ERDC/CERL TR-08-5, Vol. 2

Construction Engineering Research Laboratory

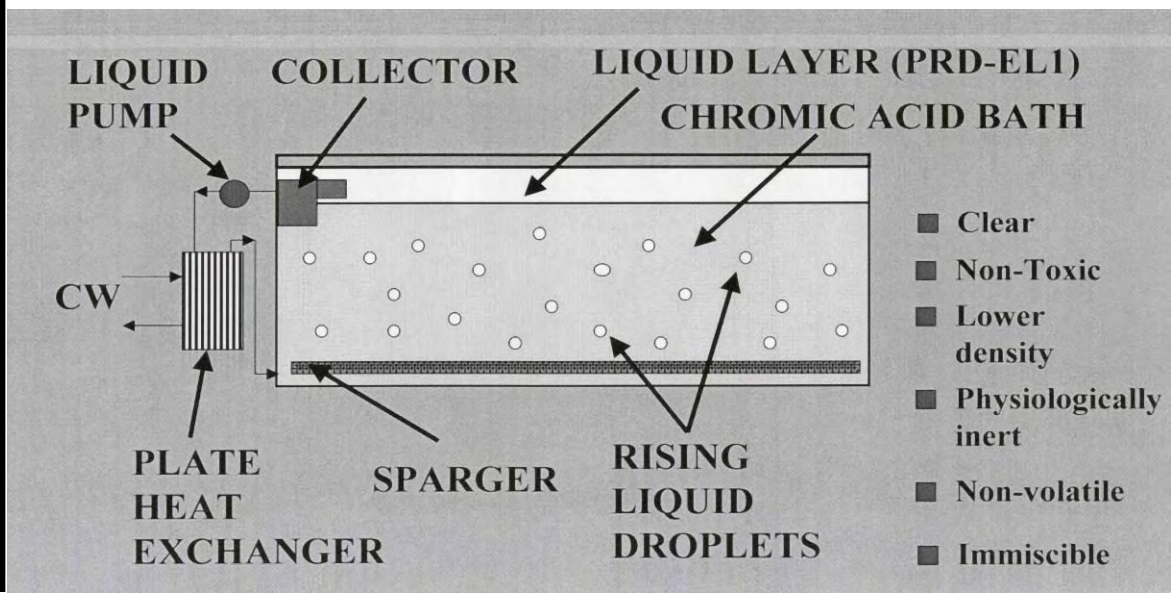
US Army Corps of Engineers®
Engineer Research and Development Center

# Technology Demonstration of the Zero Emissions Chromium Electroplating System

## Appendix I: CHPPM Report on Air Sampling

K. James Hay, Stephen W. Maloney, John J. Cannon, Max R. Phelps, and Jason Modrell

February 2008



ERDC/CERL TR-08-5, Vol. 2
February 2008

# Technology Demonstration of the Zero Emissions Chromium Electroplating System, Appendix I: CHPPM Report on Air Sampling

Final Report

Approved for public release; distribution is unlimited.

Prepared for U.S. Environmental Protection Agency
26 West Martin Luther King Drive
Cincinnati, OH 45268-0001

Under Work Unit #CNE-B091

**ABSTRACT:** Volume 1 of this report documents the demonstration of a technology developed by PRD, Inc, for control of chromium emissions during hard chromium electroplating, the Zero Emissions System. The technology involves placing a blanket of a proprietary fluid, called PRD-EL1, on top of the plating bath. This fluid blanket prevents the formation of aerosols, which is the mechanism by which chromium is emitted from the plating bath to the air. The majority of the testing was directed at demonstration of the effectiveness of chromium plating in the presence of the immiscible blanket. Testing was conducted at Benét Laboratories on coupons and actual parts from Army vehicles. The results indicate that PRD-EL1 may cause deleterious effects on the plating process, as some of the parts failed qualitative tests performed at Benét. However, some parts, which were plated without the fluid blanket present as a baseline control, also failed the tests. Air sampling results indicate that the presence of the PRD-EL1 fluid reduced the chromium emissions to below the standard and the indoor air concentration below the previously established exposure limit but near the new exposure limit.. Overall, the results indicate that the use of the PRD process would require additional testing before it could be accepted for use in Army production and maintenance operations.

This second volume of the technical document is the Center for Health Promotion and Preventive Medicine's report on air sampling performed during the Zero Emission System's technology demonstration.

# Preface

This study was conducted for Headquarters, Department of the Army, under Program Element 063728A, "Environmental Technology Demonstration"; Project 002, "Environmental Compliance Technology"; Work Unit CNE-B091, "Hazardous Air Pollutants Technology Demonstrations." This project is part of the Army Environmental Quality Technology (EQT) Program. The ERDC technical reviewer was Hany Zaghloul, Program Manager.

The work was performed by the Environmental Processes (CN-E) Branch of the Installations Division (CN), Construction Engineering Research Laboratory (CERL). The CERL Principal Investigator was Dr. K. James Hay. Part of this work was done by Anniston Army Depot (POC: Tony Pollard), Benét Laboratories (POC: John Cannon), the Center for Health Promotion and Preventive Medicine (POC: Tim Hilyard), and PRD, Inc. (POC: Dr. Ramesh Melarkode). The technical editor was Linda L. Goersch, Information Technology Laboratory. Deborah Curtin is Chief, CN-E, and Dr. John T. Bandy is Chief, CN. Dr. Kirankumar V. Topudurti is Deputy Director of CERL and the Director of CERL is Dr. Ilker R. Adiguzel.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL Richard B. Jenkins. The Director of ERDC is Dr. James R. Houston.

# Appendix I: CHPPM Report on Air Sampling

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5403

REPLY TO ATTENTION OF

MCHB-TS-EAQ (40) 18 AUG 2003

MEMORANDUM FOR Commander, USACERL (W-ERDC-CERL-IL/Dr. Steve W. Maloney), U.S. Army Engineering Research and Development Center, Champaign, IL 61826-3482

SUBJECT: Air Pollution Management Study No. 43-EL-5116-03, PRD Zero-Emission Process, Building 114, Anniston Army Depot, Alabama, 3-5 June 2003

Two copies of subject report with Executive Summary are enclosed.

The point of contact is Mr. Timothy Hilyard or the undersigned, DSN 584-2509/3500 or commercial (410) 436-2509/3500.

FOR THE COMMANDER:

Encl

FOR JAMES D. WOOD, P.E.
Program Manager
Air Quality Surveillance

CF:
CDR, ANAD (AMSTA-AN-PECE/JEREMY TURNER)

*Readiness thru Health*

U.S. Army Center for Health Promotion and Preventive Medicine

USCHPPM

AIR POLLUTION MANAGEMENT STUDY
NO. 43-EL-5116-03
PRD ZERO-EMISSION PROCESS
BUILDING 114
ANNISTON ARMY DEPOT
ANNISTON, ALABAMA
3-5 JUNE 2003



Readiness Thru Health

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REPLY TO ATTENTION OF

MCHB-TS-EAQ

EXECUTIVE SUMMARY
AIR POLLUTION MANAGEMENT STUDY
NO. 43-EL-5116-03
PRD ZERO-EMISSION PROCESS
BUILDING 114
ANNISTON ARMY DEPOT
ANNISTON, ALABAMA
3-5 JUNE 2003

1. PURPOSE. The purpose of this assessment is to determine the effectiveness of the Process Research and Development Technologies (PRD Tech. Inc) Zero-Emission Process in removing chromium (Cr) emissions from a full-scale chrome plating operation.

2. CONCLUSION. The average total Cr concentrations for each test series, as measured per the U.S. Environmental Protection Agency (USEPA) Method 306, was below the 0.015 milligram per dry standard cubic meter National Emission Standards for Hazardous Air Pollutants Cr standard.

3. RECOMMENDATIONS. Provide a copy of this report to the USEPA. If another demonstration is needed, conduct the testing without any other plating in progress during the demonstration. Also, a background test series should be conducted to determine how much Cr from the indoor air is exhausted out of the exhaust stack.

*Readiness thru Health*

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

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## LIST OF ACRONYMS

| | |
|---|---|
| ANAD | Anniston Army Depot |
| C | Celsius |
| $CO_2$ | carbon dioxide |
| Cr | chromium |
| DLS | Directorate of Laboratory Sciences |
| dscm | dry standard cubic meter |
| F | Fahrenheit |
| ft | foot |
| g | gram |
| GFAAS | Graphite Furnace Atomic Absorption Spectrometry |
| $H_2O$ | water |
| hr | hour |
| ICP-MS | inductively coupled plasma-mass spectroscopy |
| ID | inside diameter |
| in | inch |
| K | Kelvin |
| lb | pound |
| $m^3$ | cubic meter |
| mg | milligram |
| mL | milliliter |
| mm | millimeter |
| $N_2$ | nitrogen |
| NaOH | sodium hydroxide |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| NIST | National Institute of Standards and Technology |
| $O_2$ | oxygen |
| PRD Tech. Inc. | Process Research and Development Technologies |
| QA/QC | quality assurance/quality control |
| RM | reference method |
| TSP | Total Suspended Particulate |
| USACHPPM | U.S. Army Center for Health Promotion and Preventive Medicine |
| USEPA | U.S. Environmental Protection Agency |
| ° | degree |
| % | percent |
| µ | micro |

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AIR POLLUTION MANAGEMENT STUDY
NO. 43-EL-5116-03
PRD ZERO-EMISSION PROCESS
BUILDING 114
ANNISTON ARMY DEPOT
ANNISTON, ALABAMA
3-5 JUNE 2003

1. REFERENCES. See Appendix A for a listing of references.

2. PURPOSE. The purpose of this assessment is to determine the effectiveness of the Process Research and Development Technologies (PRD Tech. Inc) liquid in removing chromium (Cr) emissions from a full-scale chrome plating operation.

3. GENERAL.

a. Background. Chrome plating of machinery parts produces a surface coating that helps reduce wear and corrosion. The military uses this process as a cheap and effective way to combat the wear and corrosion that parts suffer during usage. The problem with chrome plating is the emission of a fine aerosol, during the plating process. Once in the atmosphere, the aerosol forms chromic acid. Chrome has long been known to be a carcinogen and a cause of perforated nasal passages, skin rashes and other medical problems. The Cr emissions are currently controlled by capturing the aerosols at the surface using airflow directed across the plating vat. The air is pulled through an exhaust duct manifold (located on the opposite side of the vat) by an induced draft fan through an entrainment separator, and then exhausted from a stack outside the building. PRD Tech. Inc has developed a proprietary immiscible liquid that covers the top of the chrome bath during the plating process (see Figure 1). This liquid is designed to prevent the aerosols of Cr from reaching the atmosphere by trapping the bubbles before they reach the liquid-air interface. If successful, this process may replace expensive scrubber technology currently used to deal with Cr emissions.

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FIGURE 1. CHROME VAT WITH 4-INCHES OF PRD LIQUID

b. Facility Description. The Zero-Emission demonstration took place in Building 114 on the Anniston Army Depot (ANAD). This building houses the depot's metal finishing operations. Line 2 was used in this demonstration to allow for continued concurrent production on Line 1. Line 2 has a total of four chrome vats. For this demonstration only vats 12A and 12B were used.

c. Exhaust System Description. The exhausts from all the chrome vats join into one duct. The fumes are pulled through an induced draft fan and exhausted through an entrainment separator to a 38-inch inside diameter (ID) stack. For this demonstration, Alabama Department of Environmental Management (ADEM) has allowed the separator to be removed from this system.

d. U.S. Environmental Protection Agency (USEPA) Method 306 Sampling (Total Chrome).

(1) Sampling Location. Line 2 of the Chrome Plating Finishing Complex exhausts to a 38-inch ID stack (see Figure 2). Two 4-inch ID ports, located at right angles to each other, are 114 inches (3 duct diameters) downstream and 53 ½ inches (1.4 duct diameters) upstream from the nearest flow disturbances (the induced draft fan and top of the stack, respectively). Per USEPA Reference Method (RM) 1 (reference 1), a velocity traverse of 24 sampling points (12 per traverse) was conducted using a pitot tube/thermocouple assembly. A cyclonic flow check was performed per USEPA RM 1 and was found to be acceptable. Velocity traverse and the cyclonic flow data are found in Appendix D.

FIGURE 2. LINE 2 EXHAUST STACK

(2) Sampling Procedures and Equipment. All sampling was conducted according to USEPA sampling methods. The USEPA RMs 1-4 (reference 1) were used to verify sampling points, conduct velocity traverse and cyclonic flow checks, and to determine moisture and stack gas content. Total chromium samples were collected according to USEPA Method 306 (reference 2). A detailed description of the sampling procedures and equipment used in the test is included in Appendix B.

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FIGURE 3. TSP-WEST LOCATION

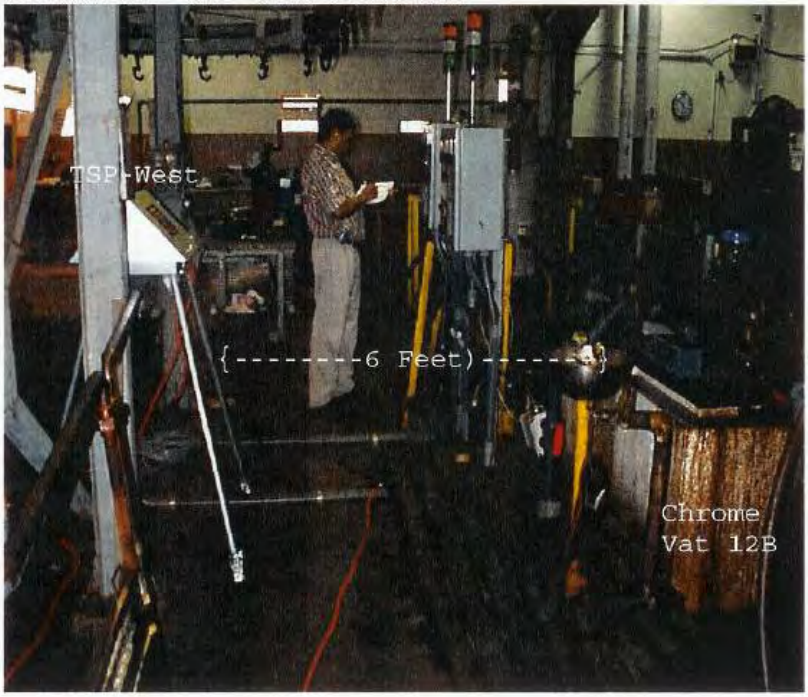


FIGURE 4. TSP-EAST LOCATION

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(3) Sample Recovery and Analysis. The procedures for recovery and analysis of all samples are discussed in Appendix C. The U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) contract lab, Severn Trent Laboratory located in Sacramento, California, performed USEPA RM 306 analyses.

e. Indoor Ambient Air Sampling. At the request of the USEPA, Total Suspended Particulate (TSP) samplers were used to determine the Cr levels in the indoor atmosphere.

(1) Sampling Location. Two high-volume TSP samplers were sited on the chrome plating line in Building 114. The West sampler was located approximately six feet west of chrome plating vat 12B (SN K0966). The East sampler was located approximately 12 feet east of chrome plating vat 12B. Both locations are shown in Figures 3-5.

(2) Sampling Procedures and Equipment. High-Volume TSP samplers were used to collect air samples from the atmosphere inside of Building 114. The sampling was to determine the emissions generated from the chromic acid used in the chrome plating operation. The TSP is considered to be all airborne solid and low vapor pressure liquid particles (mist) with an aerodynamic particle size ranging from approximately 0.8µm to greater then 100µm. All TSP samples were collected according to Title 40, Code of Federal Regulations (CFR) 50, Appendix B, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method) (reference 6). The sampling team used two Graseby-Andersen Model GT2200 high-volume TSP samplers to sample for Cr. The TSP sampler operated by drawing a measured quantity of ambient air into a covered housing and through an 8 x 10-inch quartz fiber filter for a two hour sample duration. Two-hour samples were collected to coincide with the stack sampling run times. A total of nine samples were collected with each sampler.

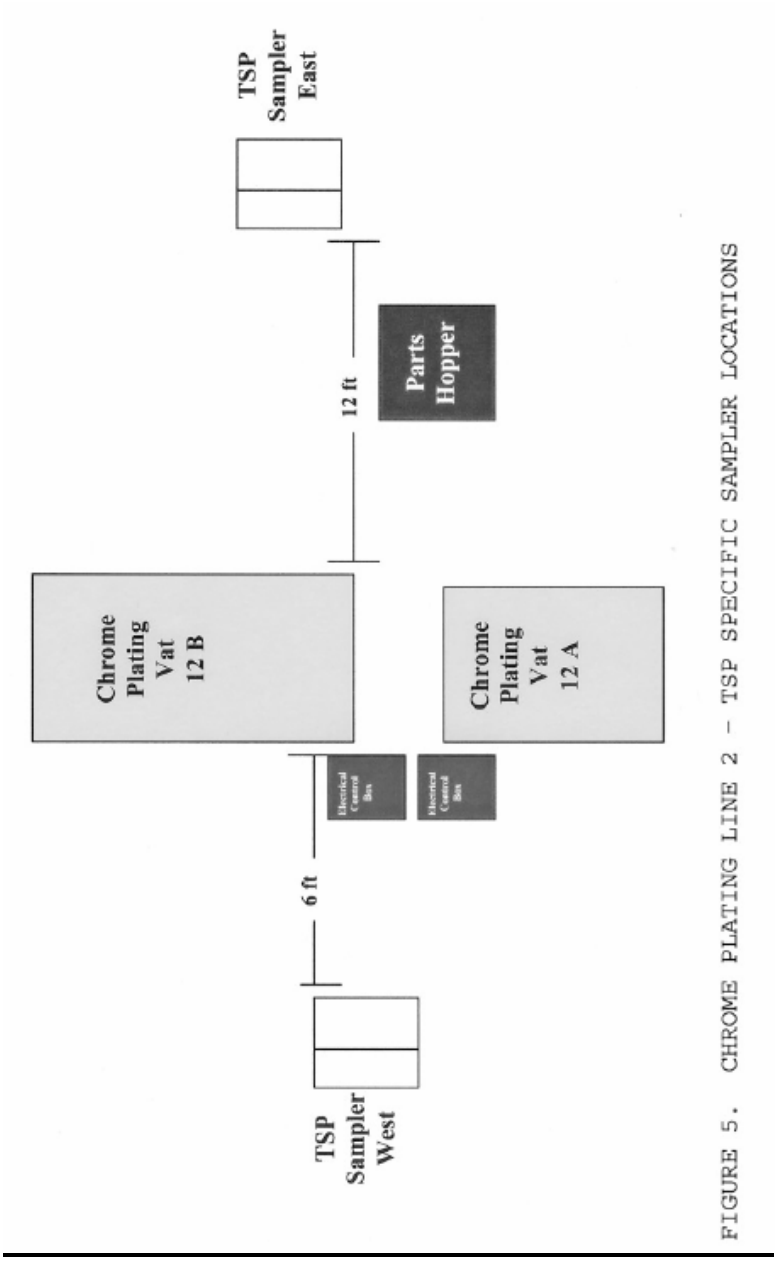


FIGURE 5. CHROME PLATING LINE 2 - TSP SPECIFIC SAMPLER LOCATIONS

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(3) Sample Recovery and Analysis. The procedures for recovery and analysis of all samples are discussed in Appendix C. At the conclusion of the ambient air-sampling mission, all filters were hand-carried by the ambient air sampling team back to USACHPPM. The USACHPPM Directorate of Laboratory Sciences (DLS) Analytical Spectrometry Division (ASD) analyzed the filters for Cr.

f. Test Series. The three test series conducted are described in Table 1.

TABLE 1. TEST SERIES

| TEST SERIES | DESCRIPTION |
|---|---|
| Test Series 1 | 4-inches of PRD Liquid |
| Test Series 2 | 2-inches of PRD Liquid |
| Test Series 3 | No PRD Liquid |

g. Assessment Personnel. The USACHPPM personnel participating in the field assessment are shown in Table 2.

TABLE 2. USACHPPM ASSESSMENT PERSONNEL

| PERSONNEL | MAJOR DUTIES/RESPONSIBILITIES |
|---|---|
| Tim Hilyard | Project Officer |
| Joe Simonovitch | Engineering Technician |
| Joe Sutphin | Engineering Technician |
| Mike McCarter | Physical Science Technician |

h. Nomenclature and Equations. The nomenclature and equations used for this assessment are found in Appendix E.

4. FINDINGS AND DISCUSSION.

a. Non-Standard Events.

(1) Run 1. During Run 1, chrome plating was occuring in a vat on line 2 which was not being used for this demonstration. Because of this condition, the results for this run may be biased high. The vat was on line 2 and was covered with plastic for the duration of the study.

(2) Run 4 was started at 0820, however vat 12B was not turned on until 0900. Thus, the plating was not maximized for this entire run. This could lead to the emissions being biased low.

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(3) Run 7, 8, and 9.

(a) For the test series with no PRD-liquid (Runs 7, 8, and 9), there was still some left over PRD-liquid in the tanks. This could lead to a potential low bias in the emissions.

(b) During Runs 7, 8, and 9 the large vat at the end of Line 1 was plating. Potential fumes from this operation, if introduced into the Line 2 exhaust stack, could bias the results high.

b. Data Summary. Field data sheets for all sampling runs are found in Appendix F and G.

c. Plating Items. For this demonstration test coupons were plated for 12 hours.

d. Emission Data. The average total Cr emission data, as tested, is summarized in Table 3. This data may have been biased by events discussed in section a. Cr emission data can be found in Appendix K.

TABLE 3. AVERAGE TOTAL CHROME CONCENTRATIONS

| Test Series | 4-Inches of PRD Liquid (Runs 1-3) | 2-Inches of PRD Liquid (Runs 4-6) | No PRD Liquid (Runs 7-9) |
|---|---|---|---|
| Amperage | | | |
| Vat 12A | 1,100 | 1,100 | 1,100 |
| Vat 12B | 267 | 300 | 300 |
| Total Amperage | 1,367 | 1,400 | 1,400 |
| STACK EMISSION DATA | | | |
| Actual Total Cr Concentration (mg/dscm) | 0.011 | 0.008 | 0.014 |
| NESHAP Cr Standard (mg/dscm) | **0.015** | **0.015** | **0.015** |
| TSP SAMPLER DATA | | | |
| Total Cr | | | |
| TSP-West ($mg/m^3$) | 0.046 | 0.016 | 0.100 |
| TSP-East ($mg/m^3$) | 0.025 | 0.005 | 0.019 |

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(1) Test Series 1. The first test series consisted of three runs with 4-inches of PRD liquid in the chromium vats. The average emission data for the 4-inches of PRD liquid Test Series can be found in Table 3. Individual run data is found in Table 4.

(a) USEPA Method 306. The average concentration of total Cr for the three runs was 0.011 mg/dscm. The concentration for each individual run was 0.016 mg/dscm, 0.009 mg/dscm and 0.007 mg/dscm, respectively.

(b) TSP Samplers. The average concentrations of total Cr for the three runs were 0.046 $mg/m^3$ and 0.025 $mg/m^3$ for the TSP-West and TSP-East respectively. The TSP-West had concentrations of 0.125 $mg/m^3$, 0.010 $mg/m^3$, and 0.004 $mg/m^3$ for the individual run. The TSP-East had concentrations of 0.067 $mg/m^3$, 0.005 $mg/m^3$, and 0.002 $mg/m^3$ for each run.

TABLE 4. TOTAL CHROME CONCENTRATIONS 4-INCHES OF PRD LIQUID

| Run Number | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Amperage | | | |
| Vat 12A | 1,100 | 1,100 | 1,100 |
| Vat 12B | 200 | 300 | 300 |
| Total Amperage | 1,300 | 1,400 | 1,400 |
| STACK EMISSION DATA | | | |
| Total Cr | | | |
| Concentration (mg/dscm) | 0.016 | 0.009 | 0.007 |
| TSP SAMPLER DATA | | | |
| Total Cr | | | |
| TSP-West ($mg/m^3$) | 0.125 | 0.010 | 0.004 |
| TSP-East ($mg/m^3$) | 0.067 | 0.005 | 0.002 |

(2) Test Series 2. A two-inch thickness of PRD liquid was used for Series 2. Average emission data for the 2-inches of PRD liquid test series can be found in Table 3 and individual run data in Table 5.

(a) USEPA Method 306. The average Cr concentration for the three runs was 0.008 mg/dscm. The concentrations were

0.011 mg/dscm, 0.004 mg/dscm, and 0.008 mg/dscm for Runs 4-6 respectively.

(b) TSP Samplers. The average total Cr concentration for the three runs was 0.016 mg/m$^3$ and 0.005 mg/m$^3$ for TSP-West and TSP-East, respectively. TSP-West had concentrations of 0.020 mg/m$^3$, 0.019 mg/m$^3$, and 0.009 mg/m$^3$ for each run. While TSP-East had concentrations of 0.006 mg/m$^3$, 0.005 mg/m$^3$, and 0.004 mg/m$^3$ for each run.

TABLE 5. TOTAL CHROME CONCENTRATIONS 2-INCHES OF PRD Liquid

| Run Number | Run 4 | Run 5 | Run 6 |
|---|---|---|---|
| Amperage | | | |
| Vat 12A | 1,100 | 1,100 | 1,100 |
| Vat 12B | 300 | 300 | 300 |
| Total Amperage | 1,400 | 1,400 | 1,400 |
| STACK EMISSION DATA | | | |
| Total Cr | | | |
| Concentration (mg/dscm) | 0.011 | 0.004 | 0.008 |
| TSP SAMPLER DATA | | | |
| Total Cr | | | |
| TSP-West (mg/m$^3$) | 0.020 | 0.019 | 0.009 |
| TSP-East (mg/m$^3$) | 0.006 | 0.005 | 0.004 |

(3) Test Series 3. The third test series consisted of three runs with no PRD liquid in the chromium vats. Average Emission data is found in Table 3 and individual run data is found in Table 6.

(a) USEPA RM 306. 0.014 mg/dscm was the average Cr concentration for the three runs. Runs 7-9 concentrations were 0.013 mg/dscm, 0.013 mg/dscm, and 0.015 mg/dscm, respectively.

(b) TSP Samplers. The average total Cr concentration for the three runs was 0.100 mg/m$^3$ and 0.019 mg/m$^3$ for the TSP sampler West and TSP sampler East respectively. TSP sampler West had total chrome concentrations of 0.130 mg/m$^3$, 0.098 mg/m$^3$, and

0.071 mg/m$^3$. TSP sampler East had concentrations of 0.027 mg/m$^3$, 0.021 mg/m$^3$, and 0.011 mg/m$^3$ for each run.

e. Sampling/Analytical Techniques. A summary of the sampling and analysis performed for this PRD Zero-Emission Study is found in Table 7.

TABLE 6. TOTAL CHROME CONCENTRATIONS NO PRD LIQUID

| Run Number | Run 7 | Run 8 | Run 9 |
|---|---|---|---|
| Amperage | | | |
| Vat 12A | 1,100 | 1,100 | 1,100 |
| Vat 12B | 300 | 300 | 300 |
| Total Amperage | 1,400 | 1,400 | 1,400 |
| STACK EMISSION DATA | | | |
| Total Cr | | | |
| Concentration (mg/dscm) | 0.013 | 0.013 | 0.015 |
| TSP SAMPLER DATA | | | |
| Total Cr | | | |
| TSP-West (mg/m$^3$) | 0.130 | 0.098 | 0.071 |
| TSP-East (mg/m$^3$) | 0.027 | 0.021 | 0.011 |

TABLE 7. SAMPLING/ANALYTICAL TECHNIQUES

| POLLUTANT CATEGORY | SAMPLING METHOD | ANALYSIS METHOD | CONSTITUENTS TO BE DETERMINED |
|---|---|---|---|
| Total Cr | USEPA Method 306 | GFAAS | Total Cr |
| Total Cr | TSP Samplers | ICP-MS | Total Cr |

(1) Sampling Procedures. The sampling procedures used during the PRD Zero-Emission Study are detailed in Appendix B.

(2) Sampling Duration/Volumes. The sampling durations and sample volumes for each of the trains can by found in Appendix F.

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f. Sampling/Analytical Quality Assurance (QA)/Quality Control (QC).

(1) QA/QC objectives. The QA/QC objectives and methods for this Treatability Study are provided in the following paragraphs.

(2) USEPA RM 306 Procedures. The QA/QC for emission sampling consisted primarily of performing necessary calibrations per references 1 and 7 and operating stack-sampling equipment per reference 1. Appendix I contains a summary of the calibration data. The QA/QC procedures for this train included analysis of media blanks such as the filter and reagents. The blank analytical results are provided in Appendix H.

(3) TSP Samplers.

(a) Equipment Calibration. The high-volume TSP samplers were calibrated and checked for leaks at the staging area prior to set up at the sample sites. A calibrated orifice transfer standard kit, traceable to NIST, was used to calculate each sampler's flow parameters. Calibration of the two high-volume samplers yielded acceptable correlation coefficients (r) greater than 0.990, as required by 40 CFR Part 50, Appendix B (reference 6). Flow checks were performed at the beginning and end of each sampling event to ensure proper equipment operation. Periodic flow checks during sampling events were also performed. Valid samples had flow rates between 1.1 and 1.7 $m^3$/minute, and a total sample time of 2 hrs. The results of the flow checks were entered on TSP field data sheets (see Appendix G).

(b) Sample Preservation. Prior to field use, all quartz fiber filters were visually inspected for tears and pinholes. Each filter was then placed in individual, protective filter envelopes. While at ANAD all filters were maintained in their envelopes and stored in the chemistry laboratory in Building 114. All filters were prepared and recovered in this same room.

(c) Sample Validation Criteria. All sample run times were within the two-hour sample duration as well as the required flow rate of 1.1 - 1.7 cubic meters per minute ($m^3$/min). All calibration criteria were met, to include that no single point flow check was greater than +/- 10% deviation and sampler regression coefficients were greater than 0.99.

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g. Sample Custody. The integrity of the samples was maintained with completed sample chain-of-custody sheets. These sheets provided a unique sample number, volumes, and descriptions for each sample. The custody sheets also specified names of sample custodians, dates, and run numbers. Appendix J includes the sample custody sheets.

5. CONCLUSION. The average total Cr concentrations for each test series, as measured per USEAP Method 306, was below the 0.015 milligram per dry standard cubic meter (mg/dscm) National Emission Standards for Hazardous Air Pollutants (NESHAP) Cr standard.

6. RECOMMENDATIONS. Provide a copy of this report to the USEPA. If another demonstration is needed, conduct the testing without any other plating in progress during the demonstration. Also a background test series should be conducted to determine how much chromium from the indoor air is exhausted out of the exhaust stack.

TIMOTHY D. HILYARD
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Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

## APPENDIX A

## REFERENCES

1. Title 40 CFR, 1998 Revision, Part 60 Appendix A, Reference Methods.

2. Title 40 CFR, 2001 Revision, Part 63 Appendix A, Test Methods.

3. Test Methods for Evaluating Solid Waste, SW-846, Third Edition, December 1996, USEPA.

4. USEPA, Manual APTD-0576, March 1983, Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment.

5. USEPA, Publication No. 600/4-77-027B, March 1983, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Stationary Source Specific Methods.

6. Title 40 CFR, 1998 Revision, Part 50, Appendix B, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High Volume Method).

# APPENDIX B

# SAMPLING EQUIPMENT AND PROCEDURES

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

1. STACK SAMPLING EQUIPMENT. The USEPA RM 306 (reference 2) will be used to measure the Cr emissions being released to the atmosphere at the stack. The train configuration is as follows:

Pyrex® sample nozzle
Teflon® union
Pyrex lined probe sheath assembly
Teflon® flex line
90° elbow
Impinger No. 1-100 mL 0.1 N NaOH solution
180° glass connector
Impinger No. 2-100 mL 0.1 N NaOH solution
180° glass connector
Impinger No. 3-dry
180° glass connector
Impinger No. 4-silica gel

S-type pitot tubes and thermocouples will be attached to the sampling probe. The pitot tubes will be 0.75-in. from the probe nozzle, and the thermocouples will be placed to eliminate any disturbance in the velocity measurements. The probe will be attached to a sample box containing the impinger train by a Teflon flex line. The impingers will be packed in an ice bath to cool the gas and to remove the moisture from the gas sample. The sample box will be connected to an umbilical cord, which contains the vacuum line, pitot lines, electrical connections and thermocouple wires. The meter box has a calibrated dry gas meter and calibrated orifice. A vacuum pump will be used to draw the sample through the sampling equipment. Two manometers, mounted on the meter box, will measure the velocity pressure in the stack and the pressure differential across the meter box orifice.

2. STACK SAMPLING PROCEDURES. Traverse points were determined and a preliminary velocity, temperature, and cyclonic flow traverse was conducted in accordance with USEPA RMs 1 and 2 of reference 1. Following these initial traverses, nine separate sampling runs were performed according to USEPA RM 306. The USEPA RM 306 sampling train will be operated isokinetically. Sampling will be performed by controlling the sampling flow rates, so the velocities of the gases entering the sampling nozzle are equal (within ±10%) to those of the undisturbed stack gas stream at the sampling points. Since this is not a fuel burning source, gas composition will be considered as ambient air (i.e., 79 percent $N_2$, and 21 percent $O_2$).

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® Pyrex is registered trademark of Corning Glass Works, Houghton Park, Corning, New York

® Teflon is a registered trademark of E.I. DuPont de Nemours & Co., Inc., Wilmington, Delaware.

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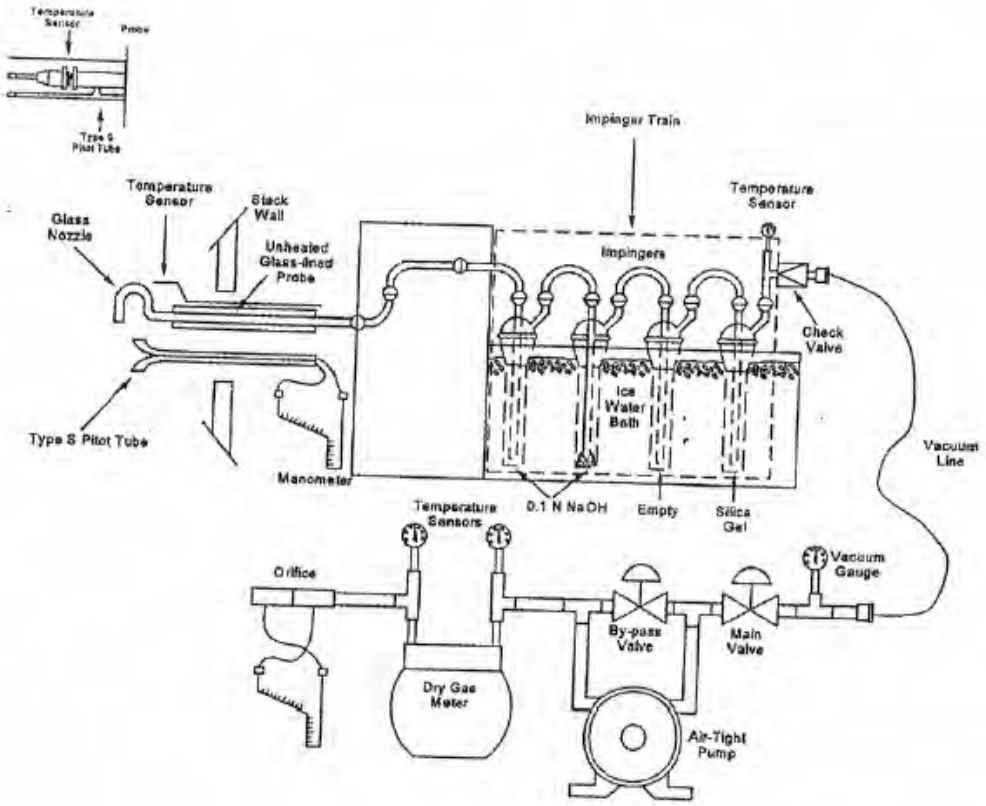


Impinger Contents

Impinger 1 - 100 mL 0.1 N NaOH
Impinger 2 - 100 mL 0.1 N NaOH
Impinger 3 - Initially Dry
Impinger 4 - Silica Gel

FIGURE 1. USEPA RM 306 Sampling Train

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3. SAMPLING POINTS. The Line 2 stack is 38 inches ID. Two 4-inch ID sampling ports were installed on the exhaust stack approximately 53 ½ inches (1.4 duct diameters) from the nearest upstream disturbance (the top of the stack) and 114 inches (3 duct diameters) from the nearest downstream disturbance (the exhaust fan). Based on the disturbances and USEPA RM 1, a total of 24 traverse points were to be sampled. Stack velocity pressure and temperature readings were taken every 5 minutes throughout each 2-hour run. Figure B-3 shows the preliminary velocity/temperature traverse point locations within the stack and the approximate sampling location during the single point sampling runs.

4. STACK GAS MOISTURE. Moisture was collected in the impingers of each sample train. All impingers were kept in an ice bath so that the final impinger stack gas exit temperature did not exceed 68 °F. Total moisture was determined by weighing the impingers and contents before and after each run. The weight, in grams, gained by the impingers was equal to the volume, in mL, collected during the run. The impingers were weighed on a top loading balance accurate to 0.1 gram.

5. STACK GAS COMPOSITION. Since this is not a fuel burning source, gas composition will be considered as ambient air (i.e., 79 percent $N_2$, and 21 percent $O_2$).

6. TSP SAMPLERS. High-Volume Total Suspended Particulate (TSP) samplers (see Figure 1) were used to collect air samples from the atmosphere inside of Building 114. The sampling was to evaluate the emissions generated from the chromic acid used in the chrome plating operation. TSP is considered to be all airborne solid and low vapor pressure liquid particles (mist) with an aerodynamic particle size ranging from approximately 0.8µm to greater then 100µm. All TSP samples were collected according to Title 40, Code of Federal Regulations (CFR) 50, Appendix B, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method) (reference 5). The sampling team used two Graseby-Andersen Model GT2200 high-volume TSP samplers to sample for Chromium. The TSP sampler operated by drawing a measured quantity of ambient air into a covered housing and through an 8 x 10 inch quartz fiber filter for a two hour sample duration. Two-hour samples were collected to coincide with the stack sampling run times. A total of nine samples were collected with each sampler.

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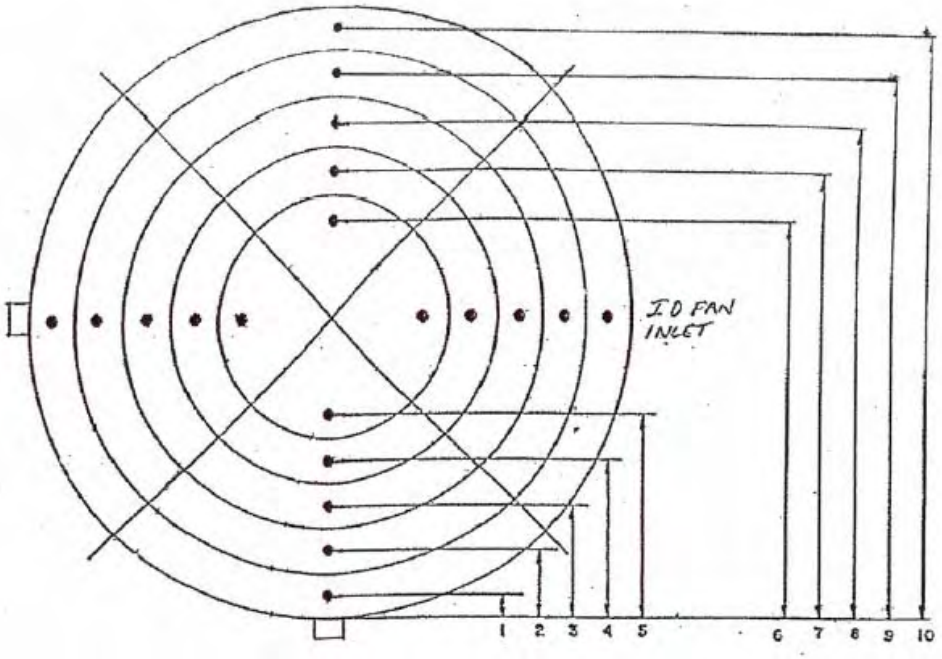


| Point No. | Percentage of Stack Diameter | Distance From Stack Wall |
|---|---|---|
| 1,13 | 2.1 | 7/8" |
| 2,14 | 6.7 | 2 1/2" |
| 3,15 | 11.8 | 4 1/2" |
| 4,16 | 17.7 | 6 3/4" |
| 5,17 | 25.0 | 9 1/2" |
| 6,18 | 35.6 | 13 1/2" |
| 7,19 | 64.4 | 24 1/2" |
| 8,20 | 75.0 | 28 1/2" |
| 9,21 | 82.3 | 31 1/4" |
| 10,22 | 88.2 | 33 1/2" |
| 11,23 | 93.3 | 35 1/2" |
| 12,24 | 97.9 | 37 1/8" |

Figure B-3. Preliminary Traverse Point and Sampling Locations for ANAD Line 2 Exhaust Stack

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APPENDIX C
SAMPLE RECOVERY AND ANALYSIS

1. STACK GAS.

a. Stack Gas Composition. Since this is not a fuel burning source, gas composition will be considered as ambient air (i.e., 79 percent $N_2$, and 21 percent $O_2$).

b. Stack Gas Moisture Determination. Moisture was collected in the impingers of each sample train. All impingers were kept in an ice bath so that the final impinger stack gas exit temperature did not exceed 68 °F. Total moisture was determined by weighing the impingers and contents before and after each run. The weight, in grams, gained by the impingers was equal to the volume, in mL, collected during the run. The impingers were weighed on a top loading balance accurate to 0.1 gram.

2. USEPA RM 306 DETERMINATION. Total chromium emissions were collected using RM 306 (reference 2) sampling trains.

a. Sample 1. Measured the volume of the first, second, and third impingers, then quantitatively transferred the liquid into a labeled sample container (Container 1). Rinsed the probe nozzle, probe liner, flex line, the three impingers and connecting glassware with approximately 200 to 300 mL of 0.1 N NaOH. This rinse was added to Container 1. Then, placed a signed and dated sample custody seal over the lid and top of jar to ensure the lid is not removed prior to the analytical lab receiving the sample.

3. TSP SAMPLER. The indoor chromium was collected using TSP samplers. The sampler operates by drawing a measured quantity of ambient air into a covered housing and through an 8 x 10 inch QMA quartz fiber filter for a desired sample period. Chromium samples were prepared according to 40 CFR 50, Appendix G (reference 6). Any Chromium collected was leached off the filter with a diluted nitric acid solution on a hot plate for approximately 30 minutes and then analyzed by USEPA Method 200.8-Inductively Coupled Plasma-Mass Spectrometry (IPC-MS). The concentration of Chromium was determined by dividing the reported mass by the volume of air drawn through the filter during the sampling period. A field blank and a trip blank were submitted with the batch of samples.

# APPENDIX D

## TRAVERSE POINT, VELOCITY TRAVERSE AND CYCLONIC FLOW DATA

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

STACK GAS VELOCITY AND CYCLONIC FLOW DATA

| INSTALLATION/PROJECT NUMBER: Anniston Army Depot, Alabama / 43-EL-5116-03 | | | DATE: 3 June 2003 |
|---|---|---|---|
| SAMPLING LOCATION: Chrome Plating Finishing Complex BLDG 114 | | | TIME: 0845 |
| OPERATOR: H. Ilyard | AMBIENT TEMP (°F) 70°F | $P_{bar}$ (in.Hg) | $P_{stat}$ (in.$H_2O$) |
| MOLECULAR WT (lb/lb mole) | EXHAUST STACK ID (in.) ID SIDE 1: 38" | ID SIDE 2: 38" | PITOT TUBE $C_p$: 0.84 |

| TRAVERSE POINT | | POSITION (in.) | STACK GAS VELOCITY HEAD (in. $H_2O$) | | STACK GAS TEMPERATURE (°F) | | YAW ANGLE (°) | |
|---|---|---|---|---|---|---|---|---|
| 1 | 13 | | 0.310 | 0.430 | 76 | 77 | 15°8° | 12° |
| 2 | 14 | | 0.310 | 0.430 | 76 | 77 | 18°12° | 18° |
| 3 | 15 | | 0.350 | 0.428 | 76 | 78 | 13° | 2° |
| 4 | 16 | | 0.360 | 0.360 | 76 | 76 | 15° | 22° |
| 5 | 17 | | 0.350 | 0.31 | 77 | 76 | 16° | 19° |
| 6 | 18 | | 0.300 | 0.30 | 78 | 76 | 10° | 5° |
| 7 | 19 | | 0.320 | 0.32 | 77 | 76 | 22° | 11° |
| 8 | 20 | | 0.360 | 0.34 | 77 | 76 | 13° | 15° |
| 9 | 21 | | 0.340 | 0.34 | 77 | 76 | 11° | 23° |
| 10 | 22 | | 0.400 | 0.36 | 77 | 77 | 18° | 18° |
| 11 | 23 | | 0.430 | 0.37 | 77 | 76 | 17° | 18° |
| 12 | 24 | | 0.430 | 0.37 | 77 | 77 | 15 | 18° |
| AVERAGES | | | 0.359 "$H_2O$ | | 77 °F | | 14° | |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

TRAVERSE POINT LOCATION FOR CIRCULAR STACKS

INSTALLATION: Anniston Army Depot, Alabama PROJECT NUMBER: 43-EL-5116-03

DATE: 2 June 03 SAMPLING LOCATION: Chrome Plating Finishing Complex, BLDG 114

INSIDE OF FAR WALL TO OUTSIDE
OF NIPPLE (DISTANCE A): 38"

INSIDE OF NEAR WALL TO OUTSIDE
OUTSIDE OF NIPPLE (DISTANCE B): 0"

STACK I.D. (A - B): 38"

NEAREST UPSTREAM DISTURBANCE: ~~114"~~ 53 1/2" (1.4dd) ~~(3dd)~~ 6dd

NEAREST DOWNSTREAM DISTURBANCE: ~~53 1/2"~~ ~~(1.4dd)~~ ~~6dd~~ 114" (3dd)

SCHEMATIC OF SAMPLING LOCATION

PITOT TUBE BLOCKAGE CORRECTION FACTOR:

External Sheath and % Blockage > 3% K = 1.0197 - 0.0098 (% Blockage)

No External Sheath and % Blockage > 2% K = 1.0132 - 0.0101 (% Blockage)

% Blockage = (Stack Dia/2 - Nozzle Length)(Sheath Dia)/Stack Area X 100

$C_{p_{std}} = 0.84\,K$

| Traverse Point Number | Fraction of Stack ID | Stack ID | Traverse Point Location (To Nearest 1/8") | Distance B | Traverse Point Location From Outside Nipple |
|---|---|---|---|---|---|
| 1/13 | 2.1 | 38" | 7/8 | 0" | 7/8 |
| 2/14 | 6.7 | | 2 1/2 | | 2 1/2 |
| 3/15 | 11.8 | | 4 1/2 | | 4 1/2 |
| 4/16 | 17.7 | | 6 3/4 | | 6 3/4 |
| 5/17 | 25.0 | | 9 1/2 | | 9 1/2 |
| 6/18 | 35.6 | | 13 1/2 | | 13 1/2 |
| 7/19 | 64.4 | | 24 1/2 | | 24 1/2 |
| 8/20 | 75.0 | | 28 1/2 | | 28 1/2 |
| 9/21 | 82.3 | | 31 1/4 | | 31 1/4 |
| 10/22 | 88.2 | | 33 1/2 | | 33 1/2 |
| 11/23 | 93.3 | | 35 1/2 | | 35 1/2 |
| 12/24 | 97.9 | | 37 1/8 | | 37 1/8 |

# APPENDIX E

# NOMENCLATURE AND EQUATIONS

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

NOMENCLATURE

| SYMBOL | UNITS | DESCRIPTION |
|---|---|---|
| $A_n$ | $ft^2$ | Cross-sectional area of nozzle |
| $A_s$ | $ft^2$ | Cross-sectional area of stack |
| $B_{WO}$ | decimal | Mole fraction of stack as water content |
| $C_m$ | mg/dscm | chromium concentration of stack gas |
| $C_p$ | - | S-type pitot tube coefficient |
| $C_{TSP}$ | $mg/m^3$ | chromium concentration of TSP Sampler |
| $CO_2$ | % | Concentration of $CO_2$ in gas stream as measured by an orsat analyzer, dry basis |
| $\Delta H$ | inches $H_2O$ | Average pressure drop across the meter box orifice |
| I | % | The ratio of the sampling velocity to the stack velocity, 100% when the two are equal |
| $M_m$ | mg | Mass of chromium collected |
| $M_s$ | lb/lb mole | Molecular weight of stack gas |
| $N_2$ | % | Concentration of $N_2$ in gas stream as determined by an orsat analyzer, dry basis |
| $O_2$ | % | Concentration of $O_2$ in gas stream as measured by an orsat analyzer, dry basis |
| $\Delta P$ | inches $H_2O$ | Velocity head of stack gas |
| $P_{bar}$ | inches Hg | Barometric pressure at local elevation |
| $P_m$ | inches Hg | Absolute pressure ($P_{bar} + \Delta H/13.6$) at meter |
| $P_s$ | Inches Hg | Absolute pressure ($P_{bar} + P_{stat}/13.6$) at stack |

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| SYMBOL | UNITS | DESCRIPTION |
|---|---|---|
| $P_{stat}$ | Inches $H_2O$ | Static pressure in stack |
| $Q_s$ | dscf/hr | Average stack gas volumetric flow rate, dry, at standard conditions |
| $T_m$ | °R | Average dry gas meter temperature (°F + 460) |
| $T_s$ | °R | Average stack gas temperature (°F + 460) |
| $T_{std}$ | °R | Standard absolute temperature, 528°F |
| $V_{lc}$ | g | Total mass of liquid collected in the impingers and silica gel |
| $V_m$ | $ft^3$ | Volume of gas through the dry gas meter at meter conditions |
| $V_{m\ std}$ | dscf | Volume of dry gas sampled at standard conditions |
| $V_s$ | ft/sec | Average stack gas velocity at sampling site |
| $V_{std}$ | $M^3$ | Volume pulled through the TSP samplers |
| $V_{w\ std}$ | scf | Water vapor volume at standard conditions |
| $W_n$ | $mg/m^3$ | Net weight of TSP filters |
| $\theta$ | min | Total sampling time per run |
| $\gamma_m$ | - | Dry gas meter coefficient |

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EQUATIONS

1. ABSOLUTE PRESSURE, $P_m$ and $P_s$ (inches Hg).

$$P_m = P_{bar} + \frac{\Delta H}{13.6}$$

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$

2. DRY GAS METER VOLUME, STANDARD CONDITIONS, $V_{mstd}$ (dscf).

$$V_{m_{std}} = \frac{17.65\, V_m\, \gamma_m\, P_m}{T_m}$$

3. WATER VAPOR VOLUME, STANDARD CONDITIONS, $V_{wstd}$ (scf).

$$V_{w_{std}} = 0.04707\, V_{lc}$$

4. MOISTURE CONTENT, $B_{wo}$ (percent).

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}}$$

5. STACK GAS MOLECULAR WEIGHT, $M_s$ (lb/lb-mole).

$$M_s = (1 - B_{wo})\,[0.44(\%CO) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO_2)] + 18\, B_{wo}$$

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6. AVERAGE STACK GAS VELOCITY, $v_s$ (ft/sec).

$$v_s = 85.48\, C_p (\Delta P^{0.5})_{avg} \left(\frac{T_s}{P_s M_s}\right)^{0.5}$$

7. AVERAGE STACK GAS VOLUMETRIC FLOW RATE, $Q_s$ (dscf/hr).

$$Q_s = \frac{63,529(1 - B_{wo})(V_s)(A_s)(P_s)}{T_s}$$

8. ISOKINETIC SAMPLING RATE, I (percent).

$$I = \frac{0.0945(T_s)(V_{m\,std})}{\theta\, V_s P_s A_n (1 - B_{wo})}$$

9. STACK CHROMIUM CONCENTRATION, $C_m$ (mg/dscm)

$$C_m = \frac{35,51 M_m}{V_{m\,std}}$$

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10. TSP SAMPLER CHROMIUM CONCENTRATION, (mg/m$^3$)

$$C_{TSP} = \frac{W_N}{V_{STD}}$$

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# APPENDIX F

# SAMPLING TRAIN DATA SUMMARY

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLING DATA AND ISOKINETIC SHEETS

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 3 Jun

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 1

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 536 $A_s$ = 7.876 $V_s$ = 79.231 $P_{bar}$ = 29.13 $\sqrt{\Delta P}_{avg}$ = 0.576

$\theta$ = 120 / 29.231 $T_m$ = 540 $A_n$ = 3.982e-3 $\gamma_m$ = 1.009 $P_{stat}$ = -0.20 $\Delta H$ = 1.448

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 46.3 $M_s$ = ____ $\%CO_2$ = 0.0 $\%O_2$ = 20.9 $\%N_2$ = 78.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.24 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.14 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65\, V_m\, \gamma_m\, P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 76.39 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.028$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

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ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 3 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 1

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44\,(\%CO_2) + 0.32\,(\%O_2) + 0.28\,(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1 - \quad)[0.44(\quad) + 0.32(\quad) + 0.28(\quad)] + 18(\quad) = \underline{28.54}\ \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\,C_p\sqrt{\Delta P}_{avg}\sqrt{\frac{T_s}{P_s M_s}} = 85.48(\quad)(\quad)\sqrt{\frac{(\quad)}{(\quad)(\quad)}} = \underline{33.16}\ \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\,V_{s_{avg}}\,A_s\,P_s}{T_s} = \frac{63{,}529\,(1 - \quad)(\quad)(\quad)(\quad)}{(\quad)} = \underline{877{,}212}\ \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\,T_s\,V_{m_{std}}}{\Theta\,V_s\,P_s\,A_n\,(1 - B_{wo})} = \frac{0.0945(\quad)(\quad)}{(\quad)(\quad)(\quad)(\quad)(1 - \quad)} = \underline{101.5}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | | RUN NO. 1 | | DATE 3 JUN 03 | |
|---|---|---|---|---|---|
| Project Number: 43-EL-5116-03 | | Installation: Anniston Army Depot, Alabama | | Meter Box Operator: Simonov, tch | |
| Sample Location: Chrome Plating Finishing Complex, BLDG 114 | | | | | |
| Type of Sample: (Total Chrome) | | (Moisture) | | | |
| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.360 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 1 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | 0.84 |
| $T_m$ 540 | $T_s$ 537 | | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.20 | | 0.250 | $C_{p,eff}$ 0.84 | |
| Ref $\Delta P$ | | $D_{n,avg}$ 0.249 | | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 90496 | | Dry Gas Meter $\gamma_m$ 1.009 | | $D_s$ 38 " | $A_s$ 7.876 |
| Filter | | | Probe | | |
| Type | Number | | Length | Liner | Heat Set |
| NA | NA | | 3' EFF. | QUARTZ | 248 |
| Initial Leak Check | | | Initial Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 0.0 in. $H_2O$ per 15 Sec. | | |
| 15 | 0.001 $ft^3$ per 1 Min. | | at 5.8 / 6.3 in. $H_2O$ | | |
| Final Leak Check | | | Final Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 0.0 in. $H_2O$ per 15 Sec. | | |
| 5 | 0.001 $ft^3$ per 1 Min. | | at 5.3 / 5.7 in. $H_2O$ | | |
| Gas Bag System Leak Check | | | Component Leak Check | | |
| Initial | Final | | Vacuum (in Hg.) | Leak Rate | |
| $P_{bar}$ 29.13 | $P_{stat}$ +0.20 | | | $ft^3$ per Min. | |
| Start Time 1115 | End Time 1525 | | | $ft^3$ per Min. | |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | Θ (min) | $V_m$ ($ft^3$) $V_i$= 394.793 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_i$ | $t_f$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | ~~Filter Temp.~~ (°F) | Remark ~~Stack~~ $K_p$= 4.20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North 075 | | | | | | | | | | | | |
| 1 | 5 | 398.23 | 0.38 | 0.616 | 1.60 | 71 | 72 | 74 | 2.0 | 53 | – | 240 |
| 2 | 10 | 401.67 | 0.38 | 0.616 | 1.60 | 77 | 72 | 76 | 2.0 | 52 | – | 241 |
| 3 | 15 | 404.99 | 0.39 | 0.625 | 1.51 | 76 | 72 | 76 | 2.0 | 55 | – | 245 |
| 4 | 20 | 408.18 | 0.34 | 0.533 | 1.43 | 76 | 72 | 76 | 2.0 | 54 | – | 251 |
| 5 | 25 | 411.51 | 0.35 | 0.592 | 1.47 | 76 | 72 | 75 | 2.0 | 58 | – | 243 |
| 6 | 30 | 414.83 | 0.34 | 0.533 | 1.43 | 83 | 73 | 76 | 2.0 | 59 | – | 240 |
| 7 | 35 | 418.13 | 0.34 | 0.533 | 1.43 | 84 | 73 | 76 | 2.0 | 58 | – | 238 |
| 8 | 40 | 421.47 | 0.33 | 0.574 | 1.39 | 83 | 72 | 76 | 2.0 | 57 | – | 245 |
| 9 | 45 | 424.65 | 0.31 | 0.557 | 1.30 | 86 | 74 | 76 | 1.5 | 60 | – | 247 |
| 10 | 50 | 428.35 | 0.42 | 0.648 | 1.76 | 86 | 75 | 76 | 2.0 | 58 | – | 239 |
| 11 | 55 | 432.37 | 0.47 | 0.686 | 1.97 | 88 | 75 | 77 | 2.5 | 58 | – | 250 |
| 12 | 60 | 436.130 | 0.47 | 0.686 | 1.97 | 89 | 76 | 77 | 2.5 | 58 | – | 246 |
| | | 436.151 | | | | | | | | | | |
| West 075 | | | | | | | | | | | | |
| 13 | 65 | 439.46 | 0.33 | 0.574 | 1.39 | 76 | 77 | 76 | 1.5 | 56 | – | 250 |
| 14 | 70 | 442.58 | 0.32 | 0.566 | 1.34 | 84 | 77 | 76 | 1.5 | 30 | – | 245 |
| 15 | 75 | 445.85 | 0.32 | 0.566 | 1.34 | 86 | 77 | 77 | 1.5 | 52 | – | – |
| 16 | 80 | 448.75 | 0.29 | 0.539 | 1.218 | 55 | 77 | 76 | 1.5 | 52 | – | – |
| 17 | 85 | 451.92 | 0.29 | 0.539 | 1.218 | 88 | 78 | 77 | 1.5 | 55 | – | – |
| 18 | 90 | 454.90 | 0.28 | 0.529 | 1.176 | 88 | 78 | 77 | 1.5 | 57 | – | – |
| 19 | 95 | 457.97 | 0.28 | 0.529 | 1.176 | 88 | 78 | 77 | 1.5 | 55 | – | – |
| 20 | 100 | 461.13 | 0.34 | 0.533 | 1.43 | 88 | 79 | 77 | 1.5 | 56 | – | – |
| 21 | 105 | 464.43 | 0.33 | 0.574 | 1.39 | 89 | 79 | 77 | 1.5 | 55 | – | – |
| 22 | 110 | 467.73 | 0.34 | 0.533 | 1.43 | 87 | 79 | 77 | 1.5 | 55 | – | – |
| 23 | 115 | 470.83 | 0.33 | 0.574 | 1.39 | 90 | 80 | 77 | 1.5 | 56 | – | – |
| 24 | 120 | 474.024 | 0.33 | 0.574 | 1.39 | 89 | 80 | 77 | 1.5 | 56 | – | – |
| TOTAL | | 79.251 | 0.330 | 13.821 | 34.748 | 2079 3832 | | 1853 1755 | | | | |
| AVERAGE | | | | 0.576 | 1.448 | 80 °F | | 76 °F | | | | |
| | | | | | | 540 °R | | 536 °R | | | | |

Start 1115 Start 1237
Stop 1215 Stop 1337

Mid pt ck area 0.005 ΔP p. in @ 3" Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 3 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 2

FROM FIELD DATA SHEET:

$C_p$ = 0.838 $T_s$ = 537 $A_s$ = 7.876 $V_m$ = 78.076 $P_{bar}$ = 29.13 $\sqrt{\Delta P}_{avg}$ = 0.577

$\theta$ = 120 $T_m$ = 545 $A_n$ = 3.382×10⁻⁴ $\gamma_m$ = 1.009 $P_{stat}$ = +0.20 $\Delta H$ = ~~0.4~~ 1.40 ton

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 48.1 $M_n$ = ____ $\%CO_2$ = ~~20.9~~ 0.0 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.23 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.14 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65 V_m \gamma_m P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 74.58 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.030$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 3 June

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 2

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1- \quad )[0.44( \quad ) + 0.32( \quad ) + 0.28( \quad )] + 18( \quad ) = \underline{28.52} \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\, C_p \sqrt{\Delta P_{avg}} \sqrt{\frac{T_s}{P_s M_s}} = 85.48( \quad )( \quad ) \sqrt{\frac{( \quad )}{( \quad )( \quad )}} = \underline{33.52} \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\, V_{s_{avg}} A_s\, P_s}{T_s} = \frac{63{,}529\,(1- \quad )( \quad )( \quad )( \quad )}{( \quad )} = \underline{876{,}646} \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\, T_s\, V_{m_{std}}}{\Theta\, V_s\, P_s\, A_n\, (1 - B_{wo})} = \frac{0.0945( \quad )( \quad )}{( \quad )( \quad )( \quad )( \quad )(1- \quad )} = \underline{99.1}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | RUN NO. 2 | DATE 3 June 2003 |
|---|---|---|
| Project Number: 43-EL-5116-03 | Installation: Anniston Army Depot, Alabama | Meter Box Operator: Simonovitch |

Sample Location: Chrome Plating Finishing Complex, BLDG 114

Type of Sample: (Total Chrome) (Moisture)

| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
|---|---|---|---|---|---|
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.366 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 1 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | 0.84 |
| $T_m$ 540 | $T_s$ 537 | | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.26 | | 0.250 | $C_{p,eff}$ 0.84 | |
| Ref. $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 90496 | | Dry Gas Meter $\gamma_m$ 1.009 | | $D_s$ 38" | $A_s$ 7.876 |

| Filter | | Probe | | |
|---|---|---|---|---|
| Type | Number | Length | Liner | Heat Set |
| — | — | 3' Eff | Quartz | — |

| Initial Leak Check | | Initial Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 15 | 0.001 $ft^3$ per 1 Min. | at 6.3 / 6.1 in. $H_2O$ |

| Final Leak Check | | Final Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 5 | 0.001 $ft^3$ per 1 Min. | at 7.1 / 6.3 in. $H_2O$ |

| Gas Bag System Leak Check | | Component Leak Check | |
|---|---|---|---|
| Initial | Final | Vacuum (in Hg.) | Leak Rate |
| $P_{bar}$ 28.13 | $P_{stat}$ +0.20 | | $ft^3$ per Min. |
| Start Time 1425 | End Time 1635 | | $ft^3$ per Min. |

F-9

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | Θ (min) | $V_m$ (ft³) $V_i$= 474.243 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_i$ | $t_f$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | Filter Temp. (°F) | Remark $K_p$= 4.20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 477.55 | 0.35 | 0.592 | 1.47 | 75 | 76 | 75 | 2.0 | 63 | — | 4.20 |
| 2 | 10 | 480.88 | 0.36 | 0.600 | 1.51 | 80 | 77 | 77 | 2.0 | 61 | — | 4.20 |
| 3 | 15 | 484.19 | 0.35 | 0.592 | 1.47 | 83 | 76 | 76 | 2.0 | 55 | — | 4.20 |
| 4 | 20 | 487.45 | 0.30 | 0.548 | 1.26 | 86 | 77 | 76 | 2.0 | 58 | — | 4.20 |
| 5 | 25 | 490.51 | 0.31 | 0.557 | 1.30 | 87 | 77 | 76 | 1.5 | 55 | — | 4.20 |
| 6 | 30 | 493.43 | 0.27 | 0.520 | 1.13 | 88 | 78 | 76 | 1.5 | 58 | — | 4.20 |
| 7 | 35 | 496.36 | 0.26 | 0.510 | 1.09 | 88 | 78 | 76 | 1.5 | 56 | — | 4.20 |
| 8 | 40 | 499.33 | 0.30 | 0.548 | 1.26 | 88 | 78 | 77 | 1.5 | 55 | — | 4.20 |
| 9 | 45 | 502.57 | 0.31 | 0.557 | 1.30 | 89 | 78 | 77 | 1.5 | 55 | — | 4.20 |
| 10 | 50 | 505.63 | 0.31 | 0.557 | 1.30 | 90 | 79 | 77 | 1.5 | 54 | — | 4.20 |
| 11 | 55 | 508.83 | 0.32 | 0.566 | 1.34 | 91 | 79 | 77 | 1.5 | 55 | — | 4.20 |
| 12 | 60 | 512.180 | 0.33 | 0.574 | 1.39 | 91 | 80 | 77 | 1.5 | 56 | — | 4.20 |
| | | | | | | | | | | | | |
| 13 | 65 | 515.59 | 0.39 | 0.624 | 1.64 | 84 | 81 | 77 | 2.0 | 58 | — | 4.20 |
| 14 | 70 | 518.09 | 0.38 | 0.616 | 1.60 | 87 | 80 | 77 | 2.0 | 53 | — | 4.20 |
| 15 | 75 | 522.61 | 0.39 | 0.624 | 1.64 | 91 | 81 | 77 | 2.0 | 54 | — | 4.20 |
| 16 | 80 | 525.66 | 0.28 | 0.529 | 1.18 | 92 | 81 | 78 | 1.5 | 55 | — | 4.20 |
| 17 | 85 | 528.75 | 0.28 | 0.529 | 1.18 | 92 | 82 | 78 | 1.5 | 56 | — | 4.20 |
| 18 | 90 | 531.92 | 0.26 | 0.510 | 1.09 | 93 | 82 | 78 | 1.5 | 56 | — | 4.20 |
| 19 | 95 | 534.71 | 0.31 | 0.557 | 1.30 | 93 | 82 | 78 | 1.5 | 55 | — | 4.20 |
| 20 | 100 | 537.98 | 0.31 | 0.557 | 1.30 | 94 | 83 | 78 | 1.5 | 56 | — | 4.20 |
| 21 | 105 | 541.10 | 0.32 | 0.566 | 1.34 | 96 | 84 | 79 | 1.5 | 56 | — | 4.20 |
| 22 | 110 | 544.81 | 0.44 | 0.667 | 1.85 | 95 | 84 | 78 | 2.0 | 56 | — | 4.20 |
| 23 | 115 | 548.53 | 0.44 | 0.663 | 1.85 | 94 | 85 | 78 | 2.0 | 58 | — | 4.20 |
| 24 | 120 | 552.319 | 0.43 | 0.656 | 1.81 | 94 | 85 | 78 | 2.0 | 58 | — | 4.20 |
| TOTAL | | 78.076 | | 13.841 | 33.60 | 4064 | | 1851 | | | | |
| | | AVERAGE | | 0.577 | 1.40 | 85 °F | | 77 °F | | | | |
| | | | | | | 545 °R | | 537 °R | | | | |

Start 1425 Start 1528
Stop 1525 Stop 1828

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 3 June

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 3

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 540 $A_s$ = 7.876 $V_m$ = 77.904 $P_{bar}$ = 28.13 $\sqrt{\Delta P}_{avg}$ = 0.545

$\theta$ = 120 $T_m$ = 549 $A_n$ = $3.5824 \times 10^{-4}$ $Y_m$ = 1.009 $P_{stat}$ = 0.20 $\Delta H$ = 1.361

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 47.7 $M_d$ = ____ $\%CO_2$ = 0.0 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.23 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.14 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65\, V_m\, \gamma_m\, P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 73.87 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.030$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 3 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 3

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1 - \quad)[0.44(\quad) + 0.32(\quad) + 0.28(\quad)] + 18(\quad) = \underline{28.52}\ \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\, C_p \sqrt{\Delta P}_{avg} \sqrt{\frac{T_s}{P_s M_s}} = 85.48(\quad)(\quad)\sqrt{\frac{(\quad)}{(\quad)(\quad)}} = \underline{31.51}\ \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\, V_{s_{avg}} A_s\, P_s}{T_s} = \frac{63{,}529\,(1 - \quad)(\quad)(\quad)(\quad)}{(\quad)} = \underline{825{,}699}\ \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\, T_s\, V_{m_{std}}}{\Theta V_s P_s A_n (1 - B_{wo})} = \frac{0.0945(\quad)(\quad)}{(\quad)(\quad)(\quad)(\quad)(1 - \quad)} = \underline{104.2}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | RUN NO. 3 | DATE 3 June 2003 |
|---|---|---|
| Project Number: 43-EL-5116-03 | Installation: Anniston Army Depot, Alabama | Meter Box Operator: Simonovitch |

Sample Location: Chrome Plating Finishing Complex, BLDG 114

Type of Sample: (Total Chrome) (Moisture)

| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
|---|---|---|---|---|---|
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 1 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | 0.84 |
| $T_m$ 540 | $T_s$ 537 | ↓ | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.20 | ↓ | 0.250 | $C_{p,eff}$ 0.84 | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 10496 | | Dry Gas Meter $\gamma_m$ | 1.009 | $D_s$ 38" | $A_s$ 7.876 |

| Filter | | Probe | | |
|---|---|---|---|---|
| Type | Number | Length | Liner | Heat Set |
| — | — | 3' Ext | Quartz | — |

| Initial Leak Check | | Initial Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| ~~0.003~~ TDY 15" | 0.003 TDY ft³ per 1 Min. | at 6.5 / 7.2 in. $H_2O$ |

| Final Leak Check | | Final Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 5" | 0.001 ft³ per 1 Min. | at 7.3 / 7.1 in. $H_2O$ |

| Gas Bag System Leak Check | | Component Leak-Check | |
|---|---|---|---|
| Initial | Final | Vacuum (in Hg.) | Leak Rate |
| $P_{bar}$ 29.13 | $P_{stat}$ -0.20 | | ft³ per Min. |
| Start Time 1700 | End Time 1910 | | ft³ per Min. |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | Θ (min) | $V_m$ ($ft^3$) $V_i$= 552.581 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_i$ | $t_f$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | Filter Temp. (°F) | Remark $K_p$= 4.20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N 01 | | | | | | | | | | | | |
| 1 | 5 | 556.14 | 0.42 | 0.648 | 1.76 | 80 | 81 | 78 | 2.0 | 63 | ~~63~~ 65 | 4.20 |
| 2 | 10 | 559.87 | 0.41 | 0.640 | 1.72 | 85 | 81 | 79 | 2.0 | 53 | – | 4.20 |
| 3 | 15 | 563.40 | 0.42 | 0.648 | 1.76 | 91 | 82 | 79 | 2.0 | 52 | – | 4.20 |
| 4 | 20 | 566.97 | 0.37 | 0.608 | 1.55 | 94 | 83 | 80 | 2.0 | 52 | – | 4.20 |
| 5 | 25 | 570.48 | 0.38 | 0.616 | 1.60 | 94 | 83 | 80 | 2.0 | 52 | – | 4.20 |
| 6 | 30 | 573.47 | 0.28 | 0.529 | 1.18 | 94 | 83 | 80 | 1.5 | 52 | – | 4.20 |
| 7 | 35 | 576.50 | 0.28 | 0.529 | 1.18 | 95 | 84 | 80 | 1.5 | 52 | – | 4.20 |
| 8 | 40 | 579.47 | 0.27 | 0.520 | 1.13 | 95 | 84 | 80 | 1.5 | 52 | – | 4.20 |
| 9 | 45 | 582.51 | 0.28 | 0.529 | 1.18 | 97 | 85 | 80 | 1.5 | 54 | – | 4.20 |
| 10 | 50 | 585.71 | 0.30 | 0.548 | 1.26 | 95 | 85 | 79 | 1.5 | 51 | – | 4.20 |
| 11 | 55 | 589.10 | 0.35 | 0.592 | 1.47 | 95 | 85 | 79 | 1.5 | 53 | – | 4.20 |
| 12 | 60 | 592.580 | 0.35 | 0.592 | 1.47 | 96 | 85 | 79 | 1.5 | 52 | – | 4.20 |
| | | | | | | | | | | | | |
| W 02 | | | | | | | | | | | | |
| 13 | 65 | 595.67 | 0.31 | 0.548 | 1.30 | 90 | 85 | 79 | 1.5 | 56 | – | 4.20 |
| 14 | 70 | 598.93 | 0.32 | 0.566 | 1.34 | 94 | 86 | 80 | 1.5 | 57 | – | 4.20 |
| 15 | 75 | 602.14 | 0.32 | 0.566 | 1.34 | 94 | 85 | 80 | 1.5 | 52 | – | 4.20 |
| 16 | 80 | 605.44 | 0.31 | 0.548 | 1.30 | 95 | 86 | 80 | 1.5 | 53 | – | 4.20 |
| 17 | 85 | 608.68 | 0.32 | 0.566 | 1.34 | 96 | 86 | 80 | 1.5 | 54 | – | 4.20 |
| 18 | 90 | 611.52 | 0.26 | 0.509 | 1.10 | 96 | 86 | 80 | 1.5 | 54 | – | 4.20 |
| 19 | 95 | 614.51 | 0.27 | 0.520 | 1.13 | 95 | 85 | 80 | 1.5 | 54 | – | 4.20 |
| 20 | 100 | 617.64 | 0.29 | 0.539 | 1.22 | 95 | 86 | 80 | 1.5 | 55 | – | 4.20 |
| 21 | 105 | 620.89 | 0.32 | 0.566 | 1.34 | 96 | 86 | 80 | 1.5 | 53 | – | 4.20 |
| 22 | 110 | 624.11 | 0.33 | 0.574 | 1.39 | 96 | 86 | 80 | 1.5 | 54 | – | 4.20 |
| 23 | 115 | 627.29 | 0.31 | 0.548 | 1.30 | 96 | 86 | 80 | 1.5 | 53 | – | 4.20 |
| 24 | 120 | 630.485 | 0.31 | 0.548 | 1.30 | 95 | 86 | 80 | 1.5 | 54 | – | 4.20 |
| TOTAL | | 77.904 | | 13.068 | 32.66 | 4279 | | 1912 | | | | |
| AVERAGE | | | | 0.545 | 1.361 | 89 °F | | 80 °F | | | | |
| | | | | | | 549 °R | | 540 °R | | | | |

START 1700 STOP 1800

START 1810 STOP 1910

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 4 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 4

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 537 $A_s$ = 7.876 $V_m$ = 84.318 $P_{bar}$ = 29.19 $\sqrt{\Delta P_{avg}}$ = 0.621

$\theta$ = 120 $T_m$ = 556 $A_n$ = 3.382 $\gamma_m$ = 1.009 $P_{stat}$ = +0.20 $\Delta H$ = 1.62

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 32.6 $M_n$ = ____ $\%CO_2$ = 0.0 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.31 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.20 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65 V_m \gamma_m P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 79.16 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{ws} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.019$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 4 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 4

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1 - \quad)[0.44(\quad) + 0.32(\quad) + 0.28(\quad)] + 18(\quad) = \underline{28.63}\ \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\, C_p \sqrt{\Delta P}_{avg} \sqrt{\frac{T_s}{P_s M_s}} = 85.48(\quad)(\quad)\sqrt{\frac{(\quad)}{(\quad)(\quad)}} = \underline{36.69}\ \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\,V_{s_{avg}}\,A_s\,P_s}{T_s} = \frac{63{,}529\,(1 - \quad)(\quad)(\quad)(\quad)}{(\quad)} = \underline{952{,}742}\ \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\,T_s\,V_{m_{std}}}{\Theta\,V_s\,P_s\,A_n\,(1 - B_{wo})} = \frac{0.0945(\quad)(\quad)}{(\quad)(\quad)(\quad)(\quad)(1 - \quad)} = \underline{96.8}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | | RUN NO. 4 | | DATE 4 June 2003 | |
|---|---|---|---|---|---|
| Project Number: 43-EL-5116-03 | | Installation: Anniston Army Depot, Alabama | | Meter Box Operator: Simanovitch | |
| Sample Location: Chrome Plating Finishing Complex, BLDG 114 | | | | | |
| Type of Sample: Total Chrome | | Moisture | | | |
| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ 0.84 |
| $\%H_2O$ 2 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | |
| $T_m$ 545 | $T_s$ 537 | ↓ | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.16 | ↓ | 0.250 | $C_{p,eff}$ 0.84 | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 9048 (96) | | Dry Gas Meter $\gamma_m$ 1.009 | | $D_s$ 38" | $A_s$ 7.871 |
| Filter | | | Probe | | |
| Type | Number | | Length | Liner | Heat Set |
| NA | NA | | 3'Est | Quartz | — |
| Initial Leak Check | | | Initial Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 6.0 in. $H_2O$ per 15 Sec. | | |
| 15 | 0.001 $ft^3$ per 1 Min. | | at 6.5 / 7.3 in. $H_2O$ | | |
| Final Leak Check | | | Final Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 0.0 in. $H_2O$ per 15 Sec. | | |
| 2.5 | 0.001 $ft^3$ per 1 Min. | | at 6.2 / 6.8 in. $H_2O$ | | |
| Gas Bag System Leak Check | | | Component Leak Check | | |
| Initial | Final | | Vacuum (in Hg.) | Leak Rate | |
| $P_{bar}$ 29.19 | $P_{stat}$ +0.20 | | | $ft^3$ per Min. | |
| Start Time 0820 | End Time 1030 | | | $ft^3$ per Min. | |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | θ (min) | $V_m$ ($ft^3$) $V_i$= 630.644 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_1$ | $t_f$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | Filter Temp. (°F) | Remark $K_p$= 4.16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 634.08 | 0.38 | 0.616 | 1.58 | 81 | 80 | 78 | 1.5 | 55 | - | 4.16 |
| 2 | 10 | 637.42 | 0.37 | 0.608 | 1.54 | 81 | 80 | 78 | 1.5 | 54 | - | 4.16 |
| 3 | 15 | 640.77 | 0.37 | 0.608 | 1.54 | 85 | 81 | 77 | 1.5 | 52 | - | 4.16 |
| 4 | 20 | 644.12 | 0.39 | 0.624 | 1.62 | 89 | 82 | 77 | 1.5 | 54 | - | 4.16 |
| 5 | 25 | 647.24 | 0.30 | 0.548 | 1.25 | 94 | 86 | 77 | 1.5 | 59 | - | 4.16 |
| 6 | 30 | 650.32 | 0.29 | 0.539 | 1.20 | 96 | 87 | 77 | 1.5 | 58 | - | 4.16 |
| 7 | 35 | 653.41 | 0.30 | 0.547 | 1.25 | 99 | 89 | 77 | 1.5 | 59 | - | 4.16 |
| 8 | 40 | 656.75 | 0.33 | 0.574 | 1.37 | 100 | 90 | 77 | 1.5 | 56 | - | 4.16 |
| 9 | 45 | 660.02 | 0.34 | 0.583 | 1.41 | 100 | 92 | 77 | 1.5 | 55 | - | 4.16 |
| 10 | 50 | 663.53 | 0.39 | 0.624 | 1.62 | 101 | 93 | 77 | 1.5 | 53 | - | 4.16 |
| 11 | 55 | 667.02 | 0.38 | 0.616 | 1.58 | 103 | 94 | 77 | 1.5 | 53 | - | 4.16 |
| 12 | 60 | 670.512 | 0.37 | 0.608 | 1.54 | 103 | 95 | 77 | 1.5 | 55 | - | 4.16 |
| | | | | | | | | | | | | |
| 13 | 65 | 674.15 | 0.42 | 0.648 | 1.75 | 100 | 97 | 77 | 2.0 | 55 | - | 4.16 |
| 14 | 70 | 677.99 | 0.44 | 0.663 | 1.83 | 101 | 98 | 77 | 2.0 | 54 | - | 4.16 |
| 15 | 75 | 681.65 | 0.41 | 0.640 | 1.71 | 103 | 99 | 77 | 2.0 | 55 | - | 4.16 |
| 16 | 80 | 685.40 | 0.42 | 0.648 | 1.75 | 103 | 99 | 77 | 2.0 | 53 | - | 4.16 |
| 17 | 85 | 689.08 | 0.41 | 0.640 | 1.71 | 104 | 100 | 77 | 2.0 | 54 | - | 4.16 |
| 18 | 90 | 692.57 | 0.39 | 0.624 | 1.62 | 104 | 100 | 76 | 2.0 | 56 | - | 4.16 |
| 19 | 95 | 695.71 | 0.29 | 0.539 | 1.20 | 103 | 100 | 77 | 1.5 | 54 | - | 4.16 |
| 20 | 100 | 699.10 | 0.37 | 0.608 | 1.54 | 103 | 100 | 76 | 1.5 | 55 | - | 4.16 |
| 21 | 105 | 702.81 | 0.44 | 0.663 | 1.83 | 101 | 100 | 76 | 2.0 | 58 | - | 4.16 |
| 22 | 110 | 706.91 | 0.53 | 0.728 | 2.21 | 103 | 101 | 77 | 2.5 | 57 | - | 4.16 |
| 23 | 115 | 710.92 | 0.50 | 0.707 | 2.08 | 105 | 101 | 77 | 2.5 | 56 | - | 4.16 |
| 24 | 120 | 714.962 | 0.50 | 0.707 | 2.08 | 105 | 101 | 77 | 2.5 | 54 | - | 4.16 |
| TOTAL | | 84.318 | 9.72 | 14.91 | 38.81 | 4612 | | 1847 | | | | |
| | | AVERAGE | 0.405 | 0.621 | 1.62 | 96 °F | | 77 °F | | | | |
| | | | | | | 556 °R | | 537 °R | | | | |

Start 0825 Start 0930
Stop 0925 Stop 1030

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 6/4/03

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 5

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 540 $A_s$ = 7.876 $V_m$ = 82.512 $P_{bar}$ = 29.19 $\sqrt{\Delta P}_{avg}$ = 0.600

$\theta$ = 120 $T_m$ = 560 $A_n$ = $3.2821 \times 10^{-3}$ $\gamma_m$ = 1.009 $P_{stat}$ = 0.20 $\Delta H$ = 1.54

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 34.3 $M_n$ = ____ $\%CO_2$ = 0.0 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.30 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.20 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65\, V_m\, \gamma_m\, P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 76.80 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.021$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 6/4/03

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 5

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1 - \quad)[0.44(\quad) + 0.32(\quad) + 0.28(\quad)] + 18(\quad) = \underline{28.61}\ \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\, C_p \sqrt{\Delta P}_{avg} \sqrt{\frac{T_s}{P_s M_s}} = 85.48(\quad)(\quad)\sqrt{\frac{(\quad)}{(\quad)(\quad)}} = \underline{34.59}\ \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\, V_{s_{avg}}\, A_s\, P_s}{T_s} = \frac{63{,}529\,(1 - \quad)(\quad)(\quad)(\quad)}{(\quad)} = \underline{916{,}783}\ \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\, T_s\, V_{m_{std}}}{\Theta\, V_s\, P_s\, A_n\, (1 - B_{wo})} = \frac{0.0945(\quad)(\quad)}{(\quad)(\quad)(\quad)(\quad)(1 - \quad)} = \underline{97.7}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | RUN NO. 5 | DATE 4 June 2003 |
|---|---|---|
| Project Number: 43-EL-5116-03 | Installation: Anniston Army Depot, Alabama | Meter Box Operator: Simonovitch |

Sample Location: Chrome Plating Finishing Complex, BLDG 114

Type of Sample: (Total Chrome) (Moisture)

| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
|---|---|---|---|---|---|
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 2 | $P_s/P_m$ 1.0 | N-1 | 0.249 | ~~0.85-3~~ | 0.84 |
| $T_m$ 546 | $T_s$ 537 | ↓ | 0.247 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.19 ~~4.24~~ | ↓ | 0.250 | $C_{p,eff}$ | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 904 ~~96~~ | | Dry Gas Meter $\gamma_m$ | 1.009 | $D_s$ 38" | $A_s$ 7.876 |

| Filter | | Probe | | |
|---|---|---|---|---|
| Type | Number | Length | Liner | Heat Set |
| NA | NA | 3' Est | Quartz | |

| Initial Leak Check | | Initial Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 15" | 0.003 $ft^3$ per / Min. | at 7.5 / 6.8 in. $H_2O$ |

| Final Leak Check | | Final Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 20" | 0.001 $ft^3$ per / Min. | at 7.1 / 7.2 in. $H_2O$ |

| Gas Bag System Leak Check | | Component Leak Check | |
|---|---|---|---|
| Initial | Final | Vacuum (in Hg.) | Leak Rate |
| $P_{bar}$ 29.19 | $P_{stat}$ + 0.20 | | $ft^3$ per Min. |
| Start Time 1100 | End Time 1305 | | $ft^3$ per Min. |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | Θ (min) | $V_m$ ($ft^3$) $V_i$= 715.286 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_i$ | $t_f$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | Filter Temp. (°F) | Remark $K_p$= 1.004 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | | | | | | | | | | | | | |
| 1 | 5 | 719.30 | 0.44 | 0.663 | 1.87 | 96 | 101 | 78 | 2.5 | 65 | - | 4.19 | 4.25 |
| 0 | 10 | 722.89 | 0.45 | 0.671 | 1.91 | 96 | 101 | 78 | 2.5 | 62 | - | 4.19 | 4.25 |
| 3 | 15 | 726.87 | 0.45 | 0.671 | 1.91 | 102 | 101 | 78 | 2.5 | 49 | - | 4.19 | 4.25 |
| 4 | 20 | 730.66 | 0.44 | 0.663 | 1.87 | 101 | 99 | 78 | 2.5 | 46 | - | 4.19 | 4.25 |
| 5 | 25 | 733.97 | 0.32 | 0.566 | 1.36 | 100 | 99 | 78 | 1.5 | 45 | - | 4.19 | 4.25 |
| 6 | 30 | 736.99 | 0.32 | 0.566 | 1.36 | 101 | 100 | 78 | 1.5 | 46 | - | 4.19 | 4.25 |
| 7 | 35 | 740.46 | 0.27 | 0.520 | 1.14 | 102 | 99 | 79 | 1.5 | 47 | - | 4.19 | 4.25 |
| 8 | 40 | 743.28 | 0.26 | 0.509 | 1.11 | 102 | 99 | 80 | 1.5 | 45 | - | 4.19 | 4.25 |
| 9 | 45 | 746.36 | 0.28 | 0.529 | 1.19 | 102 | 99 | 81 | 1.5 | 43 | - | 4.19 | 4.25 |
| 10 | 50 | 749.46 | 0.30 | 0.548 | 1.28 | 103 | 99 | 81 | 1.5 | 46 | - | 4.19 | 4.25 |
| 11 | 55 | 752.75 | 0.34 | 0.583 | 1.45 | 105 | 100 | 82 | 2.0 | 50 | - | 4.19 | 4.25 |
| 12 | 60 | 756.053 | 0.34 | 0.583 | 1.45 | 105 | 99 | 82 | 2.0 | 51 | - | 4.19 | 4.25 |
| | | | | | | | | | | | | | |
| V | 13 | 65 | 759.59 | 0.37 | 0.608 | 1.57 | 99 | 99 | 81 | 2.0 | 55 | - | 4.19 | 4.25 |
| 0 | 14 | 70 | 763.13 | 0.39 | 0.625 | 1.66 | 99 | 98 | 81 | 2.0 | 47 | - | 4.19 | .5 |
| | 15 | 75 | 766.81 | 0.40 | 0.632 | 1.70 | 100 | 98 | 81 | 2.0 | 46 | - | 4.19 | 4.25 |
| | 16 | 80 | 770.36 | 0.39 | 0.625 | 1.66 | 102 | 98 | 81 | 2.0 | 50 | - | 4.19 | 4.25 |
| | 17 | 85 | 773.49 | 0.30 | 0.548 | 1.28 | 102 | 98 | 82 | 1.5 | 47 | - | 4.19 | 4.25 |
| | 18 | 90 | 776.51 | 0.28 | 0.529 | 1.19 | 102 | 97 | 82 | 1.5 | 49 | - | 4.19 | 4.25 |
| | 19 | 95 | 779.65 | 0.30 | 0.548 | 1.28 | 104 | 97 | 82 | 1.5 | 48 | - | 4.19 | 4.25 |
| | 20 | 100 | 783.05 | 0.38 | 0.616 | 1.62 | 106 | 98 | 82 | 2.0 | 49 | - | 4.19 | 4.25 |
| | 21 | 105 | 786.44 | 0.36 | 0.606 | 1.53 | 103 | 97 | 81 | 2.0 | 48 | - | 4.19 | 4.25 |
| | 22 | 110 | 790.22 | 0.45 | 0.671 | 1.91 | 104 | 97 | 81 | 2.0 | 49 | - | 4.19 | 4.25 |
| | 23 | 115 | 794.01 | 0.44 | 0.663 | 1.87 | 105 | 98 | 81 | 2.0 | 50 | - | 4.19 | 4.25 |
| | 24 | 120 | 797.798 | 0.44 | 0.663 | 1.87 | 106 | 98 | 81 | 2.0 | 49 | - | 4.19 | 4.25 |
| TOTAL | | | 82.512 | 8.71 | 14.400 | 37.04 | 4816 | | 1929 | | | | |
| | | AVERAGE | | 0.36 | 0.600 | 1.54 | 100 °F | | 80 °F | | | | |
| | | | | | | | 560 °R | | 540 °R | | | | |

START 1105 1205

STOP 1200 1305

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 4 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 6

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 544 $A_s$ = 7.876 $V_m$ = 80.795 $P_{bar}$ = 29.18 $\sqrt{\Delta P}_{avg}$ = 0.586

$\theta$ = 120 $T_m$ = 560 $A_n = 3.382 \times 10^{-4}$ $\gamma_s$ = 1.009 $P_{stat}$ = 0.20 $\Delta H$ = 1.47

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 34.5 $M_n$ = ____ $\%CO_2$ = 0.0 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.36 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.20 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65\, V_m\, \gamma_m\, P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 75.28 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{ws} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.021$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 4 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 6

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1 - \quad)[0.44(\quad) + 0.32(\quad) + 0.28(\quad)] + 18(\quad) = \underline{28.61}\ \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\, C_p \sqrt{\Delta P}_{avg} \sqrt{\frac{T_s}{P_s M_s}} = 85.48(\quad)(\quad)\sqrt{\frac{(\quad)}{(\quad)(\quad)}} = \underline{33.91}\ \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\, V_{s_{avg}} A_s\, P_s}{T_s} = \frac{63{,}529\,(1 - \quad)(\quad)(\quad)(\quad)}{(\quad)} = \underline{891{,}684}\ \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\, T_s\, V_{m_{std}}}{\Theta\, V_s\, P_s\, A_n\, (1 - B_{wo})} \frac{0.0945(\quad)(\quad)}{(\quad)(\quad)(\quad)(\quad)(1 - \quad)} = \underline{98.4}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | | RUN NO. 6 | | DATE 4 June 2003 | |
|---|---|---|---|---|---|
| Project Number: 43-EL-5116-03 | | Installation: Anniston Army Depot, Alabama | | Meter Box Operator: Simmons/Bes | |
| Sample Location: Chrome Plating Finishing Complex, BLDG 114 | | | | | |
| Type of Sample: Total Chrome | | Moisture | | | |
| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 2 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | 0.84 |
| $T_m$ 545 | $T_s$ 537 | ↓ | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ TM' 426 ~~428~~ | ↓ | 0.251 | $C_{p,eff}$ | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 90496 | | Dry Gas Meter $\gamma_m$ 1.089 | | $D_s$ 3/8" | $A_s$ 7.876 |
| Filter | | | Probe | | |
| Type | Number | | Length | Liner | Heat Set |
| NA | NA | | 3' ~~Est~~ | Quartz | — |
| Initial Leak Check | | | Initial Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 0.0 in. $H_2O$ per 15 Sec. | | |
| 15" | 0.004 $ft^3$ per / Min. | | at 7.1 / 6.8 in. $H_2O$ | | |
| Final Leak Check | | | Final Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 0.0 in. $H_2O$ per 15 Sec. | | |
| 5" | 0.002 $ft^3$ per / Min. | | at 7.3 / 7.4 in. $H_2O$ | | |
| Gas Bag System Leak Check | | | Component Leak Check | | |
| Initial | Final | | Vacuum (in Hg.) | Leak Rate | |
| $P_{bar}$ 29.19 | $P_{stat}$ 0.20 | | | $ft^3$ per Min. | |
| Start Time 1330 | End Time 1533 | | | $ft^3$ per Min. | |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | Θ (min) | $V_m$ (ft³) $V_1$= 797.956 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_1$ | $t_2$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | Filter Temp. (°F) | Remark ~~4.49~~ $K_p$= 1pH ~~4.21~~ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W 01F ~~5~~ 1 | 5 | 801.73 | 0.36 | 0.600 | 1.53 | 94 | 95 | 84 | 1.5 | 62 | – | 4.25 |
| ~~10~~ 2 | 10 | 804.91 | 0.37 | 0.608 | 1.57 | 97 | 95 | 84 | 1.5 | 51 | – | 4.25 |
| ~~15~~ 3 | 15 | 808.40 | 0.37 | 0.608 | 1.57 | 99 | 94 | 84 | 1.5 | 49 | – | 4.25 |
| ~~20~~ 4 | 20 | 811.73 | 0.31 | 0.557 | 1.32 | 100 | 94 | 84 | 1.5 | 48 | – | 4.25 |
| 25 5 | 25 | 814.90 | 0.32 | 0.566 | 1.36 | 100 | 94 | 84 | 1.5 | 48 | – | 4.25 |
| 6 | 30 | 818.03 | 0.29 | 0.534 | 1.23 | 101 | 94 | 84 | 1.5 | 50 | – | 4.25 |
| 7 | 35 | 821.10 | 0.28 | 0.529 | 1.19 | 101 | 95 | 84 | 1.5 | 49 | – | 4.25 |
| 8 | 40 | 823.99 | 0.25 | 0.500 | 1.06 | 102 | 95 | 83 | 1.0 | 50 | – | 4.25 |
| 9 | 45 | 827.35 | 0.27 | 0.520 | 1.15 | 102 | 95 | 83 | 1.0 | 48 | – | 4.25 |
| 10 | 50 | 830.52 | 0.34 | 0.583 | 1.44 | 103 | 95 | 83 | 1.5 | 49 | – | 4.25 |
| 11 | 55 | 833.69 | 0.36 | 0.600 | 1.53 | 103 | 95 | 83 | 1.5 | 49 | – | 4.25 |
| 12 | 60 | 837.001 | 0.34 | 0.583 | 1.44 | 103 | 95 | 83 | 1.5 | 48 | – | 4.25 |
| | | | | | | | | | | | | |
| N 07F 13 | 65 | 840.57 | 0.39 | 0.624 | 1.66 | 98 | 95 | 83 | 1.5 | 54 | – | 4.25 |
| 14 | 70 | 844.12 | 0.39 | 0.624 | 1.66 | 99 | 95 | 84 | 1.5 | 50 | – | 4.25 |
| 15 | 75 | 847.77 | 0.40 | 0.632 | 1.70 | 103 | 95 | 83 | 2.0 | 50 | – | 4.25 |
| 16 | 80 | 851.13 | 0.31 | 0.557 | 1.32 | 103 | 95 | 83 | 1.5 | 50 | – | 4.25 |
| 17 | 85 | 854.18 | 0.32 | 0.566 | 1.36 | 103 | 96 | 83 | 1.5 | 51 | – | 4.25 |
| 18 | 90 | 857.38 | 0.32 | 0.586 | 1.36 | 103 | 95 | 83 | 1.5 | 49 | – | 4.25 |
| 19 | 95 | 860.51 | 0.29 | 0.534 | 1.23 | 103 | 96 | 83 | 1.5 | 49 | – | 4.25 |
| 20 | 100 | 863.68 | 0.27 | 0.520 | 1.15 | 102 | 96 | 83 | 1.0 | 48 | – | 4.25 |
| 21 | 105 | 867.20 | 0.37 | 0.608 | 1.57 | 103 | 96 | 83 | 1.5 | 49 | – | 4.25 |
| 22 | 110 | 870.000 | 0.45 | 0.671 | 1.91 | 103 | 96 | 84 | 2.0 | 50 | – | 4.25 |
| 23 | 115 | 874.98 | 0.48 | 0.693 | 2.04 | 104 | 96 | 84 | 2.0 | 50 | – | 4.25 |
| 24 | 120 | 878.751 | 0.46 | 0.678 | 1.96 | 104 | 96 | 84 | 2.0 | 50 | – | 4.25 |
| TOTAL | | 80.795 | 8.71 | 14.061 | 36.31 | 4812 | | ~~4930~~ 4806 | | | | |
| | | AVERAGE | 0.35 | 0.586 | 1.47 | 100 °F | | 84 °F | | | | |
| | | | | | | 560 °R | | 544 °R | | | | |

START 1330 START 1433

STOP 1830 STOP 1537

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 5 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 7

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 539 $A_s$ = 7.876 $V_s$ = 85.137 $P_{bar}$ = 29.37 $\sqrt{\Delta P_{avg}}$ = 0.620

$\theta$ = 120 $T_m$ = 561 $A_n$ = $3.362 \times 10^{-4}$ $\gamma_m$ = 1.009 $P_{stat}$ = 0.26 $\Delta H$ = 1.64

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 31.2 $M_s$ = ____ $\%CO_2$ = 0.0 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = \underline{29.46}\ in.\ Hg$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = \underline{29.35}\ in.\ Hg$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65\, V_m\, \gamma_m\, P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = \underline{81.07}\ dscf$$

MOISTURE CONTENT:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = \underline{0.018}$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 5 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 7

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1 - \quad)[0.44(\quad) + 0.32(\quad) + 0.28(\quad)] + 18(\quad) = \underline{28.64}\ \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\, C_p \sqrt{\Delta P}_{avg} \sqrt{\frac{T_s}{P_s M_s}} = 85.48(\quad)(\quad)\sqrt{\frac{(\quad)}{(\quad)(\quad)}} = \underline{35.60}\ \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\, V_{s_{avg}} A_s\, P_s}{T_s} = \frac{63{,}529\,(1 - \quad)(\quad)(\quad)(\quad)}{(\quad)} = \underline{952{,}843}\ \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\, T_s\, V_{m_{std}}}{\Theta V_s P_s A_n (1 - B_{wo})} = \frac{0.0945(\quad)(\quad)}{(\quad)(\quad)(\quad)(\quad)(1 - \quad)} = \underline{99.1}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | RUN NO. 7 | DATE 5 June 2003 |
|---|---|---|
| Project Number: 43-EL-5116-03 | Installation: Anniston Army Depot, Alabama | Meter Box Operator: Simonovitch |

Sample Location: Chrome Plating Finishing Complex, BLDG 114

Type of Sample: Total Chrome Moisture

| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
|---|---|---|---|---|---|
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 2 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | 0.84 |
| $T_m$ 560 | $T_s$ 540 | ↓ | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.25 | ↓ | 0.250 | $C_{p,eff}$ 0.84 | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-1}$ | |
| Meter Box No. 90496 | | Dry Gas Meter $\gamma_m$ 1.009 | | $D_s$ 38" | $A_s$ 7.876 |

| Filter | | Probe | | |
|---|---|---|---|---|
| Type | Number | Length | Liner | Heat Set |
| N/A | N/A | 3' Est | Quartz | |

| Initial Leak Check | | Initial Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 6.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 15" | 0.004 $ft^3$ per 1 Min. | at 6.7 / 6.9 in. $H_2O$ |

| Final Leak Check | | Final Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 6.0 / 6.0 in. $H_2O$ per 15 Sec. |
| 2" | 0.001 $ft^3$ per 1 Min. | at 7.1 / 6.5 in. $H_2O$ |

| Gas Bag System Leak Check | | Component Leak Check | |
|---|---|---|---|
| Initial | Final | Vacuum (in Hg.) | Leak Rate |
| $P_{bar}$ 29.34 | $P_{stat}$ 0.20 | | $ft^3$ per Min. |
| Start Time 0927 | End Time 1131 | | $ft^3$ per Min. |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | Θ (min) | $V_m$ ($ft^3$) $V_i$= 884,552 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_i$ | $t_f$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | Filter Temp. (°F) | Remark $K_p$= 4.25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 888.31 | 0.41 | 0.640 | 1.74 | 83 | 86 | 77 | 2.0 | 58 | – | 4.25 |
| 2 | 10 | 891.86 | 0.40 | 0.632 | 1.70 | 83 | 86 | 77 | 2.0 | 49 | – | 4.25 |
| 3 | 15 | 895.42 | 0.41 | 0.640 | 1.74 | 88 | 86 | 78 | 2.0 | 52 | – | 4.25 |
| 4 | 20 | 898.95 | 0.40 | 0.632 | 1.70 | 88 | 86 | 78 | 2.0 | 51 | – | 4.25 |
| 5 | 25 | 902.65 | 0.38 | 0.616 | 1.62 | 90 | 86 | 77 | 2.0 | 53 | – | 4.25 |
| 6 | 30 | 906.07 | 0.39 | 0.624 | 1.66 | 91 | 87 | 78 | 2.0 | 55 | – | 4.25 |
| 7 | 35 | 909.75 | 0.38 | 0.616 | 1.62 | 93 | 88 | 78 | 2.0 | 56 | – | 4.25 |
| 8 | 40 | 913.10 | 0.34 | 0.583 | 1.45 | 92 | 87 | 78 | 2.0 | 56 | – | 4.25 |
| 9 | 45 | 916.32 | 0.32 | 0.566 | 1.36 | 92 | 87 | 78 | 1.5 | 55 | – | 4.25 |
| 10 | 50 | 919.99 | 0.39 | 0.624 | 1.66 | 92 | 88 | 78 | 2.0 | 56 | – | 4.25 |
| 11 | 55 | 923.41 | 0.38 | 0.616 | 1.62 | 95 | 89 | 79 | 2.0 | 57 | – | 4.25 |
| 12 | 60 | 926.991 | 0.37 | 0.608 | 1.57 | 96 | 89 | 79 | 1.5 | 56 | – | 4.25 |
| | | | | | | | | | | | | |
| 13 | 65 | 930.54 | 0.37 | 0.608 | 1.57 | 93 | 91 | 78 | 1.5 | 56 | – | 4.25 |
| 14 | 70 | 933.99 | 0.37 | 0.608 | 1.57 | 93 | 90 | 78 | 1.5 | 54 | – | 4.25 |
| 15 | 75 | 937.44 | 0.36 | 0.600 | 1.53 | 93 | 90 | 78 | 1.5 | 54 | – | 4.25 |
| 16 | 80 | 940.95 | 0.38 | 0.616 | 1.62 | 93 | 90 | 78 | 2.0 | 56 | – | 4.25 |
| 17 | 85 | 944.30 | 0.35 | 0.592 | 1.49 | 94 | 90 | 79 | 1.5 | 56 | – | 4.25 |
| 18 | 90 | 947.58 | 0.34 | 0.583 | 1.45 | 95 | 90 | 79 | 1.5 | 58 | – | 4.25 |
| 19 | 95 | 950.91 | 0.31 | 0.557 | 1.32 | 94 | 90 | 79 | 1.5 | 56 | – | 4.25 |
| 20 | 100 | 954.43 | 0.38 | 0.616 | 1.62 | 97 | 91 | 81 | 2.0 | 56 | – | 4.25 |
| 21 | 105 | 958.20 | 0.47 | 0.686 | 2.00 | 97 | 91 | 79 | 2.0 | 57 | – | 4.25 |
| 22 | 110 | 962.00 | 0.45 | 0.671 | 1.91 | 97 | 91 | 79 | 2.0 | 57 | – | 4.25 |
| 23 | 115 | 965.79 | 0.46 | 0.678 | 1.86 | 99 | 92 | 80 | 2.0 | 57 | – | 4.25 |
| 24 | 120 | 969.689 | 0.46 | 0.678 | 1.86 | 100 | 92 | 80 | 2.0 | 57 | – | 4.25 |
| TOTAL | | 85.137 | 9.27 | 14.89 | 39.49 | 4361 | | 1885 | | | | |
| | | AVERAGE | 0.39 | 0.620 | 1.64 | 91 °F | | 79 °F | | | | |
| | | | | | | 551 °R | | 539 °R | | | | |

START 0927 START 1031
STOP 1027 STOP 1131

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 5 June 2003

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 8

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 544 $A_n$ = 7.876 $V_m$ = 60.903 $P_{bar}$ = 29.54 $\sqrt{\Delta P}_{avg}$ = 0.597

$\theta$ = 120 $T_m$ = 557 $A_n$ = 0.3824 $\gamma_m$ = 1.009 $P_{stat}$ = 0.20 $\Delta H$ = 1.52

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 30.9 $M_s$ = ____ $\%CO_2$ = 0.6 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.45 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.35 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65 V_m \gamma_m P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 76.18 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.019$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | RUN NO. 8 | DATE 5 June 2003 |
|---|---|---|
| Project Number: 43-EL-5116-03 | Installation: Anniston Army Depot, Alabama | Meter Box Operator: Simmons, Ted |

Sample Location: Chrome Plating Finishing Complex, BLDG 114

Type of Sample: (Total Chrome) (Moisture)

| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
|---|---|---|---|---|---|
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 2 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | 0.84 |
| $T_m$ 560 | $T_s$ 540 | ↓ | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.25 | ↓ | 0.250 | $C_{p,eff}$ 0.84 | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 90496 | | Dry Gas Meter $\gamma_m$ | 1.009 | $D_s$ 38" | $A_s$ 7.876 |

| Filter | | Probe | | |
|---|---|---|---|---|
| Type | Number | Length | Liner | Heat Set |
| N/A | N/A | 3' Eff | Quartz | — |

| Initial Leak Check | | Initial Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 15" | 0.008 $ft^3$ per 1 Min. | at 6.1 / 7.3 in. $H_2O$ |

| Final Leak Check | | Final Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 2.0" | 0.006 $ft^3$ per 1 Min. | at 7.1 / 6.8 in. $H_2O$ |

| Gas Bag System Leak Check | | Component Leak Check | |
|---|---|---|---|
| Initial | Final | Vacuum (in Hg.) | Leak Rate |
| $P_{bar}$ 29.34 | $P_{stat}$ 0.20 | | $ft^3$ per Min. |
| Start Time 1155 | End Time 1406 | | $ft^3$ per Min. |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| Point No. | Θ (min) | $V_m$ ($ft^3$) $V_i$= 961.869 | ΔP ("$H_2O$) | $(\Delta P)^{1/2}$ | ΔH ("$H_2O$) | $T_m$ (°F) $t_i$ | $t_f$ | $T_s$ (°F) | Vacuum ("Hg) | Final Imp. Temp. (°F) | Filter Temp. (°F) | Remark $K_p$= 4.25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 973.72 | 0.36 | 0.600 | 1.53 | 93 | 93 | 80 | 2.0 | 62 | – | 4.25 |
| 2 | 10 | 977.69 | 0.37 | 0.608 | 1.57 | 94 | 93 | 81 | 2.0 | 60 | – | 4.25 |
| 3 | 15 | 980.35 | 0.38 | 0.616 | 1.62 | 97 | 93 | 81 | 2.0 | 53 | – | 4.25 |
| 4 | 20 | 983.75 | 0.38 | 0.616 | 1.62 | 99 | 93 | 82 | 2.0 | 52 | – | 4.25 |
| 5 | 25 | 987.29 | 0.37 | 0.608 | 1.57 | 101 | 94 | 83 | 2.0 | 51 | – | 4.25 |
| 6 | 30 | 990.87 | 0.29 | 0.539 | 1.23 | 101 | 94 | 83 | 2.0 | 52 | – | 4.25 |
| 7 | 35 | 993.35 | 0.30 | 0.548 | 1.28 | 100 | 94 | 84 | 2.0 | 52 | – | 4.25 |
| 8 | 40 | 996.39 | 0.26 | 0.510 | 1.11 | 100 | 93 | 84 | 2.0 | 50 | – | 4.25 |
| 9 | 45 | 999.28 | 0.25 | 0.500 | 1.06 | 100 | 94 | 84 | 1.5 | 49 | – | 4.25 |
| 10 | 50 | 1002.27 | 0.29 | 0.534 | 1.23 | 100 | 94 | 85 | 1.5 | 49 | – | 4.25 |
| 11 | 55 | 1005.07 | 0.29 | 0.534 | 1.23 | 100 | 94 | 85 | 1.5 | 50 | – | 4.25 |
| 12 | 60 | 1007.786 | 0.28 | 0.529 | 1.19 | 101 | 94 | 85 | 1.5 | 51 | – | 4.25 |
| | | | | | | | | | | | | |
| 13 | 65 | 1011.59 | 0.43 | 0.656 | 1.83 | 96 | 94 | 84 | 2.0 | 55 | – | 4.25 |
| 14 | 70 | 1015.27 | 0.42 | 0.648 | 1.79 | 97 | 94 | 84 | 2.0 | 53 | – | 4.25 |
| 15 | 75 | 1018.00 | 0.43 | 0.656 | 1.83 | 99 | 93 | 85 | 2.0 | 51 | – | 4.25 |
| 16 | 80 | 1022.74 | 0.43 | 0.656 | 1.83 | 102 | 93 | 85 | 2.0 | 51 | – | 4.25 |
| 17 | 85 | 1026.36 | 0.42 | 0.648 | 1.79 | 102 | 94 | 85 | 2.0 | 48 | – | 4.25 |
| 18 | 90 | 1029.87 | 0.38 | 0.616 | 1.62 | 103 | 94 | 85 | 2.0 | 49 | – | 4.25 |
| 19 | 95 | 1032.90 | 0.26 | 0.500 | 1.11 | 104 | 94 | 85 | 1.5 | 49 | – | 4.25 |
| 20 | 100 | 1035.07 | 0.29 | 0.539 | 1.23 | 101 | 94 | 86 | 1.5 | 49 | – | 4.25 |
| 21 | 105 | 1039.53 | 0.37 | 0.608 | 1.57 | 101 | 94 | 84 | 2.0 | 48 | – | 4.25 |
| 22 | 110 | 1043.14 | 0.41 | 0.640 | 1.74 | 103 | 95 | 84 | 2.0 | 49 | – | 4.25 |
| 23 | 115 | 1046.95 | 0.46 | 0.678 | 2.00 | 102 | 94 | 84 | 2.0 | 48 | – | 4.25 |
| 24 | 120 | 1050.772 | 0.45 | 0.671 | 1.91 | 101 | 94 | 84 | 2.0 | 49 | – | 4.25 |
| TOTAL | | 80.903 | 8.57 | 14.528 | 36.49 | 4647 | | 2012 | | | | |
| | | AVERAGE | 0.36 | 0.597 | 1.52 | 97 °F | | 84 °F | | | | |
| | | | | | | 557 °R | | 544 °R | | | | |

START 1155 START 1300

STOP 1255 STOP 1400

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | | RUN NO. 8 | | DATE 5 June 2003 | |
|---|---|---|---|---|---|
| Project Number: 43-EL-5116-03 | | Installation: Anniston Army Depot, Alabama | | Meter Box Operator: Simmons, Tech | |
| Sample Location: Chrome Plating Finishing Complex, BLDG 114 | | | | | |
| Type of Sample: (Total Chrome) | | (Moisture) | | | |
| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 2 | $P_s/P_m$ 1.0 | N-1 | 0.249 | 5-3 | 0.84 |
| $T_m$ 560 | $T_s$ 540 | ↓ | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.25 | ↓ | 0.250 | $C_{p,eff}$ 0.84 | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 90496 | | Dry Gas Meter $\gamma_m$ 1.009 | | $D_s$ 38" | $A_s$ 7.876 |
| Filter | | | Probe | | |
| Type | Number | | Length | Liner | Heat Set |
| N/A | N/A | | 3' Eff | Quartz | — |
| Initial Leak Check | | | Initial Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 0.0 in. $H_2O$ per 15 Sec. | | |
| 15" | 0.008 $ft^3$ per 1 Min. | | at 6.1 / 7.3 in. $H_2O$ | | |
| Final Leak Check | | | Final Pitot Tube Leak Check | | |
| Vacuum (in. Hg) | Leak Rate | | 0.0 / 0.0 in. $H_2O$ per 15 Sec. | | |
| 2.0" | 0.006 $ft^3$ per 1 Min. | | at 7.1 / 8.8 in. $H_2O$ | | |
| Gas Bag System Leak Check | | | Component Leak Check | | |
| Initial | Final | | Vacuum (in Hg.) | Leak Rate | |
| $P_{bar}$ 29.54 | $P_{stat}$ 0.20 | | | $ft^3$ per Min. | |
| Start Time 1155 | End Time 1400 | | | $ft^3$ per Min. | |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 6/5/03

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 9

FROM FIELD DATA SHEET:

$C_p$ = 0.839 $T_s$ = 541 $A_s$ = 7.676 $V_s$ = 81.731 $P_{bar}$ = 29.39 $\sqrt{\Delta P}_{avg}$ = 0.591

$\theta$ = 120 $T_m$ = 561 $A_n$ = $3.382 \times 10^{-4}$ $\gamma_m$ = 1.009 $P_{stat}$ = 0.20 $\Delta H$ = 1.50

FROM PHYSICAL SCIENCE:

$V_{lc}$ = 29.2 $M_n$ = ____ $\%CO_2$ = 0.0 $\%O_2$ = 20.9 $\%N_2$ = 79.1

PRESSURE CALCULATIONS:

$$P_m = P_{bar} + \frac{\Delta H}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.45 \text{ in. Hg}$$

$$P_s = P_{bar} + \frac{P_{stat}}{13.6} = (\quad) + \frac{(\quad)}{13.6} = 29.35 \text{ in. Hg}$$

DRY GAS VOLUME:

$$V_{m_{std}} = \frac{17.65 V_m \gamma_m P_m}{T_m} = \frac{17.65(\quad)(\quad)(\quad)}{(\quad)} = 76.50 \text{ dscf}$$

MOISTURE CONTENT:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} = \frac{(\quad)}{(\quad)+(\quad)} = 0.018$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

ISOKINETIC DATA SHEET[1]
(Continued)

INSTALLATION: Anniston Army Depot, AL PROJECT NUMBER: 43-EL-5116-03 DATE: 6/5/03

LOCATION: Chrome Plating Finishing Complex, BLDG 114 RUN NUMBER: 9

STACK GAS MOLECULAR WEIGHT:

$$M_s = (1 - B_{wo})[0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)] + 18B_{wo}$$

$$= (1 - \quad)[0.44(\quad) + 0.32(\quad) + 0.28(\quad)] + 18(\quad) = \underline{28.64}\ \frac{lb}{lb\ mole\ wet}$$

STACK GAS VELOCITY:

$$V_{s_{avg}} = 85.48\, C_p \sqrt{\Delta P}_{avg} \sqrt{\frac{T_s}{P_s M_s}} = 85.48(\quad)(\quad)\sqrt{\frac{(\quad)}{(\quad)(\quad)}} = \underline{34.15}\ \frac{ft}{sec}$$

STACK GAS VOLUMETRIC FLOW RATE:

$$Q_s = \frac{63{,}529\,(1 - B_{wo})\, V_{s_{avg}} A_s P_s}{T_s} = \frac{63{,}529\,(1 - \quad)(\quad)(\quad)(\quad)}{(\quad)} = \underline{902{,}542}\ \frac{dscf}{hr}$$

PERCENT ISOKINETIC:

$$I = \frac{0.0945\, T_s V_{m_{std}}}{\Theta V_s P_s A_n (1 - B_{wo})} = \frac{0.0945(\quad)(\quad)}{(\quad)(\quad)(\quad)(\quad)(1 - \quad)} = \underline{98.8}\ \%$$

[1] Standard Temperature = 68°F (528°R); Standard Pressure = 29.92 in. Hg

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

| FIELD DATA SHEET | RUN NO. 9 | DATE 5 June 2003 |
|---|---|---|
| Project Number: 43-EL-5116-03 | Installation: Anniston Army Depot, Alabama | Meter Box Operator: Simmonds |

Sample Location: Chrome Plating Finishing Complex, BLDG 114

Type of Sample: (Total Chrome) (Moisture)

| Nomograph/Calculator | | Nozzle | | Pitot Tube | |
|---|---|---|---|---|---|
| $\Delta H_@$ 1.86 | $\Delta P_{avg}$ 0.36 | No. | $D_n$ | No. | $C_p$ |
| $\%H_2O$ 2 | $P_s/P_m$ 1.0 | N-1 | 0.249 | S-3 | 0.84 |
| $T_m$ 560 | $T_s$ 540 | ↓ | 0.248 | $F_{blockage}$ 1.411 | |
| "C" Factor | $K_p$ 4.28 | ↓ | 0.250 | $C_{p,err}$ 0.84 | |
| Ref $\Delta P$ | | $D_{n,avg}$ | 0.249 | $A_n$ $3.382 \times 10^{-4}$ | |
| Meter Box No. 90496 | | Dry Gas Meter $\gamma_m$ 1.009 | | $D_s$ 38" | $A_s$ 7.876 |

| Filter | | Probe | | |
|---|---|---|---|---|
| Type | Number | Length | Liner | Heat Set |
| N/A | N/A | 3' ESS | Quartz | |

| Initial Leak Check | | Initial Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | 0.0 / 0.0 in. $H_2O$ per 15 Sec. |
| 15" | 0.001 $ft^3$ per / Min. | at 6.4 / 6.8 in. $H_2O$ |

| Final Leak Check | | Final Pitot Tube Leak Check |
|---|---|---|
| Vacuum (in. Hg) | Leak Rate | / in. $H_2O$ per 15 Sec. |
| 2.5" | 0.001 $ft^3$ per / Min. | at / in. $H_2O$ |

| Gas Bag System Leak Check | | Component Leak Check | |
|---|---|---|---|
| Initial | Final | Vacuum (in Hg.) | Leak Rate |
| $P_{bar}$ 29.34 | $P_{stat}$ 0.20 | | $ft^3$ per Min. |
| Start Time 1425 | End Time 1625 | | $ft^3$ per Min. |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

MOISTURE DATA SHEETS

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

LAB DATA SHEET

**PART I - GENERAL:**

INSTALLATION : Anniston Army Depot

ANALYST : Louis M. McCarter

SOURCE : Chrome Electroplating Facility

BAROMETRIC PRESSURE(In, Hg) : 29.13

SAMPLING DATE : 6/3/03

SAMPLING SITE : LEVEL

TIME OF SAMPLING : 1115

RUN # : AAD - 1

TRAIN : RM 306

**PART II - MOISTURE DETERMINATION**

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g,) : | 718.6 | 601.8 | 593.8 | 842.6 |
| INITIAL WEIGHT (g.) : | 700.1 | 593.0 | 591.2 | 826.2 |
| DIFFERENCE (g.) : | 18.5 | 8.8 | 2.6 | 16.4 |

TOTAL MOISTURE (g.) = 46.3

**PART III - VOLUME OF FIRST THREE IMPINGERS.**

TOTAL FINAL VOLUME : _____ ml.

TOTAL INITIAL VOLUME : 200 ml.

DIFFERENCE : _____ ml.

begins pH = 11.0

Final pH = 10.5

~~Impingers~~

**PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.**

TOTAL FINAL VOLUME OF IMPINGERS, PROBE RINSE AND CONNECTING GLASSWARE RINSE : 525 ml.

**AUTHENTICATION :**

TECHNICIAN : Louis M McCarter PROJECT OFFICER : C-T D YA

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

LAB DATA SHEET

**PART I - GENERAL:**

INSTALLATION : Anniston Army Depot

ANALYST : Louis M. McCarter

SOURCE : Chrome Electroplating Facility

BAROMETRIC PRESSURE(In, Hg) : 29.13

SAMPLING DATE : 6/3/03

SAMPLING SITE : LEVEL

TIME OF SAMPLING : 1425

RUN # : AAD - 2

TRAIN : RM 306

**PART II - MOISTURE DETERMINATION**

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g,) : | 744.9 | 676.7 | 598.6 | 765.2 |
| INITIAL WEIGHT (g.) : | 721.9 | 669.9 | 595.9 | 749.6 |
| DIFFERENCE (g.) : | 23.0 | 6.8 | 2.7 | 15.6 |

TOTAL MOISTURE (g.) = 48.1

**PART III - VOLUME OF FIRST THREE IMPINGERS.**

begins pH = 11.0

Final pH = 10.5

TOTAL FINAL VOLUME : _____ ml.

TOTAL INITIAL VOLUME : 200 ml.

DIFFERENCE : _____ ml.

**PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.**

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

**AUTHENTICATION :**

TECHNICIAN : Jm McCarter

PROJECT OFFICER : [illegible]

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

**LAB DATA SHEET**

**PART I - GENERAL:**

INSTALLATION : Anniston Army Depot

ANALYST : Louis M. McCarter

SOURCE : Chrome Electroplating Facility

BAROMETRIC PRESSURE(In, Hg) : 29.13

SAMPLING DATE : 6/3/03

SAMPLING SITE : LEVEL

TIME OF SAMPLING : 1700

RUN # : AAD - 3

TRAIN : RM 306

**PART II - MOISTURE DETERMINATION**

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g.) : | 723.8 | 674.5 | 590.9 | 731.1 |
| INITIAL WEIGHT (g.) : | 696.9 | 670.1 | 588.8 | 716.8 |
| DIFFERENCE (g.) : | 26.9 | 4.4 | 2.1 | 14.3 |
| | | | TOTAL MOISTURE (g.) = | 47.7 |

**PART III - VOLUME OF FIRST THREE IMPINGERS.**

TOTAL FINAL VOLUME : _____ ml.

TOTAL INITIAL VOLUME : 200 ml.

DIFFERENCE : _____ ml.

begins pH = 11.0

Final pH = 10.0

**PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.**

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

**AUTHENTICATION :**

TECHNICIAN : Jon M McCarter PROJECT OFFICER : [illegible]

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

LAB DATA SHEET

PART I - GENERAL:

INSTALLATION : Anniston Army Depot
ANALYST : Louis M. McCarter
SOURCE : Chrome Electroplating Facility
BAROMETRIC PRESSURE(In, Hg) : 29.19
SAMPLING DATE : 6/4/03
SAMPLING SITE : LEVEL
TIME OF SAMPLING : 0820
RUN # : AAD - 4
TRAIN : RM 306

PART II - MOISTURE DETERMINATION

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g.) : | 731.0 | 692.7 | 620.5 | 803.0 |
| INITIAL WEIGHT (g.) : | 718.8 | 688.9 | 618.9 | 788.0 |
| DIFFERENCE (g.) : | 12.2 | 3.8 | 1.6 | 15 |
| | | | TOTAL MOISTURE (g.) = | 32.6 |

PART III - VOLUME OF FIRST THREE IMPINGERS.

TOTAL FINAL VOLUME : _____ ml.
TOTAL INITIAL VOLUME : 200 ml.
DIFFERENCE : _____ ml.

BEGINS pH = 9.5
FINAL pH = 8.5

PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

AUTHENTICATION :

TECHNICIAN : Louis M. McCarter PROJECT OFFICER : [signature]

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

**LAB DATA SHEET**

**PART I - GENERAL:**

INSTALLATION : Anniston Army Depot

ANALYST : Louis M. McCarter

SOURCE : Chrome Electroplating Facility

BAROMETRIC PRESSURE(In, Hg) : 29.19

SAMPLING DATE : 6/4/03

SAMPLING SITE : LEVEL

TIME OF SAMPLING : 1100

RUN # : AAD - 5

TRAIN : RM 306

**PART II - MOISTURE DETERMINATION**

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g.) : | 734.7 | 673.9 | 620.5 | 747.3 |
| INITIAL WEIGHT (g.) : | 719.0 | 670.2 | 618.9 | 734.0 |
| DIFFERENCE (g.) : | 15.7 | 3.7 | 1.6 | 13.3 |
| | | | TOTAL MOISTURE (g.) = | 34.3 |

**PART III - VOLUME OF FIRST THREE IMPINGERS.**

TOTAL FINAL VOLUME : _____ ml.

TOTAL INITIAL VOLUME : 200 ml.

DIFFERENCE : _____ ml.

Begins pH = 9.5

Final pH = 8.5

**PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.**

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

**AUTHENTICATION :**

TECHNICIAN : Lou M. McCarter

PROJECT OFFICER : C. J. D. H.

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

LAB DATA SHEET

PART I - GENERAL:

INSTALLATION : Anniston Army Depot

ANALYST : Louis M. McCarter

SOURCE : Chrome Electroplating Facility

BAROMETRIC PRESSURE(In, Hg) : 29.19

SAMPLING DATE : 6/4/03

SAMPLING SITE : LEVEL

TIME OF SAMPLING : 1330

RUN # : AAD - 6

TRAIN : RM 306

PART II - MOISTURE DETERMINATION

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g,) : | 746.5 | 667.7 | 616.4 | 724.8 |
| INITIAL WEIGHT (g.) : | 730.5 | 663.8 | 614.9 | 711.7 |
| DIFFERENCE (g.) : | 16.0 | 3.9 | 1.5 | 13.1 |
| | | | TOTAL MOISTURE (g.) = | 34.5 |

PART III - VOLUME OF FIRST THREE IMPINGERS.

TOTAL FINAL VOLUME : _____ ml.

TOTAL INITIAL VOLUME : 200 ml.

DIFFERENCE : _____ ml.

Begins pH = 9.5

Final pH = 8.5

PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

AUTHENTICATION :

TECHNICIAN : Louis M. McCarter

PROJECT OFFICER : _____

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

LAB DATA SHEET

**PART I - GENERAL:**

INSTALLATION : Anniston Army Depot

ANALYST : Louis M. McCarter

SOURCE : Chrome Electroplating Facility

BAROMETRIC PRESSURE(In, Hg) : 29.34

SAMPLING DATE : 6/5/03

SAMPLING SITE : LEVEL

TIME OF SAMPLING : 0927

RUN # : AAD - 7

TRAIN : RM 306

**PART II - MOISTURE DETERMINATION**

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g,) : | 747.0 | 727.0 | 630.8 | 778.3 |
| INITIAL WEIGHT (g.) : | ~~736.9~~ 739.0 | ~~718.5~~ 722.4 | 628.6 | 761.9 |
| DIFFERENCE (g.) : | 8.0 | 4.6 | 2.2 | 16.4 |
| | | | TOTAL MOISTURE (g.) = | 31.2 |

**PART III - VOLUME OF FIRST THREE IMPINGERS.**

TOTAL FINAL VOLUME : _____ ml.

TOTAL INITIAL VOLUME : 200 ml.

DIFFERENCE : _____ ml.

Begins pH = 13.0

Final pH = 12.0

**PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.**

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

**AUTHENTICATION :**

TECHNICIAN : Louis M McCarter

PROJECT OFFICER : [illegible]

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

LAB DATA SHEET

**PART I - GENERAL:**

INSTALLATION : Anniston Army Depot

ANALYST : Louis M. McCarter

SOURCE : Chrome Electroplating Facility

BAROMETRIC PRESSURE(In, Hg) : 29.34

SAMPLING DATE : 6/5/03

SAMPLING SITE : LEVEL

TIME OF SAMPLING : 1155

RUN # : AAD - 8

TRAIN : RM 306

**PART II - MOISTURE DETERMINATION**

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g,) : | 749.0 | 722.3 | 638.3 | 751.3 |
| INITIAL WEIGHT (g.) : | 738.8 | 717.6 | 636.7 | 736.9 |
| DIFFERENCE (g.) : | 10.2 | 4.7 | 1.6 | 14.4 |
| | | | TOTAL MOISTURE (g.) = | 30.9 |

**PART III - VOLUME OF FIRST THREE IMPINGERS.**

TOTAL FINAL VOLUME : _____ ml.

TOTAL INITIAL VOLUME : 200 ml.

DIFFERENCE : _____ ml.

Begins pH = 13.0

Final pH = 12.5

**PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.**

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

**AUTHENTICATION :**

TECHNICIAN : Jon McCarter

PROJECT OFFICER : T. J. D. [illegible]

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

**LAB DATA SHEET**

**PART I - GENERAL:**

INSTALLATION : Anniston Army Depot
ANALYST : Louis M. McCarter
SOURCE : Chrome Electroplating Facility
BAROMETRIC PRESSURE(In, Hg) : 29.34
SAMPLING DATE : 6/5/03
SAMPLING SITE : LEVEL
TIME OF SAMPLING : 1423
RUN # : AAD - 9
TRAIN : RM 306

**PART II - MOISTURE DETERMINATION**

| IMPINGER # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CONTENTS | 100 ml. 0.1 N NaOH | 100 ml. 0.1 N NaOH | DRY | Silica Gel |
| FINAL WEIGHT (g,) : | 743.7 | 727.0 | 637.3 | 731.3 |
| INITIAL WEIGHT (g.) : | 734.1 | 723.1 | 635.5 | 717.4 |
| DIFFERENCE (g.) : | 9.6 | 3.9 | 1.8 | 13.9 |
| | | | TOTAL MOISTURE (g.) = | 29.2 |

**PART III - VOLUME OF FIRST THREE IMPINGERS.**

TOTAL FINAL VOLUME : _____ ml.
TOTAL INITIAL VOLUME : 200 ml.
DIFFERENCE : _____ ml.

Begins pH = 13.0
Final pH = 12.5

**PART IV - TOTAL VOLUME OF SAMPLE CONTAINER.**

TOTAL FINAL VOLUME OF IMPINGERS,
PROBE RINSE AND CONNECTING GLASSWARE RINSE : 450 ml.

**AUTHENTICATION :**

TECHNICIAN : Jon M McCarter PROJECT OFFICER : T.J. D Yd

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

# APPENDIX G

## TSP SAMPLER DATA SUMMARY

Air Pollution Management Study No. 43-EL-5116-03, 3-

TSP SAMPLER WEST FIELD DATA SHEET

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-03-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 1 |
| Operator: | Sutphin | Filter ID No. | Q0113427 |
| Pa (mm Hg) | 740.41 | Sampler S/N: | 0510 |
| Ta ( °K ) | 297.9 | Start Time: | 1112 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1312 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.8 |
| Final Pex (in. $H_2O$) | 5.6 |
| Mean Pex (in. $H_2O$) | 5.7 |

**Sampler:**
**Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00202.80 End: 00204.79

Check Point @ 1207 hrs, 5.7 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.636

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.59 |
| Vstd (m3)= | 191.32 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-03-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 2 |
| Operator: | Sutphin | Filter ID No. | Q0113425 |
| Pa (mm Hg) | 740.16 | Sampler S/N: | 0510 |
| Ta ( °K ) | 297.7 | Start Time: | 1422 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1622 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.6 |
| Final Pex (in. $H_2O$) | 5.5 |
| Mean Pex (in. $H_2O$) | 5.6 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00204.80 End: 00206.79

Check Point @ 1519 hrs, 5.5 in H2O

**Total Time:**

**Minutes** 120 **Mean Qa (m3/min)=** 1.614

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.57 |
| Vstd (m3)= | 188.80 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-03-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 3 |
| Operator: | Sutphin | Filter ID No. | Q0113423 |
| Pa (mm Hg) | 738.89 | Sampler S/N: | 0510 |
| Ta ( °K ) | 298 | Start Time: | 1700 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1900 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.4 |
| Final Pex (in. $H_2O$) | 5.3 |
| Mean Pex (in. $H_2O$) | 5.4 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00206.79 End: 00208.79

Check Point @ 1802 hrs, 5.3 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.586

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.54 |
| Vstd (m3)= | 185.09 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-04-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 4 |
| Operator: | Sutphin | Filter ID No. | Q0113421 |
| Pa (mm Hg) | 741.43 | Sampler S/N: | 0510 |
| Ta ( °K ) | 294.5 | Start Time: | 0825 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1025 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.4 |
| Final Pex (in. $H_2O$) | 5.3 |
| Mean Pex (in. $H_2O$) | 5.4 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00208.79 End: 00210.79

Check Point @ 0926 hrs, 5.3 in H2O

**Total Time:**

**Minutes** 120 **Mean Qa (m3/min)=** 1.574

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.55 |
| Vstd (m3)= | 186.51 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

**Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)**
**Mean Qa = Mean Qstd(760/Pa)(Ta/298)**
**Vstd = (Qstd)*(Total Time)**
**TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$**
**Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates**
**Pav & Tav = Daily Mean Baro. Pressure and Temperature**
**Mean Qa range must be 1.1 to 1.7 m3/min.**

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-03-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 3 |
| Operator: | Sutphin | Filter ID No. | Q0113423 |
| Pa (mm Hg) | 738.89 | Sampler S/N: | 0510 |
| Ta ( °K ) | 298 | Start Time: | 1700 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1900 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.4 |
| Final Pex (In. $H_2O$) | 5.3 |
| Mean Pex (in. $H_2O$) | 5.4 |

**Sampler:**
**Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00206.79 End: 00208.79

Check Point @ 1802 hrs, 5.3 in H2O

**Total Time:**

**Minutes** 120 **Mean Qa (m3/min)=** 1.586

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.54 |
| Vstd (m3)= | 185.09 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

**Mean Qstd = [(Delta Pex)(Pa/760)(298/Ta)]$^{1/2}$ -b)(1/m)**
**Mean Qa = Mean Qstd(760/Pa)(Ta/298)**
**Vstd = (Qstd)*(Total Time)**
**TSP Concentration (micrograms/m3) = (Wn)(10$^6$)/Vstd**
**Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates**
**Pav & Tav = Daily Mean Baro. Pressure and Temperature**
**Mean Qa range must be 1.1 to 1.7 m3/min.**

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-04-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 4 |
| Operator: | Sutphin | Filter ID No. | Q0113421 |
| Pa (mm Hg) | 741.43 | Sampler S/N: | 0510 |
| Ta ( °K ) | 294.5 | Start Time: | 0825 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1025 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.4 |
| Final Pex (in. $H_2O$) | 5.3 |
| Mean Pex (in. $H_2O$) | 5.4 |

**Sampler:**
**Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00208.79 End: 00210.79
Check Point @ 0926 hrs, 5.3 in H2O

**Total Time:**
Minutes: 120 **Mean Qa (m3/min)=** 1.574

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.55 |
| Vstd (m3)= | 186.51 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

**Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)**
**Mean Qa = Mean Qstd(760/Pa)(Ta/298)**
**Vstd = (Qstd)*(Total Time)**
**TSP Concentration (micrograms/m3) = $(Wn)(10^6)$/Vstd**
**Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates**
**Pav & Tav = Daily Mean Baro. Pressure and Temperature**
**Mean Qa range must be 1.1 to 1.7 m3/min.**

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-04-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 5 |
| Operator: | Sutphin | Filter ID No. | Q0113419 |
| Pa (mm Hg) | 741.43 | Sampler S/N: | 0510 |
| Ta ( °K ) | 294.5 | Start Time: | 1105 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1305 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.3 |
| Final Pex (in. $H_2O$) | 5.2 |
| Mean Pex (in. $H_2O$) | 5.3 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

Comments: Elapsed Time; Start: 00210.79 End: 00212.79

Check Point @ 1205 hrs, 5.3 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.560

**Laboratory Calculations:**

| | | | |
|---|---|---|---|
| Mean Qstd (m3/min)= | 1.54 | Final (Wf) | N/A |
| Vstd (m3)= | 184.75 | Initial (Wi) | N/A |
| TSP Concentration = | N/A | Net (Wn) | N/A |

**Filter Weights (grams):**

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-04-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 6 |
| Operator: | Sutphin | Filter ID No. | Q0113415 |
| Pa (mm Hg) | 742.19 | Sampler S/N: | 0510 |
| Ta ( °K ) | 297.3 | Start Time: | 1330 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1530 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.4 |
| Final Pex (in. $H_2O$) | 5.3 |
| Mean Pex (in. $H_2O$) | 5.4 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00212.79 End: 00214.79

Check Point @ 1433 hrs, 5.3 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.581

**Laboratory Calculations:**

| | | | |
|---|---|---|---|
| Mean Qstd (m3/min)= | 1.55 | Final (Wf) | N/A |
| Vstd (m3)= | 185.72 | Initial (Wi) | N/A |
| TSP Concentration = | N/A | Net (Wn) | N/A |

**Filter Weights (grams):**

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-05-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 7 |
| Operator: | Sutphin | Filter ID No. | Q0113413 |
| Pa (mm Hg) | 745.24 | Sampler S/N: | 0510 |
| Ta ( °K ) | 294.3 | Start Time: | 0925 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1125 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.3 |
| Final Pex (in. $H_2O$) | 5.2 |
| Mean Pex (in. $H_2O$) | 5.3 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00214.79 End: 00216.79

Check Point @ 1020 hrs, 5.2 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.555

**Laboratory Calculations:**

| | | | |
|---|---|---|---|
| Mean Qstd (m3/min)= | 1.54 | Final (Wf) | N/A |
| Vstd (m3)= | 185.29 | Initial (Wi) | N/A |
| TSP Concentration = | N/A | Net (Wn) | N/A |

**Filter Weights (grams):**

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-05-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 8 |
| Operator: | Sutphin | Filter ID No. | Q0113411 |
| Pa (mm Hg) | 745.49 | Sampler S/N: | 0510 |
| Ta (°K) | 296.8 | Start Time: | 1157 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1357 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.3 |
| Final Pex (in. $H_2O$) | 5.2 |
| Mean Pex (in. $H_2O$) | 5.3 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00216.79 End: 00218.80
Check Point @ 1301 hrs, 5.2 in H2O

**Total Time:**

Minutes: 120 **Mean Qa (m3/min)=** 1.561

**Laboratory Calculations:**

| | | | |
|---|---|---|---|
| Mean Qstd (m3/min)= | 1.54 | Final (Wf) | N/A |
| Vstd (m3)= | 184.53 | Initial (Wi) | N/A |
| TSP Concentration = | N/A | Net (Wn) | N/A |

**Filter Weights (grams):**

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-05-03 |
| Site ID: | Crome Plating Ficility | Run Number: | WEST 9 |
| Operator: | Sutphin | Filter ID No. | Q0113409 |
| Pa (mm Hg) | 744.47 | Sampler S/N: | 0510 |
| Ta ( °K ) | 299.1 | Start Time: | 1425 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1625 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.2 |
| Final Pex (in. $H_2O$) | 5.1 |
| Mean Pex (In. $H_2O$) | 5.2 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.4679 |
| b= | 0.0166 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00218.80 End: 00220.81
Check Point @ 1530 hrs, 5.1 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.553

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.52 |
| Vstd (m3)= | 181.92 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = (Wn)($10^6$)/Vstd
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

Pollution Management Study No. 43-EL-5116-03, 3-5

TSP SAMPLER EAST FIELD DATA SHEET

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-03-03 |
| Site ID: | Crome Plating Ficility | Run Number: | EAST 1 |
| Operator: | Sutphin | Filter ID No. | Q0113426 |
| Pa (mm Hg) | 740.41 | Sampler S/N: | 6631 |
| Ta ( °K ) | 297.9 | Start Time: | 1113 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1311 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 6.1 |
| Final Pex (in. $H_2O$) | 5.9 |
| Mean Pex (in. $H_2O$) | 6.00 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00596.26 End: 00598.22

Check Point @ 1209 hrs, 5.9 in H2O

**Total Time:**

**Minutes** 118 **Mean Qa (m3/min)=** 1.554

**Laboratory Calculations:**

| | | | |
|---|---|---|---|
| Mean Qstd (m3/min)= | 1.51 | Final (Wf) | N/A |
| Vstd (m3)= | 178.75 | Initial (Wi) | N/A |
| TSP Concentration = | N/A | Net (Wn) | N/A |

**Filter Weights (grams):**

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-03-03 |
| Site ID: | Crome Plating Ficility | Run Number: | EAST 2 |
| Operator: | Sutphin | Filter ID No. | Q0113424 |
| Pa (mm Hg) | 740.16 | Sampler S/N: | 6631 |
| Ta ( °K ) | 297.7 | Start Time: | 1424 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1623 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 6.0 |
| Final Pex (in. $H_2O$) | 5.8 |
| Mean Pex (in. $H_2O$) | 5.9 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00598.23 End: 00600.22

Check Point @ 1521 hrs, 5.9 in H2O

**Total Time:**

Minutes: 119 **Mean Qa (m3/min)=** 1.541

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.50 |
| Vstd (m3)= | 178.72 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-03-03 |
| Site ID: | Crome Plating Ficility | Run Number: | EAST 3 |
| Operator: | Sutphin | Filter ID No. | Q0113422 |
| Pa (mm Hg) | 739.89 | Sampler S/N: | 6631 |
| Ta ( °K ) | 298 | Start Time: | 1702 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1903 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 6.0 |
| Final Pex (in. $H_2O$) | 5.8 |
| Mean Pex (in. $H_2O$) | 5.9 |

**Sampler:**
**Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00600.23 End: 00602.23
Check Point @ 1806 hrs, 5.8 in H2O

**Total Time:**
Minutes 121 Mean Qa (m3/min)= 1.542

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.50 |
| Vstd (m3)= | 181.59 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-6422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-04-03 |
| Site ID: | Crome Plating Ficility | Run Number: | EAST 4 |
| Operator: | Sutphin | Filter ID No. | Q0113420 |
| Pa (mm Hg) | 741.43 | Sampler S/N: | 6631 |
| Ta ( °K ) | 294.5 | Start Time: | 0826 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1027 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.9 |
| Final Pex (in. $H_2O$) | 5.9 |
| Mean Pex (in. $H_2O$) | 5.9 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00602.23 End: 00604.24

Check Point @ 0927 hrs, 5.9 in H2O

**Total Time:**

Minutes: 121 — Mean Qa (m3/min)= 1.531

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.51 |
| Vstd (m3)= | 182.92 |
| TSP Concentration = | N/A |

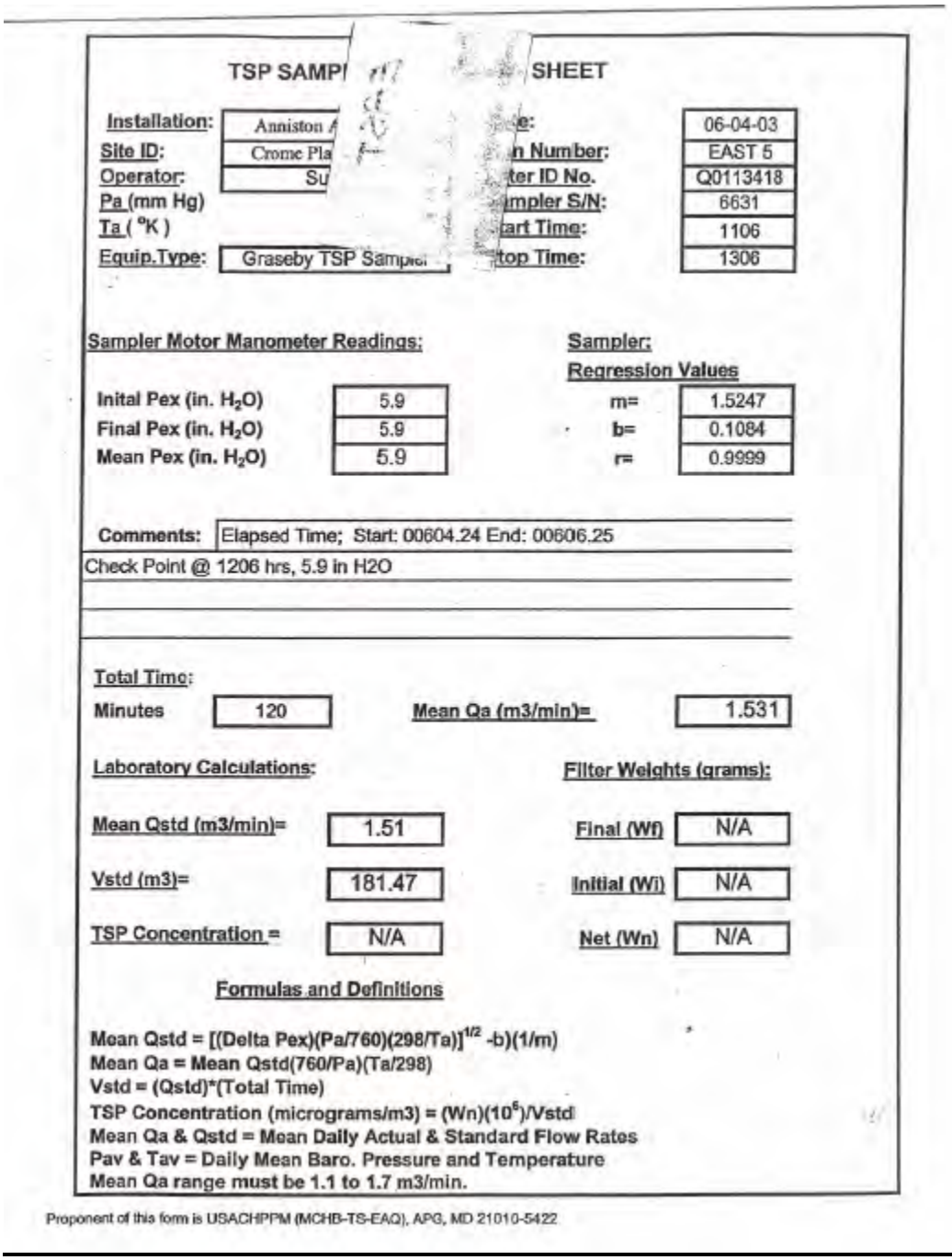
**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = (Wn)($10^6$)/Vstd
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422



TSP SAMPL[illegible] SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston A | e: | 06-04-03 |
| Site ID: | Crome Pla | n Number: | EAST 5 |
| Operator: | Su | ter ID No. | Q0113418 |
| Pa (mm Hg) | | mpler S/N: | 6631 |
| Ta ( °K ) | | art Time: | 1106 |
| Equip.Type: | Graseby TSP Sampler | top Time: | 1306 |

Sampler Motor Manometer Readings:

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.9 |
| Final Pex (in. $H_2O$) | 5.9 |
| Mean Pex (in. $H_2O$) | 5.9 |

Sampler:
Regression Values

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

Comments: Elapsed Time; Start: 00604.24 End: 00606.25
Check Point @ 1206 hrs, 5.9 in H2O

Total Time:
Minutes 120 Mean Qa (m3/min)= 1.531

Laboratory Calculations:

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.51 |
| Vstd (m3)= | 181.47 |
| TSP Concentration = | N/A |

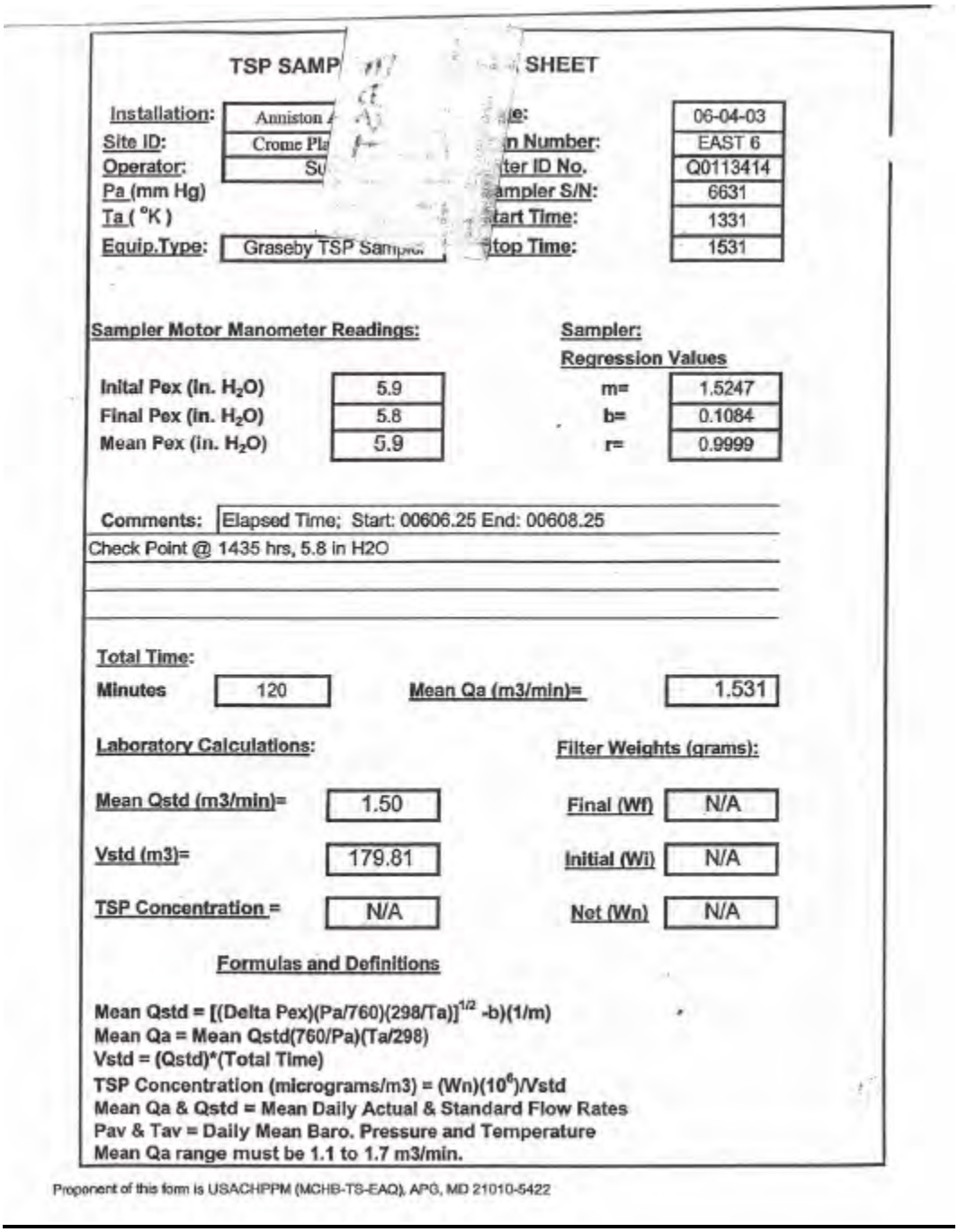
Filter Weights (grams):

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

Formulas and Definitions

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422



TSP SAMP[illegible] SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston [illegible] | [illegible]e: | 06-04-03 |
| Site ID: | Crome Pla[illegible] | [illegible]n Number: | EAST 6 |
| Operator: | Su[illegible] | [illegible]ter ID No. | Q0113414 |
| Pa (mm Hg) | | [illegible]ampler S/N: | 6631 |
| Ta ( °K ) | | [illegible]tart Time: | 1331 |
| Equip.Type: | Graseby TSP Sampler | [illegible]top Time: | 1531 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.9 |
| Final Pex (in. $H_2O$) | 5.8 |
| Mean Pex (in. $H_2O$) | 5.9 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00606.25 End: 00608.25

Check Point @ 1435 hrs, 5.8 in H2O

**Total Time:**

**Minutes** 120 **Mean Qa (m3/min)=** 1.531

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.50 |
| Vstd (m3)= | 179.81 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = (Wn)($10^6$)/Vstd
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-05-03 |
| Site ID: | Crome Plating Ficility | Run Number: | EAST 7 |
| Operator: | Sutphin | Filter ID No. | Q0113412 |
| Pa (mm Hg) | 745.24 | Sampler S/N: | 6631 |
| Ta ( °K ) | 294.3 | Start Time: | 0926 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1126 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (In. $H_2O$) | 6.0 |
| Final Pex (In. $H_2O$) | 6.1 |
| Mean Pex (In. $H_2O$) | 6.1 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

Comments: Elapsed Time; Start: 00608.25 End: 00610.26
Check Point @ 1022 hrs, 6.1 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.547

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.54 |
| Vstd (m3)= | 184.37 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-05-03 |
| Site ID: | Crome Plating Ficility | Run Number: | EAST 8 |
| Operator: | Sutphin | Filter ID No. | Q0113410 |
| Pa (mm Hg) | 745.49 | Sampler S/N: | 6631 |
| Ta ( °K ) | 296.8 | Start Time: | 1157 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1357 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 6.1 |
| Final Pex (in. $H_2O$) | 6.0 |
| Mean Pex (in. $H_2O$) | 6.1 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

Comments: Elapsed Time; Start: 00610.26 End: 00612.26

Check Point @ 1302 hrs, 6.0 in H2O

**Total Time:**

Minutes: 120 Mean Qa (m3/min)= 1.553

**Laboratory Calculations:**

| | |
|---|---|
| Mean Qstd (m3/min)= | 1.53 |
| Vstd (m3)= | 183.59 |
| TSP Concentration = | N/A |

**Filter Weights (grams):**

| | |
|---|---|
| Final (Wf) | N/A |
| Initial (Wi) | N/A |
| Net (Wn) | N/A |

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

## TSP SAMPLER FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Date: | 06-05-03 |
| Site ID: | Crome Plating Ficility | Run Number: | EAST 9 |
| Operator: | Sutphin | Filter ID No. | Q0113408 |
| Pa (mm Hg) | 744.47 | Sampler S/N: | 6631 |
| Ta ( °K ) | 299.1 | Start Time: | 1426 |
| Equip.Type: | Graseby TSP Sampler | Stop Time: | 1627 |

**Sampler Motor Manometer Readings:**

| | |
|---|---|
| Inital Pex (in. $H_2O$) | 5.9 |
| Final Pex (in. $H_2O$) | 5.9 |
| Mean Pex (in. $H_2O$) | 5.9 |

**Sampler: Regression Values**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

**Comments:** Elapsed Time; Start: 00610.26 End: 00612.26

Check Point @ 1302 hrs, 6.0 in H2O

**Total Time:**

Minutes: 121 Mean Qa (m3/min)= 1.540

**Laboratory Calculations:**

| | | | |
|---|---|---|---|
| Mean Qstd (m3/min)= | 1.50 | Final (Wf) | N/A |
| Vstd (m3)= | 181.83 | Initial (Wi) | N/A |
| TSP Concentration = | N/A | Net (Wn) | N/A |

**Filter Weights (grams):**

**Formulas and Definitions**

Mean Qstd = $[(\text{Delta Pex})(Pa/760)(298/Ta)]^{1/2}$ -b)(1/m)
Mean Qa = Mean Qstd(760/Pa)(Ta/298)
Vstd = (Qstd)*(Total Time)
TSP Concentration (micrograms/m3) = $(Wn)(10^6)/Vstd$
Mean Qa & Qstd = Mean Daily Actual & Standard Flow Rates
Pav & Tav = Daily Mean Baro. Pressure and Temperature
Mean Qa range must be 1.1 to 1.7 m3/min.

Proponent of this form is USACHPPM (MCHB-TS-EAQ), APG, MD 21010-5422

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

# APPENDIX H

# ANALYTICAL PACKAGE

Air Pollution Management Study No. 43-EL-5116-03,

USEPA RM 306 ANALYTICAL PACKAGE

CASE NARRATIVE

STL SACRAMENTO PROJECT NUMBER G3F110295

There were no anomalies associated with this project.

*STL Sacramento*

## Quality Control Definitions

| QC Parameter | Definition |
|---|---|
| QC Batch | A set of up to 20 field samples plus associated laboratory QC samples that are similar in composition (matrix) and that are processed within the same time period with the same reagent and standard lots. |
| Duplicate Control Sample (DCS) | Consist of a pair of LCSs analyzed within the same QC batch to monitor precision and accuracy independent of sample matrix effects. This QC is performed only if required by client or when insufficient sample is available to perform MS/MSD. |
| Duplicate Sample (DU) | A second aliquot of an environmental sample, taken from the same sample container when possible, that is processed independently with the first sample aliquot. The results are used to assess the effect of the sample matrix on the precision of the analytical process. The precision estimated using this sample is not necessarily representative of the precision for other samples in the batch. |
| Laboratory Control Sample (LCS) | A volume of reagent water for aqueous samples or a contaminant-free solid matrix (Ottawa sand) for soil and sediment samples which is spiked with known amounts of representative target analytes and required surrogates. An LCS is carried through the entire analytical process and is used to monitor the accuracy of the analytical process independent of potential matrix effects. |
| Matrix Spike and Matrix Spike Duplicate (MS/MSD) | A field sample fortified with known quantities of target analytes that are also added to the LCS. Matrix spike duplicate is a second matrix spike sample. MSs/MSDs are carried through the entire analytical process and are used to determine sample matrix effect on accuracy of the measurement system. The accuracy and precision estimated using MS/MSD is only representative of the precision of the sample that was spiked. |
| Method Blank (MB) | A sample composed of all the reagents (in the same quantities) in reagent water carried through the entire analytical process. The method blank is used to monitor the level of contamination introduced during sample preparation steps. |
| Surrogate Spike | Organic constituents not expected to be detected in environmental media and are added to every sample and QC at a known concentration. Surrogates are used to determine the efficiency of the sample preparation and the analytical process. |

Source: STL Sacramento Laboratory Quality Manual

**STL Sacramento Certifications:**
Alaska (UST-055), Arizona (#AZ00616), Arkansas, California (NELAP # 01119CA) (ELAP #I-2439), Connecticut (#PH-0691), Florida (E87570), Hawaii, Louisiana (AI # 30612), New Jersey (Lab ID 44005), Nevada (#CA 044), New York (LAB ID 11666 serial # 107407), Oregon (LAB ID CA 044), South Carolina (LAB ID 87014, Cert. # 870140), Utah (E-168), Virginia (#00178), Washington (# C087), West Virginia (# 9930C), Wisconsin (Lab 998204680), USNAVY, USACE, USDA Foreign Plant (Permit # 37-82605), USDA Foreign Soil (Permit # S-46613)..

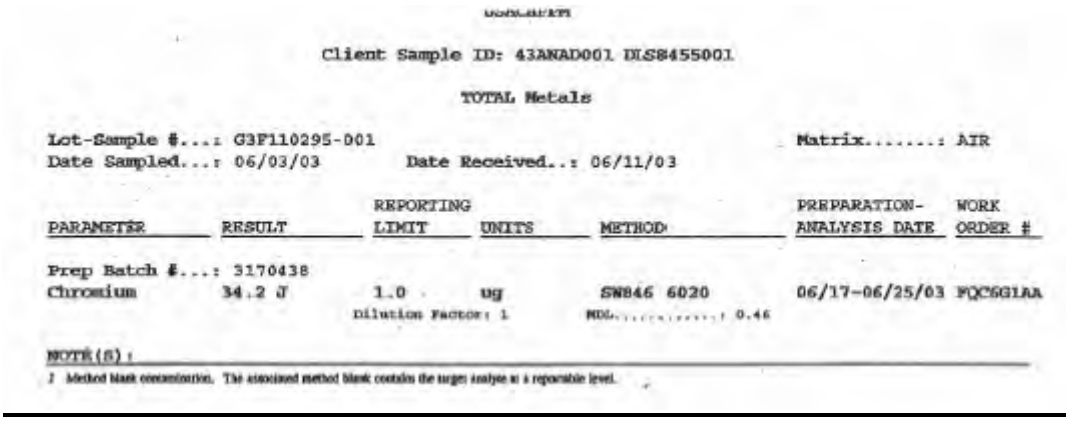
# Sample Summary
# G3F110295

| WO# | Sample # | Client Sample ID | Sampling Date | Received Date |
|---|---|---|---|---|
| FQC6G | 1 | 43ANAD001 DLS8455001 | 6/3/03 | 6/11/03 09:05 AM |
| FQC6G | 1 | 43ANAD001 DLS8455001 DUP | 6/3/03 | 6/11/03 09:05 AM |
| FQC6V | 2 | 43ANAD004 DLS8455002 | 6/3/03 | 6/11/03 09:05 AM |
| FQC65 | 3 | 43ANAD007 DLS8455003 | 6/3/03 | 6/11/03 09:05 AM |
| FQC67 | 4 | 43ANAD013 DLS8455004 | 6/4/03 | 6/11/03 09:05 AM |
| FQC69 | 5 | 43ANAD016 DLS8455005 | 6/4/03 | 6/11/03 09:05 AM |
| FQC7C | 6 | 43ANAD019 DLS8455018 | 6/4/03 | 6/11/03 09:05 AM |
| FQC7G | 7 | 43ANAD023 DLS8455019 | 6/5/03 | 6/11/03 09:05 AM |
| FQC7H | 8 | 43ANAD026 DLS8455020 | 6/5/03 | 6/11/03 09:05 AM |
| FQC7P | 9 | 43ANAD029 DLS8455021 | 6/5/03 | 6/11/03 09:05 AM |
| FQC7T | 10 | 43ANAD010 DLS8455031 | 6/3/03 | 6/11/03 09:05 AM |
| FQC70 | 11 | 43ANAD022 DLS8455032 | 6/4/03 | 6/11/03 09:05 AM |
| FQC71 | 12 | 43ANAD032 DLS8455033 | 6/5/03 | 6/11/03 09:05 AM |

Notes(s):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity, pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight

AIR, 306/6020, Chromium



Client Sample ID: 43ANAD001 DLS8455001

TOTAL Metals

Lot-Sample #...: G3F110295-001 Matrix.....: AIR
Date Sampled...: 06/03/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 34.2 J | 1.0 | ug | SW846 6020 | 06/17-06/25/03 | FQC6G1AA |
| | | Dilution Factor: 1 | | MDL.....: 0.46 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD004 DLS8455002

TOTAL Metals

Lot-Sample #...: G3F110295-002 Matrix.....: AIR
Date Sampled...: 06/03/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 20.4 J | 0.90 | ug | SW846 6020 | 06/17-06/25/03 | FQC6V1AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD007 DLS8455003

TOTAL Metals

Lot-Sample #...: G3F110295-003 Matrix.....: AIR
Date Sampled...: 06/03/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 14.5 J | 0.90 | ug | SW846 6020 | 06/17-06/25/03 | FQC651AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD013 DLS8455004

TOTAL Metals

Lot-Sample #...: G3F110295-004 Matrix.....: AIR
Date Sampled...: 06/04/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 25.2 J | 0.90 | ug | SW846 6020 | 06/17-06/25/03 | FQC671AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD016 DLS8455005

TOTAL Metals

Lot-Sample #...: G3P110295-005 Matrix.....: AIR
Date Sampled...: 06/04/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 9.2 J | 0.89 | ug | SW846 6020 | 06/17-06/25/03 | FQC691AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD019 DLS8455018

TOTAL Metals

Lot-Sample #...: G3F110295-006 Matrix.....: AIR
Date Sampled...: 06/04/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 17.9 J | 0.90 | ug | SW846 6020 | 06/17-06/25/03 | FQC7C1AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD023 DLS8455019

TOTAL Metals

Lot-Sample #...: G3F110295-007 Matrix.....: AIR
Date Sampled...: 06/05/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 31.7 J | 0.90 | ug | SW846 6020 | 06/17-06/25/03 | FQC7G1AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD026 DLS8455020

TOTAL Metals

Lot-Sample #...: G3F110295-008 Matrix.....: AIR
Date Sampled...: 06/05/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 30.0 J | 0.90 | ug | SW846 6020 | 06/17-06/25/03 | FQC7B1AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD029 DLS8455021

TOTAL Metals

Lot-Sample #...: G3F110295-009 Matrix.....: AIR
Date Sampled...: 06/05/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 34.2 J | 0.90 | ug | SW846 6020 | 06/17-06/25/03 | FQC7P1AA |
| | | Dilution Factor: 1 | | MDL.....: 0.41 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD010 DLS8455031

TOTAL Metals

Lot-Sample #...: G3F110295-010 Matrix.....: AIR
Date Sampled...: 06/03/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 0.66 B,J | 0.99 | ug | SW846 6020 | 06/17-06/25/03 | FQC7T1AA |
| | | Dilution Factor: 1 | | MDL.....: 0.46 | | |

NOTE(S):

B Estimated result. Result is less than RL.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD022 DLS8455032

TOTAL Metals

Lot-Sample #...: G3F110295-011 Matrix.....: AIR
Date Sampled...: 06/04/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 0.76 B,J | 0.99 | ug | SW846 6020 | 06/17-06/25/03 | FQC701AA |
| | | Dilution Factor: 1 | | MDL.....: 0.46 | | |

NOTE(S):

B Estimated result. Result is less than RL.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Client Sample ID: 43ANAD032 DLS8455033

TOTAL Metals

Lot-Sample #...: G3F110295-012 Matrix.....: AIR
Date Sampled...: 06/05/03 Date Received..: 06/11/03

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER |
|---|---|---|---|---|---|---|
| Prep Batch #...: 3170438 | | | | | | |
| Chromium | 1.1 J | 0.99 | ug | SW846 6020 | 06/17-06/25/03 | FQC71 |
| | | Dilution Factor: 1 | | MDL.....: 0.46 | | |

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

# QC DATA ASSOCIATION SUMMARY

G3F110295

Sample Preparation and Analysis Control Numbers

| SAMPLE# | MATRIX | ANALYTICAL METHOD | LEACH BATCH # | PREP BATCH # | MS RUN# |
|---|---|---|---|---|---|
| 001 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 002 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 003 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 004 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 005 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 006 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 007 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 008 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 009 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 010 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 011 | AIR | SW846 6020 | | 3170438 | 3170181 |
| 012 | AIR | SW846 6020 | | 3170438 | 3170181 |

METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: G3F110295 Matrix.....: AIR

| PARAMETER | RESULT | REPORTING LIMIT | UNITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|
| MB Lot-Sample #: G3F190000-438 Prep Batch #...: 3170438 | | | | | | |
| Chromium | 0.43 B | 0.89 | ug | SW846 6020 | 06/17-06/25/03 | FQVFS1AA |

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

B Estimated result. Result is less than RL.

LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Lot-Sample #...: G3F110295 Matrix.....: AIR

| PARAMETER | SPIKE AMOUNT | MEASURED AMOUNT | UNITS | PERCNT RECVRY | RPD | METHOD | PREPARATION-ANALYSIS DATE | PREP BATCH # |
|---|---|---|---|---|---|---|---|---|
| Chromium | 89.0 | 87.5 | ug | 98 | | SW846 6020 | 06/17-06/25/03 | 3170438 |
| | 89.0 | 86.5 | ug | 97 | 1.2 | SW846 6020 | 06/17-06/25/03 | 3170438 |

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

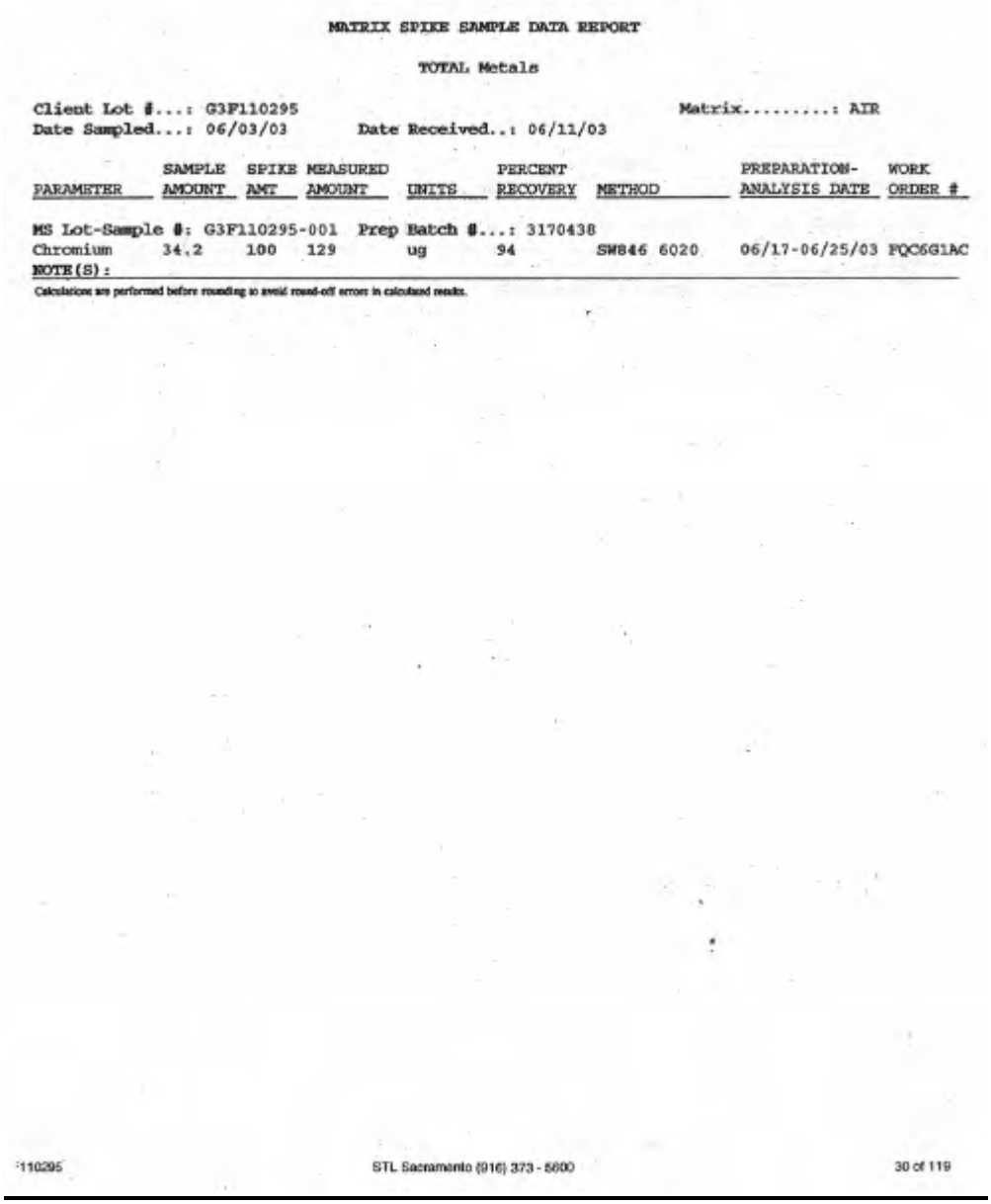
TOTAL Metals

Lot-Sample #...: G3F110295 Matrix.....: AIR

| PARAMETER | PERCENT RECOVERY | RECOVERY LIMITS | RPD | RPD LIMITS | METHOD | PREPARATION-ANALYSIS DATE | PREP-BATCH # |
|---|---|---|---|---|---|---|---|
| Chromium | 98 | (82 - 119) | | | SW846 6020 | 06/17-06/25/03 | 3170438 |
| | 97 | (82 - 119) | 1.2 | (0-20) | SW846 6020 | 06/17-06/25/03 | 3170438 |

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.



MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: G3F110295 Matrix.....: AIR
Date Sampled...: 06/03/03 Date Received..: 06/11/03

| PARAMETER | SAMPLE AMOUNT | SPIKE AMT | MEASURED AMOUNT | UNITS | PERCENT RECOVERY | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|---|---|---|
| MS Lot-Sample #: G3F110295-001 Prep Batch #...: 3170438 | | | | | | | | |
| Chromium | 34.2 | 100 | 129 | ug | 94 | SW846 6020 | 06/17-06/25/03 | FQC6G1AC |

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: G3F110295 Matrix.....: AIR
Date Sampled...: 06/03/03 Date Received..: 06/11/03

| PARAMETER | PERCENT RECOVERY | RECOVERY LIMITS | METHOD | PREPARATION-ANALYSIS DATE | WORK ORDER # |
|---|---|---|---|---|---|
| MS Lot-Sample #: G3F110295-001 Prep Batch #...: 3170438 | | | | | |
| Chromium | 94 | (82 - 119) | SW846 6020 | 06/17-06/25/03 | FQC6G1AC |

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

SAMPLE DUPLICATE EVALUATION REPORT

Metals

Client Lot #...: G3F110295 Work Order #...: FQC6G-SMP Matrix.....: AIR
FQC6G-DUP
Date Sampled...: 06/03/03 Date Received..: 06/11/03

| PARAM | RESULT | DUPLICATE RESULT | UNITS | RPD | RPD LIMIT | METHOD | PREPARATION-ANALYSIS DATE | PREP BATCH # |
|---|---|---|---|---|---|---|---|---|
| Chromium | | | | | | SD Lot-Sample #: G3F110295-001 | | |
| | 34.2 J | 35.6 | ug | 3.9 | (0-20) | SW846 6020 | 06/17-06/25/03 | 3170438 |

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Air Pollution Management Study No. 43-EL-5116-03, 3-

TSP SAMPLER ANALYTICAL PACKAGE

CASE NARRATIVE
Microbac Laboratories, Inc., Gascoyne Division

Report Number: 0306390 July 8, 2003

Report To: U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM)
Aberdeen Proving Ground, MD 21010-5422
**Project #DAAD05-01-D-0006 Metals**



Pick-Up Order: 051/3
Date Samples Received: 06/17/03

Sample Numbers: 8455006 – 8455017, 8455022 – 8455030 Matrix: Air Filter

Twenty-one samples were transported to Microbac Laboratories, Inc., Gascoyne Division via laboratory courier and were relinquished to lab personnel in the sample control department for log-in. The sample containers were checked and were noted to be in satisfactory condition. The Field ID for sample 8455025 was incorrectly identified on the Pick-up Order, compared to the sample container. The USACHPPM COR was notified and the laboratory was instructed to correct the ID on the paperwork.

Requested test parameters performed by Microbac Laboratories, Inc., Gascoyne Division:

* Metals analysis, using EPA SW-846 methodology

References:

Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Office of Solid Waste and Emergency Response, USEPA, Wash.,DC, November 1986; Final Update I, July 1992 Final Update II, September 1994 Final Update III, December 1996

NOTE: Exceptions to the requested test parameters are as follows: The requested analysis on the Pick-up Order was EPA 200.8. Since the samples were air filters, the USACHPPM COR was notified and the laboratory was instructed to change the requested test to EPA 6020.

All laboratory quality control parameters were met with the following exceptions:

1. The concentrations of the Matrix Spike and Matrix Spike Duplicate (0306390-001 8455006) were inappropriate compared to the native concentration in the sample. The sample was diluted and reanalyzed. Recoveries of Post Digestion Spikes were acceptable.

Enclosed are the following:

1. Report of Analysis (original plus one copy)
2. Chain-of-Custody (original plus one copy)
3. Pick-Up Order/Delivery Order (original plus one copy)
4. Laboratory Chronicle / Case Narrative (original plus one copy)
5. Quality Control Summary Report (original plus one copy)
6. Raw data (one copy)

Microbac Laboratories, Inc., Gascoyne Division

June A. Main
Quality Assurance Officer

CASE NARRATIVE
**Microbac Laboratories, Inc., Gascoyne Division**

Report Number: 0306390 July 8, 2003

Report To: U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM)
Aberdeen Proving Ground, MD 21010-5422
**Project #DAAD05-01-D-0006 Metals**



Pick-Up Order: 051/3
Date Samples Received: 06/17/03

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* Metals analysis, using EPA SW-846 methodology

References:

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4. Laboratory Chronicle / Case Narrative (original plus one copy)
5. Quality Control Summary Report (original plus one copy)
6. Raw data (one copy)

Microbac Laboratories, Inc., Gascoyne Division

June A. Main
Quality Assurance Officer

Microbac
www.microbac.com

**Microbac Laboratories, Inc.**
Gascoyne Division

2101 Van Deman Street
Baltimore, MD 21224

Phone: 410-633-1800
Fax: 410-633-6553
www.gascoyne.com

# REPORT OF ANALYSIS

USACHPPM-Metals
Contract #DAAD05-01-D-0006
Bldg E2100, Rm 201
APG, MD 21010-5422
Attn: Richard Puzniak



Report No. 0306390

This report of analysis contains test results for samples received at Microbac Laboratories, Inc., Gascoyne Division on 6/17/2003

This Data Package contains the following:

- This Cover Page
- Sample Summary
- Test Results
- Case Narrative [Attachment]
- QC Report [Attachment]
- Terms and Conditions [Attachment]
- Chain of Custody [Attachment]

This Report of Analysis Contains 24 Pages plus Attachment(s)

Final report reviewed by: Wen H. Pan, Ph.D. Laboratory Director 7-8-2003 Report issue date

Microbac Laboratories, Inc. Gascoyne Division- laboratory accreditations: Maryland 109, Virginia 00152, New Jersey 60637, Pennsylvania 68-339, New York 11158, A2LA 410.01, AIHA 100491 and US Army Corps of Engineers.

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# REPORT OF ANALYSIS
## Sample Summary



**Client:** USACHPPM-Metals
**Project:** 27678-5116
**Report No:** 0306390
**Date Received:** 6/17/2003

| Client Sample ID | Lab Sample ID | Collection Date | Collection Time |
|---|---|---|---|
| 8455006 43ANAD002 | 0306390-001 | 6/3/2003 | 0:00 |
| 8455007 43ANAD003 | 0306390-002 | 6/3/2003 | 0:00 |
| 8455008 43ANAD005 | 0306390-003 | 6/3/2003 | 0:00 |
| 8455009 43ANAD006 | 0306390-004 | 6/3/2003 | 0:00 |
| 8455010 43ANAD008 | 0306390-005 | 6/3/2003 | 0:00 |
| 8455011 43ANAD009 | 0306390-006 | 6/3/2003 | 0:00 |
| 8455012 43ANAD011 (Field Blank) | 0306390-007 | | |
| 8455013 43ANAD012 (Trip Blank) | 0306390-008 | | |
| 8455014 43ANAD014 | 0306390-009 | 6/4/2003 | 0:00 |
| 8455015 43ANAD015 | 0306390-010 | 6/4/2003 | 0:00 |
| 8455016 43ANAD017 | 0306390-011 | 6/4/2003 | 0:00 |
| 8455017 43ANAD018 | 0306390-012 | 6/4/2003 | 0:00 |
| 8455022 43ANAD020 | 0306390-013 | 6/4/2003 | 0:00 |
| 8455023 43ANAD021 | 0306390-014 | 6/4/2003 | 0:00 |
| 8455024 43ANAD024 | 0306390-015 | 6/5/2003 | 0:00 |
| 8455025 43ANAD025 | 0306390-016 | 6/5/2003 | 0:00 |
| 8455026 43ANAD027 | 0306390-017 | 6/5/2003 | 0:00 |
| 8455027 43ANAD028 | 0306390-018 | 6/5/2003 | 0:00 |
| 8455028 43ANAD030 | 0306390-019 | 6/5/2003 | 0:00 |

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Sample Summary
REPORT OF ANALYSIS



**Client:** USACHPPM-Metals
**Project:** 27678-5116
**Report No:** 0306390
**Date Received:** 6/17/2003

| Client Sample ID | Lab Sample ID | Collection Date | Collection Time |
|---|---|---|---|
| 8455029 43ANAD031 | 0306390-020 | 6/5/2003 | 0:00 |
| 8455030 43ANAD033 (Blank) | 0306390-021 | | |

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Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455006 43ANAD002 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-001 |
| **Matrix:** | FILTER | **Collection Date:** | 6/3/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:06 AM | | Prep Analyst | MCA |
| Chromium | 24,000 | 150 | ug/Filter | 7/1/2003 19:59 |

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# REPORT OF ANALYSIS
Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455007 43ANAD003 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-002 |
| **Matrix:** | FILTER | **Collection Date:** | 6/3/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 12,000 | 60 | ug/Filter | 7/1/2003 20:24 |

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# REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455008 43ANAD005 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-003 |
| **Matrix:** | FILTER | **Collection Date:** | 6/3/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 1,800 | 3.0 | ug/Filter | 7/1/2003 15:13 |

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## REPORT OF ANALYSIS
Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455009 43ANAD006 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-004 |
| | | **Collection Date:** | 6/3/2003 0:00 |
| **Matrix:** | FILTER | | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 810 | 3.0 | ug/Filter | 7/1/2003 15:18 |

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# REPORT OF ANALYSIS
Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455010 43ANAD008 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-005 |
| **Matrix:** | FILTER | **Collection Date:** | 6/3/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:05 AM | | Prep Analyst MCA | |
| Chromium | 720 | 3.0 | ug/Filter | 7/1/2003 15:22 |

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## REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455011 43ANAD009 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-006 |
| | | **Collection Date:** | 6/3/2003 0:00 |
| **Matrix:** | FILTER | | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 290 | 3.0 | ug/Filter | 7/1/2003 15:27 |

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# REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455012 43ANAD011 (Field Blank) |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-007 |
| **Matrix:** | FILTER | **Collection Date:** | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: | 7/1/2003 9:31:08 AM | Prep Analyst | MCA |
| Chromium | 29 | 3.0 | ug/Filter | 7/1/2003 15:32 |

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# REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455013 43ANAD012 (Trip Blank) |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-008 |
| **Matrix:** | FILTER | **Collection Date:** | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 31 | 3.0 | ug/Filter | 7/1/2003 15:37 |

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Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455014 43ANAD014 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-009 |
| | | **Collection Date:** | 6/4/2003 0:00 |
| **Matrix:** | FILTER | | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst MCA | |
| Chromium | 3,800 | 3.0 | ug/Filter | 7/1/2003 15:42 |

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## REPORT OF ANALYSIS
Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455015 43ANAD015 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-010 |
| **Matrix:** | FILTER | **Collection Date:** | 6/4/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 1,100 | 3.0 | ug/Filter | 7/1/2003 16:05 |

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## REPORT OF ANALYSIS
Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455016 43ANAD017 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-011 |
| **Matrix:** | FILTER | **Collection Date:** | 6/4/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 3,600 | 3.0 | ug/Filter | 7/1/2003 16:10 |

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# REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455017 43ANAD018 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-012 |
| **Matrix:** | FILTER | **Collection Date:** | 6/4/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 840 | 3.0 | ug/Filter | 7/1/2003 16:15 |

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Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455022 43ANAD020 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-013 |
| **Matrix:** | FILTER | **Collection Date:** | 6/4/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| **ICPMS METALS-AIR FILTERS ( EPA 6020 )** | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst MCA | |
| Chromium | 1,600 | 3.0 | ug/Filter | 7/1/2003 16:20 |

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# REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455023 43ANAD021 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-014 |
| **Matrix:** | FILTER | **Collection Date:** | 6/4/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:06 AM | | Prep Analyst | MCA |
| Chromium | 710 | 3.0 | ug/Filter | 7/1/2003 16:25 |

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## REPORT OF ANALYSIS

Test Results

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| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455024 43ANAD024 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-015 |
| **Matrix:** | FILTER | **Collection Date:** | 6/5/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: | 7/1/2003 9:31:00 AM | Prep Analyst | MCA |
| Chromium | 24,000 | 150 | ug/Filter | 7/1/2003 20:57 |

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## REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455025 43ANAD025 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-016 |
| | | **Collection Date:** | 6/5/2003 0:00 |
| **Matrix:** | FILTER | | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: | 7/1/2003 9:31:08 AM | Prep Analyst | MCA |
| Chromium | 4,900 | 3.0 | ug/Filter | 7/1/2003 16:35 |

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Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455026 43ANAD027 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-017 |
| | | **Collection Date:** | 6/5/2003 0:00 |
| **Matrix:** | FILTER | | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 8:31:08 AM | | Prep Analyst | MCA |
| Chromium | 18,000 | 150 | ug/Filter | 7/1/2003 21:02 |

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REPORT OF ANALYSIS
Test Results

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| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455027 43ANAD028 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-018 |
| **Matrix:** | FILTER | **Collection Date:** | 6/5/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 8:31:08 AM | | Prep Analyst | MCA |
| Chromium | 3,800 | 3.0 | ug/Filter | 7/1/2003 16:45 |

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# REPORT OF ANALYSIS
## Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455028 43ANAD030 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-019 |
| **Matrix:** | FILTER | **Collection Date:** | 6/5/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| **ICPMS METALS-AIR FILTERS ( EPA 6020 )** | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 13,000 | 60 | ug/Filter | 7/1/2003 21:07 |

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# REPORT OF ANALYSIS
Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455029 43ANAD031 |
| **Report No:** | 0306390 | | |
| **Project:** | 27678-5116 | **Lab ID:** | 0306390-020 |
| **Matrix:** | FILTER | **Collection Date:** | 6/5/2003 0:00 |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:08 AM | | Prep Analyst | MCA |
| Chromium | 2,000 | 3.0 | ug/Filter | 7/1/2003 17:13 |

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# REPORT OF ANALYSIS

Test Results



| | | | |
|---|---|---|---|
| **Client:** | USACHPPM-Metals | **Client Sample ID:** | 8455030 43ANAD033 (Blank) |
| **Report No:** | 0306390 | **Lab ID:** | 0306390-021 |
| **Project:** | 27678-5116 | **Collection Date:** | |
| **Matrix:** | FILTER | | |

| Analyses | Test Results | Reporting Limit | Units | Date/Time Analyzed |
|---|---|---|---|---|
| ICPMS METALS-AIR FILTERS ( EPA 6020 ) | | | | Analyst: PBK |
| Prep. Method: 40 CFR-50 | Prep. Date: 7/1/2003 9:31:06 AM | | Prep Analyst MCA | |
| Chromium | 43 | 3.0 | ug/Filter | 7/1/2003 17:18 |

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

APPENDIX I

CALIBRATION PROCEDURES AND DATA

1. CALIBRATION SUMMARY. The calibration procedures are summarized in Table I-1.

Table I-1. Calibration Procedures

| PARAMETER | METHOD/STANDARD | REFERENCE |
|---|---|---|
| Meter Box Orifice | Wet Test Meter | APTD-0576[1] |
| Dry Gas Meter | Wet Test Meter | APTD-0576[1] |
| Pyrometer | NBS Reference Pyrometer | USEPA RM 5[2,3] |
| Pitot Tube | Geometry | USEPA RM 2[2,3] |
| Thermometer/Thermocouple | Reference Pyrometer | USEPA RM 2[2,3] |
| Nozzle | Micrometer | USEPA RM 5[2,3] |
| Weights | Analytical Balance | USEPA RM 5[2,3] |
| Orsat Analyzer | Calibration Gas | USEPA RM 3[2] |

[1] reference 4
[2] reference 1
[3] reference 3

2. DRY GAS METER. The dry gas meters were calibrated prior to the assessment using a wet test meter (Figure I-1) in accordance with USEPA approved procedures. Prior to the assessment, the average dry gas meter coefficient was 1.009 for meter box 90496. The posttest calibration check was performed with the orifice setting at the average ΔH experienced by the box during the test and the vacuum setting at the highest vacuum that occurred during the test. The posttest average dry gas meter coefficient was 1.004 for meter box 90496. All posttest calibration values were within the allowable 5-percent variation of the pretest value. The dry gas meter calibration data sheets are provided in this Appendix.

3. ORIFICE. Prior to testing, the orifice of the dry gas meter system was calibrated at the orifice manometer settings of 0.0 to 4.0 inches of water. The posttest calibration values were within the allowable 5-percent variation limit.

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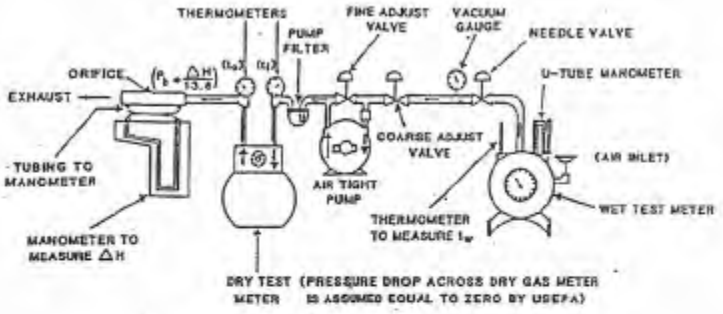


$$Y = \frac{V_w \, P_b \, (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right) (t_w + 460)}$$

$$\Delta H@ = \frac{0.0317 \, (\Delta H)}{P_b \, (t_d + 460)} \left[\frac{(t_w + 460)\,\theta}{V_w}\right]^2$$

WHERE:

$\Delta H$ = ORIFICE PRESSURE DROP ( in $H_2O$)
$V_w$ = GAS VOLUME THROUGH WET TEST METER ($ft^3$)
$V_d$ = GAS VOLUME THROUGH DRY GAS METER ($ft^3$)
$t_w$ = WET TEST METER TEMP. (°F)
$t_d$ = AVERAGE DRY TEST METER TEMP. (°F) $\left(t_d = \frac{t_1 + t_2}{2}\right)$
$P_b$ = BAROMETRIC PRESSURE (in Hg)
$\theta$ = TIME (min)
$\Delta H@$ = ORIFICE PRESSURE DROP THAT GIVES 0.75 $ft^3$/min at 70°F, 29.92 in Hg ( in $H_2O$)
Y = DIMENSIONLESS DRY GAS METER CALIBRATION COEFFICIENT

Figure I-1. Dry Gas Meter Calibration

4. PITOT TUBE. The pitot tubes, located on the sampling probe assembly, were calibrated using the geometric standard (Figure I-2) noted in USEPA RM 2 (reference 1). Since the pitot tubes met the standard, a calibration coefficient of 0.84 was assigned to each tube. Pitot tube calibration sheets are included in this Appendix.

5. NOZZLE. As explained previously in this report, one-piece probe lines/nozzles were used in the test due to the high stack temperature. Two probe liners/nozzles were used during this assessment. The nozzle diameter for nozzle N-1 was measured with a micrometer accurate to 0.001 inch. The three measurements of the nozzle varied less than the maximum allowable tolerance of 0.004 inch. Nozzle N-1 averaged 0.249 inch diameter. These measurements were used in establishing isokinetic procedures.

6. TSP Equipment Calibration. The high-volume TSP samplers were calibrated and checked for leaks at the staging area prior to set up at the sample sites. A calibrated orifice transfer standard kit, traceable to NIST, was used to calculate each sampler's flow parameters. Calibration of the two high-volume samplers yielded acceptable correlation coefficients (r) greater than 0.990, as required by 40 CFR Part 50, Appendix B (see Appendix A). Flow checks were performed at the beginning and end of each sampling event to ensure proper equipment operation. Periodic flow checks during sampling events were also performed. Valid samples had flow rates between 1.1 and 1.7 $m^3$/min, and a total sample time of 2 hrs. The results of the flow checks were entered on TSP field data sheets (see Appendix G).

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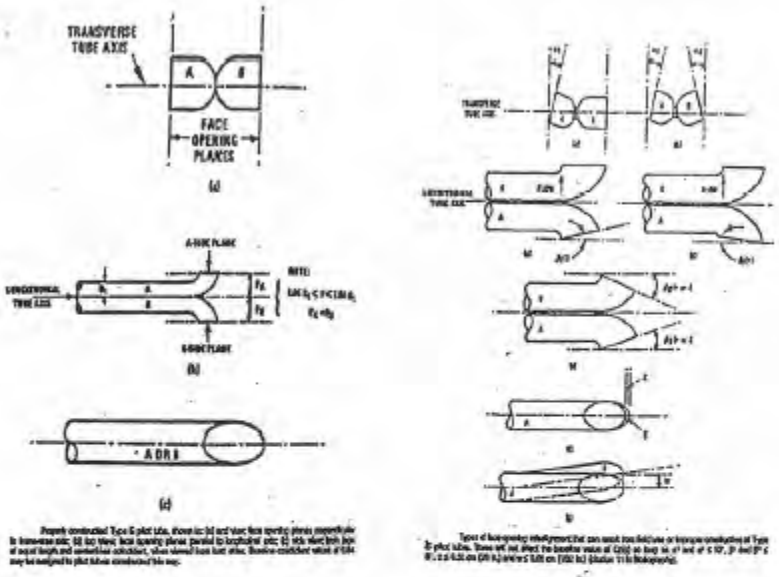


Figure I-2. Pitot Tube Geometric Calibration

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DRY GAS METER PRE/POST TEST CALIBRATION DATA SHEETS

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Calibration

Date 1/30/03 Meter box number 90496

Barometric pressure, $P_b$ = 30.15 in. Hg Calibrated by D BREMER

| Orifice manometer setting ($\Delta H$), in. $H_2O$ | Gas volume: Wet test meter ($V_w$), $ft^3$ | Gas volume: Dry gas meter ($V_d$), $ft^3$ | Temperatures: Wet test meter ($T_w$), °F | Temperatures: Dry gas meter: Inlet ($T_{di}$), °F | Temperatures: Dry gas meter: Outlet ($T_{do}$), °F | Temperatures: Dry gas meter: Avg ($T_d$), °F | Time ($\theta$), min | $Y_i$ | $\Delta H@$, in. $H_2O$ |
|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 5.0 | 5.032 | 73 | 90 | 79 | 84.5 | 9.06 | 1.013 | 1.61 |
| | | | | | | | | | |
| 2.0 | 5.0 | 5.048 | 73 | 93 | 79 | 86 | 6.51 | 1.010 | 1.85 |
| | | | | | | | | | |
| 4.0 | 5.0 | 5.061 | 73 | 96 | 80 | 87.5 | 4.68 | 1.005 | 1.91 |
| | | | | | | | | | |
| | | | | | | | Avg | 1.009 | 1.86 |

Vacuum 3 in. Hg.

| $\Delta H$, in. $H_2O$ | $\frac{\Delta H}{13.6}$ | $Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$ | $\Delta H@ = \frac{0.0317\,\Delta H}{P_b (t_d + 460)} \left[ \frac{(t_w + 460)\,\theta}{V_w} \right]^2$ |
|---|---|---|---|
| 1.0 | 0.074 | Meter Box | Wet Test Meter |
| 2.0 | 0.147 | Front Half Leak Check OK | Meter No. 11AL4 |
| 4.0 | 0.294 | Back Half Leak Check OK | Capacity 1 cf/rev. |
| | | Vacuum Gauge Check OK | Calibration Data 3 POINT |
| | | Thermometer Check (+/-)3° F | Leak Check OK |
| | | of ASTM HG) In OK Out OK | Water Level Check OK |

*If there is only one thermometer on the dry gas meter, record the temperature under $t_d$. CCD

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Post Calibration

Date 6/12/03 Meter box number 90496

Barometric pressure, $P_b$ = 29.92 in. Hg Calibrated by M. MCCARTER

| Orifice manometer setting ($\Delta H$), in. $H_2O$ | Gas volume: Wet test meter ($V_w$), $ft^3$ | Gas volume: Dry gas meter ($V_d$), $ft^3$ | Temperatures: Wet test meter ($T_w$), °F | Temperatures: Dry gas meter: Inlet ($T_{di}$), °F | Temperatures: Dry gas meter: Outlet ($T_{do}$), °F | Temperatures: Dry gas meter: Avg ($T_d$), °F | Time ($\theta$), min | $Y_i$ | $\Delta H@$, in. $H_2O$ |
|---|---|---|---|---|---|---|---|---|---|
| 1.5 | 5.0 | 5.096 | 71.5 | 92 | 79 | 85.5 | 7.58 | 1.003 | 1.89 |
| | | | | | | | | | |
| 1.5 | 5.0 | 5.088 | 71.5 | 92 | 80 | 86 | 7.57 | 1.006 | 1.88 |
| | | | | | | | | | |
| 1.5 | 5.0 | 5.097 | 71.5 | 92 | 80 | 86 | 7.58 | 1.004 | 1.89 |
| | | | | | | | | | |
| | | | | | | | Avg | 1.004 | 1.89 |

Vacuum 2.5 in. Hg.

| $\Delta H$, in. $H_2O$ | $\frac{\Delta H}{13.6}$ | $Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$ | $\Delta H@ = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[ \frac{(t_w + 460)\theta}{V_w} \right]^2$ |
|---|---|---|---|
| 1.5 | 0.110 | Meter Box | Wet Test Meter |
| | | Front Half Leak Check ok | Meter No. 11AL4 |
| | | Back Half Leak Check ok | Capacity 1 Cf/rev |
| | | Vacuum Gauge Check ok | Calibration Data 31 OCT 02 |
| | | Thermometer Check(+/-)3° F | Leak Check ok |
| | | of ASTM HG) In ok Out ok | Water Level Check ok |

*If there is only one thermometer on the dry gas meter, record the temperature under $t_d$.

llution Management Study No. 43-EL-5116-03, 3-5

PITOT TUBE CALIBRATION DATA SHEETS

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

PITOT NUMBER: I-5-3
INSPECTOR: D BREMER
DATE: 4/1/03

PITOT-NOZZLE-THERMOCOUPLE-PROBE CONFIGURATION

| | |
|---|---|
| 1. External Tubing Diameter, $D_t$(3/16" to 3/8") | 3/8 |
| 2. Base of Pitot to Opening Plane Distance, Impact, $P_A$(1.05 to 1.5$D_t$) | 0.557 |
| 0.3938 - 0.5625 A= 1.114 | |
| Static, $P_B$(1.05 to 1.5$D_t$) | 0.557 |
| 3. Angle between plane of impact face of pitot tube and transverse tube axis, $\alpha_1$(<10°) | 1° |
| 4. Angle between plane of static pitot tube face and transverse tube axis, $\alpha_2$(<10°) | 0 |
| 5. Angle between plane of impact pitot tube face and longitudinal axis, $\beta_1$(< +/- 5°) | 1° |
| 6. Angle between plane of static pitot tube face and longitudinal axis, $\beta_2$(< +/- 5°) | 0 |
| 7. Distance between leading tip of the impact and static tubes Z(<1/8") y = 0 A= 1.114 | z = 0 |
| 8. Distance between the transverse axes for the impact and static pitot faces, w(<1/32") θ = 0 A= 1.114 | w = 0 |
| 9. Pitot - Nozzle Separation, x (>3/4") | X > 3/4" |
| 10. Pitot plane above nozzle entry (yes) | YES |
| 11. Nozzle type (button hook) | YES |
| 12. Distance between thermocouple and pitot, Z (>3/4") | Z > 3/4" |
| 13. Distance between tangent to thermocouple body and centerline of impact opening, w (>3") | W > 3" |
| 14. Distance between gas line and centerline of impact opening, Z (>2") | Z > 2" |
| 15. Distance between sample probe ferrule and centerline of impact opening, Y (>3") | Y > 3" |

Air Pollution Management Study No. 43-EL-5116-03, 3-

TSP SAMPLER CALIBRATION DATA SHEETS

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

## TSP SAMPLER CALIBRATION DATA SHEET

WEST

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Cal Date: | 24 Mar 03 |
| Site ID: | Chrome Plating Facility | Site Elev. (Ft): | N/A |
| Operator: | Sutphin | Sampler S/N: | 0510 |
| Pa (mm Hg): | 763.0 | OrificeS/N: | 0113 |
| Ta (°K): | 299.0 | | |
| Equip. Type: | Graseby TSP Sampler | | |

Orifice Calibration Values: m= 2.0134
Orifice Cal Date: 03/14/03 b= -0.0610
r= 0.9997

| Plate Number | Delta H (in H2O) | Qstd (X) (m3/min) | Delta Pex (in H2O) | Y | Y cal. | Dev (%) |
|---|---|---|---|---|---|---|
| 18 | 10.10 | 1.609 | 6.20 | 2.374 | 2.379 | -0.185 |
| 13 | 8.10 | 1.444 | 5.00 | 2.132 | 2.137 | -0.207 |
| 10 | 6.50 | 1.297 | 4.10 | 1.931 | 1.920 | 0.543 |
| 7 | 3.90 | 1.011 | 2.50 | 1.508 | 1.501 | 0.427 |
| 5 | 2.50 | 0.816 | 1.60 | 1.206 | 1.214 | -0.660 |

**Standard Condition Regression**

| | |
|---|---|
| Correlation Coeff. (R) | 0.9999 |
| Intercept Coefficient (b) | 0.0166 |
| Slope (m) | 1.4679 |
| Observations | 5 |

**Samplers Regression Values:**

m= 1.4679
b= 0.0166
r= 0.9999

**Formulas and Definitions**

Qstd=[Delta H(Pa/760)(298/Ta)]$^{1/2}$ -b (1/m)
Y = [Delta Pex (Pa/760)(298/Ta+30)]$^{1/2}$
Delta H= Cal. Orifice Pressure Drop.
Delta Pex= Sampler Motor Pressure Drop
Ycal = Sampler (m) x Qstd + Sampler (b)
Pa & Ta=Ambient Bp & Temp. During Cal.
Baro. pressure (Bp) elevation correction is -0.1 inch Hg per 100 feet above Sea Level.

Site Elev. = Used For Bp Correction
Qstd = X-axis
Y = Y-axis
Dev = (Y- Ycal)/Ycal(100)
Dev = + or - 5%

Proponent of this form is USACHPPM (MCHB-DC-EAQ), APG,MD 21010-5422

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

## TSP SAMPLER CALIBRATION DATA SHEET
EAST

| | | | |
|---|---|---|---|
| Installation: | Anniston Army Depot | Cal Date: | 24 Mar 03 |
| Site ID: | Chrome Plating Facility | Site Elev. (Ft): | N/A |
| Operator: | Sutphin | Sampler S/N: | 6631 |
| Pa (mm Hg): | 763.0 | Orifice S/N: | 0113 |
| Ta (°K): | 299.0 | | |
| Equip. Type: | Graseby TSP Sampler | | |

| | | | |
|---|---|---|---|
| Orifice Calibration Values: | | m= | 2.0134 |
| Orifice Cal Date: | 03/14/03 | b= | -0.0610 |
| | | r= | 0.9997 |

| Plate Number | Delta H (in H2O) | Qstd (X) (m3/min) | Delta Pex (in H2O) | Y | Y cal. | Dev (%) |
|---|---|---|---|---|---|---|
| 18 | 9.20 | 1.537 | 6.60 | 2.450 | 2.452 | -0.097 |
| 13 | 7.60 | 1.400 | 5.50 | 2.236 | 2.243 | -0.290 |
| 10 | 6.30 | 1.277 | 4.70 | 2.067 | 2.056 | 0.557 |
| 7 | 3.90 | 1.011 | 3.00 | 1.652 | 1.651 | 0.069 |
| 5 | 2.50 | 0.816 | 2.00 | 1.349 | 1.352 | -0.275 |

**Standard Condition Regression**

| | |
|---|---|
| Correlation Coeff. (R) | 0.9999 |
| Intercept Coefficient (b) | 0.1084 |
| Slope (m) | 1.5247 |
| Observations | 5 |

**Samplers Regression Values:**

| | |
|---|---|
| m= | 1.5247 |
| b= | 0.1084 |
| r= | 0.9999 |

**Formulas and Definitions**

Qstd=[Delta H(Pa/760)(298/Ta)]$^{1/2}$ -b (1/m)
Y = [Delta Pex (Pa/760)(298/Ta+30)]$^{1/2}$
Delta H= Cal. Orifice Pressure Drop.
Delta Pex= Sampler Motor Pressure Drop
Ycal = Sampler (m) x Qstd + Sampler (b)
Pa & Ta=Ambient Bp & Temp. During Cal.
Baro. pressure (Bp) elevation correction is -0.1 inch Hg per 100 feet above Sea Level.

Site Elev. = Used For Bp Correction
Qstd = X-axis
Y = Y-axis
Dev = (Y- Ycal)/Ycal(100)
Dev = + or - 5%

Proponent of this form is USACHPPM (MCHB-DC-EAQ), APG,MD 21010-5422

ir Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

APPENDIX J

SAMPLE CUSTODY SHEETS

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLE CUSTODY SHEET
(USEPA RM 306 - TOTAL CHROMIUM)
RUN SAMPLES

Installation: Anniston Army Depot, Alabama Date: 4 June 2003

Project Officer: HILYARD Project No.: 43-EL-5116-03

| SAMPLE NO. | COMPONENT DESCRIPTION | VOL/ WT | RUN NO. | REMARKS |
|---|---|---|---|---|
| 43ANAD001 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 526 g | 1 | 0.1 N NaOH Rinse |
| 43ANAD004 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 ml | 2 | 0.1 N NaOH Rinse |
| 43ANAD007 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 ml | 3 | 0.1 N NaOH Rinse |
| 43ANAD013 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 ml | 4 | 0.1 N NaOH Rinse |
| 43ANAD016 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 ml | 5 | 0.1 N NaOH Rinse |
| Total Chromium | | | | |

Samples Recovered By: Jon M McCarter Samples Received By: [signature]

**********

Relinquished By: [signature] Received By: Jon M McCarter

Relinquished By: Jon M McCarter Received By: Allyson Berkshire

Relinquished By: _____ Received By: _____

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLE CUSTODY SHEET
(TSP SAMPLERS - TOTAL CHROMIUM)
RUN SAMPLES

Installation: Anniston Army Depot, Alabama Date: 3 June 2003

Project Officer: HILYARD Project No.: 43-EL-5116-03

| SAMPLE NO. | COMPONENT DESCRIPTION | VOL/ WT | RUN NO. | REMARKS |
|---|---|---|---|---|
| 43ANAD002 | TSP Filter | N/A | 1 | Q0113427 West |
| 43ANAD003 | TSP Filter | N/A | 1 | Q0113426 East |
| 43ANAD005 | TSP Filter | N/A | 2 | Q0113425 West |
| 43ANAD006 | TSP Filter | N/A | 2 | Q0113424 East |
| 43ANAD008 | TSP Filter | N/A | 3 | Q0113423 West |
| 43ANAD009 | TSP Filter | N/A | 3 | Q0113422 East |
| Total Chromium | MET 675F Chromium<br>MET 701 Prep | | | |

Samples Recovered By: _____ Samples Received By: _____

**********

Relinquished By: _____ Received By: _____

Relinquished By: _____ Received By _____

Relinquished By: _____ Received By: _____

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLE CUSTODY SHEET
(TSP SAMPLERS - TOTAL CHROMIUM)
RUN SAMPLES

Installation: Anniston Army Depot, Alabama Date: 4 June 2003

Project Officer: HILYARD Project No.: 43-EL-5116-03

| SAMPLE NO. | COMPONENT DESCRIPTION | VOL/ WT | RUN NO. | REMARKS |
|---|---|---|---|---|
| 43ANAD011 | TSP Filter Q0113416 | N/A | Blank | Field Blank |
| 43ANAD012 | TSP Filter Q0113417 | N/A | Blank | Trip Blank |
| 43ANAD014 | TSP Filter Q0113421 | N/A | 4 | West |
| 43ANAD015 | TSP Filter Q0113420 | N/A | 4 | East |
| 43ANAD017 | TSP Filter Q0113419 | N/A | 5 | West |
| 43ANAD018 | TSP Filter Q0113418 | N/A | 5 | East |
| Total Chromium MET676P Chromium<br>MET701 Prep | | | | |

Samples Recovered By: [signature] Samples Received By: [signature]

**********

Relinquished By: [signature] Received By: [signature]

Relinquished By: [signature] Received By: [signature]

Relinquished By: _____ Received By: _____

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLE CUSTODY SHEET
(USEPA RM 306 - TOTAL CHROMIUM)
RUN SAMPLES

Installation: Anniston Army Depot, Alabama Date: 4 June 2003

Project Officer: HILYARD Project No.: 43-EL-5116-03

| SAMPLE NO. | COMPONENT DESCRIPTION | VOL/ WT | RUN NO. | REMARKS |
|---|---|---|---|---|
| 43ANAD019 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 mL | 6 | 0.1 N NaOH Rinse |
| 43ANAD023 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 mL | 7 | 0.1 N NaOH Rinse |
| 43ANAD026 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 mL | 8 | 0.1 N NaOH Rinse |
| 43ANAD029 | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | 450 mL | 9 | 0.1 N NaOH Rinse |
| 43ANAD | Probe/FH Rinse plus Impinger Contents plus Impinger Rinse | | | 0.1 N NaOH Rinse |
| Total Chromium | | | | |

Samples Recovered By: Jon M McEuen Samples Received By: [signature]

**********

Relinquished By: [signature] Received By: Jon M McEuen

Relinquished By: Jon M McEuen Received By: Alyson Berkshire

Relinquished By: _____ Received By: _____

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLE CUSTODY SHEET
(TSP SAMPLERS - TOTAL CHROMIUM)
RUN SAMPLES

Installation: Anniston Army Depot, Alabama Date: 4 June 2003

Project Officer: HILYARD Project No.: 43-EL-5116-03

| SAMPLE NO. | COMPONENT DESCRIPTION | VOL/ WT | RUN NO. | REMARKS |
|---|---|---|---|---|
| 43ANAD 020 | TSP Filter Q0113415 | N/A | 6 | WEST |
| 43ANAD 021 | TSP Filter Q0113414 | N/A | 6 | EAST |
| 43ANAD 024 | TSP Filter Q0113413 | N/A | 7 | WEST |
| 43ANAD 025 | TSP Filter Q0113412 | N/A | 7 | EAST |
| 43ANAD 027 | TSP Filter Q0113411 | N/A | 8 | WEST |
| 43ANAD 028 | TSP Filter Q0113410 | N/A | 8 | EAST |
| Total Chromium MET675 F Chromium<br>MET701 Prep | | | | |

Samples Recovered By: [signature] Samples Received By: [signature]

**********

Relinquished By: [signature] Received By: [signature]

Relinquished By: [signature] Received By: [signature]

Relinquished By: _____ Received By: _____

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLE CUSTODY SHEET
(TSP SAMPLERS - TOTAL CHROMIUM)
RUN SAMPLES

Installation: Anniston Army Depot, Alabama Date: 6 June 2003

Project Officer: HILYARD Project No.: 43-EL-5116-03

| SAMPLE NO. | COMPONENT DESCRIPTION | VOL/ WT | RUN NO. | REMARKS |
|---|---|---|---|---|
| 43ANAD030 | TSP Filter Q0113469 | N/A | 9 | WEST |
| 43ANAD031 | TSP Filter Q0113468 | N/A | 9 | EAST |
| 43ANAD033 | TSP Filter Q0113428 | N/A | Blank | Lab Blank |
| 43ANAD | TSP Filter | N/A | Blank | |
| 43ANAD | TSP Filter | N/A | Blank | |
| 43ANAD | TSP Filter | N/A | | |
| Total Chromium MET675F Chromium<br>MET701 Prep | | | | |

Samples Recovered By: [signature] Samples Received By: C&D

**********

Relinquished By: C&D Received By: Jan McCants

Relinquished By: Jan McCants Received By: Alyson Berkshire

Relinquished By: _____ Received By: _____

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

SAMPLE CUSTODY SHEET
(USEPA RM 306 - Total Chromium)
BLANK SAMPLES

Installation: Anniston Army Depot, Alabama , Date: 3 June 2003

Project Officer: HILYARD Project No.: 43-EL-5116-03

| SAMPLE NO. | COMPONENT DESCRIPTION | VOL/ WT | RUN NO. | REMARKS |
|---|---|---|---|---|
| 43ANADBID | 0.1 N NaOH | 500 ml | - Blank | Run 1, 2, 3 |
| 43 ANAD022 | 0.1 N NaOH | 500 ml | Blank | Runs 4-6 |
| 43ANAD032 | 0.1 N NaOH | 500 ml | Blank | Runs 7-8 |
| Total Chromium | | | | |

Samples Recovered By: [signature] Samples Received By: [signature]

**********

Relinquished By: [signature] Received By: [signature]

Relinquished By: [signature] Received By: [signature]

Relinquished By: _____ Received By: _____

: Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

APPENDIX K

CHROMIUM CONCENTRATION/EMISSION DATA

Air Pollution Management Study No. 43-EL-5116-03, 3-5 June 2003

**PROJECT: 43 EL-5116-03 - Zero Chromium Emission Study**
**INSTALLATION: ANNISTON ARMY DEPOT, AL**
**SOURCE: CHROME PLATING FINISHING COMPLEX, BLDG 114**

Filter Dia = 0.00 in Filter Area = 0.00 sq in
FH Amicro = 0.00 micrograms BH micro = 0.00 micrograms

**Blank Data:**

| | Cr | | Mass (ug) |
|---|---|---|---|
| NaOH Blank Runs 1-3 | 0.6600 | TSP Field Blank | 29 |
| NaOH Blank Runs 4-6 | 0.7600 | TSP Trip Blank | 31 |
| NaOH Blank Runs 7-9 | 1.1000 | TSP Lab Blank | 43 |

non-dectects reported at 0.00 to allow for highest concentration

**Method 306**

| Run # | FH/BH | MBlank | TRAIN TOTAL |
|---|---|---|---|
| 1 | 34.20 | 0.66 | **33.54** |
| 2 | 20.40 | 0.66 | **19.74** |
| 3 | 14.50 | 0.66 | **13.84** |
| 4 | 25.20 | 0.76 | **24.44** |
| 5 | 9.20 | 0.76 | **8.44** |
| 6 | 17.90 | 0.76 | **17.14** |
| 7 | 31.70 | 1.10 | **30.60** |
| 8 | 30.00 | 1.10 | **28.90** |
| 9 | 34.20 | 1.10 | **33.10** |

**TSP Sampler (West)**

| Run # | Mass (ug) | Field Blank | Trip Blank | Lab Blank | Total |
|---|---|---|---|---|---|
| 1 | 24000 | 29.000 | 31.000 | 43.000 | **24000** |
| 2 | 1800 | 29.000 | 31.000 | 43.000 | **1800** |
| 3 | 720 | 29.000 | 31.000 | 43.000 | **720** |
| 4 | 3800 | 29.000 | 31.000 | 43.000 | **3800** |
| 5 | 3600 | 29.000 | 31.000 | 43.000 | **3600** |
| 6 | 1600 | 29.000 | 31.000 | 43.000 | **1600** |
| 7 | 24000 | 29.000 | 31.000 | 43.000 | **24000** |
| 8 | 18000 | 29.000 | 31.000 | 43.000 | **18000** |
| 9 | 13000 | 29.000 | 31.000 | 43.000 | **13000** |

**TSP Sampler (East)**

| Run # | Mass (ug) | Field Blank | Trip Blank | Lab Blank | Total |
|---|---|---|---|---|---|
| 1 | 12000 | 29.000 | 31.000 | 43.000 | **12000** |
| 2 | 810 | 29.000 | 31.000 | 43.000 | **810** |
| 3 | 290 | 29.000 | 31.000 | 43.000 | **290** |
| 4 | 1100 | 29.000 | 31.000 | 43.000 | **1100** |
| 5 | 840 | 29.000 | 31.000 | 43.000 | **840** |
| 6 | 710 | 29.000 | 31.000 | 43.000 | **710** |
| 7 | 4900 | 29.000 | 31.000 | 43.000 | **4900** |
| 8 | 3800 | 29.000 | 31.000 | 43.000 | **3800** |
| 9 | 2000 | 29.000 | 31.000 | 43.000 | **2000** |



lues in Italics Indicate Samples that were Below Analytical Detection Limit

Air Pollution Management Study No. 43-EL-5116-03, 3

**PROJECT: 43 EL-5116-03 - Zero Chromium Emission Study**
**INSTALLATION: ANNISTON ARMY DEPOT, AL**
**SOURCE: CHROME PLATING FINISHING COMPLEX, BLDG 114**

**CONCENTRATIONS / EMISSION RATES:**

**Metals Data**

| | | | | | | |
|---|---|---|---|---|---|---|
| Run 1 | Qs (dscf/hr) = | 871,212 | Vm (dscf)= | 76.39 | TSP West Volume (m3)= | 181.32 |
| | | | | | TSP East Volume (m3)= | 178.76 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0335 | 8.49E-07 | 1.93E+02 | 0.015 | | |
| TSP Sampler (West) | 24.00 | | | | 0.125 | |
| TSP Sampler (East) | 12.00 | | | | 0.067 | |
| Run 2 | Qs (dscf/hr) = | 876,645 | Vm (dscf)= | 74.68 | TSP West Volume (m3)= | 186.80 |
| | | | | | TSP East Volume (m3)= | 178.72 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0197 | 5.12E-07 | 1.16E+02 | 0.009 | | |
| TSP Sampler (West) | 1.80 | | | | 0.010 | |
| TSP Sampler (East) | 0.81 | | | | 0.005 | |
| Run 3 | Qs (dscf/hr) = | 826,609 | Vm (dscf)= | 73.87 | TSP West Volume (m3)= | 185.06 |
| | | | | | TSP East Volume (m3)= | 181.56 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0138 | 3.41E-07 | 7.73E+01 | 0.007 | | |
| TSP Sampler (West) | 0.72 | | | | 0.004 | |
| TSP Sampler (East) | 0.29 | | | | 0.002 | |
| Run 4 | Qs (dscf/hr) = | 952,743 | Vm (dscf)= | 79.18 | TSP West Volume (m3)= | 186.51 |
| | | | | | TSP East Volume (m3)= | 182.92 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0244 | 6.48E-07 | 1.47E+02 | 0.011 | | |
| TSP Sampler (West) | 3.80 | | | | 0.020 | |
| TSP Sampler (East) | 1.10 | | | | 0.006 | |
| Run 5 | Qs (dscf/hr) = | 816,783 | Vm (dscf)= | 70.60 | TSP West Volume (m3)= | 184.75 |
| | | | | | TSP East Volume (m3)= | 181.47 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0084 | 2.22E-07 | 5.04E+01 | 0.004 | | |
| TSP Sampler (West) | 3.60 | | | | 0.019 | |
| TSP Sampler (East) | 0.84 | | | | 0.005 | |
| Run 6 | Qs (dscf/hr) = | 891,684 | Vm (dscf)= | 76.28 | TSP West Volume (m3)= | 185.72 |
| | | | | | TSP East Volume (m3)= | 179.83 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0171 | 4.48E-07 | 1.02E+02 | 0.008 | | |
| TSP Sampler (West) | 1.60 | | | | 0.009 | |
| TSP Sampler (East) | 0.71 | | | | 0.004 | |
| Run 7 | Qs (dscf/hr) = | 952,843 | Vm (dscf)= | 81.07 | TSP West Volume (m3)= | 185.29 |
| | | | | | TSP East Volume (m3)= | 184.87 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0306 | 7.93E-07 | 1.80E+02 | 0.013 | | |
| TSP Sampler (West) | 24.00 | | | | 0.130 | |
| TSP Sampler (East) | 4.90 | | | | 0.027 | |
| Run 8 | Qs (dscf/hr) = | 912,557 | Vm (dscf)= | 78.18 | TSP West Volume (m3)= | 184.53 |
| | | | | | TSP East Volume (m3)= | 183.59 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0288 | 7.63E-07 | 1.73E+02 | 0.013 | | |
| TSP Sampler (West) | 18.00 | | | | 0.098 | |
| TSP Sampler (East) | 3.80 | | | | 0.021 | |
| Run 9 | Qs (dscf/hr) = | 902,542 | Vm (dscf)= | 76.60 | TSP West Volume (m3)= | 181.92 |
| | | | | | TSP East Volume (m3)= | 181.83 |
| | Total Wt. (mg) | E (lb/hr) | E (mg/hr) | Cm (mg/dscm) | TSP Concentration (mg/m3) | |
| Method 306 | 0.0331 | 8.61E-07 | 1.95E+02 | 0.015 | | |
| TSP Sampler (West) | 13.00 | | | | 0.071 | |
| TSP Sampler (East) | 2.00 | | | | 0.011 | |

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**14. ABSTRACT**

This volume is an Appendix to the main report, Volume 1, which documents the demonstration of a technology developed by PRD, Inc, for control of chromium emissions during hard chromium electroplating, the Zero Emissions System. The technology involves placing a blanket of a proprietary fluid, called PRD-EL1, on top of the plating bath. This fluid blanket prevents the formation of aerosols, which is the mechanism by which chromium is emitted from the plating bath to the air. The majority of the testing was directed at demonstration of the effectiveness of chromium plating in the presence of the immiscible blanket. Testing was conducted at Benét Laboratories on coupons and actual parts from Army vehicles. The results indicate that PRD-EL1 may cause deleterious effects on the plating process, as some of the parts failed qualitative tests performed at Benét. However, some parts, which were plated without the fluid blanket present as a baseline control, also failed the tests. Air sampling results indicate that the presence of the PRD-EL1 fluid reduced the chromium emissions and indoor air concentration below standard levels. Overall, the results indicate that the use of the PRD process would require additional testing before it could be accepted for use in Army production and maintenance operations.

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