DEPARTMENT OF THE ARMY
US ARMY INSTITUTE OF PUBLIC HEALTH
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MCHB-IP-RDE

10 AUG 2011

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: Deployment Occupational and Environmental Health Surveillance Sample Report, Airborne Particulate Matter, Kandahar, Afghanistan, 2-26 April 2011, U_AFG_KANDAHAR_IP_A10_20110426

1. The enclosed report details the assessment of particulate matter (PM) air samples collected by 5th Preventive Medicine Detachment personnel, from four sites at Kandahar, Afghanistan, 2-26 April 2011. The samples were collected for airborne PM less than 10 micrometers in diameter ($PM_{10}$) and analyzed for a set of metals typically associated with PM.

2. Based on the sample results and associated exposure information assessed in this report, the tactical risk estimate for $PM_{10}$ in the Burn Pit area on both typical exposure and peak exposure days during the sampled timeframe is **moderate**. The tactical risk estimate for $PM_{10}$ in the South Park; Board Walk; and Morale, Welfare, and Recreation facility areas on both typical exposure and peak exposure days during the sampled timeframe is **low**.

FOR THE DIRECTOR:

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MCHB-IP-RDE
SUBJECT: Deployment Occupational and Environmental Health Surveillance Sample Report, Airborne Particulate Matter, Kandahar, Afghanistan, 2-26 April 2011, U_AFG_KANDAHAR_IP_A10_20110426

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Deployment Occupational and Environmental Health Surveillance Sample Report,
U_AFG_KANDAHAR_IP_A10_20110426
Health Risk Management Portfolio

Airborne Particulate Matter, Kandahar, Afghanistan

Prepared by (b) (6)
Deployment Environmental Surveillance Program



Preventive Medicine Surveys: 40-5f1

# ACKNOWLEDGEMENTS

# DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL HEALTH SURVEILLANCE SAMPLE REPORT AIRBORNE PARTICULATE MATTER KANDAHAR, AFGHANISTAN 2-26 APRIL 2011 U_AFG_KANDAHAR_IP_A10_20110426

## 1 References

See Appendix A for a list of references.

## 2 Purpose

This report provides the U.S. Army Public Health Command (USAPHC), Army Institute of Public Health (AIPH) assessment of the laboratory analytical results and exposure information associated with the samples collected by 5th Preventive Medicine Detachment on 2-26 April 2011 at four sites at Kandahar, Afghanistan according to the 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 exposures, and 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 (Prov) Technical Guide (TG) 230 “Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel, June 2010 Revision.” The assessment is based on limited data representing a specific time period and assesses short-term exposure risks only. Therefore, this report 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 Laboratory Analysis

Filters used to collect deployment air samples of particulate matter (PM) are shipped to the USAPHC, AIPH, and weighed to determine particulate mass and calculate ambient concentrations. The USAPHC, AIPH laboratory also analyzes the PM for a standard set of metals typically found in PM. 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 Appendix B.

## 5 Exposure Setting

Appendix C contains information about the sampling location, environmental conditions, and associated potential population exposure for each sample site. The information was provided on the field data sheets submitted with the sample set unless otherwise noted. Information about the individual samples including sample date and site, is provided in Appendix B. Correction and clarification of exposure assumptions by the sampling unit is encouraged.

## 6 Prescreen

Table 1 shows parameters identified as potential hazards because their peak single sample concentrations were greater than their most health-protective screening level USAPHC (Prov) TG 230 military exposure guidelines (MEGs). Potential hazards are further assessed to determine if they are acute hazards. Parameters analyzed but not shown in Table 1 are not considered hazards. The pre-screening is conducted as described in USAPHC (Prov) TG 230, section 3.4.3. The sample results were compared to MEGs on 4 March 2011.

### Table 1. Results of Prescreen

| Parameter | Detections/ Samples | Peak Single Sample Concentration ($\mu g/m^3$) | 1-year Negligible MEG ($\mu g/m^3$) | Result |
|---|---|---|---|---|
| $PM_{10}$ at the Burn Pit Site | 3/3 | 670 | none | Retain as potential hazard |
| $PM_{10}$ at the South Park Site | 3/3 | 549 | none | Retain as potential hazard |
| $PM_{10}$ at the Board Walk Site | 2/2 | 375 | none | Retain as potential hazard |
| $PM_{10}$ at the MWR Site | 2/2 | 365 | none | Retain as potential hazard |

Legend: $\mu g/m^3$ = micrograms per cubic meter

## 7 Acute Risk Assessment

### 7.1 Acute Screen

Table 2 shows parameters identified as acute hazards because their peak sample day concentrations were greater than their acute screening MEGs. Acute hazards are further assessed to estimate the acute risk from exposure to these parameters in the ambient air. The acute screening is conducted as described in USAPHC (Prov) TG 230, section 3.4.5.1.

## Table 2. Results of Acute Screen

| Parameter | Peak Sample Day Concentration (µg/m$^3$) | Screening MEG (µg/m$^3$) | Result |
|---|---|---|---|
| $PM_{10}$ at the Burn Pit Site | 670 | 24-hour Negligible MEG: 250 | Retain as acute hazard |
| $PM_{10}$ at the South Park Site | 549 | 24-hour Negligible MEG: 250 | Retain as acute hazard |
| $PM_{10}$ at the Board Walk Site | 375 | 24-hour Negligible MEG: 250 | Retain as acute hazard |
| $PM_{10}$ at the MWR Site | 365 | 24-hour Negligible MEG: 250 | Retain as acute hazard |

Legend: µg/m$^3$ = micrograms per cubic meter

### 7.2 Hazard Severity

Table 3 summarizes the hazard severity levels determined by comparing the peak and average sample day 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 (Prov) TG 230, section 3.4.5.2.

## Table 3. Hazard Severity

| Parameter | Concentration (µg/m$^3$) | Comparison MEGs (µg/m$^3$) | Hazard Severity |
|---|---|---|---|
| $PM_{10}$ at the Burn Pit Site | Peak: 670 | Is ≥ 24-hour Critical MEG: 600 | Critical |
| | Average: 614 | Is ≥ 24-hour Critical MEG: 600 | Critical |
| $PM_{10}$ at the South Park Site | Peak: 549 | Is > 24-hour Marginal MEG: 420, but < 24-hour Critical MEG: 600 | Marginal |
| | Average: 340 | Is > 24-hour Negligible MEG: 250, but < 24-hour Marginal MEG: 420 | Negligible |
| $PM_{10}$ at the Board Walk Site | Peak: 375 | Is > 24-hour Negligible MEG: 250, but < 24-hour Marginal MEG: 420 | Negligible |
| | Average: 324 | Is > 24-hour Negligible MEG: 250, but < 24-hour Marginal MEG: 420 | Negligible |
| $PM_{10}$ at the MWR Site | Peak: 365 | Is > 24-hour Negligible MEG: 250, but < 24-hour Marginal MEG: 420 | Negligible |
| | Average: 358 | Is > 24-hour Negligible MEG: 250, but < 24-hour Marginal MEG: 420 | Negligible |

Legend: µg/m$^3$ = micrograms per cubic meter

### 7.3 Hazard Probability

Table 4 summarizes the hazard probability determinations for each acute hazard. Refer to USAPHC (Prov) TG 230, section 3.4.5.3 for additional information about hazard probability scoring methodology. The detailed hazard probability scoring tables are provided in Appendix D.

## Table 4. Hazard Probability

| Parameter | Concentration ($\mu g/m^3$) | Hazard Probability |
|---|---|---|
| $PM_{10}$ at the Burn Pit Site | Peak: 670 | Seldom |
| | Average: 614 | Seldom |
| $PM_{10}$ at the South Park Site | Peak: 549 | Seldom |
| | Average: 340 | Seldom |
| $PM_{10}$ at the Board Walk Site | Peak: 375 | Seldom |
| | Average: 324 | Seldom |
| $PM_{10}$ at the MWR Site | Peak: 365 | Seldom |
| | Average: 358 | Seldom |

### 7.4 Tactical Risk Estimate

Table 5 summarizes the acute risk assessment for exposure to each of the acute hazards. The tactical risk estimate was determined using the USAPHC (Prov) TG 230, Table 3-1 “Military Risk Assessment Matrix.” The tactical risk estimates are color-coded consistent with the black, red, amber, green system described in Field Manual 1-02 "Operational Terms and Graphics."

## Table 5. Risk Assessment Summary

| Parameter | Type of Exposure | Hazard Severity | Hazard Probability | Tactical Risk Estimate |
|---|---|---|---|---|
| $PM_{10}$ at the Burn Pit Site | Peak | Critical | Seldom | Moderate |
| | Average | Critical | Seldom | Moderate |
| $PM_{10}$ at the South Park Site | Peak | Marginal | Seldom | Low |
| | Average | Negligible | Seldom | Low |
| $PM_{10}$ at the Board Walk Site | Peak | Negligible | Seldom | Low |
| | Average | Negligible | Seldom | Low |
| $PM_{10}$ at the MWR Site | Peak | Negligible | Seldom | Low |
| | Average | Negligible | Seldom | Low |

# 8 Conclusion

Refer to USAPHC (Prov) TG 230, Table 3-2 for the potential consequences to military operations and force readiness associated with this risk level.

Based on the sample results and associated exposure information assessed in this report, the tactical risk estimate for $PM_{10}$ in the Burn Pit area on both typical exposure and peak exposure days during the sampled timeframe is **moderate**. Note the samples collected near the burn pit during this sampling event were not intended to specifically characterize exposure to burn pit emissions. The tactical risk estimate for $PM_{10}$ in the South Park, Board Walk, and MWR areas on both typical exposure and peak exposure days during the sampled timeframe is **low**.

# 9 Limitations

## 9.1 Field Data Quality

The field data sheets provided with the sample set were not adequately filled out. The post sample time was recorded incorrectly. The post sample time is the time the sample equipment stops actively sampling the air; not the time the sample collector returns to pick up the equipment/media.

The sample collected on 26 April 2011 at the MWR was invalid due to flow differential.

## 9.2 Sample Receipt at USAPHC Laboratory

The sample set was packaged correctly.

## 9.3 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).

## 9.4 Risk Assessment

If a parameter was not detected in all samples, half of the laboratory reporting limit was used to calculate an average.

# 10 Recommendations and Notes

Maintain communication with USAPHC, AIPH points of contact (POCs) and continue standard surveillance of airborne PM and metals in accordance with defined Occupational and Environmental Health Site Assessment (OEHSA) Exposure Pathways and sampling plans for your location.

If an OEHSA and/or specific sampling plans have not yet been completed for Kandahar, Afghanistan, collect ambient PM air samples from sites that best represent exposures at least once every 6 days to better characterize conditions over time.

## 11 Points of Contact

The USAPHC, AIPH POCs for this assessment are Ms. (b) (6) and Ms. (b) (6). Ms. (b) (6) may be contacted at e-mail (b) (6) and Ms. (b) may be contacted at e-mail (b) (6) DSN (b) (6) or commercial (b) (6).

(b) (6)

Environmental Scientist
Deployment Environmental Surveillance Program

Approved by:

(b) (6)

LTC, MS
Program Manager
Deployment Environmental Surveillance

# Appendix A

## References

1. Department of Defense Directive (DoDD) 6490.02E, Comprehensive Health Surveillance, 21 October 2004.

2. Department of Defense Instruction (DoDI) 6490.03, Deployment Health, 11 August 2006.

3. Department of the Army (DA) Field Manual (FM) 5-19, Composite Risk Management, 21 August 2006.

4. DA FM 1-02, Operational Terms and Graphics, 21 September 2004.

5. USAPHC (Prov) Technical Guide (TG) 230, Chemical Exposure Guidelines for Deployed Military Personnel, June 2010.

# Appendix B

## Sample Identification Information

| DOEHRS-EH Sample ID | Sample ID Reported on Field Data Sheet | Sample Site | Date and Time Sample Collected | Sample Invalid (Yes/No) Reason for Invalid Sample |
|---|---|---|---|---|
| 00004P0L | AFG_KANDAH_10193 _PM10DPS | Burn Pit | 2011/04/02 1127 | No |
| 00004P0N | AFG_KANDAH_10193 _PM10DPS | South Park | 2011/04/02 1143 | No |
| 00004P0R | AFG_KANDAH_10193 _PM10DPS | MWR | 2011/04/02 1154 | No |
| 00004P0A | AFG_KANDAH_10193 _PM10DPS | Board Walk | 2011/04/14 1113 | No |
| 00004P0F | AFG_KANDAH_10193 _PM10DPS | MWR | 2011/04/14 1124 | No |
| 00004P04 | AFG_KANDAH_10193 _PM10DPS | South Park | 2011/04/14 1137 | No |
| 00004P0I | AFG_KANDAH_10193 _PM10DPS | Burn Pit | 2011/04/14 1151 | No |
| 00004P02 | AFG_KANDAH_10193 _PM10DPS | Burn Pit | 2011/04/26 0921 | No |
| 00004OZZ | AFG_KANDAH_10193 _PM10DPS | South Park | 2011/04/26 0932 | No |
| 00004OZU | AFG_KANDAH_10193 _PM10DPS | MWR | 2011/04/26 0944 | Yes- Flow Differential |
| 00004OZN | AFG_KANDAH_10193 _PM10DPS | Board Walk | 2011/04/26 0955 | No |

# Appendix C

## Exposure Setting Information

### Table C-1. Exposure Information at the Burn Pit Site

| Questions About Exposure | Information Provided and Assumptions |
|---|---|
| What is the exposure event or ambient environmental condition under consideration? | Exposure to PM less than 10 micrometers in diameter ($PM_{10}$) and metals in the ambient air at this location. |
| What is the population at risk? | The population in the area of the burn pit and incinerators. |
| What is the timeframe under consideration? | The samples were collected on 2-26 April 2011. This encompasses a timeframe of approximately 3 weeks from the first day of sampling to the last. Although personnel will be deployed to this location for approximately 1 year, only this timeframe of 3 weeks is being considered. |
| What are the activity patterns of the exposed population? | Typical exertion. It is assumed personnel spend part of each day indoors. |
| What is known about sources of potential contamination? | Incinerators and Burn pit. |
| What is known about the exposure setting? | Information not provided, but it is assumed few personnel frequent the area. |
| What are the exposure pathways? | Inhalation. |
| Where are the sampling sites relative to where exposure occurs? | The sampler was attached to a building near the two incinerators and burn pit. |

Note: Questions are extracted from USAPHC (Prov) TG 230

## Table C-2. Exposure Information at the South Park Site

| Questions About Exposure | Information Provided and Assumptions |
|---|---|
| What is the exposure event or ambient environmental condition under consideration? | Exposure to PM less than 10 micrometers in diameter ($PM_{10}$) and metals in the ambient air at this location. |
| What is the population at risk? | The population in the South Park area. |
| What is the timeframe under consideration? | The samples were collected on 2-26 April 2011. This encompasses a timeframe of approximately 3 weeks from the first day of sampling to the last. Although personnel will be deployed to this location for approximately 1 year, only this timeframe of 3 weeks is being considered. |
| What are the activity patterns of the exposed population? | Typical exertion. It is assumed personnel spend part of each day indoors. |
| What is known about sources of potential contamination? | None provided. |
| What is known about the exposure setting? | The South Park area appears to be a living area with latrines and tents. |
| What are the exposure pathways? | Inhalation. |
| Where are the sampling sites relative to where exposure occurs? | The sampler was located on a post between the latrines and tents. |

Note: Questions are extracted from USAPHC (Prov) TG 230

## Table C-3. Exposure Information at the Board Walk Site

| Questions About Exposure | Information Provided and Assumptions |
|---|---|
| What is the exposure event or ambient environmental condition under consideration? | Exposure to PM less than 10 micrometers in diameter ($PM_{10}$) and metals in the ambient air at this location. |
| What is the population at risk? | The population at the Board Walk. |
| What is the timeframe under consideration? | The valid samples were collected on 14 and 26 April 2011. This encompasses a timeframe of approximately 2 weeks from the first day of sampling to the last. Although personnel will be deployed to this location for approximately 1 year, only this timeframe of 2 weeks is being considered. |
| What are the activity patterns of the exposed population? | Typical exertion. It is assumed personnel spend part of each day indoors. |
| What is known about sources of potential contamination? | None provided. |
| What is known about the exposure setting? | The Boardwalk site is located by the hockey rink and volleyball court. It is assumed many personnel frequent this area. |
| What are the exposure pathways? | Inhalation. |
| Where are the sampling sites relative to where exposure occurs? | The sampler was next to the hockey rink. |

Note: Questions are extracted from USAPHC (Prov) TG 230

## Table C-4. Exposure Information at the Morale, Welfare, and Recreation (MWR) Site

| Questions About Exposure | Information Provided and Assumptions |
|---|---|
| What is the exposure event or ambient environmental condition under consideration? | Exposure to PM less than 10 micrometers in diameter ($PM_{10}$) and metals in the ambient air at this location. |
| What is the population at risk? | The population in the area of the MWR building. |
| What is the timeframe under consideration? | The valid samples were collected on 2 and 14 April 2011. Although this encompasses a timeframe of approximately 2 weeks from the first day of sampling to the last only one sample was valid therefore only this timeframe of 2 weeks is being considered. |
| What are the activity patterns of the exposed population? | Typical exertion. It is assumed personnel spend part of each day indoors. |
| What is known about sources of potential contamination? | None provided. |
| What is known about the exposure setting? | Information not provided, but it is assumed the area around the sample site is frequented by all personnel at this camp. |
| What are the exposure pathways? | Inhalation. |
| Where are the sampling sites relative to where exposure occurs? | The sampler was located between the gym and computer room #2. |

Note: Questions are extracted from USAPHC (Prov) TG 230

# Appendix D

## Hazard Probability Scoring Tables

### Table D-1. Hazard Probability Scoring for $PM_{10}$ at the Burn Pit Site

| Concentration ($\mu g/m^3$) | Hazard Probability Scoring for Exposure Factors | | | | Hazard Probability |
|---|---|---|---|---|---|
| | Degree of Exposure | Represent-ativeness of Sample Data | Duration of Exposure | Rate of Exposure | |
| Peak: 670 | Score 2: Concentration is >Critical MEG and next higher severity MEG does not exist. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |
| Average: 614 | Score 2: Concentration is >Critical MEG and next higher severity MEG does not exist. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |

## Table D-2. Hazard Probability Scoring for $PM_{10}$ at the South Park Site

| Concentration ($\mu g/m^3$) | Hazard Probability Scoring for Exposure Factors | | | | Hazard Probability |
|---|---|---|---|---|---|
| | Degree of Exposure | Represent-ativeness of Sample Data | Duration of Exposure | Rate of Exposure | |
| Peak: 549 | Score 2: Concentration is at or between 25th and 75th percentiles of severity range. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |
| Average: 340 | Score 2: Concentration is at or between 25th and 75th percentiles of severity range. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |

## Table D-3. Hazard Probability Scoring for $PM_{10}$ at the Board Walk Site

| Concentration ($\mu g/m^3$) | Hazard Probability Scoring for Exposure Factors | | | | Hazard Probability |
|---|---|---|---|---|---|
| | Degree of Exposure | Represent-ativeness of Sample Data | Duration of Exposure | Rate of Exposure | |
| Peak: 375 | Score 2: Concentration is at or between 25th and 75th percentiles of severity range. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |
| Average: 324 | Score 2: Concentration is at or between 25th and 75th percentiles of severity range. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |

## Table D-4. Hazard Probability Scoring for $PM_{10}$ at the MWR Site

| Concentration ($\mu g/m^3$) | Hazard Probability Scoring for Exposure Factors | | | | Hazard Probability |
|---|---|---|---|---|---|
| | Degree of Exposure | Represent-ativeness of Sample Data | Duration of Exposure | Rate of Exposure | |
| Peak: 365 | Score 2: Concentration is at or between 25th and 75th percentiles of severity range. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |
| Average: 358 | Score 2: Concentration is at or between 25th and 75th percentiles of severity range. | Score 2: Field data adequately estimates population exposure (Routine Sampling). | Score 1: Field exposure duration to MEG exposure duration is <1 (Personnel will not spend the entire 24-hours at the sampling location). | Score 2: Typical exertion (no information to indicate otherwise). | Total Score 7: Seldom |