Dräger CMS Validation

SEAP '04

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Introduction

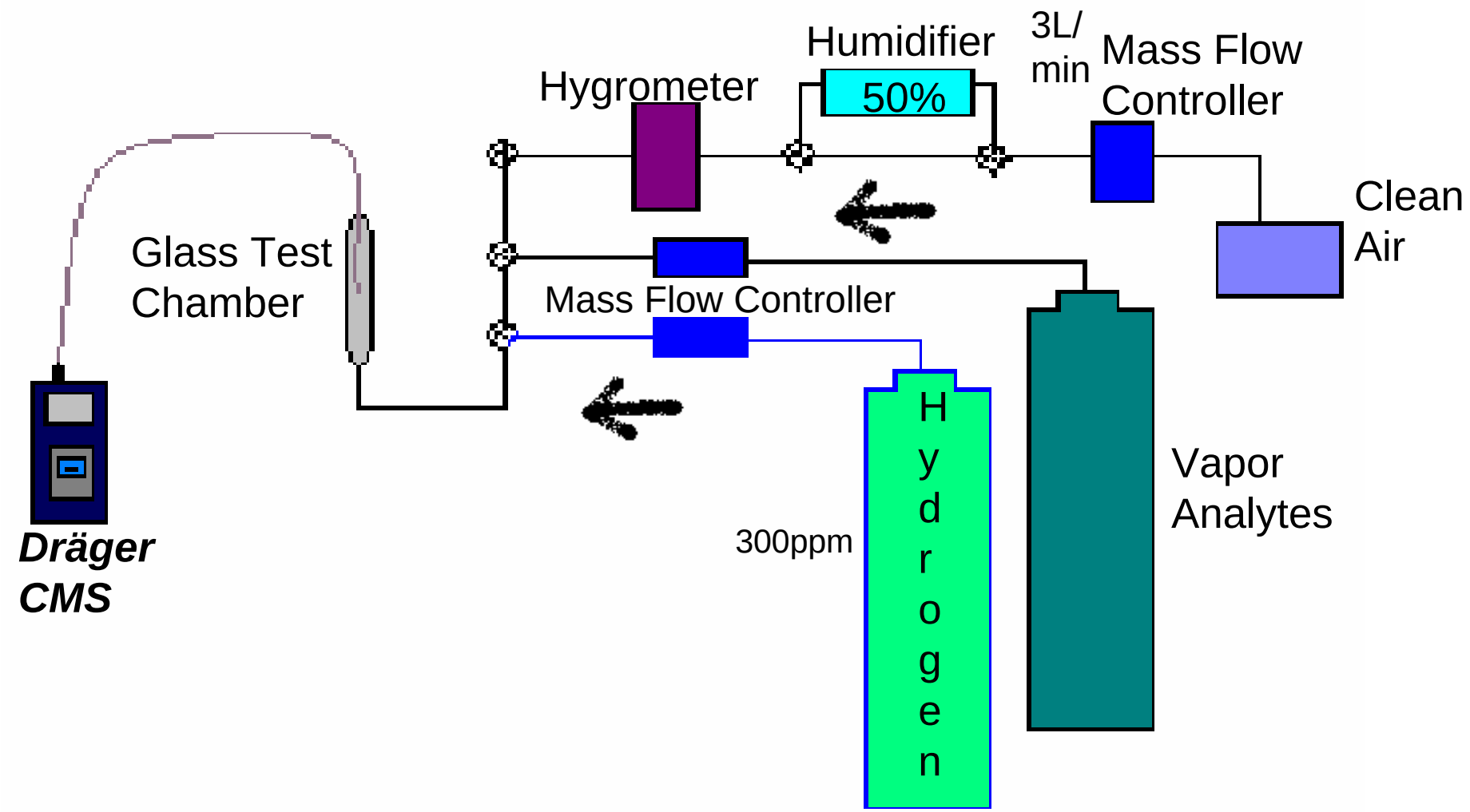
- Submarine Atmosphere- Unique environment- Sailor extended exposure.
- Hard to detect- exposure to hazardous chemical and biological agents.
- Sailors on Navy submarines need equipment to detect these easily and fast.
- ***Dräger*** tubes being used currently.
  - Manually operated pumps
  - Human error

- Evaluate ***Dräger CMS*** response
  - To known concentrations of applied gasses
  - To the interference gas (Hydrogen, the submarines normal background) introduced.
  - Two tests for applied gasses, five trials each.
- Hydrogen(H_2) Background tested
  - 300ppm
  - Submarine background varies from 200ppm-10,000ppm

- ***Dräger CMS (Chip Measurement System)- an electronic based analyzer with integrated Data Recorder and remote system.***

- ***Chips-Substance-specific colorimetric measuring chips:***

Vapor Generation System



Dräger CMS Results
Data/results

% Relative Standard Deviation

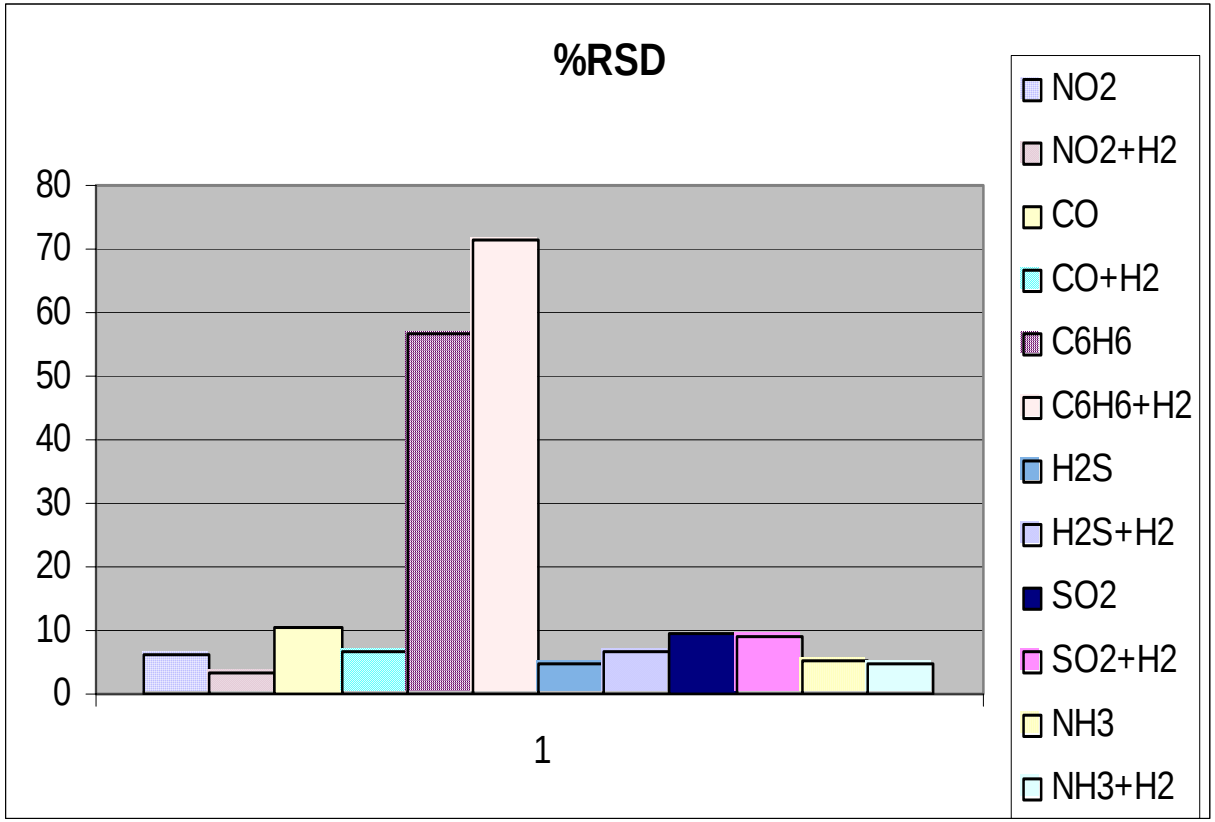


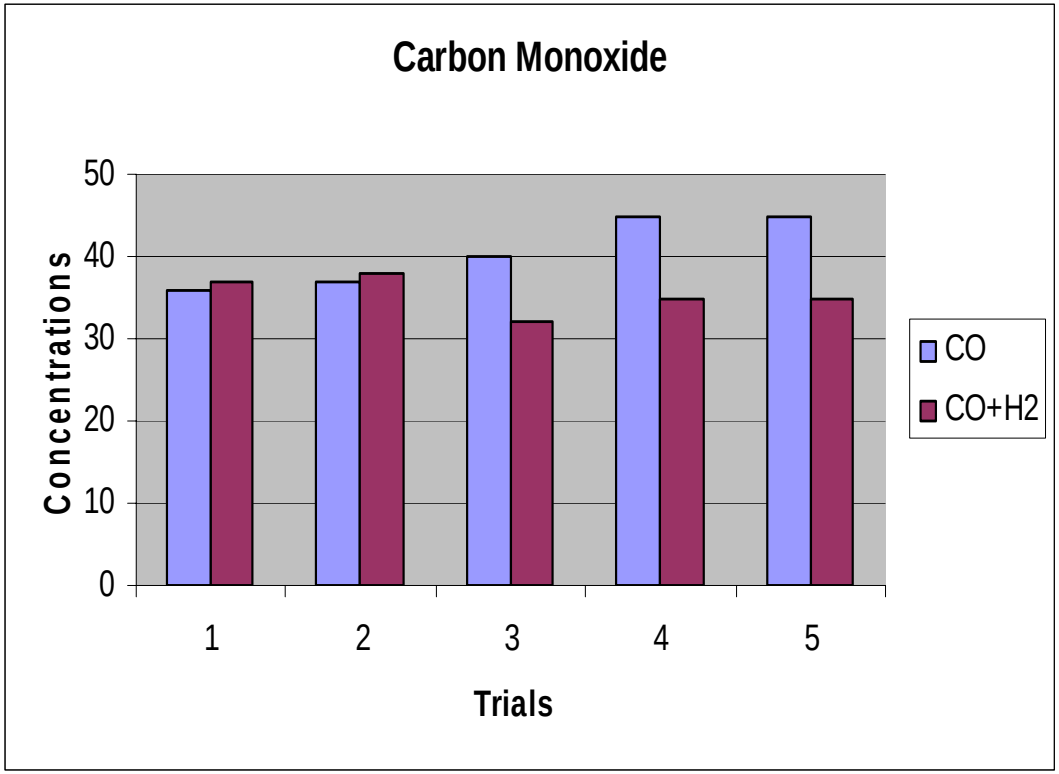
Table1

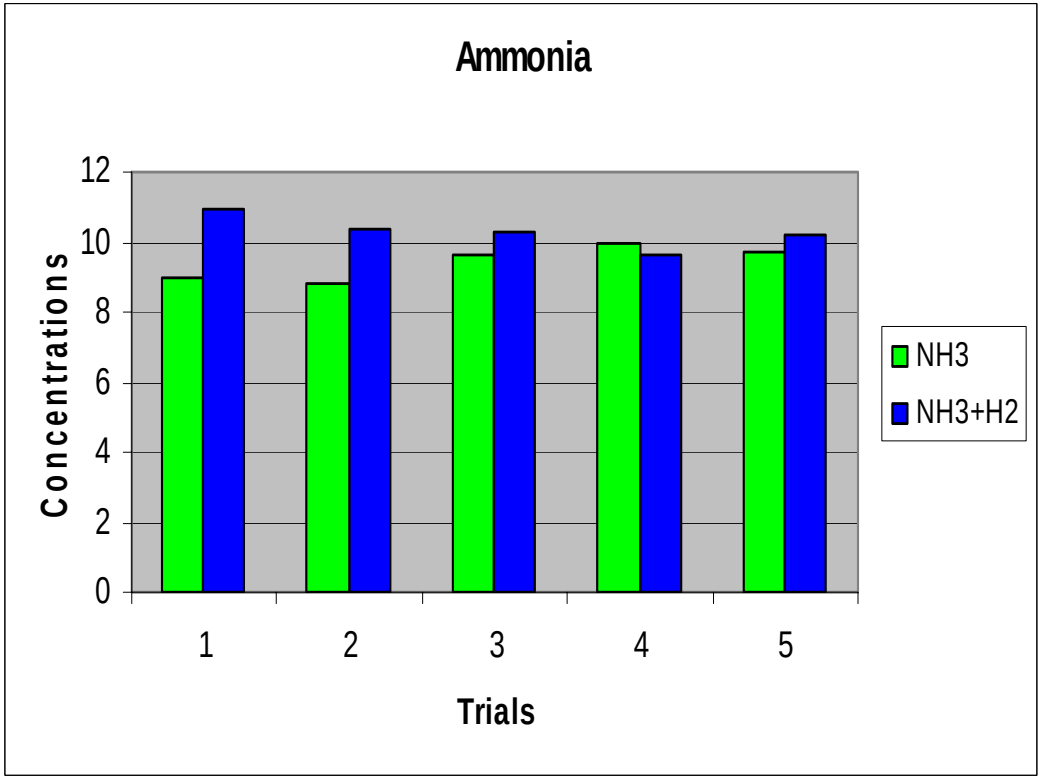
Tests / Calculations	Tests Without H_2	Tests With H_2	Tests Without H_2	Tests With H_2	Tests Without H_2	Tests With H_2	Tests Without H_2	Tests With H_2
Chemical name	***Nitrogen Dioxide***	***Nitrogen Dioxide***	***Benzene***	***Benzene***	***Hydrogen Sulfide***	***Hydrogen Sulfide***	***Sulpher Dioxide***	***Sulpher Dioxide***
Concentration Tested	6ppm	6ppm	1ppm	1ppm	10ppm	10ppm	15ppm	15ppm
Standard Deviation	0.36ppm	0.19ppm	0.68ppm	0.82ppm	0.51ppm	0.68ppm	1.13ppm	1.08ppm
%RSD	6.22%	3.27%	56.49%	71.47%	4.78%	6.77%	9.76%	9.13%
Student's T-Test	95% chance No significant Difference		95% chance No significant Difference		95% chance No significant Difference		95% chance No significant Difference	

Table 2

Tests Calculations	Tests Without H2	Tests With H2	Tests Without H2	Tests With H2
Chemical name	***Carbon Monoxide***	***Carbon Monoxide***	***Ammonia***	***Ammonia***
Concentration Tested	50ppm	50ppm	10ppm	10ppm
Standard Deviation	4.28ppm	2.30ppm	0.50ppm	0.47ppm
%RSD	10.54%	6.50%	5.33%	4.53%
Student's T-Test	95% chance there IS a significant difference		95% chance there IS a significant difference	

Hydrogen Interference





Conclusion

- Stable and Reproducible results
- %RSD <10%
  - Except for the pump failure on Benzene
- Suggested Hydrogen interference in Ammonia and Carbon Monoxide tests.
- Overall, reliable in testing known analytes in known concentrations.

- Future
  - a universal detector vs. individual sample for one analyte.
- Acknowledgments
  - I would like to thank
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    - My mentors Dr. S. Rose-Pehrsson & Kimberly Parker & Mark Hammond
- THANK YOU