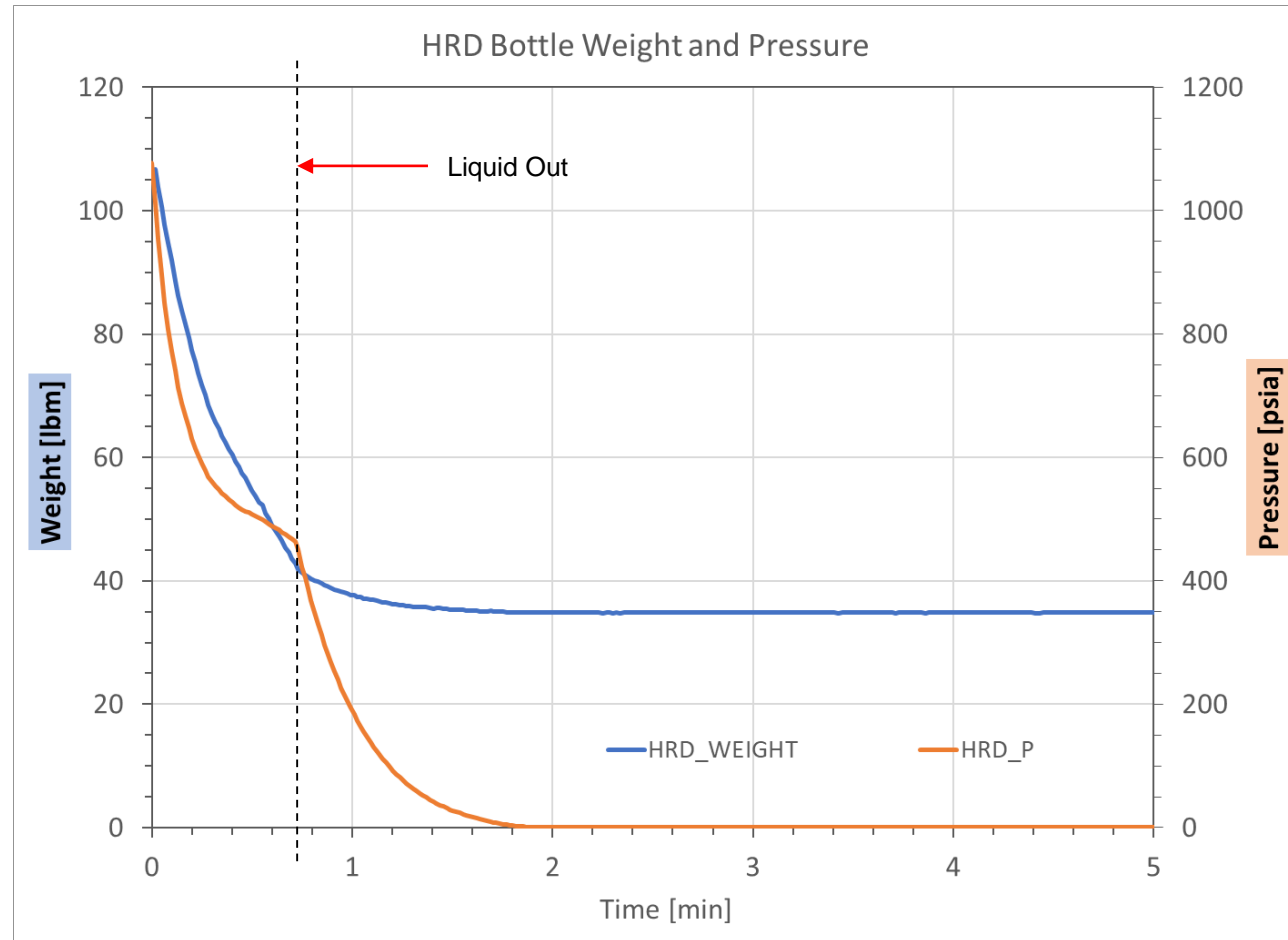
- High Rate Discharge (HRD)



MPS Verdagent[®] Discharge Performance Test

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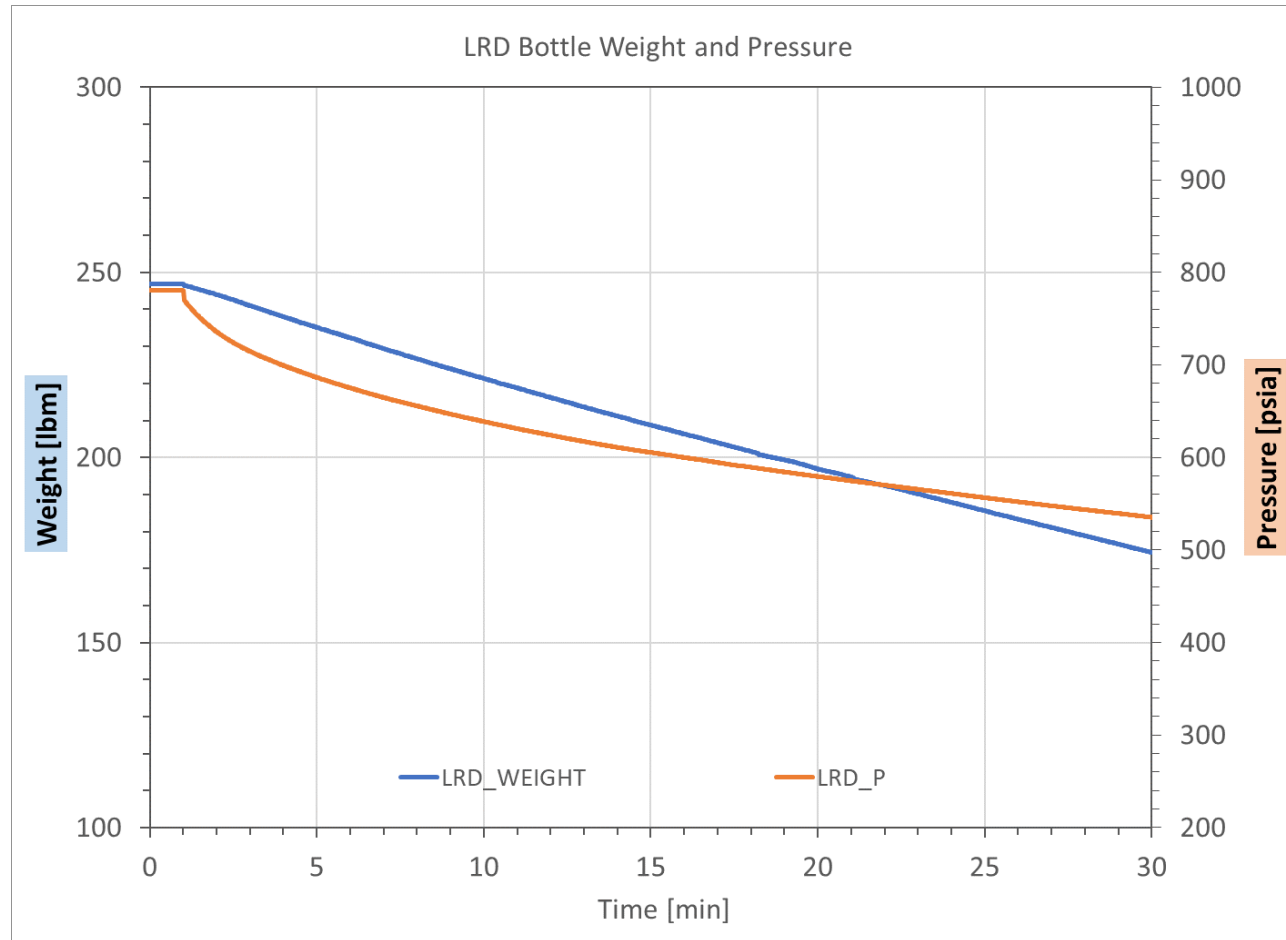
■ High Rate Discharge (HRD)



MPS Verdagent[®] Discharge Performance Test

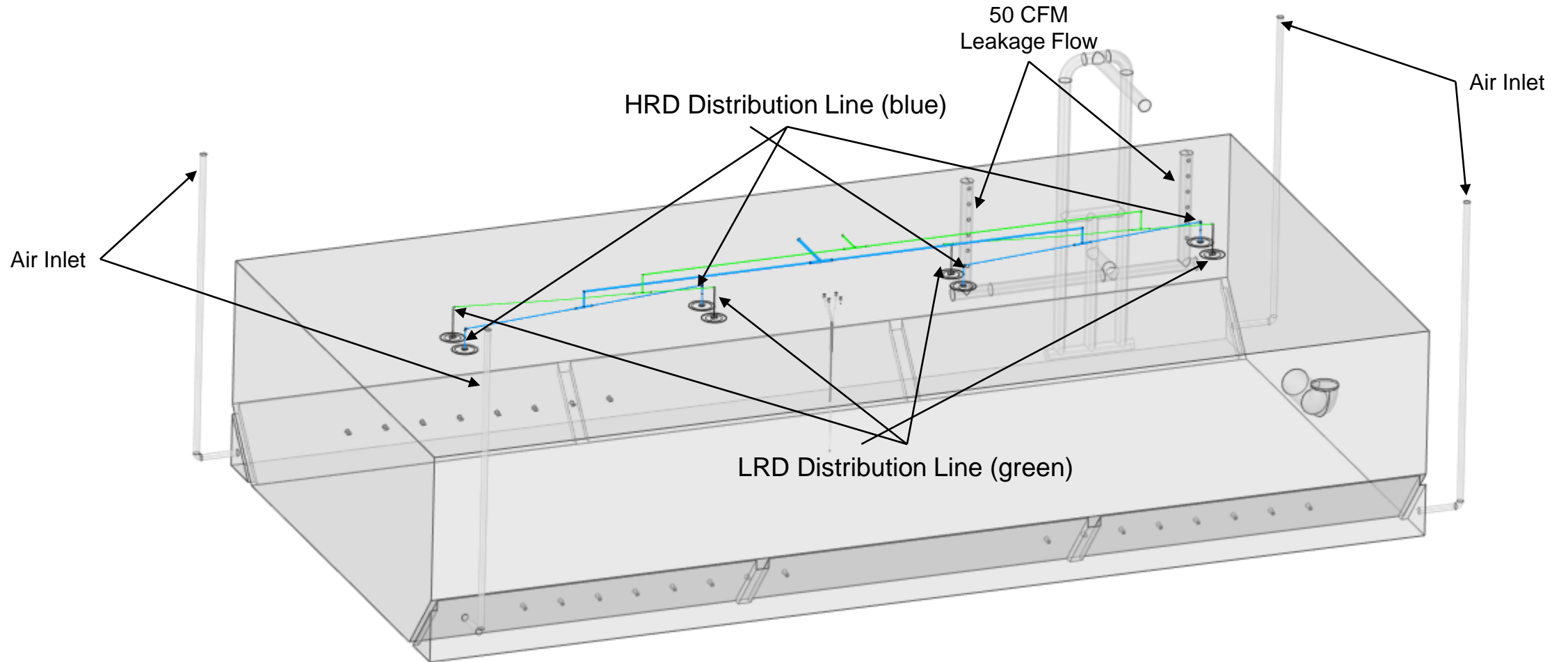
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■ Low Rate Discharge (LRD)



MPS Chamber CFD Model Geometry

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CFD Modeling Approach

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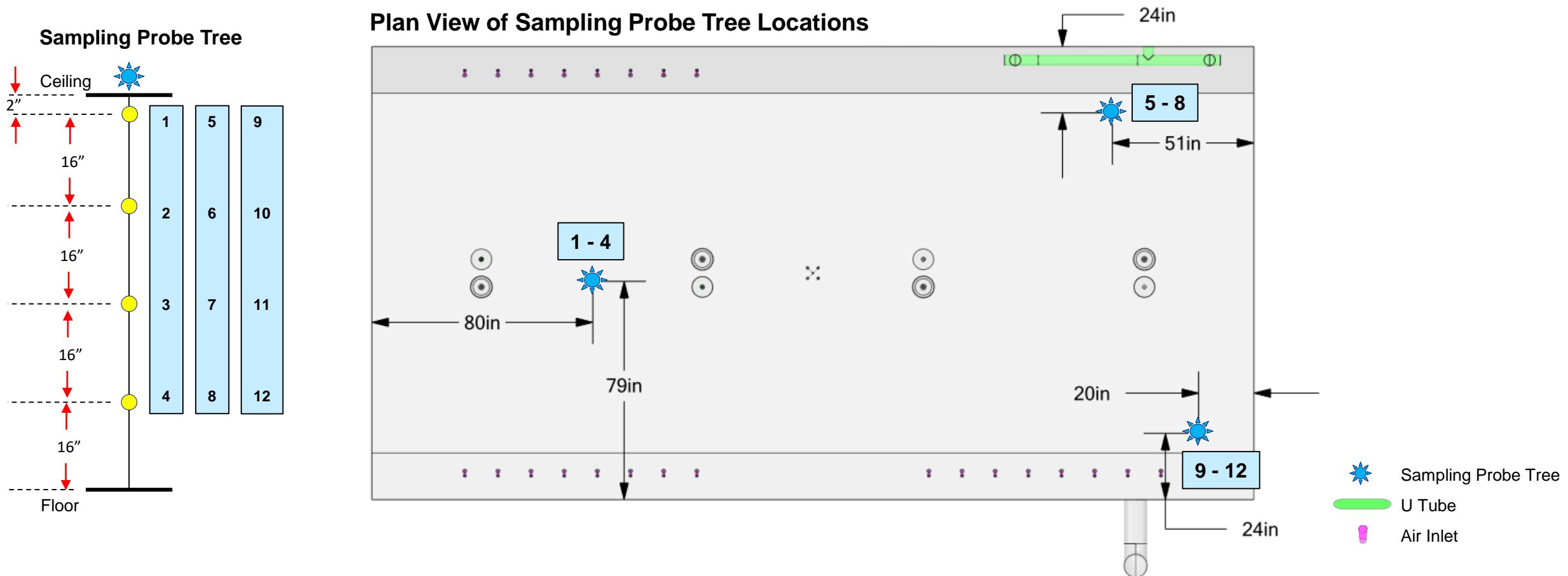
- Transient Analysis
- Ideal Gas Compressible Flow
- Turbulence Modeling: Realizable κ - ε model
- Species Transport
- Droplet Modeling: Discrete Phase Model (Lagrangian scheme)
 - Coupled – interaction with continuous phase
 - Evaporation

Gas Sampling Locations Diagram

Emerson Rosemount Continuous Gas Analyzer

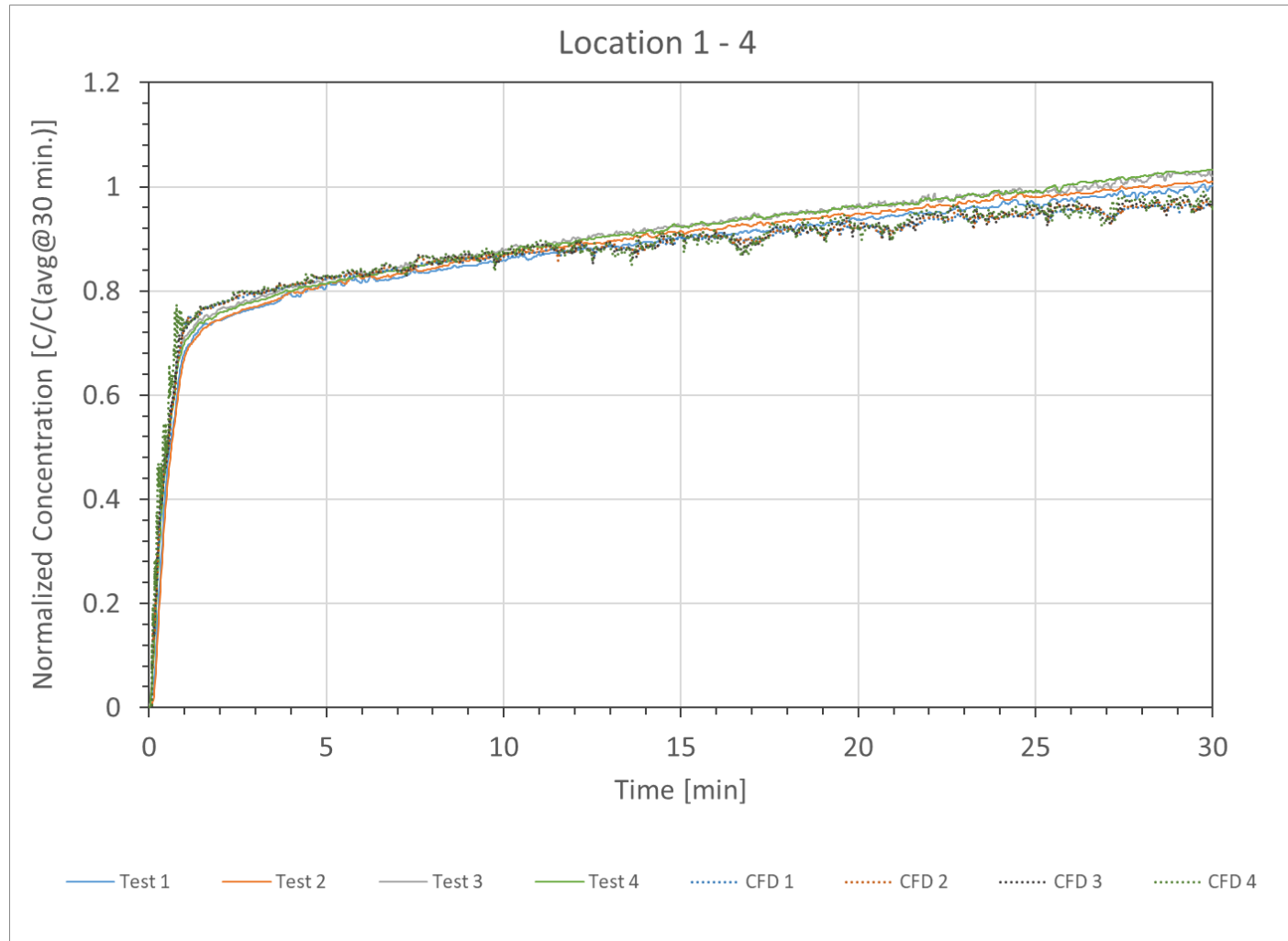
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- 2-BTP and CO₂ concentrations are continuously recorded at 1 Hz



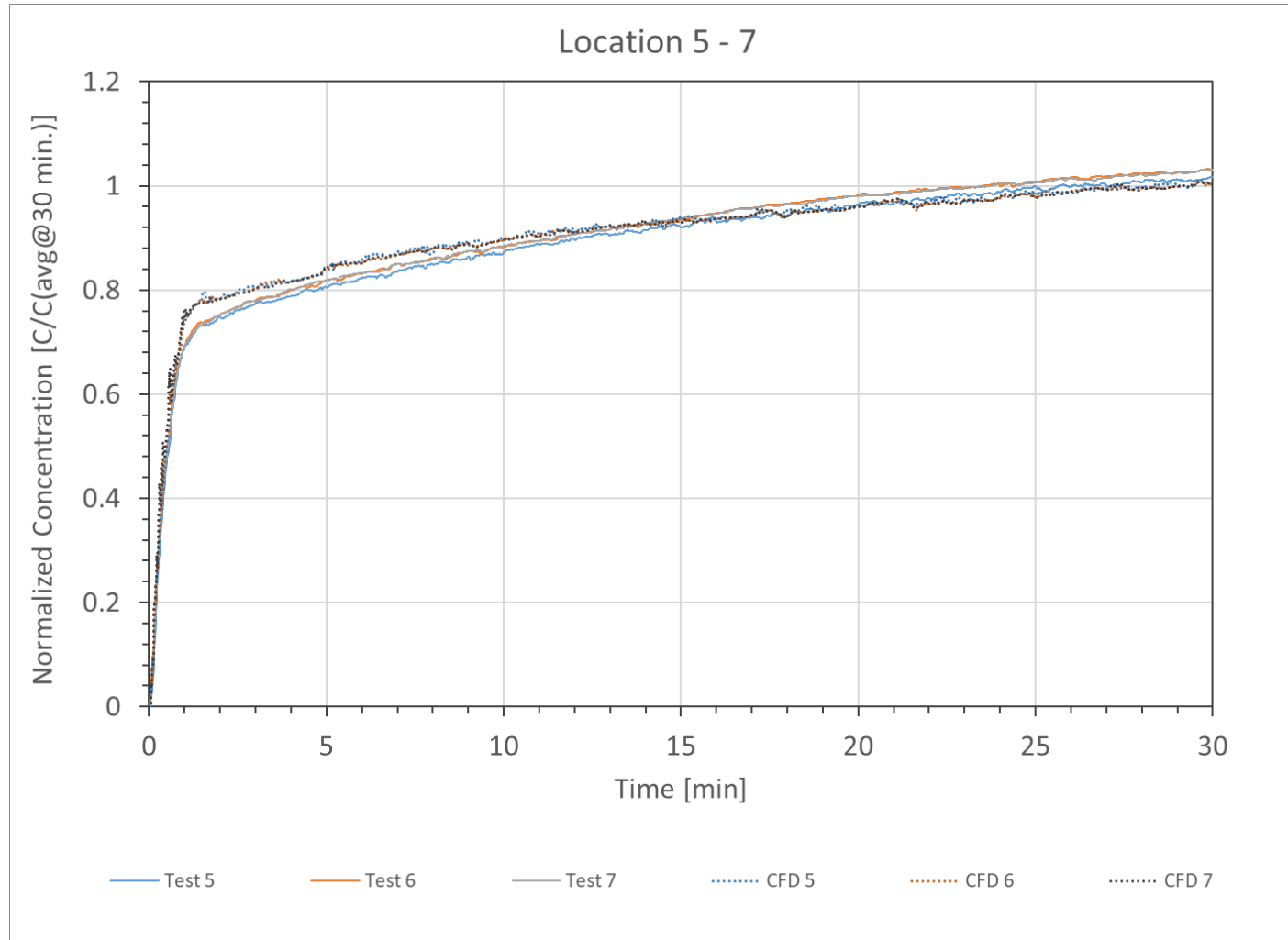
Verdagent[®] Concentration Comparison of Locations 1 to 4

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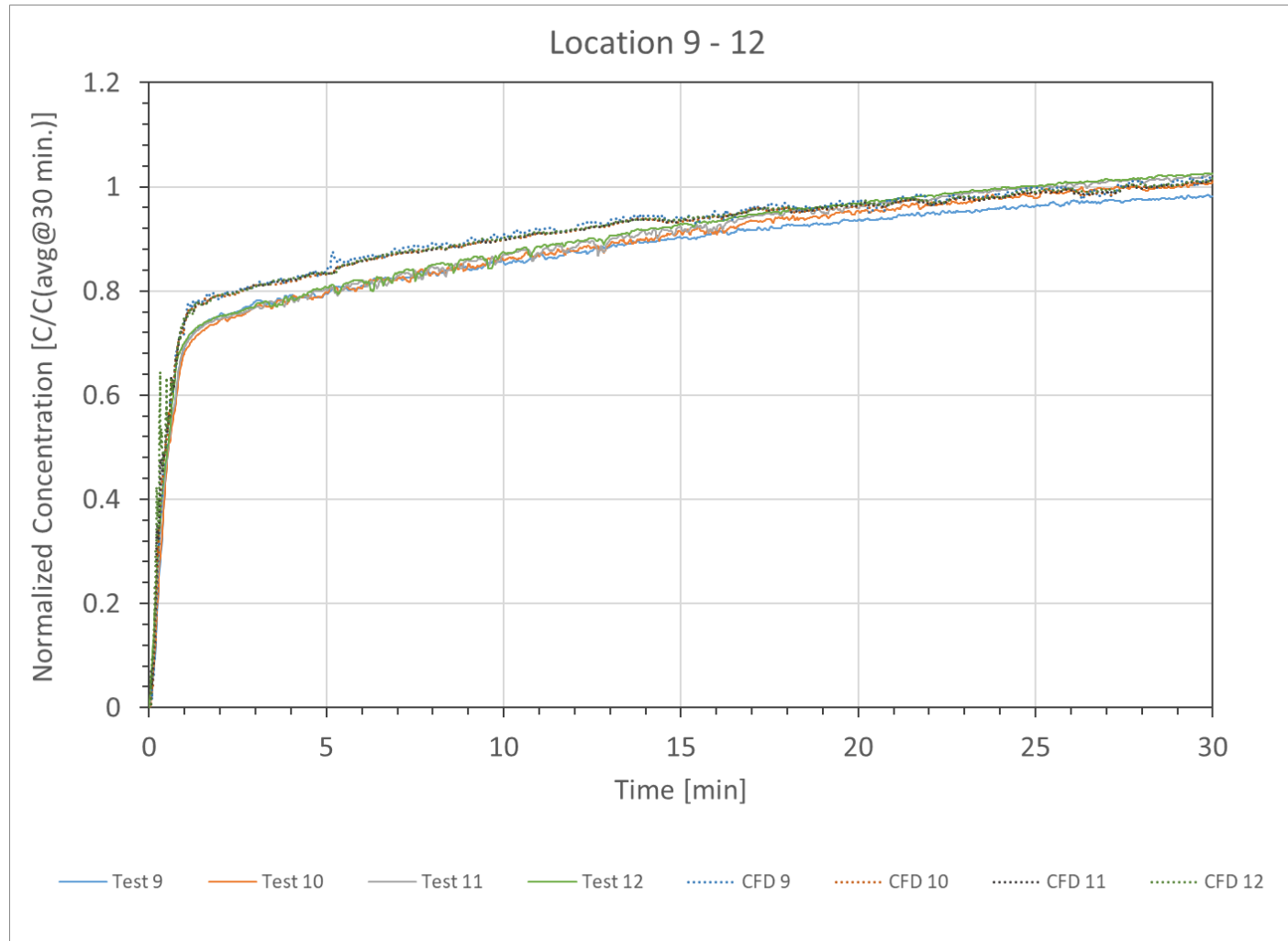
Verdagent[®] Concentration Comparison of Locations 5 to 7

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Verdagent[®] Concentration Comparison of Locations 9 to 12

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Summary

- Emerson Rosemount Continuous Gas Analyzer has demonstrated its robust repeatability and tight span on measuring VERDAGENT[®] (Note 1) volumetric concentration, which is important for CFD model validation
- The CFD model was meshed with polyhedral cells and with the current approach the results have shown good correlations with the test data
- Will continue studying effects of meshing, turbulence models, and modeling assumptions on agent concentration distribution
- Will simulate other test configurations and make comparison with test data for the CFD model validation

Note 1: VERDAGENT[®] is a blend of Halotron BrX[™] and carbon dioxide (CO₂).

Halotron BrX[™] is stabilized 2-BTP (2-bromo-3,3,3-trifluoroprop-1-propene) with proprietary additives.

Acknowledgements

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