AFOEHL REPORT 90-188EQ00086KEF

Source Emission Testing of the Rail Shop Media Blast Booth Hill AFB UT

ROBERT J. O'BRIEN, Capt, USAF, BSC

OCTOBER 1990

Final Report

Distribution is unlimited; approved for public release

AF Occupational and Environmental Health Laboratory (AFSC)
Human Systems Division
Brooks Air Force Base, Texas 78235-5501

NOTICES

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
October 1990

3. REPORT TYPE AND DATES COVERED
Final

4. TITLE AND SUBTITLE
Source Emission Testing of Rail Shop Media Blast Booth, Hill AFB UT

5. FUNDING NUMBERS

6. AUTHOR(S)
Robert J. O'Brien, Capt, USAF, BSC

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
AF Occupational and Environmental Health Laboratory
Brooks AFB TX 78235-5501

8. PERFORMING ORGANIZATION REPORT NUMBER
AFOEHL Report
90-188EQ00086KEF

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Same as Blk 7

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Statement A. Unlimited, approved for public release

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

At the request of HQ Ogden ALC/EM, personnel of the AFOEHL Air Quality Function conducted source emission testing for particulates on the Rail Shop Media Blast Booth at Hill AFB. Testing was performed on 29 and 30 Aug 90. The Utah Bureau of Air Quality required testing for approval order compliance.

Particulate emissions were above the emission limits allowed by the State of Utah. Action is recommended to bring the media blast booth into compliance.

14. SUBJECT TERMS
Source Emission Testing, Particulates, Air Pollution, Media Blast Booth, Stack Sampling, Hill, O'Brien

15. NUMBER OF PAGES
59

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	SAR

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
Prescribed by ANSI Std Z39-18
298-102

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I. INTRODUCTION

On 29 & 30 Aug 1990, stationary compliance testing for particulate emissions was accomplished on the Toole Army Depot Media Blast Booth at Hill AFB by the Air Quality Function, Environmental Quality Division, Air Force Occupational and Environmental Health Laboratory (AFOEHL). This survey was requested by HQ Ogden ALC/EM via HQ AFLC/SGBE to satisfy Utah Air Conservation Regulation emission testing requirements. The request letter is found in Appendix A. Personnel involved with on-site testing are listed in Appendix B.

II. DISCUSSION

A. Background

Section 3.4.1, Utah Air Conservation Regulations, requires emissions testing of all sources with established emissions limitations at least once every five years. The media blast booth, last tested in 1983, was required to be retested by 11 Sep 1990 as directed in a Utah Bureau of Air Quality letter to Toole Army Depot dated 14 Feb 1990.

B. Site Description

The media blast booth is a 60' by 21' by 26' high facility located at the Hill AFB Rail Shop, adjacent to building 1701. Blasting is performed an average of 15 hours per week using aluminum oxide grit media. During media blasting, suspended particles are drawn out of the facility and through a connecting bag house. The fan, located on the cleanside of the bag house, then exhausts the cleaned air through a stack attached to the side of the media blast booth. A photograph of the exhaust stack is shown in Figure 1. Also during blasting, those particles landing on the floor of the media blast booth will fall through a grate and be carried to a cyclone where the large and small particles are separated. The larger particles are reused for media blasting while the smaller particles are exhausted through the bag house. The cyclone is located in the control room attached to the back-side of the media blast booth. The control equipment is manufactured by FARR (Model 3) and the bag house filters used are disposable Ten-K paper cartridges.

C. Applicable Standards

The source testing standards for particulate and visible emissions are defined in Utah Bureau of Air Quality Approval Order dated 13 Sep 1983. These standards are found in Appendix C of this report and summarized below.

1. Particulate Emissions: The outlet particulate loading shall not exceed 0.02 grains per dry standard cubic foot (gr/dscf) nor 5.31 pounds per hour (lb/hr).

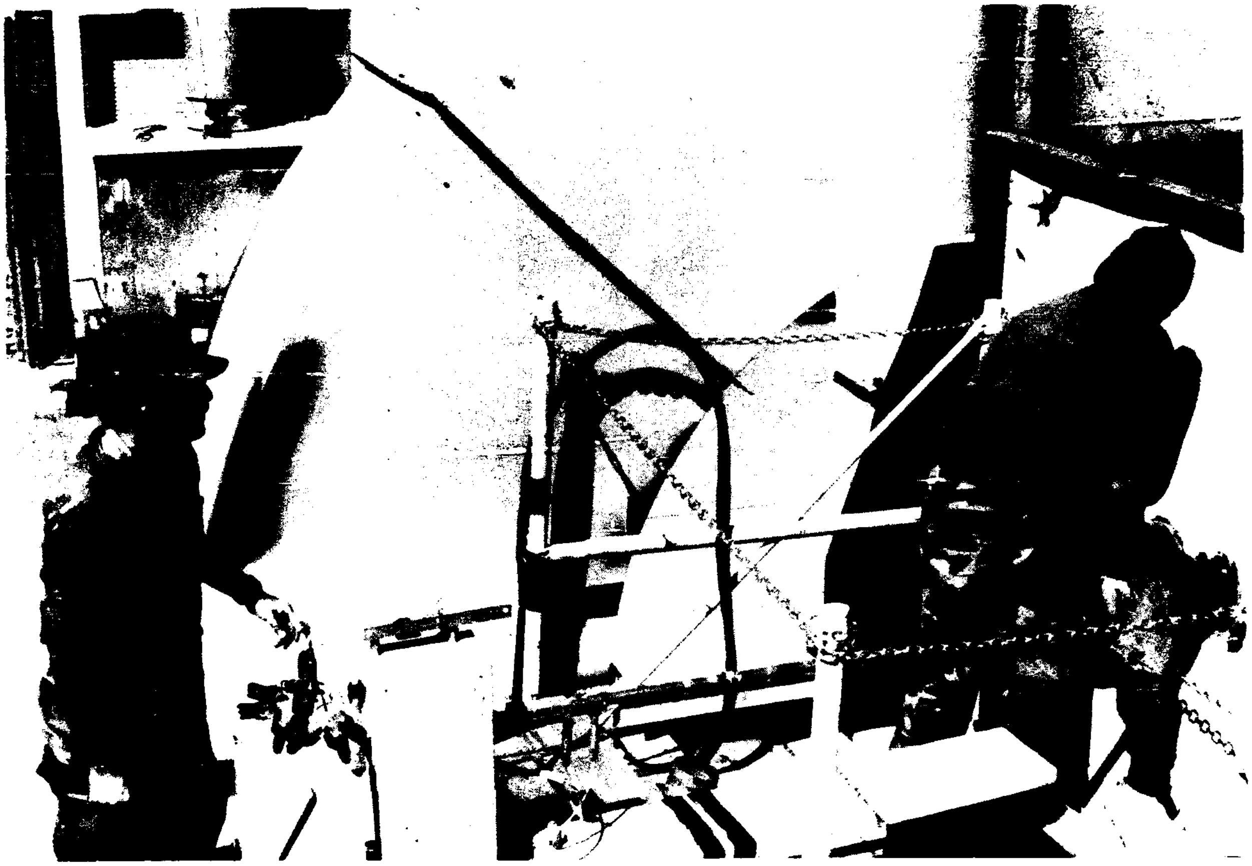

Figure 1. Media Blast Booth, Hill AFB UT

2. Visible Emissions: No visible emissions from any point shall exceed 40% opacity.

D. Sampling Methods and Procedures

Particulate emissions testing was conducted in accordance with Environmental Protection Agency (EPA) Methods 1 through 5 found in Appendix A to Title 40, Code of Federal Regulations, Part 60 (40 CFR 60) as dictated by Utah Bureau of Air Quality Approval Order dated 13 Sep 1983. Three sampling runs, 62.5 minutes each, were conducted and the results averaged to determine a final emission rate.

The media blast booth facility has a 31.5 inch by 45.75 inch rectangular stack. Five sampling ports exist on the 45.75 inch side of the stack. The port holes are on the same horizontal plane located 10.92 feet downstream and 3.08 feet upstream from any flow disturbance. With an effective inside diameter of 3.11 feet, sampling ports are greater than one half duct diameters upstream and two duct diameters downstream from any flow disturbance. Based on this information and the type of sample (particulate), twenty-five traverse points (5x5 matrix) were used to collect a representative particulate sample.

Prior to the first sample run on the stack, cyclonic flow was determined by using the Type S pitot tube and measuring the stack gas rotational angle at each point along the center traverse. Flow conditions are considered acceptable when the arithmetic mean average of the rotational angles is 20 degrees or less. Measurements show the stack air flow to be within acceptable limits. A preliminary velocity pressure traverse was also accomplished before the first sample run.

A grab sample for ORSAT analysis (measures oxygen and carbon dioxide for stack gas molecular weight determination) was taken during the first sampling run. ORSAT sampling and analysis equipment are shown in Figures 2 and 3. Flue gas moisture content, needed for determination of flue gas molecular weight, was obtained during particulate sampling.

Particulate samples were collected using the sampling train shown in Figure 4. The train consisted of a button-hook probe nozzle, heated glass-lined probe, heated glass-fiber filter, impingers, and a pumping and metering device. The probe nozzle was sized prior to the sample run so that the gas stream could be sampled isokinetically, (i.e., the velocity at the nozzle tip was the same as the stack gas velocity at each point sampled). Flue gas velocity pressure was measured at the nozzle tip using a Type S pitot tube connected to a 10-inch inclined-vertical manometer. Type K thermocouples were used to measure flue gas as well as sampling train temperatures. The probe liner was heated to minimize moisture condensation. The heated filter was used to collect particulates. The impinger train (first, third, and fourth impingers - modified Greenburg-Smith type; second impinger - standard Greenburg-Smith design) was used as a condenser to collect stack gas moisture. The pumping and metering system was used to control and monitor the sample gas flow rate. Equipment calibration data is presented in Appendix D.

Front half particulate matter (material collected on sampling train surfaces up to and including the filter) was determined for compliance purposes according to the procedures specified in EPA Method 5. Although not used in the emission calculations, back half particulate matter (material collected on sampling train surfaces after the filter) was determined at the request of the Utah Bureau of Air Quality. The method used for determining back half particulate catch is found in Appendix C. Field data from particulate sampling is presented in Appendix E. Emission calculations were accomplished using the "Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators" (EPA-340/1-85-018) developed by the EPA Office of Air Quality Planning and Standards, Research Triangle Park NC. Resulting emission calculations are presented in Appendix F.

Visible emission (opacity) readings were performed by the Utah Bureau of Air Quality.

E. Results

The table provides particulate emission test results for the media blast booth.

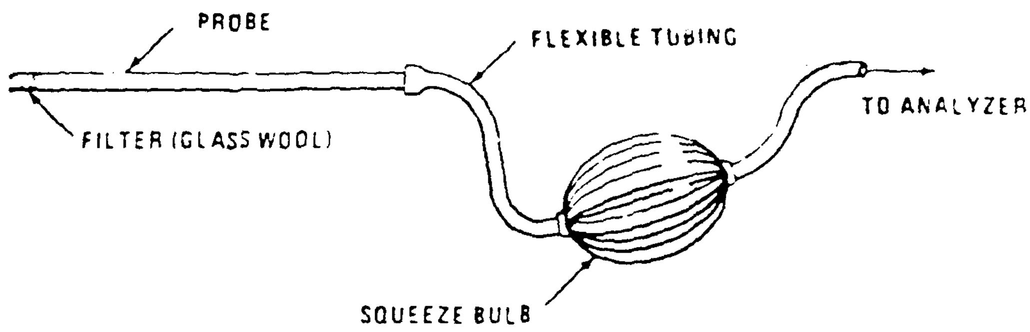

Figure 2. Grab Sampling Train

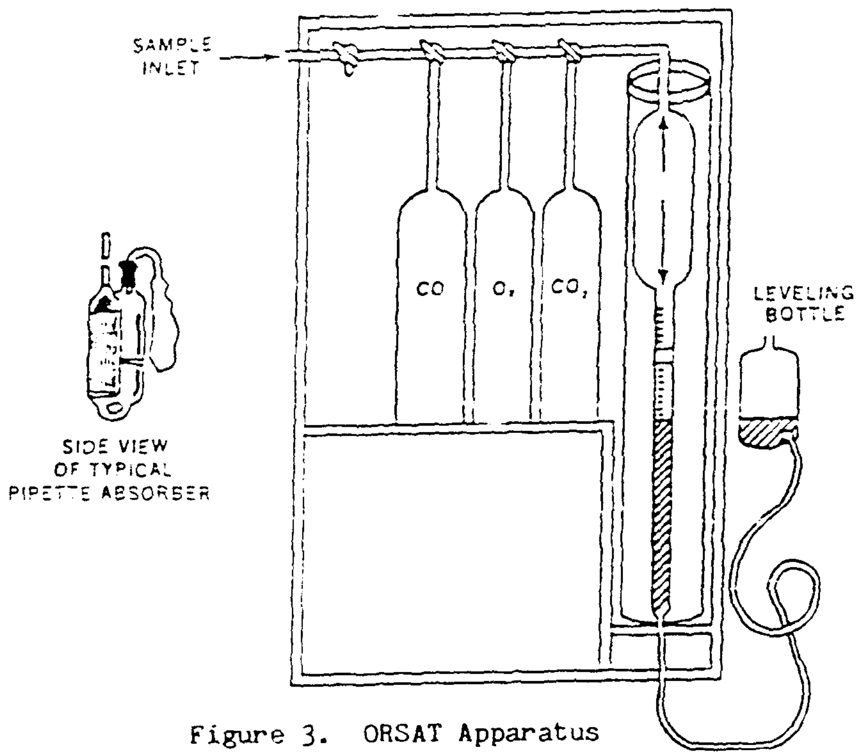

Figure 3. ORSAT Apparatus

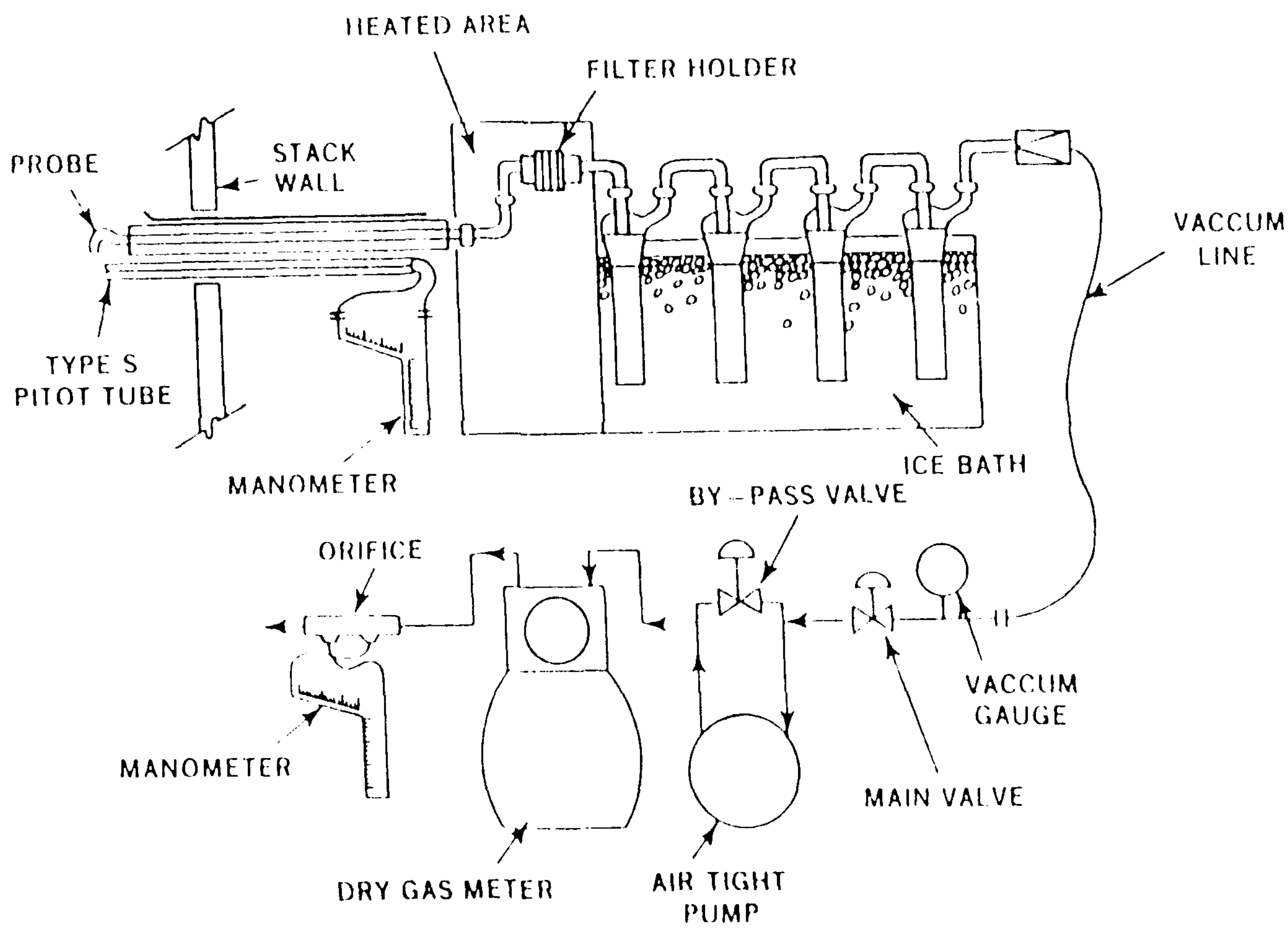

Figure 4. Particulate Sampling Train

Stack Emission Test Results

Run #	Average % Isokinetic Sampling Rate	Sample Volume (dscf)	Stack Gas Flow Rate (dscf/min)	Particulate Emissions (lb/hr)	Particulate Emissions (gr/dscf)
1	100.63	79.214	36,385	13.45	0.04
2	99.33	77.020	35,842	18.41	0.06
3	95.75	72.738	35,114	13.32	0.04
				-----	----
			Average =	15.06	0.05

Note: dscf = dry standard cubic foot
dscf/min = dry standard cubic foot per minute
lb/hr = pounds per hour
gr/dscf = grains per dry standard cubic foot

III. CONCLUSIONS

The booth exceeded the Utah Bureau of Air Quality particulate emission standard of 0.02 gr/dscf in all three runs. Possible reasons for the excessive particulate emissions include:

1. The type of bag house filters used may not be adequate for this type of operation. For example, low permeable filters should be used when the particles being filtered are predominately small and the static electric charge of the filters should be opposite that of the particles.

2. The velocity of the exhaust gas passing through the bag house may be greater than required. The higher the velocity, the greater the amount of particulate matter passing through the filters will be.

3. A leak may have developed within the bag house filters.

4. Excessive blasting pressure and/or overly fine blasting media may increase the amount of small particles being generated.

IV. RECOMMENDATIONS

An evaluation of the entire media blast facility, including emission controls, needs to be performed. This evaluation includes the following:

1. Since the facility was below the same standards when last tested in 1983, determine if any operational and/or equipment modifications have been made since that time.

2. Determine if the proper bag house filters are used for this operation, e.g., evaluate filter material, construction, permeability, and static electric charge.

3. Determine if a slower velocity (fan speed) can be used to effectively draw particulates through the bag house.

4. Routinely inspect the bag house filters to ensure optimum performance.

5. Evaluate actual blasting parameters, e.g., media type, media size, blasting pressure.

The media blast booth will need to be retested following your evaluation and implementation of corrective measures. AFOEHL will remain active in supporting the base's present and future needs.

References

1. Code of Federal Regulations. Vol 40, Parts 53-60, The Office of the Federal Register National Archives and Records Service, General Services Administration, Washington DC, July 1989.

2. Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III, Stationary Source Specific Methods, U.S. Environmental Protection Agency, EPA-600/4-77-027-b, Research Triangle Park , North Carolina, December 1984.

3. Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators, U.S. Environmental Protection Agency, EPA-340/1-85-018, Research Triangle Park, North Carolina, May 1987.

APPENDIX A
Request Letter

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OGDEN AIR LOGISTICS CENTER (AFLC)
HILL AIR FORCE BASE, UTAH 84056-5999

29 MAY 1990

REPLY TO ATTN OF: EM

SUBJECT: Stack Test for Particulate Emissions - Media Blast Booth, Bldg 1701

TO: HQ AFLC/SGBE
USAF OEHL/CC
IN TURN

1. Atch 1 is Utah Bureau of Air Quality's letter requiring that the media blast booth stack in building 1701, Rail Shop, be tested for particulate emissions using EPA Test Method 5. This test is to be conducted prior to 11 Sept 90. Atch 2 is the State Approval Order (Air Permit) stipulating air emissions limit not to exceed 0.02 Grains/DSCF or 5.31 lbs/hr.

2. Media blast booth in Rail Shop is used for grit blasting locomotive & generators using aluminum oxide grit media. Blast booth is equipped with media recovery/recycle, classifier cyclone, dust collector, an exhaust fan and a stack. Dust collector filter elements were last changed 7 May 90. The stack is rectangular measuring approximately 42" X 37" and 24' high. Five (5) sample ports each 5" diameter are provided. Sample ports elevation is about 20' above grade. Rail Shop will provide access scaffolding to sample ports.

3. Request OEHL support in performing this test to demonstrate compliance with the permit conditions. Our point of contact is Jay Gupta, OO-ALC/EME, AV 458-7651.

James R. VanOrman

JAMES R. VAN ORMAN
Director of Environmental Management

2 Atch
1. State's letter 14 Feb 90
2. Approval Order 13 Sept 83

cc: USAF Hospital Hill/SGB

1st Ind, SGBE

06 JUN 1990

TO: USAF OEHL/CC

I believe this to be an important requirement; however, this is an Army facility. Request your support, if possible.

John Joyce

JOHN JOYCE, Lt Col, USAF, BSC
Chief, Environmental Quality
Office of the Command Surgeon

AFLC COMBAT STRENGTH THROUGH LOGISTICS

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APPENDIX B
Personnel Information

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1. AFOEHL Test Team

Maj Ramon Cintron-Ocasio, Chief, Air Quality Branch
Capt Paul T. Scott, Consultant, Air Quality Meteorologist
Capt Ronald Vaughn, Consultant, Air Quality Branch
Capt Robert O'Brien, Consultant, Air Quality Branch
Sgt Stanley Dabney, Technician, Environmental Quality

AFOEHL/EQA
Brooks AFB TX 78235-5501

Phone: DSN 240-3305
Commercial (512) 536-3305

2. Hill AFB on-site representatives

Mr Jay Gupta	OO-ALC/EME
Mr Steve Rasmuson	OO-ALC/EME
	DSN 458-7651
	COM (801) 777-7651
Mr Andy Golson	SDSTE-MAI-R
Mr Parley Tingey	SDSTE-MAI-R
	DSN 458-5913
	COM (801) 777-5913

3. State of Utah representative

Colleen Delaney	288 North 1460 West
	P.O. Box 16690
	Salt Lake City UT 84116-0690
	COM (801) 538-6722

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Appendix C
State Regulations

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.M. Matheson
Governor

nes O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

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STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH

150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110-2500

Kenneth Lee Alkema, Director
Room 474 801-533-6121

September 13, 1983
533-6108

Larry Fisher
Tooele Army Depot
Tooele, Utah 84074

RE: Approval Order for Sandblasting Room (Bldg. 1701), Tooele County

Dear Mr. Fisher:

On August 6, 1983, the Executive Secretary published a notice of intent to approve baghouse controls for the sandblasting room in Building 1701, Tooele County. The 30 day public comment period has expired, and no comments were received.

This air quality approval order authorizes the baghouse controls and sandblasting operation as proposed in your notice of intent dated June 16, 1983, with the following operating conditions:

1. All emission control equipment shall be properly installed, maintained, and operated as proposed in the notice of intent dated June 16, 1983.

2. No visible emissions from any point shall exceed 40% opacity.

3. The baghouse shall be stack tested within 180 days of startup. EPA test methods 1 - 5 shall be used. The outlet particulate loading shall not exceed 0.02 gain/dscf nor 5.31 lb/hr. A pretest conference shall be held between the Bureau of Air Quality, Tooele Army Depot, and the tester.

4. The Executive Secretary shall be notified upon startup as an initial compliance inspection is required.

Sincerely,

Brent C. Bradford
Executive Secretary
Utah Air Conservation Committee

MRK/ads
cc: EPA Region VIII (J. Philbrook)
Tooele County Health Dept.
3830

ATCH-2

3.3.6 *Exemptions and Waivers*. Exemptions and waivers from the requirements of this paragraph 3.3 may be made by the Committee to the extent permitted under Federal Law.

3.3.7 *Reconstruction*. A reconstructed source will be treated as a new source for purposes of section 3.3 if it otherwise meets the definition of a major source. Reconstruction will be presumed where the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost of a comparable entirely new stationary source. Fixed capital cost means the capital needed to provide all the depreciable components.

3.4 *Emission Testing*

3.4.1 Emission testing will be required of all sources with established emission limitations at least once every five years. Sources approved in accordance with Section 3.1 will be tested within six months of start-up. Sources for which emission limitations are established pursuant to Section 3.2.1 which do not require modification will be tested within one year of the effective date of these regulations. In addition, if the Executive Secretary has reason to believe that an applicable emission limitation is being exceeded (i.e., through visible emission observations and monitoring data, etc.) he may require the owner or operator to perform such emission testing as is necessary to determine actual compliance status. The Committee may grant exceptions to the mandatory testing requirements of this paragraph 3.4.1 which are not inconsistent with the purposes of these regulations.

3.4.2 At least 30 days prior to conducting any emission testing required under any part of these regulations, the owner or operator shall notify the Executive Secretary of the date, time and place of such testing and, if determined necessary by the Executive Secretary, the owner or operator shall attend a pretest conference.

3.4.3 All tests shall be conducted while the source is operating at the maximum production or combustion rate at which such source will be operated. During the tests, the source shall burn fuels or combustion of fuels, use raw materials, and maintain process conditions representative of normal operations, and shall operate under such other relevant conditions as the Executive Secretary shall specify.

3.4.4 The Executive Secretary may reject emissions test data if they are determined to be incomplete, inadequate, not representative of operating conditions specified for the test, or if the State was not provided an opportunity to have an observer present at the test.

3.5 *Emissions Industry*. The owner or operator of a stationary source of air pollution which emits 25 tons per year or more of air contaminant must submit a report of emission to the Executive Secretary at least annually. Emission inventory reports shall include the rate and period of emission, specific plant source of air pollution, composition of air contaminant, type and efficiency of air pollution control equipment and other information necessary to quantify operation, pollution emission and evaluate pollution control.

3.6 *Prevention of Significant Deterioration of Air Quality (PSD)*

3.6.1. *Area Designations*. All areas of the State shall be designated as Class I, II, or III.

a. Pursuant to section 162(a) of the federal Clean Air Act the following areas are designated as mandatory Class I:

(1) Arches National Park

(2) Bryce Canyon National Park

(3) Canyonlands National Park

(4) Capitol Reef National Park

(5) Zion National Park

b. Pursuant to section 162(b) of the federal Clean Air Act, all other areas of the State are designated as Class II unless redesignated as provided in section 3.6.2 or are designated as non-attainment areas.

3.6.2 *Area Redesignation*.

a. Within the restrictions and requirements of this paragraph, the Committee may submit to the Governor for decision a recommendation to redesignate areas from any class to any other class.

b. In accordance with Section 162(a) of the Clean Air Act, areas designated as Class I under paragraph 3.6.1(a) may not be redesignated.

c. In accordance with Section 164(a) of the Clean Air Act, the following areas may be redesignated only as Class I or II.

(1) An area which as of August 7, 1977, exceeded 10,000 acres in size and was a national monument, a national primitive area, a national preserve, a national recreation area, a national wild and scenic river, a national wildlife refuge, a national lakeshore or seashore; and

(2) A national park or national wilderness area established after August 7, 1977, which exceeds 10,000 acres in size.

d. Except as provided in paragraphs 3.6.2.b, c, and f, the Committee may submit to the Governor for decision a recommendation to redesignate areas of the State as Class III if:

(1) There has been compliance with the requirements of paragraphs 3.6.2.e;

(2) Such redesignation will not cause, or contribute to, concentrations of any air pollutant which exceed any maximum allowable increase permitted under the classification of any other area or any national ambient air quality standard; and

(3) Any permit application for any major source or major modification which could receive an approval order only if the area in question were redesignated as Class III, and any material submitted as part of that notice of intent were available, insofar as practicable, prior to any public hearing or redesignation.

In accordance with Section 164 of the Clean Air Act, redesignations to Class III may be approved by the Governor only after consultation with appropriate committees of the legislature and if units of local government representing a majority of the residents of the proposed area to be redesignated enact ordinances concurring in the redesignation.

e. Prior to submittal to the Governor of a recommendation to redesignate any area:

(1) Notice shall be published in each daily newspaper in the affected area and written notice shall be made to local government units, other states, Indian governing bodies, Federal Land Managers whose lands may be affected by the proposed redesignation and public hearings shall be conducted in the affected areas. Such notice shall be made at least 30 days prior to the public hearing and include a statement of the availability of the discussion outlined in paragraph 3.6.2.e(2). Prior to the issuance of a notice under this paragraph respecting the redesignation of any Federal lands, a written notice shall be given to the appropriate Federal lands, a written notice shall be given to the appropriate Federal Land Manager who shall be afforded opportunity (not to exceed 60 days) to confer with the Committee respecting the redesignation and to submit written comments and recommendations. In recommending redesignation of any area with respect to which a Federal Land Manager

schedule. Compliance must be achieved as expeditiously as practicable but no later than December 31, 1983 or such later date as may be specified by Congress or EPA under the Clean Air Act.

4.10 *Abrasive Blasting.*

4.10.1 *Visible Emission Standards.*

a. No person shall, if he complies with performance standards outlined in Section 4.10.3 or if he is not located in an area of nonattainment for particulates, discharge into the atmosphere from any abrasive blasting any air contaminant for a period or periods aggregating more than three minutes in any one hour which is a shade or density darker than 40% opacity.

b. No person shall, if he is not complying with an applicable performance standard in Section 4.10.3 and is in an area of nonattainment, discharge into the atmosphere from any abrasive blasting any air contaminant for a period or periods aggregating more than three minutes in any one hour which is of a shade or density no darker than 20% opacity.

4.10.2 *Visible Emission Evaluation Techniques.* Visible emission evaluation of abrasive blasting operations shall be conducted in accordance with the following provisions:

a. Emissions from unconfined blasting shall be read at the densest point of the emission after a major portion of the spent abrasive has fallen out, at a point not less than five feet nor more than twenty-five feet from the impact surface from any single abrasive blasting nozzle.

b. Emissions from unconfined blasting employing multiple nozzles shall be judged as a single source unless it can be demonstrated by the owner or operator that each nozzle, evaluated separately, meets the emission and performance standards provided for in this Section 4.10.

c. Emissions from confined blasting shall be read at the densest point after the air contaminant leaves the enclosure.

4.10.3 *Performance Standards.*

a. To satisfy the requirements of Section 4.10.1, any abrasive blasting operation may use at least one of the following performance standards:

(1) Confined blasting;

(2) Wet abrasive blasting;

(3) Hydroblasting; or

(4) Unconfined blasting using abrasives as defined in Section 4.10.3.b.

b. *Abrasives.* Abrasives used for dry unconfined blasting referenced in paragraph 4.10.3.a shall comply with the following performance standards:

(1) Before blasting the abrasive shall not contain more than 1% by weight material passing a #70 U.S. Standard sieve.

(2) After blasting the abrasive shall not contain more than 1.8% by weight material 5 micron or smaller.

Abrasives reused for dry unconfined blasting are exempt from b(2), but must conform with b(1).

c. *Abrasive Certification.* Sources using the performance standard of Section 4.10.3.a(4) to meet the requirements of Section 4.10.1 must demonstrate they have obtained abrasives from persons which have certified (submitted test results) to the Executive Secretary at least annually that such abrasives meet the requirements of Section 4.10.3.b.

4.11

Regulation for the Control of Fluorides from Existing Plants.

a. The owner or operator of the Chevron Chemical Company Phosphate Fertilizer Plant located in the Wasatch Front Air Quality Control Region shall not after July 1, 1983, discharge, or cause the discharge of fluoride into the atmosphere in excess of the following:

1. *Wet Process Phosphoric Acid Plants.* The fluoride emissions exclusive of tank farm emissions shall not exceed 148 g/metric ton of equivalent P_2O_5 feed.

2. *Superphosphoric Acid Plants.* Total fluoride emissions shall not exceed 5 g/metric ton of equivalent P_2O_5 feed.

3. *Ammonium Phosphate Plants.* Total fluoride emissions shall not exceed 508 g/metric ton of equivalent total product.

b. Prior to the commencement of operation of any existing Triple Superphosphate Plant or Granular Triple Superphosphate Storage Facility located in the Wasatch Front Air Quality Control Region, Chevron shall submit a notice of intent to the Executive Secretary and obtain appropriate emission limitations.

c. Within 180 days following the effective date of this section, the owner or operator of the Chevron Phosphate Fertilizer Plant shall conduct testing to determine compliance with the emission limitations listed in subparagraphs a 1-3.

d. Compliance with the emission limitations shall be determined as follows:

1. Emissions from all sources in the plant or process for which compliance is being demonstrated with potential emissions greater than .2 pounds per day fluoride shall be included in the demonstration of compliance.

2. All tests shall be conducted while the source is operating at the maximum rate at which such source will be operated. During the tests, the source shall use raw materials and maintain process conditions representative of normal operations and such other relevant conditions as the Executive Secretary shall specify.

3. Fluoride shall be measured according to Method 13A or 13B, Appendix A, Part 60, Title 40, of the Code of Federal Regulations.

4. Flow rates shall be measured according to Method 1, Appendix A, Part 60, Title 40, of the Code of Federal Regulations.

5. Fugitive emissions from the sources covered in this Section 4.11 shall be estimated using methods and procedures which have been approved in advance by the Executive Secretary.

6. The Executive Secretary will be notified at least 30 days prior to the testing of any source.

7. Analysis, calculations, and preliminary results of all testing shall be made available to the Executive Secretary during any testing period.

8. Reports of all compliance testing must be submitted within 30 days of the completion of such testing unless otherwise approved by the Executive Secretary.

9. Records of all compliance testing shall be kept for a period of two years following such testing.

e. Subsequent emissions testing shall be conducted in accordance with Section 3.4 of these regulations.

4.12 — *National Emission Standards for Hazardous Air Pollutants.*

The provisions of 40 Code of Federal Regulations (CFR) Part 61, National Emission Standards for Hazardous Air Pollutants, are incorporated into these regulations by reference. References in 40 CFR Part 61 to "the Administrator" shall refer to the Executive Secretary of the Committee. See Appendix C.

Scott M. Matheson
Governor

James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

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STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110

Alvin E. Rickers, Director
Room 426 801-533-6121

533-6108

October 19, 1981

Utah Method for Analyzing the EPA Method 5 Back Half Particulate

In paragraph 4.1.3 of EPA Method 5, insert "distilled" before the word water and add to the end of the paragraph the following: "Take a volume of distilled water equal to the volume of water charged to the impingers directly from the container used to fill the impingers and place it in a clean sample container, cap the container and label "back half water blank"".

After following the procedure of paragraph 4.2 Method 5 transfer the impinger water from the graduated cylinder or (if the moisture determination was made gravametrically) directly from the impingers to a clean sample container. Mark liquid level, cap and label the container "back half water". Then rinse the first three impingers and connecting glassware including the back half of the filter holder, with acetone. Place the rinse in another sample container, mark liquid level, cap and label "back half wash".

When the evaporation of the back half wash is to begin follow the procedure called for container #2 in paragraph 4.3 of Method 5. The same procedure is to be followed for the back half water except that the water should be evaporated in an oven in which the air temperature is held at 105°C rather than at ambient temperature. The back half water blank should be determined by the same procedure used for the acetone blank listed in paragraph 4.3 and 6.6 and 6.7 of Method 5. Back half particulate is the sum of the weights of the residues of the back half water and back half acetone rinse minus the water and acetone blanks.

Back half particulate is not to be added to the front half particulate captured in the probe and filter. Back half particulate should be reported separately and not used to determine compliance with State regulations.

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Appendix D
Calibration Data

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METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Pre 4ull

Date 13 Aug 90   Vac = 5.Ø   Meter box number Nutech 2

Barometric pressure, P_b = 30.12 in. Hg   Calibrated by Scott & Vaughn

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Avg[a] (t_d), °F	Time (Θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5	4.984	79 85 542.Ø	79 88 543.5	76 81 538.5	541.Ø	13.1	1.ØØØ1	1.948
1.0	5	5.ØØ6	85 82 543.5	88 89 548.5	87 81 541.Ø	544.75	9.2	Ø.9987	1.932
1.5	10	10.Ø8Ø	82 82 542.Ø	89 94 551.5	81 84 542.5	547.Ø	15.Ø	Ø.9976	1.908
2.0	10	10.225	82 83 542.5	94 97 555.5	84 86 545	550.25	13.1	0.9871	1.932
3.0	10	10.175	83 83 543.Ø	97 100 558.5	86 88 547	552.75	1Ø.7	0.9932	1.928
Vac = 7.Ø 4.0	10	10.28Ø	83 83 543.Ø	100 100 560	89 89 549	554.5	9.2	Ø.9838	1.8947
							Avg	Ø.993	1.924

.995   1.964

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\Theta}{V_w}\right]^2$
0.5	0.0368	$Y_i = \frac{(5)(30.12)(541)}{(4.984)(30.1568)(542.0)}$	$= \frac{(.0317)(.5)}{(30.12)(541)} \left[\frac{(542)(13.1)}{5}\right]^2 = 1.948$
1.0	0.0737	$Y_i = \frac{(5)(30.12)(544.75)}{(5.006)(30.1937)(543.5)}$	$\frac{(.0317)(1.0)}{(30.12)(544.8)} \left[\frac{(543.5)(9.2)}{5}\right]^2 = 1.932$
1.5	0.110	$Y_i = \frac{(10)(30.12)(547.0)}{(10.08)(30.230)(542.0)}$	$\frac{(.0317)(1.5)}{(30.12)(547)} \left[\frac{(542)(15)}{(10)}\right]^2 = 1.9076$
2.0	0.147	$= \frac{(10)(30.12)(550.25)}{(10.225)(30.267)(542.5)}$	$\frac{(.0317)(2.0)}{(30.12)(550.75)} \left[\frac{(542.5)(13.1)}{10}\right]^2 = 1.9320$
3.0	0.221	$= \frac{(10)(30.12)(552.75)}{(10.175)(30.341)(543.0)}$	$\frac{(.0317)(3.0)}{(30.12)(552.75)} \left[\frac{(543)(10.7)}{10}\right]^2 = 1.9283$
4.0	0.294	$= \frac{(10)(30.12)(554.5)}{(10.28)(30.414)(543)}$	$\frac{(.0317)(4)}{(30.12)(554.5)} \left[\frac{(543)(9.2)}{10}\right]^2 = 1.8947$

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number One Date 20 Sep 90 Meter box number Nutech 2 Plant Post Hill AFB

Barometric pressure, P_b = 29.23 in. Hg Dry gas meter number ______ Pretest Y 0.993

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F °R	Temperature: Dry gas meter Inlet (t_{d_i}), °F	Temperature: Dry gas meter Outlet (t_{d_o}), °F	Temperature: Dry gas meter Average[a] (t_d), °R	Time (Θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
3.0	10	9.89	79 / 79 539	89 / 89	79 / 79	544	10.55	11.9	1.0129	10 (29.23) (544) / 9.89 (29.23 + 3.0/13.6) 539
3.0	10	9.942	79 / 78 538.5	90 / 93	79 / 81	545.75	10.55	11.9	1.0117	10 (29.23) (545.75) / 9.942 (29.23 + 3.0/13.6) 538.5
3.0	10	9.97	78 / 77 537.5	93 / 94	81 / 83	547.75	10.57	11.9	1.0145	10 (29.23) (547.75) / 9.97 (29.23 + 3.0/13.6) 537.5
									Y = 1.0130	

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ±0.05Y. 0.993 ± 0.04965

0.9434 ← Y_{post} → 1.0427

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

TYPE S PITOT TUBE INSPECTION DATA FORM

#6B

Pitot tube assembly level? ___✓___ yes ________ no

Pitot tube openings damaged? _____ yes (explain below) ___✓___ no

α_1 = ___0___ ° (<10°), α_2 = ___0___ ° (<10°), β_1 = ___0___ ° (<5°),

β_2 = ___1___ ° (<5°)

(1.0625)

γ = ___0___ °, θ = ___0___ °, A = ___1 1/16___ ~~cm~~ (in.)

z = A sin γ = ___0.0___ ~~cm~~ (in.); <0.32 cm (<1/8 in.),

w = A sin θ = ___0.0___ ~~cm~~ (in.); <.08 cm (<1/32 in.)
0.0313

P_A ___17/32 (0.53)___ ~~cm~~ (in.) P_b ___17/32 (0.53)___ ~~cm~~ (in.)

D_t = ___0.375___ ~~cm~~ (in.)

Comments: CONSTRUCTED IAW 40 CFR 60, APP A, METH 2, FIG 2.2. ASSIGNED BASELINE COEFFICIENT = 0.84

Calibration required? ______ yes ___✓___ no

Quality Assurance Handbook M2-1.7

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19/20 Oct 88 Thermocouple number IMPINGER D6

Ambient temperature 26 °C Barometric pressure 29.232/29.175 in. Hg

Calibrator GARRISON/SCOTT Reference: mercury-in-glass NBS

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C *
0	ICE BATH	0	0.6	0.6
—	ROOM TEMP	26	25.5	0.5

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

$$^{c}\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$$

*MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19 Oct 88 Thermocouple number STACK P1

Ambient temperature _______ °C Barometric pressure 29.232 in. Hg

Calibrator GARRISON/SCOTT Reference: mercury-in-glass NBS

other _______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
0°	ICE BATH	0.3	0.6	0.1
100°	BOILING WATER	98.9	100.6	0.5
—	GLYCERA	174.0	177.2	0.7

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c]$\left[\frac{(\text{ref temp, °C} + 23) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19 Oct 88 Thermocouple number STACK P7

Ambient temperature ______ °C Barometric pressure 29.232 in. Hg

Calibrator GARRISON/ SCOTT Reference: mercury-in-glass NBS

other ______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
0°	ICE BATH	0.3	0.3	—
100°	BOILING WATER	98.9	100.6	0.5
—	GLYCEROL	174.6	177.8	0.7

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

NUTECH #2

Date 3 JAN 89 Thermocouple number INLET/OUTLET

Ambient temperature 26 °C Barometric pressure ______ in. Hg

Calibrator GARRISON SCOTT Reference: mercury-in-glass ASTM 63F

other ______________________

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] ≤ °C *
INLET				
–	HOT WATER BATH	43.5	43	.5
–	ROOM TEMP	26	26	0
OUTLET				
–	HOT WATER BATH	43.5	42	1
–	ROOM TEMP	26	26.5	.5

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

Quality Assurance Handbook M5-2.5

* MUST BE WITHIN 3°C OF REFERENCE

NOZZLE CALIBRATION DATA FORM

Date 29 Aug 90 Calibrated by [illegible]

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
#2	0.252	0.252	0.253	0.001	0.252

where:

[a] $D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.). $\Delta D \leq (0.10$ mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

probe 6B
Stack thermo P1
Inline therm P7
impinger thermo D6

Appendix E
Field Data

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(3)

PARTICULATE SAMPLING DATA SHEET

1/2

RUN NUMBER	# 1
DATE	29 Aug 90
PLANT	Bead Blast Facility Bldg 1701
BASE	Hill AFB
SAMPLE BOX NUMBER	
METER BOX NUMBER	Nutech # 2
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

$^{o}R = {}^{o}F + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot check Pre — okay
Probe check @ 18 Hg in - okay
Post
Probe Check @ 18 Hg in - okay
Pitot check Post - okay

AMBIENT TEMP	°F
STATION PRESS	30.19 in Hg
HEATER BOX TEMP	- °F
PROBE HEATER SETTING	
PROBE LENGTH	72 in
NOZZLE AREA ~~(A)~~	.252 ~~sq ft~~
Cp	0.84
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE (in H2O)~~	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1	2.5		75		2.1	7.12	642.715	67		68	217 / 194	
2	5		70		2.2	10.01		76		67	253 / 206	
3	7.5		67		2.1	9.65	656.50	80		68	260 / 230	
4	10		65		2.1	9.74	661.2	85		70	263 / 244	74
5	12.5		66		2.0	9.27	665.27	86		71	255 / 247	71
6	15		68		6	7.42	669.13	87		72	254 / 246	71
7	17.5		68		1.8	8.35	673.48	87		73	254 / 246	71
8	20		66		1.8	8.40	677.30	90		74	255 / 247	52
9	22.5		66		1.9	8.88	681.51	90		75	255 / 247	50
10	25		66		1.9	8.88	685.82	91		75	257 / 247	50
11	27.5	8	67		0.75	4.44	681.	92		76	255 / 248	50
12	30		71		1.3	6.03		76		77	256 / 250	48
13	32.5		68		1.4	6.53	696.25	76		78	259 / 250	47
14	35	5	~~266~~ 66		1.5	7.02	699.98	69		78	258 / 247	48
15	37.5		64		1.5	7.03	703.71	70		78	257 / 248	48
16	40		74		0.52	2.38	705.8	80		79	258 / 317	40
17	42.5	3	74		.70	3.31	708.62	81		78	260 / 337	43
18	45	3	73		.70	3.50	710.15	85		78	260 / 244	45
19	47.5	3	71		.95	4.37	713.85	86		78	262 / 261	46
20	50	3	70		.77	3.58	716.74	87		78	261 / 256	48
21	52.5	3	73		.28	1.31	718.87	87		79	256 / 255	56
22	55	1	78		.34	1.56	720.68	88		79	257 / 256	47
23	57.5	1	78		.38	1.74	722.6	87		80		

OEHL FORM 18

C1

2/2

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER	#1
DATE	
PLANT	
BASE	
SAMPLE BOX NUMBER	
METER BOX NUMBER	
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

$$^{o}R = {}^{o}F + 460$$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

AMBIENT TEMP	°F
STATION PRESS	in Hg
HEATER BOX TEMP	°F
PROBE HEATER SETTING	
PROBE LENGTH	in
NOZZLE AREA (A)	sq ft
Cp	
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
34	60	2	77		.46	2.11	724.65	88		80	266 / 257	50
35	62.5	1	74		.32	1.48	726.589	87		80	261 / 262	50

Ave Ts = 70.0

$\overline{\Delta H}$ = 5.8[illegible]

Ave Tm = 81

Vm = 79.868

$\sqrt{Ps\,Ts}$ = 24.8036

OEHL FORM 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Hill AFB	29 Aug 90	# 1

BUILDING NUMBER	SOURCE NUMBER
1701	Bead Blast Facility Vent

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.4294	.2916	0.1378
ACETONE WASHINGS *(Probe, Front Half Filter)*	95.5791	95.4438	acetone rinse = 1.7 mg 0.0336
BACK HALF *(If needed)* not included in total weight			0.0222 ~~0.2214~~
	Total Weight of Particulates Collected		0.2214 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	162 ml	200	-38
IMPINGER 2 *(H20)*	210 ml	200	10
IMPINGER 3 *(Dry)*	10 ml	0	10
IMPINGER 4 *(Silica Gel)*	219.3 g	200	19.3
	Total Weight of Water Collected		1.3 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	0	0	0		0
VOL % O_2	19.4	19.4	19.4		19.4
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

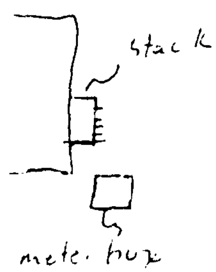
AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

PARTICULATE SAMPLING DATA SHEET

1/2

RUN NUMBER	# 2
DATE	27 Aug 90
PLANT	Bead Blast Facility Bldg 1701
BASE	Hill AFB
SAMPLE BOX NUMBER	
METER BOX NUMBER	Nutech #2
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$$^{o}R = {^{o}F} + 460$$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot check Pre - okay

Probe check @ 15 in Hg - okay

Post

Probe check @ 24 in Hg - okay

Pitot check ok

AMBIENT TEMP	°F
STATION PRESS	30.19 in Hg
HEATER BOX TEMP	°F
PROBE HEATER SETTING	
PROBE LENGTH	6 ft
NOZZLE AREA ~~(A)~~ Dia	.252 ~~sq ft~~
Cp	0.84
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)		IMPINGER OUTLET TEMP (°F)
	12.25 hrs						728.505						
1	2.5	1	76		.28	1.24	730.48	86		85	244	272	69
2	5	1	81		.33	1.49	732.25	90		85			65
3	7.5	1	83		.40	1.83	734.15	91		86	245	237	62
4	10	2	83		.46	2.11	736.2	93		86	244	236	60
5	12.5	3	82		.27	1.24	738.13	95		86	246	244	60
6	15	3	77		.70	3.24	740.30	93		87	244	247	60
7	17.5	4	80		.66	3.05	742.73	93		90	217	242	60
8	20	4	81		.75	3.48	745.12	96		92	244	268	50
9	22.5	4	80		.96	4.47	748.43	98		92	216	272	50
10	25	6	80		.79	3.67	751.445	102		92	266	256	54
11	27.5	3	84		1.10	5.07	754.3	98		93	232	237	54
12	30	7	84		1.3	6.05	757.70	103		94	270	253	57
13	32.5	8	82		1.4	6.55	761.35	106		94	260	249	61
14	35	10	83		1.4	6.56	765.15	108		95	255	248	63
15	37.5	10	81		1.4	6.57	769.005	109		95	254	247	65
16	40	8	80		1.5	7.05	772.65	104		96	258	247	63
17	42.5	11	79		1.8	8.47	776.51	107		96	256	247	63
18	45	11	78		1.7	8.05	780.37	108		97	255	248	64
19	47.5	11	80		1.8	8.50	784.31	108		98	255	248	64
20	50	11	80		1.8	8.50	788.[illegible]	108		98	256	248	65
21	52.5	9.5	80		2.3	10.84	791.10	105		99	255	247	61
22	55	11	77		2.4	11.37	795.75	103		99	251	248	61

OEHL FORM 18

PARTICULATE SAMPLING DATA SHEET

2/2

RUN NUMBER # 2	SCHEMATIC OF STACK CROSS SECTION	EQUATIONS	AMBIENT TEMP °F
DATE		$°R = °F + 460$	STATION PRESS in Hg
PLANT		$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$	HEATER BOX TEMP °F
BASE			PROBE HEATER SETTING
SAMPLE BOX NUMBER			PROBE LENGTH in
METER BOX NUMBER			NOZZLE AREA (A) sq ft
Qw/Qm			Cp
Co			DRY GAS FRACTION (Fd)

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
23	57.5	11	78		2.0	9.51	799.68	109		100	253 / 248	63
24	66.0	11	76		2.0	9.55	803.54	110		100	~~112~~ 250 / ~~103~~ 249	62
25	62.5	11	78		1.35	8.80	807.45	110		100	255 / 247	62
			$\bar{T}s$ =	81		$\overline{\Delta H}$ = 5.89						
								$\bar{T}m$ = 97				
							Vol = 79.945					

Hose Blown on Point 6 Stop testing – 1240
restarted @ 1313

$\sqrt{PsTs}$ = 24.1844

operator went to get Drink H_2O Stop 1314
restart – 1318

* Note – Actual Orifice Diff Pressure for points 17–25 was 7.4
Flow valves were completely open

OEHL FORM 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Hill AFB	27 Aug 90	#2

BUILDING NUMBER	SOURCE NUMBER
1701	Bead Blast Facility Vent

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.5070	0.2873	0.2197
ACETONE WASHINGS *(Probe, Front Half Filter)*	93.7053	93.6250	acetone rinse = 0.9 mg 0.0794
BACK HALF *(If needed)* not included in total weight			0.0209
	Total Weight of Particulates Collected		0.2991 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	180 ml	200	-20
IMPINGER 2 *(H20)*	202 ml	200	2
IMPINGER 3 *(Dry)*	3 ml	0	3
IMPINGER 4 *(Silica Gel)*	219.8 g	200	19.8
	Total Weight of Water Collected		4.8 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2					
VOL % O_2					
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

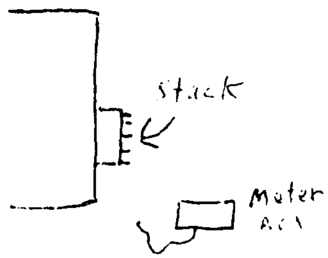
AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

PARTICULATE SAMPLING DATA SHEET

1/2

RUN NUMBER	# 3
DATE	30 Aug 90
PLANT	Bead Blast Facility (Bldg 1701)
BASE	Hill AFB
SAMPLE BOX NUMBER	
METER BOX NUMBER	Nutech #2
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$^{\circ}R = ^{\circ}F + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pre-sampling leak checks
Pitot – o.k.
Probe @ 19 in Hg – o.k.

Post sampling
Pitot – o.k.
Probe @ 15 in Hg – ok

AMBIENT TEMP	°F
STATION PRESS	29.98 in Hg
HEATER BOX TEMP	°F
PROBE HEATER SETTING	
PROBE LENGTH	72 in
NOZZLE AREA (A) dia	0.252 sq ft
Cp	0.84
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE (in H2O)~~ VAS	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H) calculated	ORIFICE DIFF. PRESS. (H) actual	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
								871.08					
1	2.5	12	81		2.1	9.47	6.2	874.32	80		77	242 271	47
2	5.0	12	80		2.1	9.54	6.2	877.88	85		78	243 282	45
3	7.5	12	80		2.2	10.02	6.2	881.42	88		78	243 279	51
4	10.0	12	81		2.1	9.49	6.2	884.93	90		79	244 265	56
5	12.5	12	81		1.9	8.68	6.1	888.46	91		80	243 264	57
6	15.0	12	81		1.6	7.27	6.2	892.10	86		80	243 266	59
7	17.5	12	81		1.8	8.22	6.1	895.58	90		81	240 261	57
8	20.0	12	81		1.7	7.77	6.1	899.19	91		81	245 259	58
9	22.5	12	81		1.8	8.24	6.1	902.67	92		82	248 258	60
10	25	12	81		1.8	8.24	6.1	906.18	92		82	250 259	60
11	27.5	8.2	81		1.05	4.80		909.58	91		82	247 260	58
12	30	10	81		1.2	5.51		912.88	93		83	247 260	54
13	32.5	10.2	81		1.25	5.74		916.31	94		83	246 260	54
14	35	12	81		1.45	6.67	6.1	919.82	95		83	247 260	54
15	37.5	12	81		1.35	6.22	6.1	923.37	97		84	245 260	55
16	40	4.9	81		0.66	3.04		925.87	94		85	246 245	56
17	42.5	4.9	81		0.65	2.99		928.44	94		85	247 248	52
18	45	5	82		0.75	3.45		931.06	95		85	246 262	51
19	47.5	7	82		0.93	4.28		933.95	96		86	248 268	51
20	50	5	82		0.71	3.28		936.73	98		86	249 254	52
21	52.5	1	82		0.27	1.24		938.41	96		86	246 249	54
22	55	1.5	81		0.31	1.43		940.14	95		87	247 255	51

OEHL FORM 18

PARTICULATE SAMPLING DATA SHEET

2/2

RUN NUMBER #3	SCHEMATIC OF STACK CROSS SECTION	EQUATIONS	AMBIENT TEMP °F
DATE		$°R = °F + 460$	STATION PRESS in Hg
PLANT		$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$	HEATER BOX TEMP °F
BASE			PROBE HEATER SETTING
SAMPLE BOX NUMBER			PROBE LENGTH in
METER BOX NUMBER			NOZZLE AREA (A) sq ft
Qw/Qm			Cp
Co			DRY GAS FRACTION (Fd)

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
2 3	57.5	2	81		0.39	1.80	942.05	95		87	248 251	51
2 4	60	2	82		0.42	1.94	944.06	96		87	247 254	51
2 5	62.5	1	82		0.29	1.34	945.920	97		87	249 261	51
			$\overline{Ts}$ 81			$\overline{\Delta H}$ 5.03			$\overline{Tm}$ 88			
							74.84					
				$\sqrt{PsTs}$ 24.7363								

OENL FORM 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Hill AFB	29 Aug 90	# 3

BUILDING NUMBER	SOURCE NUMBER
1701	Bead Blast Facility Vent

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3974	0.2876 ~~0.2723~~	0,1098
ACETONE WASHINGS *(Probe, Front Half Filter)*	105.1509	105.0507	acetone rinse = 1.4 mg 0.0988
BACK HALF *(If needed)* not included in total weight			0.0233
	Total Weight of Particulates Collected		0.2086 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	169 ml	200 ml	- 31
IMPINGER 2 *(H20)*	228 ml	200 ml	28
IMPINGER 3 *(Dry)*	1 ml	0	1
IMPINGER 4 *(Silica Gel)*	220g	200 g	20
	Total Weight of Water Collected		18 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2					
VOL % O_2					
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

PRELIMINARY SURVEY DATA SHEET NO. 1
(Stack Geometry)

BASE: Hill AFB	PLANT: Bead Blast Facility Bldg 1701
DATE: 29 Aug 90	SAMPLING TEAM: AFOEHL/EQA
SOURCE TYPE AND MAKE: Bead Blast Facility Vent Bldg 1701	
SOURCE NUMBER: N/A	INSIDE STACK DIAMETER: L = 31.5" W = 45.75" D_e = 37.3 Area = 10.0 Ft² Inches
RELATED CAPACITY:	TYPE FUEL: N/A
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER: 3.0 Inches	
NUMBER OF TRAVERSES: 5	NUMBER OF POINTS/TRAVERSE: 5

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

POINT	PERCENT OF DIAMETER	DISTANCE FROM INSIDE WALL (Inches)	TOTAL DISTANCE FROM OUTSIDE OF NIPPLE TO SAMPLING POINT (Inches)
1	1/10	3.15	6.15
2	3/10	9.45	12.45
3	5/10	15.75	18.75
4	7/10	22.05	25.05
5	9/10	28.35	31.35

OEHL FORM 15 APR 78

PRELIMINARY SURVEY DATA SHEET NO. 2
(Velocity and Temperature Traverse)

BASE: Hill AFB	DATE: 29 Aug 90
~~BOILER NUMBER~~: Bead Blast Facility Bldg 1701	
INSIDE STACK DIAMETER: L = 51.5" W = 45.75" De = 37.5 Area = 16.1 ft²	Inches
STATION PRESSURE: 30.19	In Hg
STACK STATIC PRESSURE: ~~-.75~~ .91	In H20
SAMPLING TEAM: AFOEHL	

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H20	~~$\sqrt{V_p}$~~ x	STACK TEMPERATURE (^{0}F)
1	1.0	12	70
2	1.2	3	
3	1.4	3	
4	1.6	2	
5	1.5	0	
	FPS 65	ACFM = 381	
	Ave FPM = [illegible]34		
	Ave [illegible] = [illegible]1.34		
Accel	Pla = 0.1984		
AVERAGE			

OEHL FORM APR 78 16

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Appendix F
Acetone & Distilled Water Blank Results
and Particulate Emissions Calculations

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BLANK ANALYTICAL DATA FORM

Plant Hill AFB, UT

Sample location Rail Shop bldg 1701 – Media Blast Booth

Relative humidity ____

Liquid level marked and container sealed ✓

Density of acetone (ρ_a) 0.786 g/ml

Blank volume (V_a) 450 ml

Date and time of wt 7 Sep 90 1600 Gross wt 97142.1 mg

Date and time of wt 10 Sep 90 0800 Gross wt 97141.9 mg

Average gross wt 97142.0 mg

Tare wt 97140.5 mg

Weight of blank (m_{ab}) 1.5 mg

$$C_a = \frac{m_{ab}}{V_a \rho_a} = \frac{(1.5)}{(450)(0.786)} = 0.0042 \text{ mg/g}$$

Note: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weignt) be subtracted from the sample weight.

Filters Filter number ____

Date and time of wt ____ Gross wt ____ mg

Date and time of wt ____ Gross wt ____ mg

Average gross wt ____ mg

Tare wt ____ mg

Difference wt ____ mg

Note: Average difference must be less than ±5 mg or 2% of total sample weight whichever is greater.

Remarks ____

Signature of analyst Robert J. O'Brien

Signature of reviewer ____

Quality Assurance Handbook M5-5.4

BLANK ANALYTICAL DATA FORM

Plant Hill AFB, UT

Sample location Media Blast Booth at Rail Shop, Bldg 1701

Relative humidity ____

Liquid level marked and container sealed ____

Density of ~~acetone~~ distilled H_2O (ρ_a) 1.0 g/ml

Blank volume (V_a) 500 ml

Date and time of wt 11 Sep 90 1600 Gross wt 987337 mg

Date and time of wt 13 Sep 90 0745 Gross wt 987337 mg

Average gross wt 987337 mg

Tare wt 987325 mg

Weight of blank (m_{ab}) 1.2 mg

$$C_a = \frac{m_{ab}}{V_a \ \rho_a} = \frac{(1.2)}{(500)\ (1.0)} = 0.0024 \text{ mg/g}$$

Note: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weight) be subtracted from the sample weight.

Filters Filter number ____

Date and time of wt ____ Gross wt ____ mg

Date and time of wt ____ Gross wt ____ mg

Average gross wt ____ mg

Tare wt ____ mg

Difference wt ____ mg

Note: Average difference must be less than ±5 mg or 2% of total sample weight whichever is greater.

Remarks ____

Signature of analyst Robert J. O'Brien

Signature of reviewer ____

Quality Assurance Handbook M5-5.4

XPOM "METH 5"

RUN NUMBER
ONE
RUN

METER BOX Y?
.9930 RUN
DELTA H?
5.2500 RUN
BAR PRESS ?
30.1300 RUN
METER VOL ?
79.8630 RUN
MTR TEMP F?
91.0000 RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
0.0000 RUN
STATIC H2O IN ?
-.9100 RUN
STACK TEMP.
70.0000 RUN
ML. WATER ?
1.3000 RUN

SAT % = 2.5

IMP. % H2O = 0.1

% H2O=0.1

% CO2?
0.0000 RUN
% OXYGEN?
19.4000 RUN
% CO ?
0.0000 RUN
MOL WT OTHER?
0.0000 RUN

MWD =28.78
MW WET=28.77

SQRT DETS ?
24.3079 RUN
TIME MIN ?
62.5000 RUN
NOZZLE DIA ?
.2530 RUN
STK DIA INCH ?
RUN
AREA SQ FT ?
10.0000 RUN

* VOL MTR STD = 79.214
STK PRES ABS = 30.12
VOL H2O GAS = 0.06
% MOISTURE = 0.08
MOL DRY GAS = 0.999
% NITROGEN = 80.60
MOL WT DRY = 28.78
MOL WT WET = 28.77
VELOCITY FPS = 60.51
STACK AREA = 10.00
STACK ACFM = 36,304.
* STACK DSCFM = 36,385.
% ISOKINETIC = 100.67

END OF FIELD DATA

XPOM "MASSFLO"

RUN NUMBER
ONE
RUN

VOL MTR STD ?
79.214 RUN
STACK DSCFM ?
36,385.00 RUN
FRONT 1/2 MG ?
221.40 RUN
BACK 1/2 MG ?
0.00 RUN

F GR/DSCF = 0.04
F MG/MMM = 95.72
F LB/HR = 13.45
F KG/HR = 6.10

```
XROM "METH 5"
RUN NUMBER
TWO
                    RUN
METER BOX Y?
         .9930      RUN
DELTA H?
        5.9900      RUN
BAR PRESS ?
       30.1900      RUN
METER VOL ?
       79.9450      RUN
MTR TEMP F?
       97.0000      RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
        0.0000      RUN
STATIC H2O IN ?
        -.9100      RUN
STACK TEMP.
       81.0000      RUN
ML. WATER ?
        4.8000      RUN


SAT % = 3.5


IMP. % H2O = 0.3

% H2O=0.3


% CO2?
        0.0000      RUN
% OXYGEN?
       19.4000      RUN
% CO ?
        0.0000      RUN
MOL WT OTHER?
        0.0000      RUN

MWd =29.78
MW WET=28.74


SQRT PSTS ?
       24.9844      RUN
TIME MIN ?
       62.5000      RUN
NOZZLE DIA ?
         .2520      RUN
STK DIA INCH ?
                    RUN
AREA SQ FT ?
       10.0000      RUN
```

```
* VOL MTR STD = 77.020
  STK PRES ABS = 30.12
  VOL H2O GAS = 0.23
  % MOISTURE = 0.29
  MOL DRY GAS = 0.997
  % NITROGEN = 80.60
  MOL WT DRY = 29.78
  MOL WT WET = 28.74
  VELOCITY FPS = 60.97
  STACK AREA = 10.00
  STACK ACFM = 36,584.
* STACK DSCFM = 35,842.
  % ISOKINETIC =  99.33


END OF FIELD DATA
```

```
XROM "MASSFLO"

RUN NUMBER
TWO
                    RUN

VOL MTR STD ?
         77.02      RUN
STACK DSCFM ?
     35,842.00      RUN
FRONT 1/2 MG ?
        299.10      RUN
BACK 1/2 MG ?
          0.00      RUN


F  GR/DSCF = 0.06
F  MG/MMM = 137.14
F  LB/HR = 18.41
F  KG/HR = 8.35
```

```
         XROM "METH 5"
RUN NUMBER
THREE
                        RUN
METER BOX Y?
          .9930    RUN
DELTA H?
          5.6300   RUN
BAR PRESS ?
         29.9800   RUN
METER VOL ?
         74.8400   RUN
MTR TEMP F?
         89.0000   RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
          0.0000   RUN
STATIC H2O IN ?
          -.9100   RUN
STACK TEMP.
         81.0000   RUN
ML. WATER ?
         18.0000   RUN


SAT % = 3.6


IMP. % H2O = 1.2

% H2O=1.2


% CO2?
          0.0000   RUN
% OXYGEN?
         19.4000   RUN
% CO ?
          0.0000   RUN
MOL WT OTHER?
          0.0000   RUN

MWd =28.78
MW WET=28.65


SQRT PSTE ?
         34.7367   RUN
TIME MIN ?
         52.5000   RUN
NOZZLE DIA ?
          .2520    RUN
STK DIA INCH ?
                   RUN
AREA SQ FT ?
         10.0002   RUN
```

```
* VOL MTR STD = 72.738
  STK PRES ABS = 29.91
  VOL H2O GAS = 0.85
  % MOISTURE = 1.15
  MOL DRY GAS = 0.989
  % NITROGEN = 80.60
  MOL WT DRY = 28.78
  MOL WT WET = 28.65
  VELOCITY FPS = 60.68
  STACK AREA = 10.00
  STACK ACFM = 36,406.
* STACK DSCFM = 35,114.
  % ISOKINETIC =  95.75


END OF FIELD DATA
```

```
         XROM "MASSFLO"

RUN NUMBER
THREE
                        RUN

VOL MTR STD ?
         72.738    RUN
STACK DSCFM ?
      35,114.00    RUN
FRONT 1/2 MG ?
         208.60    RUN
BACK 1/2 MG ?
           0.00    RUN


F  GR/DSCF = 0.04
F  MG/MMM = 101.27
F  LB/HR = 13.32
F  KG/HR = 6.04
```

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