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U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
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Executive Summary

Washington River Protection Solutions (WRPS) conducted tests of four types of chemical cartridges for air-purifying respirators (APR) and powered air-purifying respirators (PAPR) to determine the period of time the cartridges would provide adequate performance[1] for APRs and PAPRs used to protect workers when exposed to a mixture of Chemicals of Potential Concern (COPCs) from vapors exiting the Hanford AX tank farm exhauster slipstream. The Occupational Safety and Health Administration (OSHA) considers cartridge testing to be a valid approach for establishing a cartridge service life. Testing is applied in situations where mixtures of COPCs exist, and where other approaches, such as manufacturer recommendations and modeling, are less reliable. The tests were designed and conducted to assure measurement and/or control of the key variables OSHA identified as important to estimate the cartridge service life, including temperature, humidity, COPC concentration, breathing rate, and cartridge adsorption capacity.

Cartridge testing using vapors from a Hanford AX tank farm exhauster slipstream was conducted from August 25–27, 2017. Vapors from the exhauster slipstream were fed to two respirator cartridge test stands developed by WRPS in collaboration with HiLine Engineering (Richland, Washington). Four different cartridges were assessed. Multipurpose APR cartridges—SCOTT 7422-SD1 and SCOTT 7422-SC1 (SCOTT Safety, Monroe, North Carolina)—were assessed on separate days using an APR cartridge test stand. Multipurpose PAPR cartridges—MSA-TL (TL1) (MSA Safety Inc., Pittsburgh, Pennsylvania) and 3M FR-57 (TL2) (3M Company, Maplewood, Minnesota)—also were tested over the same two days using a separate PAPR cartridge test stand. Sample media (i.e., sorbent tubes) were used to collect samples of the vapor stream entering and exiting the respirator cartridges and were subsequently analyzed for COPC concentrations. Pacific Northwest National Laboratory was tasked with conducting an independent analysis of the analytical results and making recommendations based on the results for respiratory cartridge performance and service life. The key conclusions from the analysis are described below.

APR Cartridge Testing

Based on measured APR cartridge inlet vapor concentrations from the AX exhauster, none of the COPCs exceeded their corresponding Occupational Exposure Limits (OELs).[2] Six COPCs—ammonia, mercury, formaldehyde, N-nitrosodimethylamine (NDMA), N-nitrosodiethylamine (NDEA) and N-nitrosomorpholine—had one or more inlet concentration measurements greater than 10% of their OELs and greater than their analytical detection limit[3] (DL) or reporting limit (RL), but less than 100% of the OEL. All other COPC inlet and outlet measurements did not exceed 10% of their OELs or exceed

[1] "Adequate performance" refers to being below the breakthrough criteria used in this analysis. The breakthrough criteria for this analysis is having sustained cartridge outlet concentrations above 10% of the compound's OEL. Ultimately, Industrial Hygiene professionals will use these results along with specific hazard assessments to determine service life, change schedules and cartridge use that provides the necessary performance.

[2] OELs accepted for Hanford tank farm use are based on OELs established by a U.S. governmental agency or national professional organization (e.g., OSHA, National Institute for Occupational Safety and Health, American Conference of Governmental Industrial Hygienists), or if no U.S. OEL exists, standard toxicological practices are applied to develop OELs based on the best available science. The OEL for NDMA was established in 2005 based on the MAK (Maximale Arbeitsplatzkonzentration) Commission standard adopted in Europe.

[3] The term "detection limit" (DL) is used here to refer either to an analytical reporting limit (RL) or a DL. The use of either an RL or a DL varied among analytical laboratories. An RL (equivalent to a limit of quantification) was used instead of an analytical method DL by several laboratories for specific COPC analyses. See Appendix C and Appendix F for additional information on the specific use of RLs or DLs for each COPC.

their RLs. Summaries of cartridge performance for the COPC inlet concentrations with greater than 10% of their respective OEL values follow.

- Maximum ammonia concentrations at the respirator cartridge inlet to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 24% and 17% of the OEL, respectively. This concentration was less than a factor of 2× the historical maximum (12.9% of the OEL). All the cartridge outlet concentrations for ammonia were below the RL, indicating that no breakthrough above 10% of OEL occurred. Previous 2016 cartridge testing results obtained from SCOTT's SureLife Calculator under similar inlet concentration, temperature, relative humidity, and pressure conditions as this test showed breakthrough times much longer than 16 hours for SD1 and SC1 cartridges, which are consistent with the field experiment results.
- Maximum mercury concentrations at the inlets to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 33% and 27% of the OEL, respectively. These concentrations were 1.6× higher than the historic maximum (20% of the OEL). All cartridge outlet concentrations for mercury were below the RL (6.8 % of the OEL), indicating that no breakthrough occurred.
- Maximum formaldehyde concentrations at the inlets to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were both 17% of the OEL. These concentrations were 1.5× higher than the historical (11% of the OEL) AX exhauster measurements. All cartridge outlet concentrations for formaldehyde were higher than the DL (0.59 % of the OEL), but less than 3% of the OEL, indicating that no breakthrough occurred.
- Maximum NDMA concentrations at the inlets to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 73% and 55% of the OEL, respectively. The highest cartridge inlet concentration was approximately 1.6× higher than the historic maximum concentration (46 % of the OEL). All measured outlet concentrations were less than the analytical RL of approximately 8.5% of the OEL, indicating no breakthrough for either cartridge.
- The maximum NDEA concentration at the inlet to the SCOTT 7422-SC1 cartridge was 18% of the OEL. All inlet concentrations for the SCOTT 7422-SD1 cartridge and all outlet concentrations for both cartridges were less than the RL—approximately 16% of the OEL—indicating no breakthrough for either cartridge.
- Maximum N-nitrosomorpholine concentrations at the inlet to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 42% and 43%, respectively. These concentrations are lower than the historic maximum (151% of the OEL) concentration measurements from the AX exhauster. All outlet concentrations were less than the RL of approximately 2.5% of the OEL, indicating no breakthrough for either cartridge.
- The Overview of 2016—2018 Testing of Air-Purifying Respirator Cartridge Performance on Multiple Hanford Tank Headspaces and Exhausters, Freeman et.al. [25], provides additional information on the use of the cartridge testing results for the first 28 cartridge tests with the SCOTT service life calculator.

PAPR Cartridge Testing

Based on measured PAPR cartridge inlet vapor concentrations from the AX exhauster, none of the COPCs exceeded their corresponding OELs. Seven COPCs—ammonia, mercury, formaldehyde, NDMA, NDEA, N-nitrosomethylethylamine, and N-nitrosomorpholine—had one or more inlet concentration measurements greater than 10% of their respective OELs and greater than their analytical DLs or RLs, but less than 100% of the OEL. All other COPC inlet and outlet measurements did not exceed 10% of their OELs or exceed their RLs. Summaries of cartridge performance for the COPCs with inlet concentrations greater than 10% of their respective OEL values follow.

- Maximum ammonia concentrations at the respirator cartridge inlet to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 19% and 17% of the OEL, respectively. These concentrations were less than a factor of 2× the historical maximum (12.9% of the OEL). All cartridge outlet concentrations for ammonia were higher than the RL (2.4 % of the OEL), but less than 10% of the OEL, indicating that no breakthrough occurred. The MSA service life calculator indicates a breakthrough time longer than 16 hours for the TL1 cartridge under the experiment conditions. Using an estimation method provided by 3M,[4] the service life for the FR-57 cartridge also is estimated to be longer than 16 hours.
- Maximum mercury concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 35% and 90% of the OEL, respectively. These concentrations were approximately 4.5× and 1.9× higher than the historical average (18% of the OEL) and maximum (20% of the OEL) AX exhauster measurements. All the cartridge outlet concentrations for mercury were below the RL (6.8 % of the OEL), indicating that no breakthrough occurred.
- Maximum formaldehyde concentrations at the inlets to both PAPR cartridges were 17% of the OEL. These concentrations were approximately 1.5× higher than the historical average and maximum (11% of the OEL) historic AX exhauster measurements. All outlet concentrations for both cartridges were above the DL (0.56 % of the OEL), but less than 10% of the OEL, indicating no breakthrough for either cartridge.
- Maximum NDMA concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 72% and 63% of the OEL, respectively. These concentrations are approximately 1.6× higher than the historical maximum (46% of the OEL) AX exhauster measurement. All measured outlet concentrations were less than the analytical RL of approximately 4.7% of the OEL, indicating no breakthrough for either cartridge.
- Maximum NDEA concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 18% and 20% of the OEL, respectively. These concentrations were higher than the less-than-RL historical concentration measurements from the AX exhauster. All outlet concentrations were less than the RL of approximately 10% of the OEL, indicating no breakthrough for either cartridge.
- Maximum N-nitrosomethylethylamine concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 5.4% and 40% of the OEL, respectively. These concentrations were higher than the maximum historical AX exhauster concentration measurement of 1.7% of the OEL. All outlet concentrations were less than the RL of approximately 4.1% of the OEL, indicating no breakthrough for either cartridge.
- Maximum N-nitrosomorpholine concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 51% and 45% of the OEL, respectively. These concentrations were lower than the maximum historical concentration measurement of 151% of the OEL. All outlet concentrations were less than the RL of approximately 1.5% of the OEL, indicating no breakthrough for either cartridge.

Recommendations

Based on the measurements taken for this study, no breakthrough of any COPCs, above 10% of their OELs was observed during the 16-hour test period for each of the four APR or PAPR cartridges tested. Only seven COPCs were detected above 10% of their OELs in the inlets to any of the cartridge tests on the AX exhauster slipstream. Ammonia inlet concentrations were substantially lower than many of the previous cartridge tests where ammonia breakthrough was observed. SCOTT's SureLife Calculator

[4] The 3M Service Life Software has limited models for non-organic vapors for their FR-57 PAPR cartridge. 3M provided an estimation method that is documented in Appendix G of Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, LA Mahoney. 2018. *Analysis of Powered Air-Purifying Respirator (PAPR) Cartridge Performance Testing on Hanford Tanks SX-101 and SX-104*. PNNL-27558 Vol. 1 Rev. A, Pacific Northwest National Laboratory, Richland, Washington. (unpublished).

currently is not available so exact cartridge service life estimates could not be made. However, previous results obtained from using the SureLife calculator under similar conditions showed a breakthrough time much longer than 16 hours, which is consistent with the field experiment result. Similarly, the MSA service life calculator indicated a breakthrough time longer than 16 hours for the TL1 cartridge under the experimental conditions. Using the estimation method provided by 3M,[4] the service life for the FR-57 cartridge also was estimated to be longer than 16 hours. Variations in humidity, temperature, or cartridge inlet concentration for any COPCs, especially ammonia, compared to those measured in the current study could impact breakthrough times. Still, the combined predictions continue to give confidence in the use of ammonia service life predictions for informing Industrial Hygiene experts in developing an appropriate respirator cartridge change-out schedule for adequate worker protection.

Revision History

Revision Number	Effective Date	Description of Change
A		Draft for Review
1	July 2020	This report has been revised to address external peer review comments on the Rev. A report and subsequent test reports from 2016 and 2017 cartridge testing and to correct data reporting errors. The principal changes included: 1. Addressing several external peer review comments including: • Referencing the *Overview of 2016 through 2018 Testing of Respirator Cartridge Performance on Multiple Hanford Tank Headspaces and Exhausters*,[5] which provided additional information on historic Chemical of Potential Concern source concentrations and the significance of any differences between cartridge-testing results and historic maxima. • Clarifying terminology regarding breakthrough time vs. service life and change-out schedule.

[5] Freeman CJ, J Liu, C Clayton, SK Nune, LA Mahoney, CL Bottenus, TM Brouns, MJ Minette, and P Humble. 2020. *Overview of 2016 Testing of Respirator Cartridge Performance on Multiple Hanford Tank Headspaces and Exhausters*, PNNL-26821 Revision 1, Pacific Northwest National Laboratory, Richland, Washington.

Acronyms and Abbreviations

ALS	ALS Environmental Salt Lake City
APR	air-purifying respirator
CBAL	Columbia Basin Analytical Laboratory, part of the RJ Lee Group
CFR	Code of Federal Regulations
COPC	Chemicals of Potential Concern
CVAA	Cold Vapor Atomic Absorption
DL	detection limit
EPA	U.S. Environmental Protection Agency
GC–FID	Gas Chromatography–Flame Ionization Detector
GC/MS	Gas Chromatography/Mass Spectrometry
GC–TEA	Gas Chromatography–Thermal Energy Analyzer
HPLC	High Performance Liquid Chromatography
HPLC–UV	High Performance Liquid Chromatography–Ultraviolet
IC	ion chromatography
NDEA	N-nitrosodiethylamine
NDMA	N-nitrosodimethylamine
NIOSH	National Institute of Occupational Safety and Health
NMEA	N-nitrosomethylethylamine
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
SCBA	Self-Contained Breathing Apparatus
PAPR	powered air-purifying respirator
ppm	parts per million
PNNL	Pacific Northwest National Laboratory
RL	reporting limit
SWIHD	Site-Wide Industrial Hygiene Database
TIC	Tentatively Identified Compound
VOC	Volatile Organic Compound
WHL	Wastren Hanford Laboratory (222S)
WRPS	Washington River Protection Solutions

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1.0 Introduction/Project Description

As the Tank Operations Contractor for U.S. Department of Energy operations at the Hanford site in Washington State, Washington River Protection Solutions (WRPS) is responsible for managing highly radioactive wastes stored in tanks at Hanford. WRPS recently identified the need to test air-purifying respirator (APR) and powered air-purifying respirator (PAPR) chemical cartridges commonly used at Hanford tank farms. The tests were conducted to determine the period of time that the cartridges would provide adequate performance for APRs and PAPRs used to protect workers when exposed to a mixture of Chemicals of Potential Concern (COPC) from any vapors exiting headspaces in the storage tanks. The Occupational Safety and Health Administration (OSHA) Standard promulgated in Title 29 of the Code of the Federal Regulations (CFR) 1910.134(d)(3)(iii)(b)(2) specifies that for protection against gases and vapors, employers shall implement a schedule for cartridges to ensure that change-outs occur before the end of service life.[1-4] The change schedule can be based on objective information or data that ensures cartridge change-outs occur before the end of their service life.[2-5] The primary function of the WRPS Cartridge Test Program is to obtain objective data to determine service lives for the APR and PAPR cartridges used at Hanford tank farms. WRPS contracted with Pacific Northwest National Laboratory to analyze the test data and offer an independent analysis and any recommendations. This report summarizes data analysis of APR and PAPR cartridge testing on a Hanford AX tank farm exhauster slipstream. Two different APR cartridges from SCOTT Safety (Monroe, North Carolina) and two different PAPR cartridges—one from MSA Safety Inc. (Pittsburgh, Pennsylvania) and another from 3M (Maplewood, Minnesota)—were assessed on the AX exhauster source.

2.0 Regulatory Requirements

2.1 Background on Regulatory Requirements

OSHA Respiratory Protection Standard (29 CFR 1910.134) mandates/requires that employers provide protective equipment, including respirators, to their employees to protect them against potential exposure to contaminants at or above documented Occupational Exposure Limits (OELs) and establish cartridge change-out schedules to ensure cartridges are changed before the end of service life.[1] End of service life is the time when a respirator cartridge can no longer filter/capture harmful contaminants (i.e., the cartridge no longer functions effectively).

Protective respirator cartridges are frequently used in workplaces with low contaminant concentrations, and where respirators provide essential protection for longer periods of time (greater than 2 hours). If the contaminant concentration in a workplace is high, supplied air respirators or self-contained breathing apparatuses (SCBA) must be used to provide additional protection. While the use of supplied air respirators or SCBAs offers more protection, a tradeoff exists, particularly for SCBAs that employ a large, heavy (~30 pounds), back-mounted compressed air cylinder.[1]

2.2 OSHA-Approved Methods for Determining Cartridge Change-Out Times

The National Institute of Occupational Safety and Health (NIOSH) certifies organic vapor cartridges using the criteria in 42 CFR 84, Approval of Respiratory Protective Devices. Still, there is no widely accepted, standard protocol for performing service-life testing.[4] However, OSHA has identified the three approaches described below as valid for establishing cartridge service lives.[3]

- *Conduct experimental tests* – The first step is to gather all available information about the nature of all contaminants present in the workplace. Obtain breathing rates of workers and estimate worst-case exposures. For most employers, this approach is the most time consuming, and resources needed to perform these tests may not be available. If an employer has the resources needed to pursue this approach, it is the most reliable method of estimating cartridge service life. Concentrations at different points in time are obtained using actual respirator cartridges exposed to actual or simulated gases to gather service-life information. A safety factor that includes the assumptions made, variable factors, or conditions needs to be applied to the service life and used in the respiratory protection program. This approach is commonly used in situations where mixtures of contaminants are present and also can be used to validate an existing cartridge change-out schedule.
- *Use the manufacture's recommendation* – When information about airborne contaminants (including concentrations, temperature, and humidity) has been obtained, contact the manufacturer of the respirator to be used and provide all the information. Manufacturers should be able to provide the estimated service life of different cartridges for specific chemical compounds. Manufacturers also should be able to provide the exact objective information they used to estimate the service life. . Using the information obtained, service lives are proposed. This approach is not as reliable as conducting application-specific experiments, and manufacturers may not have all the information for workplace hazards and user factors. If any safety factor is applied considering all the variable factors, it must be clearly identified in the respiratory protection program. For complex mixtures such as those present in the Hanford waste storage tanks, manufacturer recommendations may be of limited value, and experimental testing is recommended.

- *Use mathematical models* – Mathematical models are usually applicable for single contaminant exposure situations. Over the years OSHA and NIOSH have worked with researchers and industrial partners to develop mathematical models for predicting respirator cartridge service life.[3, 5-11] OSHA offers guidance on using mathematical models to estimate respirator cartridge service life based on single components, but the models have not been adopted for mixtures of components. NIOSH has developed a computer tool for estimating breakthrough times and service lives of respirator cartridges. Manufacturers can use those results to make service-life recommendations for their products (canister/cartridge) in multi-gas environments. Two types of mathematical models are used: 1) predictive models [3, 5-7] and 2) descriptive models.[9] Each model has its own mathematical basis for its estimations. To estimate the service lives of cartridges, the following information is needed:
  - Number of cartridges used by the respirator
  - Mass of the sorbent used in each cartridge
  - Carbon micro-pore volume
  - Density of the packed bed
  - Maximum temperature
  - Maximum relative humidity
  - Maximum concentration of the contaminants and the work (volumetric flow) rate.

  The primary advantages of using mathematical models are that they are relatively inexpensive and take little time. However, the estimates are not as accurate as testing; sometimes modeling might result in a service-life estimate that is shorter than it needs to be because of conservative assumptions used during calculations.

In addition to the methods described above, "rules of thumb" can be allowed as part of the overall workplace organic vapor assessment for determining a cartridge change-out schedule. Chapter 36 of the American Industrial Hygiene Association publication, *The Occupational Environment: Its Evaluation and Control and Management*, outlines the approach.[12] The "rules of thumb" may not work for every chemical or situation, but provide an estimation of cartridge life. The following are rules of thumb outlined in the publication:

- If the compound's boiling point is >70°C and the concentration is <200 ppm, a service life of 8 hours at a normal work rate can be expected.
- Service life is inversely proportional to worker breathing rate.
- Reducing the concentration of a contaminant by a factor of 10 will increase service life by a factor of 5.
- Relative humidity above 85% will reduce the service life by 50%.

These rules of thumb[6] do not apply in certain situations, including for mixtures of hazardous contaminants (e.g., Hanford tank farm vapors) and inorganic gases such as ammonia, sulfur dioxide, and hydrogen sulfide, compositions that vary with time and location, and contaminants that undergo continuous reactions. However, some of the general drivers can help in interpreting the results obtained from experimental testing of respirator cartridges.

[6] The general drivers (a.k.a., rules of thumb) are applicable to certain compounds, but not to all compounds in a mixture, such as those in specific Hanford tank mixtures. However, an Industrial Hygiene professional can use these rules of thumb to support interpretation of results from both experiments and predictions.

3.0 Description of Testing Program

Based on the OSHA guidance described in Section 2, a sample testing approach was pursued for quantifying respirator cartridge effectiveness for Hanford tank vapors. WRPS developed a sampling approach outlined in TFC-PLN-168, "Industrial Hygiene Sampling and Analysis Plan for Respirator Cartridge Testing," and "Air Purifying Respirator Cartridge Test Apparatus, RPP-STE-59226."[13,14]

Appendix A provides a description of the APR and PAPR cartridge-testing setup developed by WRPS and used for measurements of vapors from the AX tank farm exhauster.[13-15] The test system and methodology were developed in consultation with recognized subject matter experts to follow the example of tank farm headspace field sampling for the purposes of cartridge testing. The design of the APR cartridge test rig used previously [16-25] was modified to accommodate the higher flow rates and larger PAPR cartridges.

The Sampling and Analysis Plan was developed under the direction and oversight of the Industrial Hygienist in conjunction with the Tank Farms Operations Contractor Retrieval and Closure, and Tank Farms Project and/or Production Operations Project Management Team, as applicable. Trained Industrial Hygiene Technicians under the direction of a qualified Industrial Hygienist collected chemical vapor samples from the influent and effluent sides of the cartridge test apparatus. Before the test stands were transported to the tank farms, WRPS Sampling Equipment Operators, Industrial Hygiene Technicians, and Field Work Supervisors underwent training at HiLine Engineering (Richland, Washington).

The APR and PAPR cartridge tests were designed and constructed to operate to the following environmental conditions without negatively impacting system performance:

- Temperature: 32 to 115°F
- Relative Humidity: 5 to 100%
- Precipitation: Up to 4 inches in 6 hours
- Wind: Up to 20 mph with blowing dust.

WRPS developed a testing program with the following conservative conditions to support robust cartridge service life estimates:

- The flow rate through each APR cartridge was set at 30 L/min (equivalent to 60 L/min for a pair of cartridges), which corresponds to more than twice the normal breathing rate of a worker and is slightly higher than the OSHA recommended testing flow rate of 53.3 L/min.[3,5]
- The flow rate through the PAPR cartridges was set at 95 L/min, which is equivalent to 190 L/min for a two-cartridge unit, or 285 L/min for a three-cartridge unit. These test flow rates are significantly higher than the minimum PAPR flow rate requirements.[7] The flow rate also is conservative relative to the 3M-specified flow rate of 220 L/min for use in service-life estimates of their Breathe Easy PAPR with FR-57 cartridge,[4] and slightly below MSA-specified flow rate of 205 L/min assigned in their Response® Guide cartridge life expectancy calculator for the Optimair TL PAPR with hood [27].

[7] PAPR cartridges have a minimum flow rate requirement of 115 L/min for a tight-fitting mask and 170 L/min for a loose-fitting hood [26]. The MSA PAPR uses two TL1 cartridges, and the 3M PAPR uses three FR-57 (TL2) cartridges. Testing at 95 L/min provided a conservatively high flow rate for the MSA cartridge (equivalent to 190 L/min = 12% higher than minimum for a loose-fitting hood), and the 3M cartridge (equivalent to 285 L/min = 68% higher than minimum for a loose-fitting hood).

- Tank farm vapors source sampling was performed on headspace or exhauster stack vapors rather than from Hanford tank farm atmospheric concentrations (i.e., source sampling versus the breathing zone).
- A threshold concentration of 10% of the OEL for each COPC was chosen.

Using the cartridge-testing setup described in Appendix A, separate test surveys were performed on four NIOSH-approved respiratory protection cartridges: SCOTT 7422-SD1 for Survey 1 and SCOTT 7422-SC1[8] for Survey 2 using the APR test rig[28], and MSA Optifilter TL (TL1)[9] for Survey 1 and 3M FR-57 (TL2)[10] for Survey 2 using the PAPR test rig.[29,30] These cartridges were chosen because they can capture organic vapors, acid gases, ammonia, formaldehyde, and particulates.[27,28]
Vapor concentrations upstream and downstream of the cartridges were monitored with an array of sorbent tubes (see Appendix B). Influent (upstream) concentrations were measured at the beginning and end of each 16-hour verification survey. Downstream sorbent tubes were changed out every 2 hours until the experiment was finished. A measured quantity of sample air was drawn in through the sorbent tube (see Appendix A).[13,14] Compounds from the sorbent tubes were extracted and analyzed using analytical methods referenced in Appendix B.

The characteristics of 59 COPCs were the primary focus of the testing. The 59 COPCs represent a set of tank vapor chemicals found in a tank farm source greater than 10% of the OEL or are considered "known" or "probable" carcinogens by the International Agency for Research Cancer or other regulatory agencies.[31,32] A full listing of these COPCs is provided in Section 4.0.

[8] SCOTT part numbers 7422-SC1 and 7422-SD1 are multipurpose APR respirator cartridges for use on Xcel half-mask and all SCOTT full facepieces with NIOSH approval for OV/AM/MA/CL/HC/SD/CD/HF/FM/HS application. The -SD1 cartridge has the same multipurpose features as the -SC1, but also includes a P100 particulate filter. https://www.3mscott.com/download/742-series-cartridges-user-instructions-english/

[9] MSA OptiFilter TL (Part number 10143421; Reorder Number 10080456) is a multipurpose PAPR respirator cartridge for use with the OptimAir® TL PAPR, with NIOSH approval for AM/CL/CD/FM/HC/HS/MA/SD/HE/HF application. https://us.msasafety.com/Air-Purifying-Respirators-%28APR%29/Powered-Air-Purifying-Respirators-%28PAPR%29/OptimAir%C2%AE-TL-PAPR/p/000100003000001600

[10] 3M FR-57 (Part number 453-03-02R06) is a multipurpose PAPR respirator cartridge for use with the 3M RRPAS 6000 series facepieces or BE-10 series hood powered supplied air respirator systems, with NIOSH approval for OV/SD/HC/CL/CK/HF/AM/MA/FM/HE application. https://www.3m.com/3M/en_US/company-us/all-3m-products/~/3M-High-Efficiency-Cartridge-FR-57-453-03-02R06-6-EA-Case/?N=5002385+3294780228&rt=rud

4.0 Data Analysis

Respirator cartridge tests on vapors from the Hanford AX tank farm exhauster slipstream were conducted from August 25–27, 2017. Two different APR cartridges—SCOTT 7422-SD1 and SCOTT 7422-SC1—and two different multipurpose PAPR cartridges—MSA-TL (TL1) and 3M FR-57 (TL2)—were tested for approximately 16 hours of continuous run time. Testing and analyses focused on the 59 COPCs identified in Table 1 (APR Cartridges) and Table 2 (PAPR Cartridges) and other hazardous airborne contaminants.[11] Sorbent tubes were changed every 2 hours. More than 400 sorbent tubes were sent to the 222S Laboratory at Hanford and dispositioned for analyses.

In previously published cartridge reports, raw data for all contaminants analyzed during the tests were provided in Appendix C to the document. However, the extensive amount of data (over 900 pages for this report) resulted in unwieldy document file sizes. To solve this problem, we are providing the raw data in a separate volume (Volume 2) to this report. We have included an Appendix C in this document (Volume 1) to maintain consistency with the structure of the previously published reports and to direct readers who want to review the raw data to Volume 2. Volume 2 also provides the temperature and relative humidity of the sample slipstream during testing.

Appendix D of this report lists the corresponding calculated concentrations. The AX exhauster slipstream temperature ranged from 61 to 101°F, and the relative humidity ranged from 31 to 87%.[12]

Tables 1 and 2 provide overviews of the results for each of the 59 COPCs for APR and PAPR cartridges, respectively. Note that nitrous oxide was not analyzed as it is not susceptible to respirator filtration, and there are no known NIOSH-approved respirator filtration cartridges approved for nitrous oxide.

4.1 APR Cartridge Testing

Table 1 shows the measured concentrations from Hanford AX tank farm exhauster slipstream testing of APR cartridges (SCOTT 7422-SD1 and SCOTT 7422-SC1) for all of the COPCs evaluated. None of the inlet COPC concentrations exceeded their corresponding OELs. The inlet (or outlet) concentrations of six COPCs were lower than their corresponding OELs but exceeded 10%. These COPCs were ammonia, mercury, formaldehyde, N-nitrosodimethylamine (NDMA), N-nitrosodiethylamine (NDEA) and N-nitrosomorpholine. All six of these COPCs are highlighted in yellow in Table 1 and are assessed in more detail in Section 5.1. Appendix E shows similar detailed assessments for additional two COPCs with respirator cartridge inlet (or outlet) concentrations or detection limits (DL)/reporting limits (RL) less than 10% of their OELs but greater than 2%. These COPCs were N-nitrosomethylethylamine (NMEA) and 2-heptylfuran. All of the other COPCs had inlet (or outlet) concentrations less than 2% of their OELs or their DLs.

[11] At the time of testing in August 2017, the tank farm COPC list included 59 chemical compounds. In September 2017, after testing but prior to completion of data analysis and reporting, dimethylmercury and 2-propenal were added to the tank farm COPC list, thereby increasing the number of COPCs to 61. Dimethylmercury was not measured in these tests because it requires special sampling and analysis methods. 2-Propenal is regularly addressed in Industrial Hygiene sampling as part of the aldehydes sorbent tube suite of compounds. For completeness, these two new COPCs are listed in Table 1 after COPC #18 and #59.

[12] The measured temperature and relative humidity for the APR cartridge testing covered a slightly larger range than that of the PAPR cartridge testing. PAPR temperatures ranged from 63 to 98°F, and the relative humidity ranged from 34 to 72%. The difference in the range of temperature and humidity may be the result of the larger flow rate of the PAPR test rig.

Table 1. Summary of Analyzed COPCs-APR Cartridge Testing

COPC Number and Name	CAS Number	Highest Measured Value (this study)	Occupational Exposure Limit (OEL)	Approximate Analytical Detection Limit, DL[1] (% of OEL)	All Data Values (inlet and outlet) <DL or <RL	Highest Detected Value Compared to OEL
Inorganic						
1 Ammonia	7664-41-7	5.97 ppm	25 ppm	2.50%		Up to 23.9% of OEL for inlet values. All outlets ≤DL.
2 Nitrous Oxide	10024-97-2	Not Measured	50 ppm			
3 Mercury	7439-97-6	8.18 ug/m3	25 ug/m3	6.81%		Up to 32.7% of OEL for inlet values. All outlets ≤DL.
Hydrocarbons						
4 1,3-Butadiene	106-99-0	0.0201 ppm	1 ppm	2.01%	X	
5 Benzene	71-43-2	0.0003 ppm	0.5 ppm	0.021%		Up to 0.06% of OEL for inlet values. All outlets ≤0.03%.
6 Biphenyl	92-52-4	0.0001 ppm	0.2 ppm	0.047%		Up to 0.05% of OEL for inlet values. All outlets ≤DL.
Alcohols						
7 1-Butanol	71-36-3	0.0042 ppm	20 ppm	0.001%		Up to 0.02% of OEL for inlet values. All outlets ≤0.004%.
8 Methanol	67-56-1	Not Measured	200 ppm			
Ketones						
9 2-Hexanone	591-78-6	0.0002 ppm	5 ppm	0.002%		Up to 0.005% of OEL for inlet values. All outlets ≤DL.
10 3-Methyl-3-butene-2-one	814-78-8	Not Detected	0.02 ppm	TIC[2]	X	
11 4-Methyl-2-hexanone	105-42-0	0.0001 ppm	0.5 ppm	0.017%	X	
12 6-Methyl-2-heptanone	928-68-7	Not Detected	8 ppm	TIC	X	
13 3-Buten-2-one	78-94-4	0.0005 ppm	0.2 ppm	0.115%		Up to 0.23% of OEL for inlet values. All outlets ≤DL.
Aldehydes						
14 Formaldehyde	50-00-0	0.0517 ppm	0.3 ppm	0.59%		Up to 17.2% of OEL for inlet values. All outlets ≤2.1%.
15 Acetaldehyde	75-07-0	0.0797 ppm	25 ppm	0.005%		Up to 0.32% of OEL for inlet values. All outlets ≤0.29%.
16 Butanal	123-72-8	0.0011 ppm	25 ppm	0.001%		Up to 0.004% of OEL for inlet values. All outlets ≤0.001%.
17 2-Methyl-2-butenal	1115-11-3	Not Detected	0.03 ppm	TIC	X	
18 2-Ethyl-hex-2-enal	645-62-5	Not Detected	0.1 ppm	TIC	X	
New 2-Propenal	107-02-8	Not Measured	0.1 ppm	0.95%	X	

[1] An approximate DL is calculated using the reported DLs (or RLs) from the analytical laboratory and the average volume (from flowrate x time) of vapor exposed to the sorbent tube. For the furans, both DL and RL values [25] are reported as "DL/RL."

[2] Tentatively Identified Compound (TIC) indicates that a mass spectrometry "peak" not associated with calibrated compounds has been tentatively assigned to a compound based on an adequate match to the analytical methods reference library. Reference standards for the compound are not available to accurately quantify, assign an analytical DL, or definitively confirm the identity of the TIC. TICs are reported when the peak area is sufficiently large, estimated as ≥5 nanograms of TIC mass, and other analytical criteria are met. For the respirator cartridge testing, this mass of TIC represents an approximate concentration of <1.0 ppb, based on the average of all TICs in the COPC list.

[3] Furan, 2,5-dihydrofuran, and 2-methylfuran are quantified using the Carbotrap 300 TDU tube. All other substituted furans are quantified using the furans tube. See Appendix B and C for more information.

Table 1. (continued)

COPC Number and Name	CAS Number	Highest Measured Value (this study)	Occupational Exposure Limit (OEL)	Approximate Analytical Detection Limit, DL[1] (% of OEL)	All Data Values (inlet and outlet) <DL or <RL	Highest Detected Value Compared to OEL
Furans						
19 Furan	110-00-9	0.43 ppb	1 ppb	DL/RL[1] 43.3%/124%[3]	X	
20 2,3-Dihydrofuran	1191-99-7	0.04 ppb	1 ppb	3.54%/30.5%	X	
21 2,5-Dihydrofuran	1708-29-8	0.19 ppb	1 ppb	19.0%/120%[3]	X	
22 2-Methylfuran	534-22-5	0.10 ppb	1 ppb	10.3%/103%[3]	X	
23 2,5-Dimethylfuran	625-86-5	0.07 ppb	1 ppb	6.67%/22.2%	X	
24 2-Ethyl-5-methylfuran	1703-52-2	Not Detected	1 ppb	TIC	X	
25 4-(1-Methylpropyl)-2,3-dihydrofuran	34379-54-9	Not Detected	1 ppb	TIC	X	
26 3-(1,1-Dimethylethyl)-2,3-dihydrofuran	34314-82-4	Not Detected	1 ppb	TIC	X	
27 2-Pentylfuran	3777-69-3	0.06 ppb	1 ppb	5.48%/15.4%	X	
28 2-Heptylfuran	3777-71-7	0.08 ppb	1 ppb	4.14%/12.8%		Up to 6.9% of OEL for inlet values. All outlets ≤7.9%.
29 2-Propylfuran	4229-91-8	0.04 ppb	1 ppb	4.13%/19.4%	X	
30 2-Octylfuran	4179-38-8	Not Detected	1 ppb	TIC	X	
31 2-(3-Oxo-3-phenylprop-1-enyl)furan	717-21-5	Not Detected	1 ppb	TIC	X	
32 2-(2-Methyl-6-oxoheptyl)furan	51595-87-0	Not Detected	1 ppb	TIC	X	
Phthalates						
33 Diethylphthalate	84-66-2	0.0010 mg/m3	5 mg/m3	0.020%	X	
Nitriles						
34 Acetonitrile	75-05-8	0.313 ppm	20 ppm	0.003%		Up to 0.08% of OEL for inlet values. All outlets ≤1.6%.
35 Propanenitrile	107-12-0	0.0013 ppm	6 ppm	0.004%		Up to 0.02% of OEL for inlet values. All outlets ≤DL.
36 Butanenitrile	109-74-0	0.0010 ppm	8 ppm	0.002%		Up to 0.01% of OEL for inlet values. All outlets ≤DL.
37 Pentanenitrile	110-59-8	0.0002 ppm	6 ppm	0.002%		Up to 0.004% of OEL for inlet values. All outlets ≤DL.
38 Hexanenitrile	628-73-9	0.0001 ppm	6 ppm	0.001%	X	
39 Heptanenitrile	629-08-3	Not Detected	6 ppm	TIC	X	
40 2-Methylene butanenitrile	1647-11-6	Not Detected	0.3 ppm	TIC	X	
41 2,4-Pentadienenitrile	1615-70-9	Not Detected	0.3 ppm	TIC	X	

Table 1. (continued)

COPC Number and Name	CAS Number	Highest Measured Value (this study)	Occupational Exposure Limit (OEL)	Approximate Analytical Detection Limit, DL[1] (% of OEL)	All Data Values (inlet and outlet) <DL or <RL	Highest Detected Value Compared to OEL
Amines						
42 Ethylamine	75-04-7	0.0048 ppm	5 ppm	0.096%	X	
Nitrosamines						
43 N-Nitrosodimethylamine	62-75-9	0.22 ppb	0.45 ppb	8.53%		Up to 73% of OEL for inlet values. All outlets ≤DL.
44 N-Nitrosodiethylamine	55-18-5	0.02 ppb	0.02 ppb	15.7%		Up to 17.6% of OEL for inlet values. All outlets <DL.
45 N-Nitrosomethylethylamine	10595-95-6	0.02 ppb	0.03 ppb	6.62%	X	
46 N-Nitrosomorpholine	59-89-2	0.26 ppb	0.02 ppb	2.51%		Up to 42.9% of OEL for inlet values. All outlets ≤DL.
Organophospates						
47 Tributyl phosphate	126-73-8	0.12 ppb	200 ppb	0.062%	X	
48 Dibutyl butylphosphonate	78-46-6	0.05 ppb	7 ppb	0.70%	X	
Halogenated						
49 Chlorinated Biphenyls	Varies	Not Detected	1 mg/m3	TIC	X	
50 2-Fluoropropene	1184-60-7	Not Detected	0.1 ppm	TIC	X	
Pyridines						
51 Pyridine	110-86-1	0.11 ppb	1000 ppb	0.011%		Up to 0.01% of OEL for inlet values. All outlets ≤DL.
52 2,4-Dimethylpyridine	108-47-4	0.18 ppb	500 ppb	0.039%	X	
Organonitrites						
53 Methyl nitrite	624-91-9	Not Detected	0.1 ppm	TIC	X	
54 Butyl nitrite	544-16-1	Not Detected	0.1 ppm	TIC	X	
Organonitrates						
55 Butyl nitrate	928-45-0	Not Detected	2.5 ppm	TIC	X	
56 1,4-Butanediol, dinitrate	3457-91-8	Not Detected	0.05 ppm	TIC	X	
57 2-Nitro-2-methylpropane	594-70-7	Not Detected	0.3 ppm	TIC	X	
58 1,2,3-Propanetriol, 1,3-dinitrate	623-87-0	Not Detected	0.05 ppm	TIC	X	
Isocyanates						
59 Methyl Isocyanate	624-83-9	Not Detected	20 ppb	TIC	X	
Organometallic						
New Dimethylmercury	593-74-8	Not Measured	10 ug/m3			

4.2 PAPR Cartridge Testing

Table 2 shows the measured concentrations in the current study using PAPR cartridges MSA-TL (TL1) and 3M FR-57 (TL2) for all of the COPCs tested on vapors from the Hanford AX tank farm exhauster slipstream. None of the inlet COPCs concentrations exceeded their corresponding OELs. The inlet (or outlet) concentrations of seven COPCs were lower than their corresponding OELs but exceeded 10%. These COPCs were ammonia, mercury, formaldehyde, NDMA, NDEA, N-nitrosomethylethylamine, and N-nitrosomorpholine. All seven of these COPCs

are highlighted in yellow in Table 2 and are assessed in more detail in Section 5.2. All of the other COPCs had inlet (or outlet) concentrations less than 2% of their OELs or their DLs.

Table 2. Summary of Analyzed COPCs-PAPR Cartridge Testing

	COPC Number and Name	CAS Number	Highest Measured Value (this study)	Occupational Exposure Limit (OEL)	Approximate Analytical Detection Limit, DL[1] (% of OEL)	All Data Values (inlet and outlet) <DL or <RL	Highest Detected Value Compared to OEL
Inorganic							
1	Ammonia	7664-41-7	4.79 ppm	25 ppm	2.39%		Up to 19.2% of OEL for inlet values. All outlets ≤5.64%.
2	Nitrous Oxide	10024-97-2	Not Measured	50 ppm			
3	Mercury	7439-97-6	22.5 ug/m3	25 ug/m3	6.75%		Up to 90.0% of OEL for inlet values. All outlets ≤RL.
Hydrocarbons							
4	1,3-Butadiene	106-99-0	0.0193 ppm	1 ppm	1.93%	X	
5	Benzene	71-43-2	0.0005 ppm	0.5 ppm	0.019%		Up to 0.09% of OEL for inlet values. All outlets ≤0.05%.
6	Biphenyl	92-52-4	0.0001 ppm	0.2 ppm	0.042%		Up to 0.05% of OEL for inlet values. All outlets ≤0.05%.
Alcohols							
7	1-Butanol	71-36-3	0.0048 ppm	20 ppm	0.001%		Up to 0.02% of OEL for inlet values. All outlets ≤0.01%.
8	Methanol	67-56-1	2.04 ppm	200 ppm	1.02%	X	
Ketones							
9	2-Hexanone	591-78-6	0.0003 ppm	5 ppm	0.002%		Up to 0.01% of OEL for inlet values. All outlets≤DL.
10	3-Methyl-3-butene-2-one	814-78-8	Not Detected	0.02 ppm	TIC[2]	X	
11	4-Methyl-2-hexanone	105-42-0	0.0001 ppm	0.5 ppm	0.016%	X	
12	6-Methyl-2-heptanone	928-68-7	Not Detected	8 ppm	TIC	X	
13	3-Buten-2-one	78-94-4	0.0005 ppm	0.2 ppm	0.106%		Up to 0.24% of OEL for inlet values. All outlets ≤DL%.
Aldehydes							
14	Formaldehyde	50-00-0	0.0505 ppm	0.3 ppm	0.566%		Up to 16.8% of OEL for inlet values. All outlets ≤8.90%.
15	Acetaldehyde	75-07-0	0.1200 ppm	25 ppm	0.005%		Up to 0.35% of OEL for inlet values. All outlets ≤0.48%.
16	Butanal	123-72-8	0.0009 ppm	25 ppm	0.001%		Up to 0.004% of OEL for inlet values. All outlets ≤0.001%.
17	2-Methyl-2-butenal	1115-11-3	Not Detected	0.03 ppm	TIC	X	
18	2-Ethyl-hex-2-enal	645-62-5	Not Detected	0.1 ppm	TIC	X	
New	2-Propenal	107-02-8	0.0009 ppm	0.1 ppm	0.909%	X	

[1] Approximate DL is calculated using the reported DLs (or RLs) from the analytical laboratory and the average volume (from flow rate x time) of vapor exposed to the sorbent tube. For the furans, both DL and RL values [25] are reported as "DL/RL."

[2] TIC indicates that a mass spectrometry "peak" not associated with calibrated compounds has been tentatively assigned to a compound based on an adequate match to the analytical methods reference library. Reference standards for the compound are not available to accurately quantify, assign an analytical DL, or definitively confirm the identity of the TIC. TICs are reported when the peak area is sufficiently large, estimated as ≥5 nanograms of TIC mass, and other analytical criteria are met. For the respirator cartridge testing, this mass of TIC represents an approximate concentration of <1.0 ppb, based on the average of all TICs in the COPC list.

[3] Furan, 2, 5-dihydrofuran, and 2-methylfuran are quantified using the Carbotrap 300 TDU tube. All other substituted furans are quantified using the furans tube. See Appendix B and C for more information.

Table 2. (continued)

COPC Number and Name	CAS Number	Highest Measured Value (this study)	Occupational Exposure Limit (OEL)	Approximate Analytical Detection Limit, DL[1] (% of OEL)	All Data Values (inlet and outlet) <DL or <RL	Highest Detected Value Compared to OEL
Furans						
19 Furan	110-00-9	0.40 ppb	1 ppb	DL | RL[1] 39.8% | 114%[3]	X	
20 2,3-Dihydrofuran	1191-99-7	0.02 ppb	1 ppb	2.22% | 19.1%	X	
21 2,5-Dihydrofuran	1708-29-8	0.18 ppb	1 ppb	17.5% | 111%[3]	X	
22 2-Methylfuran	534-22-5	0.09 ppb	1 ppb	9.42% |94.5%[3]	X	
23 2,5-Dimethylfuran	625-86-5	0.04 ppb	1 ppb	4.17% | 13.9%	X	
24 2-Ethyl-5-methylfuran	1703-52-2	Not Detected	1 ppb	TIC	X	
25 4-(1-Methylpropyl)-2,3-dihydrofuran	34379-54-9	Not Detected	1 ppb	TIC	X	
26 3-(1,1-Dimethylethyl)-2,3-dihydrofuran	34314-82-4	Not Detected	1 ppb	TIC	X	
27 2-Pentylfuran	3777-69-3	0.03 ppb	1 ppb	3.43% | 9.67%	X	
28 2-Heptylfuran	3777-71-7	0.03 ppb	1 ppb	2.59% | 8.04%	X	
29 2-Propylfuran	4229-91-8	0.03 ppb	1 ppb	2.58% | 12.1%	X	
30 2-Octylfuran	4179-38-8	Not Detected	1 ppb	TIC	X	
31 2-(3-Oxo-3-phenylprop-1-enyl)furan	717-21-5	Not Detected	1 ppb	TIC	X	
32 2-(2-Methyl-6-oxoheptyl)furan	51595-87-0	Not Detected	1 ppb	TIC	X	
Phthalates						
33 Diethylphthalate	84-66-2	0.0009 mg/m3	5 mg/m3	0.018%	X	
Nitriles						
34 Acetonitrile	75-05-8	0.080 ppm	20 ppm	0.003%		Up to 0.40% of OEL for all inlet values. All outlets ≤1.4%.
35 Propanenitrile	107-12-0	0.0012 ppm	6 ppm	0.004%		Up to 0.02% of OEL for all inlet values. All outlets ≤DL.
36 Butanenitrile	109-74-0	0.0008 ppm	8 ppm	0.002%		Up to 0.01% of OEL for all inlet values. All outlets ≤DL.
37 Pentanenitrile	110-59-8	0.0002 ppm	6 ppm	0.002%		Up to 0.003% of OEL for all inlet values. All outlets ≤DL.
38 Hexanenitrile	628-73-9	0.0001 ppm	6 ppm	0.001%	X	
39 Heptanenitrile	629-08-3	Not Detected	6 ppm	TIC	X	
40 2-Methylene butanenitrile	1647-11-6	Not Detected	0.3 ppm	TIC	X	
41 2,4-Pentadienenitrile	1615-70-9	Not Detected	0.3 ppm	TIC	X	
Amines						
42 Ethylamine	75-04-7	0.0047 ppm	5 ppm	0.094%	X	

Table 2. (continued)

COPC Number and Name	CAS Number	Highest Measured Value (this study)	Occupational Exposure Limit (OEL)	Approximate Analytical Detection Limit, DL[1] (% of OEL)	All Data Values (inlet and outlet) <DL or <RL	Highest Detected Value Compared to OEL
Nitrosamines						
43 N-Nitrosodimethylamine	62-75-9	0.22 ppb	0.3 ppb	4.68%		Up to 71.6% of OEL for inlet values. All outlets ≤RL
44 N-Nitrosodiethylamine	55-18-5	0.02 ppb	0.1 ppb	10.2%		Up to 20.4% of OEL for inlet values. All outlets ≤RL.
45 N-Nitrosomethylethylamine	10595-95-6	0.12 ppb	0.3 ppb	4.12%		Up to 40.3% of OEL for inlet values. All outlets ≤RL
46 N-Nitrosomorpholine	59-89-2	0.31 ppb	0.6 ppb	1.49%		Up to 51.5% of OEL for inlet values. All outlets ≤RL
Organophosphates						
47 Tributyl phosphate	126-73-8	0.11 ppb	200 ppb	0.056%	X	
48 Dibutyl butylphosphonate	78-46-6	0.04 ppb	7 ppb	0.637%	X	
Halogenated						
49 Chlorinated Biphenyls	Varies	Not Detected	1 mg/m3	TIC	X	
50 2-Fluoropropene	1184-60-7	Not Detected	0.1 ppm	TIC	X	
Pyridines						
51 Pyridine	110-86-1	0.12 ppb	1000 ppb	0.010%		Up to 0.01% of OEL for inlet values. All outlets ≤DL
52 2,4-Dimethylpyridine	108-47-4	0.18 ppb	500 ppb	0.036%	X	
Organonitrites						
53 Methyl nitrite	624-91-9	Not Detected	0.1 ppm	TIC	X	
54 Butyl nitrite	544-16-1	Not Detected	0.1 ppm	TIC	X	
Organonitrates						
55 Butyl nitrate	928-45-0	Not Detected	2.5 ppm	TIC	X	
56 1,4-Butanediol, dinitrate	3457-91-8	Not Detected	0.05 ppm	TIC	X	
57 2-Nitro-2-methylpropane	594-70-7	Not Detected	0.3 ppm	TIC	X	
58 1,2,3-Propanetriol, 1,3-dinitrate	623-87-0	Not Detected	0.05 ppm	TIC	X	
Isocyanates						
59 Methyl Isocyanate	624-83-9	Not Detected	20 ppb	TIC	X	
Organometallic						
New Dimethylmercury	593-74-8	Not Measured	10 ug/m3			

5.0 Plots of COPCs with Significant Detected Values

5.1 APR Cartridge Testing

This section provides more detail on the six COPCs from the APR testing on a slipstream from the Hanford AX tank farm exhauster identified in Table 1 as having concentrations (inlet or outlet to the cartridge) greater than 10% of the corresponding OEL. Plots of the corresponding data are given, as well as the associated analyses.

Ammonia *(see Figure 1)* – The DL for ammonia corresponds to approximately 2.5% of its OEL. For both SCOTT 7422-SD1 and 7422-SC1 cartridges, the inlet ammonia concentrations were relatively constant—ranging from 11% to 24% of the OEL. However, the inlet ammonia concentration for both cartridges dropped below 4% of the OEL at 10 hours and then returned to higher concentrations for the remainder of the test. The similar decline in tests on separate days is unusual; it is possible that the abrupt decline in the inlet concentration may have resulted from operational, sampling, or analytical error. All of the outlet measurements were below the analytical DL for both respirator cartridges. Thus, there is no evidence of breakthrough at greater than 10% of the OEL for either cartridge tested.

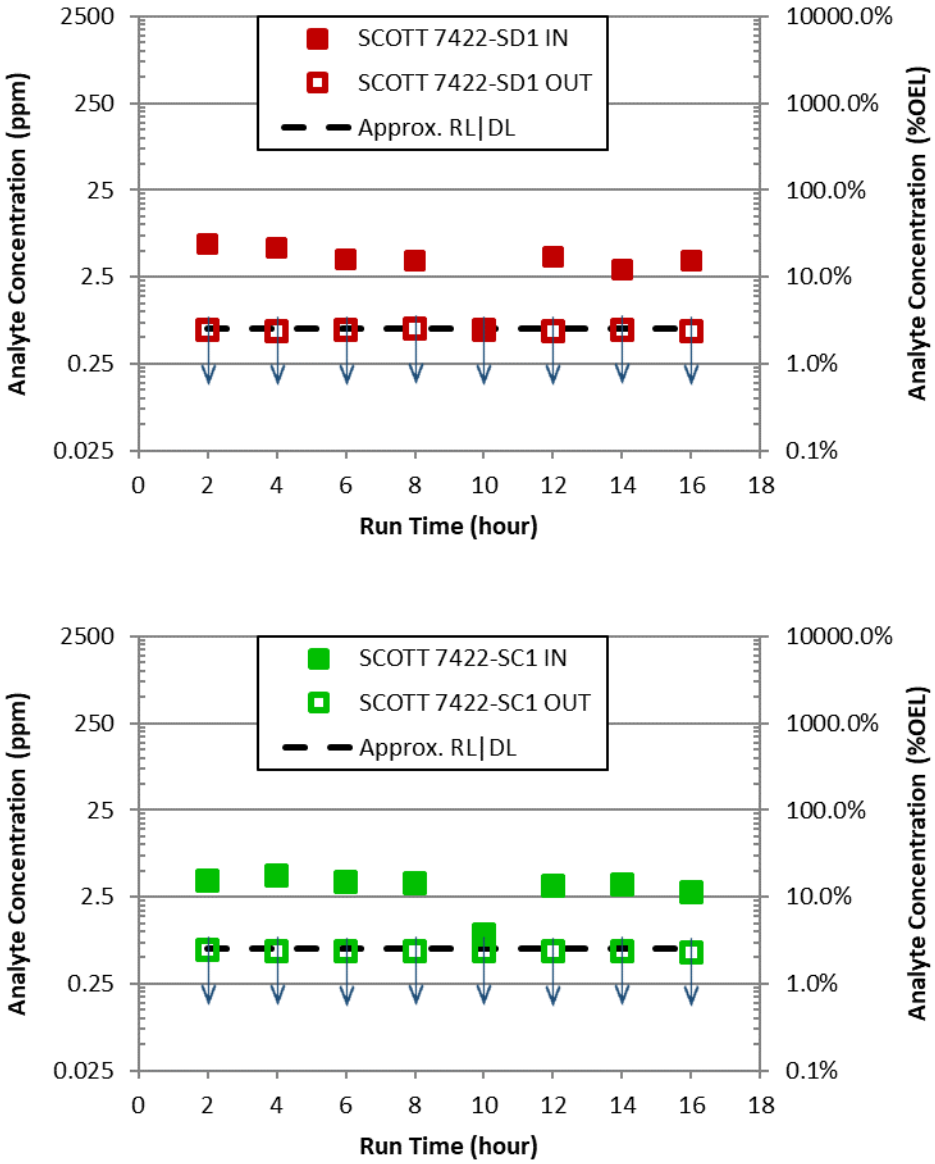

Figure 1. Plot of Measured Ammonia Concentrations before the Inlets and after the Outlets of the Two Respirator Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicates measurements less than the DL or RL. Outlet data points not visible are obscured by the inlet data points.

Mercury *(see Figure 2)* – The DL for mercury corresponds to approximately 6.8% of the OEL. Inlet concentrations measured throughout the testing period for the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges remained relatively constant, ranging between 24 to 33% of the OEL. All of the outlet measurements were below the analytical DL for both respirator cartridges. Thus, there is no evidence of breakthrough over the measured time period for either cartridge tested.

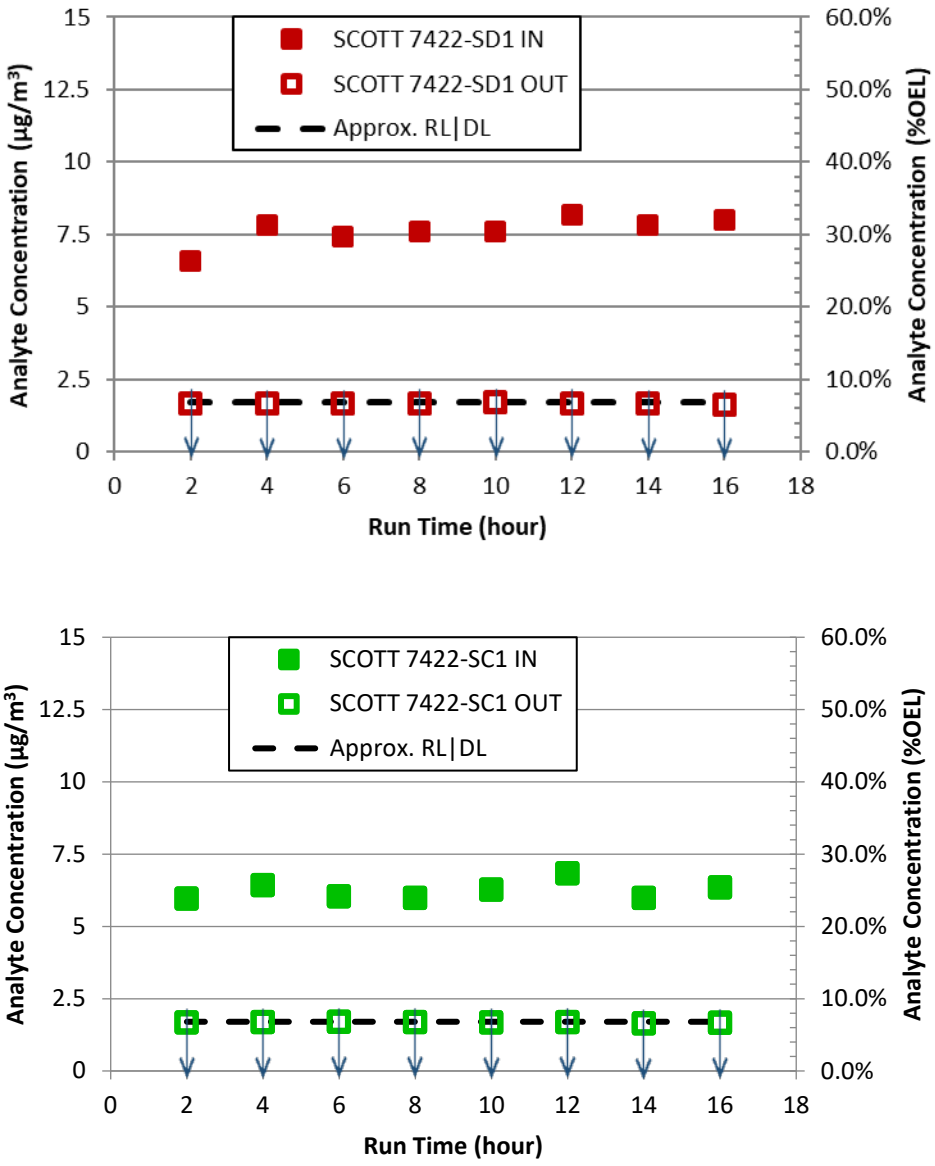

Figure 2. Plot of Measured Mercury Concentrations before the Inlets and after the Outlets of the Two Respirator Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicates measurements less than the DL or RL.

Formaldehyde *(see Figure 3)* – The DL for formaldehyde corresponds to approximately 0.6% of the OEL. Inlet concentrations measured throughout the testing period for the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges remained relatively constant, ranging between 11 to 17% of the OEL, with the exception of the single, 10- hour SCOTT 7422-SC1 sample that decreased to 6.8% of the OEL. All of the outlet measurements were above the analytical DL for both respirator cartridges, but less than 2.1% of the OEL. Therefore, there is no evidence of breakthrough above 10% of OEL over the measured time period for either cartridge tested. Note that the baseline samples with ambient air produced formaldehyde readings slightly higher than the DL, indicating that some of the elevated readings could be due to ambient sources.

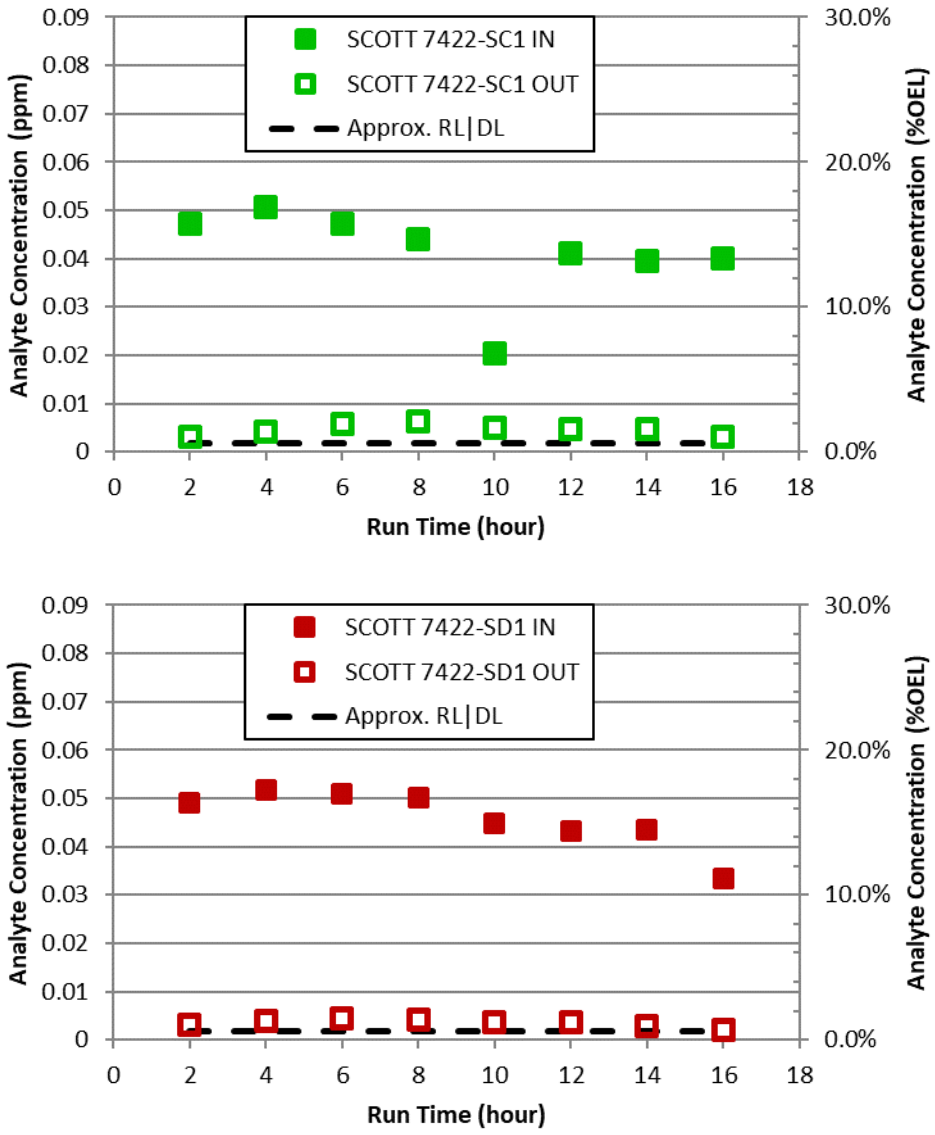

Figure 3. Plot of Measured Formaldehyde Concentrations before the Inlets and after the Outlets of the Two Respirator Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicates measurements less than the DL or RL.

N-nitrosodimethylamine (*see Figure 4****)*** – The DL for NDMA corresponds to approximately 8.5% of its OEL. Inlet concentrations measured throughout the testing period for the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges ranged between 14 to 73% of the OEL. All outlet measurements from both cartridges tested were below the analytical DL. Based on the data, there is no evidence of breakthrough over the measured time period for either cartridge tested.

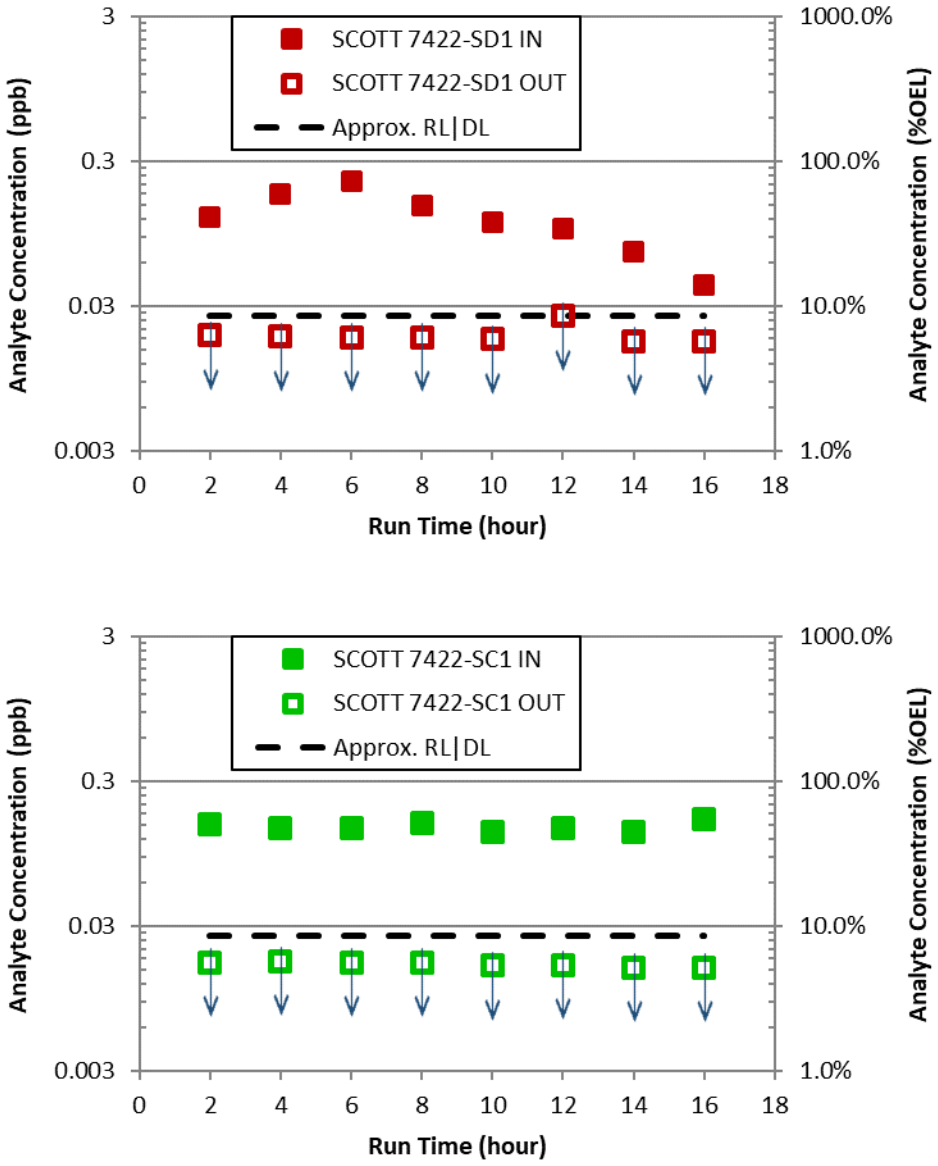

Figure 4. Plot of Measured N-nitrosodimethylamine Concentrations before the Inlets and after the Outlets of the Two Respirator Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicates measurements less than the DL or RL.

N-nitrosodiethylamine *(see Figure 5)* – The DL for NDEA corresponds to approximately 16% of its OEL. All inlet and outlet measurements for SCOTT 7422-SD1 were below the analytical DL. Inlet concentrations measured throughout the testing period for SCOTT 7422-SC1 cartridge ranged between 10 to 18% of the OEL. All of the outlet measurements for SCOTT 7422-SC1 cartridge were below the analytical DL. Thus, there is no evidence of breakthrough over the measured time period for either cartridge tested.

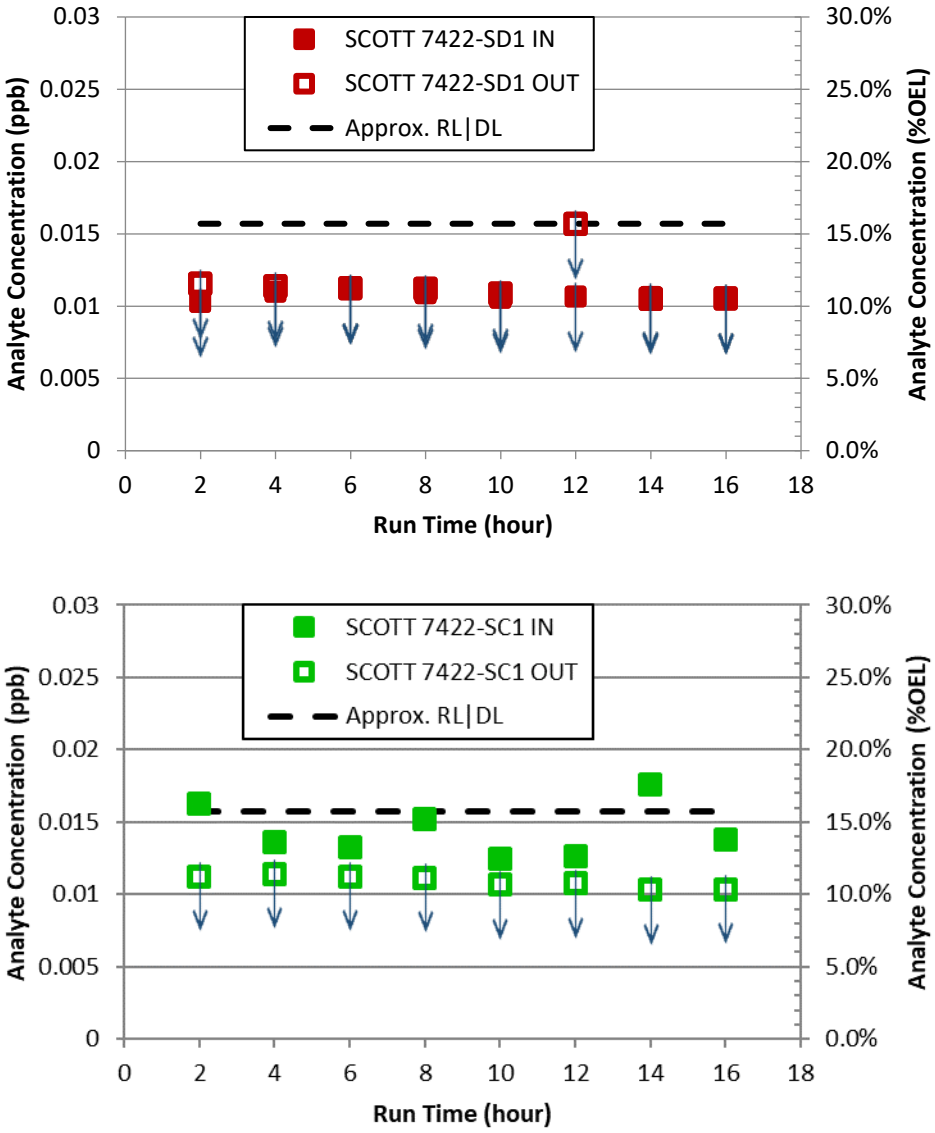

Figure 5. Plot of Measured N-nitrosodiethylamine Concentrations before the Inlets and after the Outlets of the Two Respirator Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicates measurements less than the DL or RL. Outlet data points not visible are obscured by the inlet data points.

N-nitrosomorpholine *(see Figure 6)* – The DL for N-nitrosomorpholine corresponds to approximately 2.5% of its OEL. Inlet concentrations measured throughout the testing period for the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges remained relatively constant, ranging between 34 to 43% of the OEL. All outlet measurements from both cartridges tested were below the analytical DL. Based on the data, there is no evidence of breakthrough over the measured time period for either cartridge tested.

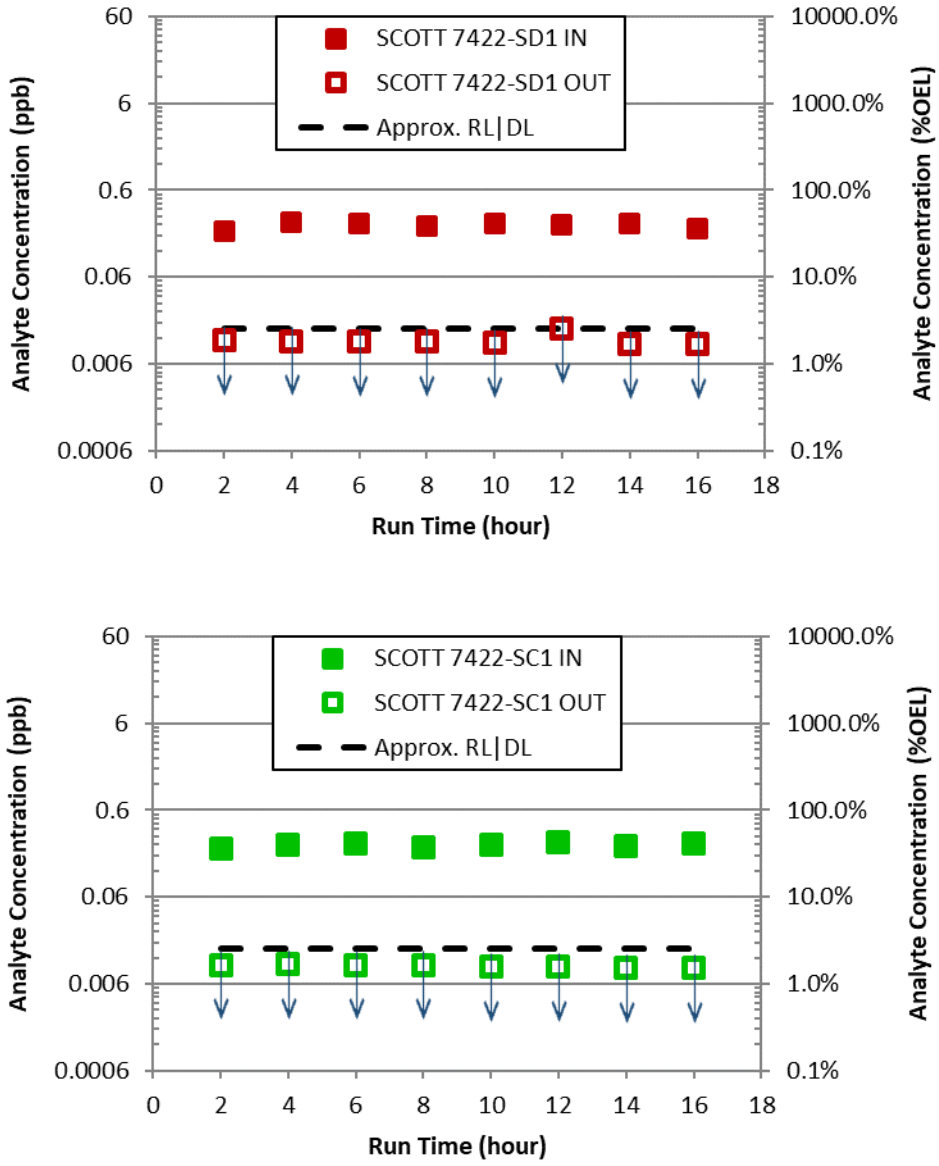

Figure 6. Plot of Measured N-nitrosomorpholine Concentrations before the Inlets and after the Outlets of the Two Respirator Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicates measurements less than the DL or RL.

5.2 PAPR Cartridge Testing

This section provides more detail on the seven COPCs from the PAPR testing on a slipstream from the Hanford AX exhauster identified in Table 2 as having concentrations (inlet or outlet to the cartridge) greater than 10% of the corresponding OEL. Plots of the corresponding data are given, as well as the associated analyses.

Ammonia *(see Figure 7)* – The DL for ammonia corresponds to approximately 2.4% of its OEL. For both MSA-TL (TL1) and 3M FR-57 (TL2) cartridges, the inlet ammonia concentrations were relatively constant, ranging from 14% to 19% of the OEL. All of the outlet measurements were higher than the analytical DL, reaching a maximum of 5.6% of the OEL, but less than 10% of the OEL for both respirator cartridges. Thus, there is no evidence of breakthrough at greater than 10% of the OEL over the measured time period for either cartridge tested. The MSA calculator indicate a breakthrough time longer than 16 hours for the TL1 cartridge under the experiment conditions. Using the estimation method provided by 3M,[4] the service life for the FR-57 cartridge is also estimated to be longer than 16 hours.

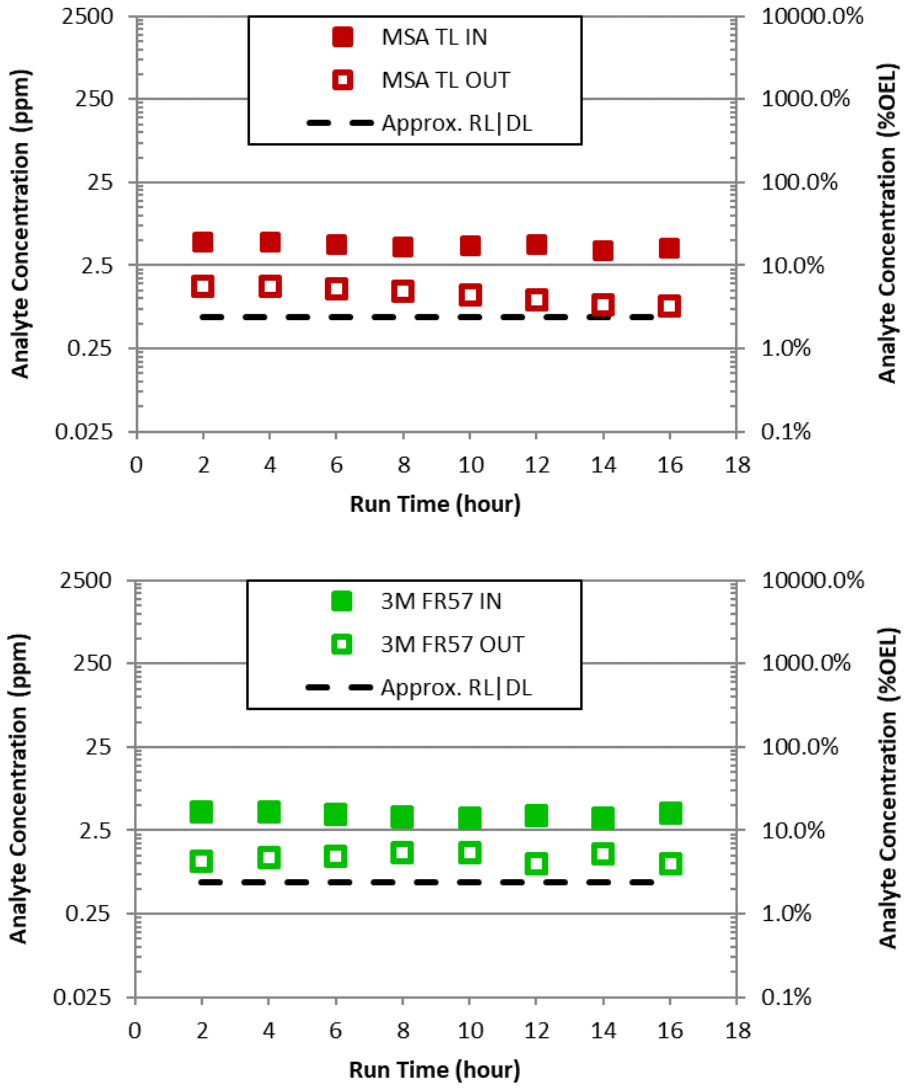

Figure 7. Plots of Measured Ammonia Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (MSA-TL [TL1] and 3M FR-57 [TL2]). Outlet data points not visible are obscured by the inlet data points.

Mercury *(see Figure 8)* – The DL for mercury corresponds to approximately 6.8% of the OEL. Inlet concentrations measured throughout the testing period for the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges ranged between 27 to 90% of the OEL. All of the outlet measurements were below the analytical DL for both respirator cartridges. Thus, there is no evidence of breakthrough over the measured time period for either cartridge tested.

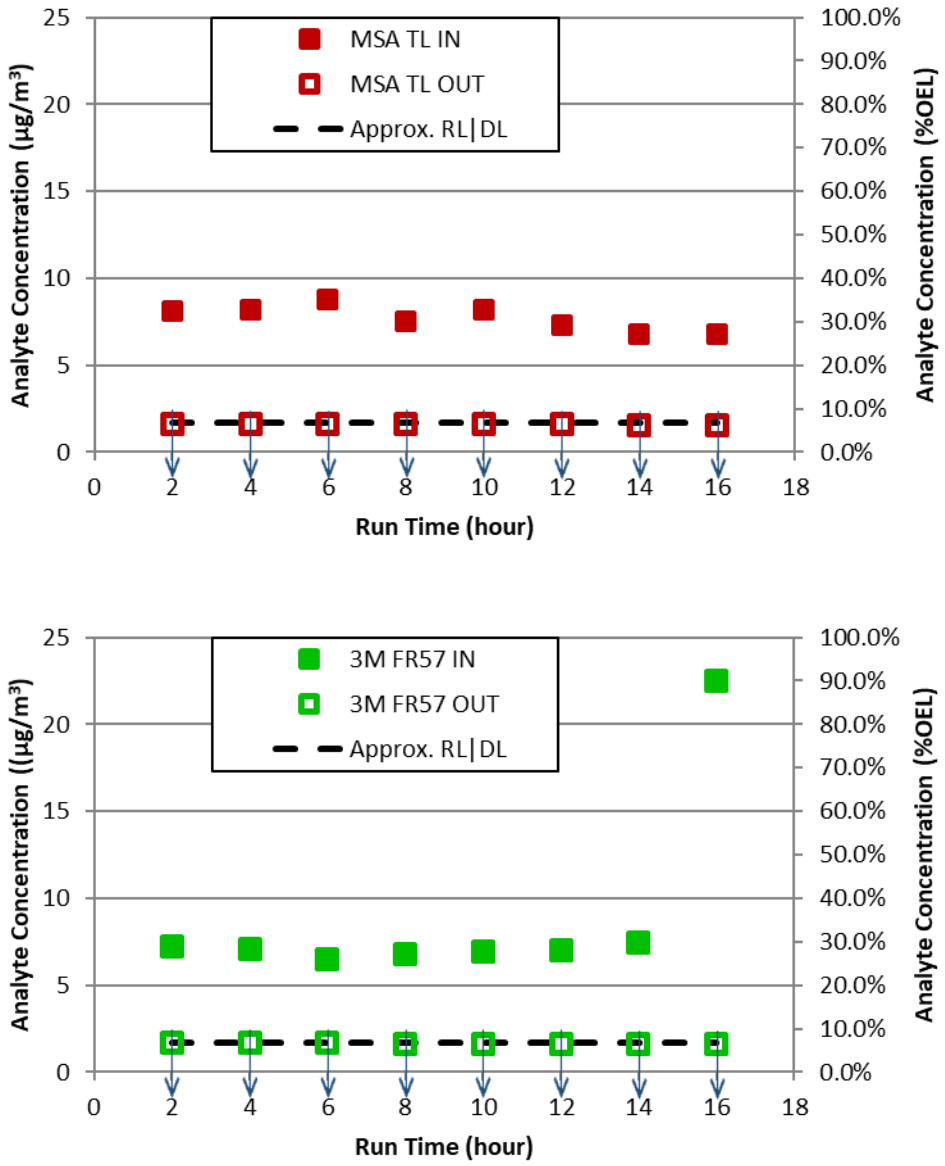

Figure 8. Plots of Measured Mercury Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (MSA-TL [TL1] and 3M FR-57 [TL2]). Data points noted with ↓ indicate measurements less than the DL or RL.

Formaldehyde (*see Figure 9)* – The DL for formaldehyde corresponds to approximately 0.6% of the OEL. Inlet concentrations measured throughout the testing period for the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges remained relatively constant, ranging between 12 and 17% of the OEL. All of the outlet measurements for both cartridges were above the analytical DL for both respirator cartridges, but below 10% of the OEL. Therefore, there is no evidence of breakthrough above 10% the OEL over the measured time period for either cartridge tested. Note that the baseline samples with ambient air produced formaldehyde readings slightly higher than the DL, indicating that some of the elevated readings could be due to ambient sources.

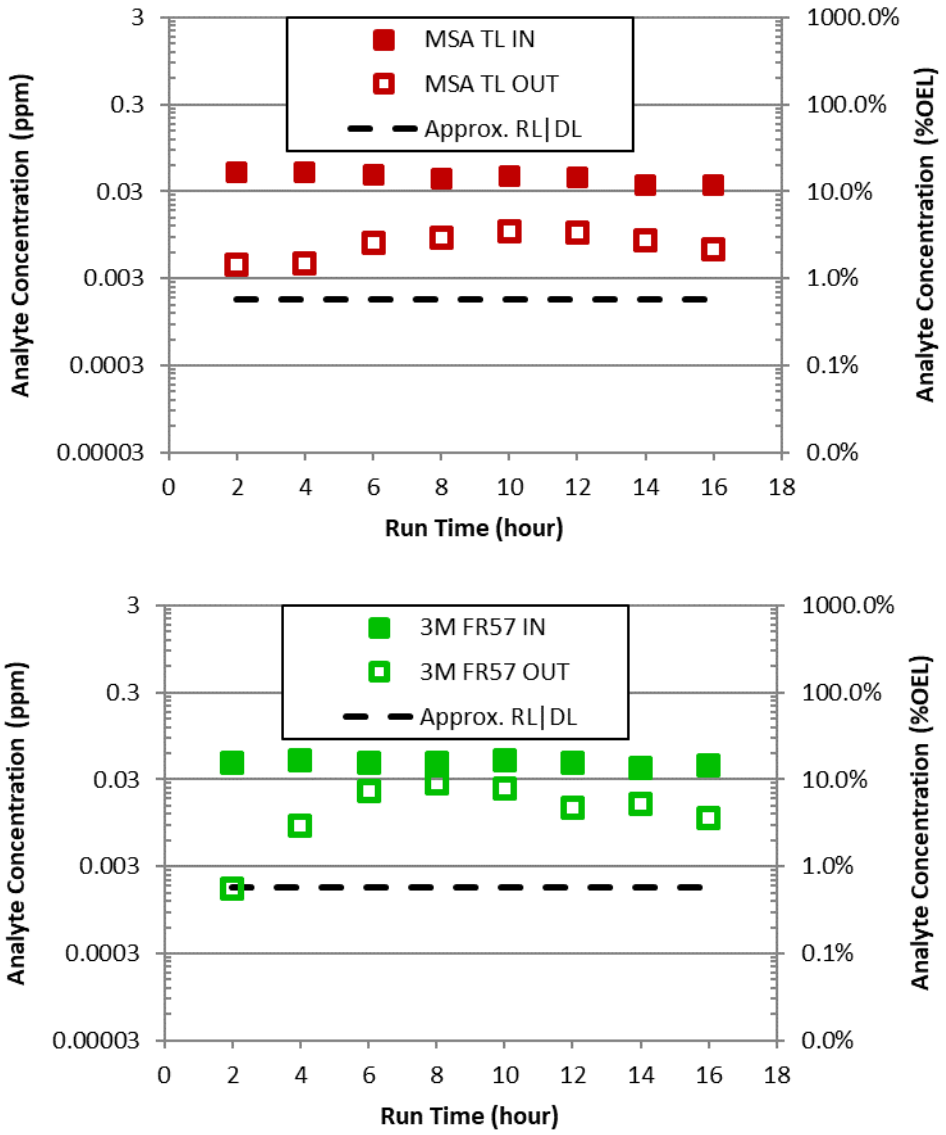

Figure 9. Plot of Measured Formaldehyde Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (MSA-TL [TL1] and 3M FR-57 [TL2]). Data points noted with ↓ indicates measurements less than the DL or RL.

N-nitrosodimethylamine (*see Figure 10****)*** – The DL for NDMA corresponds to approximately 4.7% of its OEL. All inlet concentrations for both the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were significantly greater than the OEL, ranging from approximately 46% to 72% of the OEL. All outlet measurements were below the analytical DL for both cartridges. Thus, there is no evidence of breakthrough over the measured time period for either cartridge tested.

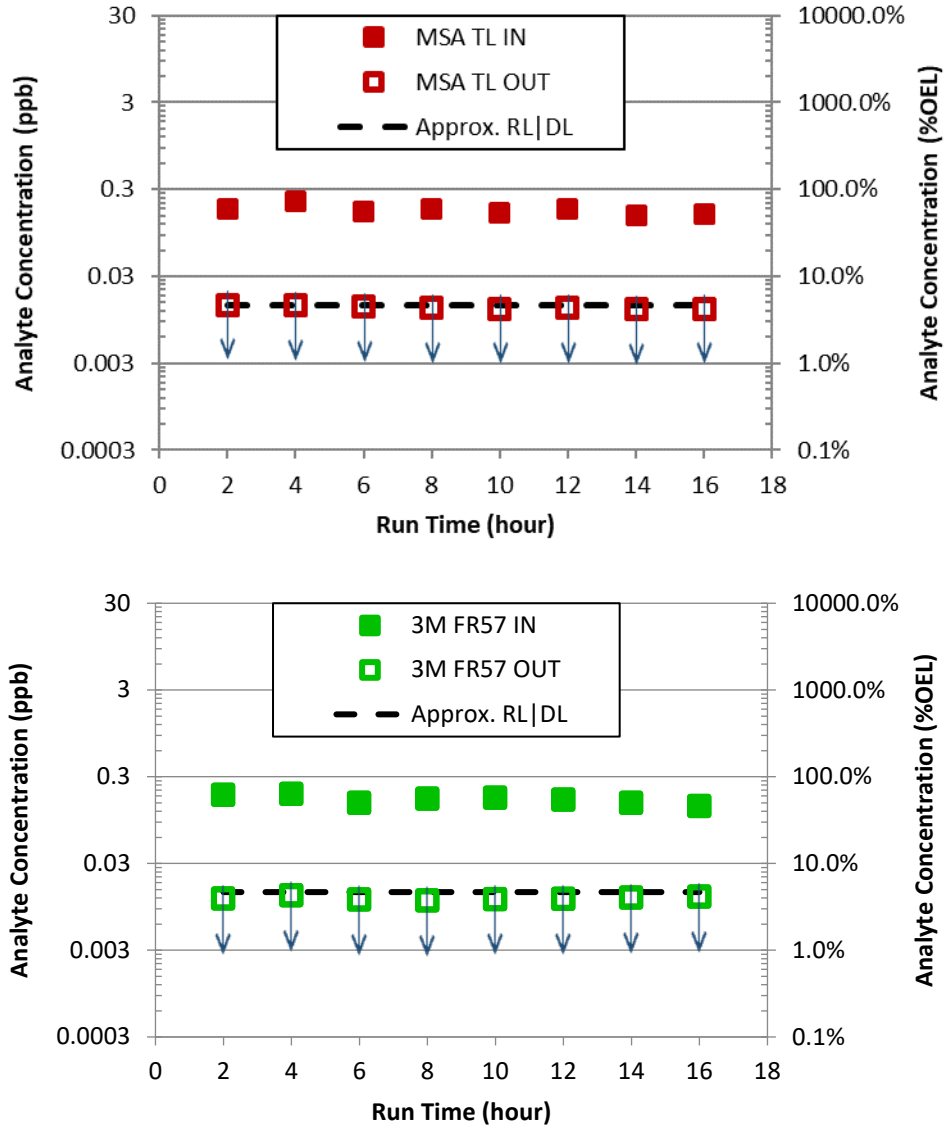

Figure 10. Plots of Measured N-nitrosodimethylamine Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (MSA-TL [TL1] and 3M FR-57 [TL2]). Data points noted with ↓ indicate measurements less than the DL or RL.

N-nitrosodiethylamine *(see Figure 11)* – The DL for NDEA corresponds to approximately 10.2% of its OEL. Inlet concentrations for both the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were consistently above 10% of the OEL, ranging from approximately 11 to 20% of the OEL. All of the outlet measurements were below the analytical DL for both respirator cartridges. Thus, there is no evidence of breakthrough over the measured time period for either cartridge tested.

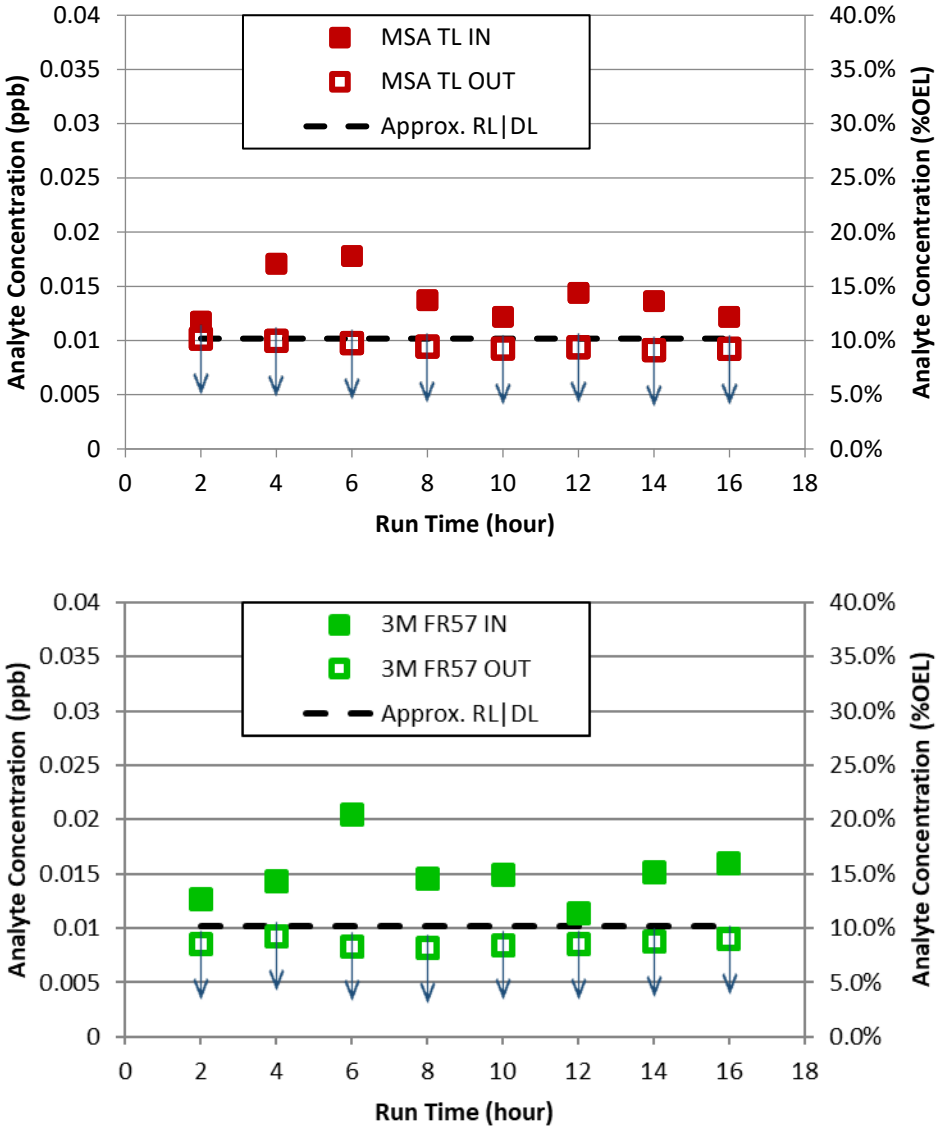

Figure 11. Plots of Measured N-nitrosodiethylamine Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (MSA-TL [TL1] and 3M FR-57 [TL2]). Data points noted with ↓ indicate measurements less than the DL or RL.

N-nitrosomethylethylamine *(see Figure 12)* – The DL for NMEA corresponds to approximately 4.1% of its OEL. Inlet measurements for both MSA-TL (TL1) and 3M FR-57 (TL2) cartridges exceeded the OEL during testing, with concentrations ranging from approximately 3 to 40% of the OEL. All of the outlet measurements were below the analytical DL for both respirator cartridges. Thus, there is no evidence of breakthrough over the measured time period for either cartridge tested.

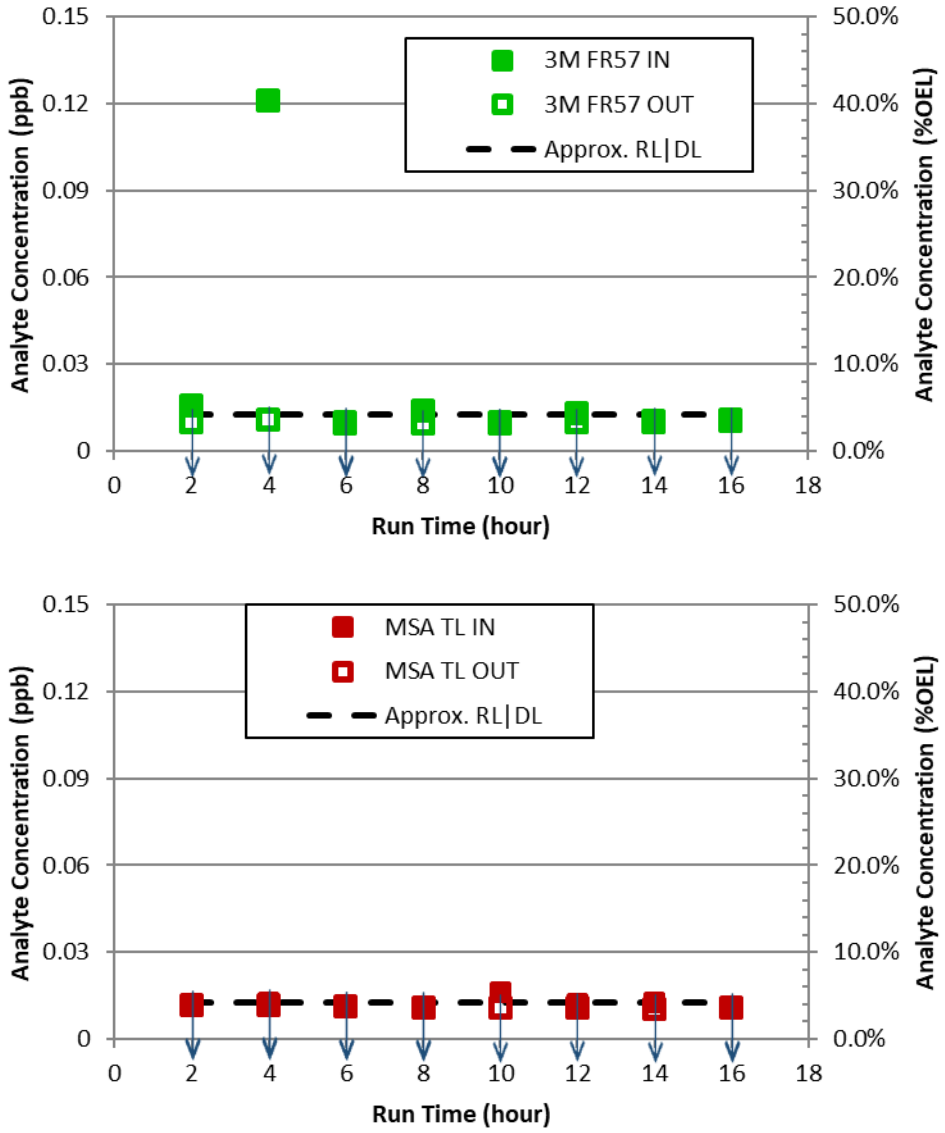

Figure 12. Plots of Measured N-nitrosomethylethylamine Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (MSA-TL [TL1] and 3M FR-57 [TL2]). Data points noted with ↓ indicate measurements less than the DL or RL. Outlet data points not visible are obscured by the inlet data points.

N-nitrosomorpholine *(see Figure 13)* – The DL for N-nitrosomorpholine corresponds to approximately 1.5% of its OEL. Inlet measurements for both MSA-TL (TL1) and 3M FR-57 (TL2) cartridges exceeded the OEL during testing, with concentrations ranging from approximately 31 to 52% of the OEL. All of the outlet measurements were below the analytical DL for both respirator cartridges. Thus, there is no evidence of breakthrough over the measured time period for either cartridge tested.

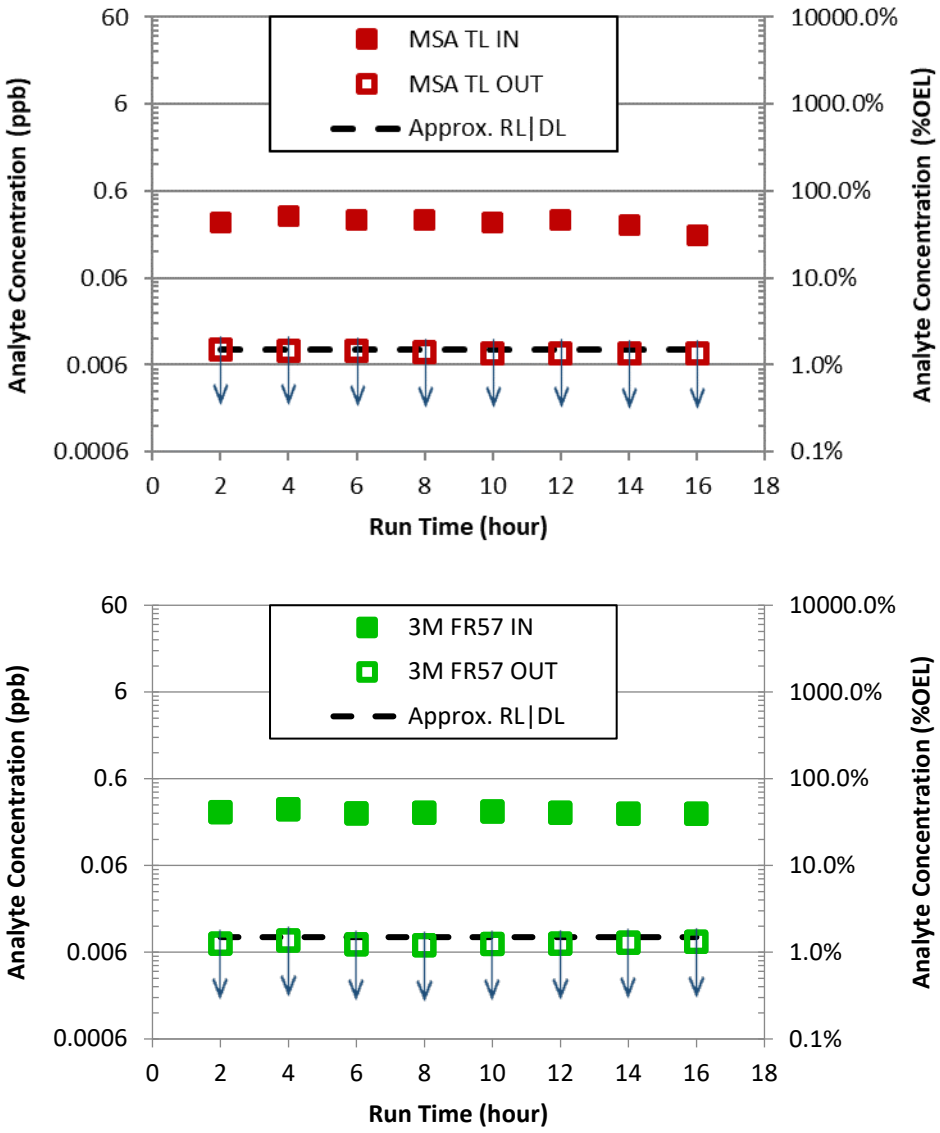

Figure 13. Plots of Measured N-nitrosomorpholine Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (MSA-TL [TL1] and 3M FR-57 [TL2]). Data points noted with ↓ indicate measurements less than the DL or RL.

6.0 Factoring in Historical Concentration Data

To fully assess respirator performance for COPC removal, historical data were reviewed to determine if the recent inlet measurements were representative of typical values. However, the AX exhauster was recently commissioned (February 2017), and only two October 2017 surveys were available for comparison to the August 2017 cartridge test data. These two historical surveys from the Site-Wide Industrial Hygiene Database only reported results for mercury, aldehydes, furans, and nitrosamines. In addition to the surveys, Hanford tank activity data available from the Tank Waste Information Network System were reviewed to assess whether any exhauster historic maximum concentrations may have resulted from waste-disturbing activities not relevant to cartridge test conditions.[25]

Two complete tables with historical and measured results for all 59 COPCs and their boiling point data are shown in Appendix F for the AX exhauster and both APR and PAPR cartridge tests, along with a description of the historic source data that were used. Because a low boiling point can be a general indicator of poor adsorption on solid media, Tables 3 and 4 show a subset of historic AX exhauster data for COPCs with boiling points below 70°C.

Table 3. Historical AX Exhauster – APR Cartridge Data for COPCs with Boiling Points less than 70°C (158°F)

					Historical Measurements[1]				Measurements in this Study	
COPC Number and Name	CAS Number	Boiling Point (°F)	Occupational Exposure Limit (OEL)	# of Values	Max. Value (in OEL units)	Average Value (in OEL units)	Max. Value (% OEL)	Average Value (% OEL)	Max Inlet Value (% OEL)	Highest Value from Cartridge Outlet (% OEL)
2 Nitrous Oxide	10024-97-2	-127	50 ppm	0	n/a	n/a	n/a	n/a	Not Measured	
1 Ammonia	7664-41-7	-28	25 ppm	2	3.22	2.83	12.9%	11.3%	23.9%	2.50% (RL)
50 2-Fluoropropene	1184-60-7	-11	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC	
14 Formaldehyde	50-00-0	-6	0.3 ppm	2	0.034	0.034	11.3%	11.2%	17.2%	2.07%
53 Methyl nitrite	624-91-9	10	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC	
4 1,3-Butadiene	106-99-0	24	1 ppm	0	n/a	n/a	n/a	n/a	2.01% (RL)	1.94% (RL)[2]
42 Ethylamine	75-04-7	62	5 ppm	0	n/a	n/a	n/a	n/a	0.096% (RL)	0.093% (RL)
15 Acetaldehyde	75-07-0	69	25 ppm	2	0.127	0.118	0.51%	0.47%	0.32%	0.29%
19 Furan	110-00-9	88	1 ppb	2	<0.063	<0.0615	<6.30%	<6.15%	40.4% (DL)[3]	43.3% (DL)
59 Methyl Isocyanate	624-83-9	103	0.02 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC	
New[5] 2-Propenal	107-02-8	127	0 ppm	2	<0.001	<0.001	<1.00%	<1.00%	0.92% (RL)	0.95% (DL)
20 2,3-Dihydrofuran	1191-99-7	130	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	3.39% (DL)[4]	3.54% (DL)
22 2-Methylfuran	534-22-5	147	1 ppb	2	<0.052	<0.051	<5.20%	<5.10%	9.56% (DL)[3]	10.3% (DL)
8 Methanol	67-56-1	148	200 ppm	0	n/a	n/a	n/a	n/a	Not Measured	
21 2,5-Dihydrofuran	1708-29-8	152	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	17.7% (DL)[3]	19.0% (DL)

[1] Historical data from TWINS industrial hygiene vapor database and SWIH database; see text for links and dates of queries. Values in italics include those data plus data from the TWINS headspace database, all samples earlier than May 2005.

** indicates that the value of the average would differ by a factor of 2 or more (in either direction) if non-reports were excluded.*

"< RL" indicates that all pertinent measurements of the analyte were less than the reporting level

Plain font in the table indicates that only the recent databases (SWIHD headspace and TWINS Industrial Hygiene) were included. Italics mean that the pre-2006 TWINS headspace data were also included.

"n/a" indicates no historical data was found in the databases

[2] "(RL) or (DL)" indicates value represents approximate reporting limit (RL) or detection limit (DL), which is calculated using the reported detection limit (or reporting limit - RL, where noted) from the analytical laboratory and the average volume (from flowrate x time) of vapor exposed to the sorbent tube.

[3] Measured using VOA (Volatile Organic Analysis) method.

[4] Measured using Furan method.

[5] 2-Propenal and Dimethyl Mercury were added to the COPC List in September, 2017.

Table 4. Historical AX Exhauster – PAPR Cartridge Data for COPCs with Boiling Points less than 70°C (158°F)

					Historical Measurements[1]					Measurements in this Study	
	COPC Number and Name	CAS Number	Boiling Point (°F)	Occupational Exposure Limit (OEL)	# of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Max. Value (% OEL)	Average Value (% OEL)	Max Inlet Value (% OEL)	Highest Value from Cartridge Outlet (% OEL)
2	Nitrous Oxide	10024-97-2	-127	50 ppm	0	n/a	n/a	n/a	n/a	Not Measured	
1	Ammonia	7664-41-7	-28	25 ppm	2	3.22	2.83	12.9%	11.3%	19.2%	5.64%
50	2-Fluoropropene	1184-60-7	-11	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC	
14	Formaldehyde	50-00-0	-6	0.3 ppm	2	0.034	0.034	11.3%	11.2%	16.8%	8.9%
53	Methyl nitrite	624-91-9	10	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC	
4	1,3-Butadiene	106-99-0	24	1 ppm	0	n/a	n/a	n/a	n/a	1.93% (RL)	1.93% (RL)
42	Ethylamine	75-04-7	62	5 ppm	0	n/a	n/a	n/a	n/a	0.09% (RL)[2]	0.09% (RL)
15	Acetaldehyde	75-07-0	69	25 ppm	2	0.13	0.12	0.51%	0.47%	0.35%	0.48%
19	Furan	110-00-9	88	1 ppb	2	<0.063	<0.0615	<6.30%	<6.15%	39.1% (DL)[3]	39.8% (DL)
59	Methyl Isocyanate	624-83-9	103	0.02 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC	
New[5]	2-Propenal	107-02-8	127	0 ppm	2	<0.001	<0.001	<1.00%	<1.00%	0.91% (DL)	0.91% (DL)
20	2,3-Dihydrofuran	1191-99-7	130	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	2.2% (DL)[4]	2.2% (DL)
22	2-Methylfuran	534-22-5	147	1 ppb	2	<0.052	<0.051	<5.20%	<5.10%	9.3% (DL)[3]	9.4% (DL)
8	Methanol	67-56-1	148	200 ppm	0	n/a	n/a	n/a	n/a	1.0 % (RL)	1.02% (RL)
21	2,5-Dihydrofuran	1708-29-8	152	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	17.2% (DL)[3]	17.5% (DL)

[1] *Historical data from TWINS industrial hygiene vapor database and SWIH database, as applicable; see text for links and dates of queries.*
Plain font in the table indicates that only the recent databases (SWIHD headspace and TWINS Industrial Hygiene as applicable) were included. Italics, if present, mean that the pre-2006 TWINS headspace data were also included.
"n/a" indicates no historical data was found in the databases
Values in parenthesis "( )", if present, indicate the maximum or average reported (detected) value >RL or >DL.
"<" indicates that all pertinent measurements of the analyte were less than the reporting or detection level
"!", if present, indicates a maximum RL that came from a sample with a volume less than 0.5 L or from a sample whose RL, for undiscernible reasons, was a factor of 5 or more high compared to other samples measured using the same analytical method.

[2] *"(RL) or (DL)" indicates value represents approximate reporting limit (RL) or detection limit (DL), which is calculated using the reported detection limit (or reporting limit - RL, where noted) from the analytical laboratory and the average volume (from flowrate x time) of vapor exposed to the sorbent tube.*

[3] *Furans measured using VOA (Volatile Organic Analysis) method.*

[4] *Measured using Furan method.*

[5] *2-Propenal and Dimethyl Mercury were added to the COPC List in September, 2017.*

6.1 APR Cartridge Testing

N-nitrosomorpholine is the only COPC that was previously measured in the AX exhauster at concentrations above 100% of its OEL. Four additional COPCs—mercury, formaldehyde, and NDMA—have been historically measured above 10% of their OELs. These four COPCs, plus ammonia and NDEA, also were measured at concentrations above 10% of their respective OELs in the inlets to the APR cartridge testing. Following are the individual comparisons of cartridge source measurements and historical measurements for these six COPCs:

- The maximum ammonia inlet concentrations measured in the APR cartridge tests was 24% of the OEL and generally consistent with historical measurements. This concentration was less than a factor of 2× the historical maximum (12.9% of the OEL).
- The maximum and average mercury concentrations measured in this APR cartridge study were approximately 1.7× higher than the historic maximum. The historic mercury concentration was 20% of the OEL, whereas the cartridge maximum was 33% of the OEL.
- Formaldehyde maximum and average cartridge inlet concentrations were approximately 1.5× higher than historic exhauster measurements. The historic formaldehyde concentration was 11% of the OEL, compared to the cartridge inlet maximum of 17% of the OEL.

- Nitrosamines including NDMA and NDEA had maximum cartridge inlet concentrations greater than the historic measurements of these COPCs. The NDMA cartridge maximum of 73% of the OEL was approximately 1.6× higher than the historic maximum concentration, but the average cartridge results were comparable. The NDEA maximum concentration (18% of the OEL) was higher than <RL historic maximum, but average cartridge inlet concentrations were also less than the RL. N-nitrosomorpholine was the only COPC with historic concentrations exceeding cartridge inlet concentrations. The historic maximum of 151% of the OEL was 3.4× the maximum cartridge inlet concentration of N-nitrosomorpholine of 43% of the OEL.

Overall, the available historic vapor surveys for the AX exhauster are generally consistent with APR cartridge inlet concentrations, with the exception of N-nitrosomorpholine.

6.2 PAPR Cartridge Testing

As described in Section 6.1, N-nitrosomorpholine is the only COPC that was measured previously in the AX exhauster at concentrations above 100% of its OEL, and three additional COPCs—mercury, formaldehyde, and NDMA—have been measured above 10% of their OELs. These four COPCs, plus ammonia, NDEA, and NMEA, also were measured at concentrations above 10% of their respective OELs in the inlets to the PAPR cartridge testing. Following are the individual comparisons of cartridge source measurements and historical measurements for these seven COPCs:

- The maximum ammonia inlet concentrations measured in the PAPR cartridge tests was 19% of the OEL. This concentration was less than a factor of 2× the historical maximum (12.9% of the OEL).
- The maximum and average “inlet” mercury concentrations measured in this APR cartridge study were approximately 4.5× and 1.7×higher than the historic maximum (20 % of the OEL) and average (18 % of the OEL), respectively. The historic maximum mercury concentration was 20% of the OEL, whereas the PAPR cartridge maximum was 90% of the OEL.
- Formaldehyde maximum and average cartridge inlet concentrations were approximately 1.5× higher than historic exhauster measurements. The historic formaldehyde concentration was 11% of the OEL, compared to cartridge inlet maximum of 17% of the OEL and the cartridge inlet average of 15% of the OEL.
- Nitrosamines including NDMA, NDEA, and NMEA had maximum cartridge inlet concentrations greater than the historic measurements of these COPCs. The NDMA cartridge maximum of 71.6% of the OEL was approximately 1.6× higher than the maximum historic concentration (45.7% of OEL). The NDEA maximum and average concentrations (20% and 15% of the OEL, respectively) were higher than the less than RL historic concentrations. The NMEA maximum cartridge inlet concentration was 24× higher (40% of the OEL) than the previous maximum of 1.7% of the OEL. N-nitrosomorpholine was the only COPC for which historic concentrations exceeded cartridge inlet concentrations. The historic maximum of 151% of the OEL was 3.0× the previous maximum cartridge inlet concentration of N-nitrosomorpholine at 51% of the OEL.

7.0 Conclusions

Tests on vapors from a Hanford AX tank farm exhauster slipstream were conducted from August 25–27, 2017. The vapors were fed to two respirator cartridge test stands developed by WRPS in collaboration with HiLine Engineering (Richland, Washington). Four different cartridges were assessed. Multipurpose APR cartridges SCOTT 7422-SD1 and SCOTT 7422-SC1 (SCOTT Safety, Monroe, North Carolina) were assessed on separate days using an APR cartridge test stand. Multipurpose PAPR cartridges MSA-TL (TL1) (MSA Safety Inc., Pittsburgh, Pennsylvania) and 3M FR-57 (TL2) (3M Company, Maplewood, Minnesota) also were tested over the same two days using a separate test stand configured for the PAPR cartridges. Sample media (i.e., sorbent tubes) were used to collect samples of the vapor stream entering and exiting the respirator cartridges and were subsequently analyzed for COPC concentrations. Pacific Northwest National Laboratory was tasked with conducting an independent analysis of the analytical results and making recommendations based on the results for respiratory cartridge performance and service life. The key conclusions from the analysis are described in this chapter.

7.1 APR Cartridge Testing

Based on measured APR cartridge inlet vapor concentrations from the AX exhauster, none of the COPCs exceeded their corresponding OELs.[13] Six COPCs—ammonia, mercury, formaldehyde, NDMA, NDEA, and N-nitrosomorpholine—had one or more inlet concentration measurements greater than 10% of their OELs and greater than their analytical DLs or RLs, but less than 100% of their OELs. All other COPC inlet and outlet measurements did not exceed 10% of their OELs or exceed their RLs. The following bullets summarize the cartridge performance for the COPCs inlet concentrations with greater than 10% of their respective OEL values.

- Maximum ammonia concentrations at the respirator cartridge inlet to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 24% and 17% of the OEL, respectively. This concentration was less than a factor of 2× the historical maximum (12.9% of the OEL). All cartridge outlet concentrations for ammonia were below the RL, indicating that no breakthrough above 10% of the OEL occurred. Previous results obtained from SCOTT's SureLife Calculator under similar inlet concentration, temperature, relative humidity, and pressure conditions as this test showed breakthrough
  times much longer than 16 hours for the SD1 and SC1 cartridges, which are consistent with the field experiment results.
- Maximum mercury concentrations at the inlets to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 33% and 27% of the OEL, respectively. These concentrations were 1.6× higher than the historic maximum (20% of the OEL). All the cartridge outlet concentrations for mercury were below the RL (6.8 % of the OEL), indicating that no breakthrough occurred.
- Maximum formaldehyde concentrations at the inlets to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were both 17% of the OEL. These concentrations were 1.5× higher than the historical (11% of the OEL) AX exhauster measurements. All cartridge outlet concentrations for formaldehyde were higher than the DL (0.59 % of the OEL), but less than 3% of the OEL, indicating that no breakthrough occurred.

[13] Occupational Exposure Limits accepted for Hanford tank farm use are based on OELs established by a U.S. governmental agency or national professional organization (e.g., OSHA, National Institute for Occupational Safety and Health, American Conference of Governmental Industrial Hygienists), or if no U.S. OEL exists, standard toxicological practices are applied to develop OELs using the best available science. The OEL for NDMA was established in 2005 based on the MAK (Maximale Arbeitsplatzkonzentration) Commission standard adopted in Europe.

- Maximum NDMA concentrations at the inlets to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 73% and 55% of the OEL, respectively. The highest cartridge inlet concentration was approximately 1.6× higher than the historic maximum concentration (46 % of the OEL). All measured outlet concentrations were less than the analytical RL of approximately 8.5% of the OEL, indicating no breakthrough for either cartridge.
- The maximum NDEA concentration at the inlet to the SCOTT 7422-SC1 cartridge was 18% of the OEL. All inlet concentrations for the SCOTT 7422-SD1 cartridge and all outlet concentrations for both cartridges were less than the RL—approximately 16% of the OEL—indicating no breakthrough for either cartridge.
- Maximum N-nitrosomorpholine concentrations at the inlet to the SCOTT 7422-SD1 and SCOTT 7422-SC1 cartridges were 42% and 43%, respectively. These concentrations are lower than the historic maximum (151% of the OEL) concentration measurements from AX exhauster. All outlet concentrations were less than the RL of approximately 2.5% of the OEL, indicating no breakthrough for either cartridge.
- The Overview of 2016—2018 Testing of Air-Purifying Respirator Cartridge Performance on Multiple Hanford Tank Headspaces and Exhausters, Freeman et.al. [25], provides additional information on the use of the cartridge testing results for the first 28 cartridge tests with the Scott's service life models.

7.2 PAPR Cartridge Testing

Based on measured PAPR cartridge inlet vapor concentrations from the AX exhauster, none of the COPCs exceeded their corresponding OELs. Seven COPCs—ammonia, mercury, formaldehyde, NDMA, NDEA, NMEA, and N-nitrosomorpholine—had one or more inlet concentration measurements greater than 10% of their OELs and greater than their analytical DLs or RLs, but less than 100% of the OELs. All other COPC inlet and outlet measurements did not exceed 10% of their OELs or exceed their RLs. Summaries of cartridge performance for the COPCs inlet concentrations with greater than 10% of their respective OEL values follow.

- Maximum ammonia concentrations at the respirator cartridge inlet to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 19% and 17% of the OEL, respectively. These concentrations were less than a factor of 2× the historical maximum (12.9% of the OEL). All cartridge outlet concentrations for ammonia were higher than the RL (2.4 % of the OEL), but less than 10% of the OEL, indicating that no breakthrough occurred. The MSA service life calculator indicates a breakthrough time longer than 16 hours for the TL1 cartridge under the experiment conditions. Using an estimation method provided by 3M,[14] the service life for the FR-57 cartridge also is estimated to be longer than 16 hours.
- Maximum mercury concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 35% and 90% of the OEL, respectively. These concentrations were approximately 4.5× and 1.9×higher than the historical average (18% of the OEL) and maximum (20% of the OEL) AX exhauster measurements. All the cartridge outlet concentrations for mercury were below the RL (6.8 % of the OEL), indicating that no breakthrough occurred.
- Maximum formaldehyde concentrations at the inlets to both PAPR cartridges were 17% of the OEL. These concentrations were approximately 1.5× higher than the historical average and maximum (11% of the OEL) historic AX exhauster measurements. All outlet concentrations for both cartridges

[14] The 3M Service Life Software has limited models for non-organic vapors for their FR-57 PAPR cartridge. 3M provided an estimation method that is documented in Appendix G of Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, LA Mahoney. 2018. *Analysis of Powered Air-Purifying Respirator (PAPR) Cartridge Performance Testing on Hanford Tanks SX-101 and SX-104*. PNNL-27558 Vol. 1 Rev. A, Pacific Northwest National Laboratory, Richland, Washington. (unpublished).

were above the DL (0.56 % of the OEL), but less than 10% of the OEL, indicating no breakthrough for either cartridge.

- Maximum NDMA concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 72% and 63% of the OEL, respectively. These concentrations are approximately 1.6× higher than the historical maximum (46% of the OEL) AX exhauster measurement. All measured outlet concentrations were less than the analytical RL of approximately 4.7% of the OEL, indicating no breakthrough for either cartridge.
- Maximum NDEA concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 18% and 20% of the OEL, respectively. These concentrations were higher than the less-than-RL historical concentration measurements from the AX exhauster. All outlet concentrations were less than the RL of approximately 10% of the OEL, indicating no breakthrough for either cartridge.
- Maximum NMEA concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 5.4% and 40% of the OEL, respectively. These concentrations were higher than the maximum historical AX exhauster concentration measurement of 1.7% of the OEL. All outlet concentrations were less than the RL of approximately 4.1% of the OEL, indicating no breakthrough for either cartridge.
- Maximum N-nitrosomorpholine concentrations at the inlets to the MSA-TL (TL1) and 3M FR-57 (TL2) cartridges were 51% and 45% of the OEL, respectively. These concentrations were lower than the maximum historical concentration measurement of 151% of the OEL. All outlet concentrations were less than the RL of approximately 1.5% of the OEL, indicating no breakthrough for either cartridge.

8.0 Recommendations

Based on the measurements taken for this study, no COPC breakthroughs above 10% of their OELs occurred during the 16 hour test period for any of the four APR or PAPR cartridges tested. Only seven COPCs were detected with concentrations above 10% of their OELs in the inlets to any of the cartridge tests on the AX exhauster slipstream. Ammonia inlet concentrations were substantially lower than many of the previous cartridge tests for which ammonia breakthrough were observed. SCOTT's SureLife Calculator was not available so exact cartridge service life estimates could not be made. However, previous results obtained from using the SureLife calculator[15] under similar conditions showed a breakthrough time much longer than 16 hours, which is consistent with the field experiment result. Similarly, the MSA service life calculator indicated a breakthrough time longer than 16 hours for the TL1 cartridge under the experiment conditions. Using the estimation method provided by 3M,[4] the service life for the FR-57 cartridge also was estimated to be longer than 16 hours. Variations in humidity, temperature, or cartridge inlet concentration for any COPCs, especially ammonia, compared to those measured in the current study could impact breakthrough times. Still, the combined predictions continue to give confidence in the use of ammonia service life estimates for informing Industrial Hygiene experts in developing an appropriate respirator cartridge change-out schedule for adequate worker protection.

[15] The Overview of 2016—2018 Testing of Air-Purifying Respirator Cartridge Performance on Multiple Hanford Tank Headspaces and Exhausters, Freeman et.al. [25], provides important additional information on the use of the cartridge testing results for the first 28 cartridge tests with the Scott's service life models.

9.0 References

1. OSHA 29 CFR 1910.134, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=12716.
2. OSHA Respirator Change Schedules – Decision Logic Flowcharts, https://www.osha.gov/SLTC/etools/respiratory/decisionlogic/flowcharti.html.
3. OSHA Respirator Change Schedules Mathematical Modeling, and Factors that Influence Cartridge Service Life, https://www.osha.gov/SLTC/etools/respiratory/change_schedule.html.
4. OSHA Standard Respirator Testing Procedures, http://www.cdc.gov/niosh/npptl/stps/aprespcbrn.html.
5. Wood GO. 1994. "Estimating Service Lives of Organic Vapor Cartridges." *American Industrial Hygiene Association Journal* 55:11−15. DOI: 10.1202/0002-8894(1994)055<0011:ESLOOV>2.0.CO;2.
6. Wood GO. 2004 "Estimating Service Lives of Organic Vapor Cartridges II: A Single Vapor at All Humidities." *Journal of Occupational and Environmental Hygiene* 1:472−492. https://doi.org/10.1080/15459620490467792.
7. Wood GO and JL Snyder. 2007. "Estimating Service Lives of Organic Vapor Cartridges III: Multiple Vapors at All Humidities." *Journal of Occupational and Environmental Hygiene* 4:363−374. DOI: 10.1080/15459620701277468.
8. Janvier F, L Tuduri, D Cossement, D Drolet, and J Lara. 2016. "Systematic Evaluation of the Adsorption of Organic Vapors onto a Miniaturized Cartridge Device using Breakthrough Tests in Parallel Experiment with a Full Size Respirator Cartridge." *Adsorption Science and Technology* 34:287-306. DOI: 10.1177/0263617416653119.
9. Yoon YH, JH Nelson, and J Lara. 1996. "Respirator Cartridge Service Life: Exposure to Mixtures." *American Industrial Hygiene Association Journal 57*:809−819. https://doi.org/10.1080/15428119691014486.
10. 3M Service life software Version 3.3, http://extra8.3m.com/SLSWeb/serviceLifeDisclaimer.html?reglId=20&langCode=EN&countryName=United%20States.
11. SCOTT's Surelife Cartridge Calculator, https://www.scottsurelife.com/DesktopUI/SelectRegion.aspx.
12. Respiratory Protection, Chapter 36 of the American Industrial Hygiene Association publication, *The Occupational Environment: Its Evaluation and Control and Management,* ISBN 1-931504-43-1.
13. Industrial Hygiene Sampling and Analysis plan for Respirator Cartridge Testing, TFC-PLN-168, REV A, June 16, 2016.
14. Air Purifying Respirator Cartridge Test Apparatus Special Tool and Equipment Evaluation, RPP-STE-59226, Rev 0, June 22, 2016.
15. Cohen HJ, SP Levine, and RP Garrison. 1991. "Development of a Field Method for Calculating the Service Lives of Organic Vapor Cartridges − Part IV. Results of Field Validation Trials. *American Industrial Hygiene Association Journal* 263−270. DOI: 10.1080/15298669191364712.

16. Nune SK, J Liu, CJ Freeman, and TM Brouns. 2016a. *Analysis of Respirator Cartridge Performance Testing on a Hanford AP Tank Farm Primary Exhauster Slipstream*. PNNL-25860, Pacific Northwest National Laboratory, Richland, Washington. https://hanfordvapors.com/wp-content/uploads/2017/01/PNNL-25860-Analysis-of-Respirator-Cartridge-Performance-Testing-on-a-Hanford-AP-Tank-Farm-Primary-Exhauster-Slipstream.pdf.

17. Nune SK, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on Hanford Tank SY-102*. PNNL-26041, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

18. Nune SK, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on Hanford Tank A-101*. PNNL-26131, Rev.1, Pacific Northwest National Laboratory, Richland, Washington.

19. Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on Hanford Tank BY-108.* PNNL-26180, Rev.1, Pacific Northwest National Laboratory, Richland, Washington.

20. Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on the 702-AZ Primary Exhauster for the Hanford AY/AZ Tank Farms*. PNNL-26243, Rev.1, Pacific Northwest National Laboratory, Richland, Washington.

21. Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on Hanford Tank. AX-101, Rev.1,* PNNL-26254, Pacific Northwest National Laboratory, Richland, Washington.

22. Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on a Hanford AW Tank Farm Exhauster Slipstream.* PNNL-26337 Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

23. Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on a Hanford AN Tank Farm Exhauster Slipstream.* PNNL-26317 Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

24. Nune SK, CK Clayton, J Liu, CJ Freeman, TM Brouns, and LA Mahoney. 2020. *Analysis of Respirator Cartridge Performance Testing on the 702-AZ Primary Exhauster for the Hanford AY/AZ Tank Farms during a Waste-Disturbing Event.* PNNL-26863 Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

25. Freeman CJ, J Liu, C Clayton, SK Nune, LA Mahoney, CL Bottenus, TM Brouns, and P Humble. 2020. *Overview of 2016 through 2018 Testing of Respirator Cartridge Performance on Multiple Hanford Tank Headspaces and Exhausters*. PNNL-26821 Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

26. NIOSH. 2008. *Determination of Ammonia Service Life Test, Powered Air-Purifying Respirators with Cartridges Standard Testing Procedure (STP)*. TEB-APR-STP-0033C, National Institute for Occupational Safety and Health, National Personal Protective Technology Laboratory, Pittsburgh, Pennsylvania.

27. MSA Safety, Inc. *Response® Guide Cartridge Life Expectancy Calculator*. http://webapps2.msasafety.com/ResponseGuide/ChemicalCalculator.aspx

28. Scott Air Purifying Respirators (742 Twin Cartridges), https://www.scottsafety.com/en/us/DocumentandMedia1/Poster_742SelectionGuide_HS_6411_0313.pdf

29. MSA Safety, Inc. OptimAir® TL PAPR, http://us.msasafety.com/Air-Purifying-Respirators-%28APR%29/Powered-Air-Purifying-Respirators-%28PAPR%29/OptimAir%C2%AE-TL-PAPR/p/000100003000001600.

30. 3M High Efficiency Cartridge FR-57, https://www.3m.com/3M/en_US/company-us/all-3m-products/~/3M-High-Efficiency-Cartridge-FR-57-453-03-02R06-6-EA-Case/?N=5002385+3294780228&rt=rud.

31. Meacham JE, JO Honeyman, TJ Anderson, ML Zabel, and JL Huckaby. 2006. *Industrial Hygiene Chemical Vapor Technical Basis*. RPP-22491, Rev. 1, CH2M Hill Hanford Group, Inc., Richland, Washington. http://www.hanford.gov/tocpmm/files.cfm/IHTechBasis_RPP-22491Rev1.pdf.

32. Industrial Hygiene Exposure Assessment Strategy, TFC-PLN-34, REV E-6, Feb 22, 2013.

Appendix A

Description of Respirator Cartridge-Testing Setup

Appendix A

Description of Respirator Cartridge-Testing Setup

The respirator cartridge-testing system was developed by Washington River Protection Solutions and HiLine Engineering (Richland, Washington) as a means to comprehensively test respirator cartridge performance with actual Hanford tank headspace or exhauster slipstream gases. Tank headspace or exhauster slipstream vapors are pulled directly from the source through a flexible hose connecting the tank or exhauster sampling port within the tank farm/exhauster fence line to the respirator cartridge-testing system outside the farm.[13,14, 16-25] Multiple in-line particulate filters are installed in the line between the tank/exhauster and test system to remove potential radioactive particulates. Each filter unit contains a hydrophobic Fluoropore™ polytetrafluoroethylene filter (Millipore Sigma, Billerica, Massachusetts) that complies with the terms of the radiological work permit. This filter medium is the same material used for routine tank vapor area monitoring as well as sampling and analysis of sources (headspace and exhausters). It was selected because of its broad chemical compatibility that minimizes sorption of, or reactions with, chemical compounds. Polytetrafluoroethylene as the filter medium is not expected to adversely impact the test objectives because all tank farm vapor sampling uses this type of filter medium.

The test equipment allows for sampling a vapor stream both before and after the cartridge, so their effectiveness in removing a given COPC can be quantified. Sorbent media tubes were used to capture the COPCs and other hazardous contaminants. After a given test segment, the sorbent tubes were removed and analyzed. Sampling of the exhaust gas was performed every 2 hours, but this timing can be modified as necessary. Vapor-sampling canisters also are used to augment the sorbent tubes for specific COPCs.

Figure A.1 is a general schematic diagram for the respirator cartridge test apparatus, and Figure A.2 shows photographs of the two test stands that have been deployed for APR and PAPR cartridge testing. For the PAPR tests, the following modifications were made to the original APR test stand design:

- The cartridge housing was enlarged, and the mounting was modified to support the larger PAPR cartridge.
- An additional sampling line and control valve was added to accommodate 12 simultaneous inlet and outlet sorbent tubes versus the 11 sorbent tubes used in the original APR test stand. The additional sampling line provides added flexibility, including accommodation of a methanol-specific sorbent tube.
- To measure effluent conditions, another set of instruments was added to directly measure pressure, temperature, and relative humidity immediately after the cartridge filter.

The test system uses vacuum to draw tank gases/vapors into the unit so the potential for leakage to atmosphere is minimized until the gases/vapors are under positive pressure downstream of the vacuum pumps. By the time gases reach the vacuum pump, COPCs are essentially captured or removed by either the sorbent tubes or the respirator cartridge.[16-25]

Flows through the respirator cartridge and through each sorbent tube are set and controlled/maintained using manual flow control valves on the outlet of each rotameter, and rotameters are calibrated against DryCal primary flow calibrators before and after testing. DryCal flow meters also are used downstream of the sorbent tubes to measure the flow through each sorbent tube (see Figure A.3). All equipment connections are leak tested before a test begins. Temperature, relative humidity, and pressure of the inlet gas/vapor stream are monitored by calibrated instrumentation.

Using Industrial Hygiene-approved materials, the cartridge test equipment was constructed so that it would not influence/interfere with vapor analysis. Stainless steel or Teflon™ tubing and fittings are used where possible because of their relatively inert nature to the vapors being analyzed. Limited portions of the assembly used acrylic, Viton™, glass, and Masterflex C-flex tubing, which are commonly used materials for various vapor-sampling applications.

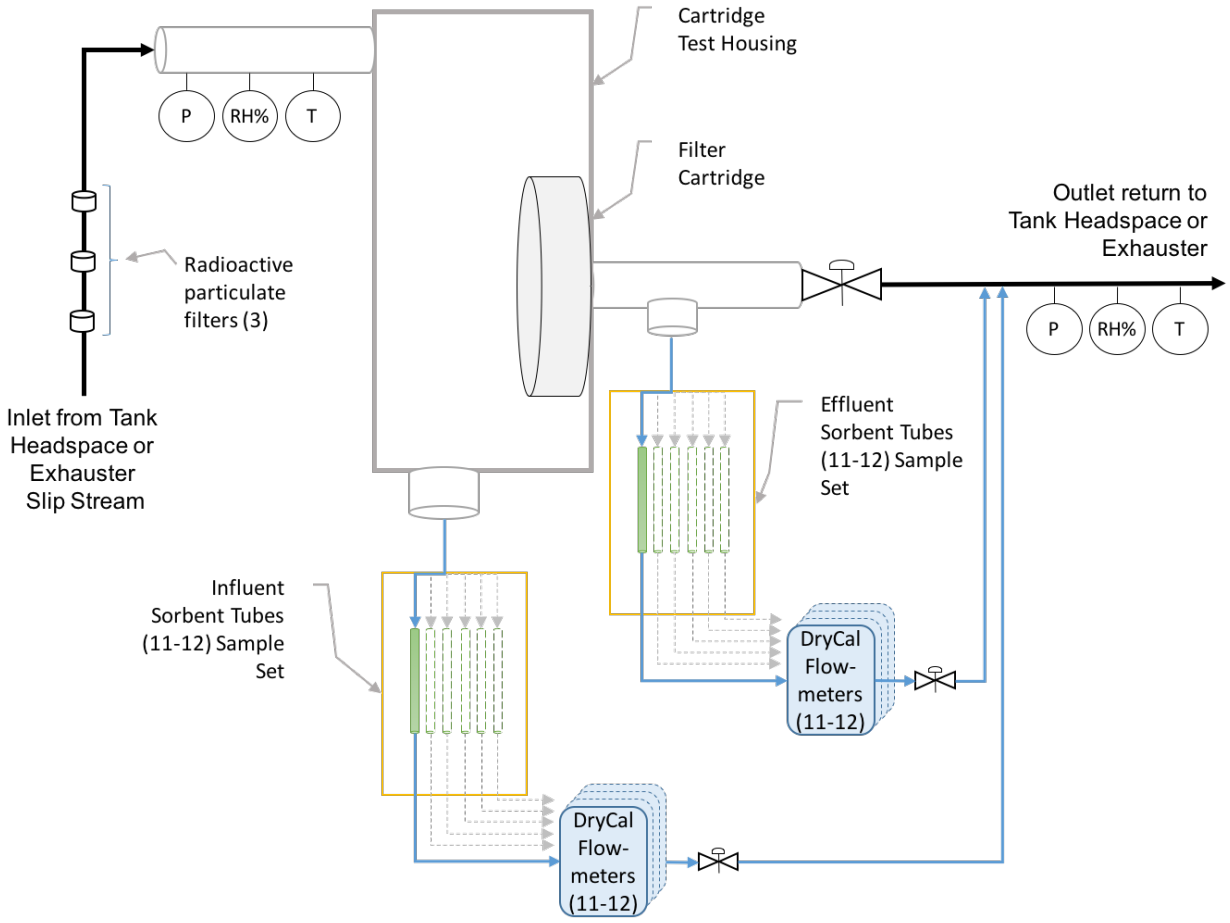

Figure A.1. General Schematic of Respirator Cartridge Test Apparatus

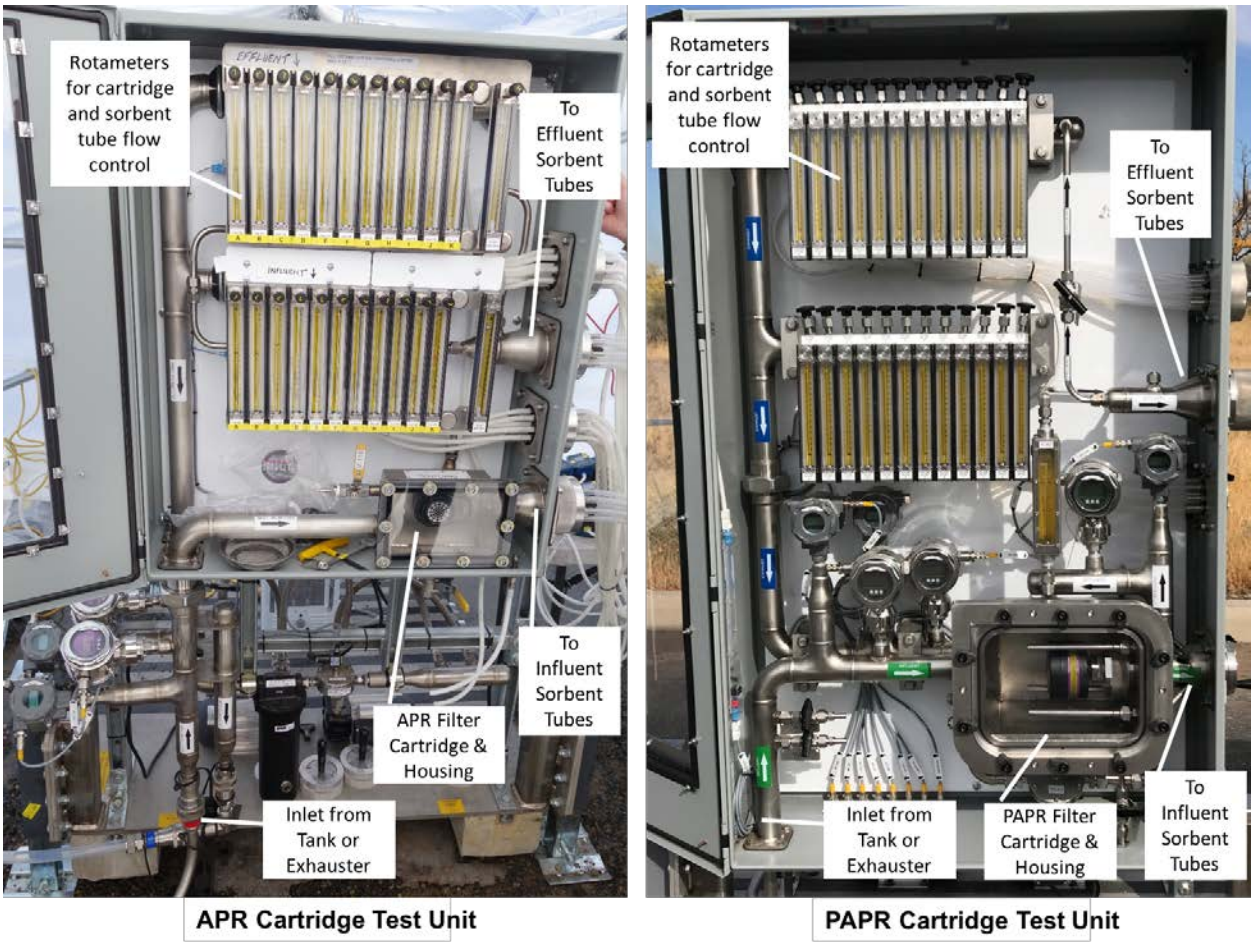

Figure A.2. Photographs of the APR (left) and PAPR (right) Cartridge Test Equipment

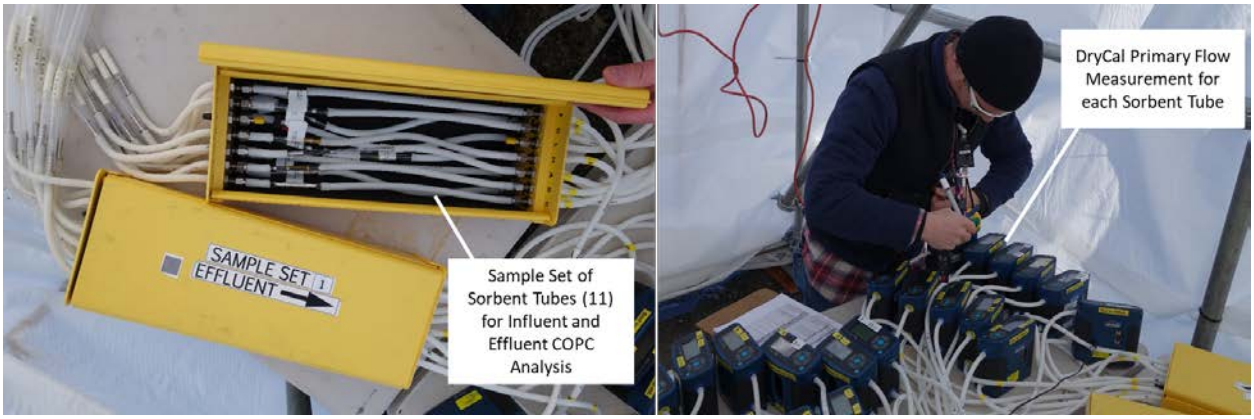

Figure A.3. Photographs of the Sorbent Tube Sampling Test Equipment

Appendix B

Analytical Testing

Appendix B

Analytical Testing

The Sampling and Analysis Plan was developed under the direction and oversight of the Industrial Hygienist in conjunction with the Tank Farms Operations Contractor Retrieval and Closure, and Tank Farms Project and/or Production Operations Project Management Team.

Chemical compounds in the tank samples were analyzed using approved Industrial Hygiene methods or National Institute of Occupational Safety and Health-approved methods for quantifying hazardous airborne contaminants in the tank farm vapors. Methods including gas chromatography/mass spectrometry were used as the primary analytical techniques for identifying hazardous airborne contaminants (see Table B.1).

Table B.1. Information on Sorbent Media used to Capture Contaminants, Flow Rates Used, Methods to used Extract Analyte from Sorbent Media, and Methods used to Quantify or Estimate the Concentrations of Hazardous Contaminant

Analyte Category	Media	Flow Rate (mL/min)	Analytical Method[a]	Instrument Used[b]	Analysis Location[c]
Acetonitrile	Charcoal Tube, SKC-226-09	100	NIOSH 1606	GC–FID	ALS
Acetonitrile	Carbotrap 300 TDU Tube	33	EPA TO-17 Modified	GC/MS	WRPS
Furans	TDU Tenax TA	50	EPA TO-17 Modified	GC/MS	WRPS
Semivolatile Organic Compounds	Carbotrap 150 TDU Tube	33	EPA TO-17 Modified	GC/MS	WRPS
Volatile Organic Compounds	Carbotrap 300 TDU tube	33	EPA TO-17 Modified	GC/MS	WRPS
Mercury	Anasorb C300, SKC-226-17-1A	250	NIOSH-6009	CVAA	WHL
Methanol	Silica Gel, SKC-226-51	33	NIOSH-2000	GC–FID	ALS
Ammonia	Anasorb 747 (sulfuric acid), SKC-226-29	200	OSHA-ID-188	IC	WHL
1,3-butadiene	Charcoal, SKC-226-37, (Parts A and B)	200	NIOSH-1024	GC–FID	ALS
Aldehyde	DNPH Treated Silica Gel, SKC-226-119	200	EPA TO-11A	HPLC	ALS
Pyridine	Coconut Shell Charcoal, SKC-226-01	1000	NIOSH-1613	GC–FID	ALS

Analyte Category	Media	Flow Rate (mL/min)	Analytical Method[a]	Instrument Used[b]	Analysis Location[c]
Nitrosamines	Thermosorb/N	2000	NIOSH-2522 Modified	GC–TEA	CBAL
Ethylamine	XAD-7 (NBD) Chloride), SKC 226-96	100	OSHA-ID-34, 36, 40,and 41	HPLC–UV	ALS

[a] Analytical Method
NIOSH: National Institute of Occupation Safety and Health
EPA: U.S. Environmental Protection Agency
OSHA: Occupational Safety and Health Administration

[b] Instrument Used
GC–FID: Gas Chromatography–Flame Ionization Detector
GC/MS: Gas Chromatography–Mass Spectrometry
CVAA: Cold Vapor Atomic Absorption
IC: Ion Chromatography
HPLC: High Performance Liquid Chromatography
GC–TEA: Gas Chromatography–Thermal Energy Analyzer
HPLC–UV: High Performance Liquid Chromatography–Ultraviolet Detector

[c] Analysis Location
ALS: ALS Environmental Salt Lake City
WRPS-222S: Washington River Protection Solutions, Organic Studies Group
WHL-222S: Wastren Hanford Laboratory
CBAL: Columbia Basin Analytical Laboratory, part of the RJ Lee Group

Appendix C

Raw Analytical Data

Appendix C

Raw Analytical Data

In previously published cartridge reports, raw data for all contaminants analyzed during testing were provided in Appendix C to the document. However, the extensive amount of data (over 900 pages for this report) resulted in unwieldy document file sizes. To solve this problem, the raw data are provided in a separate Volume 2. Appendix C in this document (Volume 1) still provides introductory information regarding the content of Volume 2, but to review the complete raw data set, readers are referred to Volume 2.

C.1 Description

This appendix includes raw data of flow rate, temperature, pressure, and humidity, and analytical data for the AX exhauster slipstream data sets. Calculations using this data are given in Appendix D.

Raw analytical data are included only in Volume 2. Washington River Protection Solutions (WRPS) converted the data into Excel data spreadsheets that were transmitted to Pacific Northwest National Laboratory. Comments on that conversion are provided below.

The analytical measurements listed in Results spreadsheet columns were transferred from entries labeled 'result' in the raw analytical .pdf files. Where a results entry was given as 'ND' in the .pdf, a '<' symbol was used. Where a detection limit (DL)/reporting limit (RL) was listed as 'n/a,' the result entry in the spreadsheet was set at the DL or RL.

The use of the RL or a DL varied among analytical laboratories. The term RL (equivalent to a limit of quantification) was used instead of a DL by ALS Environmental Salt Lake City, Columbia Basin Analytical Laboratory, and 222S–Wastren Hanford Laboratory (see Table F.1 in Appendix F for a complete correlation of which Chemicals of Potential Concern used an RL or a DL). The WRPS laboratory provided a DL rather an RL. Neither RLs nor DLs were provided for tentatively identified compounds (TIC).

Chain of custody information is provided clearly in the raw analytical data .pdf files, including analyte name, sample numbers, and laboratory-assigned numbers. Chemical Abstract Service numbers were provided by the respective analytical laboratory.

The nomenclature of the sample identification (ID) is the same for every set of chemicals. It is generally composed of a survey number, tank farm ID, test location, sample line, and tube bundle ID. Descriptions of these nomenclatures follows

'BL' means blank measurements obtained from sorbent tubes that have not had any vapor stream passed through them. 'BA' with either 'IN' or 'EF' means measurements obtained for ambient air (fresh air versus tank vapor) running through the test system from the inlet (IN) or effluent (EF) locations before initiation of tank vapor testing.

'SD1' designations correspond to testing with the SCOTT 7422-SD1 respirator cartridge, 'SC1' designations correspond to testing with the SCOTT 7422-SC1 respirator cartridge, 'TL1' designations correspond to testing with the MSA Optifilter TL respirator cartridge, and 'TL2' designations correspond

to testing with the 3M FR-57 respirator cartridge. The unique survey number is also assigned, identifying the year and a five-digit ID for each of the cartridges tested. For the AX exhauster the survey IDs included 17-05614 for SD1, 17-05613 for SC1, 17-05615 for TL1, and 17-05616 for TL2.

Position designations 'IN' with '1' and 'EF' with '1' correspond to the respirator cartridge inlet and outlet measurements, respectively, at 0- to 2-hour time intervals. Position designations '2' through '8' correspond to the subsequent 2-hour measurements for inlet (IN) and outlet (EF): '2' (2 to 4 hours), '3' (4 to 6 hours), '4' (6 to 8 hours), '5' (8 to 10 hours), '6' (10 to 12 hours), '7' (12 to 14 hours), and '8' (14 to 16 hours).

The sample IDs embed the information given above. For example, sample ID 17-05616-1-TL2-IN-2 corresponds to a particular cartridge survey (17-05616) identified as the 3M FR-57 cartridge with the (TL2), sample media line 1, influent (IN) sample bundle, and the second (2 to 4 hours) sample (2).

The target flow rate passing through the respirator cartridge was 30 L/min for the APR tests, and 95 L/min for the PAPR tests. The target sampling flow rates through the sorption tubes ranged between 30 and 200 mL/min for different chemicals that were being collected. WRPS provided these flow rates as Excel files according to Table C.1.

Table C.1. Filenames of Sample Media Volumes Provided by WRPS

Tank	Cartridge	Filename
AX Exhauster	SCOTT 7422-SC1	AX - Exhauster 127 SC-1.xlsx
AX Exhauster	SCOTT 7422-SD1	AX - Exhauster 127 SD-1.xlsx
AX Exhauster	MSA-TL (TL1)	AX - Exhauster TL 8_25_17.xlsx
AX Exhauster	3M FR-57 (TL2)	AX - Exhauster 3M FR-57 8_26_17.xlsx

WRPS provided the temperature and humidity information in files listed in Table C.2. The information is shown in the Section C.3. Several terms used in the DRI files are described below.

- Pre' and 'Post' indicate the general time signature when the direct read instrument measurements were taken. 'Pre' refers to the beginning of the 2-hour sample duration, and 'Post' refers to the end of the 2-hour sample duration.
- 'Influent' and 'Effluent' indicate the location of the measurement within the test system. 'Influent' measurements are taken at the inlet of the system upstream of the respirator cartridge. 'Effluent' measurements are taken downstream of the respirator cartridge. The pressure, temperature, and humidity effluent sensors are located at the end of the test system near the vacuum pump, whereas the DRI measurements for ammonia and volatile organic compounds (VOC) are from a sampling location between the respirator cartridge and the effluent sorbent tube samples.
- The DRI measurements for ammonia and VOCs could not be taken while the test system sample pumps were operational. 'After Sample Taken' refers to the time signature for these direct read results (e.g., Sample A DRI measurements were taken immediately after the Sample A sorbent tubes were taken and replaced with Sample B sorbent tubes).

Table C.2. Files Containing Temperature, Pressure, Relative Humidity, and DRI Data

Tank	Cartridge	Filename
AX Exhauster	SCOTT 7422-SC1	AX-Exhauster SC1 8-26-17.xlsx
AX Exhauster	SCOTT 7422-SD1	AX-Exhauster SD-1 8-25-17.xlsx
AX Exhauster	MSA-TL (TL1)	AX-Exhauster TL1 GME 8-25-17.xlsx
AX Exhauster	3M FR-57 (TL2)	AX-Exhauster TL2 FR57 8-26-17.xlsx

The raw analytical data for chemicals in each analyte category are summarized in Section C.4. Some analytes are measured using more than one method (primary and secondary). A crosswalk of COPC to analyte category, media, and analytical method for both primary and secondary methods is provided in Table C.3. In general, the primary method was used for cartridge performance analysis except in cases for which the secondary method provides improved quantitation for the specific COPC and its concentration range during a specific test.

Table C.3. Crosswalk of COPCs with Primary and Secondary Analyte Category, Media, and Analytical Method

COPC#	Analyte Name	Primary Analysis Method (Analyte Category ǀ Media ǀ Method)	Secondary Analysis Method (Analyte Category ǀ Media ǀ Method)
1	Ammonia	Ammonia ǀ Anasorb 747 ǀ OSHA-ID-188	
2	Nitrous Oxide	Not Measured	
3	Mercury	Mercury ǀ Anasorb C300 ǀ NIOSH-6009	
4	1,3-Butadiene	1,3-butadiene ǀ Charcoal ǀ NIOSH 1024	
5	Benzene	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
6	Biphenyl	SVOC ǀ Carbotrap 150 ǀ EPA TO-17 Mod	
7	1-Butanol	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
8	Methanol	Methanol ǀ Silica Gel ǀ NIOSH 2000	
9	2-Hexanone	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
10	3-Methyl-3-butene-2-one	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
11	4-Methyl-2-hexanone	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
12	6-Methyl-2-heptanone	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
13	3-Buten-2-one	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
14	Formaldehyde	Aldehyde ǀ DNPH Treated Silica Gel ǀ EPA TO-11A	
15	Acetaldehyde	Aldehyde ǀ DNPH Treated Silica Gel ǀ EPA TO-11A	
16	Butanal/Butyraldehyde	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	Aldehyde ǀ DNPH Treated Silica Gel ǀ EPA TO-11A
17	2-Methyl-2-butenal	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
18	2-Ethyl-hex-2-enal	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
New	2-Propenal/Acrolein	Aldehyde ǀ DNPH Treated Silica Gel ǀ EPA TO-11A	
19	Furan[b]	VOC ǀ Carbotrap 300ǀ EPA TO-17 Mod	Furans ǀ Tenax TA ǀ EPA TO-17 Mod
20	2,3-Dihydrofuran	Furans ǀ Tenax TA ǀ EPA TO-17 Mod	
21	2,5-Dihydrofuran[b]	VOC ǀ Carbotrap 300ǀ EPA TO-17 Mod	Furans ǀ Tenax TA ǀ EPA TO-17 Mod
22	2-Methylfuran[b]	VOC ǀ Carbotrap 300ǀ EPA TO-17 Mod	Furans ǀ Tenax TA ǀ EPA TO-17 Mod
23	2,5-Dimethylfuran	Furans ǀ Tenax TA ǀ EPA TO-17 Mod	
24	2-Ethyl-5-methylfuran	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
25	4-(1-Methylpropyl)-2,3-dihydrofuran	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
26	3-(1,1-Dimethylethyl)-2,3-dihydrofuran	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
27	2-Pentylfuran	Furans ǀ Tenax TA ǀ EPA TO-17 Mod	
28	2-Heptylfuran	Furans ǀ Tenax TA ǀ EPA TO-17 Mod	
29	2-Propylfuran	Furans ǀ Tenax TA ǀ EPA TO-17 Mod	
30	2-Octylfuran	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
31	2-(3-Oxo-3-phenylprop-1-enyl)furan	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
32	2-(2-Methyl-6-oxoheptyl) furan	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
33	Diethylphthalate	SVOC ǀ Carbotrap 150 ǀ EPA TO-17 Mod	
34	Acetonitrile	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	Acetonitrile ǀ Charcoal ǀ NIOSH 1606
35	Propanenitrile	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	

COPC#	Analyte Name	Primary Analysis Method (Analyte Category ǀ Media ǀ Method)	Secondary Analysis Method (Analyte Category ǀ Media ǀ Method)
36	Butanenitrile	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
37	Pentanenitrile	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
38	Hexanenitrile	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
39	Heptanenitrile	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
40	2-Methylene butanenitrile	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
41	2,4-Pentadienenitrile	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
42	Ethylamine	Ethylamine ǀ XAD-7 ǀ OSHA-ID-34,36,40,41	
43	N-nitrosodimethylamine	Nitrosamines ǀ Thermasorb/N ǀ NIOSH-2522 Mod	
44	N-nitrosodiethylamine	Nitrosamines ǀ Thermasorb/N ǀ NIOSH-2522 Mod	
45	N-nitrosomethylethylamine	Nitrosamines ǀ Thermasorb/N ǀ NIOSH-2522 Mod	
46	N-nitrosomorpholine	Nitrosamines ǀ Thermasorb/N ǀ NIOSH-2522 Mod	
47	Tributyl phosphate	SVOC ǀ Carbotrap 150 ǀ EPA TO-17 Mod	
48	Dibutyl butylphosphonate	SVOC ǀ Carbotrap 150 ǀ EPA TO-17 Mod	
49	Chlorinated Biphenyls	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
50	2-Fluoropropene	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
51	Pyridine	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	Pyridines ǀ Coconut Shell Charcoal ǀ NIOSH-1613
52	2,4-Dimethylpyridine	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	Pyridines ǀ Coconut Shell Charcoal ǀ NIOSH-1613
53	Methyl nitrite	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
54	Butyl nitrite	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
55	Butyl nitrate	VOC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
56	1,4-Butanediol, dinitrate	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
57	2-Nitro-2-methylpropane	VOCTIC ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
58	1,2,3-Propanetriol, 1,3-dinitrate	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
59	Methyl Isocyanate	VOCTIC[a] ǀ Carbotrap 300 ǀ EPA TO-17 Mod	
New	Dimethyl Mercury	Not Measured	

[a] Tentatively Identified Compound (TIC) indicates that a mass spectrometry "peak" not associated with calibrated compounds has been tentatively assigned to a compound based on an adequate match to the analytical methods reference library. Reference standards for the compound are not available to accurately quantify, assign an analytical DL, or definitively confirm the identity of the TIC. TICs are reported when the peak area is sufficiently large, estimated as ≥5 nanograms of TIC mass, and other analytical criteria are met. For the respirator cartridge testing, this mass of TIC represents an approximate concentration of <1.0 ppb, based on the average of all TICs in the COPC list. TIC compounds are measured through both the Carbotrap 300: EPA TO-17 and Carbotrap 150: EPA TO-17 modified methods. A few compounds are measured in the TIC analysis and another analytical technique. In these cases, the TIC analysis results were not retained because they are qualitative only and inferior to the other calibrated method.

[b] Furan, 2,5-dihydrofuran, and 2-methylfuran are quantified using the secondary method, as the primary method was determined to perform inadequately for these lower-boiling point furan compounds.

C.2 Miscellaneous Notes

All analytical flags assigned by each analytical laboratory are provided in Appendix D. Sample lines occasionally experienced flow control issues, and these instances are documented in Appendix D with a quality flag of 'S*' associated with the impacted data point.

Methanol was measured in the powered air-purifying respirator test rig only. A thirteenth sample media line was added to the new rig so methanol could be measured using a dedicated sorption tube.

C.3 Experimental Parameters

See PNNL-27860 Volume 2.

C.4 Raw Data

See PNNL-27860 Volume 2.

Appendix D

Data Reduction Steps

Appendix D

Data Reduction Steps

1. Only chemicals in the current Chemicals of Potential Concern (COPC) list were included in the calculated data. Nitrous oxide was not measured in the study, while methanol was measured only on the powered air-purifying respirator (PAPR) test apparatus. Any other missing COPCs were analyzed as "Tentatively Identified Compounds."
2. The COPCs are ranked in the order of their COPC number. Within the data section for each COPC, data are sorted by cartridge (SD1 followed by SC1, MSA TL followed by 3M FR). Within every survey, data are ranked in the order of inlet and outlet and following the time sequence.
3. COPC concentrations were calculated as parts per million (ppm) using their molecular weights and corresponding reported standard volume using the following equation:

$$C = 24.14 \frac{r}{M\,V}$$

   where C is the concentration of COPC in ppmv; r is the analytical result with units of µg/sample; V is the volume of sample gas passed through the given media tube in liters; M is the species molecular weight in g/mol. When the ratio between concentration and the corresponding Occupational Exposure Limit (OEL) is larger than 10%, the result is displayed in red font. COPC-specific reported concentrations are provided in identical units to the COPC-specific OEL. For select compounds, this required conversions from ppm_v to either ppb_v, mg/m^3, or $\mu g/m^3$.
4. The reported volume measurements in Appendix C were made via DryCal devices placed downstream of each sample media tube. This allowed for precise volume measurements through each of the tubes. The DryCal devices were set to convert the measured values to standard flow conditions. The standard flow conditions are user-defined at 70°F and 1 atm pressure.
5. The analytical detection limit (DL)—or reporting limit (RL) in some cases—for every COPC was obtained from the analytical data. Here, the average flow rate was used to calculate the approximate analytical DL as the percentage of the OEL for each COPC. Because the flow rates vary, the calculated concentrations were different for each point, even though some of the results are less than the DL in the original reading. The last columns in Tables D.1 and D.2 indicate if the original readings were less than the DL or not.
   - For ammonia and mercury, only the results obtained from the total vapors of ammonia and mercury were used.
   - For furan, 2,5-dihydrofuran, and 2-methylfuran, results from the Carbotrap 300 TDU tube were used rather than results from the furan analyte tube. For acetonitrile, results from the Carbotrap 300 TDU tube were used. For butanal, results from the Carbotrap 300 TDU tube instead of the aldehydes tube were used. For 2,4-dimethylpyridine and pyridine, results from the Carbotrap 300 TDU tube were used.
   - For N-nitrosodimethylamine and other nitrosamines, data values above analytical DLs for the same time and position were added together because the original sample was diluted into three samples for measurements. This same rule applies to 1,3-butadiene. The results in the plots and tables reflect the sum of results.

- Analytical results frequently have data qualifier flags documented for specific sample analyses. Depending on the data qualifier, specific data may be considered for deletion or removal from the analysis, or results described with appropriate clarifying language to indicate whether there are possible limitations to the data. Flags identified below were found to be associated with at least one of the COPC compounds analyzed through this effort. Here, key qualifier codes are given, along with their definitions and how they are being handled with the cartridge-testing analysis. The list does not include all flags that the analytical team may assign, but it does include the flags associated with the data set compiled within this report. In addition, specific samples were identified at the time of sampling as potentially suspect by the test operator due to potential sample volume or sample tube media issues. These samples have been flagged with a project-specific qualifier code in the data set.

Action	Flag	Flag Description
Retain (Result is treated in the analysis as a valid data point)	J	The "J" flag is applied to results that are considered estimates. Some examples of when a "J" flag are applied include (but are not limited to): • Results with concentrations greater than or equal to the method DL but less than the RL. When results are reported based on the RL, the "J" is removed from the reported data. R702-AZ data are left as received from the chemist. • Unknown constituents—Tentatively Identified Compounds or positively identified compounds.
	E	The "E" flag is applied to each analyte that exceeded the calibration range of the instrument.
	U	The "U" flag is applied to analytes that were analyzed for, but were not detected, or were detected below the method DL. If results are reported based on RL, this flag is removed from the reported data. R702-AZ data are left as received from the chemist.
	D	The "D" flag is applied to all analytes in a sample that were diluted prior to analysis.
Retain/Evaluate (Result is treated in the analysis as a valid data point, but evaluated on a case-by-case basis to determine whether clarification is needed in the analysis report to document the uncertainty or potential limitations of the data)	L	The "L" flag is applied to analyte results (both detected and not detected) within a sample batch that included a low-level standard with a percent recovery for that analyte that was outside the analytical method specified range.
	Y	The "Y" flag is a user-defined flag and is applied to results that require written descriptions or qualifying comments. This flag is used by the chemist, PC, or other technical authority to identify data that is questionable or may be inaccurate because of interferences, sampling problems, sample collection media (e.g., tubes or summa canisters) certification failures, or instrumentation limitations.
	S*	The "S*" flag is a project-specific user-defined flag applied to samples that were identified by the test operator as suspect due to potentially low sample volume/flow rate issues, or other sample tube media problems
Delete (Result is seriously suspect and should be screened out and not reported)	N/A	

Tables D.1 and D.2 show the calculated concentrations for each of the COPC measurements conducted in this study. Red highlighted values reflect measurements that were above 10% of the respective OEL values. COPCs with these highlights are plotted and shown in Section 5.0. Orange highlighted values reflect measurements in the 2 to 10% of the OEL range. COPCs with these highlights (only) are plotted and/or discussed in Appendix E.

The position numbers that start with SD1 are for the SCOTT 7422-SD1 model of cartridge, and the position numbers that start with SC1 are for the SCOTT 7422-SC1 model of cartridge. The position numbers that start with TL are for the MSA OptiFilter TL model of cartridge, and the position numbers that start with FR-57 are for the 3M FR-57 model of cartridge.

Table D.1. APR Cartridge Testing Calculated Data

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
1	Ammonia	2	SD1-IN-A	6.0E+00	25	23.9%				2.50%
1	Ammonia	4	SD1-IN-B	5.4E+00	25	21.8%				2.50%
1	Ammonia	6	SD1-IN-C	4.0E+00	25	16.2%				2.50%
1	Ammonia	8	SD1-IN-D	3.8E+00	25	15.2%				2.50%
1	Ammonia	10	SD1-IN-E	6.1E-01	25	2.43%				2.50%
1	Ammonia	12	SD1-IN-F	4.3E+00	25	17.1%				2.50%
1	Ammonia	14	SD1-IN-G	3.0E+00	25	12.0%				2.50%
1	Ammonia	16	SD1-IN-H	3.9E+00	25	15.6%				2.50%
1	Ammonia	2	SD1-EF-A	6.1E-01	25	2.42%	YES		2.42%	2.50%
1	Ammonia	4	SD1-EF-B	6.0E-01	25	2.38%	YES		2.38%	2.50%
1	Ammonia	6	SD1-EF-C	6.1E-01	25	2.44%	YES		2.44%	2.50%
1	Ammonia	8	SD1-EF-D	6.3E-01	25	2.50%	YES		2.50%	2.50%
1	Ammonia	10	SD1-EF-E	6.1E-01	25	2.43%	YES		2.43%	2.50%
1	Ammonia	12	SD1-EF-F	6.0E-01	25	2.38%	YES		2.38%	2.50%
1	Ammonia	14	SD1-EF-G	6.1E-01	25	2.45%	YES		2.45%	2.50%
1	Ammonia	16	SD1-EF-H	6.0E-01	25	2.39%	YES		2.39%	2.50%
1	Ammonia	2	SC1-IN-A	3.9E+00	25	15.5%				2.50%
1	Ammonia	4	SC1-IN-B	4.4E+00	25	17.5%				2.50%
1	Ammonia	6	SC1-IN-C	3.7E+00	25	14.6%				2.50%
1	Ammonia	8	SC1-IN-D	3.6E+00	25	14.2%				2.50%
1	Ammonia	10	SC1-IN-E	9.4E-01	25	3.74%				2.50%
1	Ammonia	12	SC1-IN-F	3.4E+00	25	13.5%				2.50%
1	Ammonia	14	SC1-IN-G	3.5E+00	25	13.9%				2.50%
1	Ammonia	16	SC1-IN-H	2.8E+00	25	11.3%				2.50%
1	Ammonia	2	SC1-EF-A	6.1E-01	25	2.42%	YES		2.42%	2.50%
1	Ammonia	4	SC1-EF-B	5.9E-01	25	2.37%	YES		2.37%	2.50%
1	Ammonia	6	SC1-EF-C	5.9E-01	25	2.37%	YES		2.37%	2.50%
1	Ammonia	8	SC1-EF-D	6.0E-01	25	2.38%	YES		2.38%	2.50%
1	Ammonia	10	SC1-EF-E	5.9E-01	25	2.37%	YES		2.37%	2.50%
1	Ammonia	12	SC1-EF-F	5.9E-01	25	2.34%	YES		2.34%	2.50%
1	Ammonia	14	SC1-EF-G	5.9E-01	25	2.38%	YES		2.38%	2.50%
1	Ammonia	16	SC1-EF-H	5.7E-01	25	2.29%	YES		2.29%	2.50%
3	Mercury	2	SD1-IN-A	7.9E-04	0.003	26.4%				6.81%
3	Mercury	4	SD1-IN-B	9.4E-04	0.003	31.3%				6.81%
3	Mercury	6	SD1-IN-C	9.0E-04	0.003	29.7%				6.81%
3	Mercury	8	SD1-IN-D	9.2E-04	0.003	30.4%				6.81%
3	Mercury	10	SD1-IN-E	9.1E-04	0.003	30.4%				6.81%
3	Mercury	12	SD1-IN-F	9.8E-04	0.003	32.7%				6.81%
3	Mercury	14	SD1-IN-G	9.4E-04	0.003	31.2%				6.81%
3	Mercury	16	SD1-IN-H	9.6E-04	0.003	32.1%				6.81%
3	Mercury	2	SD1-EF-A	2.0E-04	0.003	6.72%	YES		6.72%	6.81%
3	Mercury	4	SD1-EF-B	2.0E-04	0.003	6.64%	YES		6.64%	6.81%
3	Mercury	6	SD1-EF-C	2.0E-04	0.003	6.61%	YES		6.61%	6.81%
3	Mercury	8	SD1-EF-D	2.0E-04	0.003	6.70%	YES		6.70%	6.81%
3	Mercury	10	SD1-EF-E	2.0E-04	0.003	6.81%	YES		6.81%	6.81%
3	Mercury	12	SD1-EF-F	2.0E-04	0.003	6.74%	YES		6.74%	6.81%
3	Mercury	14	SD1-EF-G	2.0E-04	0.003	6.63%	YES		6.63%	6.81%
3	Mercury	16	SD1-EF-H	2.0E-04	0.003	6.57%	YES		6.57%	6.81%
3	Mercury	2	SC1-IN-A	7.2E-04	0.003	23.8%				6.81%
3	Mercury	4	SC1-IN-B	7.7E-04	0.003	25.7%				6.81%
3	Mercury	6	SC1-IN-C	7.3E-04	0.003	24.1%				6.81%
3	Mercury	8	SC1-IN-D	7.2E-04	0.003	23.9%				6.81%
3	Mercury	10	SC1-IN-E	7.5E-04	0.003	25.1%				6.81%
3	Mercury	12	SC1-IN-F	8.2E-04	0.003	27.3%				6.81%
3	Mercury	14	SC1-IN-G	7.2E-04	0.003	23.9%				6.81%
3	Mercury	16	SC1-IN-H	7.6E-04	0.003	25.4%				6.81%
3	Mercury	2	SC1-EF-A	2.0E-04	0.003	6.67%	YES		6.67%	6.81%
3	Mercury	4	SC1-EF-B	2.0E-04	0.003	6.71%	YES		6.71%	6.81%
3	Mercury	6	SC1-EF-C	2.0E-04	0.003	6.75%	YES		6.75%	6.81%
3	Mercury	8	SC1-EF-D	2.0E-04	0.003	6.74%	YES		6.74%	6.81%
3	Mercury	10	SC1-EF-E	2.0E-04	0.003	6.69%	YES		6.69%	6.81%
3	Mercury	12	SC1-EF-F	2.0E-04	0.003	6.74%	YES		6.74%	6.81%
3	Mercury	14	SC1-EF-G	2.0E-04	0.003	6.56%	YES		6.56%	6.81%
3	Mercury	16	SC1-EF-H	2.0E-04	0.003	6.63%	YES		6.63%	6.81%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
6	Biphenyl	2	SD1-IN-A	9.3E-05	0.20	0.046%	YES	UY	0.046%	0.0467%
6	Biphenyl	4	SD1-IN-B	5.6E-05	0.20	0.028%		JY		0.0467%
6	Biphenyl	6	SD1-IN-C	8.4E-05	0.20	0.042%		JY		0.0467%
6	Biphenyl	8	SD1-IN-D	5.3E-05	0.20	0.026%	YES	U	0.026%	0.0467%
6	Biphenyl	10	SD1-IN-E	5.2E-05	0.20	0.026%	YES	U	0.026%	0.0467%
6	Biphenyl	12	SD1-IN-F	4.9E-05	0.20	0.024%	YES	U	0.024%	0.0467%
6	Biphenyl	14	SD1-IN-G	6.5E-05	0.20	0.033%		J		0.0467%
6	Biphenyl	16	SD1-IN-H	8.7E-05	0.20	0.043%	YES	U	0.043%	0.0467%
6	Biphenyl	2	SD1-EF-A	8.6E-05	0.20	0.043%	YES	UY	0.043%	0.0467%
6	Biphenyl	4	SD1-EF-B	8.0E-05	0.20	0.040%	YES	UY	0.040%	0.0467%
6	Biphenyl	6	SD1-EF-C	9.3E-05	0.20	0.047%	YES	UY	0.047%	0.0467%
6	Biphenyl	8	SD1-EF-D	9.1E-05	0.20	0.045%	YES	UY	0.045%	0.0467%
6	Biphenyl	10	SD1-EF-E	8.4E-05	0.20	0.042%	YES	UY	0.042%	0.0467%
6	Biphenyl	12	SD1-EF-F	8.9E-05	0.20	0.044%	YES	UY	0.044%	0.0467%
6	Biphenyl	14	SD1-EF-G	8.3E-05	0.20	0.042%	YES	U	0.042%	0.0467%
6	Biphenyl	16	SD1-EF-H	8.5E-05	0.20	0.043%	YES	U	0.043%	0.0467%
6	Biphenyl	2	SC1-IN-A	8.0E-05	0.20	0.040%	YES	U	0.040%	0.0467%
6	Biphenyl	4	SC1-IN-B	5.9E-05	0.20	0.029%		J		0.0467%
6	Biphenyl	6	SC1-IN-C	9.3E-05	0.20	0.047%		J		0.0467%
6	Biphenyl	8	SC1-IN-D	4.8E-05	0.20	0.024%	YES	U	0.024%	0.0467%
6	Biphenyl	10	SC1-IN-E	5.0E-05	0.20	0.025%	YES	U	0.025%	0.0467%
6	Biphenyl	12	SC1-IN-F	4.6E-05	0.20	0.023%	YES	U	0.023%	0.0467%
6	Biphenyl	14	SC1-IN-G	6.7E-05	0.20	0.034%		J		0.0467%
6	Biphenyl	16	SC1-IN-H	8.2E-05	0.20	0.041%	YES	U	0.041%	0.0467%
6	Biphenyl	2	SC1-EF-A	8.0E-05	0.20	0.040%	YES	U	0.040%	0.0467%
6	Biphenyl	4	SC1-EF-B	8.7E-05	0.20	0.044%	YES	U	0.044%	0.0467%
6	Biphenyl	6	SC1-EF-C	8.5E-05	0.20	0.043%	YES	U	0.043%	0.0467%
6	Biphenyl	8	SC1-EF-D	8.9E-05	0.20	0.044%	YES	U	0.044%	0.0467%
6	Biphenyl	10	SC1-EF-E	8.3E-05	0.20	0.041%	YES	U	0.041%	0.0467%
6	Biphenyl	12	SC1-EF-F	8.1E-05	0.20	0.041%	YES	U	0.041%	0.0467%
6	Biphenyl	14	SC1-EF-G	8.6E-05	0.20	0.043%	YES	U	0.043%	0.0467%
6	Biphenyl	16	SC1-EF-H	8.6E-05	0.20	0.043%	YES	U	0.043%	0.0467%
7	1-Butanol	2	SD1-IN-A	3.4E-03	20	0.017%				0.00101%
7	1-Butanol	4	SD1-IN-B	2.1E-03	20	0.010%				0.00101%
7	1-Butanol	6	SD1-IN-C	1.9E-03	20	0.009%		J		0.00101%
7	1-Butanol	8	SD1-IN-D	1.8E-03	20	0.009%		J		0.00101%
7	1-Butanol	10	SD1-IN-E	1.6E-03	20	0.008%		J		0.00101%
7	1-Butanol	12	SD1-IN-F	1.4E-03	20	0.007%		J		0.00101%
7	1-Butanol	14	SD1-IN-G	2.0E-03	20	0.010%		J		0.00101%
7	1-Butanol	16	SD1-IN-H	3.9E-03	20	0.019%				0.00101%
7	1-Butanol	2	SD1-EF-A	1.9E-04	20	0.001%	YES	U	0.001%	0.00101%
7	1-Butanol	4	SD1-EF-B	8.2E-04	20	0.004%		J		0.00101%
7	1-Butanol	6	SD1-EF-C	4.1E-04	20	0.002%		J		0.00101%
7	1-Butanol	8	SD1-EF-D	2.7E-04	20	0.001%		J		0.00101%
7	1-Butanol	10	SD1-EF-E	1.9E-04	20	0.001%	YES	U	0.001%	0.00101%
7	1-Butanol	12	SD1-EF-F	1.8E-04	20	0.001%	YES	U	0.001%	0.00101%
7	1-Butanol	14	SD1-EF-G	1.9E-04	20	0.001%	YES	U	0.001%	0.00101%
7	1-Butanol	16	SD1-EF-H	1.9E-04	20	0.001%	YES	U	0.001%	0.00101%
7	1-Butanol	2	SC1-IN-A	4.2E-03	20	0.021%				0.00101%
7	1-Butanol	4	SC1-IN-B	2.0E-03	20	0.010%		JL		0.00101%
7	1-Butanol	6	SC1-IN-C	3.1E-03	20	0.016%		L		0.00101%
7	1-Butanol	8	SC1-IN-D	1.5E-03	20	0.007%		JL		0.00101%
7	1-Butanol	10	SC1-IN-E	1.4E-03	20	0.007%		JL		0.00101%
7	1-Butanol	12	SC1-IN-F	1.3E-03	20	0.007%		JL		0.00101%
7	1-Butanol	14	SC1-IN-G	1.3E-03	20	0.007%		JL		0.00101%
7	1-Butanol	16	SC1-IN-H	2.0E-03	20	0.010%				0.00101%
7	1-Butanol	2	SC1-EF-A	3.2E-04	20	0.002%		JY		0.00101%
7	1-Butanol	4	SC1-EF-B	2.0E-04	20	0.001%	YES	U	0.001%	0.00101%
7	1-Butanol	6	SC1-EF-C	4.9E-04	20	0.002%		J		0.00101%
7	1-Butanol	8	SC1-EF-D	7.4E-04	20	0.004%		J		0.00101%
7	1-Butanol	10	SC1-EF-E	1.8E-04	20	0.001%	YES	U	0.001%	0.00101%
7	1-Butanol	12	SC1-EF-F	7.2E-04	20	0.004%		J		0.00101%
7	1-Butanol	14	SC1-EF-G	1.8E-04	20	0.001%	YES	UY	0.001%	0.00101%
7	1-Butanol	16	SC1-EF-H	4.1E-04	20	0.002%		J		0.00101%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
9	2-Hexanone	2	SD1-IN-A	1.8E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	4	SD1-IN-B	2.1E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	6	SD1-IN-C	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	8	SD1-IN-D	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	10	SD1-IN-E	1.8E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	12	SD1-IN-F	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	14	SD1-IN-G	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	16	SD1-IN-H	2.2E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	2	SD1-EF-A	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	4	SD1-EF-B	9.7E-05	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	6	SD1-EF-C	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	8	SD1-EF-D	1.1E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	10	SD1-EF-E	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	12	SD1-EF-F	9.8E-05	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	14	SD1-EF-G	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	16	SD1-EF-H	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	2	SC1-IN-A	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	4	SC1-IN-B	2.3E-04	5.0	0.005%		J		0.00224%
9	2-Hexanone	6	SC1-IN-C	2.1E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	8	SC1-IN-D	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	10	SC1-IN-E	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	12	SC1-IN-F	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	14	SC1-IN-G	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	16	SC1-IN-H	2.0E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	2	SC1-EF-A	9.8E-05	5.0	0.002%	YES	UY	0.002%	0.00224%
9	2-Hexanone	4	SC1-EF-B	1.1E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	6	SC1-EF-C	1.1E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	8	SC1-EF-D	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	10	SC1-EF-E	9.9E-05	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	12	SC1-EF-F	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	14	SC1-EF-G	9.8E-05	5.0	0.002%	YES	UY	0.002%	0.00224%
9	2-Hexanone	16	SC1-EF-H	9.8E-05	5.0	0.002%	YES	U	0.002%	0.00224%
11	4-Methyl-2-hexanone	2	SD1-IN-A	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	4	SD1-IN-B	6.8E-05	0.50	0.014%	YES	U	0.014%	0.0172%
11	4-Methyl-2-hexanone	6	SD1-IN-C	7.7E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	8	SD1-IN-D	7.9E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	10	SD1-IN-E	7.4E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SD1-IN-F	7.9E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	14	SD1-IN-G	7.7E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	16	SD1-IN-H	8.0E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	2	SD1-EF-A	8.0E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	4	SD1-EF-B	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	6	SD1-EF-C	8.0E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	8	SD1-EF-D	8.3E-05	0.50	0.017%	YES	U	0.017%	0.0172%
11	4-Methyl-2-hexanone	10	SD1-EF-E	7.7E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SD1-EF-F	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	14	SD1-EF-G	7.8E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	16	SD1-EF-H	7.8E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	2	SC1-IN-A	7.0E-05	0.50	0.014%	YES	U	0.014%	0.0172%
11	4-Methyl-2-hexanone	4	SC1-IN-B	7.6E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	6	SC1-IN-C	7.3E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	8	SC1-IN-D	7.4E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	10	SC1-IN-E	7.3E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SC1-IN-F	7.0E-05	0.50	0.014%	YES	U	0.014%	0.0172%
11	4-Methyl-2-hexanone	14	SC1-IN-G	7.6E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	16	SC1-IN-H	7.3E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	2	SC1-EF-A	7.5E-05	0.50	0.015%	YES	UY	0.015%	0.0172%
11	4-Methyl-2-hexanone	4	SC1-EF-B	8.3E-05	0.50	0.017%	YES	U	0.017%	0.0172%
11	4-Methyl-2-hexanone	6	SC1-EF-C	8.6E-05	0.50	0.017%	YES	U	0.017%	0.0172%
11	4-Methyl-2-hexanone	8	SC1-EF-D	7.9E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	10	SC1-EF-E	7.6E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SC1-EF-F	7.8E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	14	SC1-EF-G	7.5E-05	0.50	0.015%	YES	UY	0.015%	0.0172%
11	4-Methyl-2-hexanone	16	SC1-EF-H	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
9	2-Hexanone	2	SD1-IN-A	1.8E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	4	SD1-IN-B	2.1E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	6	SD1-IN-C	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	8	SD1-IN-D	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	10	SD1-IN-E	1.8E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	12	SD1-IN-F	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	14	SD1-IN-G	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	16	SD1-IN-H	2.2E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	2	SD1-EF-A	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	4	SD1-EF-B	9.7E-05	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	6	SD1-EF-C	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	8	SD1-EF-D	1.1E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	10	SD1-EF-E	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	12	SD1-EF-F	9.8E-05	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	14	SD1-EF-G	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	16	SD1-EF-H	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	2	SC1-IN-A	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	4	SC1-IN-B	2.3E-04	5.0	0.005%		J		0.00224%
9	2-Hexanone	6	SC1-IN-C	2.1E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	8	SC1-IN-D	1.9E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	10	SC1-IN-E	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	12	SC1-IN-F	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	14	SC1-IN-G	1.7E-04	5.0	0.003%		J		0.00224%
9	2-Hexanone	16	SC1-IN-H	2.0E-04	5.0	0.004%		J		0.00224%
9	2-Hexanone	2	SC1-EF-A	9.8E-05	5.0	0.002%	YES	UY	0.002%	0.00224%
9	2-Hexanone	4	SC1-EF-B	1.1E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	6	SC1-EF-C	1.1E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	8	SC1-EF-D	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	10	SC1-EF-E	9.9E-05	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	12	SC1-EF-F	1.0E-04	5.0	0.002%	YES	U	0.002%	0.00224%
9	2-Hexanone	14	SC1-EF-G	9.8E-05	5.0	0.002%	YES	UY	0.002%	0.00224%
9	2-Hexanone	16	SC1-EF-H	9.8E-05	5.0	0.002%	YES	U	0.002%	0.00224%
11	4-Methyl-2-hexanone	2	SD1-IN-A	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	4	SD1-IN-B	6.8E-05	0.50	0.014%	YES	U	0.014%	0.0172%
11	4-Methyl-2-hexanone	6	SD1-IN-C	7.7E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	8	SD1-IN-D	7.9E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	10	SD1-IN-E	7.4E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SD1-IN-F	7.9E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	14	SD1-IN-G	7.7E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	16	SD1-IN-H	8.0E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	2	SD1-EF-A	8.0E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	4	SD1-EF-B	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	6	SD1-EF-C	8.0E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	8	SD1-EF-D	8.3E-05	0.50	0.017%	YES	U	0.017%	0.0172%
11	4-Methyl-2-hexanone	10	SD1-EF-E	7.7E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SD1-EF-F	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	14	SD1-EF-G	7.8E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	16	SD1-EF-H	7.8E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	2	SC1-IN-A	7.0E-05	0.50	0.014%	YES	U	0.014%	0.0172%
11	4-Methyl-2-hexanone	4	SC1-IN-B	7.6E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	6	SC1-IN-C	7.3E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	8	SC1-IN-D	7.4E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	10	SC1-IN-E	7.3E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SC1-IN-F	7.0E-05	0.50	0.014%	YES	U	0.014%	0.0172%
11	4-Methyl-2-hexanone	14	SC1-IN-G	7.6E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	16	SC1-IN-H	7.3E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	2	SC1-EF-A	7.5E-05	0.50	0.015%	YES	UY	0.015%	0.0172%
11	4-Methyl-2-hexanone	4	SC1-EF-B	8.3E-05	0.50	0.017%	YES	U	0.017%	0.0172%
11	4-Methyl-2-hexanone	6	SC1-EF-C	8.6E-05	0.50	0.017%	YES	U	0.017%	0.0172%
11	4-Methyl-2-hexanone	8	SC1-EF-D	7.9E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	10	SC1-EF-E	7.6E-05	0.50	0.015%	YES	U	0.015%	0.0172%
11	4-Methyl-2-hexanone	12	SC1-EF-F	7.8E-05	0.50	0.016%	YES	U	0.016%	0.0172%
11	4-Methyl-2-hexanone	14	SC1-EF-G	7.5E-05	0.50	0.015%	YES	UY	0.015%	0.0172%
11	4-Methyl-2-hexanone	16	SC1-EF-H	7.5E-05	0.50	0.015%	YES	U	0.015%	0.0172%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
13	3-Buten-2-one	2	SD1-IN-A	3.6E-04	0.20	0.180%		J		0.115%
13	3-Buten-2-one	4	SD1-IN-B	3.5E-04	0.20	0.173%		J		0.115%
13	3-Buten-2-one	6	SD1-IN-C	3.9E-04	0.20	0.197%		J		0.115%
13	3-Buten-2-one	8	SD1-IN-D	3.6E-04	0.20	0.178%		J		0.115%
13	3-Buten-2-one	10	SD1-IN-E	3.0E-04	0.20	0.150%		J		0.115%
13	3-Buten-2-one	12	SD1-IN-F	2.5E-04	0.20	0.124%		J		0.115%
13	3-Buten-2-one	14	SD1-IN-G	2.3E-04	0.20	0.117%		J		0.115%
13	3-Buten-2-one	16	SD1-IN-H	3.7E-04	0.20	0.187%		J		0.115%
13	3-Buten-2-one	2	SD1-EF-A	2.1E-04	0.20	0.107%	YES	U	0.107%	0.115%
13	3-Buten-2-one	4	SD1-EF-B	2.0E-04	0.20	0.100%	YES	U	0.100%	0.115%
13	3-Buten-2-one	6	SD1-EF-C	2.1E-04	0.20	0.107%	YES	U	0.107%	0.115%
13	3-Buten-2-one	8	SD1-EF-D	2.2E-04	0.20	0.111%	YES	U	0.111%	0.115%
13	3-Buten-2-one	10	SD1-EF-E	2.1E-04	0.20	0.104%	YES	U	0.104%	0.115%
13	3-Buten-2-one	12	SD1-EF-F	2.0E-04	0.20	0.100%	YES	U	0.100%	0.115%
13	3-Buten-2-one	14	SD1-EF-G	2.1E-04	0.20	0.104%	YES	U	0.104%	0.115%
13	3-Buten-2-one	16	SD1-EF-H	2.1E-04	0.20	0.105%	YES	U	0.105%	0.115%
13	3-Buten-2-one	2	SC1-IN-A	3.5E-04	0.20	0.175%		J		0.115%
13	3-Buten-2-one	4	SC1-IN-B	4.6E-04	0.20	0.230%		J		0.115%
13	3-Buten-2-one	6	SC1-IN-C	3.1E-04	0.20	0.153%		J		0.115%
13	3-Buten-2-one	8	SC1-IN-D	3.1E-04	0.20	0.154%		J		0.115%
13	3-Buten-2-one	10	SC1-IN-E	2.6E-04	0.20	0.128%		J		0.115%
13	3-Buten-2-one	12	SC1-IN-F	3.5E-04	0.20	0.176%		J		0.115%
13	3-Buten-2-one	14	SC1-IN-G	2.5E-04	0.20	0.124%		J		0.115%
13	3-Buten-2-one	16	SC1-IN-H	2.7E-04	0.20	0.136%		J		0.115%
13	3-Buten-2-one	2	SC1-EF-A	2.0E-04	0.20	0.101%	YES	UY	0.101%	0.115%
13	3-Buten-2-one	4	SC1-EF-B	2.2E-04	0.20	0.111%	YES	U	0.111%	0.115%
13	3-Buten-2-one	6	SC1-EF-C	2.3E-04	0.20	0.115%	YES	U	0.115%	0.115%
13	3-Buten-2-one	8	SC1-EF-D	2.1E-04	0.20	0.105%	YES	U	0.105%	0.115%
13	3-Buten-2-one	10	SC1-EF-E	2.0E-04	0.20	0.102%	YES	U	0.102%	0.115%
13	3-Buten-2-one	12	SC1-EF-F	2.1E-04	0.20	0.105%	YES	U	0.105%	0.115%
13	3-Buten-2-one	14	SC1-EF-G	2.0E-04	0.20	0.101%	YES	UY	0.101%	0.115%
13	3-Buten-2-one	16	SC1-EF-H	2.0E-04	0.20	0.100%	YES	U	0.100%	0.115%
14	Formaldehyde	2	SD1-IN-A	4.9E-02	0.30	16.4%				0.592%
14	Formaldehyde	4	SD1-IN-B	5.2E-02	0.30	17.2%				0.592%
14	Formaldehyde	6	SD1-IN-C	5.1E-02	0.30	17.0%				0.592%
14	Formaldehyde	8	SD1-IN-D	5.0E-02	0.30	16.7%				0.592%
14	Formaldehyde	10	SD1-IN-E	4.5E-02	0.30	14.9%				0.592%
14	Formaldehyde	12	SD1-IN-F	4.3E-02	0.30	14.4%				0.592%
14	Formaldehyde	14	SD1-IN-G	4.3E-02	0.30	14.5%				0.592%
14	Formaldehyde	16	SD1-IN-H	3.3E-02	0.30	11.1%				0.592%
14	Formaldehyde	2	SD1-EF-A	3.2E-03	0.30	1.06%				0.592%
14	Formaldehyde	4	SD1-EF-B	3.9E-03	0.30	1.29%				0.592%
14	Formaldehyde	6	SD1-EF-C	4.5E-03	0.30	1.50%				0.592%
14	Formaldehyde	8	SD1-EF-D	4.3E-03	0.30	1.42%				0.592%
14	Formaldehyde	10	SD1-EF-E	3.7E-03	0.30	1.22%				0.592%
14	Formaldehyde	12	SD1-EF-F	3.6E-03	0.30	1.21%				0.592%
14	Formaldehyde	14	SD1-EF-G	2.9E-03	0.30	0.979%				0.592%
14	Formaldehyde	16	SD1-EF-H	2.1E-03	0.30	0.706%				0.592%
14	Formaldehyde	2	SC1-IN-A	4.7E-02	0.30	15.7%				0.592%
14	Formaldehyde	4	SC1-IN-B	5.1E-02	0.30	16.9%				0.592%
14	Formaldehyde	6	SC1-IN-C	4.7E-02	0.30	15.8%				0.592%
14	Formaldehyde	8	SC1-IN-D	4.4E-02	0.30	14.7%				0.592%
14	Formaldehyde	10	SC1-IN-E	2.1E-02	0.30	6.83%				0.592%
14	Formaldehyde	12	SC1-IN-F	4.1E-02	0.30	13.7%				0.592%
14	Formaldehyde	14	SC1-IN-G	4.0E-02	0.30	13.2%				0.592%
14	Formaldehyde	16	SC1-IN-H	4.0E-02	0.30	13.3%				0.592%
14	Formaldehyde	2	SC1-EF-A	3.0E-03	0.30	1.01%				0.592%
14	Formaldehyde	4	SC1-EF-B	4.3E-03	0.30	1.42%				0.592%
14	Formaldehyde	6	SC1-EF-C	5.8E-03	0.30	1.93%				0.592%
14	Formaldehyde	8	SC1-EF-D	6.2E-03	0.30	2.07%				0.592%
14	Formaldehyde	10	SC1-EF-E	5.0E-03	0.30	1.65%				0.592%
14	Formaldehyde	12	SC1-EF-F	4.7E-03	0.30	1.58%				0.592%
14	Formaldehyde	14	SC1-EF-G	4.8E-03	0.30	1.60%				0.592%
14	Formaldehyde	16	SC1-EF-H	3.0E-03	0.30	1.01%				0.592%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
15	Acetaldehyde	2	SD1-IN-A	7.2E-02	25	0.286%				0.00484%
15	Acetaldehyde	4	SD1-IN-B	7.8E-02	25	0.310%				0.00484%
15	Acetaldehyde	6	SD1-IN-C	6.7E-02	25	0.269%				0.00484%
15	Acetaldehyde	8	SD1-IN-D	7.1E-02	25	0.283%				0.00484%
15	Acetaldehyde	10	SD1-IN-E	7.5E-02	25	0.301%				0.00484%
15	Acetaldehyde	12	SD1-IN-F	7.9E-02	25	0.317%				0.00484%
15	Acetaldehyde	14	SD1-IN-G	8.0E-02	25	0.319%				0.00484%
15	Acetaldehyde	16	SD1-IN-H	7.5E-02	25	0.300%				0.00484%
15	Acetaldehyde	2	SD1-EF-A	3.6E-02	25	0.144%				0.00484%
15	Acetaldehyde	4	SD1-EF-B	5.7E-02	25	0.228%				0.00484%
15	Acetaldehyde	6	SD1-EF-C	6.4E-02	25	0.256%				0.00484%
15	Acetaldehyde	8	SD1-EF-D	5.8E-02	25	0.232%				0.00484%
15	Acetaldehyde	10	SD1-EF-E	5.2E-02	25	0.209%				0.00484%
15	Acetaldehyde	12	SD1-EF-F	6.1E-02	25	0.244%				0.00484%
15	Acetaldehyde	14	SD1-EF-G	5.8E-02	25	0.233%				0.00484%
15	Acetaldehyde	16	SD1-EF-H	5.8E-02	25	0.233%				0.00484%
15	Acetaldehyde	2	SC1-IN-A	7.1E-02	25	0.285%				0.00484%
15	Acetaldehyde	4	SC1-IN-B	7.4E-02	25	0.294%				0.00484%
15	Acetaldehyde	6	SC1-IN-C	6.7E-02	25	0.267%				0.00484%
15	Acetaldehyde	8	SC1-IN-D	6.5E-02	25	0.259%				0.00484%
15	Acetaldehyde	10	SC1-IN-E	4.4E-02	25	0.177%				0.00484%
15	Acetaldehyde	12	SC1-IN-F	7.0E-02	25	0.281%				0.00484%
15	Acetaldehyde	14	SC1-IN-G	7.0E-02	25	0.279%				0.00484%
15	Acetaldehyde	16	SC1-IN-H	7.5E-02	25	0.300%				0.00484%
15	Acetaldehyde	2	SC1-EF-A	2.8E-02	25	0.113%				0.00484%
15	Acetaldehyde	4	SC1-EF-B	5.6E-02	25	0.224%				0.00484%
15	Acetaldehyde	6	SC1-EF-C	7.2E-02	25	0.290%				0.00484%
15	Acetaldehyde	8	SC1-EF-D	7.4E-02	25	0.294%				0.00484%
15	Acetaldehyde	10	SC1-EF-E	5.6E-02	25	0.226%				0.00484%
15	Acetaldehyde	12	SC1-EF-F	5.3E-02	25	0.212%				0.00484%
15	Acetaldehyde	14	SC1-EF-G	6.1E-02	25	0.243%				0.00484%
15	Acetaldehyde	16	SC1-EF-H	5.8E-02	25	0.231%				0.00484%
16	Butanal/Butyraldehyde	2	SD1-IN-A	5.5E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	4	SD1-IN-B	5.0E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	6	SD1-IN-C	6.2E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	8	SD1-IN-D	7.7E-04	25	0.003%		J		0.000584%
16	Butanal/Butyraldehyde	10	SD1-IN-E	4.9E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	12	SD1-IN-F	4.6E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	14	SD1-IN-G	6.1E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	16	SD1-IN-H	1.1E-03	25	0.004%		J		0.000584%
16	Butanal/Butyraldehyde	2	SD1-EF-A	1.4E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	4	SD1-EF-B	1.9E-04	25	0.001%		J		0.000584%
16	Butanal/Butyraldehyde	6	SD1-EF-C	1.4E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	8	SD1-EF-D	1.7E-04	25	0.001%		J		0.000584%
16	Butanal/Butyraldehyde	10	SD1-EF-E	1.6E-04	25	0.001%		J		0.000584%
16	Butanal/Butyraldehyde	12	SD1-EF-F	1.3E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	14	SD1-EF-G	1.3E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	16	SD1-EF-H	1.3E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	2	SC1-IN-A	6.2E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	4	SC1-IN-B	6.4E-04	25	0.003%		J		0.000584%
16	Butanal/Butyraldehyde	6	SC1-IN-C	7.2E-04	25	0.003%		J		0.000584%
16	Butanal/Butyraldehyde	8	SC1-IN-D	5.3E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	10	SC1-IN-E	3.7E-04	25	0.001%		J		0.000584%
16	Butanal/Butyraldehyde	12	SC1-IN-F	6.8E-04	25	0.003%		J		0.000584%
16	Butanal/Butyraldehyde	14	SC1-IN-G	5.6E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	16	SC1-IN-H	5.4E-04	25	0.002%		J		0.000584%
16	Butanal/Butyraldehyde	2	SC1-EF-A	1.3E-04	25	0.001%	YES	UY	0.001%	0.000584%
16	Butanal/Butyraldehyde	4	SC1-EF-B	1.4E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	6	SC1-EF-C	1.5E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	8	SC1-EF-D	1.3E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	10	SC1-EF-E	1.3E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	12	SC1-EF-F	1.3E-04	25	0.001%	YES	U	0.001%	0.000584%
16	Butanal/Butyraldehyde	14	SC1-EF-G	1.3E-04	25	0.001%	YES	UY	0.001%	0.000584%
16	Butanal/Butyraldehyde	16	SC1-EF-H	1.3E-04	25	0.001%	YES	U	0.001%	0.000584%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
19	2-Propenal/Acrolein	2	SD1-IN-A	8.8E-04	0.100	0.878%	YES		0.878%	0.951%
19	2-Propenal/Acrolein	4	SD1-IN-B	9.2E-04	0.100	0.923%	YES		0.923%	0.951%
19	2-Propenal/Acrolein	6	SD1-IN-C	9.1E-04	0.100	0.911%	YES		0.911%	0.951%
19	2-Propenal/Acrolein	8	SD1-IN-D	9.0E-04	0.100	0.897%	YES		0.897%	0.951%
19	2-Propenal/Acrolein	10	SD1-IN-E	9.2E-04	0.100	0.923%	YES		0.923%	0.951%
19	2-Propenal/Acrolein	12	SD1-IN-F	8.9E-04	0.100	0.889%	YES		0.889%	0.951%
19	2-Propenal/Acrolein	14	SD1-IN-G	9.0E-04	0.100	0.895%	YES		0.895%	0.951%
19	2-Propenal/Acrolein	16	SD1-IN-H	8.9E-04	0.100	0.892%	YES		0.892%	0.951%
19	2-Propenal/Acrolein	2	SD1-EF-A	8.9E-04	0.100	0.887%	YES		0.887%	0.951%
19	2-Propenal/Acrolein	4	SD1-EF-B	8.6E-04	0.100	0.863%	YES		0.863%	0.951%
19	2-Propenal/Acrolein	6	SD1-EF-C	9.3E-04	0.100	0.930%	YES		0.930%	0.951%
19	2-Propenal/Acrolein	8	SD1-EF-D	9.5E-04	0.100	0.951%	YES		0.951%	0.951%
19	2-Propenal/Acrolein	10	SD1-EF-E	8.9E-04	0.100	0.893%	YES		0.893%	0.951%
19	2-Propenal/Acrolein	12	SD1-EF-F	8.9E-04	0.100	0.886%	YES		0.886%	0.951%
19	2-Propenal/Acrolein	14	SD1-EF-G	9.1E-04	0.100	0.914%	YES		0.914%	0.951%
19	2-Propenal/Acrolein	16	SD1-EF-H	9.2E-04	0.100	0.915%	YES		0.915%	0.951%
19	2-Propenal/Acrolein	2	SC1-IN-A	9.0E-04	0.100	0.902%	YES		0.902%	0.951%
19	2-Propenal/Acrolein	4	SC1-IN-B	9.0E-04	0.100	0.904%	YES		0.904%	0.951%
19	2-Propenal/Acrolein	6	SC1-IN-C	9.1E-04	0.100	0.905%	YES		0.905%	0.951%
19	2-Propenal/Acrolein	8	SC1-IN-D	9.1E-04	0.100	0.909%	YES		0.909%	0.951%
19	2-Propenal/Acrolein	10	SC1-IN-E	9.2E-04	0.100	0.915%	YES		0.915%	0.951%
19	2-Propenal/Acrolein	12	SC1-IN-F	9.2E-04	0.100	0.920%	YES		0.920%	0.951%
19	2-Propenal/Acrolein	14	SC1-IN-G	8.8E-04	0.100	0.884%	YES		0.884%	0.951%
19	2-Propenal/Acrolein	16	SC1-IN-H	8.9E-04	0.100	0.893%	YES		0.893%	0.951%
19	2-Propenal/Acrolein	2	SC1-EF-A	9.2E-04	0.100	0.924%	YES		0.924%	0.951%
19	2-Propenal/Acrolein	4	SC1-EF-B	8.8E-04	0.100	0.878%	YES		0.878%	0.951%
19	2-Propenal/Acrolein	6	SC1-EF-C	8.6E-04	0.100	0.862%	YES		0.862%	0.951%
19	2-Propenal/Acrolein	8	SC1-EF-D	8.8E-04	0.100	0.876%	YES		0.876%	0.951%
19	2-Propenal/Acrolein	10	SC1-EF-E	8.9E-04	0.100	0.886%	YES		0.886%	0.951%
19	2-Propenal/Acrolein	12	SC1-EF-F	9.1E-04	0.100	0.906%	YES		0.906%	0.951%
19	2-Propenal/Acrolein	14	SC1-EF-G	9.2E-04	0.100	0.918%	YES		0.918%	0.951%
19	2-Propenal/Acrolein	16	SC1-EF-H	9.1E-04	0.100	0.908%	YES		0.908%	0.951%
20	Furan	2	SD1-IN-A	3.8E-04	0.001	38.0%	YES	U	38.0%	43.3%
20	Furan	4	SD1-IN-B	3.4E-04	0.001	34.0%	YES	U	34.0%	43.3%
20	Furan	6	SD1-IN-C	3.9E-04	0.001	38.7%	YES	U	38.7%	43.3%
20	Furan	8	SD1-IN-D	4.0E-04	0.001	39.5%	YES	U	39.5%	43.3%
20	Furan	10	SD1-IN-E	3.7E-04	0.001	37.2%	YES	U	37.2%	43.3%
20	Furan	12	SD1-IN-F	4.0E-04	0.001	39.7%	YES	U	39.7%	43.3%
20	Furan	14	SD1-IN-G	3.9E-04	0.001	38.8%	YES	U	38.8%	43.3%
20	Furan	16	SD1-IN-H	4.0E-04	0.001	40.4%	YES	U	40.4%	43.3%
20	Furan	2	SD1-EF-A	4.0E-04	0.001	40.1%	YES	U	40.1%	43.3%
20	Furan	4	SD1-EF-B	3.8E-04	0.001	37.6%	YES	U	37.6%	43.3%
20	Furan	6	SD1-EF-C	4.0E-04	0.001	40.4%	YES	U	40.4%	43.3%
20	Furan	8	SD1-EF-D	4.2E-04	0.001	41.8%	YES	U	41.8%	43.3%
20	Furan	10	SD1-EF-E	3.9E-04	0.001	39.0%	YES	U	39.0%	43.3%
20	Furan	12	SD1-EF-F	3.8E-04	0.001	37.7%	YES	U	37.7%	43.3%
20	Furan	14	SD1-EF-G	3.9E-04	0.001	39.2%	YES	U	39.2%	43.3%
20	Furan	16	SD1-EF-H	3.9E-04	0.001	39.5%	YES	U	39.5%	43.3%
20	Furan	2	SC1-IN-A	3.5E-04	0.001	35.2%	YES	U	35.2%	43.3%
20	Furan	4	SC1-IN-B	3.8E-04	0.001	38.2%	YES	U	38.2%	43.3%
20	Furan	6	SC1-IN-C	3.7E-04	0.001	36.7%	YES	U	36.7%	43.3%
20	Furan	8	SC1-IN-D	3.7E-04	0.001	37.0%	YES	U	37.0%	43.3%
20	Furan	10	SC1-IN-E	3.7E-04	0.001	36.8%	YES	U	36.8%	43.3%
20	Furan	12	SC1-IN-F	3.5E-04	0.001	35.5%	YES	U	35.5%	43.3%
20	Furan	14	SC1-IN-G	3.8E-04	0.001	38.2%	YES	U	38.2%	43.3%
20	Furan	16	SC1-IN-H	3.7E-04	0.001	36.7%	YES	U	36.7%	43.3%
20	Furan	2	SC1-EF-A	3.8E-04	0.001	38.0%	YES	UY	38.0%	43.3%
20	Furan	4	SC1-EF-B	4.2E-04	0.001	41.8%	YES	U	41.8%	43.3%
20	Furan	6	SC1-EF-C	4.3E-04	0.001	43.3%	YES	U	43.3%	43.3%
20	Furan	8	SC1-EF-D	4.0E-04	0.001	39.6%	YES	U	39.6%	43.3%
20	Furan	10	SC1-EF-E	3.8E-04	0.001	38.2%	YES	U	38.2%	43.3%
20	Furan	12	SC1-EF-F	3.9E-04	0.001	39.4%	YES	U	39.4%	43.3%
20	Furan	14	SC1-EF-G	3.8E-04	0.001	38.0%	YES	UY	38.0%	43.3%
20	Furan	16	SC1-EF-H	3.8E-04	0.001	37.8%	YES	U	37.8%	43.3%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
21	2,3-Dihydrofuran	2	SD1-IN-A	3.1E-05	0.001	3.14%	YES	U	3.14%	3.54%
21	2,3-Dihydrofuran	4	SD1-IN-B	2.9E-05	0.001	2.92%	YES	U	2.92%	3.54%
21	2,3-Dihydrofuran	6	SD1-IN-C	3.4E-05	0.001	3.39%	YES	UY	3.39%	3.54%
21	2,3-Dihydrofuran	8	SD1-IN-D	3.4E-05	0.001	3.38%	YES	U	3.38%	3.54%
21	2,3-Dihydrofuran	10	SD1-IN-E	3.2E-05	0.001	3.23%	YES	U	3.23%	3.54%
21	2,3-Dihydrofuran	12	SD1-IN-F	3.2E-05	0.001	3.21%	YES	U	3.21%	3.54%
21	2,3-Dihydrofuran	14	SD1-IN-G	3.2E-05	0.001	3.16%	YES	U	3.16%	3.54%
21	2,3-Dihydrofuran	16	SD1-IN-H	3.2E-05	0.001	3.24%	YES	U	3.24%	3.54%
21	2,3-Dihydrofuran	2	SD1-EF-A	3.5E-05	0.001	3.54%	YES	U	3.54%	3.54%
21	2,3-Dihydrofuran	4	SD1-EF-B		0.001					3.54%
21	2,3-Dihydrofuran	6	SD1-EF-C	3.4E-05	0.001	3.40%	YES	U	3.40%	3.54%
21	2,3-Dihydrofuran	8	SD1-EF-D	3.4E-05	0.001	3.42%	YES	U	3.42%	3.54%
21	2,3-Dihydrofuran	10	SD1-EF-E	3.2E-05	0.001	3.17%	YES	U	3.17%	3.54%
21	2,3-Dihydrofuran	12	SD1-EF-F	3.2E-05	0.001	3.17%	YES	U	3.17%	3.54%
21	2,3-Dihydrofuran	14	SD1-EF-G	3.2E-05	0.001	3.19%	YES	U	3.19%	3.54%
21	2,3-Dihydrofuran	16	SD1-EF-H	3.1E-05	0.001	3.15%	YES	U	3.15%	3.54%
21	2,3-Dihydrofuran	2	SC1-IN-A	3.2E-05	0.001	3.20%	YES	U	3.20%	3.54%
21	2,3-Dihydrofuran	4	SC1-IN-B	3.1E-05	0.001	3.14%	YES	U	3.14%	3.54%
21	2,3-Dihydrofuran	6	SC1-IN-C	3.2E-05	0.001	3.16%	YES	U	3.16%	3.54%
21	2,3-Dihydrofuran	8	SC1-IN-D	3.2E-05	0.001	3.17%	YES	U	3.17%	3.54%
21	2,3-Dihydrofuran	10	SC1-IN-E	3.1E-05	0.001	3.11%	YES	U	3.11%	3.54%
21	2,3-Dihydrofuran	12	SC1-IN-F	3.1E-05	0.001	3.12%	YES	U	3.12%	3.54%
21	2,3-Dihydrofuran	14	SC1-IN-G	3.1E-05	0.001	3.12%	YES	U	3.12%	3.54%
21	2,3-Dihydrofuran	16	SC1-IN-H	3.2E-05	0.001	3.20%	YES	U	3.20%	3.54%
21	2,3-Dihydrofuran	2	SC1-EF-A	3.3E-05	0.001	3.33%	YES	U	3.33%	3.54%
21	2,3-Dihydrofuran	4	SC1-EF-B	3.2E-05	0.001	3.22%	YES	U	3.22%	3.54%
21	2,3-Dihydrofuran	6	SC1-EF-C	3.2E-05	0.001	3.23%	YES	U	3.23%	3.54%
21	2,3-Dihydrofuran	8	SC1-EF-D	3.2E-05	0.001	3.24%	YES	U	3.24%	3.54%
21	2,3-Dihydrofuran	10	SC1-EF-E	3.2E-05	0.001	3.19%	YES	U	3.19%	3.54%
21	2,3-Dihydrofuran	12	SC1-EF-F	3.2E-05	0.001	3.23%	YES	U	3.23%	3.54%
21	2,3-Dihydrofuran	14	SC1-EF-G	3.2E-05	0.001	3.22%	YES	U	3.22%	3.54%
21	2,3-Dihydrofuran	16	SC1-EF-H	3.2E-05	0.001	3.23%	YES	U	3.23%	3.54%
22	2,5-Dihydrofuran	2	SD1-IN-A	1.7E-04	0.001	16.7%	YES	U	16.7%	19.0%
22	2,5-Dihydrofuran	4	SD1-IN-B	1.5E-04	0.001	14.9%	YES	U	14.9%	19.0%
22	2,5-Dihydrofuran	6	SD1-IN-C	1.7E-04	0.001	17.0%	YES	U	17.0%	19.0%
22	2,5-Dihydrofuran	8	SD1-IN-D	1.7E-04	0.001	17.4%	YES	U	17.4%	19.0%
22	2,5-Dihydrofuran	10	SD1-IN-E	1.6E-04	0.001	16.3%	YES	U	16.3%	19.0%
22	2,5-Dihydrofuran	12	SD1-IN-F	1.7E-04	0.001	17.4%	YES	U	17.4%	19.0%
22	2,5-Dihydrofuran	14	SD1-IN-G	1.7E-04	0.001	17.1%	YES	U	17.1%	19.0%
22	2,5-Dihydrofuran	16	SD1-IN-H	1.8E-04	0.001	17.7%	YES	U	17.7%	19.0%
22	2,5-Dihydrofuran	2	SD1-EF-A	1.8E-04	0.001	17.6%	YES	U	17.6%	19.0%
22	2,5-Dihydrofuran	4	SD1-EF-B	1.7E-04	0.001	16.5%	YES	U	16.5%	19.0%
22	2,5-Dihydrofuran	6	SD1-EF-C	1.8E-04	0.001	17.7%	YES	U	17.7%	19.0%
22	2,5-Dihydrofuran	8	SD1-EF-D	1.8E-04	0.001	18.4%	YES	U	18.4%	19.0%
22	2,5-Dihydrofuran	10	SD1-EF-E	1.7E-04	0.001	17.1%	YES	U	17.1%	19.0%
22	2,5-Dihydrofuran	12	SD1-EF-F	1.7E-04	0.001	16.6%	YES	U	16.6%	19.0%
22	2,5-Dihydrofuran	14	SD1-EF-G	1.7E-04	0.001	17.2%	YES	U	17.2%	19.0%
22	2,5-Dihydrofuran	16	SD1-EF-H	1.7E-04	0.001	17.3%	YES	U	17.3%	19.0%
22	2,5-Dihydrofuran	2	SC1-IN-A	1.5E-04	0.001	15.5%	YES	U	15.5%	19.0%
22	2,5-Dihydrofuran	4	SC1-IN-B	1.7E-04	0.001	16.8%	YES	U	16.8%	19.0%
22	2,5-Dihydrofuran	6	SC1-IN-C	1.6E-04	0.001	16.1%	YES	U	16.1%	19.0%
22	2,5-Dihydrofuran	8	SC1-IN-D	1.6E-04	0.001	16.3%	YES	U	16.3%	19.0%
22	2,5-Dihydrofuran	10	SC1-IN-E	1.6E-04	0.001	16.2%	YES	U	16.2%	19.0%
22	2,5-Dihydrofuran	12	SC1-IN-F	1.6E-04	0.001	15.6%	YES	U	15.6%	19.0%
22	2,5-Dihydrofuran	14	SC1-IN-G	1.7E-04	0.001	16.8%	YES	U	16.8%	19.0%
22	2,5-Dihydrofuran	16	SC1-IN-H	1.6E-04	0.001	16.1%	YES	U	16.1%	19.0%
22	2,5-Dihydrofuran	2	SC1-EF-A	1.7E-04	0.001	16.7%	YES	UY	16.7%	19.0%
22	2,5-Dihydrofuran	4	SC1-EF-B	1.8E-04	0.001	18.4%	YES	U	18.4%	19.0%
22	2,5-Dihydrofuran	6	SC1-EF-C	1.9E-04	0.001	19.0%	YES	U	19.0%	19.0%
22	2,5-Dihydrofuran	8	SC1-EF-D	1.7E-04	0.001	17.4%	YES	U	17.4%	19.0%
22	2,5-Dihydrofuran	10	SC1-EF-E	1.7E-04	0.001	16.8%	YES	U	16.8%	19.0%
22	2,5-Dihydrofuran	12	SC1-EF-F	1.7E-04	0.001	17.3%	YES	U	17.3%	19.0%
22	2,5-Dihydrofuran	14	SC1-EF-G	1.7E-04	0.001	16.7%	YES	UY	16.7%	19.0%
22	2,5-Dihydrofuran	16	SC1-EF-H	1.7E-04	0.001	16.6%	YES	U	16.6%	19.0%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
23	2-Methylfuran	2	SD1-IN-A	9.0E-05	0.001	8.99%	YES	U	8.99%	10.3%
23	2-Methylfuran	4	SD1-IN-B	8.1E-05	0.001	8.06%	YES	U	8.06%	10.3%
23	2-Methylfuran	6	SD1-IN-C	9.2E-05	0.001	9.18%	YES	U	9.18%	10.3%
23	2-Methylfuran	8	SD1-IN-D	9.4E-05	0.001	9.37%	YES	U	9.37%	10.3%
23	2-Methylfuran	10	SD1-IN-E	8.8E-05	0.001	8.80%	YES	U	8.80%	10.3%
23	2-Methylfuran	12	SD1-IN-F	9.4E-05	0.001	9.41%	YES	U	9.41%	10.3%
23	2-Methylfuran	14	SD1-IN-G	9.2E-05	0.001	9.20%	YES	U	9.20%	10.3%
23	2-Methylfuran	16	SD1-IN-H	9.6E-05	0.001	9.56%	YES	U	9.56%	10.3%
23	2-Methylfuran	2	SD1-EF-A	9.5E-05	0.001	9.50%	YES	U	9.50%	10.3%
23	2-Methylfuran	4	SD1-EF-B	8.9E-05	0.001	8.91%	YES	U	8.91%	10.3%
23	2-Methylfuran	6	SD1-EF-C	9.6E-05	0.001	9.57%	YES	U	9.57%	10.3%
23	2-Methylfuran	8	SD1-EF-D	9.9E-05	0.001	9.91%	YES	U	9.91%	10.3%
23	2-Methylfuran	10	SD1-EF-E	9.2E-05	0.001	9.23%	YES	U	9.23%	10.3%
23	2-Methylfuran	12	SD1-EF-F	8.9E-05	0.001	8.94%	YES	U	8.94%	10.3%
23	2-Methylfuran	14	SD1-EF-G	9.3E-05	0.001	9.29%	YES	U	9.29%	10.3%
23	2-Methylfuran	16	SD1-EF-H	9.3E-05	0.001	9.35%	YES	U	9.35%	10.3%
23	2-Methylfuran	2	SC1-IN-A	8.3E-05	0.001	8.34%	YES	U	8.34%	10.3%
23	2-Methylfuran	4	SC1-IN-B	9.0E-05	0.001	9.05%	YES	U	9.05%	10.3%
23	2-Methylfuran	6	SC1-IN-C	8.7E-05	0.001	8.69%	YES	U	8.69%	10.3%
23	2-Methylfuran	8	SC1-IN-D	8.8E-05	0.001	8.76%	YES	U	8.76%	10.3%
23	2-Methylfuran	10	SC1-IN-E	8.7E-05	0.001	8.72%	YES	U	8.72%	10.3%
23	2-Methylfuran	12	SC1-IN-F	8.4E-05	0.001	8.40%	YES	U	8.40%	10.3%
23	2-Methylfuran	14	SC1-IN-G	9.0E-05	0.001	9.05%	YES	U	9.05%	10.3%
23	2-Methylfuran	16	SC1-IN-H	8.7E-05	0.001	8.70%	YES	U	8.70%	10.3%
23	2-Methylfuran	2	SC1-EF-A	9.0E-05	0.001	9.00%	YES	UY	9.00%	10.3%
23	2-Methylfuran	4	SC1-EF-B	9.9E-05	0.001	9.90%	YES	U	9.90%	10.3%
23	2-Methylfuran	6	SC1-EF-C	1.0E-04	0.001	10.3%	YES	U	10.3%	10.3%
23	2-Methylfuran	8	SC1-EF-D	9.4E-05	0.001	9.37%	YES	U	9.37%	10.3%
23	2-Methylfuran	10	SC1-EF-E	9.1E-05	0.001	9.06%	YES	U	9.06%	10.3%
23	2-Methylfuran	12	SC1-EF-F	9.3E-05	0.001	9.33%	YES	U	9.33%	10.3%
23	2-Methylfuran	14	SC1-EF-G	9.0E-05	0.001	8.99%	YES	UY	8.99%	10.3%
23	2-Methylfuran	16	SC1-EF-H	9.0E-05	0.001	8.95%	YES	U	8.95%	10.3%
24	2,5-Dimethylfuran	2	SD1-IN-A	5.9E-05	0.001	5.91%	YES	U	5.91%	6.66%
24	2,5-Dimethylfuran	4	SD1-IN-B	5.5E-05	0.001	5.50%	YES	U	5.50%	6.66%
24	2,5-Dimethylfuran	6	SD1-IN-C	6.4E-05	0.001	6.38%	YES	UY	6.38%	6.66%
24	2,5-Dimethylfuran	8	SD1-IN-D	6.4E-05	0.001	6.37%	YES	U	6.37%	6.66%
24	2,5-Dimethylfuran	10	SD1-IN-E	6.1E-05	0.001	6.09%	YES	U	6.09%	6.66%
24	2,5-Dimethylfuran	12	SD1-IN-F	6.0E-05	0.001	6.04%	YES	U	6.04%	6.66%
24	2,5-Dimethylfuran	14	SD1-IN-G	6.0E-05	0.001	5.95%	YES	U	5.95%	6.66%
24	2,5-Dimethylfuran	16	SD1-IN-H	6.1E-05	0.001	6.10%	YES	U	6.10%	6.66%
24	2,5-Dimethylfuran	2	SD1-EF-A	6.7E-05	0.001	6.66%	YES	U	6.66%	6.66%
24	2,5-Dimethylfuran	4	SD1-EF-B		0.001					6.66%
24	2,5-Dimethylfuran	6	SD1-EF-C	6.4E-05	0.001	6.40%	YES	U	6.40%	6.66%
24	2,5-Dimethylfuran	8	SD1-EF-D	6.4E-05	0.001	6.45%	YES	U	6.45%	6.66%
24	2,5-Dimethylfuran	10	SD1-EF-E	6.0E-05	0.001	5.98%	YES	U	5.98%	6.66%
24	2,5-Dimethylfuran	12	SD1-EF-F	6.0E-05	0.001	5.97%	YES	U	5.97%	6.66%
24	2,5-Dimethylfuran	14	SD1-EF-G	6.0E-05	0.001	6.01%	YES	U	6.01%	6.66%
24	2,5-Dimethylfuran	16	SD1-EF-H	5.9E-05	0.001	5.92%	YES	U	5.92%	6.66%
24	2,5-Dimethylfuran	2	SC1-IN-A	6.0E-05	0.001	6.03%	YES	U	6.03%	6.66%
24	2,5-Dimethylfuran	4	SC1-IN-B	5.9E-05	0.001	5.91%	YES	U	5.91%	6.66%
24	2,5-Dimethylfuran	6	SC1-IN-C	6.0E-05	0.001	5.95%	YES	U	5.95%	6.66%
24	2,5-Dimethylfuran	8	SC1-IN-D	6.0E-05	0.001	5.97%	YES	U	5.97%	6.66%
24	2,5-Dimethylfuran	10	SC1-IN-E	5.9E-05	0.001	5.86%	YES	U	5.86%	6.66%
24	2,5-Dimethylfuran	12	SC1-IN-F	5.9E-05	0.001	5.88%	YES	U	5.88%	6.66%
24	2,5-Dimethylfuran	14	SC1-IN-G	5.9E-05	0.001	5.88%	YES	U	5.88%	6.66%
24	2,5-Dimethylfuran	16	SC1-IN-H	6.0E-05	0.001	6.03%	YES	U	6.03%	6.66%
24	2,5-Dimethylfuran	2	SC1-EF-A	6.3E-05	0.001	6.26%	YES	U	6.26%	6.66%
24	2,5-Dimethylfuran	4	SC1-EF-B	6.1E-05	0.001	6.06%	YES	U	6.06%	6.66%
24	2,5-Dimethylfuran	6	SC1-EF-C	6.1E-05	0.001	6.08%	YES	U	6.08%	6.66%
24	2,5-Dimethylfuran	8	SC1-EF-D	6.1E-05	0.001	6.11%	YES	U	6.11%	6.66%
24	2,5-Dimethylfuran	10	SC1-EF-E	6.0E-05	0.001	6.02%	YES	U	6.02%	6.66%
24	2,5-Dimethylfuran	12	SC1-EF-F	6.1E-05	0.001	6.08%	YES	U	6.08%	6.66%
24	2,5-Dimethylfuran	14	SC1-EF-G	6.1E-05	0.001	6.07%	YES	U	6.07%	6.66%
24	2,5-Dimethylfuran	16	SC1-EF-H	6.1E-05	0.001	6.09%	YES	U	6.09%	6.66%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
28	2-Pentylfuran	2	SD1-IN-A	4.9E-05	0.001	4.87%	YES	U	4.87%	5.48%
28	2-Pentylfuran	4	SD1-IN-B	4.5E-05	0.001	4.52%	YES	U	4.52%	5.48%
28	2-Pentylfuran	6	SD1-IN-C	5.2E-05	0.001	5.25%	YES	UY	5.25%	5.48%
28	2-Pentylfuran	8	SD1-IN-D	5.2E-05	0.001	5.24%	YES	U	5.24%	5.48%
28	2-Pentylfuran	10	SD1-IN-E	5.0E-05	0.001	5.01%	YES	U	5.01%	5.48%
28	2-Pentylfuran	12	SD1-IN-F	5.0E-05	0.001	4.97%	YES	U	4.97%	5.48%
28	2-Pentylfuran	14	SD1-IN-G	4.9E-05	0.001	4.90%	YES	U	4.90%	5.48%
28	2-Pentylfuran	16	SD1-IN-H	5.0E-05	0.001	5.02%	YES	U	5.02%	5.48%
28	2-Pentylfuran	2	SD1-EF-A	5.5E-05	0.001	5.48%	YES	U	5.48%	5.48%
28	2-Pentylfuran	4	SD1-EF-B		0.001					5.48%
28	2-Pentylfuran	6	SD1-EF-C	5.3E-05	0.001	5.27%	YES	U	5.27%	5.48%
28	2-Pentylfuran	8	SD1-EF-D	5.3E-05	0.001	5.30%	YES	U	5.30%	5.48%
28	2-Pentylfuran	10	SD1-EF-E	4.9E-05	0.001	4.92%	YES	U	4.92%	5.48%
28	2-Pentylfuran	12	SD1-EF-F	4.9E-05	0.001	4.91%	YES	U	4.91%	5.48%
28	2-Pentylfuran	14	SD1-EF-G	4.9E-05	0.001	4.94%	YES	U	4.94%	5.48%
28	2-Pentylfuran	16	SD1-EF-H	4.9E-05	0.001	4.87%	YES	U	4.87%	5.48%
28	2-Pentylfuran	2	SC1-IN-A	5.0E-05	0.001	4.96%	YES	U	4.96%	5.48%
28	2-Pentylfuran	4	SC1-IN-B	4.9E-05	0.001	4.86%	YES	U	4.86%	5.48%
28	2-Pentylfuran	6	SC1-IN-C	4.9E-05	0.001	4.90%	YES	U	4.90%	5.48%
28	2-Pentylfuran	8	SC1-IN-D	4.9E-05	0.001	4.91%	YES	U	4.91%	5.48%
28	2-Pentylfuran	10	SC1-IN-E	4.8E-05	0.001	4.82%	YES	U	4.82%	5.48%
28	2-Pentylfuran	12	SC1-IN-F	4.8E-05	0.001	4.84%	YES	U	4.84%	5.48%
28	2-Pentylfuran	14	SC1-IN-G	4.8E-05	0.001	4.84%	YES	U	4.84%	5.48%
28	2-Pentylfuran	16	SC1-IN-H	5.0E-05	0.001	4.96%	YES	U	4.96%	5.48%
28	2-Pentylfuran	2	SC1-EF-A	5.2E-05	0.001	5.15%	YES	U	5.15%	5.48%
28	2-Pentylfuran	4	SC1-EF-B	5.0E-05	0.001	4.99%	YES	U	4.99%	5.48%
28	2-Pentylfuran	6	SC1-EF-C	5.0E-05	0.001	5.00%	YES	U	5.00%	5.48%
28	2-Pentylfuran	8	SC1-EF-D	5.0E-05	0.001	5.03%	YES	U	5.03%	5.48%
28	2-Pentylfuran	10	SC1-EF-E	4.9E-05	0.001	4.95%	YES	U	4.95%	5.48%
28	2-Pentylfuran	12	SC1-EF-F	5.0E-05	0.001	5.00%	YES	U	5.00%	5.48%
28	2-Pentylfuran	14	SC1-EF-G	5.0E-05	0.001	5.00%	YES	U	5.00%	5.48%
28	2-Pentylfuran	16	SC1-EF-H	5.0E-05	0.001	5.01%	YES	U	5.01%	5.48%
29	2-Heptylfuran	2	SD1-IN-A	3.7E-05	0.001	3.68%	YES	U	3.68%	4.14%
29	2-Heptylfuran	4	SD1-IN-B	4.8E-05	0.001	4.79%		J		4.14%
29	2-Heptylfuran	6	SD1-IN-C	4.0E-05	0.001	3.96%	YES	UY	3.96%	4.14%
29	2-Heptylfuran	8	SD1-IN-D	4.0E-05	0.001	3.96%	YES	U	3.96%	4.14%
29	2-Heptylfuran	10	SD1-IN-E	3.8E-05	0.001	3.79%	YES	U	3.79%	4.14%
29	2-Heptylfuran	12	SD1-IN-F	3.8E-05	0.001	3.76%	YES	U	3.76%	4.14%
29	2-Heptylfuran	14	SD1-IN-G	3.7E-05	0.001	3.70%	YES	U	3.70%	4.14%
29	2-Heptylfuran	16	SD1-IN-H	3.8E-05	0.001	3.79%	YES	U	3.79%	4.14%
29	2-Heptylfuran	2	SD1-EF-A	4.1E-05	0.001	4.14%	YES	U	4.14%	4.14%
29	2-Heptylfuran	4	SD1-EF-B		0.001					4.14%
29	2-Heptylfuran	6	SD1-EF-C	4.0E-05	0.001	3.98%	YES	U	3.98%	4.14%
29	2-Heptylfuran	8	SD1-EF-D	4.0E-05	0.001	4.01%	YES	U	4.01%	4.14%
29	2-Heptylfuran	10	SD1-EF-E	3.7E-05	0.001	3.72%	YES	U	3.72%	4.14%
29	2-Heptylfuran	12	SD1-EF-F	7.4E-05	0.001	7.42%		J		4.14%
29	2-Heptylfuran	14	SD1-EF-G	3.7E-05	0.001	3.73%	YES	U	3.73%	4.14%
29	2-Heptylfuran	16	SD1-EF-H	3.7E-05	0.001	3.68%	YES	U	3.68%	4.14%
29	2-Heptylfuran	2	SC1-IN-A	3.7E-05	0.001	3.75%	YES	U	3.75%	4.14%
29	2-Heptylfuran	4	SC1-IN-B	3.7E-05	0.001	3.67%	YES	U	3.67%	4.14%
29	2-Heptylfuran	6	SC1-IN-C	3.7E-05	0.001	3.70%	YES	U	3.70%	4.14%
29	2-Heptylfuran	8	SC1-IN-D	3.7E-05	0.001	3.71%	YES	U	3.71%	4.14%
29	2-Heptylfuran	10	SC1-IN-E	3.6E-05	0.001	3.64%	YES	U	3.64%	4.14%
29	2-Heptylfuran	12	SC1-IN-F	6.9E-05	0.001	6.95%		J		4.14%
29	2-Heptylfuran	14	SC1-IN-G	3.7E-05	0.001	3.66%	YES	U	3.66%	4.14%
29	2-Heptylfuran	16	SC1-IN-H	3.7E-05	0.001	3.75%	YES	U	3.75%	4.14%
29	2-Heptylfuran	2	SC1-EF-A	3.9E-05	0.001	3.89%	YES	U	3.89%	4.14%
29	2-Heptylfuran	4	SC1-EF-B	3.8E-05	0.001	3.77%	YES	U	3.77%	4.14%
29	2-Heptylfuran	6	SC1-EF-C	3.8E-05	0.001	3.78%	YES	U	3.78%	4.14%
29	2-Heptylfuran	8	SC1-EF-D	3.8E-05	0.001	3.80%	YES	U	3.80%	4.14%
29	2-Heptylfuran	10	SC1-EF-E	3.7E-05	0.001	3.74%	YES	U	3.74%	4.14%
29	2-Heptylfuran	12	SC1-EF-F	7.9E-05	0.001	7.94%		J		4.14%
29	2-Heptylfuran	14	SC1-EF-G	3.8E-05	0.001	3.78%	YES	U	3.78%	4.14%
29	2-Heptylfuran	16	SC1-EF-H	3.8E-05	0.001	3.79%	YES	U	3.79%	4.14%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
30	2-Propylfuran	2	SD1-IN-A	3.7E-05	0.001	3.66%	YES	U	3.66%	4.13%
30	2-Propylfuran	4	SD1-IN-B	3.4E-05	0.001	3.41%	YES	U	3.41%	4.13%
30	2-Propylfuran	6	SD1-IN-C	3.9E-05	0.001	3.95%	YES	UY	3.95%	4.13%
30	2-Propylfuran	8	SD1-IN-D	3.9E-05	0.001	3.95%	YES	U	3.95%	4.13%
30	2-Propylfuran	10	SD1-IN-E	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
30	2-Propylfuran	12	SD1-IN-F	3.7E-05	0.001	3.74%	YES	U	3.74%	4.13%
30	2-Propylfuran	14	SD1-IN-G	3.7E-05	0.001	3.69%	YES	U	3.69%	4.13%
30	2-Propylfuran	16	SD1-IN-H	3.8E-05	0.001	3.78%	YES	U	3.78%	4.13%
30	2-Propylfuran	2	SD1-EF-A	4.1E-05	0.001	4.13%	YES	U	4.13%	4.13%
30	2-Propylfuran	4	SD1-EF-B		0.001					4.13%
30	2-Propylfuran	6	SD1-EF-C	4.0E-05	0.001	3.96%	YES	U	3.96%	4.13%
30	2-Propylfuran	8	SD1-EF-D	4.0E-05	0.001	3.99%	YES	U	3.99%	4.13%
30	2-Propylfuran	10	SD1-EF-E	3.7E-05	0.001	3.70%	YES	U	3.70%	4.13%
30	2-Propylfuran	12	SD1-EF-F	3.7E-05	0.001	3.70%	YES	U	3.70%	4.13%
30	2-Propylfuran	14	SD1-EF-G	3.7E-05	0.001	3.72%	YES	U	3.72%	4.13%
30	2-Propylfuran	16	SD1-EF-H	3.7E-05	0.001	3.67%	YES	U	3.67%	4.13%
30	2-Propylfuran	2	SC1-IN-A	3.7E-05	0.001	3.73%	YES	U	3.73%	4.13%
30	2-Propylfuran	4	SC1-IN-B	3.7E-05	0.001	3.66%	YES	U	3.66%	4.13%
30	2-Propylfuran	6	SC1-IN-C	3.7E-05	0.001	3.69%	YES	U	3.69%	4.13%
30	2-Propylfuran	8	SC1-IN-D	3.7E-05	0.001	3.70%	YES	U	3.70%	4.13%
30	2-Propylfuran	10	SC1-IN-E	3.6E-05	0.001	3.63%	YES	U	3.63%	4.13%
30	2-Propylfuran	12	SC1-IN-F	3.6E-05	0.001	3.64%	YES	U	3.64%	4.13%
30	2-Propylfuran	14	SC1-IN-G	3.6E-05	0.001	3.64%	YES	U	3.64%	4.13%
30	2-Propylfuran	16	SC1-IN-H	3.7E-05	0.001	3.73%	YES	U	3.73%	4.13%
30	2-Propylfuran	2	SC1-EF-A	3.9E-05	0.001	3.88%	YES	U	3.88%	4.13%
30	2-Propylfuran	4	SC1-EF-B	3.8E-05	0.001	3.75%	YES	U	3.75%	4.13%
30	2-Propylfuran	6	SC1-EF-C	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
30	2-Propylfuran	8	SC1-EF-D	3.8E-05	0.001	3.78%	YES	U	3.78%	4.13%
30	2-Propylfuran	10	SC1-EF-E	3.7E-05	0.001	3.73%	YES	U	3.73%	4.13%
30	2-Propylfuran	12	SC1-EF-F	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
30	2-Propylfuran	14	SC1-EF-G	3.8E-05	0.001	3.76%	YES	U	3.76%	4.13%
30	2-Propylfuran	16	SC1-EF-H	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
34	Diethylphthalate	2	SD1-IN-A	1.1E-04	0.54	0.020%	YES	UY	0.020%	0.0199%
34	Diethylphthalate	4	SD1-IN-B	6.0E-05	0.54	0.011%	YES	UY	0.011%	0.0199%
34	Diethylphthalate	6	SD1-IN-C	6.2E-05	0.54	0.011%	YES	UY	0.011%	0.0199%
34	Diethylphthalate	8	SD1-IN-D	6.1E-05	0.54	0.011%	YES	U	0.011%	0.0199%
34	Diethylphthalate	10	SD1-IN-E	6.0E-05	0.54	0.011%	YES	U	0.011%	0.0199%
34	Diethylphthalate	12	SD1-IN-F	5.6E-05	0.54	0.010%	YES	U	0.010%	0.0199%
34	Diethylphthalate	14	SD1-IN-G	5.6E-05	0.54	0.010%	YES	U	0.010%	0.0199%
34	Diethylphthalate	16	SD1-IN-H	1.0E-04	0.54	0.018%	YES	U	0.018%	0.0199%
34	Diethylphthalate	2	SD1-EF-A	9.9E-05	0.54	0.018%	YES	UY	0.018%	0.0199%
34	Diethylphthalate	4	SD1-EF-B	9.2E-05	0.54	0.017%	YES	UY	0.017%	0.0199%
34	Diethylphthalate	6	SD1-EF-C	1.1E-04	0.54	0.020%	YES	UY	0.020%	0.0199%
34	Diethylphthalate	8	SD1-EF-D	1.0E-04	0.54	0.019%	YES	UY	0.019%	0.0199%
34	Diethylphthalate	10	SD1-EF-E	9.7E-05	0.54	0.018%	YES	UY	0.018%	0.0199%
34	Diethylphthalate	12	SD1-EF-F	1.0E-04	0.54	0.019%	YES	UY	0.019%	0.0199%
34	Diethylphthalate	14	SD1-EF-G	9.6E-05	0.54	0.018%	YES	U	0.018%	0.0199%
34	Diethylphthalate	16	SD1-EF-H	9.9E-05	0.54	0.018%	YES	U	0.018%	0.0199%
34	Diethylphthalate	2	SC1-IN-A	9.2E-05	0.54	0.017%	YES	U	0.017%	0.0199%
34	Diethylphthalate	4	SC1-IN-B	5.5E-05	0.54	0.010%	YES	U	0.010%	0.0199%
34	Diethylphthalate	6	SC1-IN-C	5.4E-05	0.54	0.010%	YES	U	0.010%	0.0199%
34	Diethylphthalate	8	SC1-IN-D	5.6E-05	0.54	0.010%	YES	U	0.010%	0.0199%
34	Diethylphthalate	10	SC1-IN-E	5.8E-05	0.54	0.011%	YES	U	0.011%	0.0199%
34	Diethylphthalate	12	SC1-IN-F	5.3E-05	0.54	0.010%	YES	U	0.010%	0.0199%
34	Diethylphthalate	14	SC1-IN-G	5.2E-05	0.54	0.010%	YES	U	0.010%	0.0199%
34	Diethylphthalate	16	SC1-IN-H	9.5E-05	0.54	0.017%	YES	U	0.017%	0.0199%
34	Diethylphthalate	2	SC1-EF-A	9.2E-05	0.54	0.017%	YES	U	0.017%	0.0199%
34	Diethylphthalate	4	SC1-EF-B	1.0E-04	0.54	0.019%	YES	U	0.019%	0.0199%
34	Diethylphthalate	6	SC1-EF-C	9.9E-05	0.54	0.018%	YES	U	0.018%	0.0199%
34	Diethylphthalate	8	SC1-EF-D	1.0E-04	0.54	0.019%	YES	U	0.019%	0.0199%
34	Diethylphthalate	10	SC1-EF-E	9.6E-05	0.54	0.018%	YES	U	0.018%	0.0199%
34	Diethylphthalate	12	SC1-EF-F	9.4E-05	0.54	0.017%	YES	U	0.017%	0.0199%
34	Diethylphthalate	14	SC1-EF-G	1.0E-04	0.54	0.018%	YES	U	0.018%	0.0199%
34	Diethylphthalate	16	SC1-EF-H	1.0E-04	0.54	0.018%	YES	U	0.018%	0.0199%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
35	Acetonitrile	2	SD1-IN-A	7.8E-03	20	0.039%				0.00282%
35	Acetonitrile	4	SD1-IN-B	8.9E-03	20	0.044%				0.00282%
35	Acetonitrile	6	SD1-IN-C	7.6E-03	20	0.038%				0.00282%
35	Acetonitrile	8	SD1-IN-D	7.0E-03	20	0.035%				0.00282%
35	Acetonitrile	10	SD1-IN-E	7.2E-03	20	0.036%				0.00282%
35	Acetonitrile	12	SD1-IN-F	6.3E-03	20	0.031%				0.00282%
35	Acetonitrile	14	SD1-IN-G	6.9E-03	20	0.035%				0.00282%
35	Acetonitrile	16	SD1-IN-H	2.9E-03	20	0.014%				0.00282%
35	Acetonitrile	2	SD1-EF-A	3.6E-03	20	0.018%				0.00282%
35	Acetonitrile	4	SD1-EF-B	1.0E-02	20	0.050%				0.00282%
35	Acetonitrile	6	SD1-EF-C	4.9E-03	20	0.025%				0.00282%
35	Acetonitrile	8	SD1-EF-D	6.3E-03	20	0.031%				0.00282%
35	Acetonitrile	10	SD1-EF-E	5.4E-03	20	0.027%				0.00282%
35	Acetonitrile	12	SD1-EF-F	4.0E-03	20	0.020%				0.00282%
35	Acetonitrile	14	SD1-EF-G	3.7E-03	20	0.019%				0.00282%
35	Acetonitrile	16	SD1-EF-H	4.4E-03	20	0.022%				0.00282%
35	Acetonitrile	2	SC1-IN-A	1.2E-02	20	0.058%				0.00282%
35	Acetonitrile	4	SC1-IN-B	1.7E-02	20	0.083%				0.00282%
35	Acetonitrile	6	SC1-IN-C	9.4E-03	20	0.047%				0.00282%
35	Acetonitrile	8	SC1-IN-D	1.1E-02	20	0.054%				0.00282%
35	Acetonitrile	10	SC1-IN-E	1.0E-02	20	0.050%				0.00282%
35	Acetonitrile	12	SC1-IN-F	1.2E-02	20	0.062%				0.00282%
35	Acetonitrile	14	SC1-IN-G	1.3E-02	20	0.066%				0.00282%
35	Acetonitrile	16	SC1-IN-H	1.4E-02	20	0.072%				0.00282%
35	Acetonitrile	2	SC1-EF-A	1.3E-02	20	0.064%		Y		0.00282%
35	Acetonitrile	4	SC1-EF-B	1.2E-02	20	0.059%				0.00282%
35	Acetonitrile	6	SC1-EF-C	1.6E-02	20	0.082%				0.00282%
35	Acetonitrile	8	SC1-EF-D	1.3E-02	20	0.067%				0.00282%
35	Acetonitrile	10	SC1-EF-E	1.2E-01	20	0.589%		E		0.00282%
35	Acetonitrile	12	SC1-EF-F	1.3E-02	20	0.066%				0.00282%
35	Acetonitrile	14	SC1-EF-G	2.5E-02	20	0.127%		Y		0.00282%
35	Acetonitrile	16	SC1-EF-H	3.1E-01	20	1.57%		EY		0.00282%
36	Propanenitrile	2	SD1-IN-A	8.6E-04	6.0	0.014%		J		0.00446%
36	Propanenitrile	4	SD1-IN-B	1.1E-03	6.0	0.018%		J		0.00446%
36	Propanenitrile	6	SD1-IN-C	9.2E-04	6.0	0.015%		J		0.00446%
36	Propanenitrile	8	SD1-IN-D	9.3E-04	6.0	0.016%		J		0.00446%
36	Propanenitrile	10	SD1-IN-E	9.2E-04	6.0	0.015%		J		0.00446%
36	Propanenitrile	12	SD1-IN-F	8.3E-04	6.0	0.014%		J		0.00446%
36	Propanenitrile	14	SD1-IN-G	9.7E-04	6.0	0.016%		J		0.00446%
36	Propanenitrile	16	SD1-IN-H	1.3E-03	6.0	0.022%		J		0.00446%
36	Propanenitrile	2	SD1-EF-A	2.5E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	4	SD1-EF-B	2.3E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	6	SD1-EF-C	2.5E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	8	SD1-EF-D	2.6E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	10	SD1-EF-E	2.4E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	12	SD1-EF-F	2.3E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	14	SD1-EF-G	2.4E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	16	SD1-EF-H	2.4E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	2	SC1-IN-A	8.0E-04	6.0	0.013%		J		0.00446%
36	Propanenitrile	4	SC1-IN-B	9.3E-04	6.0	0.016%		J		0.00446%
36	Propanenitrile	6	SC1-IN-C	5.9E-04	6.0	0.010%		J		0.00446%
36	Propanenitrile	8	SC1-IN-D	7.5E-04	6.0	0.013%		J		0.00446%
36	Propanenitrile	10	SC1-IN-E	7.1E-04	6.0	0.012%		J		0.00446%
36	Propanenitrile	12	SC1-IN-F	8.1E-04	6.0	0.014%		J		0.00446%
36	Propanenitrile	14	SC1-IN-G	4.8E-04	6.0	0.008%		J		0.00446%
36	Propanenitrile	16	SC1-IN-H	7.6E-04	6.0	0.013%		J		0.00446%
36	Propanenitrile	2	SC1-EF-A	2.3E-04	6.0	0.004%	YES	UY	0.004%	0.00446%
36	Propanenitrile	4	SC1-EF-B	2.6E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	6	SC1-EF-C	2.7E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	8	SC1-EF-D	2.4E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	10	SC1-EF-E	2.4E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	12	SC1-EF-F	2.4E-04	6.0	0.004%	YES	U	0.004%	0.00446%
36	Propanenitrile	14	SC1-EF-G	2.3E-04	6.0	0.004%	YES	UY	0.004%	0.00446%
36	Propanenitrile	16	SC1-EF-H	2.3E-04	6.0	0.004%	YES	U	0.004%	0.00446%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
37	Butanenitrile	2	SD1-IN-A	5.4E-04	8.0	0.007%		J		0.00241%
37	Butanenitrile	4	SD1-IN-B	7.2E-04	8.0	0.009%		J		0.00241%
37	Butanenitrile	6	SD1-IN-C	6.9E-04	8.0	0.009%		J		0.00241%
37	Butanenitrile	8	SD1-IN-D	7.0E-04	8.0	0.009%		J		0.00241%
37	Butanenitrile	10	SD1-IN-E	6.7E-04	8.0	0.008%		J		0.00241%
37	Butanenitrile	12	SD1-IN-F	6.2E-04	8.0	0.008%		J		0.00241%
37	Butanenitrile	14	SD1-IN-G	6.4E-04	8.0	0.008%		J		0.00241%
37	Butanenitrile	16	SD1-IN-H	1.0E-03	8.0	0.013%		J		0.00241%
37	Butanenitrile	2	SD1-EF-A	1.8E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	4	SD1-EF-B	1.7E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	6	SD1-EF-C	1.8E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	8	SD1-EF-D	1.9E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	10	SD1-EF-E	1.7E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	12	SD1-EF-F	1.7E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	14	SD1-EF-G	1.7E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	16	SD1-EF-H	1.8E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	2	SC1-IN-A	5.5E-04	8.0	0.007%		J		0.00241%
37	Butanenitrile	4	SC1-IN-B	6.9E-04	8.0	0.009%		J		0.00241%
37	Butanenitrile	6	SC1-IN-C	4.6E-04	8.0	0.006%		J		0.00241%
37	Butanenitrile	8	SC1-IN-D	5.2E-04	8.0	0.007%		J		0.00241%
37	Butanenitrile	10	SC1-IN-E	5.0E-04	8.0	0.006%		J		0.00241%
37	Butanenitrile	12	SC1-IN-F	6.2E-04	8.0	0.008%		J		0.00241%
37	Butanenitrile	14	SC1-IN-G	5.4E-04	8.0	0.007%		J		0.00241%
37	Butanenitrile	16	SC1-IN-H	5.9E-04	8.0	0.007%		J		0.00241%
37	Butanenitrile	2	SC1-EF-A	1.7E-04	8.0	0.002%	YES	UY	0.002%	0.00241%
37	Butanenitrile	4	SC1-EF-B	1.9E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	6	SC1-EF-C	1.9E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	8	SC1-EF-D	1.8E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	10	SC1-EF-E	1.7E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	12	SC1-EF-F	1.8E-04	8.0	0.002%	YES	U	0.002%	0.00241%
37	Butanenitrile	14	SC1-EF-G	1.7E-04	8.0	0.002%	YES	UY	0.002%	0.00241%
37	Butanenitrile	16	SC1-EF-H	1.7E-04	8.0	0.002%	YES	U	0.002%	0.00241%
38	Pentanenitrile	2	SD1-IN-A	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	4	SD1-IN-B	2.1E-04	6.0	0.004%		J		0.00197%
38	Pentanenitrile	6	SD1-IN-C	1.8E-04	6.0	0.003%		J		0.00197%
38	Pentanenitrile	8	SD1-IN-D	1.5E-04	6.0	0.003%		J		0.00197%
38	Pentanenitrile	10	SD1-IN-E	1.7E-04	6.0	0.003%		J		0.00197%
38	Pentanenitrile	12	SD1-IN-F	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	14	SD1-IN-G	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	16	SD1-IN-H	2.0E-04	6.0	0.003%		J		0.00197%
38	Pentanenitrile	2	SD1-EF-A	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	4	SD1-EF-B	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	6	SD1-EF-C	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	8	SD1-EF-D	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	10	SD1-EF-E	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	12	SD1-EF-F	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	14	SD1-EF-G	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	16	SD1-EF-H	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	2	SC1-IN-A	9.6E-05	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	4	SC1-IN-B	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	6	SC1-IN-C	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	8	SC1-IN-D	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	10	SC1-IN-E	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	12	SC1-IN-F	9.7E-05	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	14	SC1-IN-G	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	16	SC1-IN-H	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	2	SC1-EF-A	1.0E-04	6.0	0.002%	YES	UY	0.002%	0.00197%
38	Pentanenitrile	4	SC1-EF-B	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	6	SC1-EF-C	1.2E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	8	SC1-EF-D	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	10	SC1-EF-E	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	12	SC1-EF-F	1.1E-04	6.0	0.002%	YES	U	0.002%	0.00197%
38	Pentanenitrile	14	SC1-EF-G	1.0E-04	6.0	0.002%	YES	UY	0.002%	0.00197%
38	Pentanenitrile	16	SC1-EF-H	1.0E-04	6.0	0.002%	YES	U	0.002%	0.00197%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
39	Hexanenitrile	2	SD1-IN-A	7.6E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	4	SD1-IN-B	6.8E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	6	SD1-IN-C	7.8E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	8	SD1-IN-D	7.9E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	10	SD1-IN-E	7.4E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	12	SD1-IN-F	8.0E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	14	SD1-IN-G	7.8E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	16	SD1-IN-H	8.1E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	2	SD1-EF-A	8.0E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	4	SD1-EF-B	7.5E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	6	SD1-EF-C	8.1E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	8	SD1-EF-D	8.4E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	10	SD1-EF-E	7.8E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	12	SD1-EF-F	7.6E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	14	SD1-EF-G	7.9E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	16	SD1-EF-H	7.9E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	2	SC1-IN-A	7.1E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	4	SC1-IN-B	7.6E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	6	SC1-IN-C	7.3E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	8	SC1-IN-D	7.4E-05	6.0	0.001%		J		0.00145%
39	Hexanenitrile	10	SC1-IN-E	7.4E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	12	SC1-IN-F	7.1E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	14	SC1-IN-G	7.6E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	16	SC1-IN-H	7.4E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	2	SC1-EF-A	7.6E-05	6.0	0.001%	YES	UY	0.001%	0.00145%
39	Hexanenitrile	4	SC1-EF-B	8.4E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	6	SC1-EF-C	8.7E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	8	SC1-EF-D	7.9E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	10	SC1-EF-E	7.7E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	12	SC1-EF-F	7.9E-05	6.0	0.001%	YES	U	0.001%	0.00145%
39	Hexanenitrile	14	SC1-EF-G	7.6E-05	6.0	0.001%	YES	UY	0.001%	0.00145%
39	Hexanenitrile	16	SC1-EF-H	7.6E-05	6.0	0.001%	YES	U	0.001%	0.00145%
43	Ethylamine	2	SD1-IN-A	4.3E-03	5.0	0.085%	YES		0.085%	0.0955%
43	Ethylamine	4	SD1-IN-B	4.4E-03	5.0	0.087%	YES		0.087%	0.0955%
43	Ethylamine	6	SD1-IN-C	4.4E-03	5.0	0.087%	YES		0.087%	0.0955%
43	Ethylamine	8	SD1-IN-D	4.8E-03	5.0	0.096%	YES		0.096%	0.0955%
43	Ethylamine	10	SD1-IN-E	4.5E-03	5.0	0.089%	YES		0.089%	0.0955%
43	Ethylamine	12	SD1-IN-F	4.3E-03	5.0	0.086%	YES		0.086%	0.0955%
43	Ethylamine	14	SD1-IN-G	4.4E-03	5.0	0.088%	YES		0.088%	0.0955%
43	Ethylamine	16	SD1-IN-H	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	2	SD1-EF-A	4.4E-03	5.0	0.088%	YES		0.088%	0.0955%
43	Ethylamine	4	SD1-EF-B	4.3E-03	5.0	0.087%	YES		0.087%	0.0955%
43	Ethylamine	6	SD1-EF-C	4.4E-03	5.0	0.087%	YES		0.087%	0.0955%
43	Ethylamine	8	SD1-EF-D	4.5E-03	5.0	0.089%	YES		0.089%	0.0955%
43	Ethylamine	10	SD1-EF-E	4.6E-03	5.0	0.091%	YES		0.091%	0.0955%
43	Ethylamine	12	SD1-EF-F	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	14	SD1-EF-G	4.6E-03	5.0	0.092%	YES		0.092%	0.0955%
43	Ethylamine	16	SD1-EF-H	4.6E-03	5.0	0.093%	YES		0.093%	0.0955%
43	Ethylamine	2	SC1-IN-A	4.2E-03	5.0	0.084%	YES		0.084%	0.0955%
43	Ethylamine	4	SC1-IN-B	4.3E-03	5.0	0.086%	YES		0.086%	0.0955%
43	Ethylamine	6	SC1-IN-C	4.5E-03	5.0	0.091%	YES		0.091%	0.0955%
43	Ethylamine	8	SC1-IN-D	4.6E-03	5.0	0.093%	YES		0.093%	0.0955%
43	Ethylamine	10	SC1-IN-E	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	12	SC1-IN-F	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	14	SC1-IN-G	4.3E-03	5.0	0.087%	YES		0.087%	0.0955%
43	Ethylamine	16	SC1-IN-H	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	2	SC1-EF-A	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	4	SC1-EF-B	4.6E-03	5.0	0.092%	YES		0.092%	0.0955%
43	Ethylamine	6	SC1-EF-C	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	8	SC1-EF-D	4.6E-03	5.0	0.092%	YES		0.092%	0.0955%
43	Ethylamine	10	SC1-EF-E	4.6E-03	5.0	0.092%	YES		0.092%	0.0955%
43	Ethylamine	12	SC1-EF-F	4.5E-03	5.0	0.089%	YES		0.089%	0.0955%
43	Ethylamine	14	SC1-EF-G	4.5E-03	5.0	0.090%	YES		0.090%	0.0955%
43	Ethylamine	16	SC1-EF-H	4.3E-03	5.0	0.086%	YES		0.086%	0.0955%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
44	N-Nitrosodimethylamine	2	SD1-IN-A	1.2E-04	0.000	41.3%				8.53%
44	N-Nitrosodimethylamine	4	SD1-IN-B	1.8E-04	0.000	59.7%				8.53%
44	N-Nitrosodimethylamine	6	SD1-IN-C	2.2E-04	0.000	73.0%				8.53%
44	N-Nitrosodimethylamine	8	SD1-IN-D	1.5E-04	0.000	49.1%				8.53%
44	N-Nitrosodimethylamine	10	SD1-IN-E	1.2E-04	0.000	38.4%				8.53%
44	N-Nitrosodimethylamine	12	SD1-IN-F	1.0E-04	0.000	34.3%				8.53%
44	N-Nitrosodimethylamine	14	SD1-IN-G	7.1E-05	0.000	23.6%				8.53%
44	N-Nitrosodimethylamine	16	SD1-IN-H	4.2E-05	0.000	14.1%				8.53%
44	N-Nitrosodimethylamine	2	SD1-EF-A	1.9E-05	0.000	6.28%	YES		6.28%	8.53%
44	N-Nitrosodimethylamine	4	SD1-EF-B	1.9E-05	0.000	6.18%	YES		6.18%	8.53%
44	N-Nitrosodimethylamine	6	SD1-EF-C	1.8E-05	0.000	6.10%	YES		6.10%	8.53%
44	N-Nitrosodimethylamine	8	SD1-EF-D	1.8E-05	0.000	6.08%	YES		6.08%	8.53%
44	N-Nitrosodimethylamine	10	SD1-EF-E	1.8E-05	0.000	5.90%	YES		5.90%	8.53%
44	N-Nitrosodimethylamine	12	SD1-EF-F	2.6E-05	0.000	8.53%	YES		8.53%	8.53%
44	N-Nitrosodimethylamine	14	SD1-EF-G	1.7E-05	0.000	5.71%	YES		5.71%	8.53%
44	N-Nitrosodimethylamine	16	SD1-EF-H	1.7E-05	0.000	5.73%	YES		5.73%	8.53%
44	N-Nitrosodimethylamine	2	SC1-IN-A	1.5E-04	0.000	50.1%				8.53%
44	N-Nitrosodimethylamine	4	SC1-IN-B	1.4E-04	0.000	47.7%				8.53%
44	N-Nitrosodimethylamine	6	SC1-IN-C	1.4E-04	0.000	47.5%				8.53%
44	N-Nitrosodimethylamine	8	SC1-IN-D	1.5E-04	0.000	51.5%				8.53%
44	N-Nitrosodimethylamine	10	SC1-IN-E	1.3E-04	0.000	44.6%				8.53%
44	N-Nitrosodimethylamine	12	SC1-IN-F	1.4E-04	0.000	47.4%				8.53%
44	N-Nitrosodimethylamine	14	SC1-IN-G	1.3E-04	0.000	44.4%				8.53%
44	N-Nitrosodimethylamine	16	SC1-IN-H	1.6E-04	0.000	54.6%				8.53%
44	N-Nitrosodimethylamine	2	SC1-EF-A	1.7E-05	0.000	5.64%	YES		5.64%	8.53%
44	N-Nitrosodimethylamine	4	SC1-EF-B	1.7E-05	0.000	5.73%	YES		5.73%	8.53%
44	N-Nitrosodimethylamine	6	SC1-EF-C	1.7E-05	0.000	5.64%	YES		5.64%	8.53%
44	N-Nitrosodimethylamine	8	SC1-EF-D	1.7E-05	0.000	5.60%	YES		5.60%	8.53%
44	N-Nitrosodimethylamine	10	SC1-EF-E	1.6E-05	0.000	5.34%	YES		5.34%	8.53%
44	N-Nitrosodimethylamine	12	SC1-EF-F	1.6E-05	0.000	5.39%	YES	,S*	5.39%	8.53%
44	N-Nitrosodimethylamine	14	SC1-EF-G	1.6E-05	0.000	5.17%	YES		5.17%	8.53%
44	N-Nitrosodimethylamine	16	SC1-EF-H	1.6E-05	0.000	5.18%	YES		5.18%	8.53%
45	N-Nitrosodiethylamine	2	SD1-IN-A	1.0E-05	0.000	10.3%	YES		10.3%	15.7%
45	N-Nitrosodiethylamine	4	SD1-IN-B	1.1E-05	0.000	11.0%	YES		11.0%	15.7%
45	N-Nitrosodiethylamine	6	SD1-IN-C	1.1E-05	0.000	11.2%	YES		11.2%	15.7%
45	N-Nitrosodiethylamine	8	SD1-IN-D	1.1E-05	0.000	10.9%	YES		10.9%	15.7%
45	N-Nitrosodiethylamine	10	SD1-IN-E	1.1E-05	0.000	10.6%	YES		10.6%	15.7%
45	N-Nitrosodiethylamine	12	SD1-IN-F	1.1E-05	0.000	10.7%	YES		10.7%	15.7%
45	N-Nitrosodiethylamine	14	SD1-IN-G	1.1E-05	0.000	10.6%	YES		10.6%	15.7%
45	N-Nitrosodiethylamine	16	SD1-IN-H	1.1E-05	0.000	10.5%	YES		10.5%	15.7%
45	N-Nitrosodiethylamine	2	SD1-EF-A	1.2E-05	0.000	11.6%	YES		11.6%	15.7%
45	N-Nitrosodiethylamine	4	SD1-EF-B	1.1E-05	0.000	11.4%	YES		11.4%	15.7%
45	N-Nitrosodiethylamine	6	SD1-EF-C	1.1E-05	0.000	11.2%	YES		11.2%	15.7%
45	N-Nitrosodiethylamine	8	SD1-EF-D	1.1E-05	0.000	11.2%	YES		11.2%	15.7%
45	N-Nitrosodiethylamine	10	SD1-EF-E	1.1E-05	0.000	10.9%	YES		10.9%	15.7%
45	N-Nitrosodiethylamine	12	SD1-EF-F	1.6E-05	0.000	15.7%	YES		15.7%	15.7%
45	N-Nitrosodiethylamine	14	SD1-EF-G	1.1E-05	0.000	10.5%	YES		10.5%	15.7%
45	N-Nitrosodiethylamine	16	SD1-EF-H	1.1E-05	0.000	10.5%	YES		10.5%	15.7%
45	N-Nitrosodiethylamine	2	SC1-IN-A	1.6E-05	0.000	16.3%				15.7%
45	N-Nitrosodiethylamine	4	SC1-IN-B	1.4E-05	0.000	13.6%				15.7%
45	N-Nitrosodiethylamine	6	SC1-IN-C	1.3E-05	0.000	13.3%				15.7%
45	N-Nitrosodiethylamine	8	SC1-IN-D	1.5E-05	0.000	15.2%				15.7%
45	N-Nitrosodiethylamine	10	SC1-IN-E	1.2E-05	0.000	12.5%				15.7%
45	N-Nitrosodiethylamine	12	SC1-IN-F	1.3E-05	0.000	12.6%				15.7%
45	N-Nitrosodiethylamine	14	SC1-IN-G	1.8E-05	0.000	17.6%				15.7%
45	N-Nitrosodiethylamine	16	SC1-IN-H	1.4E-05	0.000	13.8%				15.7%
45	N-Nitrosodiethylamine	2	SC1-EF-A	1.1E-05	0.000	11.2%	YES		11.2%	15.7%
45	N-Nitrosodiethylamine	4	SC1-EF-B	1.1E-05	0.000	11.4%	YES		11.4%	15.7%
45	N-Nitrosodiethylamine	6	SC1-EF-C	1.1E-05	0.000	11.3%	YES		11.3%	15.7%
45	N-Nitrosodiethylamine	8	SC1-EF-D	1.1E-05	0.000	11.2%	YES		11.2%	15.7%
45	N-Nitrosodiethylamine	10	SC1-EF-E	1.1E-05	0.000	10.6%	YES		10.6%	15.7%
45	N-Nitrosodiethylamine	12	SC1-EF-F	1.1E-05	0.000	10.8%	YES	,S*	10.8%	15.7%
45	N-Nitrosodiethylamine	14	SC1-EF-G	1.0E-05	0.000	10.3%	YES		10.3%	15.7%
45	N-Nitrosodiethylamine	16	SC1-EF-H	1.0E-05	0.000	10.3%	YES		10.3%	15.7%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
46	N-Nitrosomethylethylamine	2	SD1-IN-A	1.3E-05	0.000	4.34%	YES		4.34%	6.62%
46	N-Nitrosomethylethylamine	4	SD1-IN-B	1.9E-05	0.000	6.18%				6.62%
46	N-Nitrosomethylethylamine	6	SD1-IN-C	1.4E-05	0.000	4.72%	YES		4.72%	6.62%
46	N-Nitrosomethylethylamine	8	SD1-IN-D	1.4E-05	0.000	4.59%	YES		4.59%	6.62%
46	N-Nitrosomethylethylamine	10	SD1-IN-E	1.3E-05	0.000	4.45%	YES		4.45%	6.62%
46	N-Nitrosomethylethylamine	12	SD1-IN-F	1.3E-05	0.000	4.50%	YES		4.50%	6.62%
46	N-Nitrosomethylethylamine	14	SD1-IN-G	1.3E-05	0.000	4.49%	YES		4.49%	6.62%
46	N-Nitrosomethylethylamine	16	SD1-IN-H	1.3E-05	0.000	4.44%	YES		4.44%	6.62%
46	N-Nitrosomethylethylamine	2	SD1-EF-A	1.5E-05	0.000	4.87%	YES		4.87%	6.62%
46	N-Nitrosomethylethylamine	4	SD1-EF-B	1.4E-05	0.000	4.80%	YES		4.80%	6.62%
46	N-Nitrosomethylethylamine	6	SD1-EF-C	1.4E-05	0.000	4.73%	YES		4.73%	6.62%
46	N-Nitrosomethylethylamine	8	SD1-EF-D	1.4E-05	0.000	4.72%	YES		4.72%	6.62%
46	N-Nitrosomethylethylamine	10	SD1-EF-E	1.4E-05	0.000	4.58%	YES		4.58%	6.62%
46	N-Nitrosomethylethylamine	12	SD1-EF-F	2.0E-05	0.000	6.62%	YES		6.62%	6.62%
46	N-Nitrosomethylethylamine	14	SD1-EF-G	1.3E-05	0.000	4.43%	YES		4.43%	6.62%
46	N-Nitrosomethylethylamine	16	SD1-EF-H	1.3E-05	0.000	4.44%	YES		4.44%	6.62%
46	N-Nitrosomethylethylamine	2	SC1-IN-A	1.2E-05	0.000	4.06%	YES		4.06%	6.62%
46	N-Nitrosomethylethylamine	4	SC1-IN-B	1.2E-05	0.000	4.12%	YES		4.12%	6.62%
46	N-Nitrosomethylethylamine	6	SC1-IN-C	1.2E-05	0.000	4.03%	YES		4.03%	6.62%
46	N-Nitrosomethylethylamine	8	SC1-IN-D	1.2E-05	0.000	4.03%	YES		4.03%	6.62%
46	N-Nitrosomethylethylamine	10	SC1-IN-E	1.2E-05	0.000	4.08%				6.62%
46	N-Nitrosomethylethylamine	12	SC1-IN-F	1.7E-05	0.000	5.64%				6.62%
46	N-Nitrosomethylethylamine	14	SC1-IN-G	1.2E-05	0.000	4.14%	YES		4.14%	6.62%
46	N-Nitrosomethylethylamine	16	SC1-IN-H	1.7E-05	0.000	5.69%				6.62%
46	N-Nitrosomethylethylamine	2	SC1-EF-A	1.3E-05	0.000	4.34%	YES		4.34%	6.62%
46	N-Nitrosomethylethylamine	4	SC1-EF-B	1.3E-05	0.000	4.42%	YES		4.42%	6.62%
46	N-Nitrosomethylethylamine	6	SC1-EF-C	1.3E-05	0.000	4.35%	YES		4.35%	6.62%
46	N-Nitrosomethylethylamine	8	SC1-EF-D	1.3E-05	0.000	4.32%	YES		4.32%	6.62%
46	N-Nitrosomethylethylamine	10	SC1-EF-E	1.2E-05	0.000	4.11%	YES		4.11%	6.62%
46	N-Nitrosomethylethylamine	12	SC1-EF-F	1.2E-05	0.000	4.15%	YES	,S*	4.15%	6.62%
46	N-Nitrosomethylethylamine	14	SC1-EF-G	1.2E-05	0.000	3.99%	YES		3.99%	6.62%
46	N-Nitrosomethylethylamine	16	SC1-EF-H	1.2E-05	0.000	4.00%	YES		4.00%	6.62%
47	N-Nitrosomorpholine	2	SD1-IN-A	2.0E-04	0.001	34.2%				2.51%
47	N-Nitrosomorpholine	4	SD1-IN-B	2.5E-04	0.001	42.2%				2.51%
47	N-Nitrosomorpholine	6	SD1-IN-C	2.5E-04	0.001	41.5%				2.51%
47	N-Nitrosomorpholine	8	SD1-IN-D	2.3E-04	0.001	38.6%				2.51%
47	N-Nitrosomorpholine	10	SD1-IN-E	2.4E-04	0.001	40.7%				2.51%
47	N-Nitrosomorpholine	12	SD1-IN-F	2.4E-04	0.001	39.5%				2.51%
47	N-Nitrosomorpholine	14	SD1-IN-G	2.5E-04	0.001	41.4%				2.51%
47	N-Nitrosomorpholine	16	SD1-IN-H	2.1E-04	0.001	35.8%				2.51%
47	N-Nitrosomorpholine	2	SD1-EF-A	1.1E-05	0.001	1.85%	YES		1.85%	2.51%
47	N-Nitrosomorpholine	4	SD1-EF-B	1.1E-05	0.001	1.82%	YES		1.82%	2.51%
47	N-Nitrosomorpholine	6	SD1-EF-C	1.1E-05	0.001	1.80%	YES		1.80%	2.51%
47	N-Nitrosomorpholine	8	SD1-EF-D	1.1E-05	0.001	1.79%	YES		1.79%	2.51%
47	N-Nitrosomorpholine	10	SD1-EF-E	1.0E-05	0.001	1.74%	YES		1.74%	2.51%
47	N-Nitrosomorpholine	12	SD1-EF-F	1.5E-05	0.001	2.51%	YES		2.51%	2.51%
47	N-Nitrosomorpholine	14	SD1-EF-G	1.0E-05	0.001	1.68%	YES		1.68%	2.51%
47	N-Nitrosomorpholine	16	SD1-EF-H	1.0E-05	0.001	1.69%	YES		1.69%	2.51%
47	N-Nitrosomorpholine	2	SC1-IN-A	2.2E-04	0.001	36.4%				2.51%
47	N-Nitrosomorpholine	4	SC1-IN-B	2.4E-04	0.001	40.3%				2.51%
47	N-Nitrosomorpholine	6	SC1-IN-C	2.5E-04	0.001	41.3%				2.51%
47	N-Nitrosomorpholine	8	SC1-IN-D	2.3E-04	0.001	37.6%				2.51%
47	N-Nitrosomorpholine	10	SC1-IN-E	2.4E-04	0.001	39.7%				2.51%
47	N-Nitrosomorpholine	12	SC1-IN-F	2.6E-04	0.001	42.9%				2.51%
47	N-Nitrosomorpholine	14	SC1-IN-G	2.3E-04	0.001	38.7%				2.51%
47	N-Nitrosomorpholine	16	SC1-IN-H	2.5E-04	0.001	41.6%				2.51%
47	N-Nitrosomorpholine	2	SC1-EF-A	9.9E-06	0.001	1.65%	YES		1.65%	2.51%
47	N-Nitrosomorpholine	4	SC1-EF-B	1.0E-05	0.001	1.68%	YES		1.68%	2.51%
47	N-Nitrosomorpholine	6	SC1-EF-C	9.9E-06	0.001	1.65%	YES		1.65%	2.51%
47	N-Nitrosomorpholine	8	SC1-EF-D	9.8E-06	0.001	1.64%	YES		1.64%	2.51%
47	N-Nitrosomorpholine	10	SC1-EF-E	9.4E-06	0.001	1.56%	YES		1.56%	2.51%
47	N-Nitrosomorpholine	12	SC1-EF-F	9.5E-06	0.001	1.58%	YES	,S*	1.58%	2.51%
47	N-Nitrosomorpholine	14	SC1-EF-G	9.1E-06	0.001	1.51%	YES		1.51%	2.51%
47	N-Nitrosomorpholine	16	SC1-EF-H	9.1E-06	0.001	1.52%	YES		1.52%	2.51%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
48	Tributyl phosphate	2	SD1-IN-A	1.2E-04	0.20	0.061%	YES	LUY	0.061%	0.0618%
48	Tributyl phosphate	4	SD1-IN-B	6.8E-05	0.20	0.034%	YES	UY	0.034%	0.0618%
48	Tributyl phosphate	6	SD1-IN-C	6.9E-05	0.20	0.035%	YES	UY	0.035%	0.0618%
48	Tributyl phosphate	8	SD1-IN-D	6.9E-05	0.20	0.034%	YES	U	0.034%	0.0618%
48	Tributyl phosphate	10	SD1-IN-E	6.7E-05	0.20	0.034%	YES	U	0.034%	0.0618%
48	Tributyl phosphate	12	SD1-IN-F	6.3E-05	0.20	0.032%	YES	U	0.032%	0.0618%
48	Tributyl phosphate	14	SD1-IN-G	6.4E-05	0.20	0.032%	YES	U	0.032%	0.0618%
48	Tributyl phosphate	16	SD1-IN-H	1.1E-04	0.20	0.057%	YES	LU	0.057%	0.0618%
48	Tributyl phosphate	2	SD1-EF-A	1.1E-04	0.20	0.057%	YES	LUY	0.057%	0.0618%
48	Tributyl phosphate	4	SD1-EF-B	1.1E-04	0.20	0.053%	YES	LUY	0.053%	0.0618%
48	Tributyl phosphate	6	SD1-EF-C	1.2E-04	0.20	0.062%	YES	LUY	0.062%	0.0618%
48	Tributyl phosphate	8	SD1-EF-D	1.2E-04	0.20	0.060%	YES	LUY	0.060%	0.0618%
48	Tributyl phosphate	10	SD1-EF-E	1.1E-04	0.20	0.055%	YES	LUY	0.055%	0.0618%
48	Tributyl phosphate	12	SD1-EF-F	1.2E-04	0.20	0.059%	YES	LUY	0.059%	0.0618%
48	Tributyl phosphate	14	SD1-EF-G	1.1E-04	0.20	0.055%	YES	LU	0.055%	0.0618%
48	Tributyl phosphate	16	SD1-EF-H	1.1E-04	0.20	0.056%	YES	LU	0.056%	0.0618%
48	Tributyl phosphate	2	SC1-IN-A	1.1E-04	0.20	0.053%	YES	U	0.053%	0.0618%
48	Tributyl phosphate	4	SC1-IN-B	6.1E-05	0.20	0.031%	YES	U	0.031%	0.0618%
48	Tributyl phosphate	6	SC1-IN-C	6.1E-05	0.20	0.030%	YES	U	0.030%	0.0618%
48	Tributyl phosphate	8	SC1-IN-D	6.3E-05	0.20	0.031%	YES	U	0.031%	0.0618%
48	Tributyl phosphate	10	SC1-IN-E	6.5E-05	0.20	0.033%	YES	U	0.033%	0.0618%
48	Tributyl phosphate	12	SC1-IN-F	5.9E-05	0.20	0.030%	YES	U	0.030%	0.0618%
48	Tributyl phosphate	14	SC1-IN-G	5.8E-05	0.20	0.029%	YES	U	0.029%	0.0618%
48	Tributyl phosphate	16	SC1-IN-H	1.1E-04	0.20	0.054%	YES	U	0.054%	0.0618%
48	Tributyl phosphate	2	SC1-EF-A	1.1E-04	0.20	0.053%	YES	U	0.053%	0.0618%
48	Tributyl phosphate	4	SC1-EF-B	1.2E-04	0.20	0.058%	YES	U	0.058%	0.0618%
48	Tributyl phosphate	6	SC1-EF-C	1.1E-04	0.20	0.056%	YES	U	0.056%	0.0618%
48	Tributyl phosphate	8	SC1-EF-D	1.2E-04	0.20	0.059%	YES	U	0.059%	0.0618%
48	Tributyl phosphate	10	SC1-EF-E	1.1E-04	0.20	0.055%	YES	U	0.055%	0.0618%
48	Tributyl phosphate	12	SC1-EF-F	1.1E-04	0.20	0.054%	YES	U	0.054%	0.0618%
48	Tributyl phosphate	14	SC1-EF-G	1.1E-04	0.20	0.057%	YES	U	0.057%	0.0618%
48	Tributyl phosphate	16	SC1-EF-H	1.1E-04	0.20	0.057%	YES	U	0.057%	0.0618%
49	Dibutyl butylphosphonate	2	SD1-IN-A	4.9E-05	0.007	0.700%	YES	UY	0.700%	0.704%
49	Dibutyl butylphosphonate	4	SD1-IN-B	2.6E-05	0.007	0.365%	YES	UY	0.365%	0.704%
49	Dibutyl butylphosphonate	6	SD1-IN-C	2.6E-05	0.007	0.375%	YES	UY	0.375%	0.704%
49	Dibutyl butylphosphonate	8	SD1-IN-D	2.6E-05	0.007	0.371%	YES	U	0.371%	0.704%
49	Dibutyl butylphosphonate	10	SD1-IN-E	2.5E-05	0.007	0.363%	YES	U	0.363%	0.704%
49	Dibutyl butylphosphonate	12	SD1-IN-F	2.4E-05	0.007	0.342%	YES	U	0.342%	0.704%
49	Dibutyl butylphosphonate	14	SD1-IN-G	2.4E-05	0.007	0.343%	YES	U	0.343%	0.704%
49	Dibutyl butylphosphonate	16	SD1-IN-H	4.6E-05	0.007	0.655%	YES	U	0.655%	0.704%
49	Dibutyl butylphosphonate	2	SD1-EF-A	4.5E-05	0.007	0.649%	YES	UY	0.649%	0.704%
49	Dibutyl butylphosphonate	4	SD1-EF-B	4.2E-05	0.007	0.602%	YES	UY	0.602%	0.704%
49	Dibutyl butylphosphonate	6	SD1-EF-C	4.9E-05	0.007	0.704%	YES	UY	0.704%	0.704%
49	Dibutyl butylphosphonate	8	SD1-EF-D	4.8E-05	0.007	0.683%	YES	UY	0.683%	0.704%
49	Dibutyl butylphosphonate	10	SD1-EF-E	4.4E-05	0.007	0.632%	YES	UY	0.632%	0.704%
49	Dibutyl butylphosphonate	12	SD1-EF-F	4.7E-05	0.007	0.671%	YES	UY	0.671%	0.704%
49	Dibutyl butylphosphonate	14	SD1-EF-G	4.4E-05	0.007	0.627%	YES	U	0.627%	0.704%
49	Dibutyl butylphosphonate	16	SD1-EF-H	4.5E-05	0.007	0.643%	YES	U	0.643%	0.704%
49	Dibutyl butylphosphonate	2	SC1-IN-A	4.2E-05	0.007	0.600%	YES	U	0.600%	0.704%
49	Dibutyl butylphosphonate	4	SC1-IN-B	2.3E-05	0.007	0.332%	YES	U	0.332%	0.704%
49	Dibutyl butylphosphonate	6	SC1-IN-C	2.3E-05	0.007	0.329%	YES	U	0.329%	0.704%
49	Dibutyl butylphosphonate	8	SC1-IN-D	2.4E-05	0.007	0.338%	YES	U	0.338%	0.704%
49	Dibutyl butylphosphonate	10	SC1-IN-E	2.5E-05	0.007	0.352%	YES	U	0.352%	0.704%
49	Dibutyl butylphosphonate	12	SC1-IN-F	2.2E-05	0.007	0.321%	YES	U	0.321%	0.704%
49	Dibutyl butylphosphonate	14	SC1-IN-G	2.2E-05	0.007	0.316%	YES	U	0.316%	0.704%
49	Dibutyl butylphosphonate	16	SC1-IN-H	4.3E-05	0.007	0.620%	YES	U	0.620%	0.704%
49	Dibutyl butylphosphonate	2	SC1-EF-A	4.2E-05	0.007	0.603%	YES	U	0.603%	0.704%
49	Dibutyl butylphosphonate	4	SC1-EF-B	4.6E-05	0.007	0.656%	YES	U	0.656%	0.704%
49	Dibutyl butylphosphonate	6	SC1-EF-C	4.5E-05	0.007	0.643%	YES	U	0.643%	0.704%
49	Dibutyl butylphosphonate	8	SC1-EF-D	4.7E-05	0.007	0.671%	YES	U	0.671%	0.704%
49	Dibutyl butylphosphonate	10	SC1-EF-E	4.4E-05	0.007	0.625%	YES	U	0.625%	0.704%
49	Dibutyl butylphosphonate	12	SC1-EF-F	4.3E-05	0.007	0.613%	YES	U	0.613%	0.704%
49	Dibutyl butylphosphonate	14	SC1-EF-G	4.6E-05	0.007	0.651%	YES	U	0.651%	0.704%
49	Dibutyl butylphosphonate	16	SC1-EF-H	4.6E-05	0.007	0.652%	YES	U	0.652%	0.704%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
52	Pyridine	2	SD1-IN-A	9.3E-05	1.0	0.009%		J		0.0107%
52	Pyridine	4	SD1-IN-B	1.1E-04	1.0	0.011%		J		0.0107%
52	Pyridine	6	SD1-IN-C	9.5E-05	1.0	0.010%		J		0.0107%
52	Pyridine	8	SD1-IN-D	9.7E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	10	SD1-IN-E	9.1E-05	1.0	0.009%		J		0.0107%
52	Pyridine	12	SD1-IN-F	9.8E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	14	SD1-IN-G	9.6E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	16	SD1-IN-H	1.1E-04	1.0	0.011%		J		0.0107%
52	Pyridine	2	SD1-EF-A	9.9E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	4	SD1-EF-B	9.2E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	6	SD1-EF-C	9.9E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	8	SD1-EF-D	1.0E-04	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	10	SD1-EF-E	9.6E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	12	SD1-EF-F	9.3E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	14	SD1-EF-G	9.6E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	16	SD1-EF-H	9.7E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	2	SC1-IN-A	8.7E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	4	SC1-IN-B	1.1E-04	1.0	0.011%		J		0.0107%
52	Pyridine	6	SC1-IN-C	9.0E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	8	SC1-IN-D	9.1E-05	1.0	0.009%		J		0.0107%
52	Pyridine	10	SC1-IN-E	9.1E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	12	SC1-IN-F	9.4E-05	1.0	0.009%		J		0.0107%
52	Pyridine	14	SC1-IN-G	9.4E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	16	SC1-IN-H	9.0E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	2	SC1-EF-A	9.3E-05	1.0	0.009%	YES	UY	0.009%	0.0107%
52	Pyridine	4	SC1-EF-B	1.0E-04	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	6	SC1-EF-C	1.1E-04	1.0	0.011%	YES	U	0.011%	0.0107%
52	Pyridine	8	SC1-EF-D	9.7E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	10	SC1-EF-E	9.4E-05	1.0	0.009%	YES	U	0.009%	0.0107%
52	Pyridine	12	SC1-EF-F	9.7E-05	1.0	0.010%	YES	U	0.010%	0.0107%
52	Pyridine	14	SC1-EF-G	9.3E-05	1.0	0.009%	YES	UY	0.009%	0.0107%
52	Pyridine	16	SC1-EF-H	9.3E-05	1.0	0.009%	YES	U	0.009%	0.0107%
53	2,4-Dimethylpyridine	2	SD1-IN-A	1.7E-04	0.50	0.034%	YES	U	0.034%	0.0393%
53	2,4-Dimethylpyridine	4	SD1-IN-B	1.5E-04	0.50	0.031%	YES	U	0.031%	0.0393%
53	2,4-Dimethylpyridine	6	SD1-IN-C	1.8E-04	0.50	0.035%	YES	U	0.035%	0.0393%
53	2,4-Dimethylpyridine	8	SD1-IN-D	1.8E-04	0.50	0.036%	YES	U	0.036%	0.0393%
53	2,4-Dimethylpyridine	10	SD1-IN-E	1.7E-04	0.50	0.034%	YES	U	0.034%	0.0393%
53	2,4-Dimethylpyridine	12	SD1-IN-F	1.8E-04	0.50	0.036%	YES	U	0.036%	0.0393%
53	2,4-Dimethylpyridine	14	SD1-IN-G	1.8E-04	0.50	0.035%	YES	U	0.035%	0.0393%
53	2,4-Dimethylpyridine	16	SD1-IN-H	1.8E-04	0.50	0.037%	YES	U	0.037%	0.0393%
53	2,4-Dimethylpyridine	2	SD1-EF-A	1.8E-04	0.50	0.036%	YES	U	0.036%	0.0393%
53	2,4-Dimethylpyridine	4	SD1-EF-B	1.7E-04	0.50	0.034%	YES	U	0.034%	0.0393%
53	2,4-Dimethylpyridine	6	SD1-EF-C	1.8E-04	0.50	0.037%	YES	U	0.037%	0.0393%
53	2,4-Dimethylpyridine	8	SD1-EF-D	1.9E-04	0.50	0.038%	YES	U	0.038%	0.0393%
53	2,4-Dimethylpyridine	10	SD1-EF-E	1.8E-04	0.50	0.035%	YES	U	0.035%	0.0393%
53	2,4-Dimethylpyridine	12	SD1-EF-F	1.7E-04	0.50	0.034%	YES	U	0.034%	0.0393%
53	2,4-Dimethylpyridine	14	SD1-EF-G	1.8E-04	0.50	0.036%	YES	U	0.036%	0.0393%
53	2,4-Dimethylpyridine	16	SD1-EF-H	1.8E-04	0.50	0.036%	YES	U	0.036%	0.0393%
53	2,4-Dimethylpyridine	2	SC1-IN-A	1.6E-04	0.50	0.032%	YES	U	0.032%	0.0393%
53	2,4-Dimethylpyridine	4	SC1-IN-B	1.7E-04	0.50	0.035%	YES	U	0.035%	0.0393%
53	2,4-Dimethylpyridine	6	SC1-IN-C	1.7E-04	0.50	0.033%	YES	U	0.033%	0.0393%
53	2,4-Dimethylpyridine	8	SC1-IN-D	1.7E-04	0.50	0.034%	YES	U	0.034%	0.0393%
53	2,4-Dimethylpyridine	10	SC1-IN-E	1.7E-04	0.50	0.033%	YES	U	0.033%	0.0393%
53	2,4-Dimethylpyridine	12	SC1-IN-F	1.6E-04	0.50	0.032%	YES	U	0.032%	0.0393%
53	2,4-Dimethylpyridine	14	SC1-IN-G	1.7E-04	0.50	0.035%	YES	U	0.035%	0.0393%
53	2,4-Dimethylpyridine	16	SC1-IN-H	1.7E-04	0.50	0.033%	YES	U	0.033%	0.0393%
53	2,4-Dimethylpyridine	2	SC1-EF-A	1.7E-04	0.50	0.034%	YES	UY	0.034%	0.0393%
53	2,4-Dimethylpyridine	4	SC1-EF-B	1.9E-04	0.50	0.038%	YES	U	0.038%	0.0393%
53	2,4-Dimethylpyridine	6	SC1-EF-C	2.0E-04	0.50	0.039%	YES	U	0.039%	0.0393%
53	2,4-Dimethylpyridine	8	SC1-EF-D	1.8E-04	0.50	0.036%	YES	U	0.036%	0.0393%
53	2,4-Dimethylpyridine	10	SC1-EF-E	1.7E-04	0.50	0.035%	YES	U	0.035%	0.0393%
53	2,4-Dimethylpyridine	12	SC1-EF-F	1.8E-04	0.50	0.036%	YES	U	0.036%	0.0393%
53	2,4-Dimethylpyridine	14	SC1-EF-G	1.7E-04	0.50	0.034%	YES	UY	0.034%	0.0393%
53	2,4-Dimethylpyridine	16	SC1-EF-H	1.7E-04	0.50	0.034%	YES	U	0.034%	0.0393%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
16	Butanal/Butyraldehyde	2	SD1-IN-A	3.5E-03	25	0.014%				0.00296%
16	Butanal/Butyraldehyde	4	SD1-IN-B	3.4E-03	25	0.014%				0.00296%
16	Butanal/Butyraldehyde	6	SD1-IN-C	3.5E-03	25	0.014%				0.00296%
16	Butanal/Butyraldehyde	8	SD1-IN-D	3.2E-03	25	0.013%				0.00296%
16	Butanal/Butyraldehyde	10	SD1-IN-E	3.2E-03	25	0.013%				0.00296%
16	Butanal/Butyraldehyde	12	SD1-IN-F	3.3E-03	25	0.013%				0.00296%
16	Butanal/Butyraldehyde	14	SD1-IN-G	2.9E-03	25	0.012%				0.00296%
16	Butanal/Butyraldehyde	16	SD1-IN-H	2.9E-03	25	0.012%				0.00296%
16	Butanal/Butyraldehyde	2	SD1-EF-A	6.9E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	4	SD1-EF-B	6.7E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	6	SD1-EF-C	7.2E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	8	SD1-EF-D	7.4E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	10	SD1-EF-E	6.9E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	12	SD1-EF-F	6.9E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	14	SD1-EF-G	7.1E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	16	SD1-EF-H	7.1E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	2	SC1-IN-A	3.1E-03	25	0.012%				0.00296%
16	Butanal/Butyraldehyde	4	SC1-IN-B	3.7E-03	25	0.015%				0.00296%
16	Butanal/Butyraldehyde	6	SC1-IN-C	3.5E-03	25	0.014%				0.00296%
16	Butanal/Butyraldehyde	8	SC1-IN-D	7.1E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	10	SC1-IN-E	1.7E-03	25	0.007%				0.00296%
16	Butanal/Butyraldehyde	12	SC1-IN-F	3.1E-03	25	0.013%				0.00296%
16	Butanal/Butyraldehyde	14	SC1-IN-G	2.9E-03	25	0.012%				0.00296%
16	Butanal/Butyraldehyde	16	SC1-IN-H	3.1E-03	25	0.012%				0.00296%
16	Butanal/Butyraldehyde	2	SC1-EF-A	7.2E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	4	SC1-EF-B	6.8E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	6	SC1-EF-C	6.7E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	8	SC1-EF-D	6.8E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	10	SC1-EF-E	6.9E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	12	SC1-EF-F	7.0E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	14	SC1-EF-G	7.1E-04	25	0.003%	YES		0.003%	0.00296%
16	Butanal/Butyraldehyde	16	SC1-EF-H	7.1E-04	25	0.003%	YES		0.003%	0.00296%
20	Furan	2	SD1-IN-A	3.7E-05	0.001	3.68%	YES	U	3.68%	4.15%
20	Furan	4	SD1-IN-B	3.4E-05	0.001	3.42%	YES	U	3.42%	4.15%
20	Furan	6	SD1-IN-C	4.0E-05	0.001	3.97%	YES	UY	3.97%	4.15%
20	Furan	8	SD1-IN-D	4.0E-05	0.001	3.97%	YES	U	3.97%	4.15%
20	Furan	10	SD1-IN-E	3.8E-05	0.001	3.79%	YES	U	3.79%	4.15%
20	Furan	12	SD1-IN-F	3.8E-05	0.001	3.76%	YES	U	3.76%	4.15%
20	Furan	14	SD1-IN-G	3.7E-05	0.001	3.71%	YES	U	3.71%	4.15%
20	Furan	16	SD1-IN-H	3.8E-05	0.001	3.80%	YES	U	3.80%	4.15%
20	Furan	2	SD1-EF-A	4.1E-05	0.001	4.15%	YES	U	4.15%	4.15%
20	Furan	4	SD1-EF-B		0.001					4.15%
20	Furan	6	SD1-EF-C	4.0E-05	0.001	3.98%	YES	U	3.98%	4.15%
20	Furan	8	SD1-EF-D	4.0E-05	0.001	4.01%	YES	U	4.01%	4.15%
20	Furan	10	SD1-EF-E	3.7E-05	0.001	3.72%	YES	U	3.72%	4.15%
20	Furan	12	SD1-EF-F	3.7E-05	0.001	3.72%	YES	U	3.72%	4.15%
20	Furan	14	SD1-EF-G	3.7E-05	0.001	3.74%	YES	U	3.74%	4.15%
20	Furan	16	SD1-EF-H	3.7E-05	0.001	3.69%	YES	U	3.69%	4.15%
20	Furan	2	SC1-IN-A	3.8E-05	0.001	3.75%	YES	U	3.75%	4.15%
20	Furan	4	SC1-IN-B	3.7E-05	0.001	3.68%	YES	U	3.68%	4.15%
20	Furan	6	SC1-IN-C	3.7E-05	0.001	3.71%	YES	U	3.71%	4.15%
20	Furan	8	SC1-IN-D	3.7E-05	0.001	3.72%	YES	U	3.72%	4.15%
20	Furan	10	SC1-IN-E	3.6E-05	0.001	3.65%	YES	U	3.65%	4.15%
20	Furan	12	SC1-IN-F	3.7E-05	0.001	3.66%	YES	U	3.66%	4.15%
20	Furan	14	SC1-IN-G	3.7E-05	0.001	3.66%	YES	U	3.66%	4.15%
20	Furan	16	SC1-IN-H	3.8E-05	0.001	3.75%	YES	U	3.75%	4.15%
20	Furan	2	SC1-EF-A	3.9E-05	0.001	3.90%	YES	U	3.90%	4.15%
20	Furan	4	SC1-EF-B	3.8E-05	0.001	3.77%	YES	U	3.77%	4.15%
20	Furan	6	SC1-EF-C	3.8E-05	0.001	3.79%	YES	U	3.79%	4.15%
20	Furan	8	SC1-EF-D	3.8E-05	0.001	3.80%	YES	U	3.80%	4.15%
20	Furan	10	SC1-EF-E	3.7E-05	0.001	3.75%	YES	U	3.75%	4.15%
20	Furan	12	SC1-EF-F	3.8E-05	0.001	3.79%	YES	U	3.79%	4.15%
20	Furan	14	SC1-EF-G	3.8E-05	0.001	3.78%	YES	U	3.78%	4.15%
20	Furan	16	SC1-EF-H	3.8E-05	0.001	3.79%	YES	U	3.79%	4.15%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
22	2,5-Dihydrofuran	2	SD1-IN-A	3.7E-05	0.001	3.66%	YES	U	3.66%	4.13%
22	2,5-Dihydrofuran	4	SD1-IN-B	3.4E-05	0.001	3.41%	YES	U	3.41%	4.13%
22	2,5-Dihydrofuran	6	SD1-IN-C	3.9E-05	0.001	3.95%	YES	UY	3.95%	4.13%
22	2,5-Dihydrofuran	8	SD1-IN-D	3.9E-05	0.001	3.95%	YES	U	3.95%	4.13%
22	2,5-Dihydrofuran	10	SD1-IN-E	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
22	2,5-Dihydrofuran	12	SD1-IN-F	3.7E-05	0.001	3.74%	YES	U	3.74%	4.13%
22	2,5-Dihydrofuran	14	SD1-IN-G	3.7E-05	0.001	3.69%	YES	U	3.69%	4.13%
22	2,5-Dihydrofuran	16	SD1-IN-H	3.8E-05	0.001	3.78%	YES	U	3.78%	4.13%
22	2,5-Dihydrofuran	2	SD1-EF-A	4.1E-05	0.001	4.13%	YES	U	4.13%	4.13%
22	2,5-Dihydrofuran	4	SD1-EF-B		0.001					4.13%
22	2,5-Dihydrofuran	6	SD1-EF-C	4.0E-05	0.001	3.96%	YES	U	3.96%	4.13%
22	2,5-Dihydrofuran	8	SD1-EF-D	4.0E-05	0.001	3.99%	YES	U	3.99%	4.13%
22	2,5-Dihydrofuran	10	SD1-EF-E	3.7E-05	0.001	3.70%	YES	U	3.70%	4.13%
22	2,5-Dihydrofuran	12	SD1-EF-F	3.7E-05	0.001	3.70%	YES	U	3.70%	4.13%
22	2,5-Dihydrofuran	14	SD1-EF-G	3.7E-05	0.001	3.72%	YES	U	3.72%	4.13%
22	2,5-Dihydrofuran	16	SD1-EF-H	3.7E-05	0.001	3.67%	YES	U	3.67%	4.13%
22	2,5-Dihydrofuran	2	SC1-IN-A	3.7E-05	0.001	3.73%	YES	U	3.73%	4.13%
22	2,5-Dihydrofuran	4	SC1-IN-B	3.7E-05	0.001	3.66%	YES	U	3.66%	4.13%
22	2,5-Dihydrofuran	6	SC1-IN-C	3.7E-05	0.001	3.69%	YES	U	3.69%	4.13%
22	2,5-Dihydrofuran	8	SC1-IN-D	3.7E-05	0.001	3.70%	YES	U	3.70%	4.13%
22	2,5-Dihydrofuran	10	SC1-IN-E	3.6E-05	0.001	3.63%	YES	U	3.63%	4.13%
22	2,5-Dihydrofuran	12	SC1-IN-F	3.6E-05	0.001	3.64%	YES	U	3.64%	4.13%
22	2,5-Dihydrofuran	14	SC1-IN-G	3.6E-05	0.001	3.64%	YES	U	3.64%	4.13%
22	2,5-Dihydrofuran	16	SC1-IN-H	3.7E-05	0.001	3.73%	YES	U	3.73%	4.13%
22	2,5-Dihydrofuran	2	SC1-EF-A	3.9E-05	0.001	3.88%	YES	U	3.88%	4.13%
22	2,5-Dihydrofuran	4	SC1-EF-B	3.8E-05	0.001	3.76%	YES	U	3.76%	4.13%
22	2,5-Dihydrofuran	6	SC1-EF-C	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
22	2,5-Dihydrofuran	8	SC1-EF-D	3.8E-05	0.001	3.78%	YES	U	3.78%	4.13%
22	2,5-Dihydrofuran	10	SC1-EF-E	3.7E-05	0.001	3.73%	YES	U	3.73%	4.13%
22	2,5-Dihydrofuran	12	SC1-EF-F	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
22	2,5-Dihydrofuran	14	SC1-EF-G	3.8E-05	0.001	3.76%	YES	U	3.76%	4.13%
22	2,5-Dihydrofuran	16	SC1-EF-H	3.8E-05	0.001	3.77%	YES	U	3.77%	4.13%
23	2-Methylfuran	2	SD1-IN-A	4.8E-05	0.001	4.84%	YES	U	4.84%	5.45%
23	2-Methylfuran	4	SD1-IN-B	4.5E-05	0.001	4.50%	YES	U	4.50%	5.45%
23	2-Methylfuran	6	SD1-IN-C	5.2E-05	0.001	5.22%	YES	UY	5.22%	5.45%
23	2-Methylfuran	8	SD1-IN-D	5.2E-05	0.001	5.21%	YES	U	5.21%	5.45%
23	2-Methylfuran	10	SD1-IN-E	5.0E-05	0.001	4.98%	YES	U	4.98%	5.45%
23	2-Methylfuran	12	SD1-IN-F	4.9E-05	0.001	4.95%	YES	U	4.95%	5.45%
23	2-Methylfuran	14	SD1-IN-G	4.9E-05	0.001	4.87%	YES	U	4.87%	5.45%
23	2-Methylfuran	16	SD1-IN-H	5.0E-05	0.001	4.99%	YES	U	4.99%	5.45%
23	2-Methylfuran	2	SD1-EF-A	5.5E-05	0.001	5.45%	YES	U	5.45%	5.45%
23	2-Methylfuran	4	SD1-EF-B		0.001					5.45%
23	2-Methylfuran	6	SD1-EF-C	5.2E-05	0.001	5.24%	YES	U	5.24%	5.45%
23	2-Methylfuran	8	SD1-EF-D	5.3E-05	0.001	5.28%	YES	U	5.28%	5.45%
23	2-Methylfuran	10	SD1-EF-E	4.9E-05	0.001	4.89%	YES	U	4.89%	5.45%
23	2-Methylfuran	12	SD1-EF-F	4.9E-05	0.001	4.89%	YES	U	4.89%	5.45%
23	2-Methylfuran	14	SD1-EF-G	4.9E-05	0.001	4.92%	YES	U	4.92%	5.45%
23	2-Methylfuran	16	SD1-EF-H	4.8E-05	0.001	4.85%	YES	U	4.85%	5.45%
23	2-Methylfuran	2	SC1-IN-A	4.9E-05	0.001	4.93%	YES	U	4.93%	5.45%
23	2-Methylfuran	4	SC1-IN-B	4.8E-05	0.001	4.83%	YES	U	4.83%	5.45%
23	2-Methylfuran	6	SC1-IN-C	4.9E-05	0.001	4.87%	YES	U	4.87%	5.45%
23	2-Methylfuran	8	SC1-IN-D	4.9E-05	0.001	4.89%	YES	U	4.89%	5.45%
23	2-Methylfuran	10	SC1-IN-E	4.8E-05	0.001	4.80%	YES	U	4.80%	5.45%
23	2-Methylfuran	12	SC1-IN-F	4.8E-05	0.001	4.81%	YES	U	4.81%	5.45%
23	2-Methylfuran	14	SC1-IN-G	4.8E-05	0.001	4.81%	YES	U	4.81%	5.45%
23	2-Methylfuran	16	SC1-IN-H	4.9E-05	0.001	4.93%	YES	U	4.93%	5.45%
23	2-Methylfuran	2	SC1-EF-A	5.1E-05	0.001	5.13%	YES	U	5.13%	5.45%
23	2-Methylfuran	4	SC1-EF-B	5.0E-05	0.001	4.96%	YES	U	4.96%	5.45%
23	2-Methylfuran	6	SC1-EF-C	5.0E-05	0.001	4.98%	YES	U	4.98%	5.45%
23	2-Methylfuran	8	SC1-EF-D	5.0E-05	0.001	5.00%	YES	U	5.00%	5.45%
23	2-Methylfuran	10	SC1-EF-E	4.9E-05	0.001	4.92%	YES	U	4.92%	5.45%
23	2-Methylfuran	12	SC1-EF-F	5.0E-05	0.001	4.98%	YES	U	4.98%	5.45%
23	2-Methylfuran	14	SC1-EF-G	5.0E-05	0.001	4.97%	YES	U	4.97%	5.45%
23	2-Methylfuran	16	SC1-EF-H	5.0E-05	0.001	4.98%	YES	U	4.98%	5.45%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
35	Acetonitrile	2	SD1-IN-A	5.0E-01	20	2.51%	YES		2.51%	2.52%
35	Acetonitrile	4	SD1-IN-B	4.7E-01	20	2.36%	YES		2.36%	2.52%
35	Acetonitrile	6	SD1-IN-C	4.9E-01	20	2.43%	YES		2.43%	2.52%
35	Acetonitrile	8	SD1-IN-D	5.0E-01	20	2.49%	YES		2.49%	2.52%
35	Acetonitrile	10	SD1-IN-E	5.0E-01	20	2.48%	YES		2.48%	2.52%
35	Acetonitrile	12	SD1-IN-F	4.9E-01	20	2.47%	YES		2.47%	2.52%
35	Acetonitrile	14	SD1-IN-G	5.0E-01	20	2.50%	YES		2.50%	2.52%
35	Acetonitrile	16	SD1-IN-H	5.0E-01	20	2.52%	YES		2.52%	2.52%
35	Acetonitrile	2	SD1-EF-A	4.6E-01	20	2.31%	YES		2.31%	2.52%
35	Acetonitrile	4	SD1-EF-B	4.8E-01	20	2.42%	YES		2.42%	2.52%
35	Acetonitrile	6	SD1-EF-C	4.8E-01	20	2.40%	YES		2.40%	2.52%
35	Acetonitrile	8	SD1-EF-D	5.0E-01	20	2.51%	YES		2.51%	2.52%
35	Acetonitrile	10	SD1-EF-E	5.0E-01	20	2.49%	YES		2.49%	2.52%
35	Acetonitrile	12	SD1-EF-F	4.8E-01	20	2.39%	YES		2.39%	2.52%
35	Acetonitrile	14	SD1-EF-G	4.8E-01	20	2.40%	YES		2.40%	2.52%
35	Acetonitrile	16	SD1-EF-H	4.8E-01	20	2.41%	YES		2.41%	2.52%
35	Acetonitrile	2	SC1-IN-A	4.8E-01	20	2.39%	YES		2.39%	2.52%
35	Acetonitrile	4	SC1-IN-B	4.9E-01	20	2.45%	YES		2.45%	2.52%
35	Acetonitrile	6	SC1-IN-C	4.9E-01	20	2.46%	YES		2.46%	2.52%
35	Acetonitrile	8	SC1-IN-D	5.0E-01	20	2.52%	YES		2.52%	2.52%
35	Acetonitrile	10	SC1-IN-E	4.8E-01	20	2.41%	YES		2.41%	2.52%
35	Acetonitrile	12	SC1-IN-F	4.6E-01	20	2.31%	YES		2.31%	2.52%
35	Acetonitrile	14	SC1-IN-G	5.0E-01	20	2.49%	YES		2.49%	2.52%
35	Acetonitrile	16	SC1-IN-H	5.0E-01	20	2.50%	YES		2.50%	2.52%
35	Acetonitrile	2	SC1-EF-A	4.7E-01	20	2.37%	YES		2.37%	2.52%
35	Acetonitrile	4	SC1-EF-B	4.9E-01	20	2.45%	YES		2.45%	2.52%
35	Acetonitrile	6	SC1-EF-C	4.8E-01	20	2.38%	YES		2.38%	2.52%
35	Acetonitrile	8	SC1-EF-D	4.8E-01	20	2.40%	YES		2.40%	2.52%
35	Acetonitrile	10	SC1-EF-E	7.9E-01	20	3.93%				2.52%
35	Acetonitrile	12	SC1-EF-F	4.8E-01	20	2.38%	YES		2.38%	2.52%
35	Acetonitrile	14	SC1-EF-G	4.9E-01	20	2.44%	YES		2.44%	2.52%
35	Acetonitrile	16	SC1-EF-H	5.0E-01	20	2.50%	YES		2.50%	2.52%
52	Pyridine	2	SD1-IN-A	1.3E-03	1.0	0.130%	YES		0.130%	0.134%
52	Pyridine	4	SD1-IN-B	1.3E-03	1.0	0.132%	YES		0.132%	0.134%
52	Pyridine	6	SD1-IN-C	1.3E-03	1.0	0.130%	YES		0.130%	0.134%
52	Pyridine	8	SD1-IN-D	1.2E-03	1.0	0.118%	YES		0.118%	0.134%
52	Pyridine	10	SD1-IN-E	1.2E-03	1.0	0.121%	YES		0.121%	0.134%
52	Pyridine	12	SD1-IN-F	1.2E-03	1.0	0.117%	YES		0.117%	0.134%
52	Pyridine	14	SD1-IN-G	1.2E-03	1.0	0.119%	YES		0.119%	0.134%
52	Pyridine	16	SD1-IN-H	1.2E-03	1.0	0.119%	YES		0.119%	0.134%
52	Pyridine	2	SD1-EF-A	1.1E-03	1.0	0.106%	YES	,S*	0.106%	0.134%
52	Pyridine	4	SD1-EF-B	1.3E-03	1.0	0.128%	YES		0.128%	0.134%
52	Pyridine	6	SD1-EF-C	1.1E-03	1.0	0.112%	YES		0.112%	0.134%
52	Pyridine	8	SD1-EF-D	1.1E-03	1.0	0.107%	YES	,S*	0.107%	0.134%
52	Pyridine	10	SD1-EF-E	1.2E-03	1.0	0.123%	YES		0.123%	0.134%
52	Pyridine	12	SD1-EF-F	1.2E-03	1.0	0.123%	YES		0.123%	0.134%
52	Pyridine	14	SD1-EF-G	1.3E-03	1.0	0.128%	YES		0.128%	0.134%
52	Pyridine	16	SD1-EF-H	1.1E-03	1.0	0.115%	YES		0.115%	0.134%
52	Pyridine	2	SC1-IN-A	1.3E-03	1.0	0.134%	YES		0.134%	0.134%
52	Pyridine	4	SC1-IN-B	1.3E-03	1.0	0.127%	YES		0.127%	0.134%
52	Pyridine	6	SC1-IN-C	8.8E-04	1.0	0.088%	YES	,S*	0.088%	0.134%
52	Pyridine	8	SC1-IN-D	1.3E-03	1.0	0.128%	YES		0.128%	0.134%
52	Pyridine	10	SC1-IN-E	1.2E-03	1.0	0.123%	YES		0.123%	0.134%
52	Pyridine	12	SC1-IN-F	1.2E-03	1.0	0.121%	YES		0.121%	0.134%
52	Pyridine	14	SC1-IN-G	1.2E-03	1.0	0.124%	YES		0.124%	0.134%
52	Pyridine	16	SC1-IN-H	1.3E-03	1.0	0.127%	YES		0.127%	0.134%
52	Pyridine	2	SC1-EF-A	1.3E-03	1.0	0.134%	YES		0.134%	0.134%
52	Pyridine	4	SC1-EF-B	1.3E-03	1.0	0.132%	YES		0.132%	0.134%
52	Pyridine	6	SC1-EF-C	1.3E-03	1.0	0.130%	YES		0.130%	0.134%
52	Pyridine	8	SC1-EF-D	1.2E-03	1.0	0.121%	YES		0.121%	0.134%
52	Pyridine	10	SC1-EF-E	1.2E-03	1.0	0.118%	YES		0.118%	0.134%
52	Pyridine	12	SC1-EF-F	1.2E-03	1.0	0.117%	YES		0.117%	0.134%
52	Pyridine	14	SC1-EF-G	1.3E-03	1.0	0.127%	YES		0.127%	0.134%
52	Pyridine	16	SC1-EF-H	1.2E-03	1.0	0.122%	YES		0.122%	0.134%

Table D.1. APR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	<DL|RL value (%OEL)	Approx. DL|RL (%OEL)
53	2,4-Dimethylpyridine	2	SD1-IN-A	9.6E-04	0.50	0.192%	YES		0.192%	0.198%
53	2,4-Dimethylpyridine	4	SD1-IN-B	9.7E-04	0.50	0.195%	YES		0.195%	0.198%
53	2,4-Dimethylpyridine	6	SD1-IN-C	9.6E-04	0.50	0.193%	YES		0.193%	0.198%
53	2,4-Dimethylpyridine	8	SD1-IN-D	8.7E-04	0.50	0.174%	YES		0.174%	0.198%
53	2,4-Dimethylpyridine	10	SD1-IN-E	8.9E-04	0.50	0.178%	YES		0.178%	0.198%
53	2,4-Dimethylpyridine	12	SD1-IN-F	8.7E-04	0.50	0.173%	YES		0.173%	0.198%
53	2,4-Dimethylpyridine	14	SD1-IN-G	8.8E-04	0.50	0.175%	YES		0.175%	0.198%
53	2,4-Dimethylpyridine	16	SD1-IN-H	8.8E-04	0.50	0.175%	YES		0.175%	0.198%
53	2,4-Dimethylpyridine	2	SD1-EF-A	7.9E-04	0.50	0.157%	YES	,S*	0.157%	0.198%
53	2,4-Dimethylpyridine	4	SD1-EF-B	9.4E-04	0.50	0.189%	YES		0.189%	0.198%
53	2,4-Dimethylpyridine	6	SD1-EF-C	8.2E-04	0.50	0.165%	YES		0.165%	0.198%
53	2,4-Dimethylpyridine	8	SD1-EF-D	7.9E-04	0.50	0.157%	YES	,S*	0.157%	0.198%
53	2,4-Dimethylpyridine	10	SD1-EF-E	9.1E-04	0.50	0.182%	YES		0.182%	0.198%
53	2,4-Dimethylpyridine	12	SD1-EF-F	9.1E-04	0.50	0.182%	YES		0.182%	0.198%
53	2,4-Dimethylpyridine	14	SD1-EF-G	9.5E-04	0.50	0.190%	YES		0.190%	0.198%
53	2,4-Dimethylpyridine	16	SD1-EF-H	8.5E-04	0.50	0.170%	YES		0.170%	0.198%
53	2,4-Dimethylpyridine	2	SC1-IN-A	9.9E-04	0.50	0.197%	YES		0.197%	0.198%
53	2,4-Dimethylpyridine	4	SC1-IN-B	9.4E-04	0.50	0.188%	YES		0.188%	0.198%
53	2,4-Dimethylpyridine	6	SC1-IN-C	6.5E-04	0.50	0.130%	YES	,S*	0.130%	0.198%
53	2,4-Dimethylpyridine	8	SC1-IN-D	9.5E-04	0.50	0.189%	YES		0.189%	0.198%
53	2,4-Dimethylpyridine	10	SC1-IN-E	9.1E-04	0.50	0.182%	YES		0.182%	0.198%
53	2,4-Dimethylpyridine	12	SC1-IN-F	8.9E-04	0.50	0.178%	YES		0.178%	0.198%
53	2,4-Dimethylpyridine	14	SC1-IN-G	9.2E-04	0.50	0.183%	YES		0.183%	0.198%
53	2,4-Dimethylpyridine	16	SC1-IN-H	9.4E-04	0.50	0.188%	YES		0.188%	0.198%
53	2,4-Dimethylpyridine	2	SC1-EF-A	9.9E-04	0.50	0.198%	YES		0.198%	0.198%
53	2,4-Dimethylpyridine	4	SC1-EF-B	9.7E-04	0.50	0.194%	YES		0.194%	0.198%
53	2,4-Dimethylpyridine	6	SC1-EF-C	9.6E-04	0.50	0.192%	YES		0.192%	0.198%
53	2,4-Dimethylpyridine	8	SC1-EF-D	8.9E-04	0.50	0.178%	YES		0.178%	0.198%
53	2,4-Dimethylpyridine	10	SC1-EF-E	8.7E-04	0.50	0.174%	YES		0.174%	0.198%
53	2,4-Dimethylpyridine	12	SC1-EF-F	8.6E-04	0.50	0.172%	YES		0.172%	0.198%
53	2,4-Dimethylpyridine	14	SC1-EF-G	9.3E-04	0.50	0.187%	YES		0.187%	0.198%
53	2,4-Dimethylpyridine	16	SC1-EF-H	9.0E-04	0.50	0.180%	YES		0.180%	0.198%

Table D.2. PAPR Cartridge Testing Calculated Data

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
1	Ammonia	2	TL-IN-A	4.8E+00	25	19.2%			2.39%
1	Ammonia	4	TL-IN-B	4.7E+00	25	18.8%			2.39%
1	Ammonia	6	TL-IN-C	4.4E+00	25	17.8%			2.39%
1	Ammonia	8	TL-IN-D	4.2E+00	25	16.7%			2.39%
1	Ammonia	10	TL-IN-E	4.3E+00	25	17.1%			2.39%
1	Ammonia	12	TL-IN-F	4.4E+00	25	17.7%			2.39%
1	Ammonia	14	TL-IN-G	3.7E+00	25	14.8%			2.39%
1	Ammonia	16	TL-IN-H	4.0E+00	25	15.9%			2.39%
1	Ammonia	2	TL-EF-A	1.4E+00	25	5.64%			2.39%
1	Ammonia	4	TL-EF-B	1.4E+00	25	5.54%			2.39%
1	Ammonia	6	TL-EF-C	1.3E+00	25	5.18%			2.39%
1	Ammonia	8	TL-EF-D	1.2E+00	25	4.86%			2.39%
1	Ammonia	10	TL-EF-E	1.1E+00	25	4.44%			2.39%
1	Ammonia	12	TL-EF-F	9.7E-01	25	3.88%			2.39%
1	Ammonia	14	TL-EF-G	8.4E-01	25	3.34%			2.39%
1	Ammonia	16	TL-EF-H	8.2E-01	25	3.30%			2.39%
1	Ammonia	2	FR57-IN-A	4.1E+00	25	16.5%			2.39%
1	Ammonia	4	FR57-IN-B	4.2E+00	25	16.6%			2.39%
1	Ammonia	6	FR57-IN-C	3.9E+00	25	15.7%			2.39%
1	Ammonia	8	FR57-IN-D	3.6E+00	25	14.4%			2.39%
1	Ammonia	10	FR57-IN-E	3.5E+00	25	14.2%			2.39%
1	Ammonia	12	FR57-IN-F	3.7E+00	25	15.0%			2.39%
1	Ammonia	14	FR57-IN-G	3.6E+00	25	14.3%			2.39%
1	Ammonia	16	FR57-IN-H	4.0E+00	25	16.0%			2.39%
1	Ammonia	2	FR57-EF-A	1.1E+00	25	4.26%			2.39%
1	Ammonia	4	FR57-EF-B	1.2E+00	25	4.74%			2.39%
1	Ammonia	6	FR57-EF-C	1.2E+00	25	4.93%			2.39%
1	Ammonia	8	FR57-EF-D	1.4E+00	25	5.43%			2.39%
1	Ammonia	10	FR57-EF-E	1.4E+00	25	5.45%			2.39%
1	Ammonia	12	FR57-EF-F	1.0E+00	25	4.05%			2.39%
1	Ammonia	14	FR57-EF-G	1.3E+00	25	5.23%			2.39%
1	Ammonia	16	FR57-EF-H	1.0E+00	25	4.00%			2.39%
3	Mercury	2	TL-IN-A	9.7E-04	0.003	32.3%			6.75%
3	Mercury	4	TL-IN-B	9.9E-04	0.003	32.8%			6.75%
3	Mercury	6	TL-IN-C	1.1E-03	0.003	35.0%			6.75%
3	Mercury	8	TL-IN-D	9.1E-04	0.003	30.2%			6.75%
3	Mercury	10	TL-IN-E	9.8E-04	0.003	32.7%			6.75%
3	Mercury	12	TL-IN-F	8.8E-04	0.003	29.2%			6.75%
3	Mercury	14	TL-IN-G	8.2E-04	0.003	27.2%			6.75%
3	Mercury	16	TL-IN-H	8.2E-04	0.003	27.2%			6.75%
3	Mercury	2	TL-EF-A	2.0E-04	0.003	6.57%	YES		6.75%
3	Mercury	4	TL-EF-B	1.9E-04	0.003	6.43%	YES		6.75%
3	Mercury	6	TL-EF-C	1.9E-04	0.003	6.45%	YES		6.75%
3	Mercury	8	TL-EF-D	2.0E-04	0.003	6.57%	YES		6.75%
3	Mercury	10	TL-EF-E	2.0E-04	0.003	6.50%	YES		6.75%
3	Mercury	12	TL-EF-F	1.9E-04	0.003	6.39%	YES		6.75%
3	Mercury	14	TL-EF-G	1.9E-04	0.003	6.23%	YES		6.75%
3	Mercury	16	TL-EF-H	1.9E-04	0.003	6.20%	YES		6.75%
3	Mercury	2	FR57-IN-A	8.7E-04	0.003	28.8%			6.75%
3	Mercury	4	FR57-IN-B	8.5E-04	0.003	28.4%			6.75%
3	Mercury	6	FR57-IN-C	7.8E-04	0.003	25.8%			6.75%
3	Mercury	8	FR57-IN-D	8.2E-04	0.003	27.1%			6.75%
3	Mercury	10	FR57-IN-E	8.3E-04	0.003	27.7%			6.75%
3	Mercury	12	FR57-IN-F	8.4E-04	0.003	28.0%			6.75%
3	Mercury	14	FR57-IN-G	9.0E-04	0.003	29.8%			6.75%
3	Mercury	16	FR57-IN-H	2.7E-03	0.003	90.0%			6.75%
3	Mercury	2	FR57-EF-A	2.0E-04	0.003	6.64%	YES		6.75%
3	Mercury	4	FR57-EF-B	2.0E-04	0.003	6.73%	YES		6.75%
3	Mercury	6	FR57-EF-C	2.0E-04	0.003	6.75%	YES		6.75%
3	Mercury	8	FR57-EF-D	2.0E-04	0.003	6.57%	YES		6.75%
3	Mercury	10	FR57-EF-E	2.0E-04	0.003	6.49%	YES		6.75%
3	Mercury	12	FR57-EF-F	2.0E-04	0.003	6.49%	YES		6.75%
3	Mercury	14	FR57-EF-G	1.9E-04	0.003	6.47%	YES		6.75%
3	Mercury	16	FR57-EF-H	1.9E-04	0.003	6.40%	YES		6.75%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
4	1,3-Butadiene	2	TL-IN-A	1.9E-02	1.0	1.93%	YES		1.93%
4	1,3-Butadiene	4	TL-IN-B	1.9E-02	1.0	1.89%	YES		1.93%
4	1,3-Butadiene	6	TL-IN-C	1.9E-02	1.0	1.90%	YES		1.93%
4	1,3-Butadiene	8	TL-IN-D	1.9E-02	1.0	1.88%	YES		1.93%
4	1,3-Butadiene	10	TL-IN-E	1.9E-02	1.0	1.88%	YES		1.93%
4	1,3-Butadiene	12	TL-IN-F	1.9E-02	1.0	1.90%	YES		1.93%
4	1,3-Butadiene	14	TL-IN-G	1.9E-02	1.0	1.87%	YES		1.93%
4	1,3-Butadiene	16	TL-IN-H	1.9E-02	1.0	1.86%	YES		1.93%
4	1,3-Butadiene	2	TL-EF-A	1.9E-02	1.0	1.93%	YES		1.93%
4	1,3-Butadiene	4	TL-EF-B	1.9E-02	1.0	1.89%	YES		1.93%
4	1,3-Butadiene	6	TL-EF-C	1.9E-02	1.0	1.89%	YES		1.93%
4	1,3-Butadiene	8	TL-EF-D	1.9E-02	1.0	1.87%	YES		1.93%
4	1,3-Butadiene	10	TL-EF-E	1.8E-02	1.0	1.82%	YES		1.93%
4	1,3-Butadiene	12	TL-EF-F	1.8E-02	1.0	1.79%	YES		1.93%
4	1,3-Butadiene	14	TL-EF-G	1.7E-02	1.0	1.74%	YES		1.93%
4	1,3-Butadiene	16	TL-EF-H	1.7E-02	1.0	1.72%	YES		1.93%
4	1,3-Butadiene	2	FR57-IN-A	1.9E-02	1.0	1.87%	YES		1.93%
4	1,3-Butadiene	4	FR57-IN-B	1.9E-02	1.0	1.89%	YES		1.93%
4	1,3-Butadiene	6	FR57-IN-C	1.9E-02	1.0	1.85%	YES		1.93%
4	1,3-Butadiene	8	FR57-IN-D	1.9E-02	1.0	1.85%	YES		1.93%
4	1,3-Butadiene	10	FR57-IN-E	1.9E-02	1.0	1.85%	YES		1.93%
4	1,3-Butadiene	12	FR57-IN-F	1.9E-02	1.0	1.90%	YES		1.93%
4	1,3-Butadiene	14	FR57-IN-G	1.8E-02	1.0	1.81%	YES		1.93%
4	1,3-Butadiene	16	FR57-IN-H	1.9E-02	1.0	1.89%	YES		1.93%
4	1,3-Butadiene	2	FR57-EF-A	1.9E-02	1.0	1.90%	YES		1.93%
4	1,3-Butadiene	4	FR57-EF-B	1.9E-02	1.0	1.93%	YES		1.93%
4	1,3-Butadiene	6	FR57-EF-C	1.9E-02	1.0	1.89%	YES		1.93%
4	1,3-Butadiene	8	FR57-EF-D	1.9E-02	1.0	1.92%	YES		1.93%
4	1,3-Butadiene	10	FR57-EF-E	1.9E-02	1.0	1.87%	YES		1.93%
4	1,3-Butadiene	12	FR57-EF-F	1.8E-02	1.0	1.76%	YES		1.93%
4	1,3-Butadiene	14	FR57-EF-G	1.9E-02	1.0	1.87%	YES		1.93%
4	1,3-Butadiene	16	FR57-EF-H	1.9E-02	1.0	1.85%	YES		1.93%
5	Benzene	2	TL-IN-A	2.5E-04	0.50	0.050%		JY	0.0195%
5	Benzene	4	TL-IN-B	2.8E-04	0.50	0.056%		J	0.0195%
5	Benzene	6	TL-IN-C	2.6E-04	0.50	0.052%		J	0.0195%
5	Benzene	8	TL-IN-D	2.1E-04	0.50	0.042%		J	0.0195%
5	Benzene	10	TL-IN-E	2.7E-04	0.50	0.054%		J	0.0195%
5	Benzene	12	TL-IN-F	2.7E-04	0.50	0.054%		J	0.0195%
5	Benzene	14	TL-IN-G	4.6E-04	0.50	0.092%		J	0.0195%
5	Benzene	16	TL-IN-H	3.2E-04	0.50	0.065%		J	0.0195%
5	Benzene	2	TL-EF-A	1.1E-04	0.50	0.023%		J	0.0195%
5	Benzene	4	TL-EF-B	1.1E-04	0.50	0.021%		JY	0.0195%
5	Benzene	6	TL-EF-C	1.3E-04	0.50	0.027%		J	0.0195%
5	Benzene	8	TL-EF-D	1.2E-04	0.50	0.023%		J	0.0195%
5	Benzene	10	TL-EF-E	9.6E-05	0.50	0.019%		J	0.0195%
5	Benzene	12	TL-EF-F	1.2E-04	0.50	0.023%		J	0.0195%
5	Benzene	14	TL-EF-G	9.7E-05	0.50	0.019%	YES	U	0.0195%
5	Benzene	16	TL-EF-H	9.6E-05	0.50	0.019%	YES	U	0.0195%
5	Benzene	2	FR57-IN-A		0.50				0.0195%
5	Benzene	4	FR57-IN-B		0.50				0.0195%
5	Benzene	6	FR57-IN-C	2.3E-04	0.50	0.047%		J	0.0195%
5	Benzene	8	FR57-IN-D	2.9E-04	0.50	0.058%		J	0.0195%
5	Benzene	10	FR57-IN-E	2.9E-04	0.50	0.058%		J	0.0195%
5	Benzene	12	FR57-IN-F	2.7E-04	0.50	0.055%		J	0.0195%
5	Benzene	14	FR57-IN-G	2.4E-04	0.50	0.048%		J	0.0195%
5	Benzene	16	FR57-IN-H	2.5E-04	0.50	0.050%		J	0.0195%
5	Benzene	2	FR57-EF-A	8.8E-05	0.50	0.018%	YES	U	0.0195%
5	Benzene	4	FR57-EF-B	1.1E-04	0.50	0.023%		J	0.0195%
5	Benzene	6	FR57-EF-C	1.4E-04	0.50	0.029%		J	0.0195%
5	Benzene	8	FR57-EF-D	1.9E-04	0.50	0.038%		J	0.0195%
5	Benzene	10	FR57-EF-E	1.0E-04	0.50	0.020%		J	0.0195%
5	Benzene	12	FR57-EF-F	2.5E-04	0.50	0.049%		J	0.0195%
5	Benzene	14	FR57-EF-G	1.3E-04	0.50	0.027%		J	0.0195%
5	Benzene	16	FR57-EF-H		0.50				0.0195%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
6	Biphenyl	2	TL-IN-A	8.3E-05	0.20	0.042%	YES	U	0.0422%
6	Biphenyl	4	TL-IN-B	8.6E-05	0.20	0.043%		J	0.0422%
6	Biphenyl	6	TL-IN-C	8.7E-05	0.20	0.043%		J	0.0422%
6	Biphenyl	8	TL-IN-D	6.9E-05	0.20	0.035%		J	0.0422%
6	Biphenyl	10	TL-IN-E	8.9E-05	0.20	0.044%		J	0.0422%
6	Biphenyl	12	TL-IN-F	6.7E-05	0.20	0.034%		J	0.0422%
6	Biphenyl	14	TL-IN-G	6.1E-05	0.20	0.030%		J	0.0422%
6	Biphenyl	16	TL-IN-H	8.1E-05	0.20	0.041%	YES	U	0.0422%
6	Biphenyl	2	TL-EF-A	7.7E-05	0.20	0.038%	YES	U	0.0422%
6	Biphenyl	4	TL-EF-B	6.9E-05	0.20	0.035%		J	0.0422%
6	Biphenyl	6	TL-EF-C	7.8E-05	0.20	0.039%		JY	0.0422%
6	Biphenyl	8	TL-EF-D	8.4E-05	0.20	0.042%	YES	U	0.0422%
6	Biphenyl	10	TL-EF-E	8.1E-05	0.20	0.041%	YES	U	0.0422%
6	Biphenyl	12	TL-EF-F	7.7E-05	0.20	0.039%	YES	U	0.0422%
6	Biphenyl	14	TL-EF-G	8.0E-05	0.20	0.040%	YES	U	0.0422%
6	Biphenyl	16	TL-EF-H	8.3E-05	0.20	0.041%	YES	U	0.0422%
6	Biphenyl	2	FR57-IN-A	7.7E-05	0.20	0.038%	YES	U	0.0422%
6	Biphenyl	4	FR57-IN-B	6.2E-05	0.20	0.031%		J	0.0422%
6	Biphenyl	6	FR57-IN-C	1.1E-04	0.20	0.053%		J	0.0422%
6	Biphenyl	8	FR57-IN-D	7.0E-05	0.20	0.035%		J	0.0422%
6	Biphenyl	10	FR57-IN-E	7.1E-05	0.20	0.036%		J	0.0422%
6	Biphenyl	12	FR57-IN-F	4.6E-05	0.20	0.023%	YES	U	0.0422%
6	Biphenyl	14	FR57-IN-G	4.4E-05	0.20	0.022%	YES	U	0.0422%
6	Biphenyl	16	FR57-IN-H	8.6E-05	0.20	0.043%		J	0.0422%
6	Biphenyl	2	FR57-EF-A	7.7E-05	0.20	0.039%	YES	U	0.0422%
6	Biphenyl	4	FR57-EF-B	7.8E-05	0.20	0.039%	YES	U	0.0422%
6	Biphenyl	6	FR57-EF-C	8.8E-05	0.20	0.044%		J	0.0422%
6	Biphenyl	8	FR57-EF-D	1.0E-04	0.20	0.051%		J	0.0422%
6	Biphenyl	10	FR57-EF-E	8.3E-05	0.20	0.042%	YES	U	0.0422%
6	Biphenyl	12	FR57-EF-F	8.1E-05	0.20	0.041%	YES	U	0.0422%
6	Biphenyl	14	FR57-EF-G	8.2E-05	0.20	0.041%	YES	U	0.0422%
6	Biphenyl	16	FR57-EF-H	8.4E-05	0.20	0.042%	YES	U	0.0422%
7	1-Butanol	2	TL-IN-A	3.5E-03	20	0.018%		Y	0.000940%
7	1-Butanol	4	TL-IN-B	3.3E-03	20	0.016%			0.000940%
7	1-Butanol	6	TL-IN-C	2.8E-03	20	0.014%			0.000940%
7	1-Butanol	8	TL-IN-D	2.4E-03	20	0.012%			0.000940%
7	1-Butanol	10	TL-IN-E	3.1E-03	20	0.016%			0.000940%
7	1-Butanol	12	TL-IN-F	1.9E-03	20	0.009%		J	0.000940%
7	1-Butanol	14	TL-IN-G	1.6E-03	20	0.008%		J	0.000940%
7	1-Butanol	16	TL-IN-H	2.3E-03	20	0.011%			0.000940%
7	1-Butanol	2	TL-EF-A	7.6E-04	20	0.004%		J	0.000940%
7	1-Butanol	4	TL-EF-B	3.3E-04	20	0.002%		JY	0.000940%
7	1-Butanol	6	TL-EF-C	1.5E-03	20	0.007%		J	0.000940%
7	1-Butanol	8	TL-EF-D	4.3E-04	20	0.002%		J	0.000940%
7	1-Butanol	10	TL-EF-E	5.7E-04	20	0.003%		J	0.000940%
7	1-Butanol	12	TL-EF-F	9.7E-04	20	0.005%		J	0.000940%
7	1-Butanol	14	TL-EF-G	1.9E-04	20	0.001%	YES	U	0.000940%
7	1-Butanol	16	TL-EF-H	6.4E-04	20	0.003%		J	0.000940%
7	1-Butanol	2	FR57-IN-A		20				0.000940%
7	1-Butanol	4	FR57-IN-B		20				0.000940%
7	1-Butanol	6	FR57-IN-C	2.1E-03	20	0.011%		L	0.000940%
7	1-Butanol	8	FR57-IN-D	4.8E-03	20	0.024%		L	0.000940%
7	1-Butanol	10	FR57-IN-E	4.0E-03	20	0.020%		L	0.000940%
7	1-Butanol	12	FR57-IN-F	3.7E-03	20	0.018%		L	0.000940%
7	1-Butanol	14	FR57-IN-G	1.8E-03	20	0.009%		JL	0.000940%
7	1-Butanol	16	FR57-IN-H	3.8E-03	20	0.019%			0.000940%
7	1-Butanol	2	FR57-EF-A	1.7E-04	20	0.001%	YES	U	0.000940%
7	1-Butanol	4	FR57-EF-B	5.5E-04	20	0.003%		J	0.000940%
7	1-Butanol	6	FR57-EF-C	6.7E-04	20	0.003%		J	0.000940%
7	1-Butanol	8	FR57-EF-D	2.9E-03	20	0.014%			0.000940%
7	1-Butanol	10	FR57-EF-E	7.8E-04	20	0.004%		J	0.000940%
7	1-Butanol	12	FR57-EF-F	1.9E-04	20	0.001%		J	0.000940%
7	1-Butanol	14	FR57-EF-G	1.7E-03	20	0.008%		J	0.000940%
7	1-Butanol	16	FR57-EF-H		20				0.000940%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
8	Methanol	2	TL-IN-A	1.6E+00	200	0.807%	YES	, S*	1.02%
8	Methanol	4	TL-IN-B	1.8E+00	200	0.920%	YES		1.02%
8	Methanol	6	TL-IN-C	1.9E+00	200	0.946%	YES		1.02%
8	Methanol	8	TL-IN-D	2.0E+00	200	1.02%	YES		1.02%
8	Methanol	10	TL-IN-E	2.0E+00	200	0.999%	YES		1.02%
8	Methanol	12	TL-IN-F	1.9E+00	200	0.969%	YES		1.02%
8	Methanol	14	TL-IN-G	1.9E+00	200	0.958%	YES		1.02%
8	Methanol	16	TL-IN-H	1.9E+00	200	0.936%	YES		1.02%
8	Methanol	2	TL-EF-A	1.8E+00	200	0.892%	YES		1.02%
8	Methanol	4	TL-EF-B	1.8E+00	200	0.888%	YES		1.02%
8	Methanol	6	TL-EF-C	2.0E+00	200	0.987%	YES		1.02%
8	Methanol	8	TL-EF-D	2.0E+00	200	1.02%	YES		1.02%
8	Methanol	10	TL-EF-E	1.8E+00	200	0.920%	YES		1.02%
8	Methanol	12	TL-EF-F	1.9E+00	200	0.933%	YES		1.02%
8	Methanol	14	TL-EF-G	2.0E+00	200	0.992%	YES		1.02%
8	Methanol	16	TL-EF-H	2.0E+00	200	0.979%	YES		1.02%
8	Methanol	2	FR57-IN-A	1.8E+00	200	0.879%	YES		1.02%
8	Methanol	4	FR57-IN-B	1.8E+00	200	0.906%	YES		1.02%
8	Methanol	6	FR57-IN-C	1.8E+00	200	0.894%	YES		1.02%
8	Methanol	8	FR57-IN-D	1.9E+00	200	0.937%	YES		1.02%
8	Methanol	10	FR57-IN-E	1.8E+00	200	0.923%	YES		1.02%
8	Methanol	12	FR57-IN-F	1.9E+00	200	0.933%	YES		1.02%
8	Methanol	14	FR57-IN-G	2.0E+00	200	0.985%	YES		1.02%
8	Methanol	16	FR57-IN-H	1.9E+00	200	0.971%	YES		1.02%
8	Methanol	2	FR57-EF-A	1.7E+00	200	0.873%	YES		1.02%
8	Methanol	4	FR57-EF-B	1.8E+00	200	0.910%	YES		1.02%
8	Methanol	6	FR57-EF-C	1.8E+00	200	0.902%	YES		1.02%
8	Methanol	8	FR57-EF-D	1.9E+00	200	0.925%	YES		1.02%
8	Methanol	10	FR57-EF-E	1.9E+00	200	0.966%	YES		1.02%
8	Methanol	12	FR57-EF-F	1.9E+00	200	0.969%	YES		1.02%
8	Methanol	14	FR57-EF-G	1.9E+00	200	0.943%	YES		1.02%
8	Methanol	16	FR57-EF-H	2.0E+00	200	0.979%	YES		1.02%
9	2-Hexanone	2	TL-IN-A	2.0E-04	5.0	0.004%		JY	0.00206%
9	2-Hexanone	4	TL-IN-B	2.6E-04	5.0	0.005%		J	0.00206%
9	2-Hexanone	6	TL-IN-C	2.4E-04	5.0	0.005%		J	0.00206%
9	2-Hexanone	8	TL-IN-D	2.0E-04	5.0	0.004%		J	0.00206%
9	2-Hexanone	10	TL-IN-E	2.1E-04	5.0	0.004%		J	0.00206%
9	2-Hexanone	12	TL-IN-F	2.1E-04	5.0	0.004%		J	0.00206%
9	2-Hexanone	14	TL-IN-G	2.1E-04	5.0	0.004%		J	0.00206%
9	2-Hexanone	16	TL-IN-H	1.9E-04	5.0	0.004%		J	0.00206%
9	2-Hexanone	2	TL-EF-A	9.0E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	4	TL-EF-B	8.8E-05	5.0	0.002%	YES	UY	0.00206%
9	2-Hexanone	6	TL-EF-C	9.2E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	8	TL-EF-D	1.0E-04	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	10	TL-EF-E	1.0E-04	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	12	TL-EF-F	9.6E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	14	TL-EF-G	1.0E-04	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	16	TL-EF-H	1.0E-04	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	2	FR57-IN-A		5.0				0.00206%
9	2-Hexanone	4	FR57-IN-B		5.0				0.00206%
9	2-Hexanone	6	FR57-IN-C	2.6E-04	5.0	0.005%		J	0.00206%
9	2-Hexanone	8	FR57-IN-D	2.4E-04	5.0	0.005%		J	0.00206%
9	2-Hexanone	10	FR57-IN-E	2.0E-04	5.0	0.004%		J	0.00206%
9	2-Hexanone	12	FR57-IN-F	2.3E-04	5.0	0.005%		J	0.00206%
9	2-Hexanone	14	FR57-IN-G	2.3E-04	5.0	0.005%		J	0.00206%
9	2-Hexanone	16	FR57-IN-H	1.9E-04	5.0	0.004%		J	0.00206%
9	2-Hexanone	2	FR57-EF-A	9.1E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	4	FR57-EF-B	9.5E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	6	FR57-EF-C	9.5E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	8	FR57-EF-D	9.2E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	10	FR57-EF-E	9.7E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	12	FR57-EF-F	9.6E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	14	FR57-EF-G	9.9E-05	5.0	0.002%	YES	U	0.00206%
9	2-Hexanone	16	FR57-EF-H		5.0				0.00206%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
11	4-Methyl-2-hexanone	2	TL-IN-A	7.5E-05	0.50	0.015%	YES	UY	0.0158%
11	4-Methyl-2-hexanone	4	TL-IN-B	7.5E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	6	TL-IN-C	7.5E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	8	TL-IN-D	7.7E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	10	TL-IN-E	7.0E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	12	TL-IN-F	7.4E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	14	TL-IN-G	7.4E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	16	TL-IN-H	7.4E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	2	TL-EF-A	6.9E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	4	TL-EF-B	6.7E-05	0.50	0.013%	YES	UY	0.0158%
11	4-Methyl-2-hexanone	6	TL-EF-C	7.1E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	8	TL-EF-D	7.9E-05	0.50	0.016%	YES	U	0.0158%
11	4-Methyl-2-hexanone	10	TL-EF-E	7.7E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	12	TL-EF-F	7.4E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	14	TL-EF-G	7.8E-05	0.50	0.016%	YES	U	0.0158%
11	4-Methyl-2-hexanone	16	TL-EF-H	7.7E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	2	FR57-IN-A		0.50				0.0158%
11	4-Methyl-2-hexanone	4	FR57-IN-B		0.50				0.0158%
11	4-Methyl-2-hexanone	6	FR57-IN-C	7.0E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	8	FR57-IN-D	7.1E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	10	FR57-IN-E	7.8E-05	0.50	0.016%	YES	U	0.0158%
11	4-Methyl-2-hexanone	12	FR57-IN-F	7.7E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	14	FR57-IN-G	7.2E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	16	FR57-IN-H	7.2E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	2	FR57-EF-A	7.0E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	4	FR57-EF-B	7.3E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	6	FR57-EF-C	7.3E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	8	FR57-EF-D	7.0E-05	0.50	0.014%	YES	U	0.0158%
11	4-Methyl-2-hexanone	10	FR57-EF-E	7.4E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	12	FR57-EF-F	7.4E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	14	FR57-EF-G	7.6E-05	0.50	0.015%	YES	U	0.0158%
11	4-Methyl-2-hexanone	16	FR57-EF-H		0.50				0.0158%
13	3-Buten-2-one	2	TL-IN-A	2.3E-04	0.20	0.113%		JY	0.106%
13	3-Buten-2-one	4	TL-IN-B	4.9E-04	0.20	0.243%		J	0.106%
13	3-Buten-2-one	6	TL-IN-C	3.6E-04	0.20	0.178%		J	0.106%
13	3-Buten-2-one	8	TL-IN-D	3.2E-04	0.20	0.161%		J	0.106%
13	3-Buten-2-one	10	TL-IN-E	2.4E-04	0.20	0.119%		J	0.106%
13	3-Buten-2-one	12	TL-IN-F	2.3E-04	0.20	0.116%		J	0.106%
13	3-Buten-2-one	14	TL-IN-G	2.4E-04	0.20	0.121%		J	0.106%
13	3-Buten-2-one	16	TL-IN-H	2.2E-04	0.20	0.112%		J	0.106%
13	3-Buten-2-one	2	TL-EF-A	1.8E-04	0.20	0.092%	YES	U	0.106%
13	3-Buten-2-one	4	TL-EF-B	1.8E-04	0.20	0.090%	YES	UY	0.106%
13	3-Buten-2-one	6	TL-EF-C	1.9E-04	0.20	0.095%	YES	U	0.106%
13	3-Buten-2-one	8	TL-EF-D	2.1E-04	0.20	0.106%	YES	U	0.106%
13	3-Buten-2-one	10	TL-EF-E	2.1E-04	0.20	0.103%	YES	U	0.106%
13	3-Buten-2-one	12	TL-EF-F	2.0E-04	0.20	0.099%	YES	U	0.106%
13	3-Buten-2-one	14	TL-EF-G	2.1E-04	0.20	0.104%	YES	U	0.106%
13	3-Buten-2-one	16	TL-EF-H	2.0E-04	0.20	0.102%	YES	U	0.106%
13	3-Buten-2-one	2	FR57-IN-A		0.20				0.106%
13	3-Buten-2-one	4	FR57-IN-B		0.20				0.106%
13	3-Buten-2-one	6	FR57-IN-C	4.2E-04	0.20	0.211%		J	0.106%
13	3-Buten-2-one	8	FR57-IN-D	3.6E-04	0.20	0.179%		J	0.106%
13	3-Buten-2-one	10	FR57-IN-E	3.2E-04	0.20	0.158%		J	0.106%
13	3-Buten-2-one	12	FR57-IN-F	3.4E-04	0.20	0.171%		J	0.106%
13	3-Buten-2-one	14	FR57-IN-G	2.7E-04	0.20	0.135%		J	0.106%
13	3-Buten-2-one	16	FR57-IN-H	2.9E-04	0.20	0.147%		J	0.106%
13	3-Buten-2-one	2	FR57-EF-A	1.9E-04	0.20	0.094%	YES	U	0.106%
13	3-Buten-2-one	4	FR57-EF-B	2.0E-04	0.20	0.098%	YES	U	0.106%
13	3-Buten-2-one	6	FR57-EF-C	1.9E-04	0.20	0.097%	YES	U	0.106%
13	3-Buten-2-one	8	FR57-EF-D	1.9E-04	0.20	0.094%	YES	U	0.106%
13	3-Buten-2-one	10	FR57-EF-E	2.0E-04	0.20	0.100%	YES	U	0.106%
13	3-Buten-2-one	12	FR57-EF-F	2.0E-04	0.20	0.098%	YES	U	0.106%
13	3-Buten-2-one	14	FR57-EF-G	2.0E-04	0.20	0.102%	YES	U	0.106%
13	3-Buten-2-one	16	FR57-EF-H		0.20				0.106%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
14	Formaldehyde	2	TL-IN-A	5.1E-02	0.30	16.8%			0.566%
14	Formaldehyde	4	TL-IN-B	4.9E-02	0.30	16.4%			0.566%
14	Formaldehyde	6	TL-IN-C	4.6E-02	0.30	15.5%			0.566%
14	Formaldehyde	8	TL-IN-D	4.2E-02	0.30	14.1%			0.566%
14	Formaldehyde	10	TL-IN-E	4.5E-02	0.30	14.9%			0.566%
14	Formaldehyde	12	TL-IN-F	4.3E-02	0.30	14.4%			0.566%
14	Formaldehyde	14	TL-IN-G	3.5E-02	0.30	11.8%			0.566%
14	Formaldehyde	16	TL-IN-H	3.6E-02	0.30	11.9%			0.566%
14	Formaldehyde	2	TL-EF-A	4.3E-03	0.30	1.42%			0.566%
14	Formaldehyde	4	TL-EF-B	4.5E-03	0.30	1.50%			0.566%
14	Formaldehyde	6	TL-EF-C	7.7E-03	0.30	2.56%			0.566%
14	Formaldehyde	8	TL-EF-D	8.9E-03	0.30	2.96%			0.566%
14	Formaldehyde	10	TL-EF-E	1.1E-02	0.30	3.50%			0.566%
14	Formaldehyde	12	TL-EF-F	9.9E-03	0.30	3.31%			0.566%
14	Formaldehyde	14	TL-EF-G	8.2E-03	0.30	2.72%			0.566%
14	Formaldehyde	16	TL-EF-H	6.6E-03	0.30	2.20%			0.566%
14	Formaldehyde	2	FR57-IN-A	4.7E-02	0.30	15.5%			0.566%
14	Formaldehyde	4	FR57-IN-B	5.0E-02	0.30	16.7%			0.566%
14	Formaldehyde	6	FR57-IN-C	4.6E-02	0.30	15.4%			0.566%
14	Formaldehyde	8	FR57-IN-D	4.7E-02	0.30	15.6%			0.566%
14	Formaldehyde	10	FR57-IN-E	4.9E-02	0.30	16.4%			0.566%
14	Formaldehyde	12	FR57-IN-F	4.6E-02	0.30	15.3%			0.566%
14	Formaldehyde	14	FR57-IN-G	4.0E-02	0.30	13.5%			0.566%
14	Formaldehyde	16	FR57-IN-H	4.4E-02	0.30	14.7%			0.566%
14	Formaldehyde	2	FR57-EF-A	1.7E-03	0.30	0.556%			0.566%
14	Formaldehyde	4	FR57-EF-B	8.8E-03	0.30	2.92%			0.566%
14	Formaldehyde	6	FR57-EF-C	2.2E-02	0.30	7.22%			0.566%
14	Formaldehyde	8	FR57-EF-D	2.7E-02	0.30	8.90%			0.566%
14	Formaldehyde	10	FR57-EF-E	2.3E-02	0.30	7.78%			0.566%
14	Formaldehyde	12	FR57-EF-F	1.4E-02	0.30	4.75%			0.566%
14	Formaldehyde	14	FR57-EF-G	1.6E-02	0.30	5.22%			0.566%
14	Formaldehyde	16	FR57-EF-H	1.1E-02	0.30	3.63%			0.566%
15	Acetaldehyde	2	TL-IN-A	8.5E-02	25	0.340%			0.00463%
15	Acetaldehyde	4	TL-IN-B	8.3E-02	25	0.331%			0.00463%
15	Acetaldehyde	6	TL-IN-C	7.7E-02	25	0.307%			0.00463%
15	Acetaldehyde	8	TL-IN-D	7.8E-02	25	0.310%			0.00463%
15	Acetaldehyde	10	TL-IN-E	8.7E-02	25	0.349%			0.00463%
15	Acetaldehyde	12	TL-IN-F	8.4E-02	25	0.336%			0.00463%
15	Acetaldehyde	14	TL-IN-G	7.0E-02	25	0.281%			0.00463%
15	Acetaldehyde	16	TL-IN-H	7.1E-02	25	0.282%			0.00463%
15	Acetaldehyde	2	TL-EF-A	4.3E-02	25	0.170%			0.00463%
15	Acetaldehyde	4	TL-EF-B	8.1E-02	25	0.325%			0.00463%
15	Acetaldehyde	6	TL-EF-C	8.9E-02	25	0.355%			0.00463%
15	Acetaldehyde	8	TL-EF-D	7.6E-02	25	0.305%			0.00463%
15	Acetaldehyde	10	TL-EF-E	7.2E-02	25	0.286%			0.00463%
15	Acetaldehyde	12	TL-EF-F	7.0E-02	25	0.279%			0.00463%
15	Acetaldehyde	14	TL-EF-G	6.0E-02	25	0.239%			0.00463%
15	Acetaldehyde	16	TL-EF-H	5.8E-02	25	0.231%			0.00463%
15	Acetaldehyde	2	FR57-IN-A	7.7E-02	25	0.308%			0.00463%
15	Acetaldehyde	4	FR57-IN-B	7.3E-02	25	0.291%			0.00463%
15	Acetaldehyde	6	FR57-IN-C	6.8E-02	25	0.271%			0.00463%
15	Acetaldehyde	8	FR57-IN-D	7.0E-02	25	0.282%			0.00463%
15	Acetaldehyde	10	FR57-IN-E	7.4E-02	25	0.294%			0.00463%
15	Acetaldehyde	12	FR57-IN-F	6.9E-02	25	0.278%			0.00463%
15	Acetaldehyde	14	FR57-IN-G	7.1E-02	25	0.285%			0.00463%
15	Acetaldehyde	16	FR57-IN-H	7.9E-02	25	0.315%			0.00463%
15	Acetaldehyde	2	FR57-EF-A	3.6E-02	25	0.146%			0.00463%
15	Acetaldehyde	4	FR57-EF-B	8.5E-02	25	0.340%			0.00463%
15	Acetaldehyde	6	FR57-EF-C	1.2E-01	25	0.470%			0.00463%
15	Acetaldehyde	8	FR57-EF-D	1.2E-01	25	0.479%			0.00463%
15	Acetaldehyde	10	FR57-EF-E	8.6E-02	25	0.346%			0.00463%
15	Acetaldehyde	12	FR57-EF-F	5.9E-02	25	0.237%			0.00463%
15	Acetaldehyde	14	FR57-EF-G	7.3E-02	25	0.293%			0.00463%
15	Acetaldehyde	16	FR57-EF-H	7.0E-02	25	0.279%			0.00463%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
16	Butanal/Butyraldehyde	2	TL-IN-A	4.1E-04	25	0.002%		JY	0.000527%
16	Butanal/Butyraldehyde	4	TL-IN-B	7.6E-04	25	0.003%		J	0.000527%
16	Butanal/Butyraldehyde	6	TL-IN-C	4.5E-04	25	0.002%		J	0.000527%
16	Butanal/Butyraldehyde	8	TL-IN-D	4.8E-04	25	0.002%		J	0.000527%
16	Butanal/Butyraldehyde	10	TL-IN-E	5.1E-04	25	0.002%		J	0.000527%
16	Butanal/Butyraldehyde	12	TL-IN-F	4.6E-04	25	0.002%		J	0.000527%
16	Butanal/Butyraldehyde	14	TL-IN-G	4.4E-04	25	0.002%		J	0.000527%
16	Butanal/Butyraldehyde	16	TL-IN-H	6.4E-04	25	0.003%		J	0.000527%
16	Butanal/Butyraldehyde	2	TL-EF-A	1.2E-04	25	0.000%	YES	U	0.000527%
16	Butanal/Butyraldehyde	4	TL-EF-B	1.1E-04	25	0.000%	YES	UY	0.000527%
16	Butanal/Butyraldehyde	6	TL-EF-C	1.2E-04	25	0.000%		J	0.000527%
16	Butanal/Butyraldehyde	8	TL-EF-D	2.8E-04	25	0.001%		J	0.000527%
16	Butanal/Butyraldehyde	10	TL-EF-E	1.3E-04	25	0.001%	YES	U	0.000527%
16	Butanal/Butyraldehyde	12	TL-EF-F	1.3E-04	25	0.001%	YES	U	0.000527%
16	Butanal/Butyraldehyde	14	TL-EF-G	1.3E-04	25	0.001%	YES	U	0.000527%
16	Butanal/Butyraldehyde	16	TL-EF-H	1.3E-04	25	0.001%	YES	U	0.000527%
16	Butanal/Butyraldehyde	2	FR57-IN-A		25				0.000527%
16	Butanal/Butyraldehyde	4	FR57-IN-B		25				0.000527%
16	Butanal/Butyraldehyde	6	FR57-IN-C	8.7E-04	25	0.003%		J	0.000527%
16	Butanal/Butyraldehyde	8	FR57-IN-D	8.9E-04	25	0.004%		J	0.000527%
16	Butanal/Butyraldehyde	10	FR57-IN-E	6.1E-04	25	0.002%		J	0.000527%
16	Butanal/Butyraldehyde	12	FR57-IN-F	6.6E-04	25	0.003%		J	0.000527%
16	Butanal/Butyraldehyde	14	FR57-IN-G	5.5E-04	25	0.002%		J	0.000527%
16	Butanal/Butyraldehyde	16	FR57-IN-H	6.5E-04	25	0.003%		J	0.000527%
16	Butanal/Butyraldehyde	2	FR57-EF-A	1.2E-04	25	0.000%	YES	U	0.000527%
16	Butanal/Butyraldehyde	4	FR57-EF-B	1.2E-04	25	0.000%	YES	U	0.000527%
16	Butanal/Butyraldehyde	6	FR57-EF-C	1.3E-04	25	0.001%		J	0.000527%
16	Butanal/Butyraldehyde	8	FR57-EF-D	1.7E-04	25	0.001%		J	0.000527%
16	Butanal/Butyraldehyde	10	FR57-EF-E	1.3E-04	25	0.001%	YES	U	0.000527%
16	Butanal/Butyraldehyde	12	FR57-EF-F	1.2E-04	25	0.000%	YES	U	0.000527%
16	Butanal/Butyraldehyde	14	FR57-EF-G	1.3E-04	25	0.001%	YES	U	0.000527%
16	Butanal/Butyraldehyde	16	FR57-EF-H		25				0.000527%
19	2-Propenal/Acrolein	2	TL-IN-A	9.0E-04	0.100	0.902%	YES		0.909%
19	2-Propenal/Acrolein	4	TL-IN-B	8.8E-04	0.100	0.878%	YES		0.909%
19	2-Propenal/Acrolein	6	TL-IN-C	8.9E-04	0.100	0.887%	YES		0.909%
19	2-Propenal/Acrolein	8	TL-IN-D	8.7E-04	0.100	0.871%	YES		0.909%
19	2-Propenal/Acrolein	10	TL-IN-E	8.6E-04	0.100	0.856%	YES		0.909%
19	2-Propenal/Acrolein	12	TL-IN-F	8.9E-04	0.100	0.892%	YES		0.909%
19	2-Propenal/Acrolein	14	TL-IN-G	8.6E-04	0.100	0.863%	YES		0.909%
19	2-Propenal/Acrolein	16	TL-IN-H	8.7E-04	0.100	0.867%	YES		0.909%
19	2-Propenal/Acrolein	2	TL-EF-A	8.8E-04	0.100	0.879%	YES		0.909%
19	2-Propenal/Acrolein	4	TL-EF-B	8.6E-04	0.100	0.863%	YES		0.909%
19	2-Propenal/Acrolein	6	TL-EF-C	9.0E-04	0.100	0.895%	YES		0.909%
19	2-Propenal/Acrolein	8	TL-EF-D	8.8E-04	0.100	0.880%	YES		0.909%
19	2-Propenal/Acrolein	10	TL-EF-E	8.8E-04	0.100	0.879%	YES		0.909%
19	2-Propenal/Acrolein	12	TL-EF-F	8.6E-04	0.100	0.858%	YES		0.909%
19	2-Propenal/Acrolein	14	TL-EF-G	8.4E-04	0.100	0.840%	YES		0.909%
19	2-Propenal/Acrolein	16	TL-EF-H	8.4E-04	0.100	0.840%	YES		0.909%
19	2-Propenal/Acrolein	2	FR57-IN-A	8.9E-04	0.100	0.891%	YES		0.909%
19	2-Propenal/Acrolein	4	FR57-IN-B	8.9E-04	0.100	0.892%	YES		0.909%
19	2-Propenal/Acrolein	6	FR57-IN-C	8.9E-04	0.100	0.886%	YES		0.909%
19	2-Propenal/Acrolein	8	FR57-IN-D	8.9E-04	0.100	0.892%	YES		0.909%
19	2-Propenal/Acrolein	10	FR57-IN-E	8.8E-04	0.100	0.876%	YES		0.909%
19	2-Propenal/Acrolein	12	FR57-IN-F	8.8E-04	0.100	0.880%	YES		0.909%
19	2-Propenal/Acrolein	14	FR57-IN-G	9.0E-04	0.100	0.902%	YES		0.909%
19	2-Propenal/Acrolein	16	FR57-IN-H	9.1E-04	0.100	0.909%	YES		0.909%
19	2-Propenal/Acrolein	2	FR57-EF-A	8.9E-04	0.100	0.894%	YES		0.909%
19	2-Propenal/Acrolein	4	FR57-EF-B	9.0E-04	0.100	0.904%	YES		0.909%
19	2-Propenal/Acrolein	6	FR57-EF-C	9.1E-04	0.100	0.906%	YES		0.909%
19	2-Propenal/Acrolein	8	FR57-EF-D	9.0E-04	0.100	0.905%	YES		0.909%
19	2-Propenal/Acrolein	10	FR57-EF-E	8.9E-04	0.100	0.893%	YES		0.909%
19	2-Propenal/Acrolein	12	FR57-EF-F	8.3E-04	0.100	0.830%	YES		0.909%
19	2-Propenal/Acrolein	14	FR57-EF-G	8.7E-04	0.100	0.874%	YES		0.909%
19	2-Propenal/Acrolein	16	FR57-EF-H	8.8E-04	0.100	0.883%	YES		0.909%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
20	Furan	2	TL-IN-A	3.8E-04	0.001	37.7%	YES	UY	39.8%
20	Furan	4	TL-IN-B	3.8E-04	0.001	37.6%	YES	U	39.8%
20	Furan	6	TL-IN-C	3.8E-04	0.001	37.6%	YES	U	39.8%
20	Furan	8	TL-IN-D	3.9E-04	0.001	38.6%	YES	U	39.8%
20	Furan	10	TL-IN-E	3.5E-04	0.001	35.5%	YES	U	39.8%
20	Furan	12	TL-IN-F	3.7E-04	0.001	37.3%	YES	U	39.8%
20	Furan	14	TL-IN-G	3.7E-04	0.001	37.4%	YES	U	39.8%
20	Furan	16	TL-IN-H	3.7E-04	0.001	37.3%	YES	U	39.8%
20	Furan	2	TL-EF-A	3.5E-04	0.001	34.6%	YES	U	39.8%
20	Furan	4	TL-EF-B	3.4E-04	0.001	33.9%	YES	UY	39.8%
20	Furan	6	TL-EF-C	3.6E-04	0.001	35.7%	YES	U	39.8%
20	Furan	8	TL-EF-D	4.0E-04	0.001	39.8%	YES	U	39.8%
20	Furan	10	TL-EF-E	3.9E-04	0.001	38.7%	YES	U	39.8%
20	Furan	12	TL-EF-F	3.7E-04	0.001	37.1%	YES	U	39.8%
20	Furan	14	TL-EF-G	3.9E-04	0.001	39.1%	YES	U	39.8%
20	Furan	16	TL-EF-H	3.9E-04	0.001	38.5%	YES	U	39.8%
20	Furan	2	FR57-IN-A		0.001				39.8%
20	Furan	4	FR57-IN-B		0.001				39.8%
20	Furan	6	FR57-IN-C	3.5E-04	0.001	35.1%	YES	U	39.8%
20	Furan	8	FR57-IN-D	3.6E-04	0.001	35.9%	YES	U	39.8%
20	Furan	10	FR57-IN-E	3.9E-04	0.001	39.1%	YES	U	39.8%
20	Furan	12	FR57-IN-F	3.9E-04	0.001	38.9%	YES	U	39.8%
20	Furan	14	FR57-IN-G	3.6E-04	0.001	36.4%	YES	U	39.8%
20	Furan	16	FR57-IN-H	3.6E-04	0.001	36.4%	YES	U	39.8%
20	Furan	2	FR57-EF-A	3.5E-04	0.001	35.3%	YES	U	39.8%
20	Furan	4	FR57-EF-B	3.7E-04	0.001	36.7%	YES	U	39.8%
20	Furan	6	FR57-EF-C	3.7E-04	0.001	36.6%	YES	U	39.8%
20	Furan	8	FR57-EF-D	3.5E-04	0.001	35.4%	YES	U	39.8%
20	Furan	10	FR57-EF-E	3.7E-04	0.001	37.5%	YES	U	39.8%
20	Furan	12	FR57-EF-F	3.7E-04	0.001	37.0%	YES	U	39.8%
20	Furan	14	FR57-EF-G	3.8E-04	0.001	38.2%	YES	U	39.8%
20	Furan	16	FR57-EF-H		0.001				39.8%
21	2,3-Dihydrofuran	2	TL-IN-A	2.0E-05	0.001	2.05%	YES	U	2.22%
21	2,3-Dihydrofuran	4	TL-IN-B	2.0E-05	0.001	1.98%	YES	U	2.22%
21	2,3-Dihydrofuran	6	TL-IN-C	1.9E-05	0.001	1.93%	YES	U	2.22%
21	2,3-Dihydrofuran	8	TL-IN-D	2.1E-05	0.001	2.11%	YES	U	2.22%
21	2,3-Dihydrofuran	10	TL-IN-E	2.0E-05	0.001	1.98%	YES	U	2.22%
21	2,3-Dihydrofuran	12	TL-IN-F	2.1E-05	0.001	2.12%	YES	U	2.22%
21	2,3-Dihydrofuran	14	TL-IN-G	2.0E-05	0.001	2.04%	YES	U	2.22%
21	2,3-Dihydrofuran	16	TL-IN-H	2.2E-05	0.001	2.22%	YES	U	2.22%
21	2,3-Dihydrofuran	2	TL-EF-A	2.0E-05	0.001	1.96%	YES	U	2.22%
21	2,3-Dihydrofuran	4	TL-EF-B	2.0E-05	0.001	1.95%	YES	U	2.22%
21	2,3-Dihydrofuran	6	TL-EF-C	2.0E-05	0.001	1.95%	YES	U	2.22%
21	2,3-Dihydrofuran	8	TL-EF-D	2.0E-05	0.001	2.01%	YES	U	2.22%
21	2,3-Dihydrofuran	10	TL-EF-E	2.2E-05	0.001	2.15%	YES	U	2.22%
21	2,3-Dihydrofuran	12	TL-EF-F	2.0E-05	0.001	1.99%	YES	U	2.22%
21	2,3-Dihydrofuran	14	TL-EF-G	2.0E-05	0.001	1.99%	YES	U	2.22%
21	2,3-Dihydrofuran	16	TL-EF-H	2.0E-05	0.001	2.00%	YES	U	2.22%
21	2,3-Dihydrofuran	2	FR57-IN-A	1.9E-05	0.001	1.94%	YES	U	2.22%
21	2,3-Dihydrofuran	4	FR57-IN-B	1.9E-05	0.001	1.93%	YES	U	2.22%
21	2,3-Dihydrofuran	6	FR57-IN-C	1.9E-05	0.001	1.88%	YES	U	2.22%
21	2,3-Dihydrofuran	8	FR57-IN-D	2.0E-05	0.001	2.01%	YES	U	2.22%
21	2,3-Dihydrofuran	10	FR57-IN-E	2.1E-05	0.001	2.06%	YES	U	2.22%
21	2,3-Dihydrofuran	12	FR57-IN-F	2.1E-05	0.001	2.11%	YES	U	2.22%
21	2,3-Dihydrofuran	14	FR57-IN-G	2.0E-05	0.001	2.03%	YES	U	2.22%
21	2,3-Dihydrofuran	16	FR57-IN-H	2.0E-05	0.001	2.03%	YES	U	2.22%
21	2,3-Dihydrofuran	2	FR57-EF-A	2.0E-05	0.001	2.03%	YES	U	2.22%
21	2,3-Dihydrofuran	4	FR57-EF-B	1.9E-05	0.001	1.89%	YES	U	2.22%
21	2,3-Dihydrofuran	6	FR57-EF-C	2.0E-05	0.001	1.99%	YES	U	2.22%
21	2,3-Dihydrofuran	8	FR57-EF-D	2.0E-05	0.001	1.98%	YES	U	2.22%
21	2,3-Dihydrofuran	10	FR57-EF-E	2.1E-05	0.001	2.05%	YES	U	2.22%
21	2,3-Dihydrofuran	12	FR57-EF-F	2.0E-05	0.001	2.00%	YES	U	2.22%
21	2,3-Dihydrofuran	14	FR57-EF-G	2.0E-05	0.001	1.98%	YES	U	2.22%
21	2,3-Dihydrofuran	16	FR57-EF-H	2.1E-05	0.001	2.07%	YES	U	2.22%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
22	2,5-Dihydrofuran	2	TL-IN-A	1.7E-04	0.001	16.5%	YES	UY	17.5%
22	2,5-Dihydrofuran	4	TL-IN-B	1.6E-04	0.001	16.5%	YES	U	17.5%
22	2,5-Dihydrofuran	6	TL-IN-C	1.7E-04	0.001	16.5%	YES	U	17.5%
22	2,5-Dihydrofuran	8	TL-IN-D	1.7E-04	0.001	17.0%	YES	U	17.5%
22	2,5-Dihydrofuran	10	TL-IN-E	1.6E-04	0.001	15.6%	YES	U	17.5%
22	2,5-Dihydrofuran	12	TL-IN-F	1.6E-04	0.001	16.4%	YES	U	17.5%
22	2,5-Dihydrofuran	14	TL-IN-G	1.6E-04	0.001	16.5%	YES	U	17.5%
22	2,5-Dihydrofuran	16	TL-IN-H	1.6E-04	0.001	16.4%	YES	U	17.5%
22	2,5-Dihydrofuran	2	TL-EF-A	1.5E-04	0.001	15.2%	YES	U	17.5%
22	2,5-Dihydrofuran	4	TL-EF-B	1.5E-04	0.001	14.9%	YES	UY	17.5%
22	2,5-Dihydrofuran	6	TL-EF-C	1.6E-04	0.001	15.7%	YES	U	17.5%
22	2,5-Dihydrofuran	8	TL-EF-D	1.7E-04	0.001	17.5%	YES	U	17.5%
22	2,5-Dihydrofuran	10	TL-EF-E	1.7E-04	0.001	17.0%	YES	U	17.5%
22	2,5-Dihydrofuran	12	TL-EF-F	1.6E-04	0.001	16.3%	YES	U	17.5%
22	2,5-Dihydrofuran	14	TL-EF-G	1.7E-04	0.001	17.2%	YES	U	17.5%
22	2,5-Dihydrofuran	16	TL-EF-H	1.7E-04	0.001	16.9%	YES	U	17.5%
22	2,5-Dihydrofuran	2	FR57-IN-A		0.001				17.5%
22	2,5-Dihydrofuran	4	FR57-IN-B		0.001				17.5%
22	2,5-Dihydrofuran	6	FR57-IN-C	1.5E-04	0.001	15.4%	YES	U	17.5%
22	2,5-Dihydrofuran	8	FR57-IN-D	1.6E-04	0.001	15.8%	YES	U	17.5%
22	2,5-Dihydrofuran	10	FR57-IN-E	1.7E-04	0.001	17.2%	YES	U	17.5%
22	2,5-Dihydrofuran	12	FR57-IN-F	1.7E-04	0.001	17.1%	YES	U	17.5%
22	2,5-Dihydrofuran	14	FR57-IN-G	1.6E-04	0.001	16.0%	YES	U	17.5%
22	2,5-Dihydrofuran	16	FR57-IN-H	1.6E-04	0.001	16.0%	YES	U	17.5%
22	2,5-Dihydrofuran	2	FR57-EF-A	1.5E-04	0.001	15.5%	YES	U	17.5%
22	2,5-Dihydrofuran	4	FR57-EF-B	1.6E-04	0.001	16.1%	YES	U	17.5%
22	2,5-Dihydrofuran	6	FR57-EF-C	1.6E-04	0.001	16.1%	YES	U	17.5%
22	2,5-Dihydrofuran	8	FR57-EF-D	1.6E-04	0.001	15.5%	YES	U	17.5%
22	2,5-Dihydrofuran	10	FR57-EF-E	1.6E-04	0.001	16.5%	YES	U	17.5%
22	2,5-Dihydrofuran	12	FR57-EF-F	1.6E-04	0.001	16.3%	YES	U	17.5%
22	2,5-Dihydrofuran	14	FR57-EF-G	1.7E-04	0.001	16.8%	YES	U	17.5%
22	2,5-Dihydrofuran	16	FR57-EF-H		0.001				17.5%
23	2-Methylfuran	2	TL-IN-A	8.9E-05	0.001	8.92%	YES	UY	9.42%
23	2-Methylfuran	4	TL-IN-B	8.9E-05	0.001	8.90%	YES	U	9.42%
23	2-Methylfuran	6	TL-IN-C	8.9E-05	0.001	8.91%	YES	U	9.42%
23	2-Methylfuran	8	TL-IN-D	9.1E-05	0.001	9.14%	YES	U	9.42%
23	2-Methylfuran	10	TL-IN-E	8.4E-05	0.001	8.40%	YES	U	9.42%
23	2-Methylfuran	12	TL-IN-F	8.8E-05	0.001	8.84%	YES	U	9.42%
23	2-Methylfuran	14	TL-IN-G	8.9E-05	0.001	8.87%	YES	U	9.42%
23	2-Methylfuran	16	TL-IN-H	8.8E-05	0.001	8.83%	YES	U	9.42%
23	2-Methylfuran	2	TL-EF-A	8.2E-05	0.001	8.19%	YES	U	9.42%
23	2-Methylfuran	4	TL-EF-B	8.0E-05	0.001	8.04%	YES	UY	9.42%
23	2-Methylfuran	6	TL-EF-C	8.5E-05	0.001	8.46%	YES	U	9.42%
23	2-Methylfuran	8	TL-EF-D	9.4E-05	0.001	9.42%	YES	U	9.42%
23	2-Methylfuran	10	TL-EF-E	9.2E-05	0.001	9.18%	YES	U	9.42%
23	2-Methylfuran	12	TL-EF-F	8.8E-05	0.001	8.79%	YES	U	9.42%
23	2-Methylfuran	14	TL-EF-G	9.3E-05	0.001	9.26%	YES	U	9.42%
23	2-Methylfuran	16	TL-EF-H	9.1E-05	0.001	9.12%	YES	U	9.42%
23	2-Methylfuran	2	FR57-IN-A		0.001				9.42%
23	2-Methylfuran	4	FR57-IN-B		0.001				9.42%
23	2-Methylfuran	6	FR57-IN-C	8.3E-05	0.001	8.32%	YES	U	9.42%
23	2-Methylfuran	8	FR57-IN-D	8.5E-05	0.001	8.51%	YES	U	9.42%
23	2-Methylfuran	10	FR57-IN-E	9.3E-05	0.001	9.27%	YES	U	9.42%
23	2-Methylfuran	12	FR57-IN-F	9.2E-05	0.001	9.22%	YES	U	9.42%
23	2-Methylfuran	14	FR57-IN-G	8.6E-05	0.001	8.63%	YES	U	9.42%
23	2-Methylfuran	16	FR57-IN-H	8.6E-05	0.001	8.63%	YES	U	9.42%
23	2-Methylfuran	2	FR57-EF-A	8.4E-05	0.001	8.35%	YES	U	9.42%
23	2-Methylfuran	4	FR57-EF-B	8.7E-05	0.001	8.69%	YES	U	9.42%
23	2-Methylfuran	6	FR57-EF-C	8.7E-05	0.001	8.66%	YES	U	9.42%
23	2-Methylfuran	8	FR57-EF-D	8.4E-05	0.001	8.38%	YES	U	9.42%
23	2-Methylfuran	10	FR57-EF-E	8.9E-05	0.001	8.87%	YES	U	9.42%
23	2-Methylfuran	12	FR57-EF-F	8.8E-05	0.001	8.76%	YES	U	9.42%
23	2-Methylfuran	14	FR57-EF-G	9.1E-05	0.001	9.06%	YES	U	9.42%
23	2-Methylfuran	16	FR57-EF-H		0.001				9.42%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
24	2,5-Dimethylfuran	2	TL-IN-A	3.9E-05	0.001	3.86%	YES	U	4.17%
24	2,5-Dimethylfuran	4	TL-IN-B	3.7E-05	0.001	3.73%	YES	U	4.17%
24	2,5-Dimethylfuran	6	TL-IN-C	3.6E-05	0.001	3.64%	YES	U	4.17%
24	2,5-Dimethylfuran	8	TL-IN-D	4.0E-05	0.001	3.98%	YES	U	4.17%
24	2,5-Dimethylfuran	10	TL-IN-E	3.7E-05	0.001	3.73%	YES	U	4.17%
24	2,5-Dimethylfuran	12	TL-IN-F	4.0E-05	0.001	3.99%	YES	U	4.17%
24	2,5-Dimethylfuran	14	TL-IN-G	3.8E-05	0.001	3.84%	YES	U	4.17%
24	2,5-Dimethylfuran	16	TL-IN-H	4.2E-05	0.001	4.17%	YES	U	4.17%
24	2,5-Dimethylfuran	2	TL-EF-A	3.7E-05	0.001	3.69%	YES	U	4.17%
24	2,5-Dimethylfuran	4	TL-EF-B	3.7E-05	0.001	3.68%	YES	U	4.17%
24	2,5-Dimethylfuran	6	TL-EF-C	3.7E-05	0.001	3.68%	YES	U	4.17%
24	2,5-Dimethylfuran	8	TL-EF-D	3.8E-05	0.001	3.78%	YES	U	4.17%
24	2,5-Dimethylfuran	10	TL-EF-E	4.1E-05	0.001	4.05%	YES	U	4.17%
24	2,5-Dimethylfuran	12	TL-EF-F	3.7E-05	0.001	3.74%	YES	U	4.17%
24	2,5-Dimethylfuran	14	TL-EF-G	3.7E-05	0.001	3.75%	YES	U	4.17%
24	2,5-Dimethylfuran	16	TL-EF-H	3.8E-05	0.001	3.76%	YES	U	4.17%
24	2,5-Dimethylfuran	2	FR57-IN-A	3.7E-05	0.001	3.65%	YES	U	4.17%
24	2,5-Dimethylfuran	4	FR57-IN-B	3.6E-05	0.001	3.64%	YES	U	4.17%
24	2,5-Dimethylfuran	6	FR57-IN-C	3.5E-05	0.001	3.55%	YES	U	4.17%
24	2,5-Dimethylfuran	8	FR57-IN-D	3.8E-05	0.001	3.78%	YES	U	4.17%
24	2,5-Dimethylfuran	10	FR57-IN-E	3.9E-05	0.001	3.87%	YES	U	4.17%
24	2,5-Dimethylfuran	12	FR57-IN-F	4.0E-05	0.001	3.98%	YES	U	4.17%
24	2,5-Dimethylfuran	14	FR57-IN-G	3.8E-05	0.001	3.82%	YES	U	4.17%
24	2,5-Dimethylfuran	16	FR57-IN-H	3.8E-05	0.001	3.83%	YES	U	4.17%
24	2,5-Dimethylfuran	2	FR57-EF-A	3.8E-05	0.001	3.82%	YES	U	4.17%
24	2,5-Dimethylfuran	4	FR57-EF-B	3.6E-05	0.001	3.55%	YES	U	4.17%
24	2,5-Dimethylfuran	6	FR57-EF-C	3.8E-05	0.001	3.76%	YES	U	4.17%
24	2,5-Dimethylfuran	8	FR57-EF-D	3.7E-05	0.001	3.74%	YES	U	4.17%
24	2,5-Dimethylfuran	10	FR57-EF-E	3.9E-05	0.001	3.86%	YES	U	4.17%
24	2,5-Dimethylfuran	12	FR57-EF-F	3.8E-05	0.001	3.76%	YES	U	4.17%
24	2,5-Dimethylfuran	14	FR57-EF-G	3.7E-05	0.001	3.73%	YES	U	4.17%
24	2,5-Dimethylfuran	16	FR57-EF-H	3.9E-05	0.001	3.89%	YES	U	4.17%
28	2-Pentylfuran	2	TL-IN-A	3.2E-05	0.001	3.17%	YES	U	3.43%
28	2-Pentylfuran	4	TL-IN-B	3.1E-05	0.001	3.07%	YES	U	3.43%
28	2-Pentylfuran	6	TL-IN-C	3.0E-05	0.001	2.99%	YES	U	3.43%
28	2-Pentylfuran	8	TL-IN-D	3.3E-05	0.001	3.27%	YES	U	3.43%
28	2-Pentylfuran	10	TL-IN-E	3.1E-05	0.001	3.07%	YES	U	3.43%
28	2-Pentylfuran	12	TL-IN-F	3.3E-05	0.001	3.28%	YES	U	3.43%
28	2-Pentylfuran	14	TL-IN-G	3.2E-05	0.001	3.16%	YES	U	3.43%
28	2-Pentylfuran	16	TL-IN-H	3.4E-05	0.001	3.43%	YES	U	3.43%
28	2-Pentylfuran	2	TL-EF-A	3.0E-05	0.001	3.03%	YES	U	3.43%
28	2-Pentylfuran	4	TL-EF-B	3.0E-05	0.001	3.03%	YES	U	3.43%
28	2-Pentylfuran	6	TL-EF-C	3.0E-05	0.001	3.03%	YES	U	3.43%
28	2-Pentylfuran	8	TL-EF-D	3.1E-05	0.001	3.11%	YES	U	3.43%
28	2-Pentylfuran	10	TL-EF-E	3.3E-05	0.001	3.33%	YES	U	3.43%
28	2-Pentylfuran	12	TL-EF-F	3.1E-05	0.001	3.08%	YES	U	3.43%
28	2-Pentylfuran	14	TL-EF-G	3.1E-05	0.001	3.08%	YES	U	3.43%
28	2-Pentylfuran	16	TL-EF-H	3.1E-05	0.001	3.10%	YES	U	3.43%
28	2-Pentylfuran	2	FR57-IN-A	3.0E-05	0.001	3.00%	YES	U	3.43%
28	2-Pentylfuran	4	FR57-IN-B	3.0E-05	0.001	2.99%	YES	U	3.43%
28	2-Pentylfuran	6	FR57-IN-C	2.9E-05	0.001	2.92%	YES	U	3.43%
28	2-Pentylfuran	8	FR57-IN-D	3.1E-05	0.001	3.11%	YES	U	3.43%
28	2-Pentylfuran	10	FR57-IN-E	3.2E-05	0.001	3.18%	YES	U	3.43%
28	2-Pentylfuran	12	FR57-IN-F	3.3E-05	0.001	3.27%	YES	U	3.43%
28	2-Pentylfuran	14	FR57-IN-G	3.1E-05	0.001	3.14%	YES	U	3.43%
28	2-Pentylfuran	16	FR57-IN-H	3.2E-05	0.001	3.15%	YES	U	3.43%
28	2-Pentylfuran	2	FR57-EF-A	3.1E-05	0.001	3.15%	YES	U	3.43%
28	2-Pentylfuran	4	FR57-EF-B	2.9E-05	0.001	2.92%	YES	U	3.43%
28	2-Pentylfuran	6	FR57-EF-C	3.1E-05	0.001	3.09%	YES	U	3.43%
28	2-Pentylfuran	8	FR57-EF-D	3.1E-05	0.001	3.07%	YES	U	3.43%
28	2-Pentylfuran	10	FR57-EF-E	3.2E-05	0.001	3.18%	YES	U	3.43%
28	2-Pentylfuran	12	FR57-EF-F	3.1E-05	0.001	3.10%	YES	U	3.43%
28	2-Pentylfuran	14	FR57-EF-G	3.1E-05	0.001	3.07%	YES	U	3.43%
28	2-Pentylfuran	16	FR57-EF-H	3.2E-05	0.001	3.20%	YES	U	3.43%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
29	2-Heptylfuran	2	TL-IN-A	2.4E-05	0.001	2.40%	YES	U	2.59%
29	2-Heptylfuran	4	TL-IN-B	2.3E-05	0.001	2.32%	YES	U	2.59%
29	2-Heptylfuran	6	TL-IN-C	2.3E-05	0.001	2.26%	YES	U	2.59%
29	2-Heptylfuran	8	TL-IN-D	2.5E-05	0.001	2.47%	YES	U	2.59%
29	2-Heptylfuran	10	TL-IN-E	2.3E-05	0.001	2.32%	YES	U	2.59%
29	2-Heptylfuran	12	TL-IN-F	2.5E-05	0.001	2.48%	YES	U	2.59%
29	2-Heptylfuran	14	TL-IN-G	2.4E-05	0.001	2.38%	YES	U	2.59%
29	2-Heptylfuran	16	TL-IN-H	2.6E-05	0.001	2.59%	YES	U	2.59%
29	2-Heptylfuran	2	TL-EF-A	2.3E-05	0.001	2.29%	YES	U	2.59%
29	2-Heptylfuran	4	TL-EF-B	2.3E-05	0.001	2.29%	YES	U	2.59%
29	2-Heptylfuran	6	TL-EF-C	2.3E-05	0.001	2.29%	YES	U	2.59%
29	2-Heptylfuran	8	TL-EF-D	2.4E-05	0.001	2.35%	YES	U	2.59%
29	2-Heptylfuran	10	TL-EF-E	2.5E-05	0.001	2.52%	YES	U	2.59%
29	2-Heptylfuran	12	TL-EF-F	2.3E-05	0.001	2.33%	YES	U	2.59%
29	2-Heptylfuran	14	TL-EF-G	2.3E-05	0.001	2.33%	YES	U	2.59%
29	2-Heptylfuran	16	TL-EF-H	2.3E-05	0.001	2.34%	YES	U	2.59%
29	2-Heptylfuran	2	FR57-IN-A	2.3E-05	0.001	2.27%	YES	U	2.59%
29	2-Heptylfuran	4	FR57-IN-B	2.3E-05	0.001	2.26%	YES	U	2.59%
29	2-Heptylfuran	6	FR57-IN-C	2.2E-05	0.001	2.21%	YES	U	2.59%
29	2-Heptylfuran	8	FR57-IN-D	2.3E-05	0.001	2.35%	YES	U	2.59%
29	2-Heptylfuran	10	FR57-IN-E	2.4E-05	0.001	2.41%	YES	U	2.59%
29	2-Heptylfuran	12	FR57-IN-F	2.5E-05	0.001	2.47%	YES	U	2.59%
29	2-Heptylfuran	14	FR57-IN-G	2.4E-05	0.001	2.37%	YES	U	2.59%
29	2-Heptylfuran	16	FR57-IN-H	2.4E-05	0.001	2.38%	YES	U	2.59%
29	2-Heptylfuran	2	FR57-EF-A	2.4E-05	0.001	2.38%	YES	U	2.59%
29	2-Heptylfuran	4	FR57-EF-B	2.2E-05	0.001	2.21%	YES	U	2.59%
29	2-Heptylfuran	6	FR57-EF-C	2.3E-05	0.001	2.34%	YES	U	2.59%
29	2-Heptylfuran	8	FR57-EF-D	2.3E-05	0.001	2.32%	YES	U	2.59%
29	2-Heptylfuran	10	FR57-EF-E	2.4E-05	0.001	2.40%	YES	U	2.59%
29	2-Heptylfuran	12	FR57-EF-F	2.3E-05	0.001	2.34%	YES	U	2.59%
29	2-Heptylfuran	14	FR57-EF-G	2.3E-05	0.001	2.32%	YES	U	2.59%
29	2-Heptylfuran	16	FR57-EF-H	2.4E-05	0.001	2.42%	YES	U	2.59%
30	2-Propylfuran	2	TL-IN-A	2.4E-05	0.001	2.39%	YES	U	2.58%
30	2-Propylfuran	4	TL-IN-B	2.3E-05	0.001	2.31%	YES	U	2.58%
30	2-Propylfuran	6	TL-IN-C	2.3E-05	0.001	2.25%	YES	U	2.58%
30	2-Propylfuran	8	TL-IN-D	2.5E-05	0.001	2.46%	YES	U	2.58%
30	2-Propylfuran	10	TL-IN-E	2.3E-05	0.001	2.31%	YES	U	2.58%
30	2-Propylfuran	12	TL-IN-F	2.5E-05	0.001	2.47%	YES	U	2.58%
30	2-Propylfuran	14	TL-IN-G	2.4E-05	0.001	2.38%	YES	U	2.58%
30	2-Propylfuran	16	TL-IN-H	2.6E-05	0.001	2.58%	YES	U	2.58%
30	2-Propylfuran	2	TL-EF-A	2.3E-05	0.001	2.28%	YES	U	2.58%
30	2-Propylfuran	4	TL-EF-B	2.3E-05	0.001	2.28%	YES	U	2.58%
30	2-Propylfuran	6	TL-EF-C	2.3E-05	0.001	2.28%	YES	U	2.58%
30	2-Propylfuran	8	TL-EF-D	2.3E-05	0.001	2.34%	YES	U	2.58%
30	2-Propylfuran	10	TL-EF-E	2.5E-05	0.001	2.51%	YES	U	2.58%
30	2-Propylfuran	12	TL-EF-F	2.3E-05	0.001	2.32%	YES	U	2.58%
30	2-Propylfuran	14	TL-EF-G	2.3E-05	0.001	2.32%	YES	U	2.58%
30	2-Propylfuran	16	TL-EF-H	2.3E-05	0.001	2.33%	YES	U	2.58%
30	2-Propylfuran	2	FR57-IN-A	2.3E-05	0.001	2.26%	YES	U	2.58%
30	2-Propylfuran	4	FR57-IN-B	2.3E-05	0.001	2.25%	YES	U	2.58%
30	2-Propylfuran	6	FR57-IN-C	2.2E-05	0.001	2.20%	YES	U	2.58%
30	2-Propylfuran	8	FR57-IN-D	2.3E-05	0.001	2.34%	YES	U	2.58%
30	2-Propylfuran	10	FR57-IN-E	2.4E-05	0.001	2.40%	YES	U	2.58%
30	2-Propylfuran	12	FR57-IN-F	2.5E-05	0.001	2.46%	YES	U	2.58%
30	2-Propylfuran	14	FR57-IN-G	2.4E-05	0.001	2.36%	YES	U	2.58%
30	2-Propylfuran	16	FR57-IN-H	2.4E-05	0.001	2.37%	YES	U	2.58%
30	2-Propylfuran	2	FR57-EF-A	2.4E-05	0.001	2.37%	YES	U	2.58%
30	2-Propylfuran	4	FR57-EF-B	2.2E-05	0.001	2.20%	YES	U	2.58%
30	2-Propylfuran	6	FR57-EF-C	2.3E-05	0.001	2.33%	YES	U	2.58%
30	2-Propylfuran	8	FR57-EF-D	2.3E-05	0.001	2.31%	YES	U	2.58%
30	2-Propylfuran	10	FR57-EF-E	2.4E-05	0.001	2.39%	YES	U	2.58%
30	2-Propylfuran	12	FR57-EF-F	2.3E-05	0.001	2.33%	YES	U	2.58%
30	2-Propylfuran	14	FR57-EF-G	2.3E-05	0.001	2.31%	YES	U	2.58%
30	2-Propylfuran	16	FR57-EF-H	2.4E-05	0.001	2.41%	YES	U	2.58%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
34	Diethylphthalate	2	TL-IN-A	9.6E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	4	TL-IN-B	9.4E-05	0.54	0.017%	YES	U	0.0180%
34	Diethylphthalate	6	TL-IN-C	9.6E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	8	TL-IN-D	5.7E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	10	TL-IN-E	5.4E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	12	TL-IN-F	5.5E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	14	TL-IN-G	5.6E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	16	TL-IN-H	9.4E-05	0.54	0.017%	YES	U	0.0180%
34	Diethylphthalate	2	TL-EF-A	8.9E-05	0.54	0.016%	YES	U	0.0180%
34	Diethylphthalate	4	TL-EF-B	5.7E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	6	TL-EF-C	5.7E-05	0.54	0.010%	YES	UY	0.0180%
34	Diethylphthalate	8	TL-EF-D	9.8E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	10	TL-EF-E	9.4E-05	0.54	0.017%	YES	U	0.0180%
34	Diethylphthalate	12	TL-EF-F	9.0E-05	0.54	0.016%	YES	U	0.0180%
34	Diethylphthalate	14	TL-EF-G	9.2E-05	0.54	0.017%	YES	U	0.0180%
34	Diethylphthalate	16	TL-EF-H	9.6E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	2	FR57-IN-A	8.9E-05	0.54	0.016%	YES	U	0.0180%
34	Diethylphthalate	4	FR57-IN-B	5.1E-05	0.54	0.009%	YES	U	0.0180%
34	Diethylphthalate	6	FR57-IN-C	5.2E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	8	FR57-IN-D	5.8E-05	0.54	0.011%	YES	U	0.0180%
34	Diethylphthalate	10	FR57-IN-E	5.2E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	12	FR57-IN-F	5.3E-05	0.54	0.010%	YES	U	0.0180%
34	Diethylphthalate	14	FR57-IN-G	5.1E-05	0.54	0.009%	YES	U	0.0180%
34	Diethylphthalate	16	FR57-IN-H	9.1E-05	0.54	0.017%	YES	U	0.0180%
34	Diethylphthalate	2	FR57-EF-A	8.9E-05	0.54	0.016%	YES	U	0.0180%
34	Diethylphthalate	4	FR57-EF-B	9.0E-05	0.54	0.017%	YES	U	0.0180%
34	Diethylphthalate	6	FR57-EF-C	9.7E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	8	FR57-EF-D	9.6E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	10	FR57-EF-E	9.6E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	12	FR57-EF-F	9.4E-05	0.54	0.017%	YES	U	0.0180%
34	Diethylphthalate	14	FR57-EF-G	9.5E-05	0.54	0.018%	YES	U	0.0180%
34	Diethylphthalate	16	FR57-EF-H	9.7E-05	0.54	0.018%	YES	U	0.0180%
35	Acetonitrile	2	TL-IN-A	8.6E-03	20	0.043%		Y	0.00259%
35	Acetonitrile	4	TL-IN-B	2.7E-02	20	0.133%			0.00259%
35	Acetonitrile	6	TL-IN-C	8.3E-03	20	0.042%			0.00259%
35	Acetonitrile	8	TL-IN-D	9.1E-03	20	0.046%			0.00259%
35	Acetonitrile	10	TL-IN-E	9.2E-03	20	0.046%			0.00259%
35	Acetonitrile	12	TL-IN-F	6.0E-03	20	0.030%			0.00259%
35	Acetonitrile	14	TL-IN-G	4.9E-03	20	0.024%			0.00259%
35	Acetonitrile	16	TL-IN-H	6.3E-03	20	0.032%			0.00259%
35	Acetonitrile	2	TL-EF-A	2.2E-02	20	0.109%			0.00259%
35	Acetonitrile	4	TL-EF-B	6.0E-03	20	0.030%		Y	0.00259%
35	Acetonitrile	6	TL-EF-C	7.8E-03	20	0.039%			0.00259%
35	Acetonitrile	8	TL-EF-D	7.1E-03	20	0.035%			0.00259%
35	Acetonitrile	10	TL-EF-E	5.2E-03	20	0.026%			0.00259%
35	Acetonitrile	12	TL-EF-F	2.5E-02	20	0.125%			0.00259%
35	Acetonitrile	14	TL-EF-G	7.1E-03	20	0.035%			0.00259%
35	Acetonitrile	16	TL-EF-H	6.4E-03	20	0.032%			0.00259%
35	Acetonitrile	2	FR57-IN-A		20				0.00259%
35	Acetonitrile	4	FR57-IN-B		20				0.00259%
35	Acetonitrile	6	FR57-IN-C	1.5E-02	20	0.076%			0.00259%
35	Acetonitrile	8	FR57-IN-D	3.8E-02	20	0.191%			0.00259%
35	Acetonitrile	10	FR57-IN-E	8.0E-02	20	0.402%		E	0.00259%
35	Acetonitrile	12	FR57-IN-F	4.6E-02	20	0.230%			0.00259%
35	Acetonitrile	14	FR57-IN-G	1.1E-02	20	0.057%			0.00259%
35	Acetonitrile	16	FR57-IN-H	3.9E-02	20	0.194%			0.00259%
35	Acetonitrile	2	FR57-EF-A	2.4E-01	20	1.18%		E	0.00259%
35	Acetonitrile	4	FR57-EF-B	2.8E-01	20	1.38%		E	0.00259%
35	Acetonitrile	6	FR57-EF-C	3.3E-02	20	0.166%			0.00259%
35	Acetonitrile	8	FR57-EF-D	3.1E-02	20	0.154%			0.00259%
35	Acetonitrile	10	FR57-EF-E	3.1E-02	20	0.155%			0.00259%
35	Acetonitrile	12	FR57-EF-F	2.9E-02	20	0.146%			0.00259%
35	Acetonitrile	14	FR57-EF-G	8.6E-03	20	0.043%			0.00259%
35	Acetonitrile	16	FR57-EF-H		20				0.00259%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
36	Propanenitrile	2	TL-IN-A	5.3E-04	6.0	0.009%		JY	0.00410%
36	Propanenitrile	4	TL-IN-B	1.2E-03	6.0	0.020%		J	0.00410%
36	Propanenitrile	6	TL-IN-C	1.1E-03	6.0	0.018%		J	0.00410%
36	Propanenitrile	8	TL-IN-D	9.5E-04	6.0	0.016%		J	0.00410%
36	Propanenitrile	10	TL-IN-E	9.0E-04	6.0	0.015%		J	0.00410%
36	Propanenitrile	12	TL-IN-F	9.1E-04	6.0	0.015%		J	0.00410%
36	Propanenitrile	14	TL-IN-G	8.0E-04	6.0	0.013%		J	0.00410%
36	Propanenitrile	16	TL-IN-H	9.4E-04	6.0	0.016%		J	0.00410%
36	Propanenitrile	2	TL-EF-A	2.1E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	4	TL-EF-B	2.1E-04	6.0	0.003%	YES	UY	0.00410%
36	Propanenitrile	6	TL-EF-C	2.2E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	8	TL-EF-D	2.5E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	10	TL-EF-E	2.4E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	12	TL-EF-F	2.3E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	14	TL-EF-G	2.4E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	16	TL-EF-H	2.4E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	2	FR57-IN-A		6.0				0.00410%
36	Propanenitrile	4	FR57-IN-B		6.0				0.00410%
36	Propanenitrile	6	FR57-IN-C	9.0E-04	6.0	0.015%		J	0.00410%
36	Propanenitrile	8	FR57-IN-D	7.9E-04	6.0	0.013%		J	0.00410%
36	Propanenitrile	10	FR57-IN-E	9.0E-04	6.0	0.015%		J	0.00410%
36	Propanenitrile	12	FR57-IN-F	8.1E-04	6.0	0.014%		J	0.00410%
36	Propanenitrile	14	FR57-IN-G	7.6E-04	6.0	0.013%		J	0.00410%
36	Propanenitrile	16	FR57-IN-H	7.9E-04	6.0	0.013%		J	0.00410%
36	Propanenitrile	2	FR57-EF-A	2.2E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	4	FR57-EF-B	2.3E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	6	FR57-EF-C	2.3E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	8	FR57-EF-D	2.2E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	10	FR57-EF-E	2.3E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	12	FR57-EF-F	2.3E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	14	FR57-EF-G	2.4E-04	6.0	0.004%	YES	U	0.00410%
36	Propanenitrile	16	FR57-EF-H		6.0				0.00410%
37	Butanenitrile	2	TL-IN-A	4.2E-04	8.0	0.005%		JY	0.00222%
37	Butanenitrile	4	TL-IN-B	8.5E-04	8.0	0.011%		J	0.00222%
37	Butanenitrile	6	TL-IN-C	7.4E-04	8.0	0.009%		J	0.00222%
37	Butanenitrile	8	TL-IN-D	7.0E-04	8.0	0.009%		J	0.00222%
37	Butanenitrile	10	TL-IN-E	6.2E-04	8.0	0.008%		J	0.00222%
37	Butanenitrile	12	TL-IN-F	6.0E-04	8.0	0.008%		J	0.00222%
37	Butanenitrile	14	TL-IN-G	5.5E-04	8.0	0.007%		J	0.00222%
37	Butanenitrile	16	TL-IN-H	5.8E-04	8.0	0.007%		J	0.00222%
37	Butanenitrile	2	TL-EF-A	1.5E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	4	TL-EF-B	1.5E-04	8.0	0.002%	YES	UY	0.00222%
37	Butanenitrile	6	TL-EF-C	1.6E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	8	TL-EF-D	1.8E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	10	TL-EF-E	1.7E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	12	TL-EF-F	1.7E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	14	TL-EF-G	1.7E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	16	TL-EF-H	1.7E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	2	FR57-IN-A		8.0				0.00222%
37	Butanenitrile	4	FR57-IN-B		8.0				0.00222%
37	Butanenitrile	6	FR57-IN-C	6.5E-04	8.0	0.008%		J	0.00222%
37	Butanenitrile	8	FR57-IN-D	5.6E-04	8.0	0.007%		J	0.00222%
37	Butanenitrile	10	FR57-IN-E	6.1E-04	8.0	0.008%		J	0.00222%
37	Butanenitrile	12	FR57-IN-F	5.8E-04	8.0	0.007%		J	0.00222%
37	Butanenitrile	14	FR57-IN-G	6.1E-04	8.0	0.008%		J	0.00222%
37	Butanenitrile	16	FR57-IN-H	5.7E-04	8.0	0.007%		J	0.00222%
37	Butanenitrile	2	FR57-EF-A	1.6E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	4	FR57-EF-B	1.6E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	6	FR57-EF-C	1.6E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	8	FR57-EF-D	1.6E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	10	FR57-EF-E	1.7E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	12	FR57-EF-F	1.6E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	14	FR57-EF-G	1.7E-04	8.0	0.002%	YES	U	0.00222%
37	Butanenitrile	16	FR57-EF-H		8.0				0.00222%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
38	Pentanenitrile	2	TL-IN-A	1.5E-04	6.0	0.002%		JY	0.00181%
38	Pentanenitrile	4	TL-IN-B	1.9E-04	6.0	0.003%		J	0.00181%
38	Pentanenitrile	6	TL-IN-C	1.8E-04	6.0	0.003%		J	0.00181%
38	Pentanenitrile	8	TL-IN-D	1.6E-04	6.0	0.003%		J	0.00181%
38	Pentanenitrile	10	TL-IN-E	1.8E-04	6.0	0.003%		J	0.00181%
38	Pentanenitrile	12	TL-IN-F	1.6E-04	6.0	0.003%		J	0.00181%
38	Pentanenitrile	14	TL-IN-G	1.5E-04	6.0	0.002%		J	0.00181%
38	Pentanenitrile	16	TL-IN-H	1.5E-04	6.0	0.002%		J	0.00181%
38	Pentanenitrile	2	TL-EF-A	9.4E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	4	TL-EF-B	9.3E-05	6.0	0.002%	YES	UY	0.00181%
38	Pentanenitrile	6	TL-EF-C	9.7E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	8	TL-EF-D	1.1E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	10	TL-EF-E	1.1E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	12	TL-EF-F	1.0E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	14	TL-EF-G	1.1E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	16	TL-EF-H	1.1E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	2	FR57-IN-A		6.0				0.00181%
38	Pentanenitrile	4	FR57-IN-B		6.0				0.00181%
38	Pentanenitrile	6	FR57-IN-C	9.6E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	8	FR57-IN-D	9.8E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	10	FR57-IN-E	1.1E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	12	FR57-IN-F	1.1E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	14	FR57-IN-G	9.9E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	16	FR57-IN-H	9.9E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	2	FR57-EF-A	9.6E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	4	FR57-EF-B	1.0E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	6	FR57-EF-C	1.0E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	8	FR57-EF-D	9.7E-05	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	10	FR57-EF-E	1.0E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	12	FR57-EF-F	1.0E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	14	FR57-EF-G	1.0E-04	6.0	0.002%	YES	U	0.00181%
38	Pentanenitrile	16	FR57-EF-H		6.0				0.00181%
39	Hexanenitrile	2	TL-IN-A	7.5E-05	6.0	0.001%	YES	UY	0.00133%
39	Hexanenitrile	4	TL-IN-B	7.5E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	6	TL-IN-C	7.5E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	8	TL-IN-D	7.7E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	10	TL-IN-E	7.1E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	12	TL-IN-F	7.5E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	14	TL-IN-G	7.5E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	16	TL-IN-H	7.5E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	2	TL-EF-A	6.9E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	4	TL-EF-B	6.8E-05	6.0	0.001%	YES	UY	0.00133%
39	Hexanenitrile	6	TL-EF-C	7.1E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	8	TL-EF-D	8.0E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	10	TL-EF-E	7.8E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	12	TL-EF-F	7.4E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	14	TL-EF-G	7.8E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	16	TL-EF-H	7.7E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	2	FR57-IN-A		6.0				0.00133%
39	Hexanenitrile	4	FR57-IN-B		6.0				0.00133%
39	Hexanenitrile	6	FR57-IN-C	7.0E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	8	FR57-IN-D	7.2E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	10	FR57-IN-E	7.8E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	12	FR57-IN-F	7.8E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	14	FR57-IN-G	7.3E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	16	FR57-IN-H	7.3E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	2	FR57-EF-A	7.1E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	4	FR57-EF-B	7.3E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	6	FR57-EF-C	7.3E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	8	FR57-EF-D	7.1E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	10	FR57-EF-E	7.5E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	12	FR57-EF-F	7.4E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	14	FR57-EF-G	7.7E-05	6.0	0.001%	YES	U	0.00133%
39	Hexanenitrile	16	FR57-EF-H		6.0				0.00133%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
43	Ethylamine	2	TL-IN-A	4.5E-03	5.0	0.091%	YES		0.0941%
43	Ethylamine	4	TL-IN-B	4.2E-03	5.0	0.085%	YES		0.0941%
43	Ethylamine	6	TL-IN-C	4.5E-03	5.0	0.090%	YES		0.0941%
43	Ethylamine	8	TL-IN-D	4.5E-03	5.0	0.090%	YES		0.0941%
43	Ethylamine	10	TL-IN-E	4.6E-03	5.0	0.093%	YES		0.0941%
43	Ethylamine	12	TL-IN-F	4.5E-03	5.0	0.091%	YES		0.0941%
43	Ethylamine	14	TL-IN-G	4.5E-03	5.0	0.091%	YES		0.0941%
43	Ethylamine	16	TL-IN-H	4.6E-03	5.0	0.092%	YES		0.0941%
43	Ethylamine	2	TL-EF-A	4.2E-03	5.0	0.083%	YES		0.0941%
43	Ethylamine	4	TL-EF-B	4.4E-03	5.0	0.088%	YES		0.0941%
43	Ethylamine	6	TL-EF-C	4.4E-03	5.0	0.087%	YES		0.0941%
43	Ethylamine	8	TL-EF-D	4.6E-03	5.0	0.093%	YES		0.0941%
43	Ethylamine	10	TL-EF-E	4.4E-03	5.0	0.087%	YES		0.0941%
43	Ethylamine	12	TL-EF-F	4.2E-03	5.0	0.085%	YES		0.0941%
43	Ethylamine	14	TL-EF-G	4.2E-03	5.0	0.083%	YES		0.0941%
43	Ethylamine	16	TL-EF-H	4.1E-03	5.0	0.083%	YES		0.0941%
43	Ethylamine	2	FR57-IN-A	4.3E-03	5.0	0.087%	YES		0.0941%
43	Ethylamine	4	FR57-IN-B	4.3E-03	5.0	0.087%	YES		0.0941%
43	Ethylamine	6	FR57-IN-C	4.5E-03	5.0	0.090%	YES		0.0941%
43	Ethylamine	8	FR57-IN-D	4.5E-03	5.0	0.089%	YES		0.0941%
43	Ethylamine	10	FR57-IN-E	4.7E-03	5.0	0.094%	YES		0.0941%
43	Ethylamine	12	FR57-IN-F	4.5E-03	5.0	0.091%	YES		0.0941%
43	Ethylamine	14	FR57-IN-G	4.4E-03	5.0	0.088%	YES		0.0941%
43	Ethylamine	16	FR57-IN-H	4.5E-03	5.0	0.090%	YES		0.0941%
43	Ethylamine	2	FR57-EF-A	4.3E-03	5.0	0.086%	YES		0.0941%
43	Ethylamine	4	FR57-EF-B	4.2E-03	5.0	0.084%	YES		0.0941%
43	Ethylamine	6	FR57-EF-C	4.4E-03	5.0	0.088%	YES		0.0941%
43	Ethylamine	8	FR57-EF-D	4.4E-03	5.0	0.088%	YES		0.0941%
43	Ethylamine	10	FR57-EF-E	4.6E-03	5.0	0.092%	YES		0.0941%
43	Ethylamine	12	FR57-EF-F	4.5E-03	5.0	0.091%	YES		0.0941%
43	Ethylamine	14	FR57-EF-G	4.3E-03	5.0	0.085%	YES		0.0941%
43	Ethylamine	16	FR57-EF-H	4.2E-03	5.0	0.084%	YES		0.0941%
44	N-Nitrosodimethylamine	2	TL-IN-A	1.8E-04	0.000	59.7%			4.68%
44	N-Nitrosodimethylamine	4	TL-IN-B	2.1E-04	0.000	71.6%			4.68%
44	N-Nitrosodimethylamine	6	TL-IN-C	1.6E-04	0.000	54.9%			4.68%
44	N-Nitrosodimethylamine	8	TL-IN-D	1.8E-04	0.000	58.5%			4.68%
44	N-Nitrosodimethylamine	10	TL-IN-E	1.6E-04	0.000	53.8%			4.68%
44	N-Nitrosodimethylamine	12	TL-IN-F	1.8E-04	0.000	59.5%			4.68%
44	N-Nitrosodimethylamine	14	TL-IN-G	1.5E-04	0.000	50.9%			4.68%
44	N-Nitrosodimethylamine	16	TL-IN-H	1.6E-04	0.000	52.0%			4.68%
44	N-Nitrosodimethylamine	2	TL-EF-A	1.4E-05	0.000	4.68%	YES		4.68%
44	N-Nitrosodimethylamine	4	TL-EF-B	1.4E-05	0.000	4.57%	YES		4.68%
44	N-Nitrosodimethylamine	6	TL-EF-C	1.3E-05	0.000	4.48%	YES		4.68%
44	N-Nitrosodimethylamine	8	TL-EF-D	1.3E-05	0.000	4.33%	YES		4.68%
44	N-Nitrosodimethylamine	10	TL-EF-E	1.3E-05	0.000	4.25%	YES		4.68%
44	N-Nitrosodimethylamine	12	TL-EF-F	1.3E-05	0.000	4.31%	YES		4.68%
44	N-Nitrosodimethylamine	14	TL-EF-G	1.3E-05	0.000	4.18%	YES		4.68%
44	N-Nitrosodimethylamine	16	TL-EF-H	1.3E-05	0.000	4.24%	YES		4.68%
44	N-Nitrosodimethylamine	2	FR57-IN-A	1.8E-04	0.000	61.2%			4.68%
44	N-Nitrosodimethylamine	4	FR57-IN-B	1.9E-04	0.000	63.0%			4.68%
44	N-Nitrosodimethylamine	6	FR57-IN-C	1.5E-04	0.000	49.6%			4.68%
44	N-Nitrosodimethylamine	8	FR57-IN-D	1.7E-04	0.000	55.6%			4.68%
44	N-Nitrosodimethylamine	10	FR57-IN-E	1.7E-04	0.000	56.8%			4.68%
44	N-Nitrosodimethylamine	12	FR57-IN-F	1.6E-04	0.000	54.3%			4.68%
44	N-Nitrosodimethylamine	14	FR57-IN-G	1.5E-04	0.000	49.8%			4.68%
44	N-Nitrosodimethylamine	16	FR57-IN-H	1.4E-04	0.000	45.8%			4.68%
44	N-Nitrosodimethylamine	2	FR57-EF-A	1.2E-05	0.000	3.92%	YES		4.68%
44	N-Nitrosodimethylamine	4	FR57-EF-B	1.3E-05	0.000	4.27%	YES		4.68%
44	N-Nitrosodimethylamine	6	FR57-EF-C	1.1E-05	0.000	3.82%	YES		4.68%
44	N-Nitrosodimethylamine	8	FR57-EF-D	1.1E-05	0.000	3.74%	YES		4.68%
44	N-Nitrosodimethylamine	10	FR57-EF-E	1.2E-05	0.000	3.87%	YES		4.68%
44	N-Nitrosodimethylamine	12	FR57-EF-F	1.2E-05	0.000	3.90%	YES		4.68%
44	N-Nitrosodimethylamine	14	FR57-EF-G	1.2E-05	0.000	4.01%	YES		4.68%
44	N-Nitrosodimethylamine	16	FR57-EF-H	1.2E-05	0.000	4.11%	YES		4.68%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
45	N-Nitrosodiethylamine	2	TL-IN-A	1.2E-05	0.000	11.7%			10.2%
45	N-Nitrosodiethylamine	4	TL-IN-B	1.7E-05	0.000	17.1%			10.2%
45	N-Nitrosodiethylamine	6	TL-IN-C	1.8E-05	0.000	17.8%			10.2%
45	N-Nitrosodiethylamine	8	TL-IN-D	1.4E-05	0.000	13.7%			10.2%
45	N-Nitrosodiethylamine	10	TL-IN-E	1.2E-05	0.000	12.2%			10.2%
45	N-Nitrosodiethylamine	12	TL-IN-F	1.4E-05	0.000	14.4%			10.2%
45	N-Nitrosodiethylamine	14	TL-IN-G	1.4E-05	0.000	13.6%			10.2%
45	N-Nitrosodiethylamine	16	TL-IN-H	1.2E-05	0.000	12.2%			10.2%
45	N-Nitrosodiethylamine	2	TL-EF-A	1.0E-05	0.000	10.2%	YES		10.2%
45	N-Nitrosodiethylamine	4	TL-EF-B	9.9E-06	0.000	9.95%	YES		10.2%
45	N-Nitrosodiethylamine	6	TL-EF-C	9.8E-06	0.000	9.75%	YES		10.2%
45	N-Nitrosodiethylamine	8	TL-EF-D	9.4E-06	0.000	9.42%	YES		10.2%
45	N-Nitrosodiethylamine	10	TL-EF-E	9.2E-06	0.000	9.25%	YES		10.2%
45	N-Nitrosodiethylamine	12	TL-EF-F	9.4E-06	0.000	9.38%	YES		10.2%
45	N-Nitrosodiethylamine	14	TL-EF-G	9.1E-06	0.000	9.10%	YES		10.2%
45	N-Nitrosodiethylamine	16	TL-EF-H	9.2E-06	0.000	9.22%	YES		10.2%
45	N-Nitrosodiethylamine	2	FR57-IN-A	1.3E-05	0.000	12.6%			10.2%
45	N-Nitrosodiethylamine	4	FR57-IN-B	1.4E-05	0.000	14.3%			10.2%
45	N-Nitrosodiethylamine	6	FR57-IN-C	2.0E-05	0.000	20.4%			10.2%
45	N-Nitrosodiethylamine	8	FR57-IN-D	1.5E-05	0.000	14.6%			10.2%
45	N-Nitrosodiethylamine	10	FR57-IN-E	1.5E-05	0.000	14.9%			10.2%
45	N-Nitrosodiethylamine	12	FR57-IN-F	1.1E-05	0.000	11.3%			10.2%
45	N-Nitrosodiethylamine	14	FR57-IN-G	1.5E-05	0.000	15.2%			10.2%
45	N-Nitrosodiethylamine	16	FR57-IN-H	1.6E-05	0.000	16.0%			10.2%
45	N-Nitrosodiethylamine	2	FR57-EF-A	8.5E-06	0.000	8.52%	YES		10.2%
45	N-Nitrosodiethylamine	4	FR57-EF-B	9.3E-06	0.000	9.28%	YES		10.2%
45	N-Nitrosodiethylamine	6	FR57-EF-C	8.3E-06	0.000	8.32%	YES		10.2%
45	N-Nitrosodiethylamine	8	FR57-EF-D	8.1E-06	0.000	8.13%	YES		10.2%
45	N-Nitrosodiethylamine	10	FR57-EF-E	8.4E-06	0.000	8.42%	YES		10.2%
45	N-Nitrosodiethylamine	12	FR57-EF-F	8.5E-06	0.000	8.48%	YES		10.2%
45	N-Nitrosodiethylamine	14	FR57-EF-G	8.7E-06	0.000	8.73%	YES		10.2%
45	N-Nitrosodiethylamine	16	FR57-EF-H	9.0E-06	0.000	8.95%	YES		10.2%
46	N-Nitrosomethylethylamine	2	TL-IN-A	1.1E-05	0.000	3.78%	YES		4.12%
46	N-Nitrosomethylethylamine	4	TL-IN-B	1.2E-05	0.000	4.12%	YES		4.12%
46	N-Nitrosomethylethylamine	6	TL-IN-C	1.1E-05	0.000	3.81%	YES		4.12%
46	N-Nitrosomethylethylamine	8	TL-IN-D	1.1E-05	0.000	3.79%	YES		4.12%
46	N-Nitrosomethylethylamine	10	TL-IN-E	1.6E-05	0.000	5.42%			4.12%
46	N-Nitrosomethylethylamine	12	TL-IN-F	1.2E-05	0.000	4.07%			4.12%
46	N-Nitrosomethylethylamine	14	TL-IN-G	1.3E-05	0.000	4.21%			4.12%
46	N-Nitrosomethylethylamine	16	TL-IN-H	1.1E-05	0.000	3.62%	YES		4.12%
46	N-Nitrosomethylethylamine	2	TL-EF-A	1.2E-05	0.000	3.93%	YES		4.12%
46	N-Nitrosomethylethylamine	4	TL-EF-B	1.2E-05	0.000	3.84%	YES		4.12%
46	N-Nitrosomethylethylamine	6	TL-EF-C	1.1E-05	0.000	3.77%	YES		4.12%
46	N-Nitrosomethylethylamine	8	TL-EF-D	1.1E-05	0.000	3.64%	YES		4.12%
46	N-Nitrosomethylethylamine	10	TL-EF-E	1.1E-05	0.000	3.57%	YES		4.12%
46	N-Nitrosomethylethylamine	12	TL-EF-F	1.1E-05	0.000	3.62%	YES		4.12%
46	N-Nitrosomethylethylamine	14	TL-EF-G	1.1E-05	0.000	3.52%	YES		4.12%
46	N-Nitrosomethylethylamine	16	TL-EF-H	1.1E-05	0.000	3.56%	YES		4.12%
46	N-Nitrosomethylethylamine	2	FR57-IN-A	1.6E-05	0.000	5.26%			4.12%
46	N-Nitrosomethylethylamine	4	FR57-IN-B	1.2E-04	0.000	40.3%			4.12%
46	N-Nitrosomethylethylamine	6	FR57-IN-C	1.0E-05	0.000	3.38%	YES		4.12%
46	N-Nitrosomethylethylamine	8	FR57-IN-D	1.4E-05	0.000	4.57%			4.12%
46	N-Nitrosomethylethylamine	10	FR57-IN-E	9.7E-06	0.000	3.23%	YES		4.12%
46	N-Nitrosomethylethylamine	12	FR57-IN-F	1.3E-05	0.000	4.38%			4.12%
46	N-Nitrosomethylethylamine	14	FR57-IN-G	1.1E-05	0.000	3.52%			4.12%
46	N-Nitrosomethylethylamine	16	FR57-IN-H	1.1E-05	0.000	3.63%			4.12%
46	N-Nitrosomethylethylamine	2	FR57-EF-A	9.9E-06	0.000	3.29%	YES		4.12%
46	N-Nitrosomethylethylamine	4	FR57-EF-B	1.1E-05	0.000	3.59%	YES		4.12%
46	N-Nitrosomethylethylamine	6	FR57-EF-C	9.6E-06	0.000	3.22%	YES		4.12%
46	N-Nitrosomethylethylamine	8	FR57-EF-D	9.4E-06	0.000	3.14%	YES		4.12%
46	N-Nitrosomethylethylamine	10	FR57-EF-E	9.8E-06	0.000	3.25%	YES		4.12%
46	N-Nitrosomethylethylamine	12	FR57-EF-F	9.8E-06	0.000	3.28%	YES		4.12%
46	N-Nitrosomethylethylamine	14	FR57-EF-G	1.0E-05	0.000	3.37%	YES		4.12%
46	N-Nitrosomethylethylamine	16	FR57-EF-H	1.0E-05	0.000	3.46%	YES		4.12%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
47	N-Nitrosomorpholine	2	TL-IN-A	2.6E-04	0.001	43.0%			1.49%
47	N-Nitrosomorpholine	4	TL-IN-B	3.1E-04	0.001	51.5%			1.49%
47	N-Nitrosomorpholine	6	TL-IN-C	2.8E-04	0.001	46.0%			1.49%
47	N-Nitrosomorpholine	8	TL-IN-D	2.8E-04	0.001	47.1%			1.49%
47	N-Nitrosomorpholine	10	TL-IN-E	2.6E-04	0.001	43.3%			1.49%
47	N-Nitrosomorpholine	12	TL-IN-F	2.8E-04	0.001	46.5%			1.49%
47	N-Nitrosomorpholine	14	TL-IN-G	2.4E-04	0.001	40.4%			1.49%
47	N-Nitrosomorpholine	16	TL-IN-H	1.9E-04	0.001	31.3%			1.49%
47	N-Nitrosomorpholine	2	TL-EF-A	9.0E-06	0.001	1.49%	YES		1.49%
47	N-Nitrosomorpholine	4	TL-EF-B	8.7E-06	0.001	1.46%	YES		1.49%
47	N-Nitrosomorpholine	6	TL-EF-C	8.6E-06	0.001	1.43%	YES		1.49%
47	N-Nitrosomorpholine	8	TL-EF-D	8.3E-06	0.001	1.38%	YES		1.49%
47	N-Nitrosomorpholine	10	TL-EF-E	8.1E-06	0.001	1.36%	YES		1.49%
47	N-Nitrosomorpholine	12	TL-EF-F	8.2E-06	0.001	1.37%	YES		1.49%
47	N-Nitrosomorpholine	14	TL-EF-G	8.0E-06	0.001	1.33%	YES		1.49%
47	N-Nitrosomorpholine	16	TL-EF-H	8.1E-06	0.001	1.35%	YES		1.49%
47	N-Nitrosomorpholine	2	FR57-IN-A	2.4E-04	0.001	40.8%			1.49%
47	N-Nitrosomorpholine	4	FR57-IN-B	2.6E-04	0.001	44.1%			1.49%
47	N-Nitrosomorpholine	6	FR57-IN-C	2.4E-04	0.001	39.6%			1.49%
47	N-Nitrosomorpholine	8	FR57-IN-D	2.4E-04	0.001	40.1%			1.49%
47	N-Nitrosomorpholine	10	FR57-IN-E	2.5E-04	0.001	41.5%			1.49%
47	N-Nitrosomorpholine	12	FR57-IN-F	2.4E-04	0.001	40.2%			1.49%
47	N-Nitrosomorpholine	14	FR57-IN-G	2.4E-04	0.001	39.2%			1.49%
47	N-Nitrosomorpholine	16	FR57-IN-H	2.3E-04	0.001	39.1%			1.49%
47	N-Nitrosomorpholine	2	FR57-EF-A	7.5E-06	0.001	1.25%	YES		1.49%
47	N-Nitrosomorpholine	4	FR57-EF-B	8.2E-06	0.001	1.36%	YES		1.49%
47	N-Nitrosomorpholine	6	FR57-EF-C	7.3E-06	0.001	1.22%	YES		1.49%
47	N-Nitrosomorpholine	8	FR57-EF-D	7.2E-06	0.001	1.19%	YES		1.49%
47	N-Nitrosomorpholine	10	FR57-EF-E	7.4E-06	0.001	1.23%	YES		1.49%
47	N-Nitrosomorpholine	12	FR57-EF-F	7.5E-06	0.001	1.24%	YES		1.49%
47	N-Nitrosomorpholine	14	FR57-EF-G	7.7E-06	0.001	1.28%	YES		1.49%
47	N-Nitrosomorpholine	16	FR57-EF-H	7.9E-06	0.001	1.31%	YES		1.49%
48	Tributyl phosphate	2	TL-IN-A	1.1E-04	0.20	0.055%	YES	LU	0.0558%
48	Tributyl phosphate	4	TL-IN-B	1.1E-04	0.20	0.054%	YES	LU	0.0558%
48	Tributyl phosphate	6	TL-IN-C	1.1E-04	0.20	0.055%	YES	LU	0.0558%
48	Tributyl phosphate	8	TL-IN-D	6.4E-05	0.20	0.032%	YES	U	0.0558%
48	Tributyl phosphate	10	TL-IN-E	6.0E-05	0.20	0.030%	YES	U	0.0558%
48	Tributyl phosphate	12	TL-IN-F	6.2E-05	0.20	0.031%	YES	U	0.0558%
48	Tributyl phosphate	14	TL-IN-G	6.3E-05	0.20	0.032%	YES	U	0.0558%
48	Tributyl phosphate	16	TL-IN-H	1.1E-04	0.20	0.054%	YES	LU	0.0558%
48	Tributyl phosphate	2	TL-EF-A	1.0E-04	0.20	0.051%	YES	LU	0.0558%
48	Tributyl phosphate	4	TL-EF-B	6.4E-05	0.20	0.032%	YES	U	0.0558%
48	Tributyl phosphate	6	TL-EF-C	6.4E-05	0.20	0.032%	YES	UY	0.0558%
48	Tributyl phosphate	8	TL-EF-D	1.1E-04	0.20	0.056%	YES	LU	0.0558%
48	Tributyl phosphate	10	TL-EF-E	1.1E-04	0.20	0.054%	YES	LU	0.0558%
48	Tributyl phosphate	12	TL-EF-F	1.0E-04	0.20	0.051%	YES	LU	0.0558%
48	Tributyl phosphate	14	TL-EF-G	1.1E-04	0.20	0.053%	YES	LU	0.0558%
48	Tributyl phosphate	16	TL-EF-H	1.1E-04	0.20	0.055%	YES	LU	0.0558%
48	Tributyl phosphate	2	FR57-IN-A	1.0E-04	0.20	0.051%	YES	U	0.0558%
48	Tributyl phosphate	4	FR57-IN-B	5.7E-05	0.20	0.029%	YES	U	0.0558%
48	Tributyl phosphate	6	FR57-IN-C	5.9E-05	0.20	0.030%	YES	U	0.0558%
48	Tributyl phosphate	8	FR57-IN-D	6.5E-05	0.20	0.032%	YES	U	0.0558%
48	Tributyl phosphate	10	FR57-IN-E	5.9E-05	0.20	0.029%	YES	U	0.0558%
48	Tributyl phosphate	12	FR57-IN-F	6.0E-05	0.20	0.030%	YES	U	0.0558%
48	Tributyl phosphate	14	FR57-IN-G	5.8E-05	0.20	0.029%	YES	U	0.0558%
48	Tributyl phosphate	16	FR57-IN-H	1.0E-04	0.20	0.052%	YES	U	0.0558%
48	Tributyl phosphate	2	FR57-EF-A	1.0E-04	0.20	0.051%	YES	U	0.0558%
48	Tributyl phosphate	4	FR57-EF-B	1.0E-04	0.20	0.052%	YES	U	0.0558%
48	Tributyl phosphate	6	FR57-EF-C	1.1E-04	0.20	0.055%	YES	U	0.0558%
48	Tributyl phosphate	8	FR57-EF-D	1.1E-04	0.20	0.055%	YES	U	0.0558%
48	Tributyl phosphate	10	FR57-EF-E	1.1E-04	0.20	0.055%	YES	U	0.0558%
48	Tributyl phosphate	12	FR57-EF-F	1.1E-04	0.20	0.054%	YES	U	0.0558%
48	Tributyl phosphate	14	FR57-EF-G	1.1E-04	0.20	0.054%	YES	U	0.0558%
48	Tributyl phosphate	16	FR57-EF-H	1.1E-04	0.20	0.055%	YES	U	0.0558%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
49	Dibutyl butylphosphonate	2	TL-IN-A	4.4E-05	0.007	0.626%	YES	U	0.637%
49	Dibutyl butylphosphonate	4	TL-IN-B	4.3E-05	0.007	0.616%	YES	U	0.637%
49	Dibutyl butylphosphonate	6	TL-IN-C	4.4E-05	0.007	0.625%	YES	U	0.637%
49	Dibutyl butylphosphonate	8	TL-IN-D	2.4E-05	0.007	0.345%	YES	U	0.637%
49	Dibutyl butylphosphonate	10	TL-IN-E	2.3E-05	0.007	0.327%	YES	U	0.637%
49	Dibutyl butylphosphonate	12	TL-IN-F	2.3E-05	0.007	0.334%	YES	U	0.637%
49	Dibutyl butylphosphonate	14	TL-IN-G	2.5E-05	0.007	0.355%	YES	U	0.637%
49	Dibutyl butylphosphonate	16	TL-IN-H	4.3E-05	0.007	0.612%	YES	U	0.637%
49	Dibutyl butylphosphonate	2	TL-EF-A	4.0E-05	0.007	0.578%	YES	U	0.637%
49	Dibutyl butylphosphonate	4	TL-EF-B	2.4E-05	0.007	0.344%	YES	U	0.637%
49	Dibutyl butylphosphonate	6	TL-EF-C	2.4E-05	0.007	0.346%	YES	UY	0.637%
49	Dibutyl butylphosphonate	8	TL-EF-D	4.5E-05	0.007	0.637%	YES	U	0.637%
49	Dibutyl butylphosphonate	10	TL-EF-E	4.3E-05	0.007	0.612%	YES	U	0.637%
49	Dibutyl butylphosphonate	12	TL-EF-F	4.1E-05	0.007	0.584%	YES	U	0.637%
49	Dibutyl butylphosphonate	14	TL-EF-G	4.2E-05	0.007	0.601%	YES	U	0.637%
49	Dibutyl butylphosphonate	16	TL-EF-H	4.4E-05	0.007	0.625%	YES	U	0.637%
49	Dibutyl butylphosphonate	2	FR57-IN-A	4.0E-05	0.007	0.578%	YES	U	0.637%
49	Dibutyl butylphosphonate	4	FR57-IN-B	2.2E-05	0.007	0.311%	YES	U	0.637%
49	Dibutyl butylphosphonate	6	FR57-IN-C	2.2E-05	0.007	0.320%	YES	U	0.637%
49	Dibutyl butylphosphonate	8	FR57-IN-D	2.5E-05	0.007	0.350%	YES	U	0.637%
49	Dibutyl butylphosphonate	10	FR57-IN-E	2.2E-05	0.007	0.318%	YES	U	0.637%
49	Dibutyl butylphosphonate	12	FR57-IN-F	2.3E-05	0.007	0.323%	YES	U	0.637%
49	Dibutyl butylphosphonate	14	FR57-IN-G	2.2E-05	0.007	0.312%	YES	U	0.637%
49	Dibutyl butylphosphonate	16	FR57-IN-H	4.1E-05	0.007	0.592%	YES	U	0.637%
49	Dibutyl butylphosphonate	2	FR57-EF-A	4.1E-05	0.007	0.582%	YES	U	0.637%
49	Dibutyl butylphosphonate	4	FR57-EF-B	4.1E-05	0.007	0.588%	YES	U	0.637%
49	Dibutyl butylphosphonate	6	FR57-EF-C	4.4E-05	0.007	0.632%	YES	U	0.637%
49	Dibutyl butylphosphonate	8	FR57-EF-D	4.4E-05	0.007	0.624%	YES	U	0.637%
49	Dibutyl butylphosphonate	10	FR57-EF-E	4.4E-05	0.007	0.626%	YES	U	0.637%
49	Dibutyl butylphosphonate	12	FR57-EF-F	4.3E-05	0.007	0.614%	YES	U	0.637%
49	Dibutyl butylphosphonate	14	FR57-EF-G	4.3E-05	0.007	0.620%	YES	U	0.637%
49	Dibutyl butylphosphonate	16	FR57-EF-H	4.4E-05	0.007	0.633%	YES	U	0.637%
52	Pyridine	2	TL-IN-A	9.3E-05	1.0	0.009%		JY	0.00978%
52	Pyridine	4	TL-IN-B	1.2E-04	1.0	0.012%		J	0.00978%
52	Pyridine	6	TL-IN-C	1.1E-04	1.0	0.011%		J	0.00978%
52	Pyridine	8	TL-IN-D	9.5E-05	1.0	0.009%		J	0.00978%
52	Pyridine	10	TL-IN-E	1.1E-04	1.0	0.011%		J	0.00978%
52	Pyridine	12	TL-IN-F	9.2E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	14	TL-IN-G	1.1E-04	1.0	0.011%		J	0.00978%
52	Pyridine	16	TL-IN-H	9.2E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	2	TL-EF-A	8.5E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	4	TL-EF-B	8.3E-05	1.0	0.008%	YES	UY	0.00978%
52	Pyridine	6	TL-EF-C	8.8E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	8	TL-EF-D	9.8E-05	1.0	0.010%	YES	U	0.00978%
52	Pyridine	10	TL-EF-E	9.5E-05	1.0	0.010%	YES	U	0.00978%
52	Pyridine	12	TL-EF-F	9.1E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	14	TL-EF-G	9.6E-05	1.0	0.010%	YES	U	0.00978%
52	Pyridine	16	TL-EF-H	9.5E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	2	FR57-IN-A		1.0				0.00978%
52	Pyridine	4	FR57-IN-B		1.0				0.00978%
52	Pyridine	6	FR57-IN-C	9.4E-05	1.0	0.009%		J	0.00978%
52	Pyridine	8	FR57-IN-D	9.6E-05	1.0	0.010%		J	0.00978%
52	Pyridine	10	FR57-IN-E	9.6E-05	1.0	0.010%	YES	U	0.00978%
52	Pyridine	12	FR57-IN-F	9.6E-05	1.0	0.010%		J	0.00978%
52	Pyridine	14	FR57-IN-G	1.2E-04	1.0	0.012%		J	0.00978%
52	Pyridine	16	FR57-IN-H	9.0E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	2	FR57-EF-A	8.7E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	4	FR57-EF-B	9.0E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	6	FR57-EF-C	9.0E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	8	FR57-EF-D	8.7E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	10	FR57-EF-E	9.2E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	12	FR57-EF-F	9.1E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	14	FR57-EF-G	9.4E-05	1.0	0.009%	YES	U	0.00978%
52	Pyridine	16	FR57-EF-H		1.0				0.00978%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
53	2,4-Dimethylpyridine	2	TL-IN-A	1.7E-04	0.50	0.034%	YES	UY	0.0361%
53	2,4-Dimethylpyridine	4	TL-IN-B	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	6	TL-IN-C	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	8	TL-IN-D	1.8E-04	0.50	0.035%	YES	U	0.0361%
53	2,4-Dimethylpyridine	10	TL-IN-E	1.6E-04	0.50	0.032%	YES	U	0.0361%
53	2,4-Dimethylpyridine	12	TL-IN-F	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	14	TL-IN-G	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	16	TL-IN-H	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	2	TL-EF-A	1.6E-04	0.50	0.031%	YES	U	0.0361%
53	2,4-Dimethylpyridine	4	TL-EF-B	1.5E-04	0.50	0.031%	YES	UY	0.0361%
53	2,4-Dimethylpyridine	6	TL-EF-C	1.6E-04	0.50	0.032%	YES	U	0.0361%
53	2,4-Dimethylpyridine	8	TL-EF-D	1.8E-04	0.50	0.036%	YES	U	0.0361%
53	2,4-Dimethylpyridine	10	TL-EF-E	1.8E-04	0.50	0.035%	YES	U	0.0361%
53	2,4-Dimethylpyridine	12	TL-EF-F	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	14	TL-EF-G	1.8E-04	0.50	0.035%	YES	U	0.0361%
53	2,4-Dimethylpyridine	16	TL-EF-H	1.7E-04	0.50	0.035%	YES	U	0.0361%
53	2,4-Dimethylpyridine	2	FR57-IN-A		0.50				0.0361%
53	2,4-Dimethylpyridine	4	FR57-IN-B		0.50				0.0361%
53	2,4-Dimethylpyridine	6	FR57-IN-C	1.6E-04	0.50	0.032%	YES	U	0.0361%
53	2,4-Dimethylpyridine	8	FR57-IN-D	1.6E-04	0.50	0.033%	YES	U	0.0361%
53	2,4-Dimethylpyridine	10	FR57-IN-E	1.8E-04	0.50	0.036%	YES	U	0.0361%
53	2,4-Dimethylpyridine	12	FR57-IN-F	1.8E-04	0.50	0.035%	YES	U	0.0361%
53	2,4-Dimethylpyridine	14	FR57-IN-G	1.7E-04	0.50	0.033%	YES	U	0.0361%
53	2,4-Dimethylpyridine	16	FR57-IN-H	1.7E-04	0.50	0.033%	YES	U	0.0361%
53	2,4-Dimethylpyridine	2	FR57-EF-A	1.6E-04	0.50	0.032%	YES	U	0.0361%
53	2,4-Dimethylpyridine	4	FR57-EF-B	1.7E-04	0.50	0.033%	YES	U	0.0361%
53	2,4-Dimethylpyridine	6	FR57-EF-C	1.7E-04	0.50	0.033%	YES	U	0.0361%
53	2,4-Dimethylpyridine	8	FR57-EF-D	1.6E-04	0.50	0.032%	YES	U	0.0361%
53	2,4-Dimethylpyridine	10	FR57-EF-E	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	12	FR57-EF-F	1.7E-04	0.50	0.034%	YES	U	0.0361%
53	2,4-Dimethylpyridine	14	FR57-EF-G	1.7E-04	0.50	0.035%	YES	U	0.0361%
53	2,4-Dimethylpyridine	16	FR57-EF-H		0.50				0.0361%
16	Butanal/Butyraldehyde	2	TL-IN-A	3.9E-03	25	0.016%			0.00282%
16	Butanal/Butyraldehyde	4	TL-IN-B	4.1E-03	25	0.016%			0.00282%
16	Butanal/Butyraldehyde	6	TL-IN-C	4.1E-03	25	0.017%			0.00282%
16	Butanal/Butyraldehyde	8	TL-IN-D	3.5E-03	25	0.014%			0.00282%
16	Butanal/Butyraldehyde	10	TL-IN-E	3.7E-03	25	0.015%			0.00282%
16	Butanal/Butyraldehyde	12	TL-IN-F	3.5E-03	25	0.014%			0.00282%
16	Butanal/Butyraldehyde	14	TL-IN-G	3.0E-03	25	0.012%			0.00282%
16	Butanal/Butyraldehyde	16	TL-IN-H	3.0E-03	25	0.012%			0.00282%
16	Butanal/Butyraldehyde	2	TL-EF-A	6.8E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	4	TL-EF-B	6.7E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	6	TL-EF-C	7.0E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	8	TL-EF-D	6.8E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	10	TL-EF-E	6.8E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	12	TL-EF-F	6.7E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	14	TL-EF-G	6.5E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	16	TL-EF-H	6.5E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	2	FR57-IN-A	3.5E-03	25	0.014%			0.00282%
16	Butanal/Butyraldehyde	4	FR57-IN-B	3.3E-03	25	0.013%			0.00282%
16	Butanal/Butyraldehyde	6	FR57-IN-C	3.3E-03	25	0.013%			0.00282%
16	Butanal/Butyraldehyde	8	FR57-IN-D	3.6E-03	25	0.014%			0.00282%
16	Butanal/Butyraldehyde	10	FR57-IN-E	3.4E-03	25	0.014%			0.00282%
16	Butanal/Butyraldehyde	12	FR57-IN-F	3.4E-03	25	0.014%			0.00282%
16	Butanal/Butyraldehyde	14	FR57-IN-G	3.1E-03	25	0.012%			0.00282%
16	Butanal/Butyraldehyde	16	FR57-IN-H	3.7E-03	25	0.015%			0.00282%
16	Butanal/Butyraldehyde	2	FR57-EF-A	7.0E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	4	FR57-EF-B	7.0E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	6	FR57-EF-C	7.0E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	8	FR57-EF-D	7.0E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	10	FR57-EF-E	6.9E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	12	FR57-EF-F	6.5E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	14	FR57-EF-G	6.8E-04	25	0.003%	YES		0.00282%
16	Butanal/Butyraldehyde	16	FR57-EF-H	6.9E-04	25	0.003%	YES		0.00282%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
20	Furan	2	TL-IN-A	2.4E-05	0.001	2.40%	YES	U	2.60%
20	Furan	4	TL-IN-B	2.9E-05	0.001	2.89%		J	2.60%
20	Furan	6	TL-IN-C	2.7E-05	0.001	2.71%		J	2.60%
20	Furan	8	TL-IN-D	2.5E-05	0.001	2.48%	YES	U	2.60%
20	Furan	10	TL-IN-E	2.3E-05	0.001	2.32%	YES	U	2.60%
20	Furan	12	TL-IN-F	2.5E-05	0.001	2.48%	YES	U	2.60%
20	Furan	14	TL-IN-G	2.4E-05	0.001	2.39%	YES	U	2.60%
20	Furan	16	TL-IN-H	2.6E-05	0.001	2.60%	YES	U	2.60%
20	Furan	2	TL-EF-A	2.3E-05	0.001	2.29%	YES	U	2.60%
20	Furan	4	TL-EF-B	2.3E-05	0.001	2.29%	YES	U	2.60%
20	Furan	6	TL-EF-C	2.3E-05	0.001	2.29%	YES	U	2.60%
20	Furan	8	TL-EF-D	2.4E-05	0.001	2.35%	YES	U	2.60%
20	Furan	10	TL-EF-E	2.5E-05	0.001	2.52%	YES	U	2.60%
20	Furan	12	TL-EF-F	2.3E-05	0.001	2.33%	YES	U	2.60%
20	Furan	14	TL-EF-G	2.3E-05	0.001	2.33%	YES	U	2.60%
20	Furan	16	TL-EF-H	2.3E-05	0.001	2.34%	YES	U	2.60%
20	Furan	2	FR57-IN-A	2.3E-05	0.001	2.27%	YES	U	2.60%
20	Furan	4	FR57-IN-B	2.3E-05	0.001	2.26%	YES	U	2.60%
20	Furan	6	FR57-IN-C	2.2E-05	0.001	2.21%	YES	U	2.60%
20	Furan	8	FR57-IN-D	2.4E-05	0.001	2.35%	YES	U	2.60%
20	Furan	10	FR57-IN-E	2.5E-05	0.001	2.47%		J	2.60%
20	Furan	12	FR57-IN-F	2.6E-05	0.001	2.60%		J	2.60%
20	Furan	14	FR57-IN-G	2.4E-05	0.001	2.38%	YES	U	2.60%
20	Furan	16	FR57-IN-H	2.4E-05	0.001	2.38%	YES	U	2.60%
20	Furan	2	FR57-EF-A	2.4E-05	0.001	2.38%	YES	U	2.60%
20	Furan	4	FR57-EF-B	2.2E-05	0.001	2.21%	YES	U	2.60%
20	Furan	6	FR57-EF-C	2.3E-05	0.001	2.34%	YES	U	2.60%
20	Furan	8	FR57-EF-D	2.3E-05	0.001	2.33%	YES	U	2.60%
20	Furan	10	FR57-EF-E	2.4E-05	0.001	2.40%	YES	U	2.60%
20	Furan	12	FR57-EF-F	2.3E-05	0.001	2.34%	YES	U	2.60%
20	Furan	14	FR57-EF-G	2.3E-05	0.001	2.32%	YES	U	2.60%
20	Furan	16	FR57-EF-H	2.4E-05	0.001	2.42%	YES	U	2.60%
22	2,5-Dihydrofuran	2	TL-IN-A	2.4E-05	0.001	2.39%	YES	U	2.58%
22	2,5-Dihydrofuran	4	TL-IN-B	2.3E-05	0.001	2.31%	YES	U	2.58%
22	2,5-Dihydrofuran	6	TL-IN-C	2.3E-05	0.001	2.25%	YES	U	2.58%
22	2,5-Dihydrofuran	8	TL-IN-D	2.5E-05	0.001	2.46%	YES	U	2.58%
22	2,5-Dihydrofuran	10	TL-IN-E	2.3E-05	0.001	2.31%	YES	U	2.58%
22	2,5-Dihydrofuran	12	TL-IN-F	2.5E-05	0.001	2.47%	YES	U	2.58%
22	2,5-Dihydrofuran	14	TL-IN-G	2.4E-05	0.001	2.38%	YES	U	2.58%
22	2,5-Dihydrofuran	16	TL-IN-H	2.6E-05	0.001	2.58%	YES	U	2.58%
22	2,5-Dihydrofuran	2	TL-EF-A	2.3E-05	0.001	2.28%	YES	U	2.58%
22	2,5-Dihydrofuran	4	TL-EF-B	2.3E-05	0.001	2.28%	YES	U	2.58%
22	2,5-Dihydrofuran	6	TL-EF-C	2.3E-05	0.001	2.28%	YES	U	2.58%
22	2,5-Dihydrofuran	8	TL-EF-D	2.3E-05	0.001	2.34%	YES	U	2.58%
22	2,5-Dihydrofuran	10	TL-EF-E	2.5E-05	0.001	2.51%	YES	U	2.58%
22	2,5-Dihydrofuran	12	TL-EF-F	2.3E-05	0.001	2.32%	YES	U	2.58%
22	2,5-Dihydrofuran	14	TL-EF-G	2.3E-05	0.001	2.32%	YES	U	2.58%
22	2,5-Dihydrofuran	16	TL-EF-H	2.3E-05	0.001	2.33%	YES	U	2.58%
22	2,5-Dihydrofuran	2	FR57-IN-A	2.3E-05	0.001	2.26%	YES	U	2.58%
22	2,5-Dihydrofuran	4	FR57-IN-B	2.3E-05	0.001	2.25%	YES	U	2.58%
22	2,5-Dihydrofuran	6	FR57-IN-C	2.2E-05	0.001	2.20%	YES	U	2.58%
22	2,5-Dihydrofuran	8	FR57-IN-D	2.3E-05	0.001	2.34%	YES	U	2.58%
22	2,5-Dihydrofuran	10	FR57-IN-E	2.4E-05	0.001	2.40%	YES	U	2.58%
22	2,5-Dihydrofuran	12	FR57-IN-F	2.5E-05	0.001	2.46%	YES	U	2.58%
22	2,5-Dihydrofuran	14	FR57-IN-G	2.4E-05	0.001	2.36%	YES	U	2.58%
22	2,5-Dihydrofuran	16	FR57-IN-H	2.4E-05	0.001	2.37%	YES	U	2.58%
22	2,5-Dihydrofuran	2	FR57-EF-A	2.4E-05	0.001	2.37%	YES	U	2.58%
22	2,5-Dihydrofuran	4	FR57-EF-B	2.2E-05	0.001	2.20%	YES	U	2.58%
22	2,5-Dihydrofuran	6	FR57-EF-C	2.3E-05	0.001	2.33%	YES	U	2.58%
22	2,5-Dihydrofuran	8	FR57-EF-D	2.3E-05	0.001	2.31%	YES	U	2.58%
22	2,5-Dihydrofuran	10	FR57-EF-E	2.4E-05	0.001	2.39%	YES	U	2.58%
22	2,5-Dihydrofuran	12	FR57-EF-F	2.3E-05	0.001	2.33%	YES	U	2.58%
22	2,5-Dihydrofuran	14	FR57-EF-G	2.3E-05	0.001	2.31%	YES	U	2.58%
22	2,5-Dihydrofuran	16	FR57-EF-H	2.4E-05	0.001	2.41%	YES	U	2.58%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
23	2-Methylfuran	2	TL-IN-A	3.2E-05	0.001	3.16%	YES	U	3.41%
23	2-Methylfuran	4	TL-IN-B	3.1E-05	0.001	3.05%	YES	U	3.41%
23	2-Methylfuran	6	TL-IN-C	3.0E-05	0.001	2.98%	YES	U	3.41%
23	2-Methylfuran	8	TL-IN-D	3.3E-05	0.001	3.25%	YES	U	3.41%
23	2-Methylfuran	10	TL-IN-E	3.1E-05	0.001	3.06%	YES	U	3.41%
23	2-Methylfuran	12	TL-IN-F	3.3E-05	0.001	3.26%	YES	U	3.41%
23	2-Methylfuran	14	TL-IN-G	3.1E-05	0.001	3.14%	YES	U	3.41%
23	2-Methylfuran	16	TL-IN-H	3.4E-05	0.001	3.41%	YES	U	3.41%
23	2-Methylfuran	2	TL-EF-A	3.0E-05	0.001	3.02%	YES	U	3.41%
23	2-Methylfuran	4	TL-EF-B	3.0E-05	0.001	3.01%	YES	U	3.41%
23	2-Methylfuran	6	TL-EF-C	3.0E-05	0.001	3.01%	YES	U	3.41%
23	2-Methylfuran	8	TL-EF-D	3.1E-05	0.001	3.10%	YES	U	3.41%
23	2-Methylfuran	10	TL-EF-E	3.3E-05	0.001	3.32%	YES	U	3.41%
23	2-Methylfuran	12	TL-EF-F	3.1E-05	0.001	3.06%	YES	U	3.41%
23	2-Methylfuran	14	TL-EF-G	3.1E-05	0.001	3.07%	YES	U	3.41%
23	2-Methylfuran	16	TL-EF-H	3.1E-05	0.001	3.08%	YES	U	3.41%
23	2-Methylfuran	2	FR57-IN-A	3.0E-05	0.001	2.99%	YES	U	3.41%
23	2-Methylfuran	4	FR57-IN-B	3.0E-05	0.001	2.98%	YES	U	3.41%
23	2-Methylfuran	6	FR57-IN-C	2.9E-05	0.001	2.90%	YES	U	3.41%
23	2-Methylfuran	8	FR57-IN-D	3.1E-05	0.001	3.09%	YES	U	3.41%
23	2-Methylfuran	10	FR57-IN-E	3.2E-05	0.001	3.17%	YES	U	3.41%
23	2-Methylfuran	12	FR57-IN-F	3.3E-05	0.001	3.26%	YES	U	3.41%
23	2-Methylfuran	14	FR57-IN-G	3.1E-05	0.001	3.12%	YES	U	3.41%
23	2-Methylfuran	16	FR57-IN-H	3.1E-05	0.001	3.13%	YES	U	3.41%
23	2-Methylfuran	2	FR57-EF-A	3.1E-05	0.001	3.13%	YES	U	3.41%
23	2-Methylfuran	4	FR57-EF-B	2.9E-05	0.001	2.91%	YES	U	3.41%
23	2-Methylfuran	6	FR57-EF-C	3.1E-05	0.001	3.07%	YES	U	3.41%
23	2-Methylfuran	8	FR57-EF-D	3.1E-05	0.001	3.06%	YES	U	3.41%
23	2-Methylfuran	10	FR57-EF-E	3.2E-05	0.001	3.16%	YES	U	3.41%
23	2-Methylfuran	12	FR57-EF-F	3.1E-05	0.001	3.08%	YES	U	3.41%
23	2-Methylfuran	14	FR57-EF-G	3.1E-05	0.001	3.05%	YES	U	3.41%
23	2-Methylfuran	16	FR57-EF-H	3.2E-05	0.001	3.18%	YES	U	3.41%
35	Acetonitrile	2	TL-IN-A	4.6E-01	20	2.30%	YES		3.00%
35	Acetonitrile	4	TL-IN-B	5.0E-01	20	2.51%	YES		3.00%
35	Acetonitrile	6	TL-IN-C	5.0E-01	20	2.52%	YES		3.00%
35	Acetonitrile	8	TL-IN-D	5.0E-01	20	2.49%	YES		3.00%
35	Acetonitrile	10	TL-IN-E	5.0E-01	20	2.51%	YES		3.00%
35	Acetonitrile	12	TL-IN-F	5.0E-01	20	2.48%	YES		3.00%
35	Acetonitrile	14	TL-IN-G	4.8E-01	20	2.42%	YES		3.00%
35	Acetonitrile	16	TL-IN-H	4.8E-01	20	2.42%	YES		3.00%
35	Acetonitrile	2	TL-EF-A	5.0E-01	20	2.52%	YES		3.00%
35	Acetonitrile	4	TL-EF-B	4.7E-01	20	2.33%	YES		3.00%
35	Acetonitrile	6	TL-EF-C	4.9E-01	20	2.44%	YES		3.00%
35	Acetonitrile	8	TL-EF-D	5.0E-01	20	2.50%	YES		3.00%
35	Acetonitrile	10	TL-EF-E	5.2E-01	20	2.61%	YES		3.00%
35	Acetonitrile	12	TL-EF-F	5.0E-01	20	2.50%	YES		3.00%
35	Acetonitrile	14	TL-EF-G	5.2E-01	20	2.60%	YES		3.00%
35	Acetonitrile	16	TL-EF-H	5.3E-01	20	2.63%	YES		3.00%
35	Acetonitrile	2	FR57-IN-A	4.8E-01	20	2.40%	YES		3.00%
35	Acetonitrile	4	FR57-IN-B	5.0E-01	20	2.48%	YES		3.00%
35	Acetonitrile	6	FR57-IN-C	4.9E-01	20	2.46%	YES		3.00%
35	Acetonitrile	8	FR57-IN-D	4.9E-01	20	2.43%	YES		3.00%
35	Acetonitrile	10	FR57-IN-E	5.1E-01	20	2.53%	YES		3.00%
35	Acetonitrile	12	FR57-IN-F	4.8E-01	20	2.39%	YES		3.00%
35	Acetonitrile	14	FR57-IN-G	4.7E-01	20	2.37%	YES		3.00%
35	Acetonitrile	16	FR57-IN-H	4.9E-01	20	2.43%	YES		3.00%
35	Acetonitrile	2	FR57-EF-A	4.8E-01	20	2.39%	YES		3.00%
35	Acetonitrile	4	FR57-EF-B	4.8E-01	20	2.42%	YES		3.00%
35	Acetonitrile	6	FR57-EF-C	6.0E-01	20	3.00%	YES		3.00%
35	Acetonitrile	8	FR57-EF-D	4.9E-01	20	2.43%	YES		3.00%
35	Acetonitrile	10	FR57-EF-E	4.7E-01	20	2.33%	YES		3.00%
35	Acetonitrile	12	FR57-EF-F	4.8E-01	20	2.38%	YES		3.00%
35	Acetonitrile	14	FR57-EF-G	4.7E-01	20	2.37%	YES		3.00%
35	Acetonitrile	16	FR57-EF-H	4.7E-01	20	2.35%	YES		3.00%

Table D.2. PAPR Cartridge Testing Calculated Data (continued)

COPC #	Analyte	End Time (h)	Position	Conc. (ppm)	OEL (ppm)	Fraction of OEL	Measurement < DL|RL?	Quality Code	Approx. DL|RL (%OEL)
52	Pyridine	2	TL-IN-A	1.3E-03	1.0	0.125%	YES		0.129%
52	Pyridine	4	TL-IN-B	1.3E-03	1.0	0.125%	YES		0.129%
52	Pyridine	6	TL-IN-C	1.2E-03	1.0	0.124%	YES		0.129%
52	Pyridine	8	TL-IN-D	1.3E-03	1.0	0.126%	YES		0.129%
52	Pyridine	10	TL-IN-E	1.2E-03	1.0	0.121%	YES		0.129%
52	Pyridine	12	TL-IN-F	1.2E-03	1.0	0.122%	YES		0.129%
52	Pyridine	14	TL-IN-G	1.2E-03	1.0	0.117%	YES		0.129%
52	Pyridine	16	TL-IN-H	1.2E-03	1.0	0.122%	YES		0.129%
52	Pyridine	2	TL-EF-A	1.2E-03	1.0	0.123%	YES		0.129%
52	Pyridine	4	TL-EF-B	1.3E-03	1.0	0.125%	YES		0.129%
52	Pyridine	6	TL-EF-C	1.3E-03	1.0	0.128%	YES		0.129%
52	Pyridine	8	TL-EF-D	1.2E-03	1.0	0.125%	YES		0.129%
52	Pyridine	10	TL-EF-E	1.2E-03	1.0	0.122%	YES		0.129%
52	Pyridine	12	TL-EF-F	1.2E-03	1.0	0.118%	YES		0.129%
52	Pyridine	14	TL-EF-G	1.2E-03	1.0	0.120%	YES		0.129%
52	Pyridine	16	TL-EF-H	1.2E-03	1.0	0.117%	YES		0.129%
52	Pyridine	2	FR57-IN-A	1.3E-03	1.0	0.127%	YES		0.129%
52	Pyridine	4	FR57-IN-B	1.3E-03	1.0	0.129%	YES		0.129%
52	Pyridine	6	FR57-IN-C	1.3E-03	1.0	0.127%	YES		0.129%
52	Pyridine	8	FR57-IN-D	1.3E-03	1.0	0.128%	YES		0.129%
52	Pyridine	10	FR57-IN-E	1.3E-03	1.0	0.126%	YES		0.129%
52	Pyridine	12	FR57-IN-F	1.2E-03	1.0	0.119%	YES		0.129%
52	Pyridine	14	FR57-IN-G	1.3E-03	1.0	0.127%	YES		0.129%
52	Pyridine	16	FR57-IN-H	1.2E-03	1.0	0.123%	YES		0.129%
52	Pyridine	2	FR57-EF-A	1.3E-03	1.0	0.127%	YES		0.129%
52	Pyridine	4	FR57-EF-B	1.3E-03	1.0	0.129%	YES		0.129%
52	Pyridine	6	FR57-EF-C	1.3E-03	1.0	0.128%	YES		0.129%
52	Pyridine	8	FR57-EF-D	1.2E-03	1.0	0.124%	YES		0.129%
52	Pyridine	10	FR57-EF-E	1.3E-03	1.0	0.126%	YES		0.129%
52	Pyridine	12	FR57-EF-F	1.2E-03	1.0	0.117%	YES		0.129%
52	Pyridine	14	FR57-EF-G	1.2E-03	1.0	0.121%	YES		0.129%
52	Pyridine	16	FR57-EF-H	1.2E-03	1.0	0.121%	YES		0.129%
53	2,4-Dimethylpyridine	2	TL-IN-A	9.2E-04	0.50	0.185%	YES		0.191%
53	2,4-Dimethylpyridine	4	TL-IN-B	9.2E-04	0.50	0.185%	YES		0.191%
53	2,4-Dimethylpyridine	6	TL-IN-C	9.2E-04	0.50	0.183%	YES		0.191%
53	2,4-Dimethylpyridine	8	TL-IN-D	9.3E-04	0.50	0.186%	YES		0.191%
53	2,4-Dimethylpyridine	10	TL-IN-E	8.9E-04	0.50	0.178%	YES		0.191%
53	2,4-Dimethylpyridine	12	TL-IN-F	9.0E-04	0.50	0.181%	YES		0.191%
53	2,4-Dimethylpyridine	14	TL-IN-G	8.6E-04	0.50	0.173%	YES		0.191%
53	2,4-Dimethylpyridine	16	TL-IN-H	9.0E-04	0.50	0.181%	YES		0.191%
53	2,4-Dimethylpyridine	2	TL-EF-A	9.1E-04	0.50	0.181%	YES		0.191%
53	2,4-Dimethylpyridine	4	TL-EF-B	9.2E-04	0.50	0.185%	YES		0.191%
53	2,4-Dimethylpyridine	6	TL-EF-C	9.5E-04	0.50	0.189%	YES		0.191%
53	2,4-Dimethylpyridine	8	TL-EF-D	9.2E-04	0.50	0.184%	YES		0.191%
53	2,4-Dimethylpyridine	10	TL-EF-E	9.0E-04	0.50	0.180%	YES		0.191%
53	2,4-Dimethylpyridine	12	TL-EF-F	8.7E-04	0.50	0.174%	YES		0.191%
53	2,4-Dimethylpyridine	14	TL-EF-G	8.9E-04	0.50	0.177%	YES		0.191%
53	2,4-Dimethylpyridine	16	TL-EF-H	8.6E-04	0.50	0.172%	YES		0.191%
53	2,4-Dimethylpyridine	2	FR57-IN-A	9.4E-04	0.50	0.188%	YES		0.191%
53	2,4-Dimethylpyridine	4	FR57-IN-B	9.5E-04	0.50	0.190%	YES		0.191%
53	2,4-Dimethylpyridine	6	FR57-IN-C	9.4E-04	0.50	0.188%	YES		0.191%
53	2,4-Dimethylpyridine	8	FR57-IN-D	9.5E-04	0.50	0.190%	YES		0.191%
53	2,4-Dimethylpyridine	10	FR57-IN-E	9.3E-04	0.50	0.186%	YES		0.191%
53	2,4-Dimethylpyridine	12	FR57-IN-F	8.8E-04	0.50	0.175%	YES		0.191%
53	2,4-Dimethylpyridine	14	FR57-IN-G	9.4E-04	0.50	0.188%	YES		0.191%
53	2,4-Dimethylpyridine	16	FR57-IN-H	9.1E-04	0.50	0.182%	YES		0.191%
53	2,4-Dimethylpyridine	2	FR57-EF-A	9.3E-04	0.50	0.187%	YES		0.191%
53	2,4-Dimethylpyridine	4	FR57-EF-B	9.5E-04	0.50	0.191%	YES		0.191%
53	2,4-Dimethylpyridine	6	FR57-EF-C	9.5E-04	0.50	0.189%	YES		0.191%
53	2,4-Dimethylpyridine	8	FR57-EF-D	9.2E-04	0.50	0.183%	YES		0.191%
53	2,4-Dimethylpyridine	10	FR57-EF-E	9.3E-04	0.50	0.186%	YES		0.191%
53	2,4-Dimethylpyridine	12	FR57-EF-F	8.6E-04	0.50	0.172%	YES		0.191%
53	2,4-Dimethylpyridine	14	FR57-EF-G	8.9E-04	0.50	0.179%	YES		0.191%
53	2,4-Dimethylpyridine	16	FR57-EF-H	8.9E-04	0.50	0.178%	YES		0.191%

Appendix E

Plots of Other COPCs with Significant (2–10% of the OEL) Detected Values

Appendix E

Plots of Other COPCs with Significant (2–10% of the OEL) Detected Value

E.1 APR Cartridge Testing

1,3-Butadiene. The reporting limit (RL) for 1,3-butadiene slightly exceeded 2.0% of the Occupational Exposure Limit (OEL) threshold for discussion in this appendix. All measured inlet and outlet concentrations of 1,3-butadiene were less than the RL of 2.01% of the OEL. Therefore, there was no evidence of breakthrough over the measured time period for either cartridge tested. No plot of the 1,3-butadiene data is included here because all of the data points were less than the RL.

Furan and Substituted Furans. Eight furan COPCs were measured and quantified during cartridge testing using calibration standards and two different sorbent tube methods. The Carbotrap 300 TDU tube was used to sample three of the lower boiling point calibrated furans including furan, 2,5-dihydrofuran, and 2-methylfuran. The Furans TENAX TA TDU tube was used to sample the remaining non-Tentatively Identified Compound substituted furans, including 2,3-dihydrofuran, 2,5-dimethylfuran, 2-pentylfuran, 2-heptylfuran, and 2-propylfuran. The detection limit (DL) for all eight furan COPCs exceeded 2% of the OEL. In the AX exhauster testing (APR cartridges), all measured inlet and outlet concentrations of all furan COPCs were less than the DLs and RLs, with the exception of 2-heptylfuran which is discussed below. Based on the outlet concentrations, there is no indication of breakthrough for any of these seven furan COPCs. No plots of the furan data are included here because all of the data points were less than the DL and the reporting limit (RL).

2 -Heptylfuran *(see Figure E.1)* – The DL for 2-heptylfuran corresponds to 4.1% of its OEL, and the RL corresponds to 13%. For both the SCOTT 7422-SD1 and -SC1 cartridges, all measured inlet and outlet concentrations of 2-heptylfuran were less than the DL and the RL, except for a single inlet and outlet measurement at 4-hour and 12-hour samples on 7422-SD1, respectively, and both inlet and outlet measurements at the 12-hour sample on 7422-SC1. The maximum inlet and outlet concentrations measured 7.0% and 8.0% of the OEL, respectively. Each of these measurements were above the DL but less than 10% of the OEL and less than the RL. Therefore, there is no evidence of breakthrough over the measured time period for either cartridge tested.

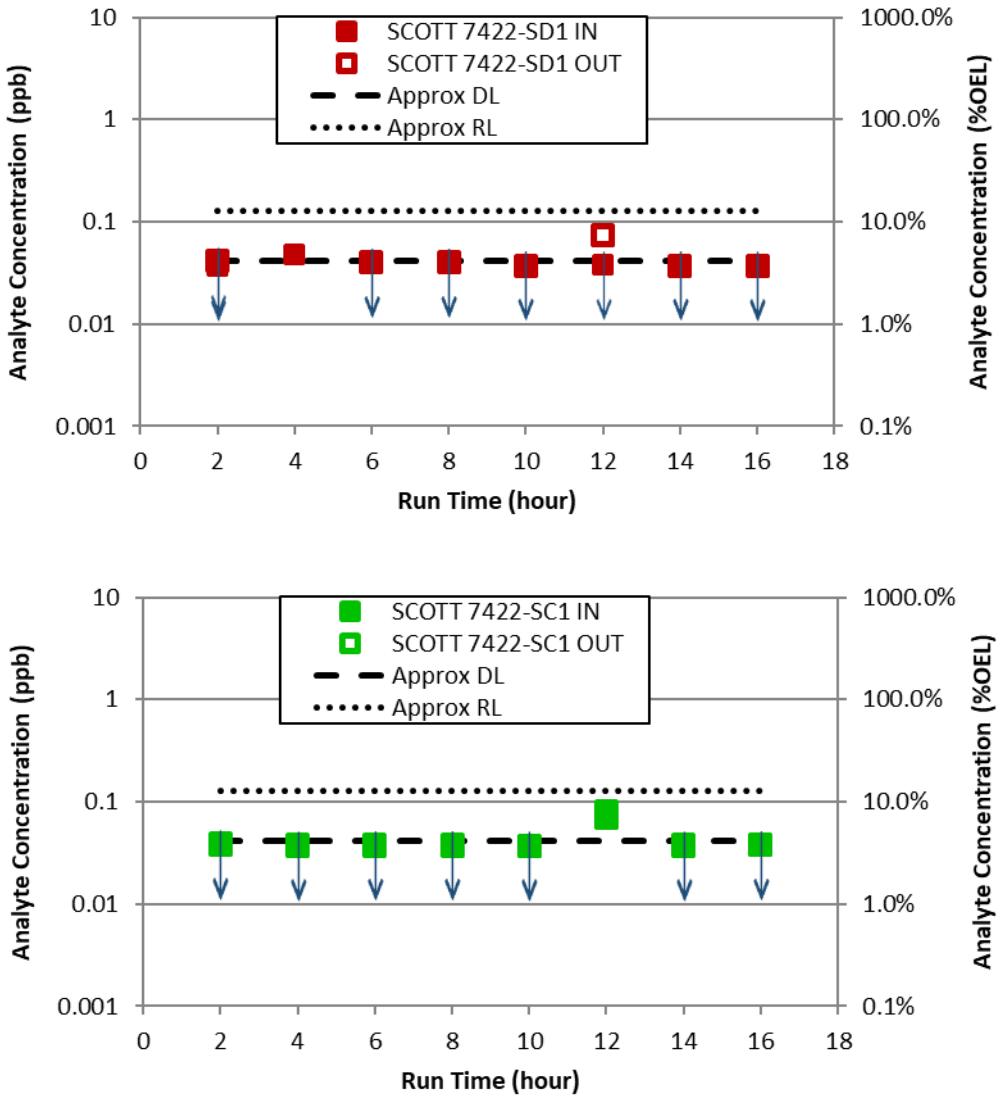

Figure E.1. Plots of Measured 2-Heptylfuran Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicate measurements less than the DL or RL. Outlet data points not visible are obscured by the inlet data points.

N-nitrosomethylethylamine *(see Figure E.2)* – The RL for NMEA corresponds to approximately 6.6% of its OEL. For both the SCOTT 7422-SD1 and 7422-SC1 cartridges, most of the inlet and outlet concentrations measured were less than the RL. However, a single inlet measurement at 4 hours for the SD1 cartridge, and three inlet measurements at 10, 12, and 16 hours for the SC1 cartridge were above but very close to the RL. All outlet values measured for both cartridges were less than the RL. Based on the outlet data, there is no evidence of breakthrough over the measured time period for either cartridge tested.

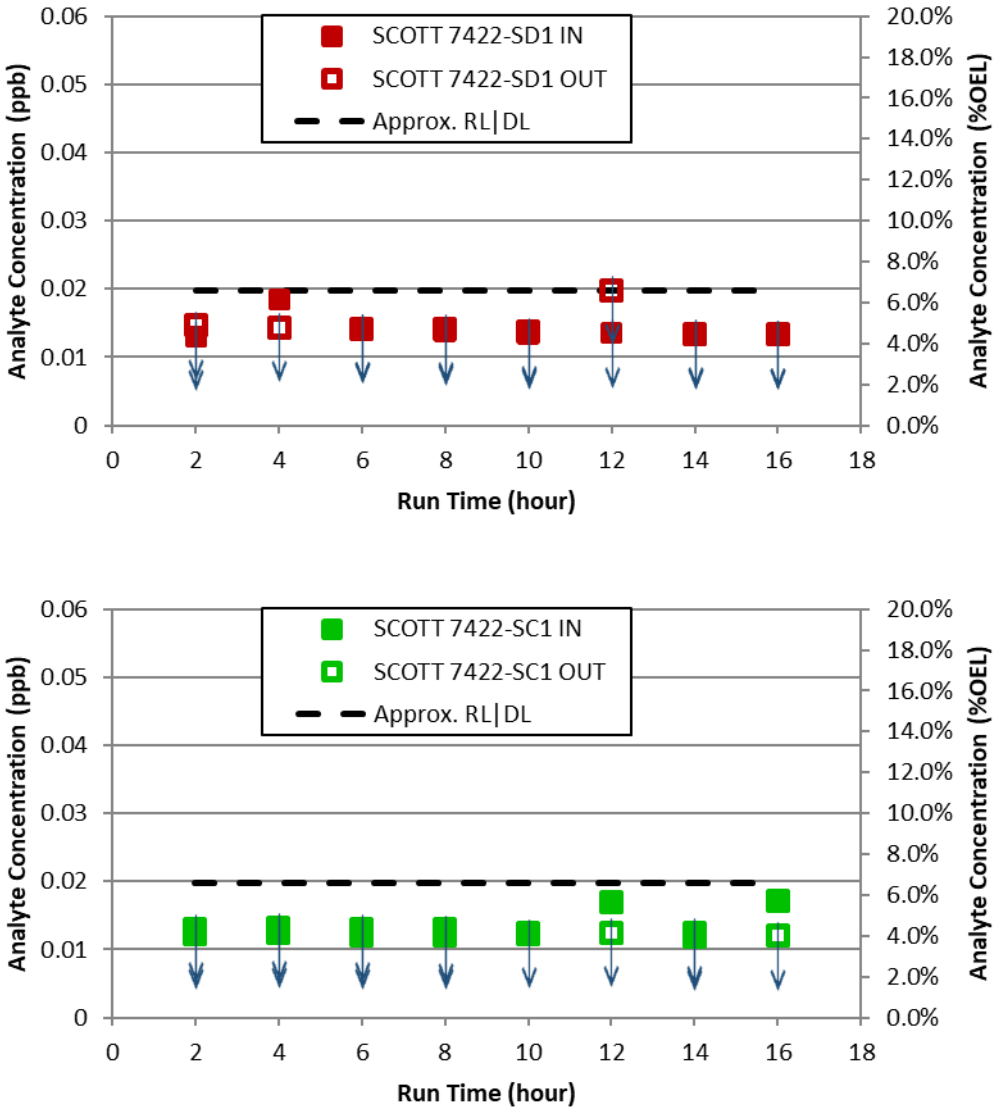

Figure E.2. Plots of Measured N-nitrosomethylethylamine Concentrations before the Inlets and after the Outlets of the Two PAPR Cartridges Tested (SCOTT 7422-SD1 and SCOTT 7422-SC1). Data points noted with ↓ indicate measurements less than the DL or RL. Outlet data points not visible are obscured by the inlet data points.

E.2 PAPR Cartridge Testing

Furan and Substituted Furans. Eight furan COPCs were measured and quantified during cartridge testing using calibration standards and two different sorbent tube methods. The Carbotrap 300 TDU tube was used to sample three of the lower boiling point calibrated furans including furan, 2,5-dihydrofuran, and 2-methylfuran. The Furans TENAX TA TDU tube was used to sample the remaining non-Tentatively Identified Compound substituted furans, including 2,3-dihydrofuran, 2,5-dimethylfuran, 2-pentylfuran, 2-heptylfuran, and 2-propylfuran. The DL for all eight furan COPCs exceeded 2% of the OEL. In the AX exhauster testing (PAPR cartridges), all measured inlet and outlet concentrations from cartridge testing were less than the DL and the RL; therefore, the concentrations are not plotted here. There is no indication of breakthrough for any of the furan COPCs.

Appendix F

Historical Data Comparison

Appendix F

Historical Data Comparison

The only available historical data for the AX exhauster were two Industrial Hygiene surveys that were carried out at the POR127 stack in October 2017, two months after the APR and PAPR cartridge test data were taken (on August 25 and August 26, 2017, respectively). These data were obtained from the Site-Wide Industrial Hygiene Database (SWIHD) source data by a query on December 7, 2017, that obtained all source data that were present as of that date, producing a set referred to as "SWIHD Source."

F.1 Data Handling and Filtering

For some of the historical data sets, each line of data in the set represents a measurement made on the contents of a single sorbent tube (or other collector). Frequently, a single sample air stream passed through a series of two or more collectors, which meant that the actual sample concentration was the sum of the contributions from all the collectors in the series. The intent of this sample collection method was to have most or all vapor deposited in the first collector, with a relatively small amount of breakthrough into the second collector. In such cases, it may be necessary to sum concentrations from single collectors to obtain the true concentration for the sample stream. However, the two surveys of AX exhauster vapor data do not appear to have employed collectors in series because there is only one measurement of each chemical in each survey. No tube combination was performed.

Some historical concentration data were removed from consideration because they were flagged as being "bad" data for the current purpose; that is, they had certain measurement quality issues. SWIHD Source data were checked for whether they were "bad" based on whether any of the following criteria were applicable:

- Were associated with a contaminant in a blank (Data Qualifier flag b or B), a laboratory control sample that was out of range (Data Qualifier flag a), or a low-level standard with percent recovery outside the specified range (Data Qualifier flag L)
- Had an excessive relative percent difference between duplicates (Data Qualifier flag c)
- Were marked with a laboratory-defined flag for which the meaning was not generically defined and might indicate a serious data-quality issue (Data Qualifier flag Y).

None of these criteria were met, so no data were excluded. However, it should be noted that sample numbers for the two surveys were marked with asterisks, indicating that the internal QA review had not been completed as of the December 2017 download date.

F.2 Data Tabulation

Maximum and average[16] headspace or source concentrations were found for each analyte for the two pertinent SWIHD Source surveys.(17) These maximum and average concentrations are given in Tables F.1

[16] Arithmetic average

[17] This evaluation used the concentration data in SWIHD and converted them to %OEL, rather than directly using the %OEL data in SWIHD. Although this approach was consistent with the methods used on the other two data

and F.2,[18] together with Occupational Exposure Limits (OELs) and counts of the number of values ("number of samples"). The notation "n/a" is used where there were no measurements of the analyte.

Because the reporting limits (RL) on concentrations in the historical database were generally higher than the RLs or detection limits (DL) in the cartridge tests, it was necessary to analyze data in a way that would let the effect of less-than-RL historical data (a.k.a., below-reports) be recognized. To do this, it was assumed that all of the below-reports in the databases had concentrations equal to the RLs of the measurement. These kinds of information are shown in Table F.1 and Table F.2 using the convention described below.

For the limited AX exhauster data set, every chemical had either both its measurements above the RL or both its measurements below the RL. If the maximum value for the overall data set is preceded by a "<" symbol, the concentrations were all below-reports and the number after the "<" is the maximum of the RLs. In the absence of the "<" symbol, the concentrations were all above-reports.

This convention applies to the concentration/OEL percentages as well as to the concentrations.

F.3 Identifying Maximum Concentrations Measured during Waste Disturbances

To better understand historical maximum concentrations, the historical data sets were reviewed to determine whether the data were taken during planned tank operations that caused disturbed the waste (typically referred to as waste-disturbing activities or operations).

Note that procedures already in place prevent air-purifying respirators from being used in downwind areas during certain types of planned operations; for example, waste transfers, other waste-disturbing activities, and ventilation restarts after outages. During these operations, tank farm personnel would use more protective equipment such as self-contained breathing apparatus or supplied air. Thus, maximum concentrations that come from data taken during these operations need to be recognized as such because they may be less pertinent to the intended purpose of cartridge testing.

For the discussion in this appendix, waste transfers, waste recirculation, and addition of water from evaporators are considered to be waste-disturbing activities. Raw water additions also are discussed when present; however, for dates when they are present without waste transfers, they are not taken as waste-disturbing events.

sets, there are cases where it gave a %OEL value smaller than that found in the SWIHD database. This difference occurs because concentrations in SWIHD may be truncated to one or two significant figures, while the %OEL values in SWIHD are calculated from concentrations before truncation. The difference between %OEL based on truncated and non-truncated concentrations is small enough to have no effect on conclusions about whether cartridge maxima are consistent with historical maxima.

[18] All % OEL values were calculated from concentration data that had been rounded to a minimum of 3 significant figures.

The information about tank activities was obtained from the Tank Waste Information Network System databases of tank transfers (post-2000).[19] These databases are related to Best Basis Inventory[20] determinations and focus on activities that change the waste inventories in tanks.

The AX Farm exhauster was installed in late February 2017. There were no activities in the AX Farm during 2017, except for an addition of less than 1 kgal of raw water during the July 18–19, 2017 timeframe. This low-volume activity is unlikely to have had any effect by the time of October 2017 when vapor data were measured. Hence, none of the available data for the AX Farm, after exhauster installation, were taken during waste-disturbing conditions.

F.4 Comparison with Historical Data – Approach

The maximum and average Chemical of Potential Concern (COPC) concentrations measured during cartridge testing were compared to the maximum and average historical concentrations. Where differences were found, the historical data were examined for explanations in the type or circumstances of sampling (e.g., waste-disturbing operations).

The APR cartridge inlet concentrations discussed in the following sections include (as appropriate) above-report concentrations, below-report concentrations (in which case RLs were used for comparison), and below-detects (in which case DLs were used for comparison). The use of below-detect versus below-report depends on the type of sample analysis performed on the cartridge inlet samples. For information about the difference between DLs and RLs for furans, see Appendix D of Freeman et al. (2017).

The larger discrepancies, or apparent discrepancies, between historical data and cartridge inlet concentrations are discussed below. Discrepancies are discussed if the cartridge inlet concentrations appeared to be low compared to historical maxima that, if present, might have been more of a challenge to the cartridge. The criteria for this condition are 1) the historical concentration of a compound was greater than 10% of the OEL and 2) the cartridge inlet concentration was between 20% and 50% of the historical value. However, discrepancies are considered significant only if the historical concentration was greater than 10% of the OEL and the cartridge inlet concentration is less than 20% of the historical value. In addition, if ammonia, mercury, nitrous oxide, and nitrosamines had cartridge inlet concentrations or historical concentrations that were greater than 10% of the OEL, they also are included below (even if not discrepant by the above definition) because these compounds are of general interest.

In cases where the cartridge inlet concentration (maximum or average) was below the RL or the DL, the RL or DL is used as a basis for comparison. The same approach is taken for historical concentrations that were below the RL (noted as “below-report” or “<RL”).

A comparison between cartridge inlet and historical maximum concentrations is made in the following sections. The comparison is limited because the two AX exhauster surveys covered only ammonia, mercury, aldehydes (analyzed by the aldehyde method), furans (analyzed by the furans method), and nitrosamines.

[19] See the “Tank Transfers” menu item under https://twins.labworks.org/twinsdata/Forms /About.aspx. Note that many entries in these databases refer to inventory changes caused not by a waste-affecting operation but by re-baselining, changes in inventory calculation assumptions, changes in level instrumentation, etc. Some (not all) spontaneous gas releases also are included.

[20] The Best-Basis Inventory (BBI) establishes the inventory of the underground waste storage tanks at Hanford by using sample data, process knowledge, surveillance data, and waste stream composition information from the Hanford Defined Waste computer model (Agnew et al. 1997).

F.5 Comparison with AX Exhauster Historical Data

F.5.1 Ammonia

The maximum cartridge inlet concentrations were 23.9% of the OEL for the APR cartridge test and 19.2% for the PAPR. The historical maximum was 3.22 ppm (12.9% of the OEL). The cartridge-inlet maximum is comparable to the historical maximum.[21]

F.5.2 Nitrous Oxide

Nitrous oxide was not measured in cartridge testing or in the relevant historical data.

F.5.3 Mercury

The maximum cartridge inlet concentrations were 32.7% of the OEL for the APR cartridge test and 90.0% for the PAPR, which were high compared to the historical maximum of 0.005 mg/m^3 (20.0% of the OEL). For this chemical, the cartridge test data and the historical data are in agreement in that there is no sign that the cartridge testing missed capturing high concentrations.

F.5.4 Formaldehyde

The maximum cartridge inlet concentration was 17.2% of the OEL for the APR cartridge test and 16.8% for the PAPR, both of which were higher than the historical maximum concentration of 11.3% of the OEL. For this chemical, the cartridge test data and historical data are in agreement.

F.5.5 N-nitrosodimethylamine (NDMA)

The maximum cartridge inlet concentrations were 73.0% of the OEL for the APR cartridge test and 71.6% for the PAPR, which were higher than the historical maximum concentration of 45.7% of the OEL. For this chemical, the cartridge test data and historical data are in agreement.

F.5.6 N-nitrosodiethylamine (NDEA)

The maximum cartridge inlet concentrations were 17.6% of the OEL for the APR cartridge test and 20.4% for the PAPR, which were higher than the historical concentrations, below-reports with a maximum RL of 3.00% of the OEL. This chemical had a cartridge test maximum concentration that exceeded the historical maximum concentration by more than a factor of 5; thus, there is no indication that the cartridge-testing missed capturing high concentrations.

F.5.7 N-nitrosomethylethylamine (NMEA)

The maximum cartridge inlet concentrations were 6.18% of the OEL for the APR cartridge test and 40.3% for the PAPR cartridge test, which were higher than the historical maximum of 1.67% of the OEL. Cartridge test maximum concentrations for NMEA exceeded historical maximum concentrations and, in

[21] In the draft version of this report, ammonia data from the AX exhauster surveys were not yet available either in SWIHD source or in TWINS IH. Since then, the data have been added to TWINS IH and are presented here.

the case of the PAPR tests, exceeded by more than a factor of 20. Thus, there is no indication that the cartridge-testing missed capturing high concentrations.

F.5.8 N-nitrosomorpholine

The maximum cartridge inlet concentrations were 42.9% of the OEL for the APR cartridge test and 51.5% for the PAPR, which were lower than the historical maximum of 151% of the OEL. For this chemical, the cartridge test and historical data are considered to be in agreement because the cartridge test maximum concentration, although lower than the historical measurement, are within a factor of 5.

F.5.9 Summary of Historical Data Comparisons

A number of APR and PAPR cartridge inlet maximum concentrations for COPCs in the AX exhauster were higher than historical maximum concentrations. These COPCs included ammonia, mercury, formaldehyde, NDMA, NDEA, and NMEA.

The cartridge inlet concentrations that were substantially lower than historical data can be described as follows:

- Differences could not be resolved, and cartridge inlet data were between 20% and 50% of historical maximum: N-nitrosomorpholine.

Table F.1. COPC Comparison of APR Tests to Historical AX Exhauster Measurements

COPC Number and Name		CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1]					Measurements in this study			
						Number of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Maximum Value (%OEL)	Average Value (%OEL)	Max Inlet (%OEL)	Avg. Inlet (%OEL)	Max outlet (%OEL)	Approx. DL[12] (%OEL)
Inorganic														
1	Ammonia	7664-41-7	-28	Poling et al., 2007[2]	25 ppm	2	3.22	2.83	12.9%	11.3%	23.9%	14.3%	<RL	2.50% (RL)
2	Nitrous Oxide	10024-97-2	-127	Poling et al., 2007	50 ppm	0	n/a	n/a	n/a	n/a	Not Measured			
3	Mercury	7439-97-6	674	Poling et al., 2007	0.025 mg/m^3	2	0.005	0.0045	20.0%	18.0%	32.7%	27.7%	<RL	6.81% (RL)
Hydrocarbons														
4	1,3-Butadiene	106-99-0	24	Poling et al., 2007	1 ppm	0	n/a	n/a	n/a	n/a	<RL	<RL	<RL	2.01% (RL)
5	Benzene	71-43-2	176	Poling et al., 2007	0.5 ppm	0	n/a	n/a	n/a	n/a	0.060%	0.052%	0.031%	0.021%
6	Biphenyl	92-52-4	491	Poling et al., 2007	0.2 ppm	0	n/a	n/a	n/a	n/a	0.047%	<DL	<DL	0.047%
Alcohols														
7	1-Butanol	71-36-3	243	NIOSH[3]	20 ppm	0	n/a	n/a	n/a	n/a	0.021%	0.011%	0.004%	0.001%
8	Methanol	67-56-1	148	Poling et al., 2007	200 ppm	0	n/a	n/a	n/a	n/a	Not Measured			
Ketones														
9	2-Hexanone	591-78-6	262	NIOSH	5 ppm	0	n/a	n/a	n/a	n/a	0.005%	0.004%	<DL	0.002%
10	3-Methyl-3-butene-2-one	814-78-8	208	CRC Handbook 1989[4]	0.02 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC[11]			
11	4-Methyl-2-hexanone	105-42-0	282	Predicted ACD/Labs[5]	0.5 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.017%
12	6-Methyl-2-heptanone	928-68-7	333	Predicted ACD/Labs	8 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
13	3-Buten-2-one	78-94-4	179	CRC Handbook 1989	0.2 ppm	0	n/a	n/a	n/a	n/a	0.23%	0.16%	<DL	0.12%
Aldehydes														
14	Formaldehyde	50-00-0	-6	NIOSH	0.3 ppm	2	0.034	0.034	11.3%	11.2%	17.2%	14.5%	2.07%	0.59% (RL)
15	Acetaldehyde	75-07-0	69	NIOSH	25 ppm	2	0.127	0.118	0.51%	0.47%	0.32%	0.28%	0.29%	0.005% (RL)
16	Butanal	123-72-8	167	Oxford safety data[6]	25 ppm	2	0.003	0.003	0.010%	0.010%	0.004%	0.002%	0.001%	0.001%
17	2-Methyl-2-butenal	1115-11-3	244	United Nations[7]	0.03 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
18	2-Ethyl-hex-2-enal	645-62-5	347	Predicted ACD/Labs	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
New[14]	2-Propenal	107-02-8	127	NIOSH	0.1 ppm	2	<0.001	<0.001	<1.00%	<1.00%	<DL	<DL	<DL	0.95%

Table F.1. (continued)

	COPC Number and Name	CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1]					Measurements in this study			
						Number of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Maximum Value (%OEL)	Average Value (%OEL)	Max Inlet (%OEL)	Avg. Inlet (%OEL)	Max outlet (%OEL)	Approx. DL[12] (%OEL)
Furans														
19	Furan	110-00-9	88	Poling et al., 2007	1 ppb	2	<0.063	<0.0615	<6.30%	<6.15%	<DL	<DL	<DL	DL/RL[12] 43.3%/124%[13]
20	2,3-Dihydrofuran	1191-99-7	130	Alfa Aesar[8]	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	<DL	<DL	<DL	3.54%/30.5%
21	2,5-Dihydrofuran	1708-29-8	152	Aldrich[9]	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	<DL	<DL	<DL	19.0%/120%[13]
22	2-Methylfuran	534-22-5	147	Oxford safety data	1 ppb	2	<0.052	<0.051	<5.20%	<5.10%	<DL	<DL	<DL	10.3%/103%[13]
23	2,5-Dimethylfuran	625-86-5	199	Alfa Aesar	1 ppb	2	<0.044	<0.0435	<4.40%	<4.35%	<DL	<DL	<DL	6.67%/22.2%
24	2-Ethyl-5-methylfuran	1703-52-2	246	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
25	4-(1-Methylpropyl)-2,3-dihydrofuran	34379-54-9	328	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
26	3-(1,1-Dimethylethyl)-2,3-dihydrofuran	34314-82-4	306	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
27	2-Pentylfuran	3777-69-3	333	Alfa Aesar	1 ppb	2	<0.031	<0.0305	<3.10%	<3.05%	<DL	<DL	<DL	5.48%/15.4%
28	2-Heptylfuran	3777-71-7	410	Alfa Aesar	1 ppb	2	<0.026	<0.0255	<2.60%	<2.55%	6.95%	<DL	7.94%	4.14%/12.8%
29	2-Propylfuran	4229-91-8	231	Alfa Aesar	1 ppb	2	<0.039	<0.038	<3.90%	<3.80%	<DL	<DL	<DL	4.13%/19.4%
30	2-Octylfuran	4179-38-8	452	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
31	2-(3-Oxo-3-phenylprop-1-enyl)furan	717-21-5	605	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
32	2-(2-Methyl-6-oxoheptyl)furan	51595-87-0	Not available	Not available	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Phthalates														
33	Diethylphthalate	84-66-2	563	NIOSH	5 mg/m^3	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.020%

Table F.1. (continued)

	COPC Number and Name	CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1] Number of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Maximum Value (%OEL)	Average Value (%OEL)	Measurements in this study Max Inlet (%OEL)	Avg. Inlet (%OEL)	Max outlet (%OEL)	Approx. DL[12] (%OEL)
Nitriles														
34	Acetonitrile	75-05-8	179	NIOSH	20 ppm	0	n/a	n/a	n/a	n/a	0.08%	0.05%	1.57%	0.003%
35	Propanenitrile	107-12-0	207	NIOSH	6 ppm	0	n/a	n/a	n/a	n/a	0.02%	0.01%	<DL	0.004%
36	Butanenitrile	109-74-0	244	NIOSH	8 ppm	0	n/a	n/a	n/a	n/a	0.01%	0.008%	<DL	0.002%
37	Pentanenitrile	110-59-8	284	Alfa Aesar	6 ppm	0	n/a	n/a	n/a	n/a	0.004%	0.002%	<DL	0.002%
38	Hexanenitrile	628-73-9	328	Predicted ACD/Labs	6 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.001%
39	Heptanenitrile	629-08-3	368	Alfa Aesar	6 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
40	2-Methylene butanenitrile	1647-11-6	Not available	Not available	0.3 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
41	2,4-Pentadienenitrile	1615-70-9	278	Predicted ACD/Labs	0.3 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Amines														
42	Ethylamine	75-04-7	62	Poling et al., 2007	5 ppm	0	n/a	n/a	n/a	n/a	<RL	<RL	<RL	0.096% (RL)
Nitrosamines														
43	N-Nitrosodimethylamine	62-75-9	306	NIOSH	0.3 ppb	2	0.137	0.131	45.7%	43.7%	73.0%	45.1%	<RL	8.53% (RL)
44	N-Nitrosodiethylamine	55-18-5	351	Oxford safety data	0.1 ppb	2	<0.003	<0.003	<3.00%	<3.00%	17.6%	<RL	<RL	15.7% (RL)
45	N-Nitrosomethylethylamine	10595-95-6	310	Predicted ACD/Labs	0.3 ppb	2	0.005	0.005	1.67%	1.67%	<RL	<RL	<RL	6.62% (RL)
46	N-Nitrosomorpholine	59-89-2	435	Oxford safety data	0.6 ppb	2	0.905	0.588	151%	98.0%	42.9%	39.5%	<RL	2.51% (RL)
Organophospates														
47	Tributyl phosphate	126-73-8	552	NIOSH	0.2 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.062%
48	Dibutyl butylphosphonate	78-46-6	602	Predicted ACD/Labs	0.007 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.70%
Halogenated														
49	Chlorinated Biphenyls	Varies	Varies	Varies	1 mg/m^3	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
50	2-Fluoropropene	1184-60-7	-11	SynQuest[10]	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Pyridines														
51	Pyridine	110-86-1	240	NIOSH	1 ppm	0	n/a	n/a	n/a	n/a	0.01%	<RL	<RL	0.011% (RL)
52	2,4-Dimethylpyridine	108-47-4	318	Alfa Aesar	0.5 ppm	0	n/a	n/a	n/a	n/a	<RL	<RL	<RL	0.039% (RL)

Table F.1. (continued)

COPC Number	COPC Name	CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1]: Number of Values	Historical Measurements[1]: Maximum Value (in OEL units)	Historical Measurements[1]: Average Value (in OEL units)	Historical Measurements[1]: Maximum Value (%OEL)	Historical Measurements[1]: Average Value (%OEL)	Measurements in this study: Max Inlet (%OEL)	Measurements in this study: Avg. Inlet (%OEL)	Measurements in this study: Max outlet (%OEL)	Measurements in this study: Approx. DL[12] (%OEL)
Organonitrites														
53	Methyl nitrite	624-91-9	10	Oxford safety data	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
54	Butyl nitrite	544-16-1	172	Alfa Aesar	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Organonitrates														
55	Butyl nitrate	928-45-0	276	Predicted ACD/Labs	2.5 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
56	1,4-Butanediol, dinitrate	3457-91-8	499	Predicted ACD/Labs	0.05 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
57	2-Nitro-2-methylpropane	594-70-7	260	Alfa Aesar	0.3 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
58	1,2,3-Propanetriol, 1,3-dinitrate	623-87-0	338	Predicted ACD/Labs	0.05 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Isocyanates														
59	Methyl Isocyanate	624-83-9	103	NIOSH	0.02 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Organometallic														
New[14]	Dimethylmercury	593-74-8	199	NIOSH	0.010 mg/m^3 (as Hg)	0	n/a	n/a	n/a	n/a	Not Measured			

[1] Historical data from TWINS industrial hygiene vapor database and SWIH database; see text for links and dates of queries. Values in italics include those data plus data from the TWINS headspace database, all samples earlier than May 2005.
** indicates that the value of the average would differ by a factor of 2 or more (in either direction) if non-reports were excluded.*
Plain font in the table indicates that only the recent databases (SWIHD headspace and TWINS Industrial Hygiene) were included. Italics mean that the pre-2006 TWINS headspace data were also included.
"n/a" indicates no historical data was found in the databases
"<RL" indicates that all pertinent measurements of the analyte were less than the reporting limit
[2] Poling, B. E.; Prausnitz, J. M.; O'Connell, J. P. The Properties of Gases and Liquids. McGraw Hill, 2007.
[3] NIOSH: National Institute of Occupational Safety and Health
[4] CRC Handbook of Chemistry and Physics, CRC Press, 1989.
[5] ACD/Labs software http://www.acdlabs.com/products/percepta/predictors.php
[6] Oxford safety data from The Physical and Theoretical Chemistry Laboratory at Oxford University
[7] Food and Agriculture Organization of the United Nations
[8] Alfa Aesar: https://www.alfa.com/
[9] Aldrich: https://www.sigmaaldrich.com/
[10] SynQuest: http://synquestlabs.com/product/id/8330.html
[11] TIC: Tentatively Identified Compounds that were not observed in this study using the specified analytical methods.
[12] Approximate Detection Limit (DL) is calculated using the reported detection limit (or reporting limit - RL where noted) from the analytical laboratory and the average volume (from flowrate x time) of vapor exposed to the sorbent tube.
For Furans, both DL and RL values are reported as "DL / RL".
[13] Furans measured using VOA (Volatile Organic Analysis) method.
[14] 2-Propenal and Dimethyl Mercury were added to the COPC List in September, 2017.

Table F.2. COPC Comparison of PAPR Tests to Historical AX Exhauster Measurements

COPC Number and Name		CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1]					Measurements in this study			
						Number of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Maximum Value (%OEL)	Average Value (%OEL)	Max Inlet (%OEL)	Avg. Inlet (%OEL)	Max outlet (%OEL)	Approx. DL[12] (%OEL)
Inorganic														
1	Ammonia	7664-41-7	-28	Poling et al., 2007[2]	25 ppm	2	3.22	2.83	12.9%	11.3%	19.2%	16.3%	5.64%	2.39% (RL)
2	Nitrous Oxide	10024-97-2	-127	Poling et al., 2007	50 ppm	0	n/a	n/a	n/a	n/a	Not Measured			
3	Mercury	7439-97-6	674	Poling et al., 2007	0.025 mg/m^3	2	0.005	0.0045	20.0%	18.0%	90.0%	33.3%	<RL	6.75% (RL)
Hydrocarbons														
4	1,3-Butadiene	106-99-0	24	Poling et al., 2007	1 ppm	0	n/a	n/a	n/a	n/a	<RL	<RL	<RL	1.93% (RL)
5	Benzene	71-43-2	176	Poling et al., 2007	0.5 ppm	0	n/a	n/a	n/a	n/a	0.092%	0.056%	0.049%	0.019% (DL)
6	Biphenyl	92-52-4	491	Poling et al., 2007	0.2 ppm	0	n/a	n/a	n/a	n/a	0.053%	<DL	0.051%	0.042% (DL)
Alcohols														
7	1-Butanol	71-36-3	243	NIOSH[3]	20 ppm	0	n/a	n/a	n/a	n/a	0.024%	0.015%	0.014%	0.001% (DL)
8	Methanol	67-56-1	148	Poling et al., 2007	200 ppm	0	n/a	n/a	n/a	n/a	<RL	<RL	<RL	1.02% (RL)
Ketones														
9	2-Hexanone	591-78-6	262	NIOSH	5 ppm	0	n/a	n/a	n/a	n/a	0.005%	0.004%	<DL	0.002% (DL)
10	3-Methyl-3-butene-2-one	814-78-8	208	CRC Handbook 1989[4]	0.02 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC[11,14]			
11	4-Methyl-2-hexanone	105-42-0	282	Predicted ACD/Labs[5]	0.5 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.016% (DL)
12	6-Methyl-2-heptanone	928-68-7	333	Predicted ACD/Labs	8 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
13	3-Buten-2-one	78-94-4	179	CRC Handbook 1989	0.2 ppm	0	n/a	n/a	n/a	n/a	0.24%	0.16%	<DL	0.11% (DL)
Aldehydes														
14	Formaldehyde	50-00-0	-6	NIOSH	0.3 ppm	2	0.034	0.034	11.3%	11.2%	16.8%	14.9%	8.90%	0.566% (RL)
15	Acetaldehyde	75-07-0	69	NIOSH	25 ppm	2	0.127	0.118	0.51%	0.47%	0.35%	0.30%	0.48%	0.005% (RL)
16	Butanal	123-72-8	167	Oxford safety data[6]	25 ppm	2	0.003	0.003	0.010%	0.010%	0.004%	0.002%	0.001%	0.001% (DL)
17	2-Methyl-2-butenal	1115-11-3	244	United Nations[7]	0.03 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
18	2-Ethyl-hex-2-enal	645-62-5	347	Predicted ACD/Labs	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
New[15]	2-Propenal	107-02-8	127	NIOSH	0.1 ppm	2	<0.001	<0.001	<1.00%	<1.00%	<DL	<DL	<DL	0.91% (DL)

Table F.2. (continued)

COPC Number and Name		CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1]					Measurements in this study			
						Number of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Maximum Value (%OEL)	Average Value (%OEL)	Max Inlet (%OEL)	Avg. Inlet (%OEL)	Max outlet (%OEL)	Approx. DL[12] (%OEL)
Furans														
19	Furan	110-00-9	88	Poling et al., 2007	1 ppb	2	<0.063	<0.0615	<6.30%	<6.15%	<DL	<DL	<DL	DL | RL[12] 39.8% | 114%[13]
20	2,3-Dihydrofuran	1191-99-7	130	Alfa Aesar[8]	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	<DL	<DL	<DL	2.22% | 19.1%
21	2,5-Dihydrofuran	1708-29-8	152	Aldrich[9]	1 ppb	2	<0.061	<0.060	<6.10%	<6.00%	<DL	<DL	<DL	17.5% | 111%[13]
22	2-Methylfuran	534-22-5	147	Oxford safety data	1 ppb	2	<0.052	<0.051	<5.20%	<5.10%	<DL	<DL	<DL	9.42% | 94.5%[13]
23	2,5-Dimethylfuran	625-86-5	199	Alfa Aesar	1 ppb	2	<0.044	<0.0435	<4.40%	<4.35%	<DL	<DL	<DL	4.17% | 13.9%
24	2-Ethyl-5-methylfuran	1703-52-2	246	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
25	4-(1-Methylpropyl)-2,3-dihydrofuran	34379-54-9	328	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
26	3-(1,1-Dimethylethyl)-2,3-dihydrofuran	34314-82-4	306	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
27	2-Pentylfuran	3777-69-3	333	Alfa Aesar	1 ppb	2	<0.031	<0.0305	<3.10%	<3.05%	<DL	<DL	<DL	3.43% | 9.67%
28	2-Heptylfuran	3777-71-7	410	Alfa Aesar	1 ppb	2	<0.026	<0.0255	<2.60%	<2.55%	<DL	<DL	<DL	2.59% | 8.04%
29	2-Propylfuran	4229-91-8	231	Alfa Aesar	1 ppb	2	<0.039	<0.038	<3.90%	<3.80%	<DL	<DL	<DL	2.58% | 12.1%
30	2-Octylfuran	4179-38-8	452	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
31	2-(3-Oxo-3-phenylprop-1-enyl)furan	717-21-5	605	Predicted ACD/Labs	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
32	2-(2-Methyl-6-oxoheptyl)furan	51595-87-0	Not available	Not available	1 ppb	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Phthalates														
33	Diethylphthalate	84-66-2	563	NIOSH	5 mg/m^3	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.018% (DL)

Table F.2. (continued)

	COPC Number and Name	CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1] Number of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Maximum Value (%OEL)	Average Value (%OEL)	Measurements in this study Max Inlet (%OEL)	Avg. Inlet (%OEL)	Max outlet (%OEL)	Approx. DL[12] (%OEL)
Nitriles														
34	Acetonitrile	75-05-8	179	NIOSH	20 ppm	0	n/a	n/a	n/a	n/a	0.402%	0.110%	1.38%	0.003% (DL)
35	Propanenitrile	107-12-0	207	NIOSH	6 ppm	0	n/a	n/a	n/a	n/a	0.020%	0.015%	<DL	0.004% (DL)
36	Butanenitrile	109-74-0	244	NIOSH	8 ppm	0	n/a	n/a	n/a	n/a	0.011%	0.008%	<DL	0.002% (DL)
37	Pentanenitrile	110-59-8	284	Alfa Aesar	6 ppm	0	n/a	n/a	n/a	n/a	0.003%	0.002%	<DL	0.002% (DL)
38	Hexanenitrile	628-73-9	328	Predicted ACD/Labs	6 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.001% (DL)
39	Heptanenitrile	629-08-3	368	Alfa Aesar	6 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
40	2-Methylene butanenitrile	1647-11-6	Not available	Not available	0.3 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
41	2,4-Pentadienenitrile	1615-70-9	278	Predicted ACD/Labs	0.3 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Amines														
42	Ethylamine	75-04-7	62	Poling et al., 2007	5 ppm	0	n/a	n/a	n/a	n/a	<RL	<RL	<RL	0.094% (RL)
Nitrosamines														
43	N-Nitrosodimethylamine	62-75-9	306	NIOSH	0.3 ppb	2	0.137	0.131	45.7%	43.7%	71.6%	56.1%	<RL	4.68% (RL)
44	N-Nitrosodiethylamine	55-18-5	351	Oxford safety data	0.1 ppb	2	<0.003	<0.003	<3.00%	<3.00%	20.4%	14.5%	<RL	10.2% (RL)
45	N-Nitrosomethylethylamine	10595-95-6	310	Predicted ACD/Labs	0.3 ppb	2	0.005	0.005	1.67%	1.67%	40.3%	6.32%	<RL	4.12% (RL)
46	N-Nitrosomorpholine	59-89-2	435	Oxford safety data	0.6 ppb	2	0.905	0.588	151%	98.0%	51.5%	42.1%	<RL	1.49% (RL)
Organophosphates														
47	Tributyl phosphate	126-73-8	552	NIOSH	0.2 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.056% (DL)
48	Dibutyl butylphosphonate	78-46-6	602	Predicted ACD/Labs	0.007 ppm	0	n/a	n/a	n/a	n/a	<DL	<DL	<DL	0.64% (DL)
Halogenated														
49	Chlorinated Biphenyls	Varies	Varies	Varies	1 mg/m^3	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
50	2-Fluoropropene	1184-60-7	-11	SynQuest[10]	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Pyridines														
51	Pyridine	110-86-1	240	NIOSH	1 ppm	0	n/a	n/a	n/a	n/a	0.012%	0.010%	<RL	0.010% (RL)
52	2,4-Dimethylpyridine	108-47-4	318	Alfa Aesar	0.5 ppm	0	n/a	n/a	n/a	n/a	<RL	<RL	<RL	0.036% (RL)

Table F.2. (continued)

COPC Number and Name		CAS Number	Boiling Point (°F)	Boiling Point Source	Occupational Exposure Limit (OEL)	Historical Measurements[1] Number of Values	Maximum Value (in OEL units)	Average Value (in OEL units)	Maximum Value (%OEL)	Average Value (%OEL)	Measurements in this study Max Inlet (%OEL)	Avg. Inlet (%OEL)	Max outlet (%OEL)	Approx. DL[12] (%OEL)
Organonitrites														
53	Methyl nitrite	624-91-9	10	Oxford safety data	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
54	Butyl nitrite	544-16-1	172	Alfa Aesar	0.1 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Organonitrates														
55	Butyl nitrate	928-45-0	276	Predicted ACD/Labs	2.5 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
56	1,4-Butanediol, dinitrate	3457-91-8	499	Predicted ACD/Labs	0.05 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
57	2-Nitro-2-methylpropane	594-70-7	260	Alfa Aesar	0.3 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
58	1,2,3-Propanetriol, 1,3-dinitrate	623-87-0	338	Predicted ACD/Labs	0.05 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Isocyanates														
59	Methyl Isocyanate	624-83-9	103	NIOSH	0.02 ppm	0	n/a	n/a	n/a	n/a	Not Detected - TIC			
Organometallic														
New[15]	Dimethylmercury	593-74-8	200	NIOSH	0.010 mg/m^3 (as Hg)	0	n/a	n/a	n/a	n/a	Not Measured			

[1] Historical data from TWINS industrial hygiene vapor database and SWIH database, as applicable; see text for links and dates of queries.

Plain font in the table indicates that only the recent databases (SWIHD headspace and TWINS Industrial Hygiene, as applicable) were included. Italics, if present, mean that the pre-2006 TWINS headspace data were also included.

"n/a" indicates no historical data was found in the databases.

Values in parenthesis "( )", if present, indicate the maximum or average reported (detected) value >RL or >DL.

"!", if present, indicates a maximum RL that came from a sample with a volume less than 0.5 L or from a sample whose RL, for undiscernible reasons, was a factor of 5 or more high compared to other samples measured using the same analytical method.

"<RL", "<DL", or "<" indicates that all pertinent measurements of the analyte were less than the reporting or detection limit.

[2] Poling, B. E.; Prausnitz, J. M.; O'Connell, J. P. The Properties of Gases and Liquids. McGraw Hill, 2007.

[3] NIOSH: National Institute of Occupational Safety and Health

[4] CRC Handbook of Chemistry and Physics, CRC Press, 1989.

[5] ACD/Labs software http://www.acdlabs.com/products/percepta/predictors.php

[6] Oxford safety data from The Physical and Theoretical Chemistry Laboratory at Oxford University

[7] Food and Agriculture Organization of the United Nations

[8] Alfa Aesar: https://www.alfa.com/

[9] Aldrich: https://www.sigmaaldrich.com/

[10] SynQuest: http://synquestlabs.com/product/id/8330.html

[11] TIC: Tentatively Identified Compounds that were not observed in this study using the specified analytical methods.

[12] Approximate Detection Limit (DL) is calculated using the reported detection limit (or reporting limit - RL where noted) from the analytical laboratory and the average volume (from flowrate x time) of vapor exposed to the sorbent tube. For Furans, both DL and RL values are reported as "DL / RL".

[13] Furans measured using VOA (Volatile Organic Analysis) method.

[14] TIC (see footnote 11) do not have analytical calibration standards or quantified detection limits. Mass and concentration are estimates only.

[15] 2-Propenal and Dimethyl Mercury were added to the COPC List in September, 2017.

F.6 References

Agnew SF, J Boyer, RA Corbin, TB Duran, JR FitzPatrick, KA Jurgensen, TP Ortiz, and BL Young. 1997. *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*. LA-UR-96-3860, Los Alamos National Laboratory, Los Alamos, New Mexico.

Freeman CJ, J Liu, C Clayton, SK Nune, LA Mahoney, CL Bottenus, TM Brouns, P Humble, and MJ Minette. 2020. *Overview of 2016 through 2018 Testing of Respirator Cartridge Performance on Multiple Hanford Tank Headspaces and Exhausters*. PNNL-26821, Rev. 1 Pacific Northwest National Laboratory, Richland, Washington.

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