

# Challenge Concentration Profile Testing for Air Purification Technologies

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## Background

- Current test methodology for filter life testing uses constant challenge concentration until breakthrough is reached, reducing the length of the test.
- Modeling data obtained from the Joint Project Manager for Protection (JPM-P) shows a more operationally relevant challenge concentration would vary over time, providing a more realistic evaluation of filter performance in the field.
- Objective of this effort was to establish a method for evaluating individual protection (IP) filters against a varying challenge concentration on current breakthrough test systems.

## Modeling and Simulation

- Modeling Simulation and Analysis (MSA) Branch obtained and analyzed ammonia results from the Naval Surface Warfare Center (Figure 1).

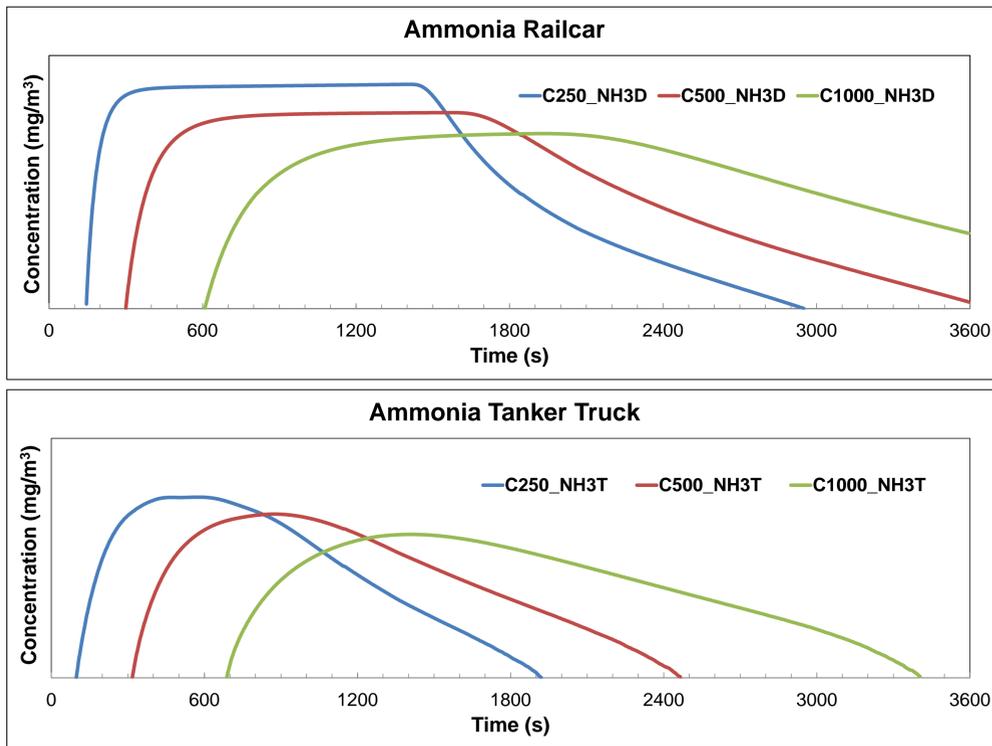


Figure 1. Modeling results for an ammonia release from a railcar and tanker truck.

## Test Approach

- Obtain modeling results
- Establish chemical flow rates based on modeling results

$$FR = \frac{C \times FR_{Total}}{\rho - C}$$

FR - chemical flow rate  
 C - target challenge concentration  
 FR<sub>Total</sub> - total flowrate of the test system  
 ρ - density of ammonia

- Determine trend line equations for flow rate data in Excel (See Figure 2 below) and enter equations into LabView program.

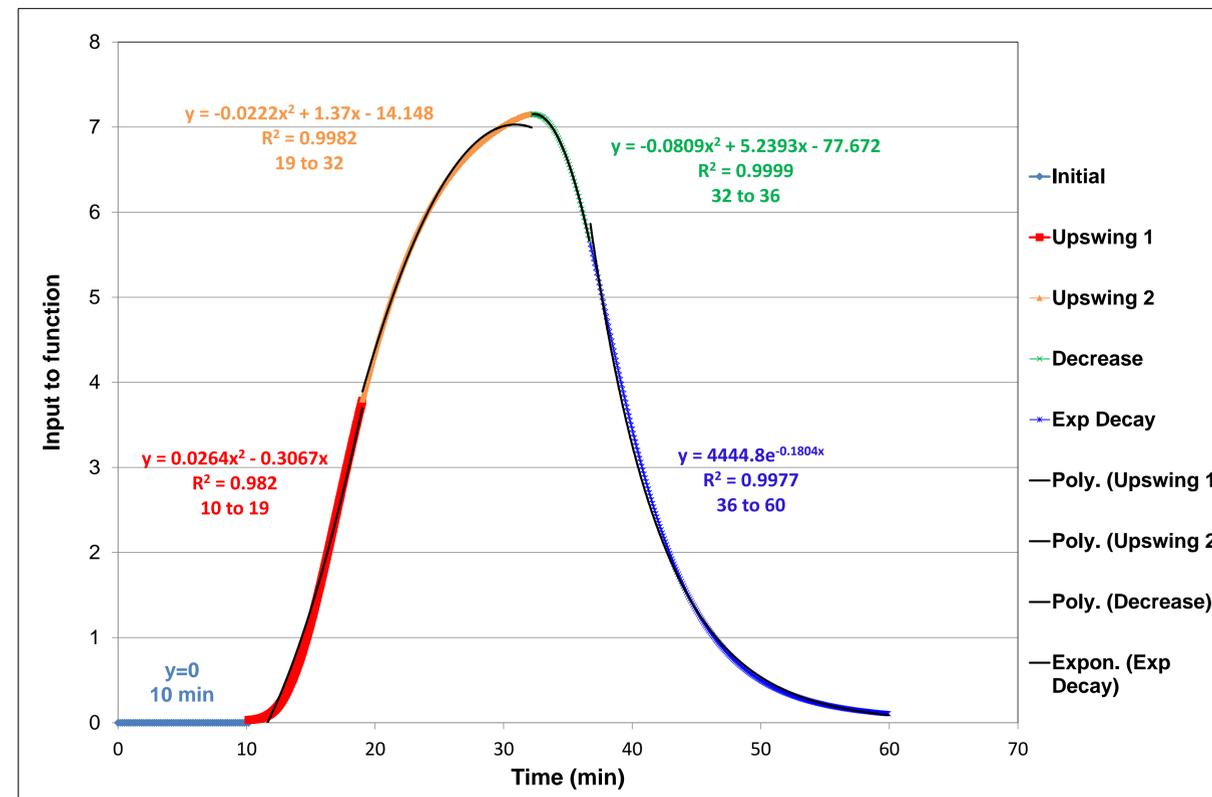


Figure 2. Trend line equations and R<sup>2</sup> values for chemical flow rate data.

## Results

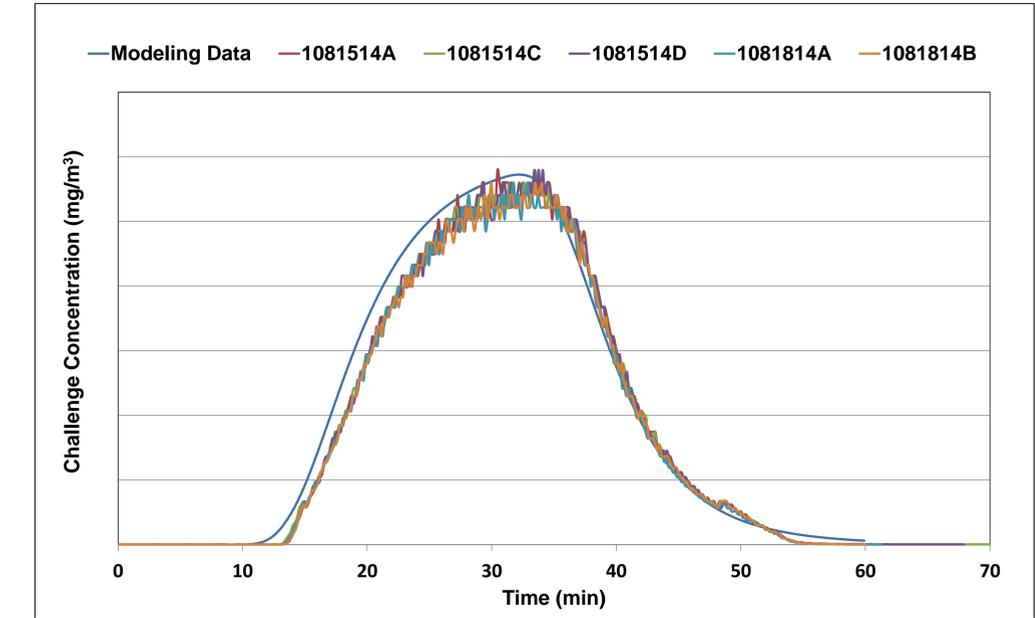


Figure 3. Measured versus Targeted (modeling) Challenge Profiles.

Test ID	% Difference: Measured vs. Target Ct
1081514A	6
1081514C	6
1081514D	5
1081814A	8
1081814B	7

## Conclusions & Next Steps

- Successfully demonstrated the method, as challenge profiles were well within the typical ±10% target for challenge concentrations.
- Further refinement in the method required to simplify the steps, and for consistency.
- Publish and disseminate results for potential further method refinement and expansion to collective protection filtration.

Acknowledgements: The authors thank the Edgewood Chemical Biological Center for their assistance and funding for this work through the Innovative Project Program (IAW Public Law 110-447, Section 219). The views expressed in this presentation are those of the authors and do not necessarily reflect the official policy or position of the Department of Defense or the US Government.

