FINAL

POHAKULOA TRAINING AREA

INDUCTIVELY COUPLED PLASMA – MASS SPECTROMETRY (ICP-MS) URANIUM RESULTS

TECHNICAL MEMORANDUM

FOR

TOTAL SUSPENDED PARTICULATE AIR FILTERS

Contract No. W52P1J-06-D-0019
Delivery Order 0004

Submitted to:

Department of the Army

Headquarters, U.S. Army Sustainment Command

Procurement Directorate, Environmental Contracting Division

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Submitted by:

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RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

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May 2008

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ACRONYMS, ABBREVIATIONS, & SYMBOLS

µg/L	microgram(s) per liter
µg/m^3	microgram per cubic meter
^{234}U	Uranium-234
^{235}U	Uranium-235
^{238}U	Uranium-238
ASR	Archives Search Report
ATSDR	Agency for Toxic Substances and Disease Registry
CABRERA	Cabrera Services, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOD	Department of Defense
DU	Depleted Uranium
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
IDL	Instrument Detection Limit
JMC	Joint Munitions Command
MRL	Minimal Risk Levels for Hazardous Substances
mg	milligram(s)
mg/m^3	milligram per cubic meter
NELAP	National Environmental Laboratory Accreditation Program
PCOC	Potential Contaminant of Concern
PTA	Pohakuloa Training Area
TSDR	Agency for Toxic Substances and Disease
TSP	Total Suspended Particulates
USACE	U.S. Army Corps of Engineers
USAG-HI	U.S. Army Garrison, Hawaii
USEPA	U.S. Environmental Protection Agency
WHO	World Heath Organization

1.0 SUMMARY

This report is provided to transmit the results of the Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) uranium assay data of four hundred and forty-one (441) filters taken for total suspended particulates (TSP) at seven (7) locations surrounding the Pohakuloa Training Area (PTA) in 2006. A description of these locations is provided in Appendix D. All samples were sent to a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory for analysis of uranium nuclide concentrations by ICP-MS. Concentrations were reported for the three naturally occurring uranium radionuclides; ^{234}U, ^{235}U, and ^{238}U.

The analysis of these filters indicates that the level of total uranium in the air is significantly below both the World Health Organization (WHO) guidance level of 1 $\mu g/m^3$ and the Agency for Toxic Substances and Disease Registry(ATSDR's) most restrictive minimal risk levels (MRLs) for highly soluble uranium salts of 0.0003 mg/m^3 (0.3 $\mu g/m^3$) .

CABRERA SERVICES, INC. (CABRERA) arranged for the air sample filter analysis and prepared this report for the transmittal of the results to the U.S. Army Joint Munitions Command (JMC), under Contract No. W52P1J-06-D-0019, Delivery Order 0004.

2.0 SITE AND SAMPLE LOCATION DESCRIPTION

PTA is located on the island of Hawaii between Mauna Loa, Mauna Kea, and the Hualalai Volcanic Mountains (Figure 2-1). It extends up the lower slopes of Mauna Kea to approximately 6,800 feet in elevation and to about 9,000 feet on Mauna Loa. The training area is about midway between Hilo on the east coast and the Army landing site at Kawaihae Harbor on the west coast. The area is the largest Department of Defense (DOD) installation in Hawaii. The area is accessible by military helicopter or land via Saddle Road from Hilo. The seven (7) air sampling locations can be seen in Figure 2-2 (Provided by James W. Morrow, DrPH).

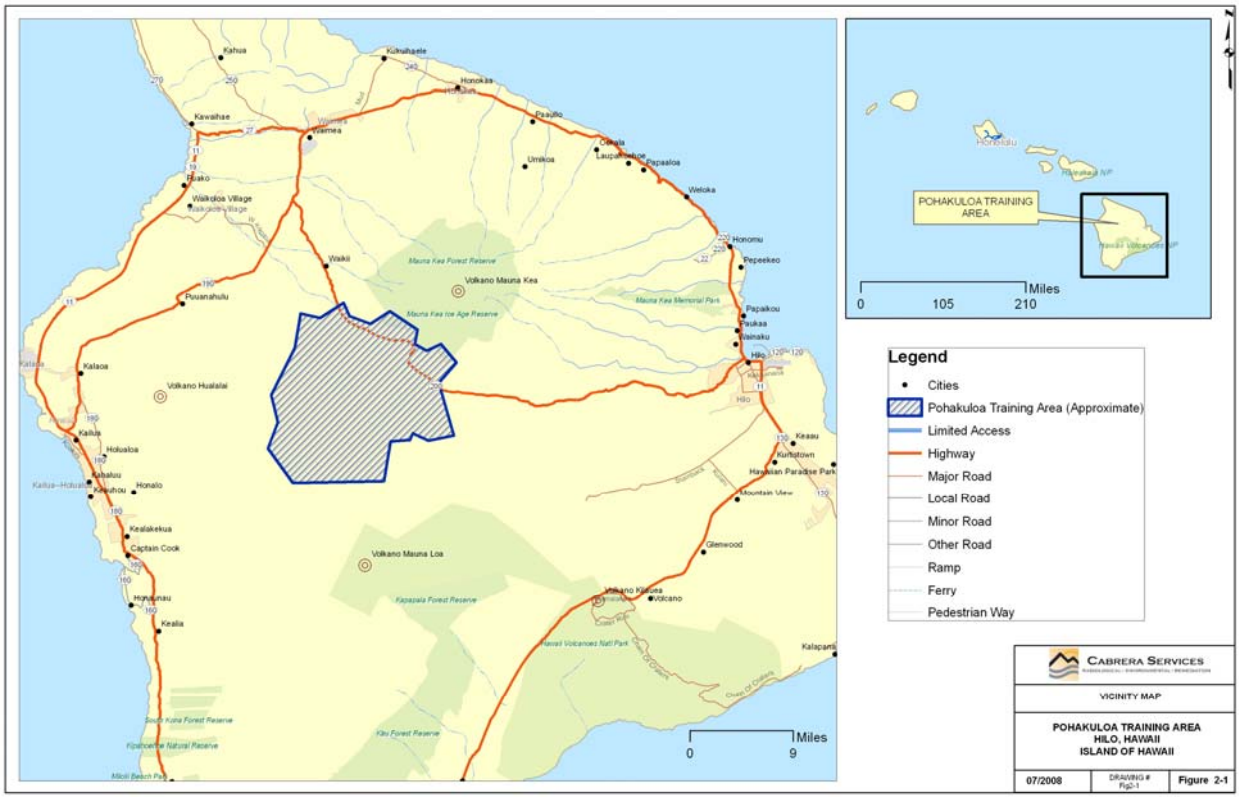

Figure 2-1. PTA Vicinity Map

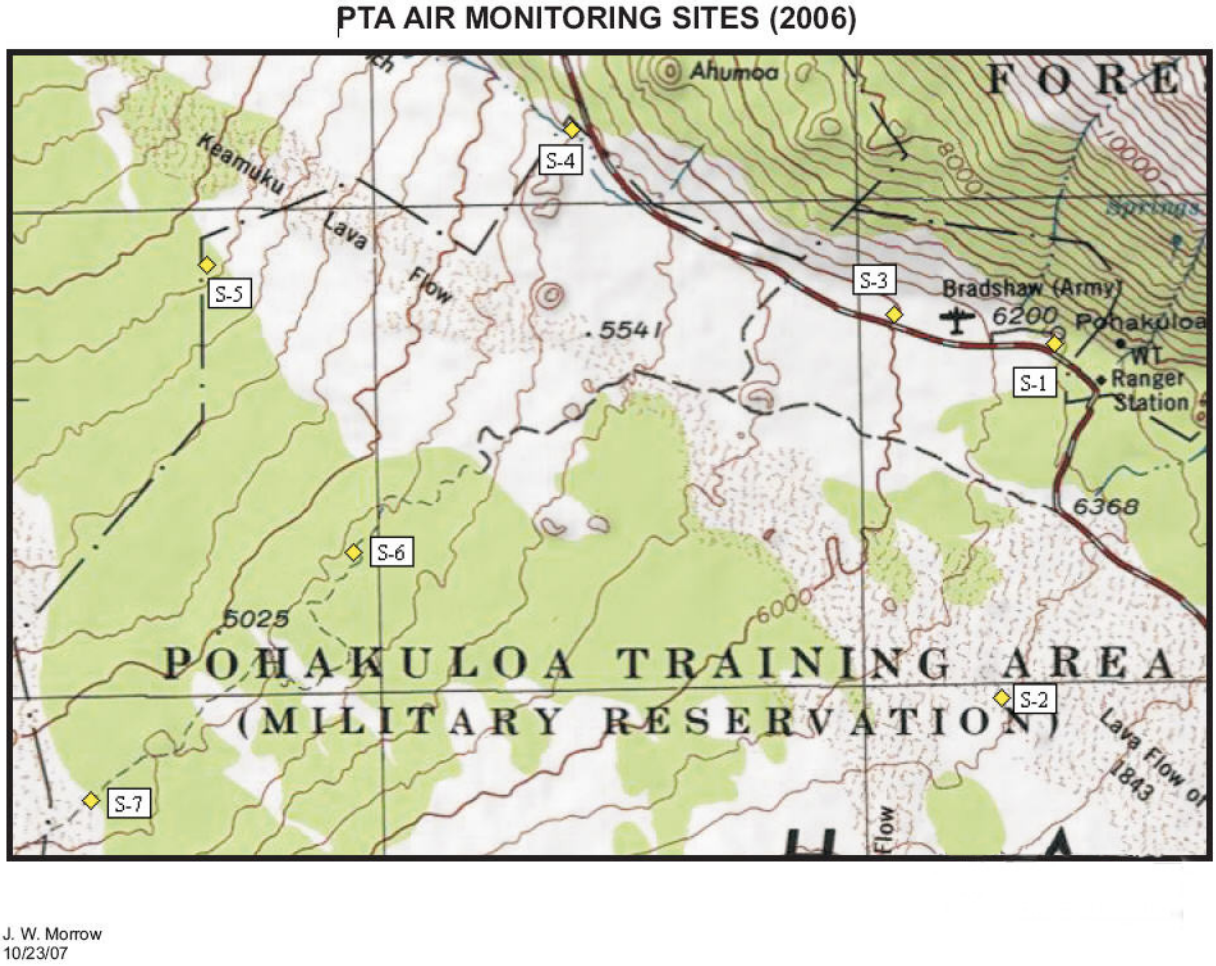

Figure 2-2: PTA Air Monitoring Site Locations

3.0 SAMPLE ANALYSIS METHODS AND EVALUATION

Each sample was collected at a flow rate of approximately 5 liters per minute for a period of approximately 24 hours using a 47 millimeter (mm) Teflon filter. The approximate volume of each sample is approximately 7.2 cubic meters (m^3) with the exceptions of filters # 436, 1410, 1424, and 1918 which were invalidated due to sampler battery failure and run times less than 23 hours.. The particulate matter filters were collected as part of a baseline air quality monitoring program under Corps of Engineers Contract No. W9128A-04-D-0019. The title of the Task Order was "Air Quality Monitoring, U.S. Army Garrison Hawaii Installations. The program design and management were the responsibility of the Corps contractor, Dr. J. W. Morrow, Environmental Management Consultant..

Samples were analyzed in accordance with the procedures developed by the off-site laboratory. In this case the samples were analyzed following SW-846, 3rd Edition procedures.

Analysis by ICP-MS followed method 6020A *(EPA 2007 USEPA Method SW-846 6020A Rev. 1 Inductively Coupled Plasma Mass Spectrometry (ICP-MS), http://epa.gov/sw-846/pdfs/6020a.pdf)* and Paragon Analytics SOP 827 Rev. 6. *(Paragon Analytics 2007 Standard Operating Procedures (SOP) 827 Rev. 6, Fort Collins, Colorado.)* The ICP-MS analyses were performed for four hundred and forty one (441) samples to quantify the target isotopes ^{234}U, ^{235}U, and ^{238}U. Samples were processed in ten (10) batches of forty (40) and one (1) batch of forty one (41) filters.

Detection limits achieved during sample analyses were reviewed to ensure that required detection limits had been met. Typically detection limit requirements are established to ensure that characterization has occurred to levels that are low enough to determine if constituents are present at hazardous levels. These levels are constituent-specific and related to each constituent's toxicity. The instrument detection limit for uranium is 1.5 E-5 microgram (µg) with a reporting limit of 2.5E-4 µg. These detection and reporting limits, when considering sample volumes, are over 10,000 times more sensitive than the applicable exposure guidance limits of the WHO (*WHO 2003 Fact Sheet N°257 Depleted uranium, World Health Organization http://www.who.int/mediacentre/factsheets/fs257/en/print.html*) or the Agency for Toxic

Substances and Disease Registry (ATSDR) (*ATSDR 1999 Minimal Risk Levels for Uranium, HZ1800-90-T and HZ1800-92-T, http://www.atsdr.cdc.gov/mrls/#bookmark02*). The maximum total uranium content detected on any single filter was 0.0017 µg in field sample number 642 from sampling station # S-7 with a total sample air volume of 7.070 m^3. This represents a maximum concentration of 0.00024 µg/m^3(2.4 E-04 µg/m^3). Figure 3-1 visually presents the air sample data in comparison to ATSDR and WHO guidance levels as well as the laboratory reporting levels.

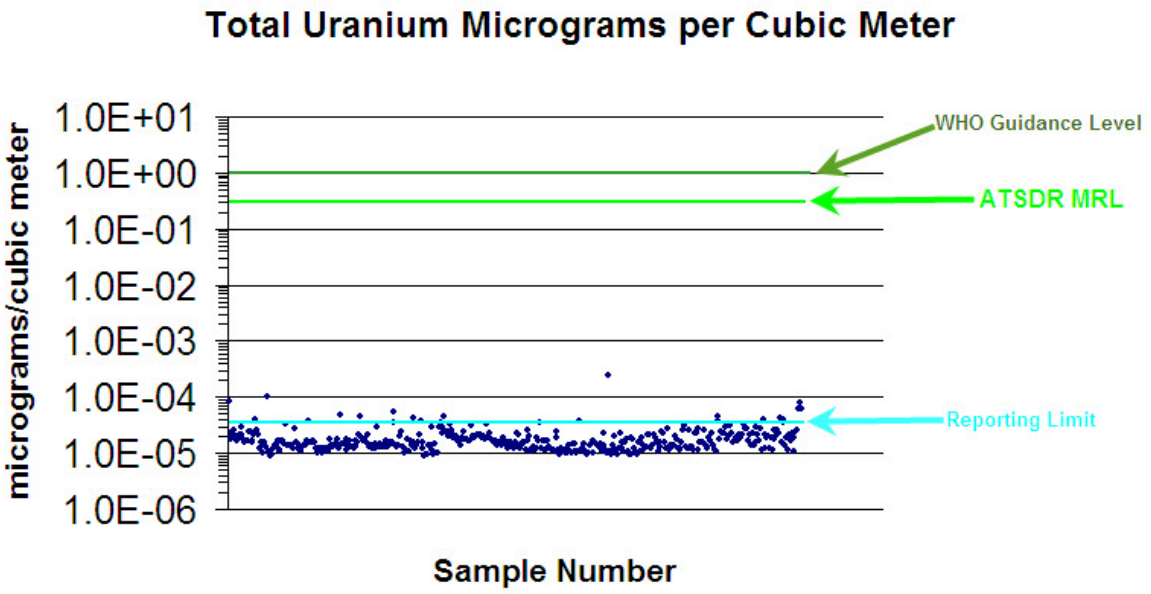

Figure 3-1: Total Uranium PTA Air Sample Data

Sample results were subjected to validation and verification by a CABRERA senior-level staff member with experience in radioactivity analysis, analytical quality assurance, and data evaluation. Initial data verification was performed by the laboratory's quality control staff.

No results were rejected as a result of the data quality assessments. All analytical results are included electronically in Appendix A. A summary of data qualifiers is presented below:

3.1 Inorganic Data Reporting Qualifiers:

The following qualifiers are used by the laboratory when reporting results of inorganic analyses. For the analysis set of four hundred forty one (441) filters there were no QC data qualifiers.

Result qualifier – The letter "B" is entered if the reported value was obtained from a reading that was less than the Practical Quantitation Limit but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for, but not detected a "U" is entered.

QC qualifier – Specified entries and their meanings are as follows:

E – The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.

M – Duplicate injection precision was not met.

N – Spiked sample recovery not within control limits. A post spike is analyzed for all 6020A analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.

Z – Spiked recovery not within control limits. An explanatory note may be included in the narrative.

* – Duplicate analysis (relative percent difference) not within control limits.

S – SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.

4.0 CONCLUSION

The analysis of 437 filters from air sampling stations surrounding the PTA facility indicates that the level of total uranium in the air is significantly below both the World Health Organization (WHO) guidance level of 1 $\mu g/m^3$ and the Agency for Toxic Substances and Disease Registry (ATSDR's) most restrictive minimal risk levels (MRLs) for highly soluble uranium salts of 0.0003 mg/m^3 (0.3 $\mu g/m^3$) .

Based on observations of the DU found at PTA the predominant chemical form of DU present appears to be solid metal fragments with very minor amounts in the form of uranium oxide. The chemical form present at PTA also reduces its hazard compared to the chemical form assumed (soluble uranium salts) as the basis for the ATSDR's MRL guidance. Concentrations of uranium in the air surrounding PTA are below both WHO and ATSDR recommendations and appear to present no hazard to the surrounding population.

APPENDIX A
ICP- MS SAMPLE RESULTS

Submitted in electronic format on compact disk

APPENDIX B
SAMPLE AIR FLOW DATA & SAMPLE LOCATIONS

Submitted in electronic format on compact disk

APPENDIX C
CHAIN OF CUSTODY DOCUMENT

Submitted in electronic format on compact disk

APPENDIX D

AIR SAMPLING STATION LOCATIONS

Site No.	UTM-E	UTM-N	Name	In (degrees) Lat	Long
1	234,289	2,186,407	Base camp	19.75556	155.53556
2	233,164	2,179,318	Red Leg Trail, vic. Pu'u Kaneohe	19.69139	155.54528
3	231,045	2,187,235	Training Area 10	19.76247	155.56665
4	224,449	2,191,147	Lightening Trail, vic. FP 502	19.79688	155.63012
5	216,817	2,188,499	West Side Firebreak	19.77189	155.70251
6	219,787	2,182,503	Training Area 22	19.71819	155.67329
7	214,242	2,177,485	Training Area 23, vic. Bobcat Trail	19.67209	155.72537