DEPARTMENT OF THE ARMY
US ARMY INSTITUTE OF PUBLIC HEALTH
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MD 21010-5403

MCHB-IP-RDE

MEMORANDUM FOR Office of the Command Surgeon (LTC (b) (6)), U.S. Central Command, 7115 South Boundary Boulevard, MacDill Air Force Base, FL 33621-5101

SUBJECT: Screening Health Risk Assessments, Bagram Airfield (BAF), Afghanistan, 12-26 September 2013

1. The enclosed report details the screening health risk assessment and the occupational and environmental health operational risk estimate for ambient air samples collected at Bagram Airfield, Afghanistan, 12-26 September 2013.

2. The occupational and environmental health (OEH) chronic risk estimate for exposure to polycyclic aromatic hydrocarbons, semivolatile organic compounds, dioxins/furans, volatile organic compounds, particulate matter (PM) less than 2.5 micrometers in aerodynamic diameter, and metals associated with PM measured in the ambient air at BAF, Afghanistan during this sampling period is **low** based on comparison to the long-term Military Exposure Guidelines. The OEH acute risk estimate is considered **low** for exposure to the sampled parameters on individual days.

3. Although some of the chemicals of potential concern (COPC) are carcinogenic, the exposure levels to carcinogenic COPCs for the BAF population are within the exposure levels that the U.S. Environmental Protection Agency generally considers will result in acceptable excess lifetime cancer risk. However, risk within this range of exposure levels should not be an absolute measure to determine whether the risk is acceptable. The calculated, noncarcinogenic hazard indices indicate the potential for short-term respiratory irritation due to a combination of chemicals, primarily acrolein. Based on our evaluation, however, these irritant effects are expected to be reversible and long-term health effects from exposure to the chemicals evaluated are not expected.

4. The technical point of contact for this report is Mr. (b) (6), U.S. Army Public Health Command, Army Institute of Publich Health, Deployment Environmental Surveillance Program, commercial (b) (6), or e-mail: (b) (6).

5. Please help us find ways to improve the products and services we provide and take a few moments of your time to complete our survey, https://usaphcapps.amedd.army.mil/Survey/se.ashx?s=2511374518790C4B. To ensure we evaluate the proper project, for Question 3 "Product/Service provided by", please indicate: Location: Army Institute of Public Health, Portfolio/Staff: Health Risk Management, Program: Deployment Environmental Surveillance; for Question 5 "Type(s) of product or service received", please indicate: Survey.

FOR THE DIRECTOR:

(b) (6)

Encl

Portfolio Director, Health Risk Management

CF: (w/encl)
USFOR-A (Surgeon/COL (b) (6))
IJC (Force Health Protection Officer/LTC (b) (6))
CJTF-10 (Force Health Protection Officer/MAJ (b))
CJTF-10 (Surgeon/LTC (b) (6))
CJTF-10 (Preventive Medicine Officer/CPT (b) (6))
926 MED DET (Environmental Science & Engineering Officer/MAJ (b) (6))
ARCENT (Surgeon/COL (b) (6))

USAPHC
U.S. ARMY PUBLIC HEALTH COMMAND
5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403

Screening Health Risk Assessments, Bagram Airfield, Afghanistan 12-26 September 2013

Prepared by (b) (6) **, Deployment Environmental Surveillance Program, and Mr.** (b) (6) **, Environmental Health Risk Assessment Program**

Preventive Medicine Surveys: 40-5f1

ACKNOWLEDGMENTS

We appreciate the significant efforts of the Combined Joint Task Force 101 and Task Force Medical – Afghanistan preventive medicine staffs to support the U.S. Army Public Health Command team in the preparation and execution of the sampling mission which produced the results used in the screening health risk assessments.

Table of Contents

Page

Page

Appendices

Tables

Screening Health Risk Assessments
Bagram Airfield, Afghanistan
12-26 September 2013

1 Summary

1.1 Purpose and Scope

This report is intended to document the assessment of ambient air samples collected at Bagram Airfield (BAF), Afghanistan from 12-26 September 2013. The ambient air sampling was primarily intended to collect the maximum number of classes of pollutants that could be feasibly monitored with field-portable equipment and using media that could remain valid during transit back to a U.S.-based laboratory for analysis. Continuous air monitors were also fielded to provide additional qualitative data to further refine the data analysis. Air pollution from all natural and man-made sources, including but not limited to native mineral dusts, aviation operations, vehicle emissions, generators, industrial operations, local sources, and pollutants from emissions throughout the Kabul Valley, was considered. Open burning on BAF had ceased effective 1 July 2013 so these samples were not indicative of pollutants that may have been attributable to military burn pit operations. The results of the ambient air sampling provide the foundation for a screening health risk assessment (HRA) of potential occupational environmental health (OEH) exposures of military personnel located at the site as well as an operational health risk assessment which focused on the possible impact of air quality on the mission.

1.2 Conclusions

The occupational and environmental health chronic risk estimate for exposure to polycyclic aromatic hydrocarbons (PAHs), semivolatile organic compounds (SVOCs), dioxins/furans, volatile organic compounds (VOCs), particulate matter (PM) less than 2.5 micrometers (µm) in aerodynamic diameter ($PM_{2.5}$), and metals associated with PM measured in the ambient air at BAF, Afghanistan during this sampling period is **low** based on comparison to the long-term Military Exposure Guidelines (MEGs). The OEH acute risk estimate is considered **low** for exposure to the sampled parameters on individual days.

Although some of the chemicals of potential concern (COPC) are carcinogenic, the exposure levels to carcinogenic COPCs for the BAF population are within the exposure levels that the U.S. Environmental Protection Agency (EPA) generally considers will result in acceptable excess lifetime cancer risk. However, risk within this range of exposure levels should not be an absolute measure to determine whether the risk is acceptable. Management of risk should be considered for exposure levels that result in cancer risks from $1x10^{-4}$ to $1x10^{-6}$.

The calculated, noncarcinogenic hazard indices indicate the potential for short-term respiratory irritation due to a combination of chemicals, primarily acrolein. Based on our evaluation, however, these irritant effects are expected to be reversible and long-term health effects from exposure to the chemicals evaluated are not expected.

Black carbon concentrations were similar to those estimated in world urban centers and they comprised a similar percentage of $PM_{2.5}$ mass as found in U.S. cities. Black carbon does not currently have a MEG or a reference toxicity dose upon which to base a quantitative assessment of health risk.

1.3 Recommendations

Collect additional VOC samples, targeting acrolein, to better define acrolein concentrations and possible sources throughout the different seasons.

Monitor black carbon in conjunction with $PM_{2.5}$ sampling to better characterize the ambient PM.

Refine the risk communication plan to include both information products and open discussion opportunities and to reflect new and changing information on site conditions.

Implement administrative controls when practical to reduce exposures to air pollutants and reduce the generation of emissions.

Utilize the results from this sampling effort and risk assessment as well as lessons learned in planning for air surveillance efforts at other locations in theater.

Implement administrative controls when practical to reduce exposures to the ambient air during periods of observed poorer air quality, such as during an inversion. Controls could include moving indoors, using alternate outdoor locations for an activity, or altering the physical training schedule.

Inform preventive medicine and medical personnel of potential health effects resulting from exposures to the measured levels of ambient PM. If assistance and/or information are needed on health effects and/or medical implications from exposure to PM and associated heavy metals, please contact the U.S. Army Public Health Command (USAPHC), Environmental Medicine Program at commercial 001-410-436-2714.

2 References

See Appendix A for a complete list of reference information.

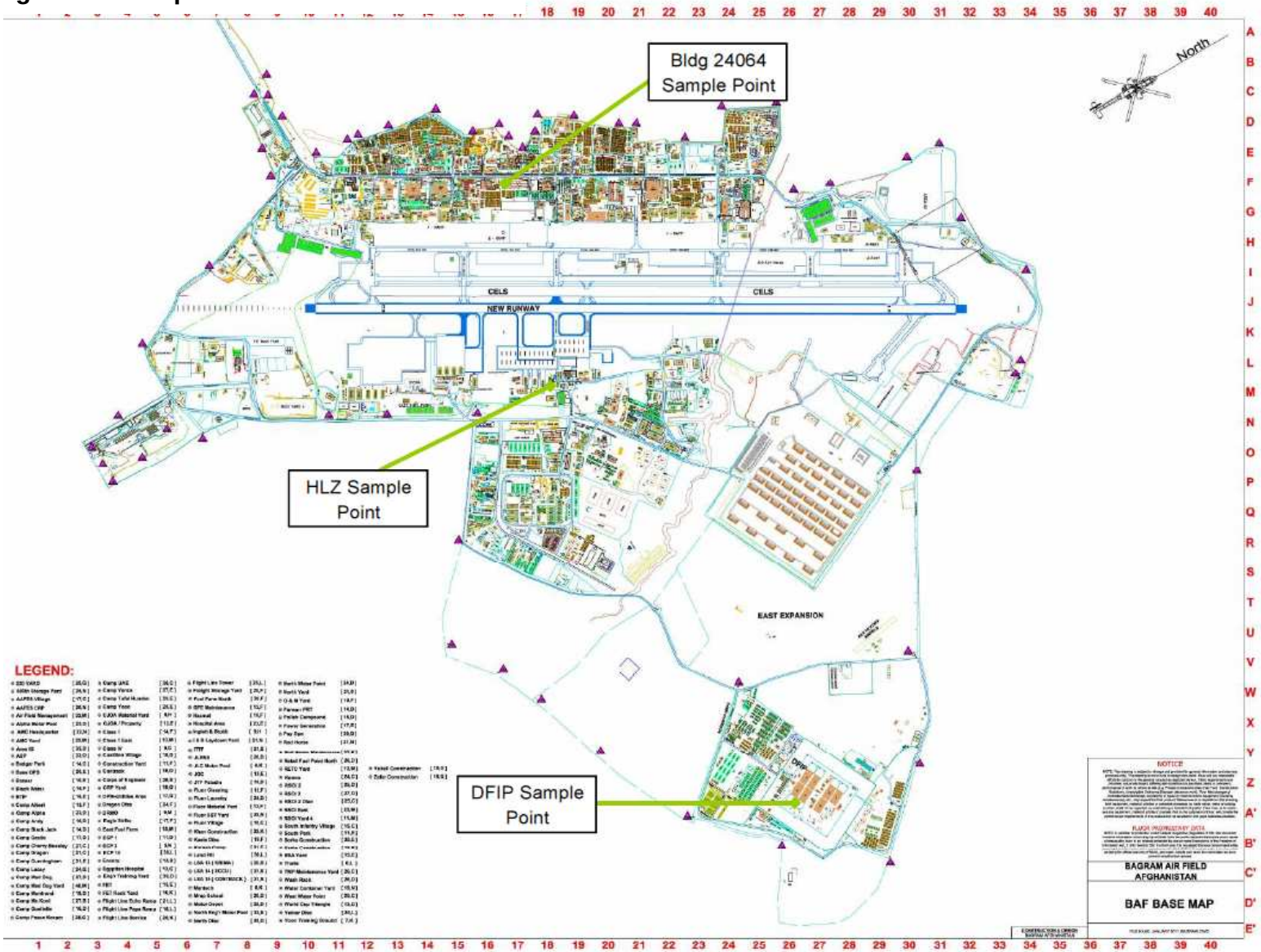
3 Authority

The assessment was conducted per Army Medical Department Resource Tasking System Tasker 13226.01C, Air Quality Assessment of BAF, 13 August 2013.

4 Background and Exposure Assumptions

Ambient air samples were collected from three locations across BAF in order to evaluate air quality at spatially diverse areas with varying pollutant sources and potentially-exposed populations. The Building 24064 sample point is located along Disney Drive in a highly-trafficked area. It is near the Koele and Dragon dining facilities, the main Post Exchange (PX), the Camp Montrond bazaar, and various housing and work sites. The Helicopter Landing Zone (HLZ) sampling site is on the southeastern side of the airfield runway between the Flightline ‘Mike’ Ramp and ‘Echo’ Ramp. Primary adjacent activities include avaiation operations, maintenance hangars, and housing. The third sample point was at the Detention Facility in Parwan (DFIP), which is located within Camp Sabalu-Harrison near the eastern perimeter of BAF. Housing, life support activities, detainee operations, and various operational activities are located in this area. The military burn pit area is immediately to the east of the DFIP; burn pit operations ceased as of 1 July 2013 though 2 solid waste incinerators remained in operation. Figure 1 shows a map of the sample point locations.

Figure 1 – Sample Point Locations



No significant weather events were observed during the collection of samples. The surrounding mountains provided a qualitiative measure of perceived air quality as the airborne haze partly to completely obscured the mountains on all but 2 days of the assessment. All personnel are expected to remain at BAF for varying periods with the most typical deployment periods being either 6 or 9 months. A conservative (protective) assumption is all personnel inhale the ambient air 24 hours/day for their entire deployment period. In addition, it is assumed that control measures and/or personal protective equipment are not used.

Since 2002, ambient air samples have been collected at multiple points and timeframes on BAF primarily to assess the potential health risk associated with exposure to the PM and associated metals. Over 1,000 samples for either PM less than 10 micometers in diameter (PM_{10}) or $PM_{2.5}$ have been assessed. All published risk assessment reports for those samples can be found in the Military Exposure Surveillance Library (https://mesl.apgea.army.mil/mesl/) and the sample data can be found in the Defense Occupational and Environmental Health Readiness System (DOEHRS) – Industrial Hygiene, Environmental Health Business Area (https://doehrs-ih.csd.disa.mil/Doehrs/). Note that both systems require an account for access. The short-term and long-term health risks due to exposure to the PM_{10} and $PM_{2.5}$ based on all data from 2002-2010 were published in the Periodic Occupational and Environmental Monitoring Summary (POEMS) for BAF on 25 April 2011. For both PM_{10} and $PM_{2.5}$ the short-term health risk on typical days ranged from low to moderate while on peak days it ranged from low to high. For $PM_{2.5}$ the long-term health risk ranged from low to moderate. There is no long-term health-based standard for PM_{10}. The risk due to metals in the PM was considered low. An updated POEMS covering sample data through 31 May 2013 is in progress via the Army Insitute of Public Health (AIPH) as of the date of this report.

5 Quantitative Screening Health Risk Assessment

5.1 Methodology

The methodology employed for the quantitative screening HRA follows EPA guidance (reference 5). The four basic steps of this process are selection of the COPC, exposure assessment, toxicity assessment, and risk characterization. The process was used for calculation of both carcinogenic and noncarcinogenic risk. Each step and the results are detailed in Appendix C. Note that PM was not included because no toxicity reference dose exists.

5.2 Carcinogenic Risk

The lifetime carcinogenic risk was calculated for each of the sampled locations as well as for the overall site for two deployment durations, 6 months or 9 months. The “acceptable” upper range for carcinogenic risk is $1x10^{-4}$ to $1x10^{-6}$. Total cancer risks for all receptors at each of the exposure points were calculated to be between $1x10^{-6}$ and $3x10^{-6}$, so all are at the lower end of the acceptable cancer risk range. All calculations can be found in Appendix C.

5.3 Noncarcinogenic Risk

The noncarcinogenic risk was calculated for each of the sampled locations as well as for the overall site for two deployment durations, 6 months or 9 months. Risk characterization for noncarcinogenic effects involves calculating chemical-specific hazard quotients (HQ), which represent the ratio of the chronic average daily intake calculated in this evaluation for a specific chemical to the toxicological reference value for that chemical. When an HQ exceeds 1.0, the reference value is more thoroughly scrutinized as to its basis, health endpoint, target population, and uncertainties to

ensure the value used is appropriate. The individual HQs are summed over all chemicals to obtain an overall hazard index (HI) for the site. This approach assumes that simultaneous subthreshold exposures to several exposure pathways could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to respective acceptable exposures. A HI of less than or equal to 1.0 indicates that the occurrence of adverse health effects as a result of the evaluated chemical exposure is unlikely. When the HI exceeds unity (is greater than 1.0), there may be a concern for potential health effects so the contributors are evaluated more closely to assess which HQs are reasonably additive due to their potential for combined effect(s). The calculated HIs are provided as a range because of acrolein, for which there was uncertainty in both the measured concentrations and the underlying factors from which the reference dose was derived.

The calculated HIs for the 6-month and 9-month scenarios at all locations and the overall site were greater than 1.0, which indicates there may be a concern for potential health effects and the contributors to the HI are evaluated more closely for their potential combined effect(s). It does not necessarily indicate that a health effect will occur. Only one compound—acrolein—had an individual HQ greater than 1.0 at each site. To further refine the assessment, the individual COPCs were segregated by target organ/system, new HIs were then calculated. The respiratory system was the only body organ/system for which an HI greater than 1.0 was calculated. The primary contributor to that HI was acrolein, which is a known respiratory irritant. If acrolein was not included in the calculations, the only HI greater than 1.0 would be at Building 24064 for both the 6-month and 9-month scenarios, and that was due to an elevated detection of trichlorethene in one sample. See Table 1 for a summary of calculated HIs and Appendix C for all calculations.

Table 1. Noncarcinogenic Hazard Indices Ranges for Ambient Air

Receptor	Overall Base	Building 24064	HLZ	DFIP
Personnel present for 9 months	**2.96-7.90**	**5.20-8.51**	**3.68-10.06**	**1.40-3.74**
Personnel present for 6 months	**1.98-5.27**	**3.45-5.65**	**2.45-6.70**	0.93-**2.49**

Note:
The HIs are presented as ranges to show the upper and lower bounds calculated by varying the assumed protective factors used to develop the reference dose and incorporating exposure point concentrations (EPC) sensitivity analysis. Per EPA guidelines, noncancer health hazards are assessed as unlikely for even sensitive populations to experience adverse health effects if the HI is less than 1.0; [i.e., if the sum of the ratios is below 1.0 for all chemicals of concern (COC)]. An HI above 1.0 indicates a potential for health effects under the specific exposure conditions chosen. It does not indicate that a health effect will occur; however there may be concern for potential noncancer effects so further evaluation is necessary.

6 Operational Risk Assessment

6.1 Methodology

The method used to conduct the operational risk assessment followed risk management doctrine [Field Manual (FM) 5-19] (reference 6), and the relatively conservative (protective) assumptions and methods provided in the USAPHC Technical Guide (TG) 230 (reference 7). Sample results are first

screened against the MEGs as published in TG 230. When parameters are found at concentrations above a given MEG, the severity of the potential health threat is estimated. Next, the likelihood that individuals within a given population will be exposed to the measured concentrations is estimated. The severity and frequency are used with the matrices provided in USAPHC TG 230 (reference 7) to determine the operational risk estimate for each identified hazard. Complete details on this process are provided in Appendix B.

6.2 Hazard Identification

Four of the sampled parameters were found at concentrations greater than their respective screening criteria in at least 1 sample. Three were chemicals: acrolein, benzoic acid, and naphthalene, a VOC, an SVOC, and a PAH, respectively. All were measured at concentrations greater than their respective 1-year MEGs. The other parameter was $PM_{2.5}$, which was measured at concentrations above its 1-year MEG. These parameters were carried through the operational risk assessment process. All other parameters were either not detected or were at concentrations below their respective screening criteria so their risk is considered low and they are not assessed further. Process details are provided in Appendix B.

6.3 Operational Risk Estimate

Each parameter identified as a potential hazard was assessed for acute and chronic severity and probability of exposure at each of the sample locations. The risk matrices in FM 5-19 (reference 6) and USAPHC TG 230 (reference 7) were used to determine the risk level for each scenario. Tables 2 and 3 below summarize the calculated acute and chronic risk estimates.

Table 2. Acute Risk Estimate Summary for Exposure to Measured Ambient Air Parameters, Bagram Airfield, Afghanistan, 12-26 September 2013

Parameter	Type of Exposure	Hazard Severity	Hazard Probability	Acute Risk Estimate
$PM_{2.5}$ at BLDG 24064	Peak	Negligible	Unlikely	Low
	Average	Negligible	Unlikely	Low
$PM_{2.5}$ at HLZ	Peak	Negligible	Unlikely	Low
	Average	Negligible	Unlikely	Low
$PM_{2.5}$ at DFIP	Peak	Negligible	Unlikely	Low
	Average	Negligible	Unlikely	Low

Table 3. Chronic Risk Estimate Summary for Exposure to Measured Ambient Air Parameters, Bagram Airfield, Afghanistan, 12-26 September 2013

Parameter	Type of Exposure	Hazard Severity	Hazard Probability	Chronic Risk Estimate
Acrolein at BLDG 24064	Chronic	Negligible	Seldom	Low
Acrolein at HLZ	Chronic	Negligible	Seldom	Low
Acrolein at DFIP	Chronic	Negligible	Seldom	Low
$PM_{2.5}$ at BLDG 24064	Chronic	Negligible	Occasional	Low
$PM_{2.5}$ at HLZ	Chronic	Negligible	Occasional	Low
$PM_{2.5}$ at DFIP	Chronic	Negligible	Seldom	Low
Benzoic acid at BLDG 24064	Chronic	Marginal	Seldom	Low
Benzoic acid at HLZ	Chronic	Marginal	Seldom	Low

7 Other Monitoring

7.1 Toxic Gas Monitoring

Continuous toxic gas monitors were set up at the HLZ and Building 24064 sample points to directly measure common ambient air pollutants that cannot be collected and shipped for laboratory analysis. Two different monitors were used. The first type consisted of electrochemical sensors with 4 sensors per detector unit and 4 detector units per sample site. The sensors were chemical-specific for monitoring carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and hydrogen chloride (HCl), with the average concentration datalogged every 2 minutes. The CO was not measured at a concentration greater than its 8-hour negligible MEG [25 parts per million (ppm)] in any individual measurement. The SO_2 was not measured above its 8-hour negligible MEG (0.2 ppm) during any 8-hour period. No HCl data were collected because the HCl sensors did not respond to the calibration gas, resulting in failed calibration. The NO_2 sensors failed to hold calibration after 4 days of use, presumably due to failure of the electrochemical cells. Measured NO_2 values ranged from 1.5 to 2.1 ppm in the ambient air and from 1.4 to 2.2 ppm when the sensors were checked with “zero air” (laboratory-grade containerized air certified to contain no measureable concentration of the target gases). After the equipment was returned, the sensors were rechecked and 6 of the 8 sensors showed the “zero air” concentrations to be in the range of 1.3 to 2.1 ppm; one sensor read 0.3 ppm and the final sensor read 3.0 ppm.

7.2 Black Carbon Monitoring

The second monitor used was a portable aethalometer for measuring the black carbon component of the PM (references 1-4). The aethalometer was a dual-channel optical monitor that measured both the elemental carbon and the ultraviolet-light absorbing carbon compounds typically associated with fresh diesel exhaust. Two aethalometers were initially installed at the HLZ site but one failed due to its internal battery overheating. The second aethalometer was operated at the HLZ site from 11-18 September 2013, then relcoated to the Building 24064 site from 19-26 September 2013. At the HLZ site, the black carbon concentration ranged from 2.2 to 7.3 micrograms per cubic meter ($\mu g/m^3$) with a mean of 4 $\mu g/m^3$. As a percentage of the $PM_{2.5}$

measured using a deployable particulate sampler, the black carbon composed 4.3 to 10.5 percent of the $PM_{2.5}$. At Building 24064, the black carbon concentration ranged from 6.2 to 13 $\mu g/m^3$ with a mean of 9.7 $\mu g/m^3$. As a percentage of the $PM_{2.5}$ measured, the black carbon composed 13.5 to 17.3 percent of the $PM_{2.5}$. Global ground-level black carbon concentrations are estimated to range up to 15 $\mu g/m^3$ in urban centers and in the U.S., black carbon is estimated to comprise 5 to 10 percent of average urban $PM_{2.5}$ mass (reference 4).

Black carbon does not currently have a MEG or a reference toxicity dose upon which to base a quantitative assessment of health risk. Reviews of the results of published toxicological studies by the World Health Organization (reference 3) suggest that black carbon may not be a major directly toxic component of PM, but it may operate as a universal carrier of a wide variety of chemical constituents of varying toxicity to sensitive targets in the human body. In their Report to Congress on Black Carbon (reference 4), the EPA cited 36 epidemiologic studies where associations were observed between ambient black carbon at mean concentrations up to 3 $\mu g/m^3$ and various health effects. Association does not imply causality, and one of the "key messages" from EPA was that the study results for black carbon are variable and further research is needed to address remaining uncertainties.

8 Conclusions

Although some of the COPCs are carcinogenic, the level of exposure does not exceed the EPA's acceptable cancer risk range of $1x10^{-4}$ to $1x10^{-6}$.

The exposure levels of the receptors to carcinogenic COPCs are within the exposure levels that the EPA generally considers acceptable excess lifetime cancer risk. However, risk within this range of exposure levels should not be used as an absolute measure to determine whether the risk is acceptable. Management of risk should be considered for exposure levels that result in cancer risks from $1x10^{-4}$ to $1x10^{-6}$.

The estimated cancer risks are protective of sensitive populations (asthmatics, children, and the elderly). However because personnel at BAF are not part of a sensitive population and cancer risks for all receptors at all locations were at the more protective end of the range ($1x10^{-6}$), it is unlikely that exposure to carcinogenic COPCs will result in increased cancer risk. Though increased risk of cancer is not expected from this deployment it is always wise whenever possible to reduce exposure to carcinogens.

The calculated, noncarcinogenic hazard indices indicate the potential for short-term respiratory irritation due to a combination of chemicals, primarily acrolein, which was the only chemical with an HQ greater than 1.0 at each site. Based on our evaluation, long-term health effects from exposure to the chemicals evaluated are not expected. At the concentrations detected during this sampling effort, these chemicals may cause short-term health effects such as mucous membrane irritation (eye, nose, throat, lungs) and lightheadedness or drowsiness. More sensitive individuals, such as asthmatics, might be more prone to develop worse symptoms such as wheezing or bronchitis from exposure to acrolein and other VOCs. Though these may last longer than the momentary or short-term irritation associated with concentrations of acrolein, they are expected to be reversible because of the limited, subchronic time of exposure and the minimally elevated intermittent concentrations expected to be experienced. The combination of these chemicals may potentially increase the short-term health effects that would be experienced by contact with any of them individually. The PM concentrations were not quantitatively included in the noncarcinogenic risk results but it is reasonable to assume that high concentrations of PM could increase the potential for health effects on the respiratory system.

The chronic OEH operational risk estimate for exposure to PAHs, SVOCs, VOCs, dioxins/furans, $PM_{2.5}$, and associated metals in the ambient air at BAF, Afghanistan is **low**. The acute OEH operational risk estimate is **low** for an average day as well as for peak pollutant days.

9 Recommendations and Notes

9.1 Recommendations

Collect additional VOC samples, targeting acrolein, to better define acrolein concentrations and possible sources throughout the different seasons.

Monitor black carbon in conjunction with $PM_{2.5}$ sampling to better characterize the PM.

Refine the risk communication plan to include both information products and open discussion opportunities and to reflect new and changing information on site conditions. While information products can be helpful in increasing understanding, open discussion opportunities are proven to help minimize unnecessary concerns by outwardly reinforcing leadership focus on force health protection; clarifying misinformation/misperceptions; and by ensuring that decision makers remain cognizant of nonexperts' interests, values, and concerns.

Implement administrative controls when practical to reduce exposures to air pollutants and reduce the generation of emissions.

Utilize the results from this sampling effort and screening HRA in planning for air surveillance efforts at other locations in theater.

Continue to pursue field-portable, ruggedized monitoring equipment for long-term surveillance of ambient toxic gases.

Incorporate these results into the next POEMS for BAF.

Implement administrative controls when practical to reduce exposures to the ambient air during periods of observed poorer air quality, such as during an inversion. Controls could include moving indoors, using alternate outdoor locations for an activity, or altering the physical training schedule.

Inform preventive medicine and medical personnel of potential health effects resulting from exposures to the measured levels of ambient PM. Disease and nonbattle injury (DNBI) rates of respiratory diseases, particularly asthma, should be followed and assessed during periods of high PM levels, especially in more susceptible persons (those with pre-existing respiratory or cardiopulmonary disease). If elevated DNBI respiratory illness rates (that is, above two standard deviations), or an increase in the incidence or severity of asthma or respiratory conditions are noted during periods of high PM levels, ensure appropriate individual medical follow-up and medical surveillance-related items are documented. If assistance and/or information are needed on environmental health effects and/or medical implications from exposure to PM and associated heavy metals, please contact the USAPHC Environmental Medicine Program at commercial 001-410-436-2714.

9.2 Notes

The risk assessments are specific to the exposure assumptions identified above and the sample results assessed in this report. If the assumed exposure scenario changes or additional information is available, provide the updated information so the risk estimate can be reassessed. If additional samples from this site and/or area are collected, a new OEH risk assessment will be completed.

Only 4 of the 180 samples collected for laboratory analysis were deemed invalid and, therefore, not considered in the risk assessments. Reasons for invalidation of samples included the media being damaged and equipment failure. Appendix B contains a listing of the invalid samples.

10 Points of Contact

The USAPHC, AIPH POCs for this assessment are Mr. (b) (6) and Ms. (b) (6) of the Deployment Environmental Surveillance Program, commercial (b) (6), DSN (b) (6). Mr. (b) (6) may be contacted at e-mail (b) (6) and Ms. (b) (6) may be contacted at email (b) (6)

(b) (6)
Environmental Engineer
Deployment Environmental Surveillance Program

Approved by:

(b) (6)
Program Manager
Deployment Environmental Surveillance

Appendix A
References

1. *Black Carbon as an Additional Indicator of the Adverse Health Effects of Airborne Particles Compared with PM_{10} and $PM_{2.5}$*, Environmental Health Perspectives, 119(12): 1691-1699, December 2011.

2. *Associations between Health Effects and Particulate Matter and Black Carbon in Subjects with Respiratory Disease*, Environmental Health Perspectives, 113(12): 1741-1746, December 2005.

3. Health Effects of Black Carbon, World Health Organization Regional Office for Europe, 2012.

4. USEPA Report to Congress on Black Carbon, Department of the Interior, Environment, and Related Agencies Appropriation Act, 2010, March 2012.

5. USEPA. 1989. EPA/540/1-89/002, Risk Assessment Guidance for Superfund. Office of Emergency and Remedial Response.

6. Department of the Army, FM 5-19, Composite Risk Management, 21 August 2006.

7. USAPHC. 2010. TG 230, Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel.

8. DoDD 6490.02E, Comprehensive Health Surveillance, 23 April 2007.

9. DoDI 6490.03, Deployment Health, 11 August 2006.

10. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-9A, Determination Of Polychlorinated, Polybrominated And Brominated/Chlorinated Dibenzo-p-Dioxins And Dibenzofurans In Ambient Air. Center for Environmental Research Information Office of Research and Development.

11. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-13A Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS). Center for Environmental Research Information Office of Research and Development.

12. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-15A, Determination Of Volatile Organic Compounds (VOCs) In Ambient Air Using Specially Prepared Canisters With Subsequent Analysis By Gas Chromatography. Center for Environmental Research Information Office of Research and Development.

13. USEPA. 1999. Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air. Center for Environmental Research Information Office of Research and Development.

Appendix B
USAPHC AIPH
Deployment Occupational and Environmental Health Risk Characterization
Ambient Air Samples
Bagram Airfield, Afghanistan
12-26 September 2013
U_AFG_BAGRAM_IP_AAA_20130926

Annex 1 to Appendix B
Table of Contents

Page

Page

Appendices

Tables

Page

Annex 2 to Appendix B
Deployment Occupational and Environmental Health Risk Characterization
Ambient Air Samples
Bagram Airfield, Afghanistan
12–26 September 2013
U_AFG_BAGRAM_IP_AAA_20130926

1 References

See Appendix A for a complete list of reference information.

2 Purpose

This annex provides the Army Institute of Public Health assessment of the analytical results and exposure information associated with the deployment samples collected by United States Army Public Health Command (USAPHC) personnel on 12-26 September 2013 at Bagram Airfield (BAF), Afghanistan according to U.S. Department of Defense deployment occupational and environmental health (DOEH) surveillance requirements. The assessment serves several purposes. It identifies DOEH hazards that may be related to acute health effects that could occur in personnel during their deployment. It provides an official record of observed exposure conditions for use in future site evaluations. It identifies whether or not there is a potential for chronic health concerns which may require additional characterization. Finally, this report includes preventive steps to reduce or eliminate occupational and environmental health exposures, as well as surveillance and/or sampling recommendations as necessary.

3 Scope

The assessment of sample results and exposure information in this report follows the process published in the USAPHC Technical Guide (TG) 230 (*Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel*, June 2010). The assessment is based on limited data representing a specific time period and assesses short-term exposure risks only. This report, therefore, cannot be used alone to estimate the risk of chronic health effects from exposures. In addition, this assessment does not address all DOEH hazards to which U.S. personnel may be exposed.

4 Background

Ambient air samples were collected from three areas on BAF, Afghanistan from 12-26 September 2013. The three areas were chosen to represent the entire base camp population. The Building 24064 sample point is located along Disney Drive in a highly-trafficked area. It is near the Koele and Dragon dining facilities, the main PX, the Camp Montrond bazaar, and various housing and work sites. The Helicopter Landing Zone (HLZ) sampling site is on the southeastern side of the airfield runway between the Flightline ‘Mike’ Ramp and ‘Echo’ Ramp. Primary adjacent activities include avaiation operations, maintenance hangars, and housing. The third sample point was at the Detention Facility in Parwan (DFIP), which is located within Camp Sabalu-Harrison near the

eastern perimeter of BAF. Housing, life support activities, detainee operations, and various operational activities are located in this area. The burn pit area was immediately to the east of the DFIP; burn pit operations ceased as of 1 July 2013 though 2 solid waste incinerators remained in operation.

5 Exposure Setting

Annex 2 to Appendix B Tables 1-3 contain information about the sampling locations, environmental conditions, and associated potential population exposure. The information was provided on the field data sheets submitted with the sample set unless otherwise noted. Correction and clarification of exposure assumptions by the sampling unit is encouraged.

Annex 2 to Appendix B Table 1. Exposure Information for BLDG 24064

Questions About Exposure*	Information Provided and Assumptions
What is the exposure event or ambient environmental condition under consideration?	Exposure to VOCs, PAHs, dioxins/furans, $PM_{2.5}$, and associated metals in the ambient air at BAF, Afghanistan.
What is the population at risk?	Personnel who work, reside, and commute through this highly populated area.
What is the timeframe under consideration?	The samples were collected on 12–26 September 2013. This encompasses a timeframe of 15 days from the first day of sampling to the last. However, personnel generally deploy to this location for approximately 9 months, so 9 months is the timeframe under consideration.
What are the activity patterns of the exposed population?	Typical exertion associated with walking and physical training.
What is known about sources of potential contamination?	Ambient PM, vehicle and aircraft emissions, and generators were present. Also, vehicle traffic would be expected to generate locally suspended PM.
What is known about the exposure setting?	This sampled area is on the west side of the main runway in the center portion of the highest population area of BAF.
What are the exposure pathways?	Inhalation only.
Where are the sampling sites relative to where exposure occurs?	The BLDG 24064 site is surrounded by a heavily used dining facility, Post Exchange complex, indoor bazaar, and is a highly populated area.

Legend:
VOC – volatile organic compound
PAH – polycyclic aromatic hydrocarbon
$PM_{2.5}$ – particulate matter less than 2.5 micrometers in diameter
Notes:
*Questions are extracted from USAPHC TG 230.

Annex 2 to Appendix B Table 2. Exposure Information for HLZ

Questions About Exposure*	Information Provided and Assumptions
What is the exposure event or ambient environmental condition under consideration?	Exposure to VOCs, PAHs, dioxins/furans, $PM_{2.5}$, and associated metals in the ambient air at BAF, Afghanistan.
What is the population at risk?	Personnel that spend time in the HLZ and surrounding area.
What is the timeframe under consideration?	The samples were collected from 12–26 September 2013. This encompasses a timeframe of 15 days from the first day of sampling to the last. However, personnel generally deploy to this location for approximately 9 months, so 9 months is the timeframe under consideration.
What are the activity patterns of the exposed population?	Typical exertion associated with walking by and working in vicinity of the HLZ.
What is known about sources of potential contamination?	Ambient PM, vehicle and aircraft emissions, and generators were present. Also, vehicle and helicopter traffic would be expected to generate locally suspended PM.
What is known about the exposure setting?	The HLZ area is on the southeast side of the airbase and east of the main runway.
What are the exposure pathways?	Inhalation only.
Where are the sampling sites relative to where exposure occurs?	The HLZ area contains all HLZ support personnel and is continuously occupied.

Note:
*Questions are extracted from USAPHC TG 230.

Annex 2 to Appendix B Table 3. Exposure Information for DFIP

Questions About Exposure*	Information Provided and Assumptions
What is the exposure event or ambient environmental condition under consideration?	Exposure to VOCs, PAHs, dioxins/furans, $PM_{2.5}$, and associated metals in the ambient air at BAF, Afghanistan.
What is the population at risk?	Personnel that live and/or work on Sabalu-Harrison including the DFIP and surrounding area.
What is the timeframe under consideration?	The samples were collected from 12–26 September 2013. This encompasses a timeframe of 15 days from the first day of sampling to the last. However, personnel generally deploy to this location for approximately 9 months, so 9 months is the timeframe under consideration.
What are the activity patterns of the exposed population?	Typical exertion associated with personnel living and working on Sabalu Harrison.
What is known about sources of potential contamination?	Ambient PM, vehicle and aircraft emissions, and generators were present. Also, vehicle traffic would be expected to generate locally suspended PM.
What is known about the exposure setting?	The Sabalu-Harrison area is at the northeast edge of the airbase perimeter.
What are the exposure pathways?	Inhalation only.
Where are the sampling sites relative to where exposure occurs?	The Sabalu-Harrison area has rotating work populations, detainees, and personnel housing within 100 meters of the sampling site.

Note:
*Questions are extracted from USAPHC TG 230.

6 Sample Collection and Laboratory Analysis

Deployment Particulate Samplers (DPS™) were used with quartz fiber filters to collect samples of particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from the ambient air. The filters were shipped to the AIPH and weighed to determine particulate mass and calculate ambient concentrations. The AIPH laboratory also analyzed the PM for a set of metals typically found in particulate matter. (DPS™ is a trademark of SKC, Inc.)

Summa canisters were used to passively sample the ambient air. The canisters were analyzed for VOCs using a modified EPA Toxic Organic (TO)-15 method.

A PS-1 high volume air sampler was used with polyurethane foam and XAD®-2 resin sample media to collect samples of dioxin/furans and polycyclic aromatic hydrocarbons (PAHs)/semivolatile organic compounds (SVOCs) using modified TO-9 and TO-13 methods, respectively. (XAD® is a registered trademark of Rohm & Haas Co.)

The complete analytical sample results can be viewed in the Defense Occupational and Environmental Health Readiness System-Environmental Health (DOEHRS-EH). Log into the DOEHRS-EH and search for the samples using the DOEHRS sample identification numbers (IDs)

provided in Annexes 4-12 of this Appendix. The annexes contain tables of basic information about each sample collected during this sampling event. Annex 2 to Appendix B Table 4 shows the ratio of invalid to total samples for each site and set of parameters.

Annex 2 to Appendix B Table 4. Number of Valid to Invalid Samples by Sampled Parameter and Sample Site

Sample Site	Sampled Parameters			
	VOCs	PAHs	Dioxins/Furans	$PM_{2.5}$ and metals
BLDG 24064	15/0	15/0	15/0	14/1
HLZ	15/0	15/0	15/0	13/2
DFIP	14/1	15/0	15/0	15/0

7 Prescreen

Annex 2 to Appendix B Table 5 shows parameters identified as potential hazards because their peak concentrations were greater than their most health-protective screening level military exposure guidelines (MEGs). Potential hazards are further assessed to determine if they are acute hazards. The prescreening is conducted as described in USAPHC TG 230, section 3.4.3.

Annex 2 to Appendix B Table 5. Results of Prescreen

Parameter	Detections/ Samples	Peak Concentration ($\mu g/m^3$)	1-year Negligible MEG ($\mu g/m^3$)	Result
Acrolein at BLDG 24064	15/15	1.8	0.137	Retain as potential hazard
Acrolein at HLZ	12/15	6.5	0.137	Retain as potential hazard
Acrolein at DFIP	10/14	1.1	0.137	Retain as potential hazard
$PM_{2.5}$ at BLDG 24064	14/14	75	15	Retain as potential hazard
$PM_{2.5}$ at HLZ	13/13	88	15	Retain as potential hazard
$PM_{2.5}$ at DFIP	15/15	70	15	Retain as potential hazard
Benzoic acid at BLDG 24064	14/15	2.31	1.37	Retain as potential hazard
Benzoic acid at HLZ	15/15	17.04	1.37	Retain as potential hazard
Benzoic acid at DFIP	15/15	1.56	1.37	Retain as potential hazard
Naphthalene at HLZ	15/15	3.67	2.0548	Retain as potential hazard

Legend:
$\mu g/m^3$ – microgram per cubic meter

8 Acute Risk Assessment

8.1 Acute Screen

Annex 2 to Appendix B Table 6 shows whether parameters were identified as acute hazards because their peak concentrations were greater than their acute screening MEGs. Acute hazards are further assessed to estimate the tactical risk from exposure to these parameters in the ambient air. The acute screening is conducted as described in USAPHC TG 230, section 3.4.5.1.

Annex 2 to Appendix B Table 6. Results of Acute Screen

Parameter	Peak Concentration ($\mu g/m^3$)	Screening MEG ($\mu g/m^3$)	Result
Acrolein at BLDG 24064	1.8	14-day Negligible MEG: 46	Exclude as a hazard
Acrolein at HLZ	6.5	14-day Negligible MEG: 46	Exclude as a hazard
Acrolein at DFIP	1.1	14-day Negligible MEG: 46	Exclude as a hazard
PM2.5 at BLDG 24064	75	24-hour Negligible MEG: 65	Retain as acute hazard
PM2.5 at HLZ	88	24-hour Negligible MEG: 65	Retain as acute hazard
PM2.5 at DFIP	70	24-hour Negligible MEG: 65	Retain as acute hazard
Benzoic acid at BLDG 24064	2.31	1-hour Negligible MEG: 12500	Exclude as acute hazard
Benzoic acid at HLZ	17.044	1-hour Negligible MEG: 12500	Exclude as acute hazard
Benzoic acid at DFIP	1.56	1-hour Negligible MEG: 12500	Exclude as acute hazard
Naphthalene at HLZ	3.6711	14-day Negligible MEG: 17955	Exclude as acute hazard

8.2 Acute Hazard Severity

Annex 2 to Appendix B Table 7 summarizes the hazard severity levels determined by comparing the peak and average concentrations of the acute hazards to the appropriate MEGs. The peak concentration is intended to represent the worst exposure conditions and the average concentration is intended to represent typical exposure conditions. Hazard severity is determined using USAPHC TG 230, section 3.4.5.2.

Annex 2 to Appendix B Table 7. Acute Hazard Severity

Parameter	Concentration ($\mu g/m^3$)	Comparison MEGs ($\mu g/m^3$)	Hazard Severity
$PM_{2.5}$ at BLDG 24064	Peak: 75	Is > 24-hour Negligible MEG: 65, but < 24-hour Marginal MEG: 250	Negligible
	Average: 54	Is ≤ 24-hour Negligible MEG: 65	Negligible
$PM_{2.5}$ at HLZ	Peak: 88	Is > 24-hour Negligible MEG: 65, but < 24-hour Marginal MEG: 250	Negligible
	Average: 54	Is ≤ 24-hour Negligible MEG: 65	Negligible
$PM_{2.5}$ at DFIP	Peak: 70	Is > 24-hour Negligible MEG: 65, but < 24-hour Marginal MEG: 250	Negligible
	Average: 52	Is ≤ 24-hour Negligible MEG: 65	Negligible

8.3 Acute Hazard Probability

Annex 2 to Appendix B, Tables 8–10 summarizes the hazard probability determinations for each acute hazard. Refer to USAPHC TG 230, section 3.4.5.3 for additional information about hazard probability scoring methodology.

Annex 2 to Appendix B Table 8. Hazard Probability Scoring for $PM_{2.5}$ at BLDG 24064

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
Peak: 75	Score: 1	Score: 2	Score: 1	Score: 2	Total Score: 6
	Concentration is <25th percentile of severity range.	Field data adequately estimate population exposure (Daily sampling).	Field exposure duration to MEG exposure duration ratio is less than 1. (24hr MEG compared to less than 24 hour exposure; it is assumed personnel spend part of each day indoors)	Score 2: Typical exertion (no information to indicate otherwise).	Unlikely
Average: 54	Score: 1	Score: 2	Score: 1	Score: 2	Total Score: 6
	Concentration is ≤Negligible MEG	Field data adequately estimate population exposure (Daily sampling).	Field exposure duration to MEG exposure duration ratio is less than 1. (24hr MEG compared to less than 24 hour exposure; it is assumed that personnel spend part of each day indoors)	Typical exertion (no information to indicate otherwise).	Unlikely

Annex 2 to Appendix B Table 9. Hazard Probability Scoring for $PM_{2.5}$ at HLZ

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
Peak: 88	Score: 1	Score: 2	Score: 1	Score: 2	Total Score: 6
	Concentration is <25th percentile of severity range.	Field data adequately estimate population exposure (Daily sampling).	Field exposure duration to MEG exposure duration ratio is less than 1. (24hr MEG compared to less than 24 hr exposure; it is assumed that personnel spend part of each day indoors)	Score 2: Typical exertion (no information to indicate otherwise).	Unlikely
Average: 54	Score: 1	Score: 2	Score: 1	Score: 2	Total Score: 6
	Concentration is ≤Negligible MEG	Field data adequately estimate population exposure (Daily sampling).	Field exposure duration to MEG exposure duration ratio is less than 1. (24hr MEG compared to less than 24hr exposure; it is assumed personnel spend part of each day indoors)	Typical exertion (no information to indicate otherwise).	Unlikely

Annex 2 to Appendix B Table 10. Hazard Probability Scoring for $PM_{2.5}$ at DFIP

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
Peak: 70	Score: 1	Score: 2	Score: 1	Score: 2	Total Score: 6
	Concentration is <25th percentile of severity range.	Field data adequately estimate population exposure (Daily sampling).	Field exposure duration to MEG exposure duration ratio is less than 1. (24hr MEG compared to less than 24hr exposure; it is assumed that personnel spend part of each day indoors)	Score 2: Typical exertion (no information to indicate otherwise).	Unlikely
Average: 52	Score: 1	Score: 2	Score: 1	Score: 2	Total Score: 6
	Concentration is ≤Negligible MEG	Field data adequately estimate population exposure (Daily sampling).	Field exposure duration to MEG exposure duration ratio is less than 1. (24hr MEG compared to less than 24hr exposure; it is assumed that personnel spend part of each day indoors)	Typical exertion (no information to indicate otherwise).	Unlikely

8.4 Tactical Risk Estimate

Annex 2 to Appendix B Table 11 summarizes the acute risk assessment for exposure to each of the acute hazards. The tactical risk estimates were determined using the USAPHC TG 230, Table 3-1 "Military Risk Assessment Matrix."

Annex 2 to Appendix B Table 11. Acute Risk Assessment Summary

Parameter	Type of Exposure	Hazard Severity	Hazard Probability	Tactical Risk Estimate
$PM_{2.5}$ at BLDG 24064	Peak	Negligible	Unlikely	Low
	Average	Negligible	Unlikely	Low
$PM_{2.5}$ at HLZ	Peak	Negligible	Unlikely	Low
	Average	Negligible	Unlikely	Low
$PM_{2.5}$ at DFIP	Peak	Negligible	Unlikely	Low
	Average	Negligible	Unlikely	Low

9 Chronic Risk Assessment

9.1 Chronic Screen

Annex 2 to Appendix B Table 12 shows parameters identified as chronic hazards because they were detected in at least 5 percent of samples, and their average concentrations were greater than their chronic screening MEGs. Chronic hazards are further assessed to estimate the life-cycle risk from exposure to these parameters in the ambient air over an extended period of time. The chronic screening is conducted as described in USAPHC TG 230, section 3.4.6.1.

Annex 2 to Appendix B Table 12. Results of Chronic Screen

Parameter	Average Concentration (µg/m^3)	Screening MEG (µg/m^3)	Result
Acrolein at BLDG 24064	1.154	1-year Negligible MEG: 0.137	Retain as a chronic hazard
Acrolein at HLZ	1.633	1-year Negligible MEG: 0.137	Retain as a chronic hazard
Acrolein at DFIP	0.645	1-year Negligible MEG: 0.137	Retain as a chronic hazard
$PM_{2.5}$ at BLDG 24064	54	1-year Negligible MEG: 15	Retain as a chronic hazard
$PM_{2.5}$ at HLZ	54	1-year Negligible MEG: 15	Retain as a chronic hazard
$PM_{2.5}$ at DFIP	52	1-year Negligible MEG: 15	Retain as a chronic hazard
Benzoic acid at BLDG 24064	1.57	1-year Negligible MEG: 1.37	Retain as a chronic hazard
Benzoic acid at HLZ	2.46	1-year Negligible MEG: 1.37	Retain as a chronic hazard
Benzoic acid at DFIP	1.137	1-year Negligible MEG: 1.37	Exclude as a chronic hazard
Naphthalene at HLZ	0.526	1-year Negligible MEG: 2.0548	Exclude as a chronic hazard

9.2 Chronic Hazard Severity

Annex 2 to Appendix B Table 13 summarizes the hazard severity levels determined by comparing the average concentrations of the chronic hazards to the appropriate MEGs. Hazard severity is determined using USAPHC TG 230, section 3.4.6.2.

Annex 2 to Appendix B Table 13. Chronic Hazard Severity

Parameter	Average Concentration (µg/m^3)	Comparison MEGs (µg/m^3)	Hazard Severity
Acrolein at BLDG 24064	1.154	Is ≥ 1-year Negligible MEG: (0.137), 1-year Marginal MEG not available	Negligible
Acrolein at HLZ	1.633	Is ≥ 1-year Negligible MEG: (0.137), 1-year Marginal MEG not available	Negligible
Acrolein at DFIP	0.645	Is ≥ 1-year Negligible MEG: (0.137), 1-year Marginal MEG not available	Negligible
$PM_{2.5}$ at BLDG 24064	54	Is ≥ 1-year Negligible MEG: 15, but < 1-year Marginal MEG: 65	Negligible
$PM_{2.5}$ at HLZ	54	Is ≥ 1-year Negligible MEG: 15, but < 1-year Marginal MEG: 65	Negligible
$PM_{2.5}$ at DFIP	52	Is ≥ 1-year Negligible MEG: 15, but < 1-year Marginal MEG: 65	Negligible
Benzoic acid at BLDG 24064	1.57	Is ≥ 1-year Negligible MEG: (1.37), 1-year Marginal MEG not available	Marginal
Benzoic acid at HLZ	2.46	Is ≥ 1-year Negligible MEG: (1.37), 1-year Marginal MEG not available	Marginal

Acrolein was determined to be a Negligible hazard without a 1-year Marginal MEG because the health effects from exposure to low levels of acrolein are primarily irritation of the respiratory tract and the 1-year Negligible MEG is based on a conservative subchronic animal study.

Benzoic acid was determined to be a Marginal hazard without a 1-year Marginal MEG because the health effects from exposure to low levels of benzoic acid are related to irritation of the respiratory tract and pulmonary fibrosis—scarring and thickening of lung tissues. A Marginal hazard severity at the detected concentrations is likely overly conservative; however, pulmonary fibrosis is a chronic health effect that is irreversible and can progressively worsen. Confidence in this hazard severity is low because the 1-year Negligible MEG is based on a single subchronic animal study.

9.3 Chronic Hazard Probability

Annex 2 to Appendix B Tables 14–21 summarizes the hazard probability determinations for each chronic hazard. Refer to USAPHC TG 230, section 3.4.6.3 for additional information about hazard probability scoring methodology.

Annex 2 to Appendix B Table 14. Hazard Probability Scoring for Acrolein at BLDG 24064

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
1.154	Score: 2	Score: 2	Score: 1	Score: 2	Total Score: 7
	Concentration is > 1-year Negligible MEG and next higher severity MEG does not exist.	Field data are adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG).	Typical Exertion.	Seldom

Annex 2 to Appendix B Table 15. Hazard Probability Scoring for Acrolein at HLZ

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
1.633	Score: 2	Score: 2	Score: 1	Score: 2	Total Score: 7
	Concentra-tion is > 1-year Negligible MEG and next higher severity MEG does not exist.	Field data is adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG).	Typical Exertion.	Seldom

Annex 2 to Appendix B Table 16. Hazard Probability Scoring for Acrolein at DFIP

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
0.645	Score: 2	Score: 2	Score: 1	Score: 2	Total Score: 7
	Concentration is > 1-year Negligible MEG and next higher severity MEG does not exist.	Field data is adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG)	Typical Exertion	Seldom

Annex 2 to Appendix B Table 17. Hazard Probability Scoring for $PM_{2.5}$ at BLDG 24064

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
54	Score: 3	Score: 2	Score: 1	Score: 2	Total Score: 8
	Concentration is >75th percentile of severity range.	Field data is adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG).	Typical Exertion.	Occasional

Annex 2 to Appendix B Table 18. Hazard Probability Scoring for $PM_{2.5}$ at HLZ

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
54	Score: 3	Score: 2	Score: 1	Score: 2	Total Score: 8
	Concentration is >75th percentile of severity range.	Field data is adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG).	Typical Exertion.	Occasional

Annex 2 to Appendix B Table 19. Hazard Probability Scoring for $PM_{2.5}$ at DFIP

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
52	Score: 2	Score: 2	Score: 1	Score: 2	Total Score: 7
	Concentration is at or between 25th and 75th percentiles of severity range.	Field data is adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG).	Typical Exertion.	Seldom

Annex 2 to Appendix B Table 20. Hazard Probability Scoring for Benzoic Acid at BLDG 24064

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
1.567	Score: 2	Score: 2	Score: 1	Score: 2	Total Score: 7
	Concentration is > 1-year Negligible MEG and next higher severity MEG does not exist.	Field data are adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG).	Typical Exertion.	Seldom

Annex 2 to Appendix B Table 21. Hazard Probability Scoring for Benzoic Acid at HLZ

Concentration ($\mu g/m^3$)	Hazard Probability Scoring for Exposure Factors				Hazard Probability
	Degree of Exposure	Representativeness of Sample Data	Duration of Exposure	Rate of Exposure	
2.464	Score: 2	Score: 2	Score: 1	Score: 2	Total Score: 7
	Concentration is > 1-year Negligible MEG and next higher severity MEG does not exist.	Field data are adequate to estimate exposure for this timeframe (no information to suggest otherwise).	Field exposure duration to MEG exposure duration ratio is less than 1 (9 month exposure to 1-year MEG).	Typical Exertion.	Seldom

9.4 Lifecycle Risk Estimate

Annex 2 to Appendix B Table 22 summarizes the chronic risk assessment for exposure to each of the chronic hazards. The lifecycle risk estimate was determined using the USAPHC TG 230, Table 3-1 "Military Risk Assessment Matrix."

Annex 2 to Appendix B Table 22. Chronic Risk Assessment Summary

Parameter	Hazard Severity	Hazard Probability	Lifecycle Risk Estimate
Acrolein at BLDG 24064	Negligible	Seldom	Low
Acrolein at HLZ	Negligible	Seldom	Low
Acrolein at DFIP	Negligible	Seldom	Low
$PM_{2.5}$ at BLDG 24064	Negligible	Occasional	Low
$PM_{2.5}$ at HLZ	Negligible	Occasional	Low
$PM_{2.5}$ at DFIP	Negligible	Seldom	Low
Benzoic acid at BLDG 24064	Marginal	Seldom	Low
Benzoic acid at HLZ	Marginal	Seldom	Low

10 Conclusion

The $PM_{2.5}$ was identified as acute hazards at all three sample areas. The estimated tactical risk for typical exposure days for $PM_{2.5}$ at all three sample areas is **low**.

Acrolein and $PM_{2.5}$ were identified as a chronic hazards at all three sample areas. Benzoic acid was identified as a chronic hazard at BLDG 24064 and the HLZ. The estimated chronic risk for exposure to acrolein, $PM_{2.5,}$ and benzoic acid at all samples sites is **low**.

These risk estimates were based solely on the samples and associated exposure information assessed in this report.

11 Limitations

11.1 Field Data Quality

The field data sheets provided with the sample set were adequately completed.

Four of the 180 samples (2%) collected for laboratory analysis were invalid due to damaged sampling media, sampler malfunction, or battery failure.

11.2 Sample Receipt at AIPH Laboratory

The sample sets were packaged correctly.

11.3 Laboratory Data Quality

Some parameters in this data set are flagged with a J code (J). This code indicates an estimated value that was detected above the method detection limit but below the method reporting limit (also known as limit of quantitation or practical quantitation limit).

Benzoic acid was detected in the method blank, the laboratory control sample and the laboratory control sample duplicate, indicating that this analyte is present in the sampling media. This could have affected all of the PAH/SVOC samples.

12 Recommendations and Notes

Collect additional VOC samples, targeting acrolein, to better define acrolein concentrations and possible sources throughout the different seasons.

Refine the risk communication information provided in September 2013 to include both information products and open discussion opportunities and to reflect new and changing information on site conditions.

Implement administrative controls when practical to reduce exposures to air pollutants and reduce the generation of military-based emissions.

Inform preventive medicine and medical personnel of potential health effects resulting from exposures to the measured levels of ambient PM.

Utilize the results from this sampling effort and risk assessment as well as lessons learned in planning for air surveillance efforts at other locations in theater.

13 Point of Contact

The AIPH point of contact for this assessment is the Deployment Environmental Surveillance Program (DESP). The DESP may be contacted at e-mail usarmy.apg.medcom-phc.list.desp-request@mail.mil, or DSN 312-584-6096 or commercial 001-410-436-6096.

Annex 3 to Appendix B
References

1. DoD. 2007. Directive 6490.02E, Comprehensive Health Surveillance.

2. DoD. 2006. Instruction 6490.03, Deployment Health.

3. Department of the Army. 2006. Field Manual 5-19, Composite Risk Management.

4. USAPHC. 2010. TG 230, Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel.

5. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-9A, Determination of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air. Center for Environmental Research Information Office of Research and Development.

6. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-13A Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS). Center for Environmental Research Information Office of Research and Development.

7. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-15A, Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters with Subsequent Analysis by Gas Chromatography. Center for Environmental Research Information Office of Research and Development.

8. USEPA. 1999. Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air. Center for Environmental Research Information Office of Research and Development.

Annex 4 to Appendix B
Information Summary
Ambient Air Samples (TO-9 and TO-13)
BAF, Afghanistan (BLDG 24064)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample
00009ZJ0	AFG_BAGRAM_20130912_TO09_01	BAGRAM	Building 24064	2013/09/12 0849	1452.6 min	No
00009ZQJ	AFG_BAGRAM_20130913_TO09_01	BAGRAM	Building 24064	2013/09/13 0927	1434.6 min	No
00009ZRC	AFG_BAGRAM_20130914_TO09_01	BAGRAM	Building 24064	2013/09/14 0925	1436.4 min	No
00009ZT8	AFG_BAGRAM_20130915_TO09_01	BAGRAM	Building 24064	2013/09/15 0932	1439.4 min	No
0000A0AU	AFG_BAGRAM_20130916_TO09_01	BAGRAM	Building 24064	2013/09/16 0934	1439.4 min	No
0000A0X2	AFG_BAGRAM_20130917_TO09_01	BAGRAM	Building 24064	2013/09/17 0937	1426.2 min	No
0000A1AT	AFG_BAGRAM_20130918_TO09_01	BAGRAM	Building 24064	2013/09/18 0926	1433.4 min	No
0000A1R8	AFG_BAGRAM_20130919_TO09_01	BAGRAM	Building 24064	2013/09/19 0939	1432.8 min	No
0000A1YY	AFG_BAGRAM_20130920_TO09_01	BAGRAM	Building 24064	2013/09/20 0936	1439.4 min	No
0000A1ZH	AFG_BAGRAM_20130921_TO09_01	BAGRAM	Building 24064	2013/09/21 0939	1442.4 min	No
0000A22D	AFG_BAGRAM_20130922_TO09_01	BAGRAM	Building 24064	2013/09/22 0946	1438.8 min	No
0000A2BY	AFG_BAGRAM_20130923_TO09_01	BAGRAM	Building 24064	2013/09/23 0952	1440.0 min	No
0000A2KD	AFG_BAGRAM_20130924_TO09_01	BAGRAM	Building 24064	2013/09/24 0954	1439.4 min	No
0000A2XK	AFG_BAGRAM_20130925_TO09_01	BAGRAM	Building 24064	2013/09/25 0955	1439.4 min	No
0000A593	AFG_BAGRAM_20130926_TO09_01	BAGRAM	Building 24064	2013/09/26 1001	1446.6 min	No
00009ZJ4	AFG_BAGRAM_20130912_TO13_01	BAGRAM	Building 24064	2013/09/12 0849	1467.0 min	No
00009ZQK	AFG_BAGRAM_20130913_TO13_01	BAGRAM	Building 24064	2013/09/13 0924	1444.8 min	No
00009ZRD	AFG_BAGRAM_20130914_TO13_01	BAGRAM	Building 24064	2013/09/14 0930	1430.4 min	No
00009ZT9	AFG_BAGRAM_20130915_TO13_01	BAGRAM	Building 24064	2013/09/15 0932	1440.0 min	No
0000A0AP	AFG_BAGRAM_20130916_TO13_01	BAGRAM	Building 24064	2013/09/16 0938	1435.8 min	No
0000A0XI	AFG_BAGRAM_20130917_TO13_01	BAGRAM	Building 24064	2013/09/17 0929	1440.0 min	No
0000A1AU	AFG_BAGRAM_20130918_TO13_01	BAGRAM	Building 24064	2013/09/18 0932	1428.0 min	No

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample
0000A1R9	AFG_BAGRAM_20130919_TO13_01	BAGRAM	Building 24064	2013/09/19 0939	1434.6 min	No
0000A1YZ	AFG_BAGRAM_20130920_TO13_01	BAGRAM	Building 24064	2013/09/20 0932	1444.2 min	No
0000A1ZJ	AFG_BAGRAM_20130921_TO13_01	BAGRAM	Building 24064	2013/09/21 0939	1444.2 min	No
0000A22F	AFG_BAGRAM_20130922_TO13_01	BAGRAM	Building 24064	2013/09/22 0943	1442.4 min	No
0000A2BZ	AFG_BAGRAM_20130923_TO13_01	BAGRAM	Building 24064	2013/09/23 0952	1442.4 min	No
0000A2KE	AFG_BAGRAM_20130924_TO13_01	BAGRAM	Building 24064	2013/09/24 0951	1441.2 min	No
0000A2XL	AFG_BAGRAM_20130925_TO13_01	BAGRAM	Building 24064	2013/09/25 0955	1443.6 min	No
0000A5BG	AFG_BAGRAM_20130926_TO13_01	BAGRAM	Building 24064	2013/09/26 0957	1446.6 min	No

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 5 to Appendix B
Information Summary
Ambient Air Samples (TO-15)
BAF, Afghanistan (BLDG 24064)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample	Canister Serial #
00009ZJ5	AFG_BAGRAM_20130912_TO14_01	BAGRAM	Building 24064	2013/09/12 0958	1384.0 minutes	No	1970 TO-15 Canister
00009ZQL	AFG_BAGRAM_20130913_TO14_01	BAGRAM	Building 24064	2013/09/13 0950	1426.0 minutes	No	2679 TO-15 Canister
00009ZRB	AFG_BAGRAM_20130914_TO14_01	BAGRAM	Building 24064	2013/09/14 0945	1440.0 minutes	No	2689 TO-15 Canister
00009ZTY	AFG_BAGRAM_20130915_TO14_01	BAGRAM	Building 24064	2013/09/15 0950	1430.0 minutes	No	2727 TO-15 Canister
0000A09Q	AFG_BAGRAM_20130916_TO14_01	BAGRAM	Building 24064	2013/09/16 0942	1440.0 minutes	No	5862 TO-15 Canister
0000A0WB	AFG_BAGRAM_20130917_TO14_01	BAGRAM	Building 24064	2013/09/17 0943	1432.0 minutes	No	5865 TO-15 Canister
0000A1AS	AFG_BAGRAM_20130918_TO14_01	BAGRAM	Building 24064	2013/09/18 0947	1440.0 minutes	No	5840 TO-15 Canister
0000A1RA	AFG_BAGRAM_20130919_TO14_01	BAGRAM	Building 24064	2013/09/19 1007	1422.0 minutes	No	5859 TO-15 Canister
0000A1Z0	AFG_BAGRAM_20130920_TO14_01	BAGRAM	Building 24064	2013/09/20 0957	1440.0 minutes	No	5850 TO-15 Canister
0000A1ZG	AFG_BAGRAM_20130921_TO14_01	BAGRAM	Building 24064	2013/09/21 1000	1440.0 minutes	No	5867 TO-15 Canister
0000A22C	AFG_BAGRAM_20130922_TO14_01	BAGRAM	Building 24064	2013/09/22 1000	1440.0 minutes	No	1975 TO-15 Canister
0000A2C0	AFG_BAGRAM_20130923_TO14_01	BAGRAM	Building 24064	2013/09/23 1003	1440.0 minutes	No	5255 TO-15 Canister
0000A2KC	AFG_BAGRAM_20130924_TO14_01	BAGRAM	Building 24064	2013/09/24 1006	1440.0 minutes	No	4751 TO-15 Canister
0000A2XJ	AFG_BAGRAM_20130925_TO14_01	BAGRAM	Building 24064	2013/09/25 1008	1440.0 minutes	No	2715 TO-15 Canister
0000A56S	AFG_BAGRAM_20130926_TO14_01	BAGRAM	Building 24064	2013/09/26 1009	1440.0 minutes	No	4690 TO-15 Canister

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 6 to Appendix B
Information Summary
Ambient Air Samples ($PM_{2.5}$)
BAF, Afghanistan (BLDG 24064)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample	Filter ID
00009ZJ6	AFG_BAGRAM_20130912_PM2.5_01	BAGRAM	Building 24064	2013/09/12 1019	1451.0 minutes	No	47-12-2401
00009ZQM	AFG_BAGRAM_20130913_PM2.5_01	BAGRAM	Building 24064	2013/09/13 1032	1426.0 minutes	No	47-12-2404
00009ZRE	AFG_BAGRAM_20130914_PM25DPS_01	BAGRAM	Building 24064	2013/09/14 1036	1411.0 minutes	No	47-12-2407
00009ZU3	AFG_BAGRAM_20130915_PM25DPS_01	BAGRAM	Building 24064	2013/09/15 1012	1413.0 minutes	No	47-12-2410
0000A09J	AFG_BAGRAM_20130916_PM25DPS_01	BAGRAM	Building 24064	2013/09/16 0950	1440.0 minutes	No	47-12-2413
0000A0W1	AFG_BAGRAM_20130917_PM25DPS_01	BAGRAM	Building 24064	2013/09/17 0954	1440.0 minutes	No	47-12-2416
0000A1AR	AFG_BAGRAM_20130918_PM25DPS_01	BAGRAM	Building 24064	2013/09/18 1012	1440.0 minutes	No	47-12-2419
0000A1R7	AFG_BAGRAM_20130919_PM25DPS_01	BAGRAM	Building 24064	2013/09/19 1015	1440.0 minutes	No	47-12-2422
0000A1YX	AFG_BAGRAM_20130920_PM25DPS_01	BAGRAM	Building 24064	2013/09/20 1021	1440.0 minutes	No	47-12-2425
0000A1ZF	AFG_BAGRAM_20130921_PM25DPS_01	BAGRAM	Building 24064	2013/09/21 1029	1440.0 minutes	Yes, Flow Differential	47-12-2428
0000A22B	AFG_BAGRAM_20130922_PM25DPS_01	BAGRAM	Building 24064	2013/09/22 1035	1440.0 minutes	No	47-12-2431
0000A2C5	AFG_BAGRAM_20130923_PM25DPS_01	BAGRAM	Building 24064	2013/09/23 1043	1440.0 minutes	No	47-12-2434
0000A2KB	AFG_BAGRAM_20130924_PM25DPS_01	BAGRAM	Building 24064	2013/09/24 1048	1440.0 minutes	No	47-12-2437
0000A2XI	AFG_BAGRAM_20130925_PM25DPS_01	BAGRAM	Building 24064	2013/09/25 1050	1440.0 minutes	No	47-12-2440
0000A574	AFG_BAGRAM_20130926_PM25DPS_01	BAGRAM	Building 24064	2013/09/26 1056	1444.0 minutes	No	47-12-2443

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 7 to Appendix B
Information Summary
Ambient Air Samples (TO-9 and TO-13)
BAF, Afghanistan (HLZ)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample
00009ZJ8	AFG_BAGRAM_20130912_TO09_02	BAGRAM	HLZ	2013/09/12 0925	1440.0 min	No
00009ZR3	AFG_BAGRAM_20130913_TO09_02	BAGRAM	HLZ	2013/09/13 1002	1860.0 min	No
00009ZRJ	AFG_BAGRAM_20130914_TO09_02	BAGRAM	HLZ	2013/09/14 1015	1343.4 min	No
00009ZVW	AFG_BAGRAM_20130915_TO09_02	BAGRAM	HLZ	2013/09/15 0940	1440.0 min	No
0000A0CH	AFG_BAGRAM_20130916_TO09_02	BAGRAM	HLZ	2013/09/16 0945	1440.0 min	No
0000A0YD	AFG_BAGRAM_20130917_TO09_02	BAGRAM	HLZ	2013/09/17 0952	1426.2 min	No
0000A1BI	AFG_BAGRAM_20130918_TO09_02	BAGRAM	HLZ	2013/09/18 0942	1432.2 min	No
0000A1SP	AFG_BAGRAM_20130919_TO09_02	BAGRAM	HLZ	2013/09/19 0937	1440.0 min	No
0000A1Z4	AFG_BAGRAM_20130920_TO09_02	BAGRAM	HLZ	2013/09/20 0942	1437.0 min	No
0000A1ZO	AFG_BAGRAM_20130921_TO09_02	BAGRAM	HLZ	2013/09/21 0941	1440.0 min	No
0000A22U	AFG_BAGRAM_20130922_TO09_02	BAGRAM	HLZ	2013/09/22 0945	1440.0 min	No
0000A2C7	AFG_BAGRAM_20130923_TO09_02	BAGRAM	HLZ	2013/09/23 0946	1440.0 min	No
0000A2KJ	AFG_BAGRAM_20130924_TO09_02	BAGRAM	HLZ	2013/09/24 0951	1440.0 min	No
0000A2XR	AFG_BAGRAM_20130925_TO09_02	BAGRAM	HLZ	2013/09/25 0952	1435.2 min	No
0000A5BS	AFG_BAGRAM_20130926_TO09_02	BAGRAM	HLZ	2013/09/26 0950	1440.0 min	No
00009ZJ9	AFG_BAGRAM_20130912_TO13_02	BAGRAM	HLZ	2013/09/12 0930	1440.0 min	No
00009ZR4	AFG_BAGRAM_20130913_TO13_02	BAGRAM	HLZ	2013/09/13 1005	1680.0 min	No
00009ZRI	AFG_BAGRAM_20130914_TO13_02	BAGRAM	HLZ	2013/09/14 1015	1410.0 min	No
00009ZVZ	AFG_BAGRAM_20130915_TO13_02	BAGRAM	HLZ	2013/09/15 0944	1440.0 min	No
0000A0CF	AFG_BAGRAM_20130916_TO13_02	BAGRAM	HLZ	2013/09/16 0945	1440.0 min	No
0000A0YF	AFG_BAGRAM_20130917_TO13_02	BAGRAM	HLZ	2013/09/17 0957	1420.8 min	No

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample
0000A1BK	AFG_BAGRAM_20130918_TO13_02	BAGRAM	HLZ	2013/09/18 0942	1436.4 min	No
0000A1SR	AFG_BAGRAM_20130919_TO13_02	BAGRAM	HLZ	2013/09/19 0940	1440.0 min	No
0000A1Z6	AFG_BAGRAM_20130920_TO13_02	BAGRAM	HLZ	2013/09/20 0942	1440.0 min	No
0000A1ZQ	AFG_BAGRAM_20130921_TO13_02	BAGRAM	HLZ	2013/09/21 0944	1440.0 min	No
0000A22V	AFG_BAGRAM_20130922_TO13_02	BAGRAM	HLZ	2013/09/22 0945	1439.9 min	No
0000A2C8	AFG_BAGRAM_20130923_TO13_02	BAGRAM	HLZ	2013/09/23 0943	1440.0 min	No
0000A2KL	AFG_BAGRAM_20130924_TO13_02	BAGRAM	HLZ	2013/09/24 0951	1440.0 min	No
0000A2XU	AFG_BAGRAM_20130925_TO13_02	BAGRAM	HLZ	2013/09/25 0953	1434.0 min	No
0000A5C1	AFG_BAGRAM_20130926_TO13_02	BAGRAM	HLZ	2013/09/26 0950	1440.0 min	No

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 8 to Appendix B
Information Summary
Ambient Air Samples (TO-15)
BAF, Afghanistan (HLZ)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample	Canister Serial #
00009ZJA	AFG_BAGRAM_20130912_TO14_02	BAGRAM	HLZ	2013/09/12 0944	1413.0 minutes	No	4735 TO-15 Canister
00009ZR2	AFG_BAGRAM_20130913_TO14_02	BAGRAM	HLZ	2013/09/13 0924	1440.0 minutes	No	2690 TO-15 Canister
00009ZRL	AFG_BAGRAM_20130914_TO14_02	BAGRAM	HLZ	2013/09/14 0945	1409.0 minutes	No	2731 TO-15 Canister
00009ZW4	AFG_BAGRAM_20130915_TO14_02	BAGRAM	HLZ	2013/09/15 0920	1440.0 minutes	No	1206 TO-15 Canister
0000A0CI	AFG_BAGRAM_20130916_TO14_02	BAGRAM	HLZ	2013/09/16 0923	1439.0 minutes	No	2763 TO-15 Canister
0000A0YC	AFG_BAGRAM_20130917_TO14_02	BAGRAM	HLZ	2013/09/17 0926	1440.0 minutes	No	2688 TO-15 Canister
0000A1BL	AFG_BAGRAM_20130918_TO14_02	BAGRAM	HLZ	2013/09/18 0928	1436.0 minutes	No	2719 TO-15 Canister
0000A1ST	AFG_BAGRAM_20130919_TO14_02	BAGRAM	HLZ	2013/09/19 0928	1440.0 minutes	No	2691 TO-15 Canister
0000A1Z8	AFG_BAGRAM_20130920_TO14_02	BAGRAM	HLZ	2013/09/20 0932	1440.0 minutes	No	5813 TO-15 Canister
0000A1ZR	AFG_BAGRAM_20130921_TO14_02	BAGRAM	HLZ	2013/09/21 0935	1440.0 minutes	No	5888 TO-15 Canister
0000A22W	AFG_BAGRAM_20130922_TO14_02	BAGRAM	HLZ	2013/09/22 0938	1440.0 minutes	No	5842 TO-15 Canister
0000A2C9	AFG_BAGRAM_20130923_TO14_02	BAGRAM	HLZ	2013/09/23 0940	1437.0 minutes	No	4753 TO-15 Canister
0000A2KN	AFG_BAGRAM_20130924_TO14_02	BAGRAM	HLZ	2013/09/24 0943	1440.0 minutes	No	4738 TO-15 Canister
0000A2XP	AFG_BAGRAM_20130925_TO14_02	BAGRAM	HLZ	2013/09/25 0947	1435.0 minutes	No	4739 TO-15 Canister
0000A56U	AFG_BAGRAM_20130926_TO14_02	BAGRAM	HLZ	2013/09/26 0945	1440.0 minutes	No	2714 TO-15 Canister

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 9 to Appendix B
Information Summary
Ambient Air Samples ($PM_{2.5}$)
BAF, Afghanistan (HLZ)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample	Filter ID
00009ZJ7	AFG_BAGRAM_20130912_PM2.5_03	BAGRAM	HLZ	2013/09/12 0908	1451.0 min	Yes, Battery Failure	47-12-2403
00009ZR1	AFG_BAGRAM_20130913_PM25DPS_02	BAGRAM	HLZ	2013/09/13 0954	1440.0 min	No	47-12-2405
00009ZRG	AFG_BAGRAM_20130914_PM25_02	BAGRAM	HLZ	2013/09/14 1008	1400.0 min	No	47-12-2408
00009ZW3	AFG_BAGRAM_20130915_PM25DPS_02	BAGRAM	HLZ	2013/09/15 0935	1440.0 min	No	47-12-2411
0000A0CK	AFG_BAGRAM_20130916_PM25DPS_02	BAGRAM	HLZ	2013/09/16 0940	1440.0 min	No	47-12-2414
0000A0YA	AFG_BAGRAM_20130917_PM25DPS_02	BAGRAM	HLZ	2013/09/17 0947	1440.0 min	No	47-12-2417
0000A1BF	AFG_BAGRAM_20130918_PM25DPS_02	BAGRAM	HLZ	2013/09/18 0953	1440.0 min	No	47-12-2420
0000A1SU	AFG_BAGRAM_20130919_PM25DPS_02	BAGRAM	HLZ	2013/09/19 0959	1440.0 min	No	47-12-2423
0000A1Z1	AFG_BAGRAM_20130920_PM25DPS_02	BAGRAM	HLZ	2013/09/20 1010	1440.0 min	Yes, Flow Differential	47-12-2426
0000A1ZL	AFG_BAGRAM_20130921_PM25DPS_02	BAGRAM	HLZ	2013/09/21 1001	1430.0 min	No	47-12-2429
0000A22R	AFG_BAGRAM_20130922_PM25DPS_02	BAGRAM	HLZ	2013/09/22 0953	1440.0 min	No	47-12-2432
0000A2C6	AFG_BAGRAM_20130923_PM25DPS_02	BAGRAM	HLZ	2013/09/23 0958	1440.0 min	No	47-12-2435
0000A2KH	AFG_BAGRAM_20130924_PM25DPS_02	BAGRAM	HLZ	2013/09/24 1003	1440.0 min	No	47-12-2438
0000A2XN	AFG_BAGRAM_20130925_PM25DPS_02	BAGRAM	HLZ	2013/09/25 1007	1423.0 min	No	47-12-2441
0000A576	AFG_BAGRAM_20130926_PM25DPS_02	BAGRAM	HLZ	2013/09/26 0956	1440.0 min	No	47-12-2444

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 10 to Appendix B
Information Summary
Ambient Air Samples (TO-9 and TO-13)
BAF, Afghanistan (DFIP)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample
00009ZJM	AFG_SABALU_20130912_TO09	SABALU-HARRISON	DFIP	2013/09/12 1210	1419.6 min	No
00009ZR8	AFG_SABALU_20130913_TO09	SABALU-HARRISON	DFIP	2013/09/13 1159	1388.4 min	No
00009ZRK	AFG_SABALU_20130914_TO09	SABALU-HARRISON	DFIP	2013/09/14 1118	1394.0 min	No
00009ZW2	AFG_SABALU_20130915_TO09	SABALU-HARRISON	DFIP	2013/09/15 1035	1450.8 min	No
0000A0CE	AFG_SABALU_20130916_TO09	SABALU-HARRISON	DFIP	2013/09/16 1059	1423.2 min	No
0000A0YI	AFG_SABALU_20130917_TO09	SABALU-HARRISON	DFIP	2013/09/17 1044	1441.8 min	No
0000A1BD	AFG_SABALU_20130918_TO09	SABALU-HARRISON	DFIP	2013/09/18 1054	1442.4 min	No
0000A1SN	AFG_SABALU_20130919_TO09	SABALU-HARRISON	DFIP	2013/09/19 1101	1441.2 min	No
0000A1Z3	AFG_SABALU_20130920_TO09	SABALU-HARRISON	DFIP	2013/09/20 1111	1314.0 min	No
0000A1ZN	AFG_SABALU_20130921_TO09	SABALU-HARRISON	DFIP	2013/09/21 1127	1408.2 min	No
0000A22Y	AFG_SABALU_20130922_TO09	SABALU-HARRISON	DFIP	2013/09/22 1101	1427.4 min	No
0000A2CJ	AFG_SABALU_20130923_TO09	SABALU-HARRISON	DFIP	2013/09/23 1052	1440.6 min	No
0000A2KI	AFG_SABALU_20130924_TO09	SABALU-HARRISON	DFIP	2013/09/24 1059	1388.4 min	No
0000A2XV	AFG_SABALU_20130925_TO09	SABALU-HARRISON	DFIP	2013/09/25 1058	1430.4 min	No
0000A5C9	AFG_SABALU_20130926_TO09	SABALU-HARRISON	DFIP	2013/09/26 1050	1500.6 min	No
00009ZJO	AFG_SABALU_20130912_TO13_03	SABALU-HARRISON	DFIP	2013/09/12 1210	1432.2 min	No
00009ZR9	AFG_SABALU_20130913_TO13	SABALU-HARRISON	DFIP	2013/09/13 1210	1384.2 min	No
00009ZRM	AFG_SABALU_20130914_TO13	SABALU-HARRISON	DFIP	2013/09/14 1118	1383.6 min	No
00009ZW1	AFG_SABALU_20130915_TO13	SABALU-HARRISON	DFIP	2013/09/15 1030	1455.0 min	No
0000A0CG	AFG_SABALU_20130916_TO13	SABALU-HARRISON	DFIP	2013/09/16 1059	1428.0 min	No
0000A0YJ	AFG_SABALU_20130917_TO13	SABALU-HARRISON	DFIP	2013/09/17 1048	1438.2 min	No

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample
0000A1BE	AFG_SABALU_20130918_TO13	SABALU-HARRISON	DFIP	2013/09/18 1054	1442.4 min	No
0000A1SQ	AFG_SABALU_20130919_TO13	SABALU-HARRISON	DFIP	2013/09/19 1105	1438.8 min	No
0000A1Z2	AFG_SABALU_20130920_TO13	SABALU-HARRISON	DFIP	2013/09/20 1111	1314.0 min	No
0000A1ZP	AFG_SABALU_20130921_TO13	SABALU-HARRISON	DFIP	2013/09/21 1123	1411.8 min	No
0000A231	AFG_SABALU_20130922_TO13	SABALU-HARRISON	DFIP	2013/09/22 1101	1434.0 min	No
0000A2CK	AFG_SABALU_20130923_TO13	SABALU-HARRISON	DFIP	2013/09/23 1059	1436.4 min	No
0000A2KK	AFG_SABALU_20130924_TO13	SABALU-HARRISON	DFIP	2013/09/24 1059	1392.6 min	No
0000A2XW	AFG_SABALU_20130925_TO13	SABALU-HARRISON	DFIP	2013/09/25 1102	1426.2 min	No
0000A5CI	AFG_SABALU_20130926_TO13	SABALU-HARRISON	DFIP	2013/09/26 1055	1492.2 min	No

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 11 to Appendix B
Information Summary
Ambient Air Samples (TO-15)
BAF, Afghanistan (DFIP)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample	Canister Serial #
00009ZJT	AFG_SABALU_20130912_TO14	SABALU-HARRISON	DFIP	2013/09/12 1205	1435.0 minutes	No	1216 TO-15 Canister
00009ZR6	AFG_SABALU_20130913_TO14	SABALU-HARRISON	DFIP	2013/09/13 1200	1440.0 minutes	Yes, Sample Malfunction	5851 TO-15 Canister
00009ZRH	AFG_SABALU_20130914_TO14	SABALU-HARRISON	DFIP	2013/09/14 1124	1394.0 minutes	No	2692 TO-15 Canister
00009ZW0	AFG_SABALU_20130915_TO14	SABALU-HARRISON	DFIP	2013/09/15 1035	1035.0 minutes	No	5260 TO-15 Canister
0000A0CL	AFG_SABALU_20130916_TO14	SABALU-HARRISON	DFIP	2013/09/16 1043	1427.0 minutes	No	2687 TO-15 Canister
0000A0YH	AFG_SABALU_20130917_TO14	SABALU-HARRISON	DFIP	2013/09/17 1030	1440.0 minutes	No	2723 TO-15 Canister
0000A1BJ	AFG_SABALU_20130918_TO14	SABALU-HARRISON	DFIP	2013/09/18 1037	1440.0 minutes	No	1404 TO-15 Canister
0000A1SS	AFG_SABALU_20130919_TO14	SABALU-HARRISON	DFIP	2013/09/19 1042	1446.0 minutes	No	1271 TO-15 Canister
0000A1Z7	AFG_SABALU_20130920_TO14	SABALU-HARRISON	DFIP	2013/09/20 1052	1440.0 minutes	No	5834 TO-15 Canister
0000A1ZM	AFG_SABALU_20130921_TO14	SABALU-HARRISON	DFIP	2013/09/21 1057	1428.0 minutes	No	5844 TO-15 Canister
0000A235	AFG_SABALU_20130922_TO14	SABALU-HARRISON	DFIP	2013/09/22 1047	1421.0 minutes	No	5866 TO-15 Canister
0000A2CL	AFG_SABALU_20130923_TO14	SABALU-HARRISON	DFIP	2013/09/23 1045	1440.0 minutes	No	4742 TO-15 Canister
0000A2KM	AFG_SABALU_20130924_TO14	SABALU-HARRISON	DFIP	2013/09/24 1048	1440.0 minutes	No	2729 TO-15 Canister
0000A2XT	AFG_SABALU_20130925_TO14	SABALU-HARRISON	DFIP	2013/09/25 1053	1444.0 minutes	No	4748 TO-15 Canister
0000A56V	AFG_SABALU_20130926_TO14	SABALU-HARRISON	DFIP	2013/09/26 1100	1440.0 minutes	No	5259 TO-15 Canister

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Annex 12 to Appendix B
Information Summary
Ambient Air Samples ($PM_{2.5}$)
BAF, Afghanistan (DFIP)
12-26 September 2013

DOEHRS Sample ID	Field/Local Sample ID	Location	Sampling Point	Start Date/Time	Sample Time	Invalid Sample	Filter ID
00009ZJJ	AFG_SABALU_20130912_PM25_02	SABALU-HARRISON	DFIP	2013/09/12 1210	1440.0 minutes	No	47-12-2402
00009ZR7	AFG_SABALU_20130913_PM25DPS	SABALU-HARRISON	DFIP	2013/09/13 1225	1382.0 minutes	No	47-12-2406
00009ZRF	AFG_SABALU_20130914_PM25DPS	SABALU-HARRISON	DFIP	2013/09/14 1134	1390.0 minutes	No	47-12-2409
00009ZVX	AFG_SABALU_20130915_PM25DPS	SABALU-HARRISON	DFIP	2013/09/15 1049	1440.0 minutes	No	47-12-2412
0000A0CJ	AFG_SABALU_20130916_PM25DPS	SABALU-HARRISON	DFIP	2013/09/16 1054	1420.0 minutes	No	47-12-2415
0000A0YG	AFG_SABALU_20130917_PM25DPS	SABALU-HARRISON	DFIP	2013/09/17 1038	1440.0 minutes	No	47-12-2418
0000A1BH	AFG_SABALU_20130918_PM25DPS	SABALU-HARRISON	DFIP	2013/09/18 1047	1440.0 minutes	No	47-12-2421
0000A1RK	AFG_SABALU_20130919_PM25DPS	SABALU-HARRISON	DFIP	2013/09/19 1058	1440.0 minutes	No	47-12-2424
0000A1Z5	AFG_SABALU_20130920_PM25DPS	SABALU-HARRISON	DFIP	2013/09/20 1102	1440.0 minutes	No	47-12-2427
0000A1ZK	AFG_SABALU_20130921_PM25DPS	SABALU-HARRISON	DFIP	2013/09/21 1119	1412.0 minutes	No	47-12-2430
0000A22X	AFG_SABALU_20130922_PM25DPS	SABALU-HARRISON	DFIP	2013/09/22 1055	1440.0 minutes	No	47-12-2433
0000A2CI	AFG_SABALU_20130923_PM25DPS	SABALU-HARRISON	DFIP	2013/09/23 1126	1418.0 minutes	No	47-12-2436
0000A2KG	AFG_SABALU_20130924_PM25DPS	SABALU-HARRISON	DFIP	2013/09/24 1109	1440.0 minutes	No	47-12-2439
0000A2XQ	AFG_SABALU_20130925_PM25DPS	SABALU-HARRISON	DFIP	2013/09/25 1115	1430.0 minutes	No	47-12-2442
0000A578	AFG_SABALU_20130926_PM25DPS	SABALU-HARRISON	DFIP	2013/09/26 1111	1439.0 minutes	No	47-12-2445

Legend:
DOEHRS Sample ID = Defense Operational and Environmental Health Readiness System Identification Number

Appendix C

USAPHC AIPH
Screening Health Risk Assessment
Ambient Air Exposures
Bagram Airfield, Afghanistan
September 2013

Annex 1 to Appendix C
Table of Contents

Page

Figures

Annex 2 to Appendix C
Screening Health Risk Assessment
Ambient Air Exposures
Bagram Airfield, Afghanistan
September 2013

1 Summary

1.1 Purpose

This report is intended to document the results of ambient air sampling conducted at Bagram Airfield (BAF), Afghanistan by on-site military public health personnel in September 2013.

1.2 Scope

The ambient air sampling effort was intended to collect pollutants found in the ambient air at BAF per Army Medical Department Resource Tasking System Tasker 13226.01C, Air Quality Assessment of BAF, 13 August 2013. Open burning ceased as of 1 October 2013. Although burn pit emissions were no longer present, other air pollution sources including flight operations, vehicular emissions, generators, and off-site sources were present and likely contributing to the pollutant levels found during this sampling effort. The results of the ambient air sampling provide the foundation for a screening health risk assessment (HRA) for military personnel stationed at the base and potentially exposed to the pollutants. The ambient sampling relied upon for this report was performed 12 September 2013 through 26 September 2013.

2 References

See Annex 3 to Appendix C for a complete list of reference information.

3 Introduction and Background

3.1 Location

The BAF is located in the Parwan Province of northern Afghanistan approximately 11 kilometers (km) southwest of the city of Charikar, 47 km north of Kabul and is situated approximately 1,500 meters (m) above sea level. The airfield is approximately 38,000 acres in size and has an 11,820 foot runway serving as a hub for air freight and the movement of military personnel for eastern Afghanistan, and receives and stages larger freight transported overland from the Port of Karachi. The BAF has three large hangers, a control tower, and numerous support buildings.

3.2 Adjacent Land Use

The adjacent property is the city of Bagram, which has a population of over 75,000 people. Some of the more common industries in Bagram burn tire rubber, plastic waste and other combustibles as cheap energy sources (e.g., brick factories). Additionally, rationed power exacerbates the situation as it forces people to use more polluting fuel sources such as wood, coal and heating oil for cooking

and heating. Vehicle emissions are considered a major contributor to air pollution in the city of Bagram. Most of these vehicles are over 10 years old, and generally use substandard fuels (reference 1).

3.3 Climate

The climate is semi-arid with precipitation (snow and rain) concentrated in the winter months. Weather conditions can vary widely with temperature ranging from 21 to 33 degrees Celsius (°C) (70 to 91 degrees Fahrenheit [°F]) in the summer months, and -7 to 10°C (19 to 50°F). Strong winds (above 25 knots) can create intense dust storms, especially during the spring and summer. Spring in Bagram starts in late March and is the wettest time of year.

3.4 Sampling Effort

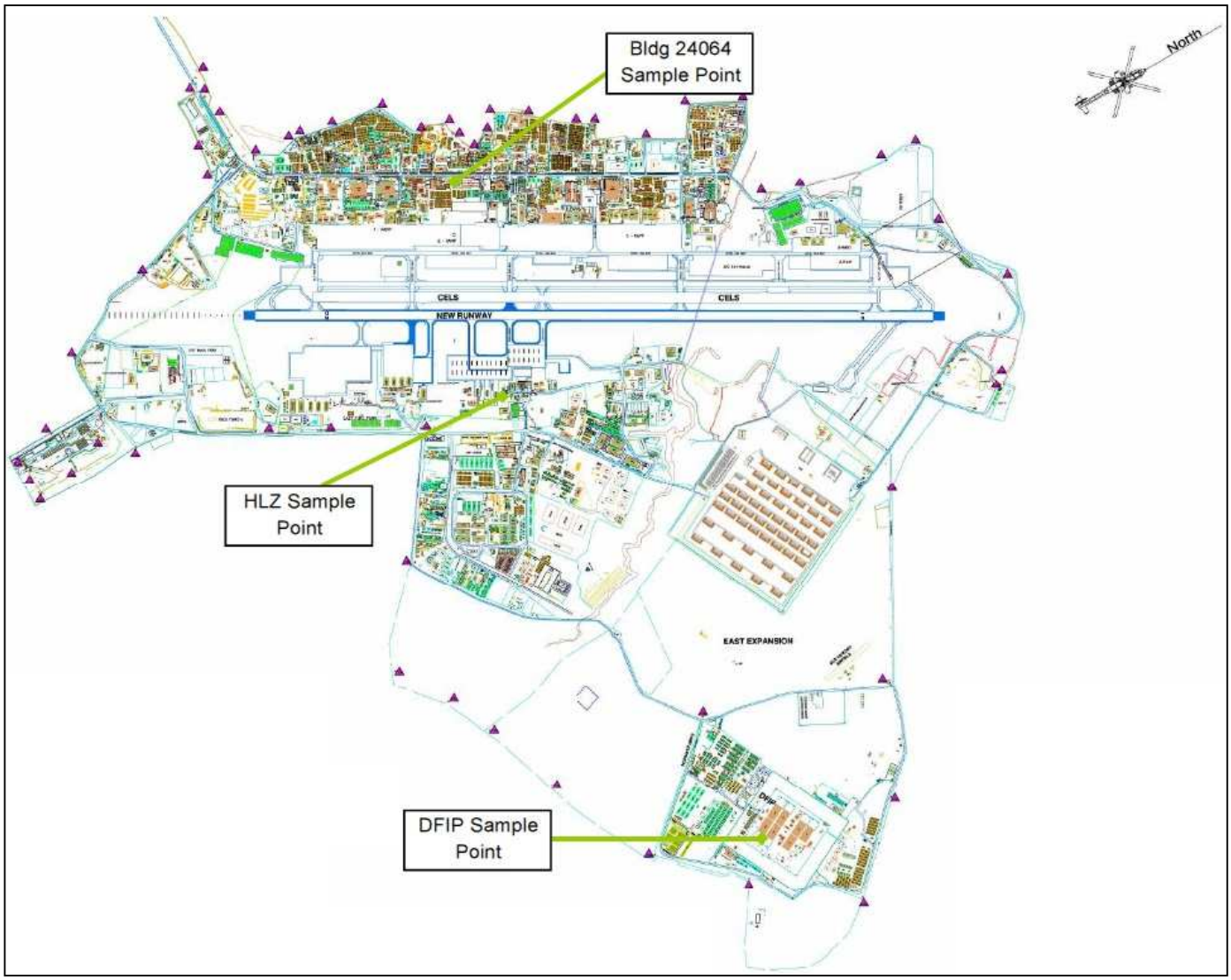
Ambient air samples were collected from three areas on BAF, Afghanistan from 12-26 September 2013. The three areas were chosen to represent the entire base camp population. The Building 24064 sample point is located along Disney Drive in a highly-trafficked area. It is near the Koele and Dragon dining facilities, the main PX, the Camp Montrond bazaar, and various housing and work sites. The Helicopter Landing Zone (HLZ) sampling site is on the southeastern side of the airfield runway between the Flightline 'Mike' Ramp and 'Echo' Ramp. Primary adjacent activities include avaiation operations, maintenance hangars, and housing. The third sample point was at the Detention Facility in Parwan (DFIP), which is located within Camp Sabalu-Harrison near the eastern perimeter of BAF. Housing, life support activities, detainee operations, and various operational activities are located in this area. The burn pit area was immediately to the east of the DFIP; burn pit operations ceased as of 1 July 2013 though 2 solid waste incinerators remained in operation.

Table 1 summarizes the data parameters collected during this period, and Figure 1 illustrates the relative locations of sites of interest at BAF.

Annex 2 to Appendix C Table 1. Summary of Data Parameters Collected

Sampling Methodology	Number of Analytes Per Sample	Sample Duration[1]	Total Number of Valid Samples	Sampling Equipment
$PM_{2.5}$[3] (with 10 Metals)	1 (plus 10 metals)	24 hrs	41	SKC Inc. DPS[2]
Toxic Organic (TO)-9 Halogenated Dioxins and Furans	17	24 hrs	45	Hi-Volume PS-1
TO-13 Polycyclic Aromatic Hydrocarbons (PAHs) and Semivolatile Organic Compounds (SVOCs)	74	24 hrs	45	Hi-Volume PS-1
TO-15 Volatile Organic Compounds (VOCs)	81	24 hrs	44	6 liter (L) Stainless Summa Canister

Notes:
[1]=Per the U.S. Environmental Protection Agency (EPA) sampling methodology.
[2]=DPS – Deployable Particulate Sampler
[3]=$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 micrometers (1 micrometer = $1x10^{-6}$ meters) and less.
[4]=N/A-Not Applicable.



Annex 2 to Appendix C Figure 1. Diagram of Bagram Airfield Sites of Interest

4 Screening Health Risk Assessment Introduction

The potential for a health threat from exposures at a site can be estimated through the use of screening health risk assessment techniques. A quantitative screening HRA was performed in addition to the composite risk estimate. This provides another source of information and can address the potential for additive long-term health effects that would not be considered fully in a composite risk estimate. These techniques estimate chemical exposures from anticipated use of a site, and if long-term health effects might be anticipated from the degree of exposure. These estimates are useful to support the need for any preventive/remedial actions if the degree of exposure indicates that health needs to be protected. The techniques and calculations include conservative assumptions and safety factors so the level of risk is thought to be protective of even

the most sensitive population for long-term exposures. When this level is exceeded, it does not mean a health effect will occur, but the higher above this level the exposure is, the more likely a health effect may occur.

This report presents a quantitative screening HRA performed for evaluating the potential for health implications to on-site military personnel at BAF in Afghanistan from exposure to ambient air at the site. The screening HRA is limited to these receptors because they represent a range of exposed individuals based on their duration of assignment at BAF. This quantitative approach provides an understanding of the potential health threats and any need for remediation or protective actions to prevent the potential health threats that may be posed by being stationed at the site d for specific durations of deployment.

This quantitative screening HRA follows the same methods used for conducting a quantitative screening risk assessment as outlined by the EPA (reference 2).

The following three points about a screening HRA should be emphasized:

- First, an estimate of carcinogenic risk or noncarcinogenic hazard index is dependent upon the assumptions and numerical values used in the risk characterization, toxicity evaluation, and exposure assessment components. Risk assessment estimates should not be taken as absolute measure of an individual's probability of an adverse health effect. Rather, the estimates should be viewed as a threshold of concern only for the receptor populations. Since most exposure parameters incorporate methods designed to yield a high-end estimate plus some degree of safety factor, the estimate of risk usually represents an overestimate of risk for the general population.

- Second, these estimates do not indicate that an adverse outcome will occur; they only indicate the likelihood or probability that such outcomes might occur under very specific exposure conditions. However, the flexibility to adjust exposure assumptions and values allows risk managers to analyze a number of different exposure conditions and reach a more informed decision than if a risk assessment was not conducted.

- Third, a screening HRA is only one of several tools that can provide useful information for risk management decisions. The results are not the final solution. When all uncertainties associated with the assumptions and exposure values are identified; however, a screening HRA can assist policy developers and risk managers in reaching a more informed risk management decision.

5 Screening Health Risk Assessment Methodology and Organization of Document

The methodology employed for the quantitative screening risk assessment follows EPA guidance. Four steps in the screening risk assessment process are outlined below. These steps are discussed in more detail in Sections 6 through 9.

5.1 Selection of Chemicals of Concern (Section 6)

This section summarizes how samples were evaluated and discusses the reasons for eliminating chemicals from further evaluation in the screening risk assessment.

5.2 Exposure Assessment (Section 7)

For human exposure to occur, a pathway must be complete. This includes: (1) a source, a transport medium (e.g., air); (2) an exposure point (e.g., location); (3) and an exposure route (e.g., inhalation). This section includes derivation and presentation of the exposures expected at the site and used in the human HRA. Examples of scenarios which may be active on this site include personnel present at the site for 9 months and 6 months. Chemical intake values are calculated based on exposure pathways, specific exposure values, and assumptions. Equations used to calculate intakes for all applicable exposure pathways are presented in this section.

5.3 Toxicity Assessment (Section 8)

This section presents the toxicity values used in the human health risk calculations. Reference to the appropriate data sources, such as the Integrated Risk Information System (reference 3), is provided to support the toxicity values.

5.4 Risk Characterization (Section 9)

This section presents the risk calculations for all complete human health exposure pathways. Noncarcinogenic and carcinogenic risk estimates are summarized for each receptor and exposure pathway. In all scenarios, the calculated risk values apply to a hypothetical individual on the site and represents an upper-bound (reasonable maximum) risk estimate. Thus, the calculated risk is not directly applicable to actual individuals working on the site. All of the exposure assumptions have been chosen to protect the reasonable maximally exposed individual. This provides a conservative estimate of risk, which tends to overestimate the maximum risk to any actual individual.

6 Selection of Chemicals of Potential Concern

For this study, a sampling scheme was developed which involved sampling ambient air at BAF. Ambient air samples were collected via EPA methodology guidance and using Hi-Volume PS-1 Samplers, SKC Inc. DPS, and Summa Canisters. Air samples were analyzed for dioxins and furans using the EPA-approved TO-9A Method (reference 4); PAHs using the EPA-approved TO-13A Method (reference 5); VOCs using the EPA-approved TO-15A Method (reference 6); and metals and particulate matter with an aerodynamic diameter of 2.5 micrometers and less ($PM_{2.5}$) using the EPA-approved 200.8 and I03.1 methods, respectively (reference 7).

Some of the samples had analytes detected at or above the statistically determined method detection limit (MDL) but below the validated/verified quantitation limit (which is most appropriately not below the low standard in the calibration curve) and were noted with a J-qualifier in the lab reports. In these cases, the lab is confident the analyte is present (99 percent confidence the compound is present if standard MDL-determination procedures are followed). However, there is uncertainty in the reported value. So a J-flag could be interpreted as meaning "the analyte is there, at some concentration below the quantitation limit and above the MDL, but the actual numerical concentration generated by the instrument can only be considered an estimate because testing another aliquot of the sample could produce a different value in that same range." According to EPA guidance (reference 2), despite the imprecision of these values the J-qualified concentrations were used in the same manner as data without this qualifier were used. The uncertainties associated with J-qualified data are discussed further in Section 10.1.3.

A large variety of these commonly detected analytes were found in one or more samples. Per the standard EPA risk assessment practice (reference 2), compounds with a frequency of detection of less than 5 percent were eliminated from further consideration. Annex 2 to Appendix C Table 2 summarizes the analyzed chemicals, their frequency of detection and whether they were further evaluated.

A complete list of the COPCs retained for the quantitative screening risk assessment is shown in Annex 2 to Appendix C Table 3. Chemicals listed in the table as a carcinogen have been designated by EPA as at least standard EPA classification Group C (possible carcinogens based on some evidence in animals). The designations for degree of evidence are provided in the toxicity section. These chemicals were assessed as part of the cancer risk assessment unless cancer toxicity values were unavailable. Some of these carcinogen chemicals may also have noncarcinogenic effects and toxicity values and they were assessed as part of the noncancer risk assessment. Chemicals listed in the table as a noncarcinogen show no evidence for carcinogenicity and were only assessed as part of the noncancer risk assessment. The carcinogenic classification of some chemicals may be unknown due to lack of enough evidence for the designation of a cancer classification. These chemicals were not assessed as part of the cancer risk assessment, although if they have noncarcinogenic effects and toxicity values they were assessed as part of the noncancer risk assessment.

Annex 2 to Appendix C Table 2. COPCs Frequency of Detection

Chemical	Sampling Methodology	Number of Samples	Detection Frequency	Notes
1,2,3,4,6,7,8-HeptaCDD	TO-9A	45	42.22%	Evaluated as a COPC
1,2,3,4,6,7,8-HeptaCDF	TO-9A	45	80.00%	Evaluated as a COPC
1,2,3,4,7,8,9-HeptaCDF	TO-9A	45	11.11%	Evaluated as a COPC
1,2,3,4,7,8-HexaCDD	TO-9A	45	0.00%	Not evaluated further [b]
1,2,3,4,7,8-HexaCDF	TO-9A	45	77.78%	Evaluated as a COPC
1,2,3,6,7,8-HexaCDD	TO-9A	45	2.22%	Not evaluated further [b]
1,2,3,6,7,8-HexaCDF	TO-9A	45	77.78%	Evaluated as a COPC
1,2,3,7,8,9-HexaCDD	TO-9A	45	6.67%	Evaluated as a COPC
1,2,3,7,8,9-HexaCDF	TO-9A	45	15.56%	Evaluated as a COPC
1,2,3,7,8-PentaCDD	TO-9A	45	15.56%	Evaluated as a COPC
1,2,3,7,8-PentaCDF	TO-9A	45	77.78%	Evaluated as a COPC
2,3,4,6,7,8-HexaCDF	TO-9A	45	68.89%	Evaluated as a COPC
2,3,4,7,8-PentaCDF	TO-9A	45	77.78%	Evaluated as a COPC
2,3,7,8-TetraCDD	TO-9A	45	57.78%	Evaluated as a COPC
2,3,7,8-TetraCDF	TO-9A	45	82.22%	Evaluated as a COPC
OctaCDD	TO-9A	45	22.22%	Evaluated as a COPC
OctaCDF	TO-9A	45	11.11%	Evaluated as a COPC
Particulate	PM-2.5	41	100.0%	Not evaluated further [a]
1,2,4-Trichlorobenzene	TO-13A	45	0.00%	Not evaluated further [b]
1,2-Dichlorobenzene	TO-13A	45	0.00%	Not evaluated further [b]
1,2-Diphenylhydrazine	TO-13A	45	0.00%	Not evaluated further [b]
1,3-Dichlorobenzene	TO-13A	45	0.00%	Not evaluated further [b]
1,4-Dichlorobenzene	TO-13A	45	0.00%	Not evaluated further [b]

Annex 2 to Appendix C Table 2. COPCs Frequency of Detection (continued)

Chemical	Sampling Methodology	Number of Samples	Detection Frequency	Notes
2,4,5-Trichlorophenol	TO-13A	45	0.00%	Not evaluated further [b]
2,4,6-Trichlorophenol	TO-13A	45	0.00%	Not evaluated further [b]
2,4-Dichlorophenol	TO-13A	45	0.00%	Not evaluated further [b]
2,4-Dimethylphenol	TO-13A	45	0.00%	Not evaluated further [b]
2,4-Dinitrophenol	TO-13A	45	0.00%	Not evaluated further [b]
2,4-Dinitrotoluene	TO-13A	45	0.00%	Not evaluated further [b]
2,6-Dinitrotoluene	TO-13A	45	2.22%	Not evaluated further [b]
2-Chloronaphthalene	TO-13A	45	0.00%	Not evaluated further [b]
2-Chlorophenol	TO-13A	45	0.00%	Not evaluated further [b]
2-Methyl-4,6-dinitrophenol	TO-13A	45	0.00%	Not evaluated further [b]
2-Methylnaphthalene	TO-13A	45	95.56%	Evaluated as a COPC
2-Methylphenol (o-Cresol)	TO-13A	45	77.78%	Evaluated as a COPC
2-Nitroaniline	TO-13A	45	0.00%	Not evaluated further [b]
2-Nitrophenol	TO-13A	45	75.56%	Evaluated as a COPC
3,3'-Dichlorobenzidine	TO-13A	45	0.00%	Not evaluated further [b]
3-Nitroaniline	TO-13A	45	0.00%	Not evaluated further [b]
4-Chloro-3-methylphenol	TO-13A	45	0.00%	Not evaluated further [b]
4-Chloroaniline	TO-13A	45	0.00%	Not evaluated further [b]
4-Nitroaniline	TO-13A	45	0.00%	Not evaluated further [b]
4-Nitrophenol	TO-13A	45	4.44%	Not evaluated further [b]
Acenaphthene	TO-13A	45	8.89%	Evaluated as a COPC
Acenaphthylene	TO-13A	45	77.78%	Evaluated as a COPC
Acetophenone	TO-13A	45	100.00%	Evaluated as a COPC
Aniline	TO-13A	45	0.00%	Not evaluated further [b]
Anthracene	TO-13A	45	0.00%	Not evaluated further [b]
Benzidine	TO-13A	45	0.00%	Not evaluated further [b]
Benzoic acid	TO-13A	45	97.78%	Evaluated as a COPC
Benzo[a]pyrene	TO-13A	45	0.00%	Not evaluated further [b]
Benzo[b]fluoranthene	TO-13A	45	55.56%	Evaluated as a COPC
Benzo[g,h,i]perylene	TO-13A	45	57.78%	Evaluated as a COPC
Benzo[k]fluoranthene	TO-13A	45	0.00%	Not evaluated further [b]
Benzyl alcohol	TO-13A	45	51.11%	Evaluated as a COPC
Benz[a]anthracene	TO-13A	45	35.56%	Evaluated as a COPC
Bis(2-chloroethoxy)methane	TO-13A	45	0.00%	Not evaluated further [b]
Bis(2-chloroethyl)ether	TO-13A	45	0.00%	Not evaluated further [b]
Bis(2-chloroisopropyl) ether	TO-13A	45	0.00%	Not evaluated further [b]
Butylbenzylphthalate	TO-13A	45	0.00%	Not evaluated further [b]
Carbazole	TO-13A	45	0.00%	Not evaluated further [b]
Chrysene	TO-13A	45	48.89%	Evaluated as a COPC
Di(2-ethylhexyl)phthalate	TO-13A	45	22.22%	Evaluated as a COPC
Di-n-butylphthalate	TO-13A	45	100.00%	Evaluated as a COPC
Di-n-octylphthalate	TO-13A	45	2.22%	Not evaluated further [b]
Dibenzofuran	TO-13A	45	82.22%	Evaluated as a COPC
Dibenz[a,h]anthracene	TO-13A	45	0.00%	Not evaluated further [b]
Diethylphthalate	TO-13A	45	60.00%	Evaluated as a COPC

Annex 2 to Appendix C Table 2. COPCs Frequency of Detection (continued)

Chemical	Sampling Methodology	Number of Samples	Detection Frequency	Notes
Dimethylphthalate	TO-13A	45	37.78%	Evaluated as a COPC
Fluoranthene	TO-13A	45	82.22%	Evaluated as a COPC
Fluorene	TO-13A	45	77.78%	Evaluated as a COPC
Hexachlorobenzene	TO-13A	45	0.00%	Not evaluated further [b]
Hexachlorobutadiene	TO-13A	45	0.00%	Not evaluated further [b]
Hexachlorocyclopentadiene	TO-13A	45	0.00%	Not evaluated further [b]
Hexachloroethane	TO-13A	45	0.00%	Not evaluated further [b]
Indeno[1,2,3-cd]pyrene	TO-13A	45	55.56%	Evaluated as a COPC
Isophorone	TO-13A	45	0.00%	Not evaluated further [b]
m,p-Methylphenol (m,p-Cresol)	TO-13A	45	88.89%	Evaluated as a COPC
N-Nitrosodimethylamine	TO-13A	45	0.00%	Not evaluated further [b]
N-Nitrosodiphenylamine	TO-13A	45	0.00%	Not evaluated further [b]
N-Nitrosodipropylamine	TO-13A	45	0.00%	Not evaluated further [b]
Naphthalene	TO-13A	45	95.56%	Evaluated as a COPC
Nitrobenzene	TO-13A	45	0.00%	Not evaluated further [b]
p-Bromophenyl phenyl ether	TO-13A	45	0.00%	Not evaluated further [b]
p-Chlorophenyl phenyl ether	TO-13A	45	0.00%	Not evaluated further [b]
Pentachlorobenzene	TO-13A	45	0.00%	Not evaluated further [b]
Pentachloronitrobenzene	TO-13A	45	0.00%	Not evaluated further [b]
Pentachlorophenol	TO-13A	45	0.00%	Not evaluated further [b]
Phenanthrene	TO-13A	45	100.00%	Evaluated as a COPC
Phenol	TO-13A	45	97.78%	Evaluated as a COPC
Pyrene	TO-13A	45	66.67%	Evaluated as a COPC
Pyridine	TO-13A	45	0.00%	Not evaluated further [b]
1,1,1,2-Tetrachloroethane	TO-15A	44	0.00%	Not evaluated further [b]
1,1,1-Trichloroethane	TO-15A	44	0.00%	Not evaluated further [b]
1,1,2,2-Tetrachloroethane	TO-15A	44	0.00%	Not evaluated further [b]
1,1,2-Trichloroethane	TO-15A	44	0.00%	Not evaluated further [b]
1,1-Dichloroethane	TO-15A	44	0.00%	Not evaluated further [b]
1,1-Dichloroethene	TO-15A	44	0.00%	Not evaluated further [b]
1,2,3-Trichloropropane	TO-15A	44	0.00%	Not evaluated further [b]
1,2,4-Trichlorobenzene	TO-15A	44	0.00%	Not evaluated further [b]
1,2,4-Trimethylbenzene	TO-15A	44	9.09%	Evaluated as a COPC
1,2-Dibromoethane	TO-15A	44	0.00%	Not evaluated further [b]
1,2-Dichlorobenzene	TO-15A	44	0.00%	Not evaluated further [b]
1,2-Dichloroethane	TO-15A	44	0.00%	Not evaluated further [b]
1,2-Dichloropropane	TO-15A	44	0.00%	Not evaluated further [b]
1,3,5-Trimethylbenzene	TO-15A	44	0.00%	Not evaluated further [b]
1,3-Dichlorobenzene	TO-15A	44	0.00%	Not evaluated further [b]
1,4 Dioxane	TO-15A	44	0.00%	Not evaluated further [b]
1,4-Dichlorobenzene	TO-15A	44	0.00%	Not evaluated further [b]
2-Butanone (MEK)	TO-15A	44	100.00%	Evaluated as a COPC
2-Hexanone	TO-15A	44	0.00%	Not evaluated further [b]
4-Ethyltoluene	TO-15A	44	0.00%	Not evaluated further [b]
4-Methyl-2-pentanone (MIBK)	TO-15A	44	0.00%	Not evaluated further [b]

Annex 2 to Appendix C Table 2. COPCs Frequency of Detection (continued)

Chemical	Sampling Methodology	Number of Samples	Detection Frequency	Notes
Acetone	TO-15A	44	100.00%	Evaluated as a COPC
Acetonitrile	TO-15A	44	50.00%	Evaluated as a COPC
Acrolein	TO-15A	44	84.09%	Evaluated as a COPC
Acrylonitrile	TO-15A	44	2.27%	Not evaluated further [b]
Allyl chloride	TO-15A	44	0.00%	Not evaluated further [b]
alpha-Methylstyrene	TO-15A	44	2.27%	Not evaluated further [b]
Benzene	TO-15A	44	100.00%	Evaluated as a COPC
Benzyl chloride	TO-15A	44	0.00%	Not evaluated further [b]
Bromobenzene	TO-15A	44	0.00%	Not evaluated further [b]
Bromodichloromethane	TO-15A	44	0.00%	Not evaluated further [b]
Bromoform	TO-15A	44	0.00%	Not evaluated further [b]
Bromomethane	TO-15A	44	0.00%	Not evaluated further [b]
Butadiene	TO-15A	44	0.00%	Not evaluated further [b]
Carbon disulfide	TO-15A	44	0.00%	Not evaluated further [b]
Carbon tetrachloride	TO-15A	44	0.00%	Not evaluated further [b]
Chlorobenzene	TO-15A	44	0.00%	Not evaluated further [b]
Chlorodifluoromethane	TO-15A	44	86.36%	Evaluated as a COPC
Chloroethane	TO-15A	44	0.00%	Not evaluated further [b]
Chloroform	TO-15A	44	0.00%	Not evaluated further [b]
Chloromethane	TO-15A	44	100.00%	Evaluated as a COPC
cis-1,2-Dichloroethene	TO-15A	44	0.00%	Not evaluated further [b]
cis-1,3-Dichloropropene	TO-15A	44	0.00%	Not evaluated further [b]
Cyclohexane	TO-15A	44	50.00%	Evaluated as a COPC
Dibromochloromethane	TO-15A	44	0.00%	Not evaluated further [b]
Dibromomethane	TO-15A	44	0.00%	Not evaluated further [b]
Dichlorodifluoromethane	TO-15A	44	100.00%	Evaluated as a COPC
Dichlorofluoromethane	TO-15A	44	0.00%	Not evaluated further [b]
Dichlorotetrafluoroethane	TO-15A	44	0.00%	Not evaluated further [b]
Ethyl acetate	TO-15A	44	15.91%	Evaluated as a COPC
Ethyl acrylate	TO-15A	44	0.00%	Not evaluated further [b]
Ethyl methacrylate	TO-15A	44	0.00%	Not evaluated further [b]
Ethylbenzene	TO-15A	44	22.73%	Evaluated as a COPC
Hexachlorobutadiene	TO-15A	44	0.00%	Not evaluated further [b]
Hexachloroethane	TO-15A	44	0.00%	Not evaluated further [b]
Hexane	TO-15A	44	97.73%	Evaluated as a COPC
Isooctane	TO-15A	44	13.64%	Evaluated as a COPC
Isopropyl alcohol	TO-15A	44	84.09%	Evaluated as a COPC
Isopropylbenzene	TO-15A	44	0.00%	Not evaluated further [b]
m,p-Xylene	TO-15A	44	68.18%	Evaluated as a COPC
Methyl acrylate	TO-15A	44	11.36%	Evaluated as a COPC
Methyl iodide	TO-15A	44	0.00%	Not evaluated further [b]
Methyl methacrylate	TO-15A	44	0.00%	Not evaluated further [b]
Methyl tert-butyl ether (MtBE)	TO-15A	44	0.00%	Not evaluated further [b]
Methylene chloride	TO-15A	44	100.00%	Evaluated as a COPC

Annex 2 to Appendix C Table 2. COPCs Frequency of Detection (continued)

Chemical	Sampling Methodology	Number of Samples	Detection Frequency	Notes
n-Heptane	TO-15A	44	70.45%	Evaluated as a COPC
o-Xylene	TO-15A	44	25.00%	Evaluated as a COPC
Octane	TO-15A	44	93.18%	Evaluated as a COPC
Propylene	TO-15A	44	90.91%	Evaluated as a COPC
Styrene	TO-15A	44	18.18%	Evaluated as a COPC
tert-Butyl alcohol	TO-15A	44	11.36%	Evaluated as a COPC
Tetrachloroethene (PCE)	TO-15A	44	0.00%	Not evaluated further [b]
Tetrahydrofuran	TO-15A	44	9.09%	Evaluated as a COPC
Toluene	TO-15A	44	97.73%	Evaluated as a COPC
trans-1,2-Dichloroethene	TO-15A	44	4.55%	Not evaluated further [b]
trans-1,3-Dichloropropene	TO-15A	44	0.00%	Not evaluated further [b]
Trichloroethene (TCE)	TO-15A	44	9.09%	Evaluated as a COPC
Trichlorofluoromethane	TO-15A	44	18.18%	Evaluated as a COPC
Trichlorotrifluoroethane	TO-15A	44	0.00%	Not evaluated further [b]
Vinyl acetate	TO-15A	44	38.64%	Evaluated as a COPC
Vinyl chloride	TO-15A	44	0.00%	Not evaluated further [b]
Antimony	PM-2.5	41	2.38%	Not evaluated further [b]
Arsenic	PM-2.5	41	0.00%	Not evaluated further [b]
Beryllium	PM-2.5	41	0.00%	Not evaluated further [b]
Cadmium	PM-2.5	41	0.00%	Not evaluated further [b]
Chromium	PM-2.5	41	0.00%	Not evaluated further [b]
Lead	PM-2.5	41	28.57%	Evaluated as a COPC
Manganese	PM-2.5	41	0.00%	Not evaluated further [b]
Nickel	PM-2.5	41	0.00%	Not evaluated further [b]
Vanadium	PM-2.5	41	0.00%	Not evaluated further [b]
Zinc	PM-2.5	41	2.38%	Not evaluated further [b]

Notes:
[a]=Not evaluated here further due to a lack of available toxicity data for an HRA. However, this analyte is being evaluated in a separate effort.
[b]=Not evaluated further due to a detection frequency of less than 5 percent.

Annex 2 to Appendix C Table 3. COPCs Retained for the Quantitative Screening Risk Assessment

Chemical	Carcinogen or Noncarcinogen
1,2,3,4,6,7,8-HPCDD	Carcinogen
1,2,3,4,6,7,8-HPCDF	Carcinogen
1,2,3,4,7,8,9-HPCDF	Carcinogen
1,2,3,4,7,8-HXCDD	Carcinogen
1,2,3,4,7,8-HXCDF	Carcinogen
1,2,3,6,7,8-HXCDD	Carcinogen
1,2,3,6,7,8-HXCDF	Carcinogen
1,2,3,7,8,9-HXCDD	Carcinogen
1,2,3,7,8,9-HXCDF	Carcinogen
1,2,3,7,8-PECDD	Carcinogen
1,2,3,7,8-PECDF	Carcinogen

Annex 2 to Appendix C Table 3. COPCs Retained for the Quantitative Screening Risk Assessment (continued)

Chemical	Carcinogen or Noncarcinogen
2,3,4,6,7,8-HXCDF	Carcinogen
2,3,4,7,8-PECDF	Carcinogen
2,3,7,8-TCDD	Carcinogen
2,3,7,8-TCDF	Carcinogen
OCDD	Carcinogen
OCDF	Carcinogen
1,2,4-Trimethylbenzene	Unknown
2,6-Dinitrotoluene	Carcinogen
2-Butanone (MEK)	Unknown
2-Methylnaphthalene	Unknown
2-Methylphenol (o-Cresol)	Carcinogen
2-Nitrophenol	Unknown
4-Nitrophenol	Unknown
Acenaphthene	Unknown
Acenaphthylene	Non-carcinogen
Acetone	Unknown
Acetonitrile	Unknown
Acetophenone	Non-carcinogen
Acrolein	Unknown
Acrylonitrile	Carcinogen
alpha-Methylstyrene	Unknown
Antimony	Unknown
Benzo(a)anthracene	Carcinogen
Benzene	Carcinogen
Benzo(b)fluoroanthene	Carcinogen
Benzo(g,h,i)perylene	Non-carcinogen
Benzoic acid	Non-carcinogen
Benzyl alcohol	Unknown
Chlorodifluoromethane	Unknown
Chloromethane	Non-carcinogen
Chrysene	Carcinogen
Cyclohexane	Unknown
Di(2-ethylhexyl)phthalate	Carcinogen
Dibenzofuran	Non-carcinogen
Dichlorodifluoromethane	Unknown
Diethylphthalate	Non-carcinogen
Dimethylphthalate	Non-carcinogen
Di-n-butylphthalate	Non-carcinogen
Di-n-octylphthalate	Non-carcinogen
Ethyl acetate	Unknown
Ethylbenzene	Non-carcinogen
Fluoranthene	Non-carcinogen
Fluorene	Non-carcinogen
Hexane	Unknown
Indeno(1,2,3-cd)pyrene	Carcinogen

Annex 2 to Appendix C Table 3. COPCs Retained for the Quantitative Screening Risk Assessment (continued)

Chemical	Carcinogen or Noncarcinogen
Isooctane	Unknown
Isopropyl alcohol	Unknown
Lead	Carcinogen
m,p-Methylphenol (m,p-Cresol)	Carcinogen
m,p-Xylene	Unknown
Methyl acrylate	Non-carcinogen
Methylene Chloride	Carcinogen
Naphthalene	Carcinogen
n-Heptane	Non-carcinogen
Octane	Unknown
o-Xylene	Unknown
Phenanthrene	Non-carcinogen
Phenol	Non-carcinogen
PM2.5	Unknown
Propylene	Non-carcinogen
Pyrene	Non-carcinogen
Styrene	Non-carcinogen
tert-Butyl alcohol	Unknown
Tetrahydrofuran	Unknown
Toluene	Non-carcinogen
trans-1,2-Dichloroethene	Unknown
Trichloroethene (TCE)	Carcinogen
Trichlorofluoromethane	Unknown
Vinyl acetate	Unknown
Zinc	Unknown

7 Exposure Assessment

7.1 Overview and Characterization of Exposure Setting

The objective of the exposure assessment is to estimate the type and magnitude of exposures to the COPCs that are present at the site. This component of the screening risk assessment can be performed either qualitatively or quantitatively. Quantitative assessment is preferred when toxicity factors necessary to characterize a COPC are available. The exposure assessment consists of three steps (reference 2):

7.1.1 Characterize the Exposure Setting.

This step contains general information concerning the physical characteristics of the site as it pertains to potential considerations affecting exposure. The physical setting involves climate and vegetation. All potentially exposed populations and subpopulations therein (receptors) are assessed relative to their potential for exposure. This step is a qualitative one aimed at providing a general site perspective and offering insight on the surrounding population.

7.1.2 Identify Exposure Pathways

All exposure pathways (that is, ways in which receptors can be exposed to site chemicals) are reviewed in this step. Exposure points of human contact and exposure routes are discussed before quantifying the exposure pathways in the next step.

7.1.3 Quantify Exposure

In this final step, the receptor intakes are calculated for each exposure pathway and receptor. These calculations follow EPA guidance for assumptions of intake variables and exposure factors (reference 8) and EPA-recommended calculation methods (reference 2).

7.2 Land Use and Potentially Exposed Populations

7.2.1 Land Use

The current land use at the site consists of several military deployment activities. The primary concern for this screening HRA is the combination of activities such as vehicle exhaust, generator exhaust, and other combustion sources now that disposal of solid wastes at the site via burning in open burn pits has ceased.

7.2.2 Potentially Exposed Populations

Two primary groups of receptors were present at BAF in September 2013, each with different potential exposure durations. Therefore, for the purposes of this screening risk assessment, two potentially exposed hypothetical populations were considered. These populations include personnel present at BAF for 6 months and personnel present at Bagram Airfield for 9 months. Each of these potentially exposed populations was conservatively assumed to have exposure to ambient air chemicals at “reasonable maximal” levels at the site for a duration of 24-hours per day for the duration of their deployment. Other factors defining the exposure of an individual follow the current default values as recommended by the EPA (reference 8).

7.3 Identification of Exposure Pathways

7.3.1 Exposure Estimates

Exposures are estimated only for plausible completed exposure pathways. A complete exposure pathway is comprised of the following main elements: a source and mechanism for chemical release, an environmental transport medium (exposure point), and a feasible route of exposure to a human receptor. In order for there to be a need for a risk evaluation, an exposure pathway must be potentially complete.

An exposure route is the way in which a COPC potentially comes in contact with a receptor. Generally, exposure routes include inhalation, ingestion, and dermal contact. The exposure pathway evaluated in this assessment is the inhalation of ambient air for the receptor populations of personnel deployed for one month, four months, and one year. This assessment considers only the inhalation route since the primary concern in this case is inhalation of ambient air at BAF. The sampling plan was designed to address that concern. Ingestion and dermal pathways are potentially complete exposure routes at Bagram Airfield. However, these were considered to be of lesser concern so soil sampling was not included in the sampling plan.

7.3.2 Quantification of Exposure

In this section, each receptor's potential exposures to the COPCs are quantified for the exposure pathway. In each case, the exposures are calculated following methods recommended in EPA guidance documents, such as the Risk Assessment Guidance for Superfund (reference 2). These calculations generally involve two steps. First, representative chemical concentrations in the environment, or exposure point concentrations (EPCs), are determined for each pathway and receptor. From these EPC values, the amount of chemical, which an exposed person may take into his/her body, is then calculated. This value is referred to as the human intake. This section describes the exposure scenarios, exposure assumptions, and exposure calculation methods used in this screening risk assessment.

The EPCs were calculated from the raw sampling data (found in Appendix B) using ProUCL software. This program evaluates the distribution, and then provides several estimates of a conservative mean of the data set, as well as a recommendation for selection. For this study, the value recommended by ProUCL was used as the EPC. By EPA methodology, non-detected values are listed as one half the reporting limit for the calculations. In some instances, the statistical test performed by ProUCL determined a 95^{th} percent upper confidence limit (UCL), which exceeded the maximum detected sample for a given compound. In such cases, the maximum detection was used in order to ensure that EPCs remained within the minimum and maximum levels detected during sampling. To account for site-specific exposures within the base, several sets of EPCs were calculated including the overall base, Building 24064, the HLZ, and the DFIP.

Toxicity criteria for all of the various PCDDs and PCDFs are not currently available. However, toxicity criteria are available for 2,3,7,8-TCDD. In order to assess carcinogenic risks associated with exposure to all PCDDs and PCDFs, toxicity equivalency factors (TEFs) published by the World Health Organization (WHO) were applied to their sampled air concentrations. (See Annex 2 to Appendix C Table 4 below for a list of the TEF values, which were used to adjust PCDD and PCDF congener concentrations.) Sampled air concentrations for each PCDD and PDCF were multiplied by the congener-specific TEF provided by the WHO (Van den Berg et al., reference 9). These adjusted air concentrations were then summed into a single concentration that represented the 2,3,7,8-TCDD exposure concentration for that sample. The TCDD equivalent concentrations (TEQ) for each sample were then used to represent dioxins and furans for the EPC calculation as above to determine inhalation exposure. This was combined with the 2,3,7,8-TCDD cancer slope factor (CSF) to produce a TEQ risk estimate.

Annex 2 to Appendic C Table 4. Toxicity Equivalency Factors for PCDDs and PCDFs

PCDD/PCDF Congener	CAS Number	TEF
2,3,7,8-Tetrachlorodibenzo(p)dioxin	1746-01-6	1
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	1
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	0.1
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	57653-85-7	0.1
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	0.1
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzo(p)dioxin	3268-87-9	0.0003
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	0.1
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	0.03
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	0.3
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	0.1
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	0.1
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	0.1
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	0.1
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	39001-02-0	0.0003

Annex 2 to Appendix C Table 5 lists the compounds carried through the screening risk assessment along with their respective EPCs for each area evaluated. (Full sampling data used to determine the EPCs in Annex 2 to Appendix C Table 5 can be found in Annex 4 to Appendix C.)

Annex 2 to Appendic C Table 5. Exposure Point Concentrations

Compound	Exposure Point Concentrations (mg/m^3)			
	All Samples	Building 24064	HLZ	DFIP
1,2,4-Trimethylbenzene	1.24E-03	1.24E-03	N/A	N/A
2,3,7,8-TCDD	1.21E-09	3.95E-10	5.65E-10	1.48E-09
2,6-Dinitrotoluene	N/A	N/A	2.58E-05	N/A
2-Butanone (MEK)	4.81E-03	1.03E-02	2.43E-03	2.16E-03
2-Methylnaphthalene	2.48E-04	1.52E-04	5.40E-04	8.31E-05
2-Methylphenol (o-Cresol)	2.65E-05	3.06E-05	6.99E-05	1.05E-05
2-Nitrophenol	5.06E-05	4.81E-05	8.85E-05	2.89E-05
4-Nitrophenol	N/A	4.75E-05	N/A	4.04E-05
Acenaphthene	6.54E-06	6.77E-06	3.89E-06	N/A
Acenaphthylene	2.76E-05	2.78E-05	8.72E-05	1.58E-05
Acetone	1.61E-02	1.89E-02	1.53E-02	1.92E-02
Acetonitrile	1.53E-03	2.62E-03	1.20E-03	1.11E-03
Acetophenone	4.13E-04	2.24E-04	9.28E-04	1.37E-04
Acrolein	1.99E-03	1.33E-03	2.57E-03	9.44E-04
Acrylonitrile	N/A	N/A	8.10E-04	N/A
alpha-Methylstyrene	N/A	4.80E-04	N/A	N/A
Antimony	N/A	N/A	9.23E-05	N/A
Benz[a]anthracene	5.92E-06	6.72E-06	5.19E-06	6.13E-06
Benzene	4.46E-03	4.99E-03	5.53E-03	4.01E-03
Benzo[b]fluoranthene	1.44E-05	1.16E-05	2.23E-05	1.30E-05
Benzo[g,h,i]perylene	8.83E-06	7.38E-06	1.42E-05	6.70E-06
Benzoic acid	3.27E-03	1.78E-03	7.02E-03	1.31E-03
Benzyl alcohol	5.84E-05	1.26E-04	3.64E-05	2.02E-05
Chlorodifluoromethane	3.16E-03	5.07E-03	2.27E-03	2.60E-03
Chloromethane	1.41E-03	1.47E-03	1.46E-03	1.41E-03
Chrysene	1.21E-05	8.79E-06	2.08E-05	8.47E-06
Cyclohexane	1.11E-03	1.52E-03	9.75E-04	9.76E-04

Annex 2 to Appendic C Table 5. Exposure Point Concentrations (continued)

Compound	Exposure Point Concentrations (mg/m^3)			
	All Samples	Building 24064	HLZ	DFIP
Di(2-ethylhexyl)phthalate	8.64E-05	9.47E-05	8.07E-05	1.11E-04
Dibenzofuran	4.23E-05	2.64E-05	8.11E-05	2.62E-05
Dichlorodifluoromethane	1.34E-03	1.26E-03	1.42E-03	1.40E-03
Diethylphthalate	9.40E-06	1.19E-05	6.63E-06	5.89E-06
Dimethylphthalate	1.41E-05	1.86E-05	2.90E-05	5.64E-06
Di-n-butylphthalate	1.25E-04	1.50E-04	2.92E-04	1.18E-04
Di-n-octylphthalate	N/A	2.02E-05	N/A	N/A
Ethyl acetate	2.24E-03	3.73E-03	1.93E-03	1.70E-03
Ethylbenzene	1.29E-03	1.48E-03	1.84E-03	4.81E-02
Fluoranthene	3.27E-05	1.90E-05	4.21E-05	1.88E-05
Fluorene	2.03E-05	1.88E-05	5.24E-05	1.28E-05
Hexane	2.05E-02	2.07E-02	9.87E-03	N/A
Indeno[1,2,3-cd]pyrene	9.56E-06	6.66E-06	1.61E-05	7.20E-06
Isooctane	1.24E-03	1.59E-03	N/A	9.52E-04
Isopropyl alcohol	4.75E-02	1.69E-01	1.05E-02	6.06E-03
Lead	7.70E-05	7.12E-05	7.87E-05	8.84E-05
m,p-Methylphenol (m,p-Cresol)	1.08E-04	7.99E-05	2.24E-04	3.40E-05
m,p-Xylene	2.25E-03	3.15E-03	1.96E-03	1.79E-03
Methyl acrylate	1.85E-03	1.87E-03	1.40E-03	2.48E-03
Methylene chloride	2.81E-02	2.30E-02	6.53E-02	1.21E-02
Naphthalene	6.92E-04	3.66E-04	1.52E-03	2.82E-04
n-Heptane	1.34E-03	1.87E-03	1.10E-03	1.04E-03
Octane	1.44E-03	2.19E-03	1.19E-03	1.05E-03
o-Xylene	1.34E-03	1.41E-03	9.50E-04	1.00E-03
Phenanthrene	7.34E-05	4.56E-05	1.49E-04	3.92E-05
Phenol	2.24E-04	1.63E-04	4.76E-04	6.23E-05
PM2.5	5.72E-02	6.02E-02	6.39E-02	5.79E-02
Propylene	2.22E-03	2.30E-03	3.15E-03	1.63E-03
Pyrene	1.92E-05	1.55E-05	3.16E-05	1.41E-05
Styrene	1.62E-03	1.18E-03	2.19E-03	1.79E-03
tert-Butyl alcohol	1.32E-03	1.25E-03	1.20E-03	1.72E-03
Tetrahydrofuran	1.41E-03	1.43E-03	0.00E+00	N/A
Toluene	1.15E-02	3.75E-02	4.14E-03	2.66E-03
trans-1,2-Dichloroethene	N/A	N/A	N/A	1.69E-03
Trichloroethene (TCE)	4.41E-03	4.58E-02	1.89E-03	N/A
Trichlorofluoromethane	1.29E-03	1.10E-03	1.20E-03	1.97E-03
Vinyl acetate	2.30E-03	1.62E-03	3.61E-03	1.28E-03
Zinc	N/A	N/A	N/A	1.41E-03

Legend:
mg/m^3 = milligrams per cubic meter
N/A= not applicable—the compound was not included in the risk estimates for this exposure point because the compound was detected in less than five percent of samples at this exposure point.

Risk assessment as a whole and the exposure assessment step in particular are designed to be health protective. The exposure calculations require estimates and assumptions about certain human exposure parameters such as inhalation rates. Generally, values are selected which tend to overestimate exposure.

Estimates of pathway-specific human intakes for each COPC involve assumptions about patterns of human exposure to the media being evaluated. These assumptions are combined with the EPCs to calculate intakes. Intakes are normally expressed as the amount of chemical at the environment-human receptor-exchange boundary in milligrams per kilogram of body weight per day (mg/kg-day), which represents an exposure normalized for body weight over time. The total exposure is divided by the time period of interest to obtain an average exposure. The averaging time is a function of the health endpoint. For noncarcinogenic effects, it is the exposure time specific to the scenario being assessed (1 year) and for carcinogenic effects, it is lifetime (70 years).

7.3.3 Exposure Assumptions

An important aspect of the exposure assessment is the determination of assumptions regarding how receptors may be exposed to chemicals. The EPA guidance on exposure factors is extensive and was followed throughout this exposure assessment. Standard EPA recommended default assumptions were used where appropriate.

The exposure scenarios in this assessment involve the following hypothetical receptors: personnel present at Bagram Airfield for 6 months and personnel present at Bagram Airfield for 9 months. Each of these potentially exposed populations was assumed to have exposure to ambient air at the site for a duration of 24-hours per day. The exposure assumptions for these scenarios are intended to approximate the reasonable maximal frequency, duration, and manner in which receptors are exposed to ambient air at BAF. Many parameters tend to have a safety factor imbedded into their determination such that they tend to overestimate exposure and, therefore, risk. Details of the exposure assumptions and parameters for each exposure scenario are shown in Annex 2 to Appendix C Table 6.

7.3.4. Exposure Scenarios

To quantitatively assess the potential exposures associated with the evaluated pathway, estimates of chemical concentrations at the exposure point are combined with values describing the extent, frequency, and duration of the exposure to provide an estimate of the daily intake of chemicals. Table 6 presents the values used for the various intake parameters. These values are based on EPA recommended values and are discussed below.

Annex 2 to Appendic C Table 6. Exposure Pathway Assessment Values

Pathway	Parameter	Value	Source
Inhalation	Body Weight	70 kg	EPA (reference 2)
	Exposure Time	24-hours/day	Conservative Exposure Estimate
	Exposure Frequency	270-days/year 180-days/year	Estimated Exposure Ranges
	Exposure Duration	1 year	EPA (reference 2)
	Averaging Time (noncarcinogenic)	365 days	EPA (reference 2)
	Averaging Time (carcinogenic)	25550 days	EPA (reference 2)
	Inhalation Rate	0.8 m^3/hour	EPA (reference 2)

Legend:
kg = kilograms
m^3/hour = cubic meter per hour

7.3.4.1 Body Weight (BW)

The EPA recommends a conservative BW of 70 kg for adult receptors. This represents the mean value for men and women between 19 and 65 years old.

7.3.4.2. Exposure Time (ET)

A conservative ET estimate of 24-hours per day will be used. This is an estimated value, which assumes the receptor spends all of its time on the base. This value is intended to be conservative and will tend to overestimate potential risk because concentrations and exposures can vary depending on environmental conditions such as meteorology, air quality, etc.

7.3.4.3 Exposure Frequency (EF)

The EFs are estimates based on typical deployment and contract durations of personnel at BAF. These EFs assume that the receptor remains on the base for their entire deployment or contract.

7.3.4.4 Exposure Duration (ED)

An ED of 1 year will be used for personnel present at BAF for 6 months and personnel present at BAF for 9 months.

7.3.4.5 Averaging Time (AT)

The AT for noncarcinogenic effects is the ED, 365 days (1 years). For carcinogenic effects, an average lifetime of 25,550 days (70 years) is used.

7.3.4.6 Inhalation Rate (IR)

The recommended IR for adults is 20 m^3/day. This represents a standard default value traditionally used for assessing adult males.

7.3.4.7 Inhalation of Ambient Air at BAF

For both carcinogenic and noncarcinogenic effects, intake was calculated using Equation 1, with the averaging time being the difference between them:

Equation 1:

$$\text{Intake (mg/kg-day)} = \frac{CA * IR * ET * EF * ED}{BW * AT}$$

Where:
CA = Contaminant Concentration in Air (mg/m^3)
IR = Inhalation Rate (m^3/hour)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (days)

7.3.4.8 COPC Intake

Annex 2 to Appendix C Tables 7 through 10 provide the intakes of each COPC due to inhalation for each receptor at each respective exposure point. The noncarcinogenic intakes differ from the carcinogenic intakes because different averaging times are used to evaluate exposure to noncarcinogenic COPCs and carcinogenic COPCs. When evaluating longer-term exposure to noncarcinogenic toxicants intakes are calculated by averaging intakes over the period of exposure, which is 1 year for this HRA. When evaluating carcinogens, intakes are calculated by prorating the total dose over a lifetime of 70 years. This distinction is used to represent the different mechanism of action and is based on the assumption that a dose of a carcinogen that is received over a short period of time is equivalent to a lower dose received over a lifetime

Annex 2 to Appendic C Table 7. Inhalation Intake (mg/kg-day) for Receptors Located at the EPC Containing All Samples

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
1,2,4-Trimethylbenzene	2.51E-04	3.59E-06	1.67E-04	2.39E-06
2,3,7,8-TCDD	2.45E-10	3.50E-12	1.63E-10	2.34E-12
2,6-Dinitrotoluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2-Butanone (MEK)	9.75E-04	1.39E-05	6.50E-04	9.29E-06
2-Methylnaphthalene	5.03E-05	7.19E-07	3.35E-05	4.79E-07
2-Methylphenol (o-Cresol)	5.38E-06	7.68E-08	3.58E-06	5.12E-08
2-Nitrophenol	1.03E-05	1.47E-07	6.84E-06	9.78E-08
4-Nitrophenol	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acenaphthene	1.33E-06	1.90E-08	8.85E-07	1.26E-08
Acenaphthylene	5.60E-06	8.00E-08	3.73E-06	5.33E-08
Acetone	3.26E-03	4.66E-05	2.17E-03	3.11E-05
Acetonitrile	3.11E-04	4.44E-06	2.07E-04	2.96E-06

Annex 2 to Appendic C Table 7. Inhalation Intake (mg/kg-day) for Receptors Located at the EPC Containing All Samples (continued)

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
Acetophenone	8.38E-05	1.20E-06	5.59E-05	7.98E-07
Acrolein	4.03E-04	5.76E-06	2.69E-04	3.84E-06
Acrylonitrile	0.00E+00	0.00E+00	0.00E+00	0.00E+00
alpha-Methylstyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	1.20E-06	1.72E-08	8.01E-07	1.14E-08
Benzene	9.04E-04	1.29E-05	6.03E-04	8.61E-06
Benzo(b)fluoroanthene	2.92E-06	4.17E-08	1.95E-06	2.78E-08
Benzo(g,h,i)perylene	1.79E-06	2.56E-08	1.19E-06	1.71E-08
Benzoic acid	6.64E-04	9.49E-06	4.43E-04	6.33E-06
Benzyl alcohol	1.18E-05	1.69E-07	7.90E-06	1.13E-07
Chlorodifluoromethane	6.41E-04	9.15E-06	4.27E-04	6.10E-06
Chloromethane	2.85E-04	4.08E-06	1.90E-04	2.72E-06
Chrysene	2.46E-06	3.51E-08	1.64E-06	2.34E-08
Cyclohexane	2.24E-04	3.20E-06	1.49E-04	2.14E-06
Di(2-ethylhexyl)phthalate	1.75E-05	2.50E-07	1.17E-05	1.67E-07
Dibenzofuran	8.58E-06	1.23E-07	5.72E-06	8.17E-08
Dichlorodifluoromethane	2.71E-04	3.87E-06	1.81E-04	2.58E-06
Diethylphthalate	1.91E-06	2.72E-08	1.27E-06	1.82E-08
Dimethylphthalate	2.86E-06	4.09E-08	1.91E-06	2.72E-08
Di-n-butylphthalate	2.54E-05	3.62E-07	1.69E-05	2.42E-07
Di-n-octylphthalate	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethyl acetate	4.55E-04	6.50E-06	3.03E-04	4.33E-06
Ethylbenzene	2.62E-04	3.74E-06	1.75E-04	2.50E-06
Fluoranthene	6.63E-06	9.48E-08	4.42E-06	6.32E-08
Fluorene	4.12E-06	5.88E-08	2.75E-06	3.92E-08
Hexane	4.16E-03	5.95E-05	2.78E-03	3.97E-05
Indeno(1,2,3-cd)pyrene	1.94E-06	2.77E-08	1.29E-06	1.85E-08
Isooctane	2.52E-04	3.61E-06	1.68E-04	2.40E-06
Isopropyl alcohol	9.64E-03	1.38E-04	6.43E-03	9.18E-05
Lead	1.56E-05	2.23E-07	1.04E-05	1.49E-07
m,p-Methylphenol (m,p-Cresol)	2.19E-05	3.13E-07	1.46E-05	2.09E-07
m,p-Xylene	4.56E-04	6.52E-06	3.04E-04	4.34E-06
Methyl acrylate	3.74E-04	5.35E-06	2.50E-04	3.57E-06
Methylene Chloride	5.71E-03	8.16E-05	3.81E-03	5.44E-05
Naphthalene	1.40E-04	2.01E-06	9.36E-05	1.34E-06
n-Heptane	2.72E-04	3.89E-06	1.82E-04	2.59E-06
Octane	2.93E-04	4.18E-06	1.95E-04	2.79E-06
o-Xylene	2.72E-04	3.89E-06	1.81E-04	2.59E-06
Phenanthrene	1.49E-05	2.13E-07	9.93E-06	1.42E-07

Annex 2 to Appendic C Table 7. Inhalation Intake (mg/kg-day) for Receptors Located at the EPC Containing All Samples (continued)

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
Phenol	4.54E-05	6.49E-07	3.03E-05	4.33E-07
PM2.5	1.16E-02	1.66E-04	7.74E-03	1.11E-04
Propylene	4.50E-04	6.43E-06	3.00E-04	4.28E-06
Pyrene	3.90E-06	5.57E-08	2.60E-06	3.71E-08
Styrene	3.28E-04	4.69E-06	2.19E-04	3.13E-06
tert-Butyl alcohol	2.67E-04	3.82E-06	1.78E-04	2.54E-06
Tetrahydrofuran	2.85E-04	4.08E-06	1.90E-04	2.72E-06
Toluene	2.32E-03	3.32E-05	1.55E-03	2.21E-05
trans-1,2-Dichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Trichloroethene (TCE)	8.95E-04	1.28E-05	5.97E-04	8.52E-06
Trichlorofluoromethane	2.62E-04	3.74E-06	1.75E-04	2.49E-06
Vinyl acetate	4.67E-04	6.67E-06	3.11E-04	4.45E-06
Zinc	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Notes:
mg/kg-day = milligram per kilogram per day
[1] NC = Noncarcinogenic
[2] CA = Carcinogenic

Annex 2 to Appendic C Table 8. Inhalation Intake (mg/kg-day) for Receptors Located at the Building 24064 EPC

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
1,2,4-Trimethylbenzene	2.52E-04	3.60E-06	1.68E-04	2.40E-06
2,3,7,8-TCDD	8.01E-11	1.14E-12	5.34E-11	7.63E-13
2,6-Dinitrotoluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2-Butanone (MEK)	2.08E-03	2.97E-05	1.39E-03	1.98E-05
2-Methylnaphthalene	3.08E-05	4.41E-07	2.06E-05	2.94E-07
2-Methylphenol (o-Cresol)	6.21E-06	8.87E-08	4.14E-06	5.91E-08
2-Nitrophenol	9.76E-06	1.39E-07	6.51E-06	9.29E-08
4-Nitrophenol	9.63E-06	1.38E-07	6.42E-06	9.17E-08
Acenaphthene	1.37E-06	1.96E-08	9.16E-07	1.31E-08
Acenaphthylene	5.64E-06	8.06E-08	3.76E-06	5.37E-08
Acetone	3.84E-03	5.48E-05	2.56E-03	3.66E-05
Acetonitrile	5.32E-04	7.61E-06	3.55E-04	5.07E-06
Acetophenone	4.54E-05	6.49E-07	3.03E-05	4.33E-07
Acrolein	2.69E-04	3.85E-06	1.80E-04	2.57E-06
Acrylonitrile	0.00E+00	0.00E+00	0.00E+00	0.00E+00
alpha-Methylstyrene	9.74E-05	1.39E-06	6.49E-05	9.28E-07
Antimony	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	1.36E-06	1.95E-08	9.09E-07	1.30E-08
Benzene	1.01E-03	1.45E-05	6.75E-04	9.65E-06
Benzo(b)fluoroanthene	2.35E-06	3.36E-08	1.57E-06	2.24E-08
Benzo(g,h,i)perylene	1.50E-06	2.14E-08	9.98E-07	1.43E-08
Benzoic acid	3.61E-04	5.16E-06	2.41E-04	3.44E-06
Benzyl alcohol	2.56E-05	3.65E-07	1.70E-05	2.43E-07
Chlorodifluoromethane	1.03E-03	1.47E-05	6.85E-04	9.79E-06
Chloromethane	2.97E-04	4.25E-06	1.98E-04	2.83E-06
Chrysene	1.78E-06	2.55E-08	1.19E-06	1.70E-08
Cyclohexane	3.09E-04	4.41E-06	2.06E-04	2.94E-06
Di(2-ethylhexyl)phthalate	1.92E-05	2.74E-07	1.28E-05	1.83E-07
Dibenzofuran	5.36E-06	7.65E-08	3.57E-06	5.10E-08
Dichlorodifluoromethane	2.56E-04	3.66E-06	1.71E-04	2.44E-06
Diethylphthalate	2.41E-06	3.45E-08	1.61E-06	2.30E-08
Dimethylphthalate	3.77E-06	5.39E-08	2.52E-06	3.59E-08
Di-n-butylphthalate	3.04E-05	4.35E-07	2.03E-05	2.90E-07
Di-n-octylphthalate	4.11E-06	5.87E-08	2.74E-06	3.91E-08
Ethyl acetate	7.57E-04	1.08E-05	5.04E-04	7.21E-06
Ethylbenzene	2.99E-04	4.28E-06	2.00E-04	2.85E-06
Fluoranthene	3.86E-06	5.51E-08	2.57E-06	3.67E-08
Fluorene	3.81E-06	5.45E-08	2.54E-06	3.63E-08
Hexane	4.20E-03	6.01E-05	2.80E-03	4.00E-05
Indeno(1,2,3-cd)pyrene	1.35E-06	1.93E-08	9.01E-07	1.29E-08

Annex 2 to Appendic C Table 8. Inhalation Intake (mg/kg-day) for Receptors Located at the Building 24064 EPC (continued)

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
Isooctane	3.22E-04	4.60E-06	2.15E-04	3.06E-06
Isopropyl alcohol	3.43E-02	4.90E-04	2.29E-02	3.27E-04
Lead	1.44E-05	2.06E-07	9.63E-06	1.38E-07
m,p-Methylphenol (m,p-Cresol)	1.62E-05	2.32E-07	1.08E-05	1.54E-07
m,p-Xylene	6.39E-04	9.12E-06	4.26E-04	6.08E-06
Methyl acrylate	3.79E-04	5.41E-06	2.53E-04	3.61E-06
Methylene Chloride	4.67E-03	6.68E-05	3.12E-03	4.45E-05
Naphthalene	7.43E-05	1.06E-06	4.95E-05	7.07E-07
n-Heptane	3.80E-04	5.42E-06	2.53E-04	3.62E-06
Octane	4.43E-04	6.33E-06	2.96E-04	4.22E-06
o-Xylene	2.87E-04	4.10E-06	1.91E-04	2.73E-06
Phenanthrene	9.25E-06	1.32E-07	6.17E-06	8.81E-08
Phenol	3.31E-05	4.72E-07	2.20E-05	3.15E-07
PM2.5	1.22E-02	1.75E-04	8.15E-03	1.16E-04
Propylene	4.67E-04	6.67E-06	3.11E-04	4.44E-06
Pyrene	3.14E-06	4.49E-08	2.10E-06	3.00E-08
Styrene	2.39E-04	3.42E-06	1.59E-04	2.28E-06
tert-Butyl alcohol	2.53E-04	3.62E-06	1.69E-04	2.41E-06
Tetrahydrofuran	2.89E-04	4.13E-06	1.93E-04	2.76E-06
Toluene	7.61E-03	1.09E-04	5.07E-03	7.25E-05
trans-1,2-Dichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Trichloroethene (TCE)	9.28E-03	1.33E-04	6.19E-03	8.84E-05
Trichlorofluoromethane	2.23E-04	3.19E-06	1.49E-04	2.13E-06
Vinyl acetate	3.29E-04	4.70E-06	2.19E-04	3.13E-06
Zinc	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Notes:
mg/kg-day – milligram per kilogram per day
[1] NC = Noncarcinogenic
[2] CA = Carcinogenic

Annex 2 to Appendic C Table 9. Inhalation Intake (mg/kg-day) for Receptors Located at the HLZ EPC

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
1,2,4-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDD	1.15E-10	1.64E-12	7.65E-11	1.09E-12
2,6-Dinitrotoluene	5.23E-06	7.48E-08	3.49E-06	4.98E-08
2-Butanone (MEK)	4.93E-04	7.04E-06	3.28E-04	4.69E-06
2-Methylnaphthalene	1.10E-04	1.57E-06	7.30E-05	1.04E-06
2-Methylphenol (o-Cresol)	1.42E-05	2.03E-07	9.45E-06	1.35E-07
2-Nitrophenol	1.80E-05	2.57E-07	1.20E-05	1.71E-07
4-Nitrophenol	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acenaphthene	7.90E-07	1.13E-08	5.26E-07	7.52E-09
Acenaphthylene	1.77E-05	2.53E-07	1.18E-05	1.69E-07
Acetone	3.11E-03	4.44E-05	2.07E-03	2.96E-05
Acetonitrile	2.44E-04	3.48E-06	1.62E-04	2.32E-06
Acetophenone	1.88E-04	2.69E-06	1.26E-04	1.79E-06
Acrolein	5.21E-04	7.44E-06	3.47E-04	4.96E-06
Acrylonitrile	1.64E-04	2.35E-06	1.10E-04	1.57E-06
alpha-Methylstyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	1.87E-05	2.68E-07	1.25E-05	1.78E-07
Benzo(a)anthracene	1.05E-06	1.50E-08	7.02E-07	1.00E-08
Benzene	1.12E-03	1.60E-05	7.48E-04	1.07E-05
Benzo(b)fluoroanthene	4.52E-06	6.46E-08	3.02E-06	4.31E-08
Benzo(g,h,i)perylene	2.88E-06	4.12E-08	1.92E-06	2.74E-08
Benzoic acid	1.42E-03	2.03E-05	9.49E-04	1.36E-05
Benzyl alcohol	7.39E-06	1.06E-07	4.92E-06	7.03E-08
Chlorodifluoromethane	4.60E-04	6.57E-06	3.07E-04	4.38E-06
Chloromethane	2.95E-04	4.22E-06	1.97E-04	2.81E-06
Chrysene	4.22E-06	6.03E-08	2.81E-06	4.02E-08
Cyclohexane	1.98E-04	2.83E-06	1.32E-04	1.88E-06
Di(2-ethylhexyl)phthalate	1.64E-05	2.34E-07	1.09E-05	1.56E-07
Dibenzofuran	1.65E-05	2.35E-07	1.10E-05	1.57E-07
Dichlorodifluoromethane	2.89E-04	4.12E-06	1.92E-04	2.75E-06
Diethylphthalate	1.35E-06	1.92E-08	8.97E-07	1.28E-08
Dimethylphthalate	5.88E-06	8.41E-08	3.92E-06	5.60E-08
Di-n-butylphthalate	5.92E-05	8.46E-07	3.95E-05	5.64E-07
Di-n-octylphthalate	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethyl acetate	3.91E-04	5.59E-06	2.61E-04	3.73E-06
Ethylbenzene	3.74E-04	5.34E-06	2.49E-04	3.56E-06
Fluoranthene	8.54E-06	1.22E-07	5.69E-06	8.14E-08
Fluorene	1.06E-05	1.52E-07	7.09E-06	1.01E-07
Hexane	2.00E-03	2.86E-05	1.34E-03	1.91E-05
Indeno(1,2,3-cd)pyrene	3.27E-06	4.67E-08	2.18E-06	3.11E-08

Annex 2 to Appendic C Table 9. Inhalation Intake (mg/kg-day) for Receptors Located at the HLZ EPC (continued)

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
Isooctane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Isopropyl alcohol	2.14E-03	3.06E-05	1.43E-03	2.04E-05
Lead	1.60E-05	2.28E-07	1.06E-05	1.52E-07
m,p-Methylphenol (m,p-Cresol)	4.54E-05	6.49E-07	3.03E-05	4.33E-07
m,p-Xylene	3.98E-04	5.69E-06	2.66E-04	3.79E-06
Methyl acrylate	2.84E-04	4.06E-06	1.89E-04	2.71E-06
Methylene Chloride	1.33E-02	1.89E-04	8.84E-03	1.26E-04
Naphthalene	3.08E-04	4.40E-06	2.05E-04	2.93E-06
n-Heptane	2.23E-04	3.18E-06	1.49E-04	2.12E-06
Octane	2.40E-04	3.43E-06	1.60E-04	2.29E-06
o-Xylene	1.93E-04	2.75E-06	1.29E-04	1.84E-06
Phenanthrene	3.02E-05	4.32E-07	2.02E-05	2.88E-07
Phenol	9.66E-05	1.38E-06	6.44E-05	9.20E-07
PM2.5	1.30E-02	1.85E-04	8.65E-03	1.24E-04
Propylene	6.38E-04	9.12E-06	4.26E-04	6.08E-06
Pyrene	6.41E-06	9.16E-08	4.27E-06	6.11E-08
Styrene	4.45E-04	6.36E-06	2.97E-04	4.24E-06
tert-Butyl alcohol	2.43E-04	3.48E-06	1.62E-04	2.32E-06
Tetrahydrofuran	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	8.39E-04	1.20E-05	5.59E-04	7.99E-06
trans-1,2-Dichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Trichloroethene (TCE)	3.83E-04	5.48E-06	2.56E-04	3.65E-06
Trichlorofluoromethane	2.43E-04	3.48E-06	1.62E-04	2.32E-06
Vinyl acetate	7.32E-04	1.05E-05	4.88E-04	6.98E-06
Zinc	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Notes:
mg/kg-day = milligram per kilogram per day
[1] NC = Noncarcinogenic
[2] CA = Carcinogenic

Annex 2 to Appendic C Table 10. Inhalation Intake (mg/kg-day) for Receptors Located at the DFIP EPC

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
1,2,4-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,3,7,8-TCDD	3.00E-10	4.28E-12	2.00E-10	2.85E-12
2,6-Dinitrotoluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2-Butanone (MEK)	4.38E-04	6.26E-06	2.92E-04	4.17E-06
2-Methylnaphthalene	1.69E-05	2.41E-07	1.12E-05	1.61E-07
2-Methylphenol (o-Cresol)	2.13E-06	3.04E-08	1.42E-06	2.03E-08
2-Nitrophenol	5.86E-06	8.38E-08	3.91E-06	5.58E-08
4-Nitrophenol	8.20E-06	1.17E-07	5.47E-06	7.81E-08
Acenaphthene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acenaphthylene	3.21E-06	4.58E-08	2.14E-06	3.05E-08
Acetone	3.89E-03	5.56E-05	2.59E-03	3.70E-05
Acetonitrile	2.25E-04	3.21E-06	1.50E-04	2.14E-06
Acetophenone	2.78E-05	3.97E-07	1.85E-05	2.65E-07
Acrolein	1.92E-04	2.74E-06	1.28E-04	1.82E-06
Acrylonitrile	0.00E+00	0.00E+00	0.00E+00	0.00E+00
alpha-Methylstyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	1.24E-06	1.78E-08	8.29E-07	1.18E-08
Benzene	8.14E-04	1.16E-05	5.43E-04	7.75E-06
Benzo(b)fluoroanthene	2.64E-06	3.77E-08	1.76E-06	2.51E-08
Benzo(g,h,i)perylene	1.36E-06	1.94E-08	9.06E-07	1.29E-08
Benzoic acid	2.65E-04	3.78E-06	1.77E-04	2.52E-06
Benzyl alcohol	4.10E-06	5.86E-08	2.73E-06	3.90E-08
Chlorodifluoromethane	5.28E-04	7.54E-06	3.52E-04	5.02E-06
Chloromethane	2.86E-04	4.09E-06	1.91E-04	2.73E-06
Chrysene	1.72E-06	2.46E-08	1.15E-06	1.64E-08
Cyclohexane	1.98E-04	2.83E-06	1.32E-04	1.89E-06
Di(2-ethylhexyl)phthalate	2.25E-05	3.22E-07	1.50E-05	2.15E-07
Dibenzofuran	5.32E-06	7.59E-08	3.54E-06	5.06E-08
Dichlorodifluoromethane	2.83E-04	4.05E-06	1.89E-04	2.70E-06
Diethylphthalate	1.20E-06	1.71E-08	7.97E-07	1.14E-08
Dimethylphthalate	1.14E-06	1.63E-08	7.63E-07	1.09E-08
Di-n-butylphthalate	2.39E-05	3.42E-07	1.60E-05	2.28E-07
Di-n-octylphthalate	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethyl acetate	3.45E-04	4.93E-06	2.30E-04	3.28E-06
Ethylbenzene	9.75E-03	1.39E-04	6.50E-03	9.29E-05
Fluoranthene	3.81E-06	5.45E-08	2.54E-06	3.63E-08
Fluorene	2.60E-06	3.71E-08	1.73E-06	2.47E-08
Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	1.46E-06	2.09E-08	9.74E-07	1.39E-08

Annex 2 to Appendic C Table 10. Inhalation Intake (mg/kg-day) for Receptors Located at the DFIP EPC (continued)

Compound	Receptors			
	Personnel present for 9 months		Personnel present for 6 months	
	NC Intake[1]	CA Intake[2]	NC Intake[1]	CA Intake[2]
Isooctane	1.93E-04	2.76E-06	1.29E-04	1.84E-06
Isopropyl alcohol	1.23E-03	1.76E-05	8.20E-04	1.17E-05
Lead	1.79E-05	2.56E-07	1.20E-05	1.71E-07
m,p-Methylphenol (m,p-Cresol)	6.90E-06	9.85E-08	4.60E-06	6.57E-08
m,p-Xylene	3.63E-04	5.19E-06	2.42E-04	3.46E-06
Methyl acrylate	5.03E-04	7.19E-06	3.35E-04	4.79E-06
Methylene Chloride	2.44E-03	3.49E-05	1.63E-03	2.33E-05
Naphthalene	5.72E-05	8.17E-07	3.81E-05	5.45E-07
n-Heptane	2.12E-04	3.02E-06	1.41E-04	2.02E-06
Octane	2.13E-04	3.04E-06	1.42E-04	2.03E-06
o-Xylene	2.03E-04	2.90E-06	1.35E-04	1.93E-06
Phenanthrene	7.95E-06	1.14E-07	5.30E-06	7.57E-08
Phenol	1.26E-05	1.81E-07	8.43E-06	1.20E-07
PM2.5	1.17E-02	1.68E-04	7.83E-03	1.12E-04
Propylene	3.30E-04	4.72E-06	2.20E-04	3.15E-06
Pyrene	2.86E-06	4.09E-08	1.91E-06	2.72E-08
Styrene	3.64E-04	5.20E-06	2.43E-04	3.46E-06
tert-Butyl alcohol	3.49E-04	4.99E-06	2.33E-04	3.33E-06
Tetrahydrofuran	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	5.40E-04	7.72E-06	3.60E-04	5.14E-06
trans-1,2-Dichloroethene	3.42E-04	4.88E-06	2.28E-04	3.26E-06
Trichloroethene (TCE)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Trichlorofluoromethane	4.00E-04	5.72E-06	2.67E-04	3.81E-06
Vinyl acetate	2.59E-04	3.70E-06	1.72E-04	2.46E-06
Zinc	2.86E-04	4.09E-06	1.91E-04	2.73E-06

Notes:
Mg/k/-day = milligram per kilogram per day
[1] NC = Noncarcinogenic
[2] CA = Carcinogenic

8 Toxicity Assessment

The objective of the toxicity assessment is to weigh available evidence regarding the potential of the chemicals to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse effects. For this assessment of human health risks from exposure to chemicals, there are two basic toxicity values that are of principal importance and include Reference Doses/Concentrations (RfDs/RfCs) and Cancer Slope Factors (CSFs).

The EPA recommends two different approaches for evaluating health effects: noncarcinogenic and carcinogenic. The two approaches reflect the fundamental difference in the proposed mechanism of toxic action.

8.1 Reference Doses/Concentrations

In assessing the potential for noncancer health effects, such as systemic effects to the liver or kidney, or effects on the lung, the EPA assumes that there is a toxicological threshold below which no adverse health effects occur. Oral exposures are represented by RfDs. In the case of inhaled toxins, these toxicological thresholds are represented by RfCs. (RfCs are converted to inhalation reference doses [RfDi] by multiplying an RfC by an inhalation rate of 20 cubic meter per day (m^3/day) and dividing by 70 kg to obtain units of mg/kg-day). In general, the RfC/RfDi is an estimate of an average daily exposure (even over a chronic exposure such as 30 years to a lifetime) to an individual (including sensitive individuals) below which there will not be an appreciable risk of adverse health effects. As per accepted scientific risk assessment and EPA methodology, these values are derived by finding the very lowest (threshold) dose for any effect, or no effect, in a well designed animal or epidemiological study and then using uncertainty factors (such as, to adjust from animals to humans and to protect sensitive subpopulations) to ensure that it is unlikely to underestimate the potential for adverse noncarcinogenic effects to occur. On occasion, if there is no RfC but an oral RfD does exist, and the health effect of the chemical is a systemic one, route-to-route extrapolation may be done for an important COPC.

The purpose of the RfD is to provide a benchmark against which an intake from human exposure to the scenarios/exposures being evaluated might be compared. When the average daily intake dose of the chemical in the exposure scenario evaluated is higher that the RfD, this may indicate that an inadequate margin of safety could exist for exposure to that substance and that an adverse health effect could occur. Because of the various conservative and safety/uncertainty factors included in the benchmark, excursion above the RfD does not mean a health effect *will* occur; rather the potential for adverse health effects to occur increases, the more significant the excursion. These ratios are used, not to estimate an absolute risk for particular health effects, but to indicate that overexposure may be occurring and protective/remedial actions may be needed to prevent or lower risk.

8.2 Cancer Slope Factors

8.2.1 Threshold Response

For carcinogens, the threshold response level is believed to be inappropriate. The CSFs are developed under the assumption that cancer risk is linearly related to dose. Therefore, even though most of the cancer data obtained from laboratory animal studies are for relatively high doses, it is assumed that these doses can be extrapolated down to the extremely small doses that would be expected from environmental exposure. This nonthreshold theory assumes that even a

single molecule of a carcinogen may cause changes that could result in cells to divide in an uncontrolled manner and eventually lead to cancer. It should be pointed out that this method leads to a plausible upper limit of cancer risk but does not necessarily give a realistic prediction of the true risk. The calculated risk of one molecule of exposure would be infinitesimally small, so the EPA considers that acceptable exposure levels are generally concentrations that represent an excess upper bound lifetime cancer risk (above background risks) to an individual of between $1x10^{-4}$ and $1x10^{-6}$. However, risk within this range of exposure levels should not be used as an absolute measures to determine whether the risk is acceptable. The $1x10^{-6}$ risk level should be used as the point of departure above which considerations for protection/remediation should occur.

8.2.2 Carcinogenic Potency

- The carcinogenic potency of a substance depends, in part, on its route of entry into the body. Therefore, CSFs are classified, like RfDs, according to the route of administration (inhalation, ingestion). Ideally, route-specific CSFs should be used to evaluate the carcinogenic risk posed by each carcinogen through each exposure route of concern. A chemical may be a carcinogen by one route but not anothe, or may require a different dose.

- The EPA has developed a classification system which indicates the likelihood that a particular chemical is a human carcinogen based on a weight-of-evidence (WOE) judgment using human and animal evidence. The following describes this system:

  - ***A*** – Human carcinogen.
  - ***B1*** – Probable human carcinogen—limited evidence of human carcinogenicity.
  - ***B2*** – Probable human carcinogen—sufficient animal evidence and inadequate human data.
  - ***C*** – Possible human carcinogen—limited evidence in animals and no human data.
  - ***D*** – Not classified as to carcinogenicity.
  - ***E*** – No evidence for carcinogenicity.

8.2.3 Toxicity Sources

Since only inhalation exposures are being evaluated in this study, inhalation RfDs and inhalation CSFs are the only values that will be used. The primary source of toxicity information is the EPA's Integrated Risk Information System (IRIS) (reference 3). If values were not available in IRIS, the Health Effects Assessment Summary Tables (HEAST) (reference 10), the EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (reference 11), Route-route extrapolation (extrapolation from an oral reference dose to an inhalation reference dose) or EPA National Center for Environmental Assessment (NCEA) provisional values (PPRTVs) were consulted. Annex 2 to Appendix C Table 11 provides a summary of the toxicological reference values used in this assessment. The carcinogenic WOE classification is also provided along with the source of the reference value.

Annex 2 to Appendic C Table 11. Toxicity Values

Chemical	RfC (mg/m^3)	Source	RfD_i (mg/kg-d)	Source	CSF_i $(mg/kg\text{-}d)^{-1}$	Source	Weight of Evidence Classification
1,2,4-Trimethylbenzene	7.00E-02	PPRTV	2.00E-02*	PPRTV	na	na	na
2,3,7,8-TCDD	na	na	na	na	1.50E+05	HEAST	C
2,6-Dinitrotoluene	na	na	na	na	na	na	B2
2-Butanone (MEK)	5.00E+00	IRIS	1.43E+00	IRIS	na	na	I
2-Methylnaphthalene	na	na	na	na	na	na	I
2-Methylphenol (o-Cresol)	na	na	na	na	na	na	C
2-Nitrophenol	5.00E-04	PPRTV	1.43E-04	PPRTV	na	na	na
4-Nitrophenol	na	na	na	na	na	na	na
Acenaphthene	na	na	6.00E-02	Route Extrapolation	na	na	na
Acenaphthylene	na	na	na	na	na	na	D
Acetone	na	na	9.00E-01	Route extrapolation	na	na	I
Acetonitrile	6.00E-02	IRIS	1.71E-02	IRIS	na	na	na
Acetophenone	na	na	na	na	na	na	D
Acrylonitrile	7.00E-01	IRIS	2.00E-01	IRIS	2.40E-01	HEAST	B1
alpha-Methylstyrene	na	na	na	na	na	na	na
Antimony	na	na	na	na	na	na	na
Benzo(a)anthracene	na	na	na	na	3.10E-01	EPA-NCEA provisional value	B2
Benzene	3.00E-02	IRIS	8.57E-03	IRIS	2.70E-02	IRIS	A
Benzo(b)fluoroanthene	na	na	na	na	3.90E-01	CalEPA	B2
Benzo(g,h,i)perylene	na	na	na	na	na	na	D
Benzoic acid	na	na	na	na	na	na	D
Benzyl alcohol	na	na	na	na	na	na	na
Chlorodifluoromethane	5.00E+01	IRIS	1.43E+01	IRIS	na	na	na
Chloromethane	9.00E-02	IRIS	2.57E-02	IRIS	6.30E-03	HEAST	D
Chrysene	na	na	na	na	3.90E-02	CalEPA	B2
Cyclohexane	6.00E+00	IRIS	1.71E+00	IRIS	na	na	na
Di(2-ethylhexyl)phthalate	na	na	na	na	na	na	B2
Dibenzofuran	na	na	na	na	na	na	D
Dichlorodifluoromethane	2.00E-01	HEAST	5.71E-02	HEAST	na	na	na
Diethylphthalate	na	na	na	na	na	na	D

Annex 2 to Appendic C Table 11. Toxicity Values (continued)

Chemical	RfC (mg/m^3)	Source	RfD_i (mg/kg-d)	Source	CSF_i $(mg/kg\text{-}d)^{-1}$	Source	Weight of Evidence Classification
Dimethylphthalate	na	na	na	na	na	na	D
Di-n-butylphthalate	na	na	na	na	na	na	D
Di-n-octylphthalate	na	na	na	na	na	na	D
Ethyl acetate	7.00E-02	PPRTV	2.00E-02	PPRTV	na	na	na
Ethylbenzene	1.00E+00	IRIS	2.86E-01	IRIS	8.70E-03	CalEPA	D
Fluoranthene	na	na	4.00E-02	Route extrapolation	na	na	D
Fluorene	na	na	4.00E-02	Route extrapolation	na	na	D
Hexane	7.00E-01	IRIS	2.00E-01	IRIS	na	na	I
Indeno(1,2,3-cd)pyrene	na	na	na	na	3.10E-01	EPA-NCEA provisional value	B2
Isooctane	na	na	na	na	na	na	na
Isopropyl alcohol	7.00E+00	CalEPA	2.00E+00	CalEPA	na	na	na
Lead	na	na	na	na	4.20E-02	CalEPA	C
m,p-Methylphenol (m,p-Cresol)	na	na	na	na	na	na	C
m,p-Xylene	na	na	2.00E-01	IRIS	na	na	I
Methyl acrylate	2.00E-02	PPRTV	5.71E-03	PPRTV	na	na	D
Methylene Chloride	6.00E-01	IRIS	1.71E-01	IRIS	3.50E-03	CalEPA	B2
Naphthalene	3.00E-03	IRIS	8.57E-04	IRIS	1.20E-01	CalEPA	C
n-Heptane	na	na	na	na	na	na	D
Octane	na	na	na	na	na	na	na
o-Xylene	na	na	2.00E-01	IRIS	na	na	I
Phenanthrene	na	na	na	na	na	na	D
Phenol	2.00E-01	CalEPA	5.71E-02	CalEPA	na	na	D
$PM_{2.5}$	na	na	na	na	na	na	na
Propylene	na	na	na	na	na	na	D
Pyrene	na	na	3.00E-02	Route extrapolation	na	na	D
Styrene	1.00E+00	IRIS	2.86E-01	IRIS	na	na	D
tert-Butyl alcohol	na	na	na	na	na	na	na
Tetrahydrofuran	2.00E+00	IRIS	5.71E-01	IRIS	na	na	na
Toluene	5.00E+00	IRIS	1.43E+00	IRIS	na	na	D
trans-1,2-Dichloroethene	6.00E-02	PPRTV	1.71E-02	PPRTV	na	na	I

Annex 2 to Appendic C Table 11. Toxicity Values (continued)

Chemical	RfC (mg/m^3)	Source	RfD_i (mg/kg-d)	Source	CSF_i $(mg/kg\text{-}d)^{-1}$	Source	Weight of Evidence Classification
Trichloroethene (TCE)	na	na	2.85E-03	NYSDOH	7.00E-03	CalEPA	C
Trichlorofluoromethane	7.00E-01	HEAST	2.00E-01	HEAST	na	na	I
Vinyl acetate	2.00E-01	IRIS	5.71E-02	IRIS	na	na	I
Zinc	na	na	na	na	na	na	I

Notes:
N/A = not applicable
Rte-Rte = Route-route extrapolation
EPA NCEA = EPA National Center for Environmental Assessment (NCEA) provisional value
CalEPA = California Environmental Protection Agency—cited in reference 11
NYSDOH = New York State Department of Health (reference 12)
Weight of Evidence- A: Human Carcinogen
B2: Probable human carcinogen
C: Possible human carcinogen
D: Not classifiable
E: Evidence of noncarcinogenicity for humans
I: Inadequate data for an assessment of the human carcinogenic potential
N: Not assessed by the EPA
Sources = IRIS (EPA, reference 2); HEAST (EPA, reference 10)
EPA National Center for Environmental Assessment (NCEA) (EPA, reference 11)
Route-Route extrapolation (reference 11)
PPRTV (EPA, references 13 and 14)

8.2.4 1,2,4-Trimethylbenzene

The "*" in Annex 2 to Appendix C Table 11 above indicates that for 1,2,4-trimethylbenzene, a subchronic toxicity value was entered and will be used in the risk characterization calculations. As indicated throughout this risk assessment document, the health risk assessment builds in uncertainty factors to protect even sensitive individuals for long-term (30 years to a lifetime) exposures. Chronic toxicity values are typically used. Subchronic exposures are those of shorter duration—7 years or less. This is more appropriate to evaluate a 1-year exposure. When risks/hazards are calculated to be less than the threshold toxicity values anyway, even for chronic exposures, further evaluation usually does not take place. In this case, the trimethyl benzenes were noted to be frequently detected and the EPCs were above their threshold hazard quotients for chronic exposure. Therefore on further evaluation, it was noted that EPA has provided subchronic toxicity values for 1,2,4-trimethylbenzene in the PPRTVs. These will be used, to be more representative, and a discussion of the potential health risk/hazard implications of the exposure to the COPCs, including 1,2,4-trimethylbenzene will follow in the risk characterization section.

8.2.5 Toxicity Sources

The toxicity sources referenced above were unable to provide an RfC for lead. In order to ensure that noncarcinogenic health effects due to inhalation of lead are not overlooked, the National Ambient Air Quality Standards (NAAQS) provided by the EPA were examined. The NAAQS are standards which set limits for six principle pollutants which are protective of public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly when concentrations in the ambient air are below the standard. In the case of lead, the NAAQS was 1.5 micrograms per cubic meter (ug/m^3) since 1978 and was recently lowered to 0.15 ug/m^3 in order to improve the public health protection for sensitive subpopulations—especially children (reference 15). Children are much more sensitive, especially to the developing nervous system, from lead exposure. Because it is difficult to attain these levels, even in the United States, the EPA has allowed a number of years to attain this goal. Our EPCs (ranging from 0.07 ug/m^3 to 0.09 ug/m^3) are all below the new standards and well below the old one. Considering that we have a healthy Soldier population, in a subchronic exposure scenario, we feel that the EPCs are protective of our population.

8.2.6 Acrolein Toxicity Values

Acrolein toxicity values were separated from the rest of the chemicals for this screening risk assessment evaluation because initial risk estimates for acrolein showed the exposure levels exceeded the toxicity threshold. In order to ensure that an accurate toxicity threshold was being used for the inhalation of acrolein a detailed examination of the toxicity threshold was undertaken. The examination revealed that the assumptions used to derive the toxicity value are not representative of the potential health hazard in the deployment setting. The deployed population at BAF consists of healthy adults where severe chronic diseases and all but mild asthma should have been screened out from being deployed based on current U.S. Central Command (USCENTCOM) reporting instructions. The RfC is based on protecting children, the elderly, or the infirm. The deployed exposure is a "subchronic" one of up to 12 months as opposed to the chronic 30 year to a lifetime exposure for which the RfC is protective. Deconstructing the RfC, based on our model, the uncertainty factor of 10 that EPA used to be protective from a subchronic to chronic exposure will be removed. In addition, the deployed population should not experience a full factor of 10 in inter-individual sensitivities. We have provided a range of possible adjustments to the toxicity value: the full factor of 10, a factor of 5, and a factor of 3, in our calculations. Therefore, for all calculation of acrolein hazard quotients (HQs) and hazard indices (HIs) containing acrolein HQs, a range will be

provided to illustrate the range of toxicity values used. The range of toxicity values for acrolein can be found below in Annex 2 to Appendix C Table 12.

Annex 2 to Appendic C Table 12. Acrolein Toxicity Values

Chemical	RfC (mg/m^3)	Source	RfD_i (mg/kg-d)	Source	CSF_i $(mg/kg\text{-}d)^{-1}$	Source	Weight of Evidence Classification
Acrolein (no chronic-subchronic UF, interhuman UF 10)	2.00E-04	IRIS	5.71E-05	IRIS	N/A	N/A	I
Acrolein (no chronic-subchronic UF, interhuman UF 5)	4.00E-04	IRIS	1.14E-04	IRIS	N/A	N/A	I
Acrolein (no chronic-subchronic UF, interhuman UF 3)	6.67E-04	IRIS	1.91E-04	IRIS	N/A	N/A	I

Notes:
N/A=not applicable
Weight of Evidence=I: Inadequate data for an assessment of the human carcinogenic potential
Sources=IRIS (EPA, reference 3)

9 Risk Characterization

To characterize risk, toxicity, and exposure, assessments were summarized and combined into quantitative and qualitative expressions of risk. The risk characterization presents a separate evaluation of noncarcinogenic and carcinogenic effects. The EPA methodology distinguishes between the two because organisms typically respond differently following exposure to carcinogens as opposed to noncarcinogens. However, this does not indicate that a chemical cannot have both carcinogenic and noncarcinogenic effects. In such cases, the chemical is evaluated separately for both carcinogenic and noncarcinogenic effects.

9.1 Noncarcinogenic Effects

Risk characterization for noncarcinogenic effects involves calculating an HQ, which represents the ratio of the chronic average daily intake calculated in this evaluation for a specific chemical to the toxicological reference value (i.e., inhalation reference dose (RfD_i)) for that chemical. This ratio of exposure to toxicity is calculated according to the following:

Equation 2:

$$\text{Hazard Quotient} = \frac{\text{ADI (mg/kg-day)}}{RfD_i \text{ (mg/kg-day)}}$$

Where:
ADI = Average Daily Intake calculated in the exposure assessment
RfD_i = Inhalation Reference Dose identified in the Toxicity Assessment

The noncancer HQ assumes that there is a level of exposure (i.e., an RfD_i) below which it is unlikely for even sensitive populations to experience adverse health effects, even over a prolonged exposure (e.g., 30 years to a lifetime (when using the chronic RfDs). If the HQ does not exceed the threshold of 1.0 (i.e., if ADI/RfD_i does not exceed unity), the interpretation is that there is no concern for potential noncancer effects due solely to the chemical evaluated.

The individual HQs are summed over all chemicals to obtain an overall HI for the site. This approach assumes that simultaneous subthreshold exposures to several exposure pathways could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to respective exposures. An HI of less than or equal to 1.0 indicates that the occurrence of adverse health effects as a result of the evaluated chemical exposure is unlikely. When the HI exceeds unity (when an HI is greater than 1.0), there may be a concern for potential health effects, and the contributors are evaluated more closely for their potential combined effect(s).

9.2 Carcinogenic Effects

Cancer risk is expressed as a probability (for example, $1x10^{-6}$, or 1 in 1,000,000), which indicates the risk of additional incidences of cancer over a lifetime, above the normal background cancer rate, in an exposed population. Risk estimates represent the additional probability that individuals in a population will develop cancer over a lifetime as a result of exposure to a particular carcinogen. It is assumed by the methodology that the dose-response relationship will be linear in the low-dose portion of the multistage model dose-response curve. Under this assumption, the slope factor is a constant, and risk will be directly related to intake. The probabilities are derived by multiplying the estimated daily intake by the chemical-specific CSFs. This risk estimate is calculated according to the following:

Equation 3:

$$\text{Risk} = \text{CDI (mg/kg-day)} * \text{CSF}_i\,(\text{mg/kg-day})^{-1}$$

Where:
CDI = Chronic Daily Intake Averaged Over 70 Years (for carcinogens) from exposure assessment
CSF_i = Inhalation Cancer Slope Factor from Toxicity Assessment

Because the slope factor is often an upper 95^{th} percent confidence limit of the probability of a response and is based on animal data used in the multistage model, the carcinogenic risk will generally be an upper-bound estimate. This means that the "true risk" is not likely to exceed the risk estimate derived through this model and is likely to be less than predicted. Based on EPA guidance (reference 8) this assessment considers carcinogenic risks within the $1x10^{-4}$ to $1x10^{-6}$ range to be the point of departure for the consideration of whether the exposure levels are protective of human health.

9.3 Risk Results

For each evaluated exposure site (the overall base, Building 24064, the HLZ, and the Camp Sabalu-Harrison DFIP), hazard/risk was quantified for all compounds detected in those areas for intake through inhalation. The individual compound values were then combined to calculate the pathway risk. This represents the total scenario-specific risk for the site. Noncancer hazard and cancer risk were calculated using the equations presented above.

9.3.1 Noncancer Results

A noncancer HI was calculated for personnel present at BAF for 9 months and 6 months in the overall base, Building 24064, the HLZ, and the Camp Sabalu-Harrison DFIP. These are provided in Annex 2 to Appendix C Table 13. As a reminder, acrolein is not included in these results but is evaluated separately then incorporated below.

Annex 2 to Appendic C Table 13. Combined Noncancer Hazard Indices—Not Including Acrolein

Receptor	Overall Base	Building 24064	HLZ	DFIP
Personnel present for 9 months	0.84	**3.79**	0.95	0.39
Personnel present for 6 months	0.57	**2.51**	0.63	0.26

Note:
Per EPA guidelines, noncancer health hazards are assessed as "acceptable" or "safe" if the hazard index (HI) is less than 1.0 (i.e., if the sum of the ratios is below 1.0 for all chemicals of concern (COC)). An HI above 1.0 indicates a potential for health effects under the specific exposure conditions chosen. It does not indicate that a health effect will occur; however, the safety margin for protection is being breached so further evaluation is necessary.

No COPC exceeded its toxicity value (HQ was less than one for each COPC) for the overall base, HLZ, and DFIP locations. However, trichloroethene exceded its toxicity value (HQ was greated than one) for the Building 24064 location. No other COPC exceeded its toxicity value (HQ was less than one for each other COPC) for the Building 24064 location. The combination of a number of COPCs contributed to the each location exceeding the HI of 1.0 for personnel present for 9 months and to the overall base, Building 24064, and HLZ location exceeding the HI of 1.0 for personel present for 6 months. As previously discussed, an HI above 1 does not indicate that a health effect *will* occur but that there may be concern for potential noncancer effects and there should be further evaluation. Hazard quotients for acrolein using the various toxicity values are found in Annex 2 to Appendix C Tables 14-16. The acrolein HQs were combined with the HIs of all other COPCs to create a range of HIs including acrolein that are provided in Annex 2 to Appendix C Table 17, below.

Annex 2 to Appendic C Table 14. Acrolein Noncancer Hazard Quotients Using the Acrolein Toxicity Value that Incorporated No Chronic/Subchronic Uncertainty Factor and an Interhuman Uncertainty Factor of 10

Receptor	Overall Base	Building 24064	HLZ	DFIP
Personnel present for 9 months	**7.06**	**4.72**	**9.11**	**3.35**
Personnel present for 6 months	**4.70**	**3.14**	**6.07**	**2.23**

Annex 2 to Appendic C Table 15. Acrolein Noncancer Hazard Quotients Using the Acrolein Toxicity Value that Incorporated No Chronic/Subchronic Uncertainty Factor and an Interhuman Uncertainty Factor of 5

Receptor	Overall Base	Building 24064	HLZ	DFIP
Personnel present for 9 months	**3.53**	**2.36**	**4.56**	**1.68**
Personnel present for 6 months	**2.35**	**1.57**	**3.04**	**1.12**

Annex 2 to Appendic C Table 16. Acrolein Noncancer Hazard Quotients Using the Acrolein Toxicity Value that Incorporated No Chronic/Subchronic Uncertainty Factor and an Interhuman Uncertainty Factor of 3

Receptor	Overall Base	Building 24064	HLZ	DFIP
Personnel present for 9 months	**2.12**	**1.41**	**2.73**	**1.01**
Personnel present for 6 months	**1.41**	0.94	**1.82**	0.67

Annex 2 to Appendic C Table 17. Noncancer Hazard Indices—Including Acrolein

Receptor	Overall Base	Building 24064	HLZ	DFIP
Personnel present for 9 months	**2.96-7.90**	**5.20-8.51**	**3.68-10.06**	**1.40-3.74**
Personnel present for 6 months	**1.98-5.27**	**3.45-5.65**	**2.45-6.70**	0.93-**2.49**

Notes:
The HIs are presented as ranges to show the upper and lower bounds calculated by varying the assumed protective factors used to develop the reference dose and incorporating EPC sensitivity analysis. Per EPA guidelines, noncancer health hazards are assessed as unlikely for even sensitive populations to experience adverse health effects if the HI is less than 1.0; (i.e., if the sum of the ratios is below 1.0 for all COC). An HI above 1.0 indicates a potential for health effects under the specific exposure conditions chosen. It does not indicate that a health effect will occur; however there may be concern for potential noncancer effects so further evaluation is necessary.

With the inclusion of acrolein the only COPC that exceeded its toxicity value at all locations was acrolein. As noted above trichloroethene exceeded its toxicity value only at the Building 24064 location. The combination of the COPCs contributed to the non-cancer HI ranges at all locations exceeding the HI of 1.0 for personnel present for 9 months and 6 months. An HI above 1 does not indicate that a health effect *will* occur but that there may be concern for potential noncancer effects.

9.3.2 Carcinogenic Risk Results

Carcinogenic risk was also calculated for the two receptors for each of the sampling schemes. The cancer risk range for consideration of whether the exposure levels are protective of human health for this assessment is $1x10^{-4}$ to $1x10^{-6}$. Total cancer risks for all receptors at all of the exposure points are within the cancer risk range where management of risk should be considered. Annex 2 to Appendix C Table 18 lists all of the cumulative cancer risk levels calculated in this assessment. The complete results of the quantitative screening risk assessment can be found in Annex 5 to Appendix C.

Annex 2 to Appendic C Table 18. Cancer Risk Levels

Receptor	Overall Base	Building 24064	HLZ	DFIP
Personnel present for 9 months	2E-06	2E-06	3E-06	2E-06
Personnel present for 6 months	1E-06	1E-06	2E-06	2E-06

Note:
According to guidelines provided by the EPA, this assessment considers carcinogenic risks within the $1x10^{-4}$ to $1x10^{-6}$ range to be the point of departure for the consideration of whether the exposure levels are protective of human health.

10 Uncertainty

The process of evaluating risk uses principles drawn from many scientific disciplines including chemistry, toxicology, physics, mathematics, and statistics. Because the data sets used in the calculations are incomplete, many assumptions are required. Therefore, calculated numerical risk values contain inherent uncertainties. While uncertainty from different sources is cumulative for the overall risk results, certain assumptions create more uncertainty in the risk results than others. There are uncertainties associated with each component of the screening risk assessment from data collection through risk characterization, which are discussed below. This risk evaluation should not be construed as presenting an absolute frequency of expected health affects in the populations modeled. Rather, it is an estimate intended to indicate the potential for occurrence of adverse health impacts under the exposure conditions evaluated. While all of these individual uncertainties reduce confidence in the risk estimates provided, it is important to recognize that some of these uncertainties are inherent to the performance of any HRA, and others are a function of the unique challenges presented in the assessment of the health risk associated with ambient air at BAF.

10.1 Uncertainty in Data Collection and Evaluation

10.1.1 Uncertainties in the Data Collection and Evaluation

Uncertainties in the data collection/evaluation step of the screening risk assessment limit determining whether enough samples were collected to adequately characterize the risk and also limit determining if sample analyses were conducted in a qualified manner to maximize the confidence in the results. There is also uncertainty due to the design of the sampling strategy. Errors introduced to the air sampling data are expected to predominately occur during filter pre- and post-sampling weightings ($PM_{2.5}$ and metals); field measurements of sampling equipment pre- and post-flow rates and subsequent total sampling volume calculations; sample media cross contamination; and laboratory mass detection analysis errors of target analytes. Typically variation introduced by such errors is less than ten percent.

Through routine handling of $PM_{2.5}$/metals quartz fiber filters, small mass fractions of the filter may separate and not be recovered, thus, reducing measured post weights and $PM_{2.5}$ and metals concentrations. This error is minimized through proper training of personnel on media-handling procedures. Total air sampling volumes, which are used to calculate actual ambient concentrations of target analytes, are measured using calibrated instruments and by personnel who have been properly trained to minimize errors. Media cross contamination occasionally occurs when target analytes are accidentally introduced to the sampling media through normal handling and is minimized with proper personnel training.

Errors due to volatilization of collected target analytes are monitored through “pre-spiking” media with traceable target compounds, which must then be recovered within methodology-specified percentage values. This volatilization is minimized through proper storage and shipping procedures that include media storage in cool areas and prompt media analysis. Media which do not meet these specified recovery percentages are generally not reported. Other expected laboratory errors are minimized through internal chemical standards, procedures, and laboratory personnel training.

10.1.2 Ambient Air

Because the ambient air at the site is influenced by airborne chemicals released from a large number of emission sources at BAF (gasoline powered vehicles and combustion engines,

combustion and bulk storage petroleum emissions at the BAF airport, combustion of solid wastes in waste incinerators), it is impossible to attribute all of the chemical concentrations in the ambient air to one source. Therefore, risk estimates can only speak to exposure to the ambient air at the site.

10.1.3 Analytical Data

When analytical data is produced by the laboratory, various qualifiers can be attached to certain data. One such qualifier is the J-qualifier. J-qualified data indicates that the compound was detected at or above the statistically determined method detection limit but was below the validated/verified quantitation limit (which is most appropriately not below the low standard in the calibration curve). In these cases, the lab is confident the analyte is present (99 percent confidence the compound is present if standard method detection limit determination procedures are followed). However, there is much less confidence in the accuracy of the result generated. So a J-flag could be interpreted as meaning "the analyte is there, at some concentration below the quantitation limit and above the MDL, but there is very little confidence in the actual concentration generated by the instrument."

The degree of uncertainty due to the lack of confidence in the actual concentration is exacerbated because the estimated values are very imprecise. When the analysis on the same sample for a nonqualified result is rerun, there is a known confidence that the new result will be within a certain percentage of the previously reported result. On the other hand, when the analysis on the same sample for a J qualified, estimated result is rerun a confidence range for the new result compared to the previously reported result cannot be defined. This makes the J-qualified estimated results more of a random value each time it is reanalyzed.

According to EPA guidance (reference 3), despite the imprecision of these values, these J-qualified concentrations were used in the same manner as data without this qualifier were used. Because the J-qualified concentrations vary, it is impossible to state whether the J-qualified concentration that was used in the risk estimates overestimates, or underestimates the potential for risk. However, the mere inclusion of these greatly uncertain J-qualified data ensures that a more conservative risk estimate is calculated, compared to a risk estimate which eliminated the J-qualified data because the quality of such data is in question.

The analytical methodology used for this screening risk assessment employs a detection limit for acrolein that is higher than its EPA recommended RfC. This creates the possibility that a sample of acrolein would be below the detection limit (where the sample would be managed as any other nondetected sample) while being above the RfC (where the concentration in the sample has the potential to cause adverse health effects). This does not mean that nondetected samples of acrolein will cause adverse health effects but the low RfC in comparison to the detection limit introduces the potential for nondetected acrolein samples to underestimate risk estimates of exposure to acrolein.

10.2 Uncertainty in Exposure Assessment

Once pathways are identified, EPCs must be estimated. There is always some doubt as to how well an exposure model approximates the actual conditions receptors will be exposed to at a given site. Key assumptions in estimating EPCs and exposure assumptions and their potential impact on the assessment are described in the following paragraphs:

- There are many factors which determine the level of exposure for each exposure pathway. These factors include inhalation rates, EFs, EDs, and BW. The values for these exposure

factors must be selected by the risk assessor to represent each receptor. For the scenarios in this screening risk assessment, upper-bound values were selected for each exposure factor. These multiple upper-bound exposure factor estimates compound to yield intake, which overestimate likely exposure levels. However, an individual could exceed the values used and would, therefore, represent a higher potential risk than was estimated in the assessment.

- The EPCs derived from the measured chemical concentrations are assumed to persist without change for the entire duration of each exposure scenario. It is possible that chemical concentrations in the air will change over time. Unfortunately, it is not known whether the quality will improve or degrade. Therefore, this steady-state assumption could tend to under or overestimate exposure levels.

10.3 Uncertainty in the Toxicity Assessment

There is considerable uncertainty inherent in the toxicity values for both carcinogens and noncarcinogens. These include the identification of potential health effects, the derivation of toxicity values, route-to-route extrapolation of toxicity values, and the lack of toxicity values for all COPCs. Most of the data on health effects comes from animal studies. The EPA collects and evaluates all known studies for each chemical. It uses the most sensitive animal study available and the adverse effect that occurs at the lowest dose to derive, by the application of uncertainty and modifying factors, the RfD for noncarcinogens. Humans are assumed to be even more sensitive than the most sensitive animal. The health effect in humans may not be the same, so human data are sought to corroborate the animal data. The same data-evaluation process takes place for carcinogens except the data are extrapolated to humans by using the 95th percent UCL of the mean slope from the primary study used to derive the CSF; toxicity constants often incorporate safety factors to compensate for uncertainty. Because of these methods to compensate for uncertainty in the toxicity study, chemical-specific risks may be overestimated.

Another source of uncertainty is the route-to-route extrapolation of toxicity values. Toxicity values are route-specific because absorption and metabolism vary with route of entry. Because inhalation toxicity criteria were unavailable for all chemicals evaluated, surrogate values were calculated based on oral values in some cases. This assumption may result in either an underestimation or an overestimation of risk.

Uncertainty in the toxicity assessment for dioxins is present due to the EPA's reassessment in 2003 of the toxicity of 2,3,7,8-TCDD (reference 16). The reassessment provides a draft CSF, which is six times higher than the CSF that was recommended by the EPA in 1989 and which was used in this screening risk assessment. Because the 2003 reassessment, draft CSF is under review and has not been accepted as a final value; the 1989 CSF was used for this assessment.

10.4 Uncertainty in Risk Characterization

Uncertainties in the toxicity assessment are compounded under the assumption of dose additivity for multiple substance/pathway exposure. That assumption ignores possible synergism and antagonisms among chemicals, and assumes similarity in mechanisms of action and metabolism. Overall, these assumptions could tend to under or overestimate risk. Similarly, risks summed for chemicals having different target organs may also tend to overestimate risk.

11 Conclusion

11.1 Noncarcinogenic Risk

As previously discussed, an HI above 1 does not indicate that a health effect will occur but that there are indications that there may be concern for potential noncancer effects and there should be further evaluation of potential health effects. Some of the range of HIs were greater than 1, although only acrolein and trichloroethene had individual HQs that were greater than 1.

Based on our evaluation, long-term health effects from exposure to the chemicals evaluated are not expected. Acrolein has short-term health effects such as mucous membrane irritation (eye, nose, throat, lungs) and lightheadedness or drowsiness. At concentrations of those detected during this sampling effort, Service Members may experience these short-term symptoms.

More sensitive individuals such as asthmatics might be more prone to develop worse symptoms, such as wheezing or bronchitis. These symptoms may last longer than the momentary or short-term irritation associated with concentrations of acrolein; however they are expected to be reversible because of the limited, subchronic time of exposure and the minimally elevated intermittent concentrations expected to be experienced.

Acrolein is also a VOC and a potent irritant of mucous membranes. The acrolein HQs were frequently above 1 so there is a concern for eye, nose, throat or lung irritation or bronchitis during excursions of higher concentrations—especially in sensitive individuals. The irritant effects of acrolein may compound the irritant effects of the other VOCs, which can be found in the ambient air. As discussed above, and for the same reasons, long-term health effects would not be expected for these sub-chronic exposures. However, it is wise to consider measures to reduce exposure wherever possible.

The most common adverse health effect of inhalation of trichloroethene is linked to effects on the central nervous system such as reduced motor coordination, nausea, headaches, and dizziness. At concentrations higher than those detected at the sampling points inhalation of trichloroethene can also have similar health effects as acrolein—irritation of the mucous membranes, the eyes and, the respiratory tract. The trichlorethene HQs at Building 24064 were above 1 so there is a concern for central nervous system effects and eye, nose, throat or lung irritation during excursions of higher concentrations at this location—especially in sensitive individuals.

It should be noted that trichloroethene was only detected above the reporting limit in one sample, located at Building 24064. It is likely that the single concentration detected above the reporting limit was a rare occurrence and exposure to trichloroethene at concentrations equivalent to the Building 24064 EPC occurs infrequenctly and for limited durations. The central nervous system health effects of short-term overexposure typically clear up within a few hours after exposure ceases. Therefore, personnel located at Building 24064 are unlikely to experience long-term central nervous system health effects from exposure to the concentrations at Building 24064.

Other than acute (short-term onset/reversible) respiratory irritation and central nervous system effects as discussed above, no other types of illness would be expected as a result of exposure to ambient airborne chemical pollutants measured at Bagram Airfield.

11.2 Carcinogenic Risk

Although some of the COPCs are carcinogenic, the level of exposure does not exceed the EPA's acceptable cancer risk range.

The exposure levels of the receptors to carcinogenic COPCs are within the exposure levels that the EPA generally considers acceptable excess lifetime cancer risk. However, risk within this range of exposure levels should not be used as an absolute measure to determine whether the risk is acceptable. Management of risk should be considered for exposure levels that result in cancer risks from $1x10^{-4}$ to $1x10^{-6}$.

The estimated cancer risks are protective of sensitive populations (asthmatics, children, and the elderly). However because personnel at BAF are not part of a sensitive population and cancer risks for all receptors at all locations were at the more protective end of the range ($1x10^{-6}$), it is unlikely that exposure to carcinogenic COPCs will result in increased cancer risk. Though increased risk of cancer is not expected from this deployment it is always wise whenever possible to reduce exposure to carcinogens.

12 Recommendations

Identify and implement applicable steps to help reduce the emission of COPCs from military operations into the ambient air at BAF. Efforts that are easily implemented and not costly should be implemented at the earliest opportunity.

Consider management controls to reduce the exposure of personnel to ambient air when air quality is poorest (e.g., avoid physical training exercises when inversions occur and air quality is poor.)

Annex 3 to Appendix C
References

1. AIPH. 2011. Military Deplpoyment Periodic Occupational and Environmental Monitoring Summary (POEMS): Bagram Air Field, Afghanistan CY: (2002-2010).

2. USEPA. 1989. EPA/540/1-89/002, Risk Assessment Guidance for Superfund. Office of Emergency and Remedial Response.

3. USEPA. 2007. Integrated Risk Information System (IRIS) [database on the internet]. Washington, DC: U.S. Environmental Protection Agency, National Center for Environmental Assessment. [updated 31 Jul 2007; cited Aug 2007].
Available from: (*http://www.epa.gov/iris/*)

4. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-9A, Determination Of Polychlorinated, Polybrominated And Brominated/Chlorinated Dibenzo-p-Dioxins And Dibenzofurans In Ambient Air. Center for Environmental Research Information Office of Research and Development.

5. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-13A Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS). Center for Environmental Research Information Office of Research and Development.

6. USEPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition, Compendium Method TO-15A, Determination Of Volatile Organic Compounds (VOCs) In Ambient Air Using Specially Prepared Canisters With Subsequent Analysis By Gas Chromatography. Center for Environmental Research Information Office of Research and Development.

7. USEPA. 1999. Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air. Center for Environmental Research Information Office of Research and Development.

8. USEPA. 1997. EPA/600/P-95/002Fa, Exposure Factors Handbook, Volume I General Factors. Office of Research and Development.

9. Van den Berg et al. 2006. The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. *Toxicological Sciences* 2006;93:223-241.

10. USEPA. 1997. EPA-540-R-97-036, Health Effects Summary Tables (HEAST): Annual Update, FY1997. Washington, DC: U.S. EPA, Office of Research and Development and Office of Emergency and Remedial Response.

11. USEPA. 2004. Mid-Atlantic Risk Assessment, Human Health Risk Assessment, Risk-Based Concentration Table [homepage on the Internet]. Philadelphia, PA: U.S. EPA Region III. [updated 2004; cited 2004 Sep]. Region 3 Risk Based Concentration (RBC) Table October 2004 Update download. (Available from: *http://www.epa.gov/reg3hwmd/risk*.)

12. NYSDOH. 2006. Guidance for Evaluating Soil Vapor Intrusion in the State of New York.. New York State Department of Health, Center for Environmental Health, Bureau of Environmental Exposure Investigation; October 2006.

13. USEPA. Provisional Peer Reviewed Toxicity Values for 1,2,4-Trimethylbenzene (CASRN 95-63-6). Cincinnati (OH): US Environmental Protection Agency, National Center for Environmental Assessment, Superfund Health Risk Technical Support Center; 11 June 2007.

14. USEPA. PPRTV Derivation Support Document for 1,3,5-Trimethylbenzene (CASRN 108-67-8)(No. 98-023). Cincinnati (OH): US Environmental Protection Agency, National Center for Environmental Assessment, Superfund Technical Support Center; August 2003.

15. USEPA. 2008. National Ambient Air Quality Standards (NAAQS). US EPA. [updated October 7, 2008; cited February 2009]. (Available from: *http://www.epa.gov/air/criteria.html*.)

15. USEPA. 2002. EPA/600/P-00/001Cb, Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-*p*-Dioxin (TCDD) and Related Compounds (National Academy Science Review Draft). Washington, DC: U.S. EPA, Office of Research and Development.

Annex 4 to Appendix C
Air Sampling Data

Annex 4 to Appendix C Table 21. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130912_TO09_01	AFG_BAGRAM_20130913_TO09_01	AFG_BAGRAM_20130914_TO09_01	AFG_BAGRAM_20130915_TO09_01	AFG_BAGRAM_20130916_TO09_01	AFG_BAGRAM_20130917_TO09_01
Collection Date	2013/09/12 0849	2013/09/13 0927	2013/09/14 0925	2013/09/15 0932	2013/09/16 0934	2013/09/17 0937
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	**5.31E-07**	**5.26E-07**	**5.74E-07**	**6.17E-07**	**4.86E-07**	**5.34E-07**
1,2,3,4,6,7,8-HeptaCDF	**5.31E-07**	9.46E-07	**5.74E-07**	**6.17E-07**	*1.94E-07*	6.94E-07
1,2,3,4,7,8,9-HeptaCDF	**5.31E-07**	**5.26E-07**	**5.74E-07**	**6.17E-07**	**4.86E-07**	**5.34E-07**
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	**5.31E-07**	*4.68E-07*	**5.74E-07**	**6.17E-07**	**4.86E-07**	*3.84E-07*
1,2,3,6,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	**5.31E-07**	*4.26E-07*	**5.74E-07**	**6.17E-07**	**4.86E-07**	*4.22E-07*
1,2,3,7,8,9-HexaCDD	**5.31E-07**	**5.26E-07**	**5.74E-07**	**6.17E-07**	**4.86E-07**	**5.34E-07**
1,2,3,7,8,9-HexaCDF	**5.31E-07**	**5.26E-07**	**5.74E-07**	**6.17E-07**	**4.86E-07**	**5.34E-07**
1,2,3,7,8-PentaCDD	**5.31E-07**	**5.26E-07**	**5.74E-07**	**6.17E-07**	**4.86E-07**	**5.34E-07**
1,2,3,7,8-PentaCDF	**5.31E-07**	*3.31E-07*	**5.74E-07**	**6.17E-07**	**4.86E-07**	*3.79E-07*
2,3,4,6,7,8-HexaCDF	**5.31E-07**	*3.26E-07*	**5.74E-07**	**6.17E-07**	**4.86E-07**	*2.46E-07*
2,3,4,7,8-PentaCDF	**5.31E-07**	*4.57E-07*	**5.74E-07**	**6.17E-07**	**4.86E-07**	*4.32E-07*
2,3,7,8-TetraCDD	**1.06E-07**	**1.05E-07**	**1.15E-07**	*5.31E-08*	**9.72E-08**	*5.28E-08*
2,3,7,8-TetraCDF	**1.06E-07**	2.58E-07	**1.15E-07**	**1.23E-07**	*7.78E-08*	3.52E-07
OctaCDD	**1.06E-06**	**1.05E-06**	**1.15E-06**	**1.23E-06**	**9.72E-07**	**1.07E-06**
OctaCDF	**1.06E-06**	**1.05E-06**	**1.15E-06**	**1.23E-06**	**9.72E-07**	**1.07E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 22. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130918_TO09_01	AFG_BAGRAM_20130919_TO09_01	AFG_BAGRAM_20130920_TO09_01	AFG_BAGRAM_20130921_TO09_01	AFG_BAGRAM_20130922_TO09_01	AFG_BAGRAM_20130923_TO09_01
Collection Date	2013/09/18 0926	2013/09/19 0939	2013/09/20 0936	2013/09/21 0939	2013/09/22 0946	2013/09/23 0952
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	**5.10E-07**	**5.35E-07**	**5.80E-07**	**5.49E-07**	**5.42E-07**	**5.39E-07**
1,2,3,4,6,7,8-HeptaCDF	6.63E-07	1.02E-06	*4.81E-07*	7.14E-07	7.05E-07	*4.69E-07*
1,2,3,4,7,8,9-HeptaCDF	**5.10E-07**	**5.35E-07**	**5.80E-07**	**5.49E-07**	**5.42E-07**	**5.39E-07**
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	*3.26E-07*	*4.44E-07*	*2.61E-07*	*2.86E-07*	*3.09E-07*	*2.86E-07*
1,2,3,6,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	*3.47E-07*	*4.44E-07*	*2.38E-07*	*2.31E-07*	*2.87E-07*	*1.94E-07*
1,2,3,7,8,9-HexaCDD	**5.10E-07**	**5.35E-07**	**5.80E-07**	**5.49E-07**	**5.42E-07**	**5.39E-07**
1,2,3,7,8,9-HexaCDF	**5.10E-07**	**5.35E-07**	**5.80E-07**	**5.49E-07**	**5.42E-07**	**5.39E-07**
1,2,3,7,8-PentaCDD	**5.10E-07**	**5.35E-07**	**5.80E-07**	**5.49E-07**	**5.42E-07**	**5.39E-07**
1,2,3,7,8-PentaCDF	*3.31E-07*	*4.12E-07*	*2.49E-07*	*1.98E-07*	*2.22E-07*	*2.7E-07*
2,3,4,6,7,8-HexaCDF	*2.55E-07*	*2.89E-07*	**5.80E-07**	*1.87E-07*	*1.84E-07*	**5.39E-07**
2,3,4,7,8-PentaCDF	*3.47E-07*	*4.65E-07*	*2.9E-07*	*2.75E-07*	*2.49E-07*	*2.43E-07*
2,3,7,8-TetraCDD	**1.02E-07**	**1.07E-07**	*5.1E-08*	**1.10E-07**	**1.08E-07**	*6.47E-08*
2,3,7,8-TetraCDF	2.96E-07	3.53E-07	2.73E-07	1.92E-07	1.84E-07	1.94E-07
OctaCDD	**1.02E-06**	**1.07E-06**	**1.16E-06**	**1.10E-06**	*9.21E-07*	**1.08E-06**
OctaCDF	**1.02E-06**	**1.07E-06**	**1.16E-06**	**1.10E-06**	**1.08E-06**	**1.08E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 23. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130924_TO09_01	AFG_BAGRAM_20130925_TO09_01	AFG_BAGRAM_20130926_TO09_01	AFG_BAGRAM_20130912_TO09_02	AFG_BAGRAM_20130913_TO09_02	AFG_BAGRAM_20130914_TO09_02
Collection Date	2013/09/24 0954	2013/09/25 0955	2013/09/26 1001	2013/09/12 0925	2013/09/13 1002	2013/09/14 1015
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	**6.30E-07**	**5.72E-07**	**5.58E-07**	**4.61E-07**	**3.86E-07**	**5.35E-07**
1,2,3,4,6,7,8-HeptaCDF	6.93E-07	7.44E-07	*4.13E-07*	**4.61E-07**	8.50E-07	**5.35E-07**
1,2,3,4,7,8,9-HeptaCDF	**6.30E-07**	**5.72E-07**	**5.58E-07**	**4.61E-07**	**3.86E-07**	**5.35E-07**
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	*3.72E-07*	*3.78E-07*	*2.29E-07*	**4.61E-07**	4.25E-07	**5.35E-07**
1,2,3,6,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	*2.9E-07*	*3.43E-07*	*2.34E-07*	**4.61E-07**	4.25E-07	**5.35E-07**
1,2,3,7,8,9-HexaCDD	**6.30E-07**	**5.72E-07**	**5.58E-07**	**4.61E-07**	**3.86E-07**	**5.35E-07**
1,2,3,7,8,9-HexaCDF	**6.30E-07**	**5.72E-07**	**5.58E-07**	**4.61E-07**	**3.86E-07**	**5.35E-07**
1,2,3,7,8-PentaCDD	**6.30E-07**	**5.72E-07**	**5.58E-07**	**4.61E-07**	**3.86E-07**	**5.35E-07**
1,2,3,7,8-PentaCDF	*3.15E-07*	*3.15E-07*	*1.9E-07*	**4.61E-07**	*2.98E-07*	**5.35E-07**
2,3,4,6,7,8-HexaCDF	*2.08E-07*	*2.46E-07*	**5.58E-07**	**4.61E-07**	*2.67E-07*	**5.35E-07**
2,3,4,7,8-PentaCDF	*3.02E-07*	*4.29E-07*	*2.12E-07*	**4.61E-07**	4.25E-07	**5.35E-07**
2,3,7,8-TetraCDD	*6.3E-08*	*5.72E-08*	**1.12E-07**	**9.21E-08**	*5.02E-08*	**1.07E-07**
2,3,7,8-TetraCDF	2.83E-07	3.09E-07	1.84E-07	**9.21E-08**	2.55E-07	**1.07E-07**
OctaCDD	**1.26E-06**	**1.14E-06**	**1.12E-06**	**9.21E-07**	**7.73E-07**	**1.07E-06**
OctaCDF	**1.26E-06**	**1.14E-06**	**1.12E-06**	**9.21E-07**	**7.73E-07**	**1.07E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 24. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130915_TO09_02	AFG_BAGRAM_20130916_TO09_02	AFG_BAGRAM_20130917_TO09_02	AFG_BAGRAM_20130918_TO09_02	AFG_BAGRAM_20130919_TO09_02	AFG_BAGRAM_20130920_TO09_02
Collection Date	2013/09/15 0940	2013/09/16 0945	2013/09/17 0952	2013/09/18 0942	2013/09/19 0937	2013/09/20 0942
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	**4.97E-07**	**4.61E-07**	*1.82E-07*	*1.65E-07*	*2.73E-07*	**5.28E-07**
1,2,3,4,6,7,8-HeptaCDF	**4.97E-07**	5.54E-07	1.36E-06	1.16E-06	1.91E-06	6.33E-07
1,2,3,4,7,8,9-HeptaCDF	**4.97E-07**	**4.61E-07**	**5.05E-07**	**4.85E-07**	**5.15E-07**	**5.28E-07**
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	**4.97E-07**	*2.58E-07*	7.08E-07	6.31E-07	9.28E-07	*3.11E-07*
1,2,3,6,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	**4.97E-07**	*2.49E-07*	7.58E-07	6.31E-07	8.76E-07	*2.8E-07*
1,2,3,7,8,9-HexaCDD	**4.97E-07**	**4.61E-07**	**5.05E-07**	**4.85E-07**	**5.15E-07**	**5.28E-07**
1,2,3,7,8,9-HexaCDF	**4.97E-07**	**4.61E-07**	**5.05E-07**	**4.85E-07**	**5.15E-07**	**5.28E-07**
1,2,3,7,8-PentaCDD	**4.97E-07**	**4.61E-07**	**5.05E-07**	**4.85E-07**	**5.15E-07**	**5.28E-07**
1,2,3,7,8-PentaCDF	**4.97E-07**	*2.12E-07*	6.07E-07	5.82E-07	6.70E-07	*2.74E-07*
2,3,4,6,7,8-HexaCDF	**4.97E-07**	*1.75E-07*	*4.6E-07*	*3.93E-07*	5.67E-07	*1.9E-07*
2,3,4,7,8-PentaCDF	**4.97E-07**	*2.45E-07*	7.08E-07	5.82E-07	8.76E-07	*3.17E-07*
2,3,7,8-TetraCDD	**9.95E-08**	*4.2E-08*	*6.57E-08*	*6.31E-08*	*7.21E-08*	*4.38E-08*
2,3,7,8-TetraCDF	**9.95E-08**	1.75E-07	5.56E-07	5.34E-07	6.18E-07	3.06E-07
OctaCDD	**9.95E-07**	**9.23E-07**	**1.01E-06**	**9.71E-07**	*4.69E-07*	**1.06E-06**
OctaCDF	**9.95E-07**	**9.23E-07**	**1.01E-06**	**9.71E-07**	**1.03E-06**	**1.06E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 25. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130921_TO09_02	AFG_BAGRAM_20130922_TO09_02	AFG_BAGRAM_20130923_TO09_02	AFG_BAGRAM_20130924_TO09_02	AFG_BAGRAM_20130925_TO09_02	AFG_BAGRAM_20130926_TO09_02
Collection Date	2013/09/21 0941	2013/09/22 0945	2013/09/23 0946	2013/09/24 0951	2013/09/25 0952	2013/09/26 0950
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	*2.64E-07*	*2.33E-07*	**4.94E-07**	*2.03E-07*	*2.59E-07*	*1.86E-07*
1,2,3,4,6,7,8-HeptaCDF	1.95E-06	1.77E-06	1.04E-06	1.85E-06	1.69E-06	1.36E-06
1,2,3,4,7,8,9-HeptaCDF	**5.28E-07**	**5.06E-07**	**4.94E-07**	**5.96E-07**	**5.62E-07**	**5.02E-07**
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	8.45E-07	8.10E-07	5.43E-07	1.01E-06	8.43E-07	7.03E-07
1,2,3,6,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	7.40E-07	7.09E-07	*4.3E-07*	8.34E-07	7.87E-07	6.53E-07
1,2,3,7,8,9-HexaCDD	**5.28E-07**	**5.06E-07**	**4.94E-07**	**5.96E-07**	**5.62E-07**	**5.02E-07**
1,2,3,7,8,9-HexaCDF	**5.28E-07**	**5.06E-07**	**4.94E-07**	**5.96E-07**	**5.62E-07**	**5.02E-07**
1,2,3,7,8-PentaCDD	**5.28E-07**	**5.06E-07**	**4.94E-07**	**5.96E-07**	**5.62E-07**	**5.02E-07**
1,2,3,7,8-PentaCDF	5.28E-07	6.08E-07	*3.36E-07*	7.75E-07	6.75E-07	5.53E-07
2,3,4,6,7,8-HexaCDF	*5.07E-07*	5.06E-07	*2.96E-07*	5.96E-07	*4.78E-07*	*3.92E-07*
2,3,4,7,8-PentaCDF	6.87E-07	7.09E-07	*4.59E-07*	9.53E-07	8.43E-07	7.03E-07
2,3,7,8-TetraCDD	**1.06E-07**	**1.01E-07**	**9.88E-08**	*1.01E-07*	**1.12E-07**	*8.54E-08*
2,3,7,8-TetraCDF	4.91E-07	4.66E-07	2.96E-07	5.96E-07	5.51E-07	4.97E-07
OctaCDD	*3.75E-07*	*3.6E-07*	**9.88E-07**	**1.19E-06**	**1.12E-06**	**1.00E-06**
OctaCDF	*4.33E-07*	**1.01E-06**	**9.88E-07**	**1.19E-06**	**1.12E-06**	**1.00E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 26. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_SABALU_20130912_TO09	AFG_SABALU_20130913_TO09	AFG_SABALU_20130914_TO09	AFG_SABALU_20130915_TO09	AFG_SABALU_20130916_TO09	AFG_SABALU_20130917_TO09
Collection Date	2013/09/12 1210	2013/09/13 1159	2013/09/14 1118	2013/09/15 1035	2013/09/16 1059	2013/09/17 1044
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	**5.17E-07**	**5.30E-07**	**5.74E-07**	**5.09E-07**	*2.24E-07*	*2.98E-07*
1,2,3,4,6,7,8-HeptaCDF	**5.17E-07**	*4.82E-07*	**5.74E-07**	**5.09E-07**	1.63E-06	2.66E-06
1,2,3,4,7,8,9-HeptaCDF	**5.17E-07**	**5.30E-07**	**5.74E-07**	**5.09E-07**	**5.10E-07**	*1.78E-07*
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	**5.17E-07**	*2.86E-07*	**5.74E-07**	**5.09E-07**	6.63E-07	1.25E-06
1,2,3,6,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	**5.17E-07**	*2.86E-07*	**5.74E-07**	**5.09E-07**	6.63E-07	1.25E-06
1,2,3,7,8,9-HexaCDD	**5.17E-07**	**5.30E-07**	**5.74E-07**	**5.09E-07**	**5.10E-07**	**5.22E-07**
1,2,3,7,8,9-HexaCDF	**5.17E-07**	**5.30E-07**	**5.74E-07**	**5.09E-07**	**5.10E-07**	*2.3E-07*
1,2,3,7,8-PentaCDD	**5.17E-07**	**5.30E-07**	**5.74E-07**	**5.09E-07**	**5.10E-07**	*1.98E-07*
1,2,3,7,8-PentaCDF	**5.17E-07**	*2.12E-07*	**5.74E-07**	**5.09E-07**	*4.94E-07*	8.88E-07
2,3,4,6,7,8-HexaCDF	**5.17E-07**	**5.30E-07**	**5.74E-07**	**5.09E-07**	*4.69E-07*	7.83E-07
2,3,4,7,8-PentaCDF	**5.17E-07**	*2.33E-07*	**5.74E-07**	**5.09E-07**	6.12E-07	1.15E-06
2,3,7,8-TetraCDD	**1.03E-07**	*5.09E-08*	**1.15E-07**	**1.02E-07**	*8.15E-08*	*9.92E-08*
2,3,7,8-TetraCDF	**1.03E-07**	1.96E-07	**1.15E-07**	*5.6E-08*	1.78E-07	7.31E-07
OctaCDD	**1.03E-06**	**1.06E-06**	**1.15E-06**	**1.02E-06**	**1.02E-06**	**1.04E-06**
OctaCDF	**1.03E-06**	**1.06E-06**	**1.15E-06**	**1.02E-06**	**1.02E-06**	**1.04E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 27. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_SABALU_20130918_TO09	AFG_SABALU_20130919_TO09	AFG_SABALU_20130920_TO09	AFG_SABALU_20130921_TO09	AFG_SABALU_20130922_TO09	AFG_SABALU_20130923_TO09
Collection Date	2013/09/18 1054	2013/09/19 1101	2013/09/20 1111	2013/09/21 1127	2013/09/22 1101	2013/09/23 1052
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	*3.20E-07*	*4.85E-07*	*2.13E-07*	*4.90E-07*	*3.90E-07*	*2.72E-07*
1,2,3,4,6,7,8-HeptaCDF	2.44E-06	3.94E-06	1.56E-06	3.88E-06	3.65E-06	2.29E-06
1,2,3,4,7,8,9-HeptaCDF	**5.07E-07**	*2.88E-07*	**5.19E-07**	*2.19E-07*	**6.18E-07**	**5.33E-07**
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	1.12E-06	1.77E-06	7.79E-07	1.73E-06	1.86E-06	1.07E-06
1,2,3,6,7,8-HexaCDD	**0.00E+00**	*0.00E+00*	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	1.12E-06	1.87E-06	6.75E-07	1.58E-06	1.61E-06	9.60E-07
1,2,3,7,8,9-HexaCDD	**5.07E-07**	*2.17E-07*	**5.19E-07**	*1.84E-07*	**6.18E-07**	**5.33E-07**
1,2,3,7,8,9-HexaCDF	*1.98E-07*	*3.39E-07*	**5.19E-07**	*2.40E-07*	**6.18E-07**	**5.33E-07**
1,2,3,7,8-PentaCDD	**5.07E-07**	*3.13E-07*	**5.19E-07**	*2.70E-07*	*2.84E-07*	**5.33E-07**
1,2,3,7,8-PentaCDF	8.63E-07	1.26E-06	5.71E-07	1.12E-06	1.11E-06	7.47E-07
2,3,4,6,7,8-HexaCDF	7.10E-07	1.16E-06	*4.67E-07*	1.02E-06	9.89E-07	6.40E-07
2,3,4,7,8-PentaCDF	1.01E-06	1.62E-06	7.27E-07	1.48E-06	1.55E-06	9.07E-07
2,3,7,8-TetraCDD	*8.63E-08*	*9.60E-08*	*6.75E-08*	1.22E-07	1.36E-07	*8.53E-08*
2,3,7,8-TetraCDF	8.12E-07	1.01E-06	4.83E-07	8.67E-07	9.28E-07	5.87E-07
OctaCDD	*3.55E-07*	*5.05E-07*	**1.04E-06**	*4.75E-07*	*4.27E-07*	**1.07E-06**
OctaCDF	*4.06E-07*	*8.09E-07*	**1.04E-06**	*4.75E-07*	**1.24E-06**	**1.07E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 28. Ambient Air TO-9 Methodology Samples

Sample Identification Number	AFG_SABALU_20130924_TO09	AFG_SABALU_20130925_TO09	AFG_SABALU_20130926_TO09
Collection Date	2013/09/24 1059	2013/09/25 1058	2013/09/26 1050
COPC	ug/m^3	ug/m^3	ug/m^3
1,2,3,4,6,7,8-HeptaCDD	*4.32E-07*	*4.64E-07*	*3.01E-07*
1,2,3,4,6,7,8-HeptaCDF	3.47E-06	3.65E-06	2.38E-06
1,2,3,4,7,8,9-HeptaCDF	*1.82E-07*	*2.18E-07*	**5.18E-07**
1,2,3,4,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,4,7,8-HexaCDF	1.92E-06	1.91E-06	1.30E-06
1,2,3,6,7,8-HexaCDD	**0.00E+00**	**0.00E+00**	**0.00E+00**
1,2,3,6,7,8-HexaCDF	1.66E-06	1.69E-06	1.24E-06
1,2,3,7,8,9-HexaCDD	**5.34E-07**	*1.91E-07*	**5.18E-07**
1,2,3,7,8,9-HexaCDF	*2.35E-07*	*2.29E-07*	*2.13E-07*
1,2,3,7,8-PentaCDD	*3.10E-07*	*2.78E-07*	*1.97E-07*
1,2,3,7,8-PentaCDF	1.33E-06	1.42E-06	8.81E-07
2,3,4,6,7,8-HexaCDF	1.01E-06	9.82E-07	7.77E-07
2,3,4,7,8-PentaCDF	1.71E-06	1.75E-06	1.04E-06
2,3,7,8-TetraCDD	1.28E-07	1.53E-07	*8.81E-08*
2,3,7,8-TetraCDF	1.12E-06	1.15E-06	7.26E-07
OctaCDD	*4.16E-07*	*4.75E-07*	**1.04E-06**
OctaCDF	**1.07E-06**	*3.98E-07*	**1.04E-06**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130912_TO13_01	AFG_BAGRAM_20130913_TO13_01	AFG_BAGRAM_20130914_TO13_01	AFG_BAGRAM_20130915_TO13_01	AFG_BAGRAM_20130916_TO13_01	AFG_BAGRAM_20130917_TO13_01
Collection Date	2013/09/12 0849	2013/09/13 0924	2013/09/14 0930	2013/09/15 0932	2013/09/16 0938	2013/09/17 0929
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**8.09E-02**	**6.87E-02**	**7.79E-02**	**6.87E-02**	**7.05E-02**	**7.70E-02**
2-Methylnaphthalene	*5.18E-02*	8.24E-02	*3.74E-02*	*4.06E-02*	1.13E-01	1.08E-01
2-Methylphenol	**8.09E-02**	*1.24E-02*	**7.79E-02**	**6.87E-02**	*1.41E-02*	*1.31E-02*
2-Nitrophenol	*1.46E-02*	*1.99E-02*	**7.79E-02**	**6.87E-02**	*2.26E-02*	*3.16E-02*
4-Nitrophenol	**4.04E-01**	**3.43E-01**	**3.89E-01**	**3.44E-01**	**3.52E-01**	**3.85E-01**
Acenaphthene	**8.09E-02**	**6.87E-02**	**7.79E-02**	**6.87E-02**	**7.05E-02**	**7.70E-02**
Acenaphthylene	**8.09E-02**	*1.72E-02*	**7.79E-02**	*1.51E-02*	*1.13E-02*	*8.47E-03*
Acetophenone	1.05E-01	1.44E-01	*5.92E-02*	6.87E-02	1.90E-01	1.85E-01
Benzoic acid	1.29E+00	7.56E-01	1.32E+00	1.72E+00	1.06E+00	2.00E+00
Benzo[b]fluoranthene	**8.09E-02**	**6.87E-02**	**7.79E-02**	**6.87E-02**	**7.05E-02**	*7.31E-03*
Benzo[g,h,i]perylene	**8.09E-02**	*3.57E-03*	**7.79E-02**	**6.87E-02**	**7.05E-02**	*4.00E-03*
Benzyl alcohol	*2.02E-02*	*1.99E-02*	**7.79E-01**	**6.87E-01**	*2.61E-02*	*3.46E-02*
Benz[a]anthracene	**8.09E-02**	**6.87E-02**	**7.79E-02**	**6.87E-02**	**7.05E-02**	**7.70E-02**
Chrysene	**8.09E-02**	**6.87E-02**	**7.79E-02**	**6.87E-02**	**7.05E-02**	**7.70E-02**
Di(2-ethylhexyl)phthalate	**1.62E-01**	**1.37E-01**	*5.76E-02*	**1.37E-01**	**1.41E-01**	**1.54E-01**
Di-n-butylphthalate	*2.43E-02*	1.72E-01	*9.34E-02*	1.37E-01	*8.46E-02*	1.85E-01
Di-n-octylphthalate	**8.09E-02**	**6.87E-02**	*2.02E-02*	**6.87E-02**	**7.05E-02**	**7.70E-02**
Dibenzofuran	*7.12E-03*	*1.51E-02*	**7.79E-02**	**6.87E-02**	*1.34E-02*	*2.46E-02*
Diethylphthalate	*1.29E-02*	*8.24E-03*	*9.34E-03*	*6.87E-03*	*9.16E-03*	*1.15E-02*
Dimethylphthalate	**8.09E-02**	*6.46E-03*	*1.40E-02*	**6.87E-02**	**7.05E-02**	**7.70E-02**
Fluoranthene	**8.09E-02**	*1.03E-02*	**7.79E-02**	**6.87E-02**	*9.16E-03*	*1.54E-02*
Fluorene	**8.09E-02**	*9.62E-03*	**7.79E-02**	**6.87E-02**	*9.87E-03*	*1.23E-02*
Indeno[1,2,3-cd]pyrene	**8.09E-02**	*3.92E-03*	**7.79E-02**	**6.87E-02**	**7.05E-02**	*4.62E-03*
m,p-Methylphenol	*1.70E-02*	*3.78E-02*	*1.40E-02*	*1.31E-02*	*4.58E-02*	*4.08E-02*
Naphthalene	8.09E-02	2.20E-01	*7.32E-02*	1.24E-01	2.47E-01	2.93E-01
Phenanthrene	*1.05E-02*	*2.68E-02*	*1.09E-02*	*8.94E-03*	*2.61E-02*	*3.62E-02*
Phenol	*4.93E-02*	8.93E-02	*3.89E-02*	*4.12E-02*	1.06E-01	1.08E-01
Pyrene	**8.09E-02**	*7.56E-03*	**7.79E-02**	**6.87E-02**	**7.05E-02**	*9.24E-03*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples (continued)

Sample	AFG_BAGRAM_20130918_TO13_01	AFG_BAGRAM_20130919_TO13_01	AFG_BAGRAM_20130920_TO13_01	AFG_BAGRAM_20130921_TO13_01	AFG_BAGRAM_20130922_TO13_01	AFG_BAGRAM_20130923_TO13_01
Identification Number	2013/09/18 0932	2013/09/19 0939	2013/09/20 0932	2013/09/21 0939	2013/09/22 0943	2013/09/23 0952
Collection Date	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**7.34E-02**	**8.08E-02**	**8.31E-02**	**8.56E-02**	**7.10E-02**	**7.74E-02**
2-Methylnaphthalene	1.32E-01	2.26E-01	9.97E-02	2.31E-01	1.63E-01	9.28E-02
2-Methylphenol	*1.76E-02*	*2.91E-02*	*1.74E-02*	*4.28E-02*	*2.77E-02*	*1.24E-02*
2-Nitrophenol	*3.96E-02*	*4.77E-02*	**8.31E-02**	*5.48E-02*	*5.25E-02*	*3.09E-02*
4-Nitrophenol	**3.67E-01**	**4.04E-01**	**4.15E-01**	**4.28E-01**	**3.55E-01**	**3.87E-01**
Acenaphthene	**7.34E-02**	*6.54E-03*	**8.31E-02**	**8.56E-02**	**7.10E-02**	**7.74E-02**
Acenaphthylene	*1.54E-02*	*3.72E-02*	*1.74E-02*	*3.42E-02*	*2.70E-02*	*9.28E-03*
Acetophenone	2.13E-01	2.83E-01	1.66E-01	3.51E-01	1.99E-01	1.70E-01
Benzoic acid	1.84E+00	2.18E+00	1.74E+00	2.31E+00	1.63E+00	1.78E+00
Benzo[b]fluoranthene	*6.90E-03*	*1.29E-02*	**8.31E-02**	*9.42E-03*	*9.23E-03*	**7.74E-02**
Benzo[g,h,i]perylene	**7.34E-02**	*8.08E-03*	**8.31E-02**	*5.48E-03*	*5.68E-03*	**7.74E-02**
Benzyl alcohol	**7.34E-01**	*1.94E-01*	**8.31E-01**	*1.46E-01*	**7.10E-01**	**7.74E-01**
Benz[a]anthracene	**7.34E-02**	*6.87E-03*	**8.31E-02**	**8.56E-02**	*6.39E-03*	**7.74E-02**
Chrysene	**7.34E-02**	*8.89E-03*	**8.31E-02**	*7.11E-03*	*7.81E-03*	**7.74E-02**
Di(2-ethylhexyl)phthalate	**1.47E-01**	*6.79E-02*	**1.66E-01**	*1.11E-01*	*5.54E-02*	**1.55E-01**
Di-n-butylphthalate	*6.53E-02*	2.02E-01	*4.15E-02*	2.23E-01	*3.19E-02*	1.78E-01
Di-n-octylphthalate	**7.34E-02**	**8.08E-02**	**8.31E-02**	**8.56E-02**	**7.10E-02**	**7.74E-02**
Dibenzofuran	*2.20E-02*	*3.55E-02*	*1.50E-02*	*2.83E-02*	*2.70E-02*	*1.47E-02*
Diethylphthalate	*1.10E-02*	*1.37E-02*	*8.31E-03*	*1.28E-02*	*1.28E-02*	*1.01E-02*
Dimethylphthalate	**7.34E-02**	**8.08E-02**	**8.31E-02**	*2.14E-02*	**7.10E-02**	*1.86E-02*
Fluoranthene	*1.25E-02*	*2.34E-02*	*1.33E-02*	*1.97E-02*	*1.92E-02*	*9.28E-03*
Fluorene	*1.32E-02*	*2.34E-02*	*9.97E-03*	*2.23E-02*	*2.06E-02*	*8.51E-03*
Indeno[1,2,3-cd]pyrene	**7.34E-02**	*6.87E-03*	**8.31E-02**	*5.57E-03*	*6.03E-03*	**7.74E-02**
m,p-Methylphenol	*5.73E-02*	1.05E-01	*3.32E-02*	1.20E-01	9.94E-02	*4.41E-02*
Naphthalene	3.38E-01	5.33E-01	2.57E-01	5.39E-01	3.90E-01	2.01E-01
Phenanthrene	*3.38E-02*	*5.98E-02*	*2.82E-02*	*5.31E-02*	*5.11E-02*	*2.32E-02*
Phenol	1.39E-01	2.10E-01	8.31E-02	2.40E-01	1.77E-01	9.28E-02
Pyrene	*8.81E-03*	*1.78E-02*	*9.14E-03*	*1.54E-02*	*1.63E-02*	**7.74E-02**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples (continued)

Sample	AFG_BAGRAM_20130924_TO13_01	AFG_BAGRAM_20130925_TO13_01	AFG_BAGRAM_20130926_TO13_01	AFG_BAGRAM_20130912_TO13_02	AFG_BAGRAM_20130913_TO13_02	AFG_BAGRAM_20130914_TO13_02
Identification Number	2013/09/24 0951	2013/09/25 0955	2013/09/26 0957	2013/09/12 0930	2013/09/13 1005	2013/09/14 1015
Collection Date	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**7.08E-02**	**7.50E-02**	**8.33E-02**	**6.15E-02**	**5.26E-02**	**6.68E-02**
2-Methylnaphthalene	1.91E-01	2.25E-01	**8.33E-02**	*4.55E-02*	7.36E-02	*5.81E-02*
2-Methylphenol	*2.90E-02*	*5.03E-02*	**8.33E-02**	**6.15E-02**	*8.41E-03*	*8.02E-03*
2-Nitrophenol	*6.09E-02*	*6.38E-02*	**8.33E-02**	*1.17E-02*	*1.26E-02*	**6.68E-02**
4-Nitrophenol	**3.54E-01**	**3.75E-01**	*4.75E-02*	**3.07E-01**	**2.63E-01**	**3.34E-01**
Acenaphthene	*5.24E-03*	*6.38E-03*	**8.33E-02**	**6.15E-02**	*3.89E-03*	**6.68E-02**
Acenaphthylene	*2.69E-02*	*4.58E-02*	**8.33E-02**	**6.15E-02**	*3.00E-02*	*5.95E-03*
Acetophenone	2.62E-01	3.08E-01	*1.00E-02*	7.38E-02	9.47E-02	9.36E-02
Benzoic acid	1.84E+00	1.73E+00	**8.33E-01**	1.23E+00	8.94E-01	1.47E+00
Benzo[b]fluoranthene	*1.06E-02*	*1.35E-02*	*1.17E-02*	**6.15E-02**	**5.26E-02**	**6.68E-02**
Benzo[g,h,i]perylene	*7.79E-03*	*9.00E-03*	*6.91E-03*	**6.15E-02**	**5.26E-02**	**6.68E-02**
Benzyl alcohol	**7.08E-01**	*1.35E-01*	**8.33E-01**	**6.15E-01**	*1.58E-02*	*4.08E-02*
Benz[a]anthracene	*5.24E-03*	*6.75E-03*	*6.33E-03*	**6.15E-02**	**5.26E-02**	**6.68E-02**
Chrysene	*7.08E-03*	*9.00E-03*	*9.16E-03*	**6.15E-02**	**5.26E-02**	**6.68E-02**
Di(2-ethylhexyl)phthalate	*7.08E-02*	*1.05E-01*	*9.16E-02*	**1.23E-01**	**1.05E-01**	*6.08E-02*
Di-n-butylphthalate	*6.87E-02*	1.65E-01	*1.33E-01*	*4.61E-02*	*2.95E-02*	*4.01E-02*
Di-n-octylphthalate	**7.08E-02**	**7.50E-02**	**8.33E-02**	**6.15E-02**	**5.26E-02**	**6.68E-02**
Dibenzofuran	*2.76E-02*	*3.60E-02*	**8.33E-02**	**6.15E-02**	*1.42E-02*	**6.68E-02**
Diethylphthalate	*1.20E-02*	*1.35E-02*	*1.08E-02*	**6.15E-02**	**5.26E-02**	**6.68E-02**
Dimethylphthalate	**7.08E-02**	*5.18E-03*	**8.33E-02**	*5.78E-03*	*4.58E-03*	**6.68E-02**
Fluoranthene	*1.63E-02*	*1.95E-02*	*2.75E-02*	**6.15E-02**	*8.41E-03*	**6.68E-02**
Fluorene	*1.77E-02*	*2.63E-02*	**8.33E-02**	**6.15E-02**	*8.94E-03*	**6.68E-02**
Indeno[1,2,3-cd]pyrene	*6.58E-03*	*6.98E-03*	*7.41E-03*	**6.15E-02**	**5.26E-02**	**6.68E-02**
m,p-Methylphenol	9.91E-02	1.58E-01	**8.33E-02**	*1.04E-02*	*2.37E-02*	*1.74E-02*
Naphthalene	4.53E-01	5.85E-01	**8.33E-02**	*5.90E-02*	2.47E-01	1.14E-01
Phenanthrene	*4.60E-02*	*6.15E-02*	*7.16E-02*	*6.76E-03*	*2.37E-02*	*6.08E-03*
Phenol	2.19E-01	2.78E-01	*7.91E-03*	*3.20E-02*	6.31E-02	*4.08E-02*
Pyrene	*1.35E-02*	*1.50E-02*	*2.00E-02*	**6.15E-02**	*5.79E-03*	**6.68E-02**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples (continued)

Sample	AFG_BAGRAM_20130915_TO13_02	AFG_BAGRAM_20130916_TO13_02	AFG_BAGRAM_20130917_TO13_02	AFG_BAGRAM_20130918_TO13_02	AFG_BAGRAM_20130919_TO13_02	AFG_BAGRAM_20130920_TO13_02
Identification Number	2013/09/15 0944	2013/09/16 0945	2013/09/17 0957	2013/09/18 0942	2013/09/19 0940	2013/09/20 0942
Collection Date	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**6.24E-02**	**5.92E-02**	**6.96E-02**	**6.06E-02**	**6.68E-02**	**6.26E-02**
2-Methylnaphthalene	8.74E-02	*4.33E-02*	9.05E-02	1.88E-01	1.80E-01	8.14E-02
2-Methylphenol	*7.49E-03*	*5.63E-03*	*1.04E-02*	*2.30E-02*	*1.74E-02*	*1.50E-02*
2-Nitrophenol	**6.24E-02**	*1.48E-02*	*3.20E-02*	**6.06E-02**	*3.21E-02*	**6.26E-02**
4-Nitrophenol	**3.12E-01**	**2.96E-01**	**3.48E-01**	**3.03E-01**	**3.34E-01**	**3.13E-01**
Acenaphthene	**6.24E-02**	**5.92E-02**	**6.96E-02**	**6.06E-02**	**6.68E-02**	**6.26E-02**
Acenaphthylene	*2.75E-02*	*8.89E-03*	*8.35E-03*	*3.88E-02*	*3.47E-02*	*1.38E-02*
Acetophenone	9.99E-02	7.11E-02	1.53E-01	2.30E-01	2.54E-01	1.25E-01
Benzoic acid	1.06E+00	1.13E+00	1.88E+00	1.51E+00	1.80E+00	1.13E+00
Benzo[b]fluoranthene	**6.24E-02**	*5.92E-03*	*8.35E-03*	*7.87E-03*	*1.20E-02*	**6.26E-02**
Benzo[g,h,i]perylene	**6.24E-02**	*3.38E-03*	*4.11E-03*	*4.42E-03*	*6.68E-03*	**6.26E-02**
Benzyl alcohol	*3.37E-02*	*1.30E-02*	*1.95E-02*	**6.06E-01**	*3.01E-02*	*1.69E-02*
Benz[a]anthracene	**6.24E-02**	**5.92E-02**	**6.96E-02**	*4.18E-03*	*5.54E-03*	**6.26E-02**
Chrysene	**6.24E-02**	*4.27E-03*	*5.99E-03*	*6.06E-03*	*8.02E-03*	**6.26E-02**
Di(2-ethylhexyl)phthalate	**1.25E-01**	**1.19E-01**	**1.39E-01**	**1.21E-01**	**1.34E-01**	**1.25E-01**
Di-n-butylphthalate	*4.99E-02*	*2.19E-02*	*6.89E-02*	*5.21E-02*	*9.35E-02*	*4.95E-02*
Di-n-octylphthalate	**6.24E-02**	**5.92E-02**	**6.96E-02**	**6.06E-02**	**6.68E-02**	**6.26E-02**
Dibenzofuran	*6.87E-03*	*1.54E-02*	*2.37E-02*	*2.91E-02*	*2.67E-02*	*1.32E-02*
Diethylphthalate	**6.24E-02**	**5.92E-02**	**6.96E-02**	**6.06E-02**	**6.68E-02**	**6.26E-02**
Dimethylphthalate	**6.24E-02**	**5.92E-02**	**6.96E-02**	*4.84E-03*	**6.68E-02**	**6.26E-02**
Fluoranthene	**6.24E-02**	*1.19E-02*	*1.60E-02*	*1.70E-02*	*1.94E-02*	*9.40E-03*
Fluorene	*6.87E-03*	*7.70E-03*	*9.74E-03*	*1.76E-02*	*1.67E-02*	*7.52E-03*
Indeno[1,2,3-cd]pyrene	**6.24E-02**	*3.32E-03*	*4.32E-03*	*4.78E-03*	*5.95E-03*	**6.26E-02**
m,p-Methylphenol	*1.56E-02*	*1.78E-02*	*3.34E-02*	*5.27E-02*	*6.01E-02*	*3.38E-02*
Naphthalene	2.68E-01	2.07E-01	3.06E-01	5.87E-01	5.14E-01	2.26E-01
Phenanthrene	*1.12E-02*	*2.67E-02*	*3.34E-02*	*3.94E-02*	*4.54E-02*	*2.07E-02*
Phenol	*4.49E-02*	*5.21E-02*	8.35E-02	1.15E-01	1.20E-01	6.89E-02
Pyrene	**6.24E-02**	*7.70E-03*	*1.04E-02*	*1.21E-02*	*1.40E-02*	*7.52E-03*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples (continued)

Sample	AFG_BAGRAM_20130921_TO13_02	AFG_BAGRAM_20130922_TO13_02	AFG_BAGRAM_20130923_TO13_02	AFG_BAGRAM_20130924_TO13_02	AFG_BAGRAM_20130925_TO13_02	AFG_BAGRAM_20130926_TO13_02
Identification Number	2013/09/21 0944	2013/09/22 0945	2013/09/23 0943	2013/09/24 0951	2013/09/25 0953	2013/09/26 0950
Collection Date	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**6.56E-01**	**6.40E-02**	**8.54E-02**	**5.93E-02**	**6.44E-02**	*2.58E-02*
2-Methylnaphthalene	1.31E+00	1.22E-01	1.03E-01	1.19E-01	1.67E-01	1.18E-01
2-Methylphenol	*1.70E-01*	*1.47E-02*	*1.28E-02*	*1.07E-02*	*1.93E-02*	*1.93E-02*
2-Nitrophenol	*3.15E-01*	*3.97E-02*	*2.90E-02*	*3.80E-02*	*4.25E-02*	*3.82E-02*
4-Nitrophenol	**3.28E+00**	**3.20E-01**	**4.27E-01**	**2.97E-01**	**3.22E-01**	**2.69E-01**
Acenaphthene	**6.56E-01**	**6.40E-02**	**8.54E-02**	**5.93E-02**	**6.44E-02**	**5.37E-02**
Acenaphthylene	*2.03E-01*	*2.11E-02*	*1.37E-02*	*2.43E-02*	*2.32E-02*	*1.56E-02*
Acetophenone	2.29E+00	2.05E-01	2.14E-01	1.78E-01	2.70E-01	1.93E-01
Benzoic acid	1.70E+01	1.67E+00	2.14E+00	1.42E+00	1.35E+00	1.24E+00
Benzo[b]fluoranthene	*7.87E-02*	*6.28E-03*	**8.54E-02**	*8.90E-03*	*8.37E-03*	*6.99E-03*
Benzo[g,h,i]perylene	*3.67E-02*	*3.59E-03*	**8.54E-02**	*5.10E-03*	*5.73E-03*	*4.08E-03*
Benzyl alcohol	**6.56E+00**	**6.40E-01**	*4.70E-02*	**5.93E-01**	*4.51E-02*	**5.37E-01**
Benz[a]anthracene	**6.56E-01**	**6.40E-02**	**8.54E-02**	*4.21E-03*	*4.57E-03*	**5.37E-02**
Chrysene	*5.57E-02*	**6.40E-02**	**8.54E-02**	*5.87E-03*	*7.08E-03*	*5.37E-03*
Di(2-ethylhexyl)phthalate	**1.31E+00**	**1.28E-01**	**1.71E-01**	**1.19E-01**	**1.29E-01**	*7.52E-02*
Di-n-butylphthalate	*7.21E-01*	*2.50E-02*	*1.20E-01*	*2.25E-02*	*4.89E-02*	*3.71E-02*
Di-n-octylphthalate	**6.56E-01**	**6.40E-02**	**8.54E-02**	**5.93E-02**	**6.44E-02**	**5.37E-02**
Dibenzofuran	*1.90E-01*	*2.05E-02*	*1.62E-02*	*2.08E-02*	*2.38E-02*	*2.10E-02*
Diethylphthalate	**6.56E-01**	**6.40E-02**	*6.58E-03*	**5.93E-02**	*6.44E-03*	**5.37E-02**
Dimethylphthalate	*4.72E-02*	**6.40E-02**	**8.54E-02**	**5.93E-02**	*4.83E-03*	**5.37E-02**
Fluoranthene	*1.57E-01*	*1.15E-02*	*1.03E-02*	*1.36E-02*	*1.67E-02*	*1.45E-02*
Fluorene	*1.25E-01*	*1.28E-02*	*9.40E-03*	*1.36E-02*	*1.61E-02*	*1.24E-02*
Indeno[1,2,3-cd]pyrene	*4.20E-02*	*3.91E-03*	**8.54E-02**	*4.98E-03*	*5.28E-03*	*4.41E-03*
m,p-Methylphenol	*5.57E-01*	*4.68E-02*	*3.59E-02*	*4.63E-02*	7.08E-02	5.37E-02
Naphthalene	3.67E+00	3.33E-01	2.73E-01	3.38E-01	4.44E-01	3.06E-01
Phenanthrene	*3.67E-01*	*3.07E-02*	*2.56E-02*	*3.14E-02*	*4.18E-02*	*3.55E-02*
Phenol	1.18E+00	8.97E-02	1.03E-01	9.49E-02	1.42E-01	1.02E-01
Pyrene	*1.18E-01*	*8.33E-03*	**8.54E-02**	*9.49E-03*	*1.22E-02*	*9.67E-03*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples (continued)

Sample	AFG_SABALU_20130912_TO13_03	AFG_SABALU_20130913_TO13	AFG_SABALU_20130914_TO13	AFG_SABALU_20130915_TO13	AFG_SABALU_20130916_TO13	AFG_SABALU_20130917_TO13
Identification Number	2013/09/12 1210	2013/09/13 1210	2013/09/14 1118	2013/09/15 1030	2013/09/16 1059	2013/09/17 1048
Collection Date	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	**5.98E-02**
2-Methylnaphthalene	*1.06E-02*	*2.73E-02*	*3.21E-02*	*2.95E-02*	1.19E-01	6.58E-02
2-Methylphenol	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	*9.72E-03*	*5.09E-03*
2-Nitrophenol	*7.94E-03*	*1.50E-02*	**5.73E-02**	**6.01E-02**	*1.67E-02*	*2.27E-02*
4-Nitrophenol	**2.65E-01**	**2.67E-01**	**2.86E-01**	**3.01E-01**	**2.70E-01**	**2.99E-01**
Acenaphthene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	**5.98E-02**
Acenaphthylene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	*1.30E-02*	*1.98E-02*
Acetophenone	*4.18E-02*	6.41E-02	8.02E-02	8.42E-02	1.62E-01	9.58E-02
Benzoic acid	7.94E-01	6.95E-01	1.03E+00	1.02E+00	9.72E-01	1.26E+00
Benzo[b]fluoranthene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	*8.38E-03*
Benzo[g,h,i]perylene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	*4.49E-03*
Benzyl alcohol	*1.43E-02*	*1.44E-02*	*1.26E-02*	*1.50E-02*	*1.51E-02*	*1.74E-02*
Benz[a]anthracene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	**5.98E-02**
Chrysene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	*5.75E-03*
Di(2-ethylhexyl)phthalate	**1.06E-01**	**1.07E-01**	**1.15E-01**	**1.20E-01**	**1.08E-01**	**1.20E-01**
Di-n-butylphthalate	*9.53E-02*	*2.78E-02*	*4.12E-02*	1.68E-01	*3.24E-02*	*5.15E-02*
Di-n-octylphthalate	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	**5.98E-02**
Dibenzofuran	**5.30E-02**	*1.02E-02*	**5.73E-02**	*6.62E-03*	*1.30E-02*	*2.51E-02*
Diethylphthalate	*4.29E-03*	*5.34E-03*	**5.73E-02**	**6.01E-02**	**5.40E-02**	*5.69E-03*
Dimethylphthalate	**5.30E-02**	**5.34E-02**	**5.73E-02**	*6.62E-03*	*4.16E-03*	*4.79E-03*
Fluoranthene	**5.30E-02**	*5.88E-03*	**5.73E-02**	*4.81E-03*	*7.02E-03*	*1.74E-02*
Fluorene	**5.30E-02**	*4.65E-03*	**5.73E-02**	**6.01E-02**	*9.18E-03*	*1.20E-02*
Indeno[1,2,3-cd]pyrene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	*4.79E-03*
m,p-Methylphenol	**5.30E-02**	*1.02E-02*	**5.73E-02**	**6.01E-02**	*2.81E-02*	*1.56E-02*
Naphthalene	*2.17E-02*	9.62E-02	*5.16E-02*	9.02E-02	3.73E-01	2.99E-01
Phenanthrene	*5.30E-03*	*1.50E-02*	*8.59E-03*	*1.32E-02*	*2.00E-02*	*3.89E-02*
Phenol	*1.91E-02*	*2.67E-02*	*1.60E-02*	*2.65E-02*	7.02E-02	*4.67E-02*
Pyrene	**5.30E-02**	**5.34E-02**	**5.73E-02**	**6.01E-02**	**5.40E-02**	*1.14E-02*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples (continued)

Sample	AFG_SABALU_20130918_TO13	AFG_SABALU_20130919_TO13	AFG_SABALU_20130920_TO13	AFG_SABALU_20130921_TO13	AFG_SABALU_20130922_TO13	AFG_SABALU_20130923_TO13
Identification Number	2013/09/18 1054	2013/09/19 1105	2013/09/20 1111	2013/09/21 1123	2013/09/22 1101	2013/09/23 1059
Collection Date	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**5.51E-02**	**6.10E-02**	**4.50E-02**	**5.55E-02**	**5.99E-02**	**6.23E-02**
2-Methylnaphthalene	7.16E-02	1.22E-01	*4.01E-02*	9.43E-02	1.08E-01	*4.49E-02*
2-Methylphenol	*8.26E-03*	*1.34E-02*	*4.32E-03*	*8.88E-03*	*1.20E-02*	*5.98E-03*
2-Nitrophenol	*2.64E-02*	*3.78E-02*	*7.20E-03*	*2.33E-02*	*3.89E-02*	*1.93E-02*
4-Nitrophenol	**2.75E-01**	**3.05E-01**	**2.25E-01**	**2.77E-01**	**2.99E-01**	**3.11E-01**
Acenaphthene	**5.51E-02**	**6.10E-02**	**4.50E-02**	**5.55E-02**	**5.99E-02**	**6.23E-02**
Acenaphthylene	*1.21E-02*	*1.53E-02*	*4.41E-03*	*9.99E-03*	*1.68E-02*	**6.23E-02**
Acetophenone	1.49E-01	1.95E-01	8.55E-02	1.39E-01	1.56E-01	8.72E-02
Benzoic acid	1.49E+00	1.46E+00	1.08E+00	1.44E+00	1.56E+00	1.31E+00
Benzo[b]fluoranthene	*9.91E-03*	*1.59E-02*	**4.50E-02**	*9.43E-03*	*9.58E-03*	**6.23E-02**
Benzo[g,h,i]perylene	*4.46E-03*	*8.54E-03*	*2.34E-03*	*5.22E-03*	*5.03E-03*	**6.23E-02**
Benzyl alcohol	**5.51E-01**	**6.10E-01**	**4.50E-01**	**5.55E-01**	**5.99E-01**	*2.80E-02*
Benz[a]anthracene	*4.24E-03*	*7.32E-03*	**4.50E-02**	*4.38E-03*	*4.37E-03*	**6.23E-02**
Chrysene	*6.06E-03*	*1.04E-02*	**4.50E-02**	*6.66E-03*	*5.81E-03*	**6.23E-02**
Di(2-ethylhexyl)phthalate	**1.10E-01**	**1.22E-01**	**9.00E-02**	**1.11E-01**	**1.20E-01**	**1.25E-01**
Di-n-butylphthalate	*8.81E-02*	*6.71E-02*	*2.39E-02*	*9.99E-02*	*7.78E-02*	*4.98E-02*
Di-n-octylphthalate	**5.51E-02**	**6.10E-02**	**4.50E-02**	**5.55E-02**	**5.99E-02**	**6.23E-02**
Dibenzofuran	*2.48E-02*	*3.60E-02*	*9.00E-03*	*2.44E-02*	*2.99E-02*	*1.50E-02*
Diethylphthalate	**5.51E-02**	*5.31E-03*	**4.50E-02**	*6.10E-03*	*5.99E-03*	*5.48E-03*
Dimethylphthalate	*4.85E-03*	*4.52E-03*	**4.50E-02**	*5.44E-03*	**5.99E-02**	**6.23E-02**
Fluoranthene	*1.82E-02*	*2.56E-02*	*7.20E-03*	*1.83E-02*	*1.92E-02*	*8.72E-03*
Fluorene	*1.05E-02*	*1.59E-02*	*5.40E-03*	*1.17E-02*	*1.26E-02*	*6.85E-03*
Indeno[1,2,3-cd]pyrene	*5.18E-03*	*9.15E-03*	**4.50E-02**	*5.10E-03*	*5.39E-03*	**6.23E-02**
m,p-Methylphenol	*2.48E-02*	*4.70E-02*	*1.49E-02*	*3.22E-02*	*3.65E-02*	*2.06E-02*
Naphthalene	2.97E-01	4.52E-01	1.26E-01	2.83E-01	3.77E-01	1.37E-01
Phenanthrene	*4.02E-02*	*5.61E-02*	*1.67E-02*	*4.05E-02*	*4.31E-02*	*2.24E-02*
Phenol	6.06E-02	9.76E-02	*3.83E-02*	6.10E-02	7.78E-02	*4.36E-02*
Pyrene	*1.16E-02*	*1.71E-02*	*4.50E-03*	*1.17E-02*	*1.20E-02*	**6.23E-02**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-13 Methodology Samples (continued)

Sample	AFG_SABALU_20130924_TO13	AFG_SABALU_20130925_TO13	AFG_SABALU_20130926_TO13
Identification Number	2013/09/24 1059	2013/09/25 1102	2013/09/26 1055
Collection Date	ug/m^3	ug/m^3	ug/m^3
2,6-Dinitrotoluene	**6.58E-02**	**5.68E-02**	**5.05E-02**
2-Methylnaphthalene	8.55E-02	1.19E-01	**5.05E-02**
2-Methylphenol	*9.21E-03*	*1.25E-02*	**5.05E-02**
2-Nitrophenol	*3.75E-02*	*3.24E-02*	**5.05E-02**
4-Nitrophenol	**3.29E-01**	**2.84E-01**	*4.04E-02*
Acenaphthene	**6.58E-02**	**5.68E-02**	**5.05E-02**
Acenaphthylene	*9.21E-03*	*1.88E-02*	**5.05E-02**
Acetophenone	1.45E-01	1.82E-01	*4.45E-02*
Benzoic acid	1.38E+00	1.36E+00	*1.97E-01*
Benzo[b]fluoranthene	*1.25E-02*	*1.48E-02*	*1.06E-02*
Benzo[g,h,i]perylene	*7.24E-03*	*7.96E-03*	*5.56E-03*
Benzyl alcohol	**6.58E-01**	**5.68E-01**	**5.05E-01**
Benz[a]anthracene	*5.40E-03*	*6.82E-03*	*4.55E-03*
Chrysene	*7.90E-03*	*9.66E-03*	*7.58E-03*
Di(2-ethylhexyl)phthalate	**1.32E-01**	**1.14E-01**	1.11E-01
Di-n-butylphthalate	*3.69E-02*	1.48E-01	2.83E-01
Di-n-octylphthalate	**6.58E-02**	**5.68E-02**	**5.05E-02**
Dibenzofuran	*3.29E-02*	*3.07E-02*	**5.05E-02**
Diethylphthalate	*6.58E-03*	*6.25E-03*	*4.14E-03*
Dimethylphthalate	**6.58E-02**	*5.68E-03*	**5.05E-02**
Fluoranthene	*2.30E-02*	*2.33E-02*	*2.22E-02*
Fluorene	*1.38E-02*	*1.71E-02*	**5.05E-02**
Indeno[1,2,3-cd]pyrene	*6.51E-03*	*7.96E-03*	*6.06E-03*
m,p-Methylphenol	*3.42E-02*	*4.43E-02*	**5.05E-02**
Naphthalene	3.49E-01	3.75E-01	**5.05E-02**
Phenanthrene	*5.00E-02*	*5.06E-02*	*4.85E-02*
Phenol	7.90E-02	8.53E-02	**5.05E-02**
Pyrene	*1.45E-02*	*1.53E-02*	*1.36E-02*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 29. Ambient Air TO-15 Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130912_TO14_01	AFG_BAGRAM_20130913_TO14_01	AFG_BAGRAM_20130914_TO14_01	AFG_BAGRAM_20130915_TO14_01	AFG_BAGRAM_20130916_TO14_01	AFG_BAGRAM_20130917_TO14_01
Collection Date	2013/09/12 0958	2013/09/13 0950	2013/09/14 0945	2013/09/15 0950	2013/09/16 0942	2013/09/17 0943
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
2-Butanone (MEK)	*2.2*	*1.9*	*1.5*	*1.0*	*1.1*	25
Acetone	35	15	11	8.2	9.9	27
Acetonitrile	**0.84**	**0.84**	**0.84**	**0.84**	**0.84**	1.3
Acrolein	1.4	*1.0*	1.8	*0.6*	*0.5*	1.1
Acrylonitrile	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**
alpha-Methylstyrene	**2.4**	**2.4**	*0.48*	**2.4**	**2.4**	**2.4**
Benzene	1.9	2.6	*1.2*	1.9	2.1	2.9
Chlorodifluoromethane	8	5	2.8	3.7	3	**1.8**
Chloromethane	*1.5*	*1.8*	*1.2*	*1.2*	*1.1*	*1.2*
Cyclohexane	*0.65*	**1.7**	**1.7**	**1.7**	**1.7**	3.6
Dichlorodifluoromethane	*1.2*	*1.4*	*1.3*	*1.2*	*1.1*	*1.2*
Ethyl acetate	**1.8**	*0.83*	2.1	**1.8**	**1.8**	13
Ethylbenzene	*2.1*	**2.2**	**2.2**	**2.2**	**2.2**	*1.3*
Hexane	1.8	*1.6*	2	*1.1*	2.4	16
Isooctane	*0.37*	**2.3**	**2.3**	**2.3**	**2.3**	*0.75*
Isopropyl alcohol	340	14	13	*3.3*	**4.9**	19
m,p-Xylene	6.9	*1.3*	*0.87*	**4.3**	*1.1*	*3.3*
Methyl acrylate	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	*1.3*
Methylene chloride	31	*2.6*	*2.2*	*1.3*	*3.6*	43
n-Heptane	*0.78*	*0.57*	**2**	**2**	*0.86*	2.5
o-Xylene	*2.0*	**2.2**	**2.2**	**2.2**	**2.2**	*1.2*
Octane	*1.5*	*0.75*	*1.5*	**2.3**	*1.2*	*1.5*
Propylene	*1.1*	**1.7**	*0.52*	*0.6*	*1.3*	1.8
Styrene	*0.85*	**2.1**	**2.1**	**2.1**	**2.1**	2.3
tert-Butyl alcohol	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Tetrahydrofuran	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Toluene	2.3	*1.5*	*1.2*	**1.9**	*1.4*	74
trans-1,2-Dichloroethene	**2**	**2**	**2**	**2**	**2**	**2**
Trichloroethene (TCE)	47	*1.2*	**2.7**	**2.7**	**2.7**	**2.7**
Trichlorofluoromethane	*1.0*	*1.1*	*1.1*	**2.8**	**2.8**	**2.8**
Vinyl acetate	*1.7*	**7**	**7**	**7**	**7**	*1.6*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 30. Ambient Air TO-15 Methodology Samples (continued)

Sample Identification Number	AFG_BAGRAM_20130918_TO14_01	AFG_BAGRAM_20130919_TO14_01	AFG_BAGRAM_20130920_TO14_01	AFG_BAGRAM_20130921_TO14_01	AFG_BAGRAM_20130922_TO14_01	AFG_BAGRAM_20130923_TO14_01
Collection Date	2013/09/18 0947	2013/09/19 1007	2013/09/20 0957	2013/09/21 1000	2013/09/22 1000	2013/09/23 1003
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**2.5**	*1.2*	*0.98*	*1.2*	*1.2*	**2.5**
2-Butanone (MEK)	*1.7*	*2.1*	*1.0*	*2.4*	*2.4*	*2.2*
Acetone	13	14	7.6	15	15	11
Acetonitrile	1.1	1.4	7.4	5.1	1.2	**0.84**
Acrolein	1.1	1.3	*0.8*	1.3	1.2	*0.71*
Acrylonitrile	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**
alpha-Methylstyrene	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**
Benzene	5.4	9.9	5.8	5.1	4.4	2.4
Chlorodifluoromethane	3.5	4.9	4.6	6.2	8.9	2
Chloromethane	*1.3*	*1.5*	*1.1*	*1.4*	*1.4*	*1.3*
Cyclohexane	*0.96*	*1.3*	*0.72*	2.2	*0.76*	*0.65*
Dichlorodifluoromethane	*1.2*	*1.2*	*1.3*	*1.3*	*1.2*	*1.1*
Ethyl acetate	**1.8**	**1.8**	**1.8**	*1.7*	**1.8**	**1.8**
Ethylbenzene	**2.2**	*1.0*	**2.2**	*1.0*	*1.1*	**2.2**
Hexane	2.6	5.7	2.3	4.7	19	45
Isooctane	**2.3**	**2.3**	**2.3**	*2.0*	*0.7*	**2.3**
Isopropyl alcohol	7.1	11	7.4	6.5	*1.8*	**4.9**
m,p-Xylene	*2.1*	*2.8*	*1.8*	*3.3*	*3.3*	*1.3*
Methyl acrylate	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	3.8
Methylene chloride	*3.4*	*3.4*	*6.1*	16	*9.9*	*10.0*
n-Heptane	*1.6*	2.6	*1.7*	2.2	*1.7*	*1.3*
o-Xylene	*0.83*	*1.2*	**2.2**	*1.3*	*1.3*	**2.2**
Octane	2.3	2.8	2.3	2.8	*2.2*	*1.8*
Propylene	*2*	3.3	*1.3*	3.1	2.9	*1.1*
Styrene	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**
tert-Butyl alcohol	**1.5**	*0.97*	**1.5**	2.2	**1.5**	**1.5**
Tetrahydrofuran	**1.5**	*1.4*	**1.5**	*0.91*	1.6	**1.5**
Toluene	4.6	7	3.6	4.8	3.2	*1.8*
trans-1,2-Dichloroethene	**2**	**2**	**2**	**2**	**2**	**2**
Trichloroethene (TCE)	**2.7**	**2.7**	**2.7**	**2.7**	**2.7**	**2.7**
Trichlorofluoromethane	**2.8**	**2.8**	*1.0*	**2.8**	**2.8**	**2.8**
Vinyl acetate	**7**	*1.5*	**7**	**7**	**7**	**7**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 30. Ambient Air TO-15 Methodology Samples (continued)

Sample Identification Number	AFG_BAGRAM_20130924_TO14_01	AFG_BAGRAM_20130925_TO14_01	AFG_BAGRAM_20130926_TO14_01	AFG_BAGRAM_20130912_TO14_02	AFG_BAGRAM_20130913_TO14_02	AFG_BAGRAM_20130914_TO14_02
Collection Date	2013/09/24 1006	2013/09/25 1008	2013/09/26 1009	2013/09/12 0944	2013/09/13 0924	2013/09/14 0945
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**2.5**	**2.5**	**2.5**	**3**	**2.8**	**2.5**
2-Butanone (MEK)	*2.4*	*3.7*	*2.1*	*2.3*	*2.4*	*1.0*
Acetone	15	17	13	12	14	11
Acetonitrile	1.4	1.6	1.2	*0.66*	**0.94**	**0.84**
Acrolein	1.5	1.7	1.3	**1.4**	1.7	*0.66*
Acrylonitrile	**1.1**	**1.1**	**1.1**	**1.3**	**1.2**	**1.1**
alpha-Methylstyrene	**2.4**	**2.4**	**2.4**	**3**	**2.7**	**2.4**
Benzene	4.6	5.3	4.2	*1.7*	3.4	1.8
Chlorodifluoromethane	1.9	2.4	2.1	2.3	2.6	*1.3*
Chloromethane	*1.6*	*1.6*	*1.4*	*1.6*	*1.6*	*1.1*
Cyclohexane	*0.93*	*1.3*	*0.76*	**2.1**	*0.62*	**1.7**
Dichlorodifluoromethane	*1.3*	*1.2*	*1.2*	*1.6*	*1.4*	*1.2*
Ethyl acetate	**1.8**	**1.8**	**1.8**	**2.2**	*1.1*	**1.8**
Ethylbenzene	*0.83*	*1.1*	**2.2**	**2.7**	**2.4**	**2.2**
Hexane	2.9	5.2	2.5	*1.6*	*1.5*	**1.8**
Isooctane	**2.3**	**2.3**	**2.3**	**2.9**	**2.6**	**2.3**
Isopropyl alcohol	*4.1*	12	*2.5*	*5.3*	25	12
m,p-Xylene	*2.2*	*3.1*	*2.0*	**5.3**	*1.5*	**4.3**
Methyl acrylate	**1.8**	**1.8**	**1.8**	**2.2**	**2**	**1.8**
Methylene chloride	*3.0*	*3.8*	*2.4*	*4.4*	*2.8*	*2.3*
n-Heptane	*1.8*	2.3	*1.5*	**2.5**	*0.64*	**2**
o-Xylene	*0.96*	*1.3*	*0.91*	**2.7**	**2.4**	**2.2**
Octane	*2.1*	2.5	*2.1*	*0.52*	*0.63*	*0.37*
Propylene	2.8	3.4	2.1	*0.64*	2.1	*0.88*
Styrene	**2.1**	**2.1**	**2.1**	**2.6**	*1.4*	**2.1**
tert-Butyl alcohol	**1.5**	**1.5**	**1.5**	**1.9**	**1.7**	*1.2*
Tetrahydrofuran	**1.5**	*1.2*	**1.5**	**1.8**	**1.7**	**1.5**
Toluene	3.1	4.1	2.6	*1.4*	9.7	*0.83*
trans-1,2-Dichloroethene	**2**	**2**	**2**	**2.4**	**2.2**	**2**
Trichloroethene (TCE)	**2.7**	**2.7**	**2.7**	**3.3**	*1.2*	*1.7*
Trichlorofluoromethane	**2.8**	**2.8**	**2.8**	**3.5**	**3.1**	**2.8**
Vinyl acetate	**7**	*1.4*	*1.1*	**8.7**	*1.9*	**7**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 30. Ambient Air TO-15 Methodology Samples (continued)

Sample Identification Number	AFG_BAGRAM_20130915_TO14_02	AFG_BAGRAM_20130916_TO14_02	AFG_BAGRAM_20130917_TO14_02	AFG_BAGRAM_20130918_TO14_02	AFG_BAGRAM_20130919_TO14_02	AFG_BAGRAM_20130920_TO14_02
Collection Date	2013/09/15 0920	2013/09/16 0923	2013/09/17 0926	2013/09/18 0928	2013/09/19 0928	2013/09/20 0932
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**2.9**	**2.5**	**2.9**	**3**	**3**	**2.8**
2-Butanone (MEK)	*1.0*	*1.7*	*1.3*	*3.3*	*1.7*	*2.7*
Acetone	8.6	12	9.3	17	16	17
Acetonitrile	**1**	**0.84**	**1**	**1**	**1**	1.6
Acrolein	**1.4**	1.2	**1.4**	6.5	*1.2*	2.2
Acrylonitrile	**1.3**	**1.1**	**1.3**	**1.3**	**1.3**	**1.2**
alpha-Methylstyrene	**2.9**	**2.4**	**2.9**	**3**	**2.9**	**2.8**
Benzene	2.2	5.4	3.4	5.5	5.3	5.2
Chlorodifluoromethane	*1.3*	**1.8**	*1.8*	**2.2**	**2.1**	2.9
Chloromethane	*1.2*	*1.0*	*1.2*	*1.5*	*1.2*	*1.3*
Cyclohexane	**2.1**	**1.7**	**2.1**	**2.1**	**2.1**	2.4
Dichlorodifluoromethane	*1.5*	*1.1*	*1.4*	*1.3*	*1.3*	*1.6*
Ethyl acetate	**2.2**	**1.8**	**2.2**	**2.2**	**2.2**	*1.7*
Ethylbenzene	**2.6**	**2.2**	**2.6**	**2.7**	**2.6**	*1.6*
Hexane	*1.9*	*1.7*	*1.3*	*2.1*	3	4.3
Isooctane	**2.8**	**2.3**	**2.8**	**2.9**	**2.8**	**2.7**
Isopropyl alcohol	*3.0*	12	*4.5*	*3.3*	8.9	12
m,p-Xylene	**5.2**	**4.3**	**5.2**	*1.4*	*2.4*	*1.6*
Methyl acrylate	**2.1**	**1.8**	**2.1**	**2.2**	**2.1**	**2**
Methylene chloride	*2.8*	*4.9*	*3.1*	*3.7*	*3.9*	21
n-Heptane	**2.5**	**2**	**2.5**	**2.5**	*1.1*	*0.75*
o-Xylene	**2.6**	**2.2**	**2.6**	**2.7**	*0.95*	**2.5**
Octane	*0.62*	*0.56*	*0.5*	*0.8*	*1.4*	*1.0*
Propylene	*1.2*	2.5	*1.1*	4.8	2.7	4.8
Styrene	**2.6**	**2.1**	**2.6**	*2.1*	**2.6**	5.1
tert-Butyl alcohol	**1.8**	**1.5**	**1.8**	**1.9**	**1.8**	**1.7**
Tetrahydrofuran	**1.8**	**1.5**	**1.8**	**1.8**	**1.8**	**1.7**
Toluene	*1.1*	5.5	*1.8*	2.5	2.8	4
trans-1,2-Dichloroethene	**2.4**	**2**	**2.4**	**2.4**	**2.4**	**2.3**
Trichloroethene (TCE)	**3.2**	**2.7**	**3.2**	**3.3**	**3.3**	**3.1**
Trichlorofluoromethane	*1.2*	**2.8**	**3.4**	**3.5**	**3.4**	**3.2**
Vinyl acetate	**8.5**	*0.6*	**8.5**	*4.5*	*1.0*	*3.5*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 30. Ambient Air TO-15 Methodology Samples (continued)

Sample Identification Number	AFG_BAGRAM_20130921_TO14_02	AFG_BAGRAM_20130922_TO14_02	AFG_BAGRAM_20130923_TO14_02	AFG_BAGRAM_20130924_TO14_02	AFG_BAGRAM_20130925_TO14_02	AFG_BAGRAM_20130926_TO14_02
Collection Date	2013/09/21 0935	2013/09/22 0938	2013/09/23 0940	2013/09/24 0943	2013/09/25 0947	2013/09/26 0945
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**3**	**3.1**	**2.5**	**3**	**3**	**2.5**
2-Butanone (MEK)	*1.2*	*1.9*	*1.5*	*2.0*	*2.0*	*4.3*
Acetone	13	16	9.5	11	12	24
Acetonitrile	**1**	1.7	**0.84**	1	1.3	2.2
Acrolein	*0.69*	1.5	*0.53*	*1.1*	1.4	5.2
Acrylonitrile	*0.81*	**1.4**	**1.1**	**1.3**	**1.3**	**1.1**
alpha-Methylstyrene	**2.9**	**3**	**2.4**	**2.9**	**3**	**2.4**
Benzene	4.2	7.4	1.9	4.5	5.5	10
Chlorodifluoromethane	2.6	*1.7*	*1.1*	2.7	*1.9*	3.1
Chloromethane	*1.3*	*1.5*	*1.2*	*1.5*	*1.5*	*1.7*
Cyclohexane	**2.1**	**2.2**	**1.7**	**2.1**	*0.59*	**1.7**
Dichlorodifluoromethane	*1.3*	*1.4*	*1.0*	*1.4*	*1.5*	*1.1*
Ethyl acetate	**2.2**	**2.3**	**1.8**	**2.2**	**2.2**	**1.8**
Ethylbenzene	**2.6**	**2.7**	**2.2**	**2.6**	**2.7**	*0.96*
Hexane	*1.7*	14	14	*1.7*	2.3	13
Isooctane	**2.8**	**2.9**	**2.3**	**2.8**	**2.9**	**2.3**
Isopropyl alcohol	9.5	*4.2*	*2.7*	*4.1*	*5.3*	6.7
m,p-Xylene	*1.7*	*1.8*	**4.3**	*1.5*	*2.1*	*2.0*
Methyl acrylate	**2.1**	*1.4*	**1.8**	**2.1**	**2.2**	**1.8**
Methylene chloride	*5.5*	20	*7.6*	*3.8*	*4.5*	170
n-Heptane	*0.94*	*1.4*	**2**	*0.85*	*1.2*	*0.7*
o-Xylene	**2.6**	**2.7**	**2.2**	**2.6**	**2.7**	**2.2**
Octane	*1.2*	*2.4*	*0.65*	*1.1*	*1.6*	*0.75*
Propylene	2.5	2.7	*0.65*	*2.0*	2.8	5.4
Styrene	**2.6**	**2.7**	**2.1**	**2.6**	**2.6**	*0.89*
tert-Butyl alcohol	**1.8**	**1.9**	**1.5**	**1.8**	**1.9**	**1.5**
Tetrahydrofuran	**1.8**	**1.9**	**1.5**	**1.8**	**1.8**	**1.5**
Toluene	*2.1*	*2.0*	*0.98*	2.5	2.6	3.2
trans-1,2-Dichloroethene	**2.4**	**2.5**	**2**	**2.4**	**2.4**	**2**
Trichloroethene (TCE)	**3.3**	**3.4**	**2.7**	**3.3**	**3.3**	**2.7**
Trichlorofluoromethane	**3.4**	**3.5**	**2.8**	**3.4**	**3.5**	**2.8**
Vinyl acetate	**8.5**	**8.9**	*0.77*	**8.6**	**8.7**	*5.0*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 30. Ambient Air TO-15 Methodology Samples (continued)

Sample Identification Number	AFG_SABALU_20130912_TO14	AFG_SABALU_20130914_TO14	AFG_SABALU_20130915_TO14	AFG_SABALU_20130916_TO14	AFG_SABALU_20130917_TO14	AFG_SABALU_20130918_TO14
Collection Date	2013/09/12 1205	2013/09/14 1124	2013/09/15 1035	2013/09/16 1043	2013/09/17 1030	2013/09/18 1037
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**2.5**	**2.8**	**2.7**	**2.8**	**2.5**	**2.7**
2-Butanone (MEK)	*1.8*	*1.2*	*1.3*	*1.4*	*2.4*	*1.4*
Acetone	13	9.8	8	9.4	27	10
Acetonitrile	**0.84**	**0.97**	**0.93**	**0.95**	**0.84**	**0.93**
Acrolein	*0.5*	**1.3**	*1.1*	**1.3**	*0.76*	*0.51*
Acrylonitrile	**1.1**	**1.2**	**1.2**	**1.2**	**1.1**	**1.2**
alpha-Methylstyrene	**2.4**	**2.8**	**2.7**	**2.7**	**2.4**	**2.7**
Benzene	*1.4*	*1.5*	*1.3*	3.1	3.5	3.4
Chlorodifluoromethane	2.5	2.5	*1.2*	*1.6*	**1.8**	*2*
Chloromethane	*1.5*	*1.2*	*1.1*	*1.3*	*1.3*	*1.3*
Cyclohexane	**1.7**	*0.71*	*0.57*	**1.9**	*0.52*	**1.9**
Dichlorodifluoromethane	*1.3*	*1.7*	*1.4*	*1.3*	*1.3*	*1.3*
Ethyl acetate	**1.8**	**2.1**	**2**	**2**	**1.8**	**2**
Ethylbenzene	**2.2**	**2.5**	**2.4**	**2.5**	**2.2**	**2.4**
Hexane	*1.1*	2.4	*1.9*	*1.9*	5.1	2.3
Isooctane	**2.3**	**2.7**	**2.6**	**2.6**	*0.37*	**2.6**
Isopropyl alcohol	*2.8*	*1.7*	**5.5**	*1.8*	10	**5.5**
m,p-Xylene	**4.3**	**5**	**4.8**	**4.9**	*2.3*	**4.8**
Methyl acrylate	**1.8**	**2**	**2**	**2**	**1.8**	**2**
Methylene chloride	*2.4*	*2.8*	*2.5*	*4.8*	*5.1*	*3.2*
n-Heptane	**2**	*1.0*	*0.68*	**2.3**	*0.66*	**2.3**
o-Xylene	**2.2**	**2.5**	**2.4**	**2.5**	*1.0*	**2.4**
Octane	**2.3**	*1.2*	*0.93*	**2.6**	*0.61*	*0.62*
Propylene	*0.45*	**2**	**1.9**	**1.9**	*1.2*	*1.1*
Styrene	**2.1**	**2.4**	**2.4**	**2.4**	*1.1*	**2.4**
tert-Butyl alcohol	1.8	**1.7**	**1.7**	**1.7**	**1.5**	**1.7**
Tetrahydrofuran	**1.5**	**1.7**	**1.6**	**1.7**	**1.5**	**1.6**
Toluene	*0.9*	*1.1*	*0.88*	2.6	4.3	*1.2*
trans-1,2-Dichloroethene	**2**	**2.3**	**2.2**	**2.2**	*1.1*	**2.2**
Trichloroethene (TCE)	**2.7**	**3.1**	**3**	**3**	**2.7**	**3**
Trichlorofluoromethane	**2.8**	*1.2*	*1.1*	**3.2**	**2.8**	**3.1**
Vinyl acetate	*1.2*	**8.1**	**7.8**	**8**	*1.2*	*0.78*

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 30. Ambient Air TO-15 Methodology Samples (continued)

Sample Identification Number	AFG_SABALU_20130919_TO14	AFG_SABALU_20130920_TO14	AFG_SABALU_20130921_TO14	AFG_SABALU_20130922_TO14	AFG_SABALU_20130923_TO14	AFG_SABALU_20130924_TO14
Collection Date	2013/09/19 1042	2013/09/20 1052	2013/09/21 1057	2013/09/22 1047	2013/09/23 1045	2013/09/24 1048
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**2.7**	**2.7**	**2.8**	**2.9**	**2.8**	**2.5**
2-Butanone (MEK)	*1.6*	*0.83*	*1.6*	*1.9*	*1.9*	*3.6*
Acetone	12	9.8	12	20	11	23
Acetonitrile	*0.88*	1.8	1.4	**0.99**	*0.88*	*0.76*
Acrolein	*1.1*	**1.2**	*0.63*	*1.0*	**1.3**	*0.83*
Acrylonitrile	**1.2**	**1.2**	**1.2**	**1.3**	**1.2**	**1.1**
alpha-Methylstyrene	**2.7**	**2.6**	**2.8**	**2.9**	**2.7**	**2.4**
Benzene	5.4	2.4	3.6	4	2.5	2.3
Chlorodifluoromethane	2.9	2.4	2.1	3.2	*1.8*	**1.8**
Chloromethane	*1.4*	*1.1*	*1.4*	*1.4*	*1.5*	*1.3*
Cyclohexane	*0.65*	*1.6*	*0.55*	**2**	**1.9**	*0.69*
Dichlorodifluoromethane	*1.3*	*1.3*	*1.3*	*1.4*	*1.3*	*1.1*
Ethyl acetate	**2**	**1.9**	**2.1**	**2.1**	**2**	*1.7*
Ethylbenzene	**2.4**	**2.3**	**2.5**	**2.6**	**2.4**	*1.1*
Hexane	4	3.4	20	58	99	3.7
Isooctane	**2.6**	**2.5**	**2.7**	**2.8**	**2.6**	*0.79*
Isopropyl alcohol	*2.2*	*3.5*	**5.7**	**5.8**	*4.0*	16
m,p-Xylene	*1.5*	*1.2*	*1.4*	*1.1*	**4.9**	*1.7*
Methyl acrylate	**2**	**1.9**	*1.7*	4.9	**2**	**1.8**
Methylene chloride	*4.6*	*14.0*	*7.3*	*14.0*	17	*3.1*
n-Heptane	*1.2*	*0.89*	*0.9*	*0.87*	**2.3**	*1.1*
o-Xylene	**2.4**	**2.3**	**2.5**	**2.6**	**2.4**	**2.2**
Octane	*1.1*	*1.0*	*1.2*	*1.1*	*0.37*	*0.89*
Propylene	2.7	*1.1*	*1.9*	2.1	*1.0*	*1.1*
Styrene	**2.4**	**2.3**	**2.4**	**2.5**	**2.4**	*1.6*
tert-Butyl alcohol	**1.7**	**1.6**	**1.7**	**1.8**	**1.7**	2.3
Tetrahydrofuran	**1.6**	**1.6**	**1.7**	**1.7**	**1.7**	**1.5**
Toluene	2.3	2	*1.9*	*1.6*	*1.3*	4.9
trans-1,2-Dichloroethene	**2.2**	**2.1**	**2.3**	**2.3**	**2.2**	3.5
Trichloroethene (TCE)	**3**	**2.9**	**3.1**	**3.2**	**3**	**2.7**
Trichlorofluoromethane	**3.1**	**3**	**3.2**	**3.3**	**3.1**	**2.8**
Vinyl acetate	**7.8**	**7.6**	**8.1**	**8.3**	*1.1*	**7**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 30. Ambient Air TO-15 Methodology Samples (continued)

Sample Identification Number	AFG_SABALU_20130925_TO14	AFG_SABALU_20130926_TO14
Collection Date	2013/09/25 1053	2013/09/26 1100
COPC	ug/m^3	ug/m^3
1,2,4-Trimethylbenzene	**2.8**	**2.9**
2-Butanone (MEK)	*2.1*	*2.6*
Acetone	29	16
Acetonitrile	1.1	1
Acrolein	*1.1*	*0.72*
Acrylonitrile	**1.2**	**1.3**
alpha-Methylstyrene	**2.7**	**2.8**
Benzene	5.1	6.4
Chlorodifluoromethane	3.4	3.1
Chloromethane	*1.6*	*1.4*
Cyclohexane	*0.77*	**2**
Dichlorodifluoromethane	*1.3*	*1.4*
Ethyl acetate	**2**	**2.1**
Ethylbenzene	**2.4**	**2.5**
Hexane	2.5	2.1
Isooctane	**2.6**	**2.7**
Isopropyl alcohol	**5.5**	*2.5*
m,p-Xylene	*1.6*	**5.1**
Methyl acrylate	**2**	**2.1**
Methylene chloride	*4.2*	*3.5*
n-Heptane	*1.3*	*0.67*
o-Xylene	**2.4**	**2.5**
Octane	*1.3*	*0.77*
Propylene	1.9	*1.3*
Styrene	**2.4**	**2.5**
tert-Butyl alcohol	**1.7**	**1.8**
Tetrahydrofuran	**1.7**	**1.7**
Toluene	2.5	*1.8*
trans-1,2-Dichloroethene	**2.2**	**2.3**
Trichloroethene (TCE)	**3**	**3.1**
Trichlorofluoromethane	**3.1**	*2.8*
Vinyl acetate	*1.3*	**8.2**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 31. Ambient Air $PM_{2.5}$ Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130912_PM2.5_01	AFG_BAGRAM_20130913_PM2.5_01	AFG_BAGRAM_20130914_PM25DPS_01	AFG_BAGRAM_20130915_PM25DPS_01	AFG_BAGRAM_20130916_PM25DPS_01	AFG_BAGRAM_20130917_PM25DPS_01
Collection Date	2013/09/12 1019	2013/09/13 1032	2013/09/14 1036	2013/09/15 1012	2013/09/16 0950	2013/09/17 0954
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
Antimony	**7.14E-02**	**7.12E-02**	**7.20E-02**	**6.97E-02**	**6.94E-02**	**6.78E-02**
Lead	**7.14E-02**	7.12E-02	**7.20E-02**	**6.97E-02**	**6.94E-02**	**6.78E-02**
PM2.5	4.60E+01	5.94E+01	3.47E+01	3.17E+01	3.72E+01	4.73E+01
Zinc	**3.57E-01**	**3.56E-01**	**3.60E-01**	**3.49E-01**	**3.47E-01**	**3.39E-01**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 31. Ambient Air $PM_{2.5}$ Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130918_PM25DPS_01	AFG_BAGRAM_20130919_PM25DPS_01	AFG_BAGRAM_20130920_PM25DPS_01	AFG_BAGRAM_20130922_PM25DPS_01	AFG_BAGRAM_20130923_PM25DPS_01	AFG_BAGRAM_20130924_PM25DPS_01
Collection Date	2013/09/18 1012	2013/09/19 1015	2013/09/20 1021	2013/09/22 1035	2013/09/23 1043	2013/09/24 1048
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
Antimony	**7.05E-02**	**7.27E-02**	**6.84E-02**	**6.88E-02**	**6.98E-02**	**7.01E-02**
Lead	**7.05E-02**	**7.27E-02**	**6.84E-02**	**6.88E-02**	**6.98E-02**	**7.01E-02**
PM2.5	5.23E+01	6.93E+01	4.48E+01	6.60E+01	5.29E+01	7.04E+01
Zinc	**3.53E-01**	**3.64E-01**	**3.42E-01**	**3.44E-01**	**3.49E-01**	**3.51E-01**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 31. Ambient Air $PM_{2.5}$ Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130925_PM25DPS_01	AFG_BAGRAM_20130926_PM25DPS_01	AFG_BAGRAM_20130913_PM25DPS_02	AFG_BAGRAM_20130914_PM25_02	AFG_BAGRAM_20130915_PM25DPS_02	AFG_BAGRAM_20130916_PM25DPS_02
Collection Date	2013/09/25 1050	2013/09/26 1056	2013/09/13 0954	2013/09/14 1008	2013/09/15 0935	2013/09/16 0940
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
Antimony	**6.81E-02**	**6.96E-02**	**7.08E-02**	**7.22E-02**	**7.20E-02**	**6.74E-02**
Lead	**6.81E-02**	**6.96E-02**	7.08E-02	**7.22E-02**	**7.20E-02**	**6.74E-02**
PM2.5	7.53E+01	6.31E+01	4.70E+01	2.81E+01	5.09E+01	3.21E+01
Zinc	**3.40E-01**	**3.48E-01**	**3.54E-01**	**3.61E-01**	**3.60E-01**	**3.37E-01**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 31. Ambient Air $PM_{2.5}$ Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130917_PM25DPS_02	AFG_BAGRAM_20130918_PM25DPS_02	AFG_BAGRAM_20130919_PM25DPS_02	AFG_BAGRAM_20130921_PM25DPS_02	AFG_BAGRAM_20130922_PM25DPS_02	AFG_BAGRAM_20130923_PM25DPS_02
Collection Date	2013/09/17 0947	2013/09/18 0953	2013/09/19 0959	2013/09/21 1001	2013/09/22 0953	2013/09/23 0958
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
Antimony	**7.31E-02**	**6.88E-02**	**7.01E-02**	9.23E-02	**6.94E-02**	**6.94E-02**
Lead	**7.31E-02**	**6.88E-02**	**7.01E-02**	**7.10E-02**	7.64E-02	**6.94E-02**
PM2.5	4.80E+01	6.96E+01	3.61E+01	5.28E+01	6.65E+01	5.26E+01
Zinc	**3.66E-01**	**3.44E-01**	**3.51E-01**	**3.55E-01**	**3.47E-01**	**3.47E-01**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 31. Ambient Air $PM_{2.5}$ Methodology Samples

Sample Identification Number	AFG_BAGRAM_20130924_PM25DPS_02	AFG_BAGRAM_20130925_PM25DPS_02	AFG_BAGRAM_20130926_PM25DPS_02	AFG_SABALU_20130912_PM25_02	AFG_SABALU_20130913_PM25DPS	AFG_SABALU_20130914_PM25DPS
Collection Date	2013/09/24 1003	2013/09/25 1007	2013/09/26 0956	2013/09/12 1210	2013/09/13 1225	2013/09/14 1134
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
Antimony	**7.09E-02**	**7.03E-02**	**6.94E-02**	**6.94E-02**	**7.31E-02**	**7.30E-02**
Lead	8.50E-02	**7.03E-02**	1.04E-01	**6.94E-02**	**7.31E-02**	**7.30E-02**
PM2.5	7.37E+01	7.08E+01	8.84E+01	4.01E+01	3.80E+01	3.67E+01
Zinc	**3.54E-01**	**3.51E-01**	**3.47E-01**	**3.47E-01**	**3.65E-01**	**3.65E-01**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 4 to Appendix C Table 31. Ambient Air $PM_{2.5}$ Methodology Samples

Sample Identification Number	AFG_SABALU_20130915_PM25DPS	AFG_SABALU_20130916_PM25DPS	AFG_SABALU_20130917_PM25DPS	AFG_SABALU_20130918_PM25DPS	AFG_SABALU_20130919_PM25DPS	AFG_SABALU_20130920_PM25DPS
Collection Date	2013/09/15 1049	2013/09/16 1054	2013/09/17 1038	2013/09/18 1047	2013/09/19 1058	2013/09/20 1102
COPC	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
Antimony	**7.09E-02**	**6.84E-02**	**7.23E-02**	**7.51E-02**	**7.05E-02**	**7.05E-02**
Lead	**7.09E-02**	**6.84E-02**	**7.23E-02**	**7.51E-02**	7.76E-02	**7.05E-02**
PM2.5	2.63E+01	3.60E+01	4.82E+01	5.59E+01	6.38E+01	6.74E+01
Zinc	**3.54E-01**	**3.42E-01**	**3.62E-01**	**3.75E-01**	**3.53E-01**	**3.53E-01**

Note: Bolded samples represent the sample reporting limit due to non-detection. Italicized samples represent J-qualified data.

Annex 5 to Appendix C
Quantitative Screening Risk Assessment Results by Location

Annex 5 to Appendix C Table 32. Noncarcinogenic Risk Results for Personnel Present for 9 Months

Compound	Overall Base	Building 24064	HLZ	DFIP
1,2,4-Trimethylbenzene	0.01	0.01	0.00	0.00
2,3,7,8-TCDD	0.00	0.00	0.00	0.00
2,6-Dinitrotoluene	0.00	0.00	0.00	0.00
2-Butanone (MEK)	0.00	0.00	0.00	0.00
2-Methylnaphthalene	0.00	0.00	0.00	0.00
2-Methylphenol	0.00	0.00	0.00	0.00
2-Nitrophenol	0.07	0.07	0.13	0.04
4-Nitrophenol	0.00	0.00	0.00	0.00
Acenaphthene	0.00	0.00	0.00	0.00
Acenaphthylene	0.00	0.00	0.00	0.00
Acetone	0.00	0.00	0.00	0.00
Acetonitrile	0.02	0.03	0.01	0.01
Acetophenone	0.00	0.00	0.00	0.00
Acrylonitrile	0.00	0.00	0.00	0.00
alpha-Methylstyrene	0.00	0.00	0.00	0.00
Antimony	0.00	0.00	0.00	0.00
Benz[a]anthracene	0.00	0.00	0.00	0.00
Benzene	0.11	0.12	0.13	0.09
Benzo[b]fluoranthene	0.00	0.00	0.00	0.00
Benzo[g,h,i]perylene	0.00	0.00	0.00	0.00
Benzoic acid	0.00	0.00	0.00	0.00
Benzyl alcohol	0.00	0.00	0.00	0.00
Chlorodifluoromethane	0.00	0.00	0.00	0.00
Chloromethane	0.01	0.01	0.01	0.01
Chrysene	0.00	0.00	0.00	0.00
Cyclohexane	0.00	0.00	0.00	0.00
Di(2-ethylhexyl)phthalate	0.00	0.00	0.00	0.00
Dibenzofuran	0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.00	0.00	0.01	0.00
Diethylphthalate	0.00	0.00	0.00	0.00
Dimethylphthalate	0.00	0.00	0.00	0.00
Di-n-butylphthalate	0.00	0.00	0.00	0.00
Di-n-octylphthalate	0.00	0.00	0.00	0.00
Ethyl acetate	0.02	0.04	0.02	0.02
Ethylbenzene	0.00	0.00	0.00	0.03
Fluoranthene	0.00	0.00	0.00	0.00
Fluorene	0.00	0.00	0.00	0.00

Annex 5 to Appendix C Table 32. Noncarcinogenic Risk Results for Personnel Present for 9 Months (continued)

Compound	Overall Base	Building 24064	HLZ	DFIP
Hexane	0.02	0.02	0.01	0.00
Indeno[1,2,3-cd]pyrene	0.00	0.00	0.00	0.00
Isooctane	0.00	0.00	0.00	0.00
Isopropyl alcohol	0.00	0.02	0.00	0.00
Lead	0.00	0.00	0.00	0.00
m,p-Methylphenol	0.00	0.00	0.00	0.00
m,p-Xylene	0.00	0.00	0.00	0.00
Methyl acrylate	0.07	0.07	0.05	0.09
Methylene chloride	0.03	0.03	0.08	0.01
Naphthalene	0.16	0.09	0.36	0.07
n-Heptane	0.00	0.00	0.00	0.00
Octane	0.00	0.00	0.00	0.00
o-Xylene	0.00	0.00	0.00	0.00
Phenanthrene	0.00	0.00	0.00	0.00
Phenol	0.00	0.00	0.00	0.00
PM2.5	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00
Pyrene	0.00	0.00	0.00	0.00
Styrene	0.00	0.00	0.00	0.00
tert-Butyl alcohol	0.00	0.00	0.00	0.00
Tetrahydrofuran	0.00	0.00	0.00	0.00
Toluene	0.00	0.01	0.00	0.00
trans-1,2-Dichloroethene	0.00	0.00	0.00	0.02
Trichloroethene (TCE)	0.31	3.26	0.13	0.00
Trichlorofluoromethane	0.00	0.00	0.00	0.00
Vinyl acetate	0.01	0.01	0.01	0.00
Zinc	0.00	0.00	0.00	0.00
Hazard Index	0.84	3.79	0.95	0.39

Notes:
N/A=Not Applicable
Some values appear as zeroes due to the number of significant figures used in this table. However, such values are actually above zero.

Annex 5 to Appendix C Table 33. Carcinogenic Risk Results for Personnel Present for 9 Months

Compound	Overall Base	Building 24064	HLZ	DFIP
1,2,4-Trimethylbenzene	0.E+00	0.E+00	0.E+00	0.E+00
2,3,7,8-TCDD	5.E-07	2.E-07	2.E-07	6.E-07
2,6-Dinitrotoluene	0.E+00	0.E+00	0.E+00	0.E+00
2-Butanone (MEK)	0.E+00	0.E+00	0.E+00	0.E+00
2-Methylnaphthalene	0.E+00	0.E+00	0.E+00	0.E+00
2-Methylphenol	0.E+00	0.E+00	0.E+00	0.E+00
2-Nitrophenol	0.E+00	0.E+00	0.E+00	0.E+00
4-Nitrophenol	0.E+00	0.E+00	0.E+00	0.E+00
Acenaphthene	0.E+00	0.E+00	0.E+00	0.E+00
Acenaphthylene	0.E+00	0.E+00	0.E+00	0.E+00
Acetone	0.E+00	0.E+00	0.E+00	0.E+00
Acetonitrile	0.E+00	0.E+00	0.E+00	0.E+00
Acetophenone	0.E+00	0.E+00	0.E+00	0.E+00
Acrolein	0.E+00	0.E+00	0.E+00	0.E+00
Acrylonitrile	0.E+00	0.E+00	6.E-07	0.E+00
alpha-Methylstyrene	0.E+00	0.E+00	0.E+00	0.E+00
Antimony	0.E+00	0.E+00	0.E+00	0.E+00
Benz[a]anthracene	5.E-09	6.E-09	5.E-09	6.E-09
Benzene	3.E-07	4.E-07	4.E-07	3.E-07
Benzo[b]fluoranthene	2.E-08	1.E-08	3.E-08	1.E-08
Benzo[g,h,i]perylene	0.E+00	0.E+00	0.E+00	0.E+00
Benzoic acid	0.E+00	0.E+00	0.E+00	0.E+00
Benzyl alcohol	0.E+00	0.E+00	0.E+00	0.E+00
Chlorodifluoromethane	0.E+00	0.E+00	0.E+00	0.E+00
Chloromethane	3.E-08	3.E-08	3.E-08	3.E-08
Chrysene	1.E-09	1.E-09	2.E-09	1.E-09
Cyclohexane	0.E+00	0.E+00	0.E+00	0.E+00
Di(2-ethylhexyl)phthalate	0.E+00	0.E+00	0.E+00	0.E+00
Dibenzofuran	0.E+00	0.E+00	0.E+00	0.E+00
Dichlorodifluoromethane	0.E+00	0.E+00	0.E+00	0.E+00
Diethylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Dimethylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Di-n-butylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Di-n-octylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Ethyl acetate	0.E+00	0.E+00	0.E+00	0.E+00
Ethylbenzene	3.E-08	4.E-08	5.E-08	1.E-06
Fluoranthene	0.E+00	0.E+00	0.E+00	0.E+00
Fluorene	0.E+00	0.E+00	0.E+00	0.E+00

Annex 5 to Appendix C Table 33. Carcinogenic Risk Results for Personnel Present for 9 Months (continued)

Compound	Overall Base	Building 24064	HLZ	DFIP
Hexane	0.E+00	0.E+00	0.E+00	0.E+00
Indeno[1,2,3-cd]pyrene	9.E-09	6.E-09	1.E-08	6.E-09
Isooctane	0.E+00	0.E+00	0.E+00	0.E+00
Isopropyl alcohol	0.E+00	0.E+00	0.E+00	0.E+00
Lead	9.E-09	9.E-09	1.E-08	1.E-08
m,p-Methylphenol	0.E+00	0.E+00	0.E+00	0.E+00
m,p-Xylene	0.E+00	0.E+00	0.E+00	0.E+00
Methyl acrylate	0.E+00	0.E+00	0.E+00	0.E+00
Methylene chloride	3.E-07	2.E-07	7.E-07	1.E-07
Naphthalene	2.E-07	1.E-07	5.E-07	1.E-07
n-Heptane	0.E+00	0.E+00	0.E+00	0.E+00
Octane	0.E+00	0.E+00	0.E+00	0.E+00
o-Xylene	0.E+00	0.E+00	0.E+00	0.E+00
Phenanthrene	0.E+00	0.E+00	0.E+00	0.E+00
Phenol	0.E+00	0.E+00	0.E+00	0.E+00
PM2.5	0.E+00	0.E+00	0.E+00	0.E+00
Propylene	0.E+00	0.E+00	0.E+00	0.E+00
Pyrene	0.E+00	0.E+00	0.E+00	0.E+00
Styrene	0.E+00	0.E+00	0.E+00	0.E+00
tert-Butyl alcohol	0.E+00	0.E+00	0.E+00	0.E+00
Tetrahydrofuran	0.E+00	0.E+00	0.E+00	0.E+00
Toluene	0.E+00	0.E+00	0.E+00	0.E+00
trans-1,2-Dichloroethene	0.E+00	0.E+00	0.E+00	0.E+00
Trichloroethene (TCE)	9.E-08	9.E-07	4.E-08	0.E+00
Trichlorofluoromethane	0.E+00	0.E+00	0.E+00	0.E+00
Vinyl acetate	0.E+00	0.E+00	0.E+00	0.E+00
Zinc	0.E+00	0.E+00	0.E+00	0.E+00
Cancer Risk	2.E-06	2.E-06	3.E-06	2.E-06

Note:
N/A=Not Applicable

Annex 5 to Appendix C Table 34. Noncarcinogenic Risk Results for Personnel Present for 6 Months

Compound	Overall Base	Building 24064	HLZ	DFIP
1,2,4-Trimethylbenzene	0.01	0.01	0.00	0.00
2,3,7,8-TCDD	0.00	0.00	0.00	0.00
2,6-Dinitrotoluene	0.00	0.00	0.00	0.00
2-Butanone (MEK)	0.00	0.00	0.00	0.00
2-Methylnaphthalene	0.00	0.00	0.00	0.00
2-Methylphenol	0.00	0.00	0.00	0.00
2-Nitrophenol	0.05	0.05	0.08	0.03
4-Nitrophenol	0.00	0.00	0.00	0.00
Acenaphthene	0.00	0.00	0.00	0.00
Acenaphthylene	0.00	0.00	0.00	0.00
Acetone	0.00	0.00	0.00	0.00
Acetonitrile	0.01	0.02	0.01	0.01
Acetophenone	0.00	0.00	0.00	0.00
Acrylonitrile	0.00	0.00	0.00	0.00
alpha-Methylstyrene	0.00	0.00	0.00	0.00
Antimony	0.00	0.00	0.00	0.00
Benz[a]anthracene	0.00	0.00	0.00	0.00
Benzene	0.07	0.08	0.09	0.06
Benzo[b]fluoranthene	0.00	0.00	0.00	0.00
Benzo[g,h,i]perylene	0.00	0.00	0.00	0.00
Benzoic acid	0.00	0.00	0.00	0.00
Benzyl alcohol	0.00	0.00	0.00	0.00
Chlorodifluoromethane	0.00	0.00	0.00	0.00
Chloromethane	0.01	0.01	0.01	0.01
Chrysene	0.00	0.00	0.00	0.00
Cyclohexane	0.00	0.00	0.00	0.00
Di(2-ethylhexyl)phthalate	0.00	0.00	0.00	0.00
Dibenzofuran	0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.00	0.00	0.00	0.00
Diethylphthalate	0.00	0.00	0.00	0.00
Dimethylphthalate	0.00	0.00	0.00	0.00
Di-n-butylphthalate	0.00	0.00	0.00	0.00
Di-n-octylphthalate	0.00	0.00	0.00	0.00
Ethyl acetate	0.02	0.03	0.01	0.01
Ethylbenzene	0.00	0.00	0.00	0.02
Fluoranthene	0.00	0.00	0.00	0.00
Fluorene	0.00	0.00	0.00	0.00

Annex 5 to Appendix C Table 34. Noncarcinogenic Risk Results for Personnel Present for 6 Months (continued)

Compound	Overall Base	Building 24064	HLZ	DFIP
Hexane	0.01	0.01	0.01	0.00
Indeno[1,2,3-cd]pyrene	0.00	0.00	0.00	0.00
Isooctane	0.00	0.00	0.00	0.00
Isopropyl alcohol	0.00	0.01	0.00	0.00
Lead	0.00	0.00	0.00	0.00
m,p-Methylphenol	0.00	0.00	0.00	0.00
m,p-Xylene	0.00	0.00	0.00	0.00
Methyl acrylate	0.04	0.04	0.03	0.06
Methylene chloride	0.02	0.02	0.05	0.01
Naphthalene	0.11	0.06	0.24	0.04
n-Heptane	0.00	0.00	0.00	0.00
Octane	0.00	0.00	0.00	0.00
o-Xylene	0.00	0.00	0.00	0.00
Phenanthrene	0.00	0.00	0.00	0.00
Phenol	0.00	0.00	0.00	0.00
PM2.5	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00
Pyrene	0.00	0.00	0.00	0.00
Styrene	0.00	0.00	0.00	0.00
tert-Butyl alcohol	0.00	0.00	0.00	0.00
Tetrahydrofuran	0.00	0.00	0.00	0.00
Toluene	0.00	0.00	0.00	0.00
trans-1,2-Dichloroethene	0.00	0.00	0.00	0.01
Trichloroethene (TCE)	0.21	2.17	0.09	0.00
Trichlorofluoromethane	0.00	0.00	0.00	0.00
Vinyl acetate	0.01	0.00	0.01	0.00
Zinc	0.00	0.00	0.00	0.00
Hazard Index	0.57	2.51	0.63	0.26

Notes:
N/A=Not Applicable
Some values appear as zeroes due to the number of significant figures used in this table. However, such values are actually above zero.

Annex 5 to Appendix C Table 35. Carcinogenic Risk Results for Personnel Present for 6 Months

Compound	Overall Base	Building 24064	HLZ	DFIP
1,2,4-Trimethylbenzene	0.E+00	0.E+00	0.E+00	0.E+00
2,3,7,8-TCDD	4.E-07	1.E-07	2.E-07	4.E-07
2,6-Dinitrotoluene	0.E+00	0.E+00	0.E+00	0.E+00
2-Butanone (MEK)	0.E+00	0.E+00	0.E+00	0.E+00
2-Methylnaphthalene	0.E+00	0.E+00	0.E+00	0.E+00
2-Methylphenol	0.E+00	0.E+00	0.E+00	0.E+00
2-Nitrophenol	0.E+00	0.E+00	0.E+00	0.E+00
4-Nitrophenol	0.E+00	0.E+00	0.E+00	0.E+00
Acenaphthene	0.E+00	0.E+00	0.E+00	0.E+00
Acenaphthylene	0.E+00	0.E+00	0.E+00	0.E+00
Acetone	0.E+00	0.E+00	0.E+00	0.E+00
Acetonitrile	0.E+00	0.E+00	0.E+00	0.E+00
Acetophenone	0.E+00	0.E+00	0.E+00	0.E+00
Acrolein	0.E+00	0.E+00	0.E+00	0.E+00
Acrylonitrile	0.E+00	0.E+00	4.E-07	0.E+00
alpha-Methylstyrene	0.E+00	0.E+00	0.E+00	0.E+00
Antimony	0.E+00	0.E+00	0.E+00	0.E+00
Benz[a]anthracene	4.E-09	4.E-09	3.E-09	4.E-09
Benzene	2.E-07	3.E-07	3.E-07	2.E-07
Benzo[b]fluoranthene	1.E-08	9.E-09	2.E-08	1.E-08
Benzo[g,h,i]perylene	0.E+00	0.E+00	0.E+00	0.E+00
Benzoic acid	0.E+00	0.E+00	0.E+00	0.E+00
Benzyl alcohol	0.E+00	0.E+00	0.E+00	0.E+00
Chlorodifluoromethane	0.E+00	0.E+00	0.E+00	0.E+00
Chloromethane	2.E-08	2.E-08	2.E-08	2.E-08
Chrysene	9.E-10	7.E-10	2.E-09	6.E-10
Cyclohexane	0.E+00	0.E+00	0.E+00	0.E+00
Di(2-ethylhexyl)phthalate	0.E+00	0.E+00	0.E+00	0.E+00
Dibenzofuran	0.E+00	0.E+00	0.E+00	0.E+00
Dichlorodifluoromethane	0.E+00	0.E+00	0.E+00	0.E+00
Diethylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Dimethylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Di-n-butylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Di-n-octylphthalate	0.E+00	0.E+00	0.E+00	0.E+00
Ethyl acetate	0.E+00	0.E+00	0.E+00	0.E+00
Ethylbenzene	2.E-08	2.E-08	3.E-08	8.E-07
Fluoranthene	0.E+00	0.E+00	0.E+00	0.E+00
Fluorene	0.E+00	0.E+00	0.E+00	0.E+00

Annex 5 to Appendix C Table 35. Carcinogenic Risk Results for Personnel Present for 4 Month (continued)

Compound	Overall Base	Building 24064	HLZ	DFIP
Hexane	0.E+00	0.E+00	0.E+00	0.E+00
Indeno[1,2,3-cd]pyrene	6.E-09	4.E-09	1.E-08	4.E-09
Isooctane	0.E+00	0.E+00	0.E+00	0.E+00
Isopropyl alcohol	0.E+00	0.E+00	0.E+00	0.E+00
Lead	6.E-09	6.E-09	6.E-09	7.E-09
m,p-Methylphenol	0.E+00	0.E+00	0.E+00	0.E+00
m,p-Xylene	0.E+00	0.E+00	0.E+00	0.E+00
Methyl acrylate	0.E+00	0.E+00	0.E+00	0.E+00
Methylene chloride	2.E-07	2.E-07	4.E-07	8.E-08
Naphthalene	2.E-07	8.E-08	4.E-07	7.E-08
n-Heptane	0.E+00	0.E+00	0.E+00	0.E+00
Octane	0.E+00	0.E+00	0.E+00	0.E+00
o-Xylene	0.E+00	0.E+00	0.E+00	0.E+00
Phenanthrene	0.E+00	0.E+00	0.E+00	0.E+00
Phenol	0.E+00	0.E+00	0.E+00	0.E+00
PM2.5	0.E+00	0.E+00	0.E+00	0.E+00
Propylene	0.E+00	0.E+00	0.E+00	0.E+00
Pyrene	0.E+00	0.E+00	0.E+00	0.E+00
Styrene	0.E+00	0.E+00	0.E+00	0.E+00
tert-Butyl alcohol	0.E+00	0.E+00	0.E+00	0.E+00
Tetrahydrofuran	0.E+00	0.E+00	0.E+00	0.E+00
Toluene	0.E+00	0.E+00	0.E+00	0.E+00
trans-1,2-Dichloroethene	0.E+00	0.E+00	0.E+00	0.E+00
Trichloroethene (TCE)	6.E-08	6.E-07	3.E-08	0.E+00
Trichlorofluoromethane	0.E+00	0.E+00	0.E+00	0.E+00
Vinyl acetate	0.E+00	0.E+00	0.E+00	0.E+00
Zinc	0.E+00	0.E+00	0.E+00	0.E+00
Cancer Risk	1.E-06	1.E-06	2.E-06	2.E-06

Note:
N/A=Not Applicable.

Annex 6 to Appendix C
Glossary

BAF
Bagram Airfield

COPC
Chemical of Potential Concern

DFIP
Detention Facility in Parwan

DOD
Department of Defense

HI
Hazard Index

HQ
Hazard Quotient

HRA
Health Risk Assessment

MEG
Military Exposure Guideline

OEH
occupational and environmental health

PAH
polycyclic aromatic hydrocarbons

$PM_{2.5}$
particulate matter less than 2.5 micrometers in diameter

QA
quality assurance

TO
toxic organic

USAPHC
U.S. Army Public Health Command

EPA
U.S. Environmental Protection Agency

VOC
Volatile organic compound