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Appendices

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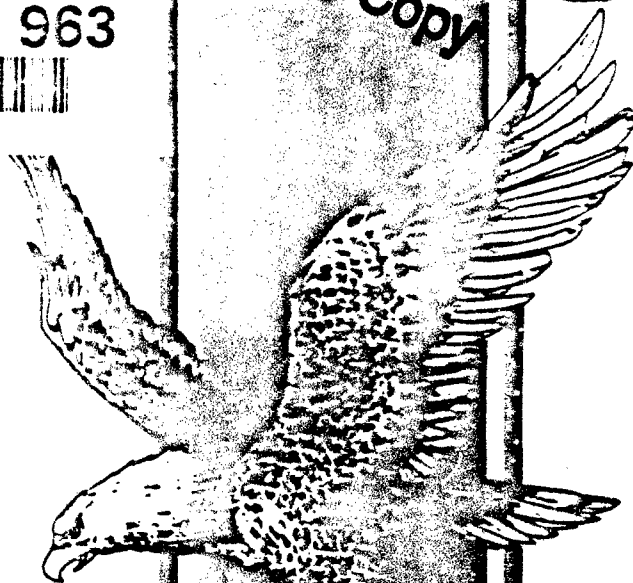


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USATHAMA

U.S. Army Toxic and Hazardous Materials Agency



Task Order - 2
Pilot Test of Hot Gas
Decontamination of Explosives-
Contaminated Equipment at
Hawthorne Army Ammunition
Plant (HWAAP)
Hawthorne, Nevada

Report No. CETHA-TE-CR-90036

July 1990

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INTRODUCTION TO APPENDICES

The following appendices are included in this report:

- Appendix A - Description of Spiking Procedures
- Appendix B - Sampling and Analytical Methods
- Appendix C - Description of CEM System
- Appendix D - Raw Operational Data Sheets
- Appendix E - Hourly Averages for CEM System Data
- Appendix F - Raw Analytical Data Sheets for Test Items
- Appendix G - Analytical Data Summary Tables for Stack Test Program
- Appendix H - Analytical Data Summary Tables for Test Items
- Appendix I - Example Calculations

Breaker pages are provided to identify each appendix listed above. A brief summary is included at the beginning of each appendix describing the contents.



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APPENDIX A
DESCRIPTION OF SPIKING PROCEDURES

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A. Description of Spiking Procedures

A description of the spiking procedures is discussed in the following subsections. Sparkless equipment was used when preparing and applying the spike solutions. WESTON personnel, in conjunction with HWAAP laboratory personnel, prepared the liquid spike solutions. HWAAP laboratory personnel prepared the paste spike solutions. HWAAP laboratory personnel applied all spike liquid/paste solutions.

A.1 TNT spiking procedures. A homogenous liquid solution (i.e., no solid TNT) was used to spike the following items of equipment:

- o powder boxes
- o steam-heated risers
- o steam-heated discharge valves
- o steel pipe
- o aluminum pipe

Prior to spiking, a batch solution was made to spike all test equipment. One hundred grams of TNT were added to 250 mL of acetone; 25 mL of the homogenous solution were added to the test equipment outlined above (using a pipet). After adding the solution to the equipment, the pipet was flushed with acetonitrile to remove residual TNT. The rinsate was added to the equipment. This resulted in a spike of 10 grams of TNT for each piece of equipment.

The liquid spike solution was added directly into the powder boxes. The boxes were agitated to swirl the liquid, exposing it to the internal surfaces. Holes or cracks in the powder boxes were plugged with parafilm wax.

For steam-heated vessels (risers and discharge valves), the bottom steam connection was covered with parafilm wax. Although it was originally planned to use rubber stoppers, parafilm was used to avoid potential analytical interference associated with rubber products. The spike solution was added to the upper steam connection. The vessel was agitated to swirl the liquid and expose it to the internal surfaces.

For pipe (aluminum and steel), one end of the pipe section was covered with parafilm wax. Spike solution was added into the open end of the pipe. The pipe was agitated to swirl the liquid, exposing it to the internal surfaces.

A heterogenous mixture (i.e., a workable paste) was used to spike the support racks for shells. For the TNT spike, 1 gram of TNT was mixed with about 0.8 mL of acetone. Although it was originally planned to spike shell support racks with 10 grams of TNT, field operations indicated that 1 gram was sufficient to cover the spike area (4 inches by 4 inches) adequately. The mixing container and applicator (spatula) were rinsed with about

50 mL acetonitrile. The rinsate was collected for analysis to determine the amount of TNT that adhered to the container and applicator.

The spiked equipment was placed on the loading dock of Building 117-15 and allowed to air dry.

A.2 Ammonium picrate spiking procedures. A homogenous liquid solution (i.e., no solid ammonium picrate) was used to spike the following items of equipment:

- o powder box
- o steam-heated riser
- o steam-heated discharge valve
- o steel pipe
- o aluminum pipe

Prior to spiking, a batch solution was made to spike all test equipment. Forty grams of ammonium picrate were added to 2400 mL of acetone; 300 mL of the homogenous solution were added to the test equipment outlined above (using a pipet). After adding the solution to the equipment, the pipet was flushed with water to remove residual ammonium picrate. The rinsate was added to the equipment. This resulted in a spike of 5 grams of ammonium picrate for each piece of equipment.

The procedures for spiking with ammonium picrate are the same as those used for spiking with TNT (for each type of equipment).

A.3 Spike recovery procedures. As outlined in the Test Plan, it was originally planned to conduct spike recovery tests. Selected pieces of test equipment were to be spiked with TNT and ammonium picrate. The spiked equipment was to be sampled (wipe samples or rinsates) to determine the efficiency of the sampling methods. During spiking activities, however, it was determined that it would never be possible to fully recover the TNT or ammonium picrate spiked on the equipment. Residual levels of explosives on the parafilm, steam connections, etc. interfered with recovery. Therefore, based on conversations with USATHAMA personnel, it was decided to conduct multiple rinses on the treated test equipment rather than on spiked equipment. Treated equipment was sampled using a series of four rinses.

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APPENDIX B
SAMPLING AND ANALYTICAL METHODS

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Appendix B provides a description of the following Sampling and Analytical Methods:

- EPA Method 1 - Sample and velocity traverses for stationary sources. (Page B-1)
- EPA Method 2 - Determination of stack gas velocity and volumetric flow rate. (Page B-5)
- EPA Method 25A - Determination of total gaseous organic concentration using a flame ionization analyzer. (Page B-17)
- EPA Method 3 - Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight. (Page B-19)
- EPA Method 10 - Determination of carbon monoxide emissions from stationary sources. (Page B-21)
- EPA Method 4 - Determination of moisture content in stack gases. (B-25)
- EPA Wipe Sampling Technique (Page B-29)
- Modified Method LW02 - Analysis of explosives in soil, wipe, and rinsate samples. (Page B-33)
- Modified Method for nitrocellulose, nitroglycerin, and PETN in water. (Page B-45)
- Ammonium Picrate in water and wipe samples by high performance liquid chromatography. (Page B-49)
- EPA Modified Method 5 - Modified method 5 sampling train. (Page B-55)
- EPA Method 5 - Determination of particulate emissions from stationary sources. (Page B-105)
- EPA Method 3A - Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources. (Page B-119)
- EPA Method 7E - Determination of nitrogen oxide emissions from stationary sources. (Page B-123)

Section 7 of the main report provides a summary of the sampling and analytical methods used to evaluate test items and air samples. The locations of the sampling points are shown in Figure 7-1 of the main report. A summary of the analytical parameters associated with each point is presented in Table 7-1 of the main report.

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EPA METHOD 1
SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

METHOD 1—SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

1. Principle and Applicability

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4), (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m² (113 in.²) cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. Procedure

2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2LW}{L+W}$$

where L=length and W=width.

An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This procedure, determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.); (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).

When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen

measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

TABLE 1-1 CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of Traverse Points	Minimum D _e
8	0.30
12	0.61
16	0.91
20	1.22
25	1.52
30	1.83
36	2.13
42	2.44
48	2.74

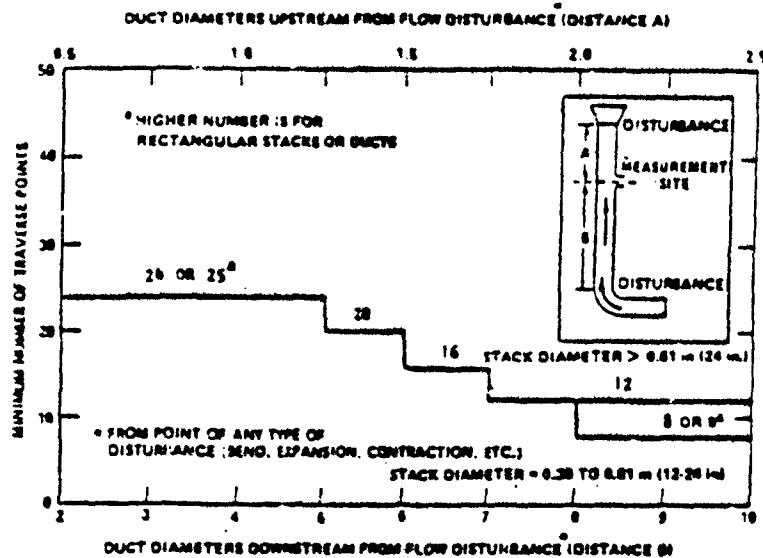


Figure 1-1. Minimum number of traverse points for particulate traverses.

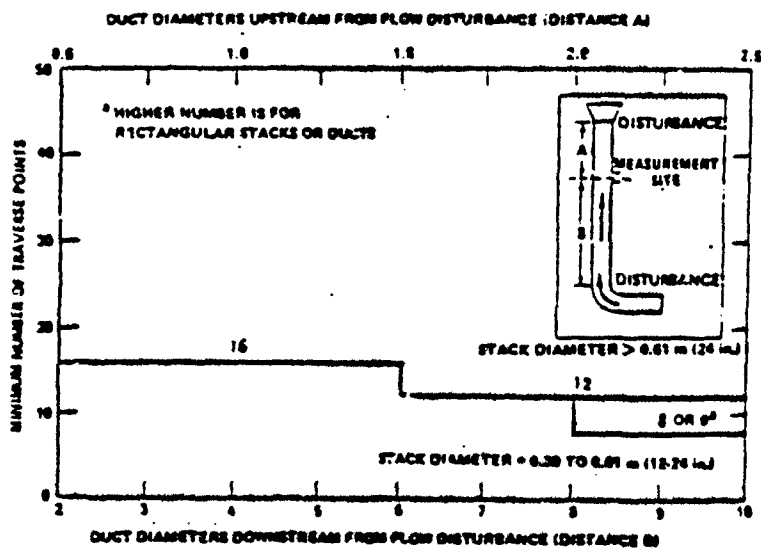


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.

2.3 Cross-sectional Layout and Location of Traverse Points.

2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator.

In addition for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeter (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls.

To meet these criteria, observe the procedures given below.

2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points is located in Section 2.3.1 (all within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter,

whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points.

Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

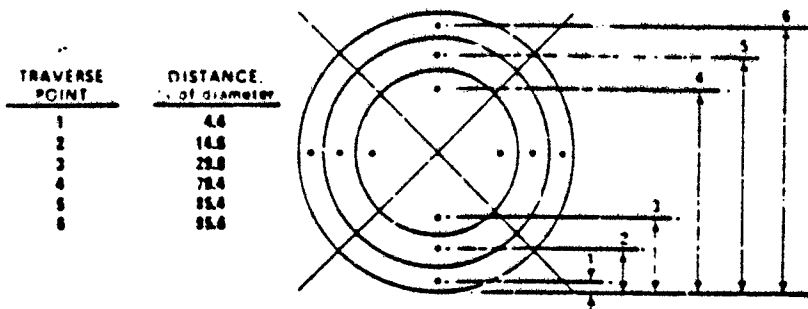


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	24	
1	14.6	8.7	4.4	2.2	2.0	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.8	4.4	3.8	3.5	3.2	2.9
3	35.4	25.0	18.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5	5.0
4	45.8	35.4	25.0	19.4	15.4	12.9	10.9	9.7	8.7	7.9	7.2	6.6
5	56.2	45.8	32.3	22.8	17.7	14.6	12.5	10.9	9.7	8.7	7.9	7.2
6	66.6	56.2	39.2	25.0	20.1	16.6	14.6	12.9	11.8	10.9	10.0	9.1
7	77.0	66.6	46.1	27.5	22.0	18.4	16.6	14.6	13.5	12.5	11.6	10.7
8	87.4	77.0	53.0	30.0	24.0	20.1	18.4	16.6	15.5	14.6	13.7	12.8
9	93.4	87.4	60.0	32.5	26.0	22.0	20.1	18.4	17.3	16.4	15.5	14.6
10	99.4	93.4	67.0	35.0	28.0	24.0	22.0	20.1	19.0	18.1	17.2	16.3
11	100.0	99.4	73.5	37.5	30.0	26.0	24.0	22.0	21.0	20.1	19.2	18.3
12	100.0	100.0	79.5	40.0	32.0	28.0	26.0	24.0	23.0	22.1	21.2	20.3
13	100.0	100.0	85.5	42.5	34.0	30.0	28.0	26.0	25.0	24.1	23.2	22.3
14	100.0	100.0	91.5	45.0	36.0	32.0	30.0	28.0	27.0	26.1	25.2	24.3
15	100.0	100.0	97.5	47.5	38.0	34.0	32.0	30.0	29.0	28.1	27.2	26.3
16	100.0	100.0	100.0	50.0	40.0	36.0	34.0	32.0	31.0	30.1	29.2	28.3
17	100.0	100.0	100.0	52.5	42.0	38.0	36.0	34.0	33.0	32.1	31.2	30.3
18	100.0	100.0	100.0	55.0	44.0	40.0	38.0	36.0	35.0	34.1	33.2	32.3
19	100.0	100.0	100.0	57.5	46.0	42.0	40.0	38.0	37.0	36.1	35.2	34.3
20	100.0	100.0	100.0	60.0	48.0	44.0	42.0	40.0	39.0	38.1	37.2	36.3
21	100.0	100.0	100.0	62.5	50.0	46.0	44.0	42.0	41.0	40.1	39.2	38.3
22	100.0	100.0	100.0	65.0	52.0	48.0	46.0	44.0	43.0	42.1	41.2	40.3
23	100.0	100.0	100.0	67.5	54.0	50.0	48.0	46.0	45.0	44.1	43.2	42.3
24	100.0	100.0	100.0	70.0	56.0	52.0	50.0	48.0	47.0	46.1	45.2	44.3

2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.

If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4x3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9x4 or 12x3, and would not necessarily have to be 6x6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area.

The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.

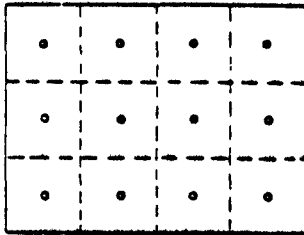


Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0" reference. Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to $\pm 90^\circ$ yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α ; assign a value of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses.

The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above. The limit of acceptability for the average value of α would remain 20°.

2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than 1/4 duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation.

Note.—Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.

2.5.1 Apparatus.

2.5.1.1 Directional Probe. Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (Note: Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional

probe, and permanently mark or engrave the number on the body of the probe. The pressure holes of directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "back-purging" with pressurized air is required.

2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., magnetic gauges) that meet the specifications described in Method 2, § 2.2.

Note.—If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, § 2.2.

2.5.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow § 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location is determined to be acceptable according to the criteria in this alternative procedure, use the same traverse point number and locations for sampling and velocity measurements.

2.5.3 Measurement Procedure.

2.5.3.1 Prepare the directional probe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H₂O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.

2.5.3.2 Level and zero the manometer. Because of vibrations and temperature changes, periodically check the level and zero during the traverses.

2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibration curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point.

A post-test check as described in 4-2.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, and repeat the flow angle measurements.

2.5.4 Calculate the resultant angle at each traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculations retaining at least one extra significant figure beyond that of the acquired data. Round the values after the final calculations.

2.5.4.1 Calculate the resultant angle at each traverse point

$$R_i = \arccosine \left(\frac{\sum (\cosine Y_i)(\cosine P_i)}{n} \right) \quad \text{Eq. 1-2}$$

Where:

R = Resultant angle at traverse point i, degree.

Y_i = Yaw angle at traverse point i, degree.

P_i = Pitch angle at traverse point i, degree.

2.5.4.2 Calculate the average resultant for the measurements:

$$\bar{R} = \frac{\sum R_i}{n} \quad \text{Eq. 1-3}$$

where:

\bar{R} = Average resultant angle, degree.

n = Total number of traverse points.

2.5.4.3 Calculate the standard deviations:

$$S_d = \sqrt{\frac{\sum_{i=1}^n (R_i - \bar{R})^2}{(n-1)}} \quad \text{Eq. 1-4}$$

Where:

S_d = Standard deviation, degree.

2.5.5 The measurement location is acceptable if $\bar{R} < 20^\circ$ and $S_d < 10^\circ$.

2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3600 ft/min).

2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurements should be made at the same point in the test section, preferably at the centroid of the test-section.

2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be $\pm 2^\circ$ of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.

2.5.6.3 Pitch Angle Calibration. Perform a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from -60° to +60° at one velocity in each of the two ranges

specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured data values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and 60°.

2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows. Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-dimensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.

3. Bibliography

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EPA METHOD 2
DETERMINATION OF STACK GAS VELOCITY AND
VOLUMETRIC FLOW RATE

METHOD 2—DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

1. Principle and Applicability

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. Apparatus

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g. stainless steel). It is recommended that the external tubing diameter (dimension D , Figure 2-2b) be between 0.48 and 0.95 centimeters ($\frac{1}{4}$ and $\frac{3}{8}$ inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_1 and P_2 , Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

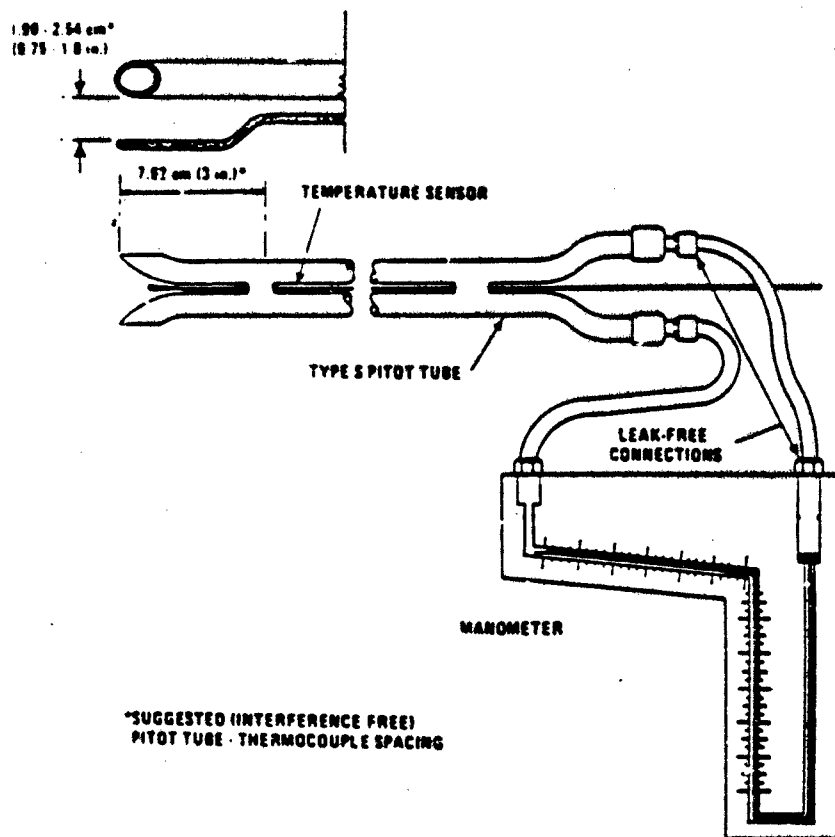


Figure 2-1. Type S pitot tube manometer assembly.

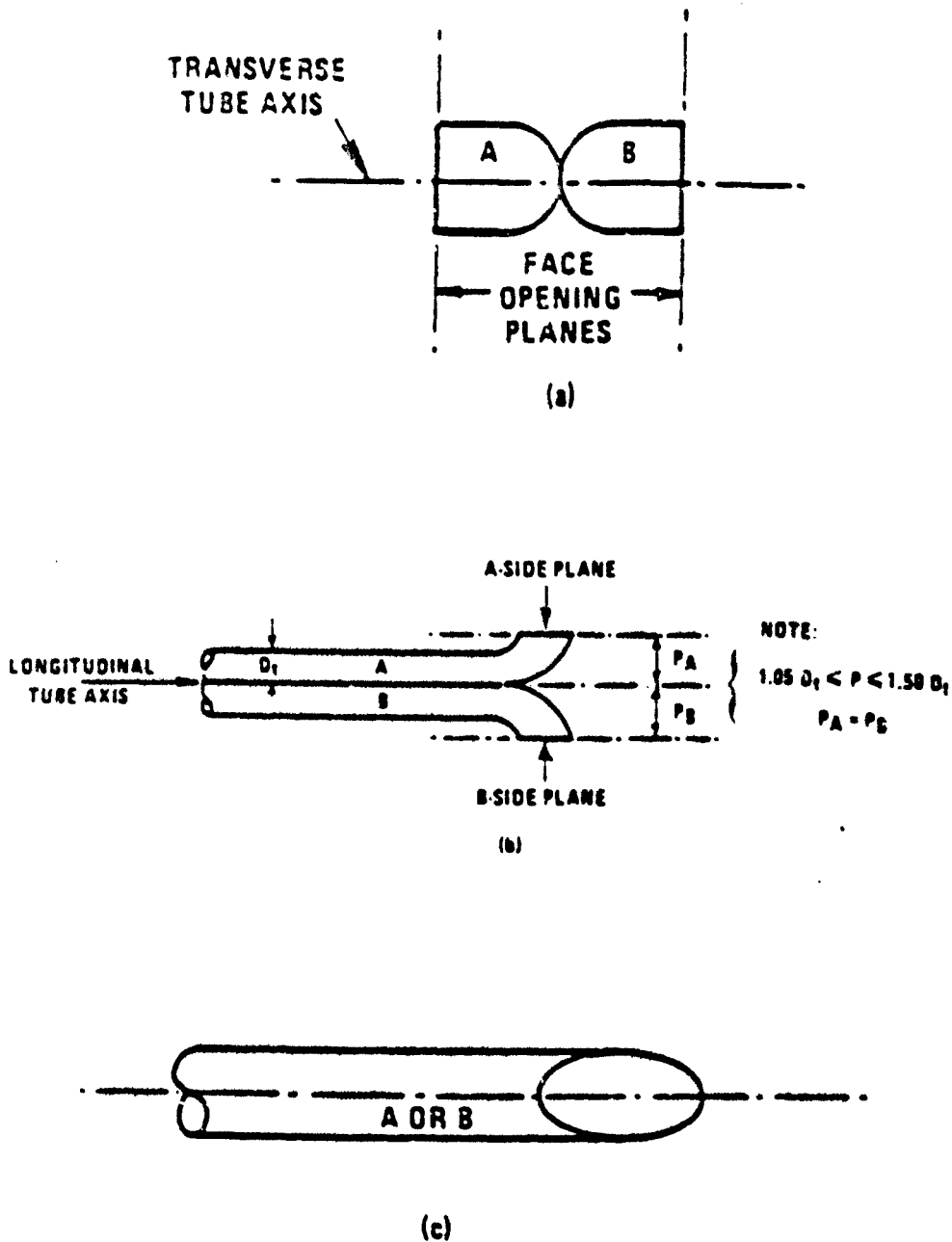


Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

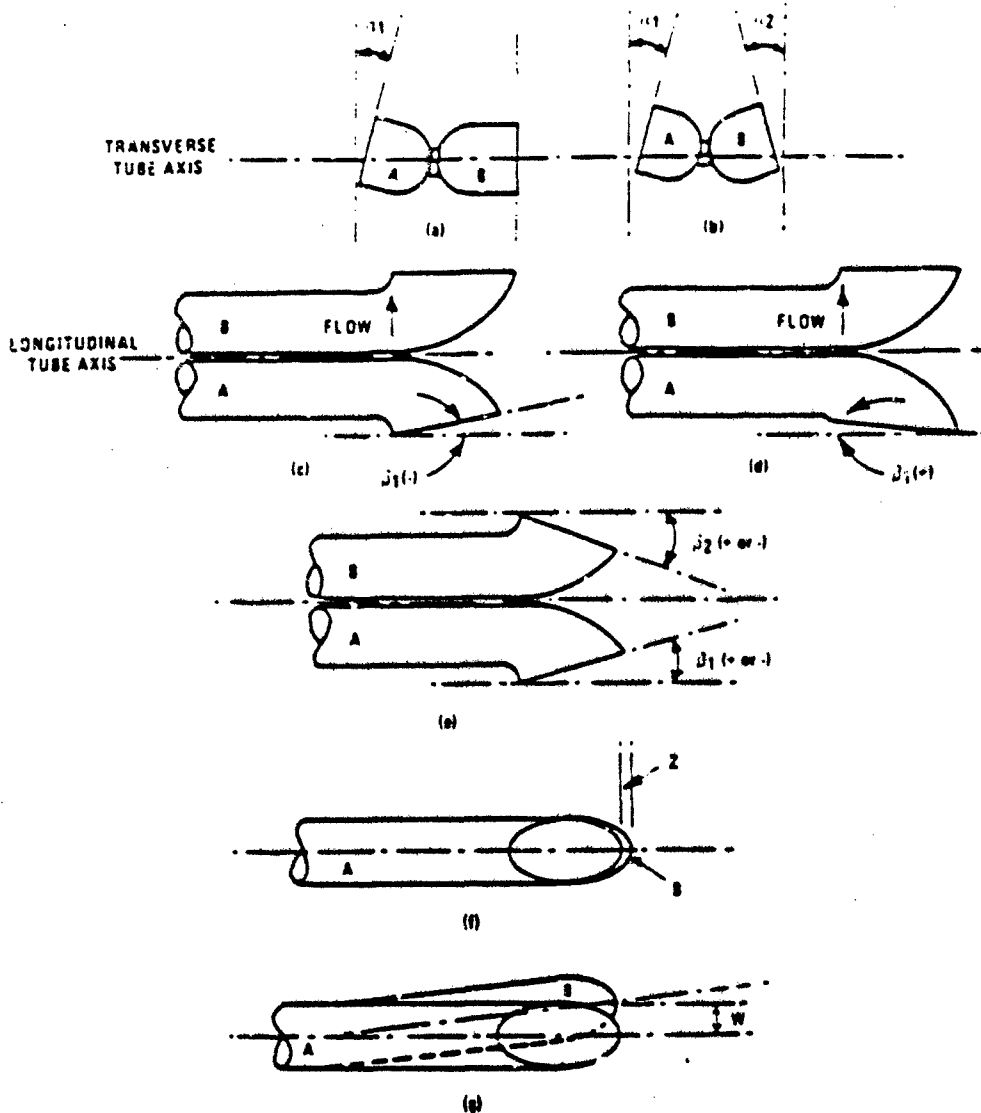


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of $C_p(s)$ so long as α_1 and $\alpha_2 \leq 10^\circ$, β_1 and $\beta_2 \leq 5^\circ$, $z \leq 0.32$ cm (1/8 in.) and $w \leq 0.08$ cm (1/32 in.) (citation 11 in Section 6).

A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at

the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same (± 5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be

taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H₂O divisions on the 0-to 1-in. inclined scale, and 0.1-in. H₂O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H₂O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H₂O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H₂O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H₂O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T = \frac{\sum_{i=1}^n \sqrt{\Delta p_i + K}}{\sum_{i=1}^n \sqrt{\Delta p_i}}$$

where:

Δp_i = Individual velocity head reading at a traverse point, mm H₂O (in. H₂O).

n = Total number of traverse points.

K = 0.13 mm H₂O when metric units are used and 0.005 in. H₂O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

Note: If differential pressure gauges other than inclined manometers are used (e.g., magnetic gauges), their calibration must be checked after each test series. To check

the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge, capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A plenumometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vice-versa for elevation decrease.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99 ± 0.01 .

2.7.1 Hemispherical (shown in Figure 2-4), ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D , the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.

2.7.5 Ninety degree bend, with curved or filtered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H₂O (0.005 in. H₂O). For multiveLOCITY calibrations, the gauge shall be readable to the nearest 0.13 mm H₂O (0.005 in. H₂O) for Δp values between 1.3 and 25 mm H₂O (0.05 and 1.0 in. H₂O), and to the nearest 1.3 mm H₂O (0.05 in. H₂O) for Δp values above 25 mm H₂O (1.0 in. H₂O). A special, more sensitive gauge will be required to read Δp values below 1.3 mm H₂O (0.05 in. H₂O) (see Citation 18 in Section 6).

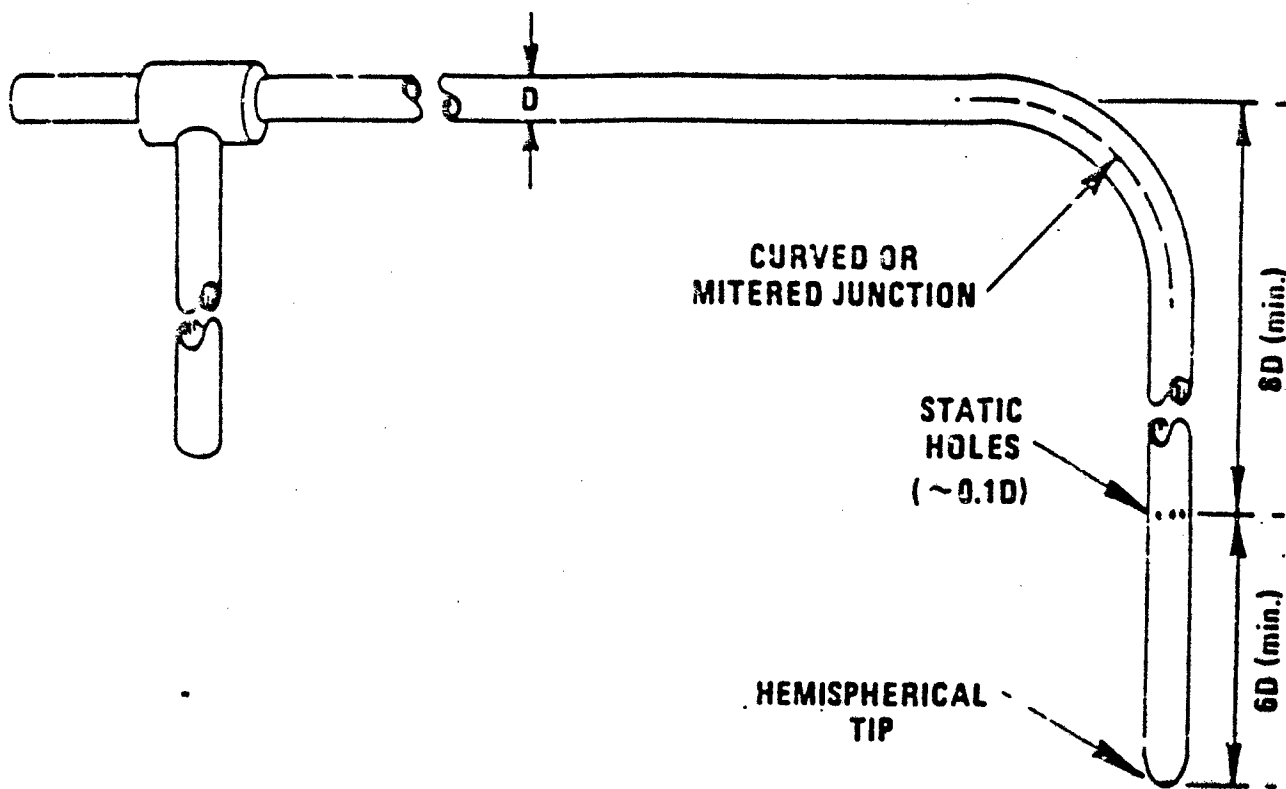


Figure 2-4. Standard pitot tube design specifications.

3. Procedure

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H₂O velocity pressure register on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H₂O. Other leak-check procedures, subject to the approval of the Administrator may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may

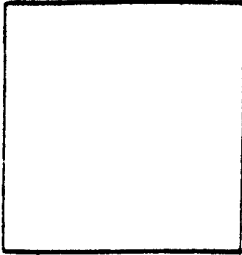
drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-3).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

PLANT _____
 DATE _____ RUN NO. _____
 STACK DIAMETER OR DIMENSIONS, m(in.) _____
 BAROMETRIC PRESSURE, mm Hg (in. Hg) _____
 CROSS SECTIONAL AREA, m²(ft²) _____
 OPERATORS _____
 PITOT TUBE I.D. NO. _____
 AVG. COEFFICIENT, C_p = _____
 LAST DATE CALIBRATED _____



SCHEMATIC OF STACK CROSS SECTION

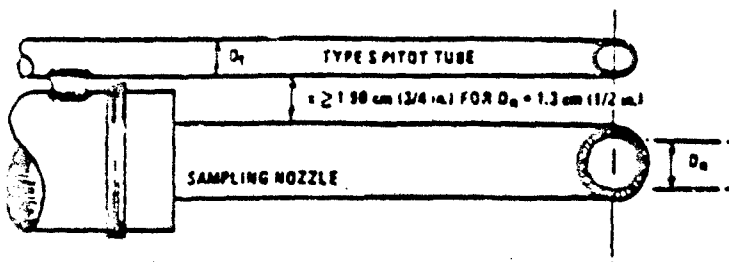
Traverse Pt. No.	Vel. Hd., Δh mm (in.) H ₂ O	Stack Temperature		P _g mm Hg (in. Hg)	√ Δh
		T _s , °C (°F)	T _s , °K (°R)		
		Average			

Figure 2-5. Velocity traverse data.

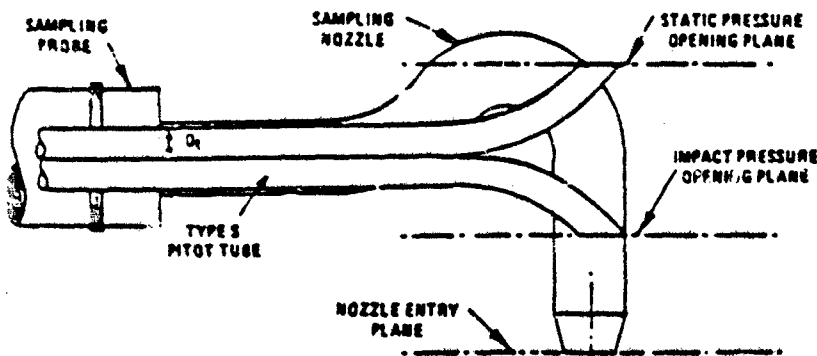
3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO, O₂, CO, and N₂, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.
 3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.
 3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. Calibration
 4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.
 After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D, Figure 2-2b) and (b) the base-to-opening plane distances (dimensions P₁ and P₂, Figure 2-2b). If D is between 0.48 and 0.99 cm (1/8 and 3/16 in.) and

if P₁ and P₂ are equal and between 1.0 and 1.58 D, there are two possible options: the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.3 through 4.1.5 below, or (2) a baseline (fixed tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, if the pitot tube is part of an assembly, calibration may still be required, despite the edge of the baseline coefficient value Section 4.1.11.
 If D, P₁, and P₂ are outside the specified limits, the pitot tube must be calibrated according to 4.1.2 through 4.1.5 below.



A. BOTTOM VIEW: SHOWING MINIMUM PITOT NOZZLE SEPARATION.



B. SIDE VIEW: TO PREVENT PITOT TUBE FROM INTERFERING WITH GAS FLOW STREAMLINES APPROACHING THE NOZZLE, THE IMPACT PRESSURE OPENING PLANE OF THE PITOT TUBE SHALL BE EVEN WITH OR ABOVE THE NOZZLE ENTRY PLANE.

Figure 2-6. Proper pitot tube-sampling nozzle configuration to prevent aerodynamic interference: burndick-type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

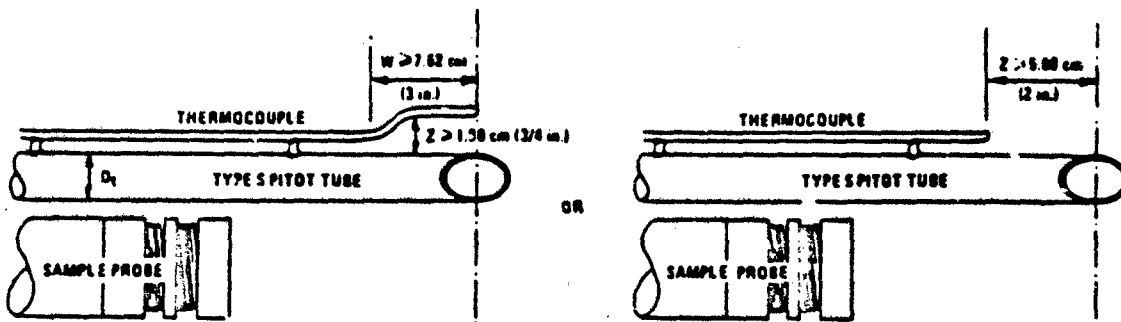


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

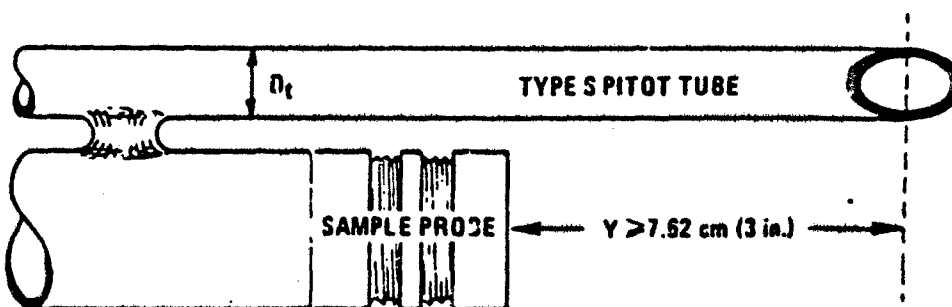


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore, an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

Note: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D = \frac{2LW}{(L+W)}$$

Equation 2-1

where:

D = Equivalent diameter

L = Length

W = Width

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

Note: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ± 3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ± 5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

PITOT TUBE IDENTIFICATION NUMBER: _____ DATE _____

CALIBRATED BY: _____

"A" SIDE CALIBRATION				
RUN NO.	ΔP_{std} cm H ₂ O (in. H ₂ O)	$\Delta P_{(s)}$ cm H ₂ O (in. H ₂ O)	$C_p(s)$	DEVIATION $C_p(s) - \bar{C}_p(A)$
1				
2				
3				
				\bar{C}_p (SIDE A)

"B" SIDE CALIBRATION				
RUN NO.	ΔP_{std} cm H ₂ O (in. H ₂ O)	$\Delta P_{(s)}$ cm H ₂ O (in. H ₂ O)	$C_p(s)$	DEVIATION $C_p(s) - \bar{C}_p(B)$
1				
2				
3				
				\bar{C}_p (SIDE B)

$$\text{AVERAGE DEVIATION} = \frac{1}{3} \sum |C_p(s) - \bar{C}_p(A \text{ OR } B)| \quad \leftarrow \text{MUST BE } < 0.01$$

$$|\bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B})| \quad \leftarrow \text{MUST BE } < 0.01$$

Figure 2-9. Pitot tube calibration data.

4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.3.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read ΔP_{std} and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same

point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read $\Delta P_{(s)}$ and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer.

4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of ΔP readings have been obtained.

4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of ΔP readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

$$C_{p_{avg}} = C_{p_{std}} \sqrt{\frac{\Delta p_{avg}}{\Delta p_s}}$$

Equation 2-2

where:

$C_{p_{avg}}$ = Type S pitot tube coefficient;

$C_{p_{std}}$ = Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.3 of this method.

Δp_{avg} = Velocity head measured by the standard pitot tube, cm H₂O (in. H₂O)

Δp_s = Velocity head measured by the Type S pitot tube, cm H₂O (in. H₂O)

4.1.4.2 Calculate \bar{C}_p (side A), the mean A-side coefficient, and \bar{C}_p (side B), the mean B-side coefficient; calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of \bar{C}_p from \bar{C}_p (side A), and the deviation of each B-side value of \bar{C}_p from \bar{C}_p (side B). Use the following equation:

$$\text{Deviation} = C_{p_{avg}} - \bar{C}_p(A \text{ or } B)$$

Equation 2-3

4.1.4.4 Calculate σ , the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma (\text{side A or B}) = \frac{\sum |C_{p_{avg}} - \bar{C}_p(A \text{ or } B)|}{3}$$

Equation 2-4

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between \bar{C}_p (A) and \bar{C}_p (B) is 0.01 or less.

4.1.5 Special considerations.

4.1.5.1 Selection of calibration point.

4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., \bar{C}_p (side A) and \bar{C}_p (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-4 through 2-8).

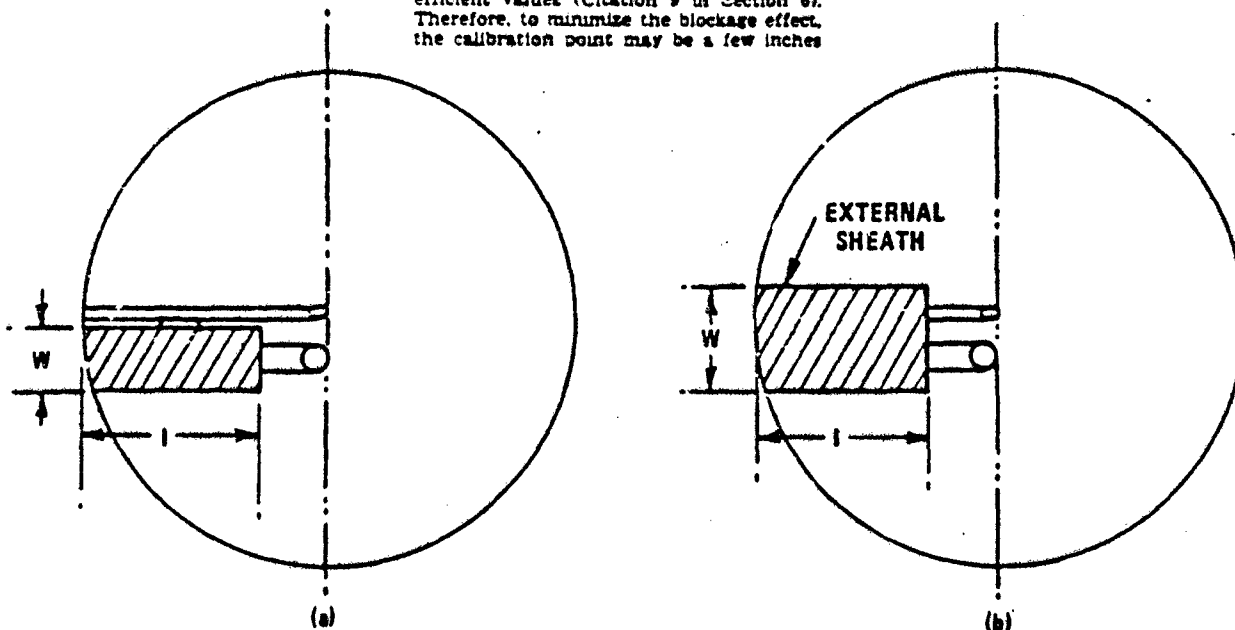
4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6, and 2-8).

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches

off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_{p_{avg}}$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or 1/4 in.) are not ordinarily used for isokinetic sampling at velocities around 215 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).



$$\text{ESTIMATED SHEATH BLOCKAGE (\%)} = \left[\frac{L \times W}{\text{DUCT AREA}} \right] \times 100$$

Figure 2-10. Projected-area models for typical pitot tube assemblies.

Figure 2-10. Projected-area models for typical pitot tube assemblies.

4.1.6 Field Use and Recalibration.
4.1.6.1 Field Use.
4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.

4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of C_p . Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 2 inches (Citation 16 in Section 6).

4.1.6.2 Recalibration.
4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully examined in top, side, and end views. If the pitot face openings are still aligned (within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has not been damaged to the extent that it no longer meets the specifications of Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 1.8.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair or damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.

4.2 Standard pitot tube (if applicable). If standard pitot tube is used for the velocity average, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of an assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).

4.3 Temperature Gauges. After each field use, calibrate dial thermometer, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature, or temperatures up to 405° C (761° F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple or potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 15° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator.

If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

A = Cross-sectional area of stack, m^2 (ft²).
 S_w = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.
 C_p = Pitot tube coefficient, dimensionless.
 K_p = Pitot tube constant.

$$34.97 \frac{m}{sec} \left[\frac{(g/g\text{-mole})(mm\ Hg)}{(^{\circ}K)(mm\ H_2O)} \right]^{1/2}$$

for the metric system and

$$34.97 \frac{ft}{sec} \left[\frac{(lb\text{-mole})(in.\ Hg)}{(^{\circ}R)(in.\ H_2O)} \right]^{1/2}$$

for the English system.

M_w = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).
 M_w = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).
 $\bar{M}_w = M_w(1 - S_w) + 18.0 S_w$

Equation 2-3

P_{atm} = Barometric pressure at measurement site, mm Hg (in. Hg).
 P_s = Stack static pressure, mm Hg (in. Hg).
 P_a = Absolute stack gas pressure, mm Hg (in. Hg).
 $= P_{atm} + P_s$

Equation 2-4

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
 Q_{std} = Dry volumetric stack gas flow rate corrected to standard conditions, $dec/m^3/hr$ ($dcft/hr$).
 t = Stack temperature, °C (°F).
 T = Absolute stack temperature, °K (°R).
 $= 273 + t$ for metric

Equation 2-7

$= 460 + t$ for English
Equation 2-8
 T_{std} = Standard absolute temperature, 293 °K (528 °R)
 v = Average stack gas velocity, m/sec (ft/sec).
 h = Velocity head of stack gas, mm H₂O (in. H₂O).
3.600 = Conversion factor, sec/hr.
18.0 = Molecular weight of water, g/g-mole (lb/lb-mole).
5.2 Average stack gas velocity.

$$v = K_p C_p (\sqrt{\Delta p})_{std} \sqrt{\frac{T_{std}}{P_{std} M_w}}$$

Equation 2-9

5.3 Average stack gas dry volumetric flow rate.

$$Q_{std} = 3.600(1 - S_w)A \left(\frac{T_{std}}{T} \right) \left(\frac{P_s}{P_{std}} \right)$$

Equation 2-10

To convert Q_{std} from $dec/m^3/hr$ ($dcft/hr$) to $dec/m^3/min$ ($dcfm$)
mol. divide Q_{std} by 60.

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EPA METHOD 25A
DETERMINATION OF TOTAL GASEOUS ORGANIC CONCENTRATION
USING A FLAME IONIZATION ANALYZER

METHOD 25A—DETERMINATION OF TOTAL GASEOUS ORGANIC CONCENTRATION USING A FLAME IONIZATION ANALYZER

1. Applicability and Principle.

1.1 Applicability. This method applies to the measurement of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

1.2 Principle. A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

2. Definitions.

2.1 Measurement System. The total equipment required for the determination of the gas concentration. The system consists of the following major subsystems:

2.1.1 Sample Interface. That portion of the system that is used for one or more of the following: sample acquisition, sample transportation, sample conditioning, or protection of the analyzer from the effects of the stack effluent.

2.1.2 Organic Analyzer. That portion of the system that senses organic concentration and generates an output proportional to the gas concentration.

2.2 Span Value. The upper limit of a gas concentration measurement range that is specified for affected source categories in the applicable part of the regulations. The span value is established in the applicable regulation and is usually 1.5 to 2.5 times the applicable emission limit. If no span value is provided, use a span value equivalent to 1.5 to 2.5 times the expected concentration. For convenience, the span value should correspond to 100 percent of the recorder scale.

2.3 Calibration Gas. A known concentration of a gas in an appropriate diluent gas.

2.4 Zero Drift. The difference in the measurement system response to a zero level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

2.5 Calibration Drift. The difference in the measurement system response to a mid-level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair or adjustment took place.

2.6 Response Time. The time interval from a step change in pollutant concentration at the inlet to the emission measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the recorder.

2.7 Calibration Error. The difference between the gas concentration indicated by the measurement system and the known concentration of the calibration gas.

1. Apparatus.

A schematic of an acceptable measurement system is shown in Figure 25A-1. The essential components of the measurement system are described below:

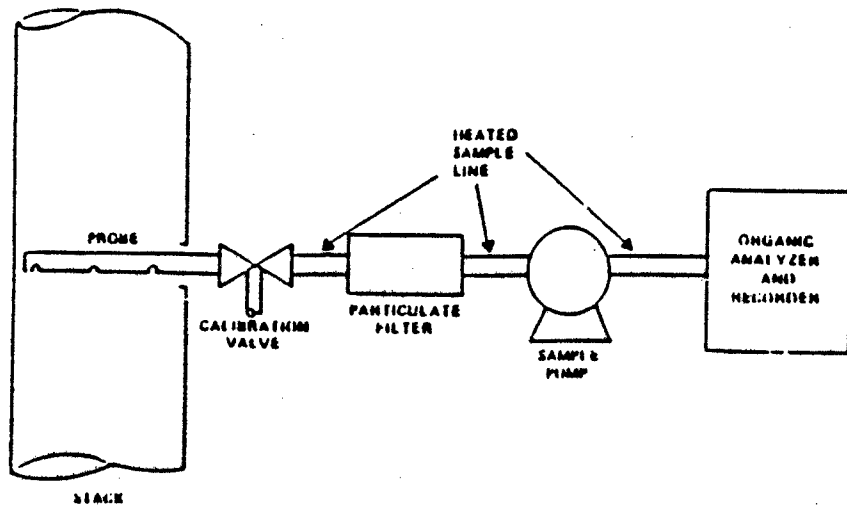


Figure 25A-1. Organic Concentration Measurement System.

3.1 Organic Concentration Analyzer. A flame ionization analyzer (FIA) capable of meeting or exceeding the specifications in this method.

3.2 Sample Probe. Stainless steel, or equivalent, three-hole rake type. Sample holes shall be 4 mm in diameter or smaller and located at 18.7, 50, and 83.3 percent of the equivalent stack diameter. Alternatively, a single opening probe may be used so that a gas sample is collected from the centrally located 10 percent area of the stack cross-section.

3.3 Sample Line. Stainless steel or Teflon® tubing to transport the sample gas to the analyzer. The sample line should be heated, if necessary, to prevent condensation in the line.

3.4 Calibration Valve Assembly. A three-way valve assembly to direct the zero and calibration gases to the analyzer is recommended. Other methods, such as quick-connect lines, to route calibration gas to the analyzer are applicable.

3.5 Particulate Filter. An in-stack or an out-of-stack glass fiber filter is recommended if exhaust gas particulate loading is significant. An out-of-stack filter should be heated to prevent any condensation.

3.6 Recorder. A strip-chart recorder, analog computer, or digital recorder for recording measurement data. The minimum data recording requirement is one measurement value per minute. Note: This method is often applied in highly explosive areas. Caution and care should be exercised in choice of equipment and installation.

4. Calibration and Other Gases.

Gases used for calibrations, fuel, and combustion air (if required) are contained in compressed gas cylinders. Preparation of calibration gases shall be done according to the procedure in Protocol No. 1, listed in Reference 9.2. Additionally, the manufacturer of the cylinder should provide a recommended shelf life for each calibration gas cylinder over which the concentration does not change more than ±2 percent from the certified value. For calibration gas values not generally available (i.e., organics between 1 and 10 percent by volume), alternative methods for preparing calibration gas mixtures, such as dilution systems, may be used with prior approval of the Administrator.

Calibration gases usually consist of propane in air or nitrogen and are determined in terms of the span value. Organic compounds other than propane can be used following the above guidelines and making the appropriate corrections for response factor.

4.1 Fuel. A 40 percent H₂/60 percent He or 40 percent H₂/60 percent N₂ gas mixture is recommended to avoid an oxygen synergism effect that reportedly occurs when oxygen concentration varies significantly from a mean value.

4.2 Zero Gas. High purity air with less than 0.1 parts per million by volume (ppmv) of organic material (propane or carbon equivalent) or less than 0.1 percent of the span value, whichever is greater.

4.3 Low-level Calibration Gas. An organic calibration gas with a concentration equivalent to 25 to 35 percent of the applicable span value.

4.4 Mid-level Calibration Gas. An organic calibration gas with a concentration equivalent to 45 to 55 percent of the applicable span value.

4.5 High-level Calibration Gas. An organic calibration gas with a concentration equivalent to 80 to 90 percent of the applicable span value.

5. Measurement System Performance Specifications.

5.1 Zero Drift. Less than ±3 percent of the span value.

5.2 Calibration Drift. Less than ±3 percent of span value.

5.3 Calibration Error. Less than ± 5 percent of the calibration gas value.

6. Pretest Preparations.

6.1 Selection of Sampling Site. The location of the sampling site is generally specified by the applicable regulation or purpose of the test; i.e., exhaust stack, inlet line, etc. The sample port shall be located at least 1.3 meters or 2 equivalent diameters (whichever is less) upstream of the gas discharge to the atmosphere.

6.2 Location of Sample Probe. Install the sample probe so that the probe is centrally located in the stack, pipe, or duct and is sealed tightly at the stack port connection.

6.3 Measurement System Preparation. Prior to the emission test, assemble the measurement system following the manufacturer's written instructions in preparing the sample interface and the organic analyzer. Make the system operable.

FLA equipment can be calibrated for almost any range of total organics concentrations. For high concentrations of organics (>1.0 percent by volume as propane) modifications to most commonly available analyzers are necessary. One accepted method of equipment modification is to decrease the size of the sample to the analyzer through the use of a smaller diameter sample capillary. Direct and continuous measurement of organic concentration is a necessary consideration when determining any modification design.

6.4 Calibration Error Test. Immediately prior to the test series (within 2 hours of the start of the test) introduce zero gas and high-level calibration gas at the calibration valve assembly. Adjust the analyzer output to the appropriate levels, if necessary. Calculate the predicted response for the low-level and mid-level gases based on a linear response line between the zero and high-level responses. Then introduce low-level and mid-level calibration gases successively to the measurement system. Record the analyzer responses for low-level and mid-level calibration gases and determine the differences between the measurement system responses and the predicted responses. These differences must be less than 5 percent of the respective calibration gas value. If not, the measurement system is not acceptable and must be replaced or repaired prior to testing. No adjustments to the measurement system shall be conducted after the calibration and before the drift check (Section 7.3). If adjustments are necessary before the completion of the test series, perform the drift checks prior to the required adjustments and repeat the calibration following the adjustments. If multiple electronic ranges are to be used, each additional range must be checked with a mid-level calibration gas to verify the multiplication factor.

6.5 Response Time Test. Introduce zero gas into the measurement system at the calibration valve assembly. When the system output has stabilized, switch quickly to the high-level calibration gas. Record the time from the concentration change to the measurement system response equivalent to 95 percent of the step change. Repeat the test three times and average the results.

7. Emission Measurement Test

7.1 Organic Measurement. Begin sampling at the start of the test period, recording time and any required process information as appropriate. In particular, note on the recording chart periods of process interruption or cyclic operation.

7.2 Drift Determination. Immediately following the completion of the test period and hourly during the test period, reintroduce the zero and mid-level calibration gases, one at a time, to the measurement system at the calibration valve assembly. (Make no adjustments to the measurement system until after both the zero and calibration drift checks are made.) Record the analyzer response. If the drift values exceed the specified limits, invalidate the test results preceding the check and repeat the test following corrections to the measurement system. Alternatively, recalibrate the test measurement system as in Section 6.4 and report the results using both sets of calibration data (i.e., data determined prior to the test period and data determined following the test period).

8. Organic Concentration Calculations.

Determine the average organic concentration in terms of ppmv as propane or other calibration gas. The average shall be determined by the integration of the output recording over the period specified in the applicable regulation.

If results are required in terms of ppmv as carbon, adjust measured concentrations using Equation 23A-1.

$$C_c = K C_m$$

Eq. 23A-1

Where:

C_c = Organic concentration as carbon, ppmv.

C_m = Organic concentration as measured, ppmv.

K = Carbon equivalent correction factor.

$K = 3$ for ethane.

$K = 3$ for propane.

$K = 4$ for butane.

K = Appropriate response factor for other organic calibration gases.

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EPA METHOD 3

**GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN,
EXCESS AIR, AND DRY MOLECULAR WEIGHT**

METHOD 3—GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

1. Principle and Applicability

1.1 Principle. A gas sample is extracted from a stack, by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent carbon dioxide (CO₂), percent oxygen (O₂), and, if necessary, percent carbon monoxide (CO). If a dry molecular weight determination is to be made, either an Orsat or a Pyrite analyzer may be used for the analysis; for excess air or emission rate correction factor determination, an Orsat analyzer must be used.

1.2 Applicability. This method is applicable for determining CO₂ and O₂ concentrations, excess air, and dry molecular weight of a sample from a gas stream of a fossil-fuel combustion process. The method may also be applicable to other processes where it has been determined that compounds other than CO₂, O₂, CO, and nitrogen (N₂) are not present in concentrations sufficient to affect the results.

Other methods, as well as modifications to the procedure described herein, are also applicable for some or all of the above determinations. Examples of specific methods and modifications include: (1) a multi-point sampling method using an Orsat analyzer to analyze individual grab samples obtained at each point; (2) a method using CO₂ or O₂ and stoichiometric calculations to determine dry molecular weight and excess air; (3) assigning a value of 30.0 for dry molecular weight, in lieu of actual measurements, for processes burning natural gas, coal, or oil. These methods and modifications may be used, but are subject to the approval of the Administrator, U.S. Environmental Protection Agency.

2. Apparatus

As an alternative to the sampling apparatus and systems described herein, other sampling systems (e.g., liquid displacement) may be used provided such systems are capable of obtaining a representative sample and maintaining a constant sampling rate, and are otherwise capable of yielding acceptable results. Use of such systems is subject to the approval of the Administrator.

2.1 Grab Sampling (Figure 3-1).

2.1.1 Probe. The probe should be made of stainless steel or borosilicate glass tubing and should be equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Any other materials inert to O₂, CO₂, CO, and N₂ and resistant to temperature at sampling conditions may be used for the probe; examples of such material are aluminum, copper, quartz glass and Teflon.

2.1.2 Pump. A one-way squeeze bulb, or equivalent, is used to transport the gas sample to the analyzer.

2.2 Integrated Sampling (Figure 3-2).

2.2.1 Probe. A probe such as that described in Section 2.1.1 is suitable.

2.2.2 Condenser. An air-cooled or water-cooled condenser, or other condenser that will not remove O₂, CO₂, CO, and N₂, may be used to remove excess moisture which would interfere with the operation of the pump and flow meter.

2.2.3 Valve. A needle valve is used to adjust sample gas flow rate.

2.2.4 Pump. A leak-free, diaphragm-type pump, or equivalent, is used to transport sample gas to the flexible bag. Install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.2.5 Rate Meter. The rotameter, or equivalent rate meter, used should be capable of measuring flow rate to within ±2 percent of the selected flow rate. A flow rate range of 500 to 1000 cm³/min is suggested.

2.2.6 Flexible Bag. Any leak-free plastic (e.g., Tedlar, Mylar, Teflon) or plastic-coated aluminum (e.g., aluminized Mylar) bag, or equivalent, having a capacity consistent with the selected flow rate and time

length of the test run, may be used. A capacity in the range of 55 to 90 liters is suggested.

To leak-check the bag, connect it to a water manometer and pressurize the bag to 5 to 10 cm H₂O (2 to 4 in. H₂O). Allow to stand for 10 minutes. Any displacement in the water manometer indicates a leak. An alternative leak-check method is to pressurize the bag to 5 to 10 cm H₂O (2 to 4 in. H₂O) and allow to stand overnight. A deflated bag indicates a leak.

2.2.7 Pressure Gauge. A water-filled U-tube manometer, or equivalent, of about 30 cm (12 in.) is used for the flexible bag leak-check.

2.2.8 Vacuum Gauge. A mercury manometer, or equivalent, of at least 760 mm Hg (30 in. Hg) is used for the sampling train leak-check.

2.3 Analysis. For Orsat and Pyrite analyzer maintenance and operation procedures, follow the instructions recommended by the manufacturer, unless otherwise specified herein.

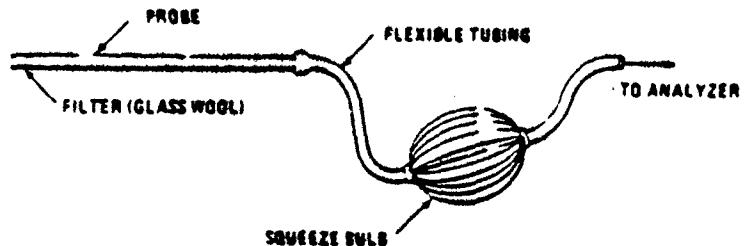


Figure 3-1. Grab sampling train.

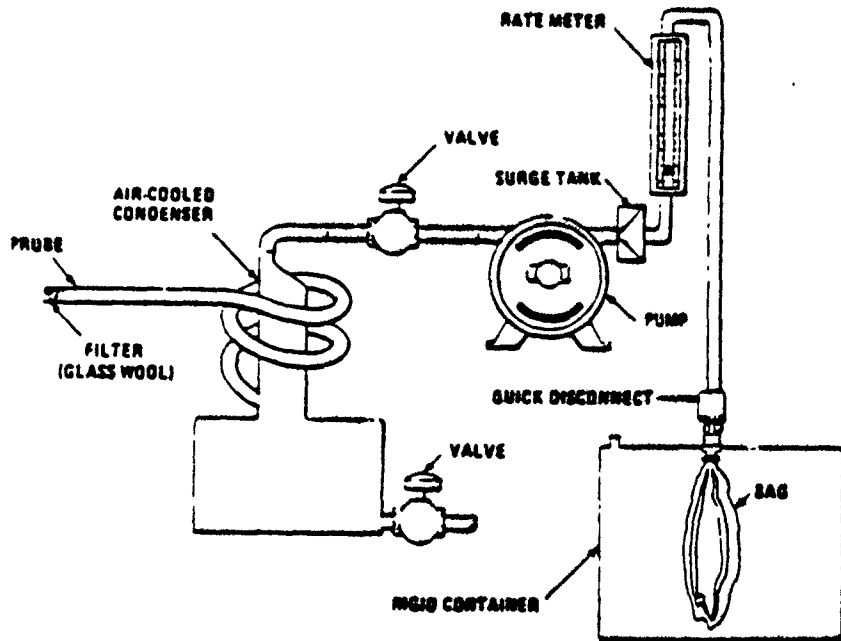


Figure 3-2. Integrated gas-carrying train.

¹Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.3.1 Dry Molecular Weight Determination. An Orsat analyzer or Fyrite type combustion gas analyzer may be used.

2.3.2 Emission Rate Correction Factor or Excess Air Determination. An Orsat analyzer must be used. For low CO₂ (less than 4.0 percent) or high O₂ (greater than 15.0 percent) concentrations, the measuring burette of the Orsat must have at least 0.1 percent subdivisions.

3. Dry Molecular Weight Determination

Any of the three sampling and analytical procedures described below may be used for determining the dry molecular weight.

3.1 Single-Point, Grab Sampling and Analytical Procedure.

3.1.1 The sampling point in the duct shall either be at the centroid of the cross section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

3.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. If an Orsat analyzer is used, it is recommended that the analyzer be leak-checked by following the procedure in Section 5; however, the leak-check is optional.

3.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer and immediately analyze it for percent CO₂ and percent O₂. Determine the percentage of the gas that is N₂ and CO by subtracting the sum of the percent CO₂ and percent O₂ from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.1.4 Repeat the sampling, analysis, and calculation procedures, until the dry molecular weights of any three grab samples differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (lb/lb-mole).

3.2 Single-Point, Integrated Sampling and Analytical Procedure.

3.2.1 The sampling point in the duct shall be located as specified in Section 3.1.1.

3.2.2 Leak-check (optional) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (optional) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum should remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

3.2.3 Sample at a constant rate. The sampling run should be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collection of at least 30 liters (1.00 ft³) of sample gas is recommended; however, smaller volumes may be collected, if desired.

3.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. Within 8 hours after the sample is taken, analyze it for percent CO₂ and percent O₂ using either an Orsat analyzer or a Fyrite-type combustion gas analyzer. If an Orsat analyzer is used, it is recommended that the Orsat leak-check described in Section 5 be performed before this determination; however, the check is optional.

Determine the percentage of the gas that is N₂ and CO by subtracting the sum of the percent CO₂ and percent O₂ from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.2.5 Repeat the analysis and calculation procedures until the individual dry molecular weights for any three analyses differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

3.3 Multi-Point, Integrated Sampling and Analytical Procedure.

3.3.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used for all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to approval of the Administrator.

3.3.2 Follow the procedures outlined in sections 3.2.2 through 3.2.5, except for the following: traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4. Emission Rate Correction Factor or Excess Air Determination

NOTE: A Fyrite-type combustion gas analyzer is not acceptable for excess air or emission rate correction factor determination, unless approved by the Administrator. If both percent CO₂ and percent O₂ are measured, the analytical results of any of the three procedures given below may also be used for calculating the dry molecular weight.

Each of the three procedures below shall be used only when specified in an applicable subpart of the standards. The use of these procedures for other purposes must have specific prior approval of the Administrator.

4.1 Single-Point, Grab Sampling and Analytical Procedure.

4.1.1 The sampling point in the duct shall either be at the centroid of the cross-section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

4.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. Leak-check the Orsat analyzer according to the procedure described in Section 5. This leak-check is mandatory.

FIGURE 3-3—SAMPLING RATE DATA

Time	Traverse pt.	O ₂ ppm	% dev.*
Average			

$$* \% \text{ Dev.} = (Q - Q_{\text{avg}}) / Q_{\text{avg}} \times 100 \quad (\text{Must be } < 10\%)$$

4.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer. For emission rate correction factor determination, immediately analyze the sample, as outlined in Sections 4.1.4 and 4.1.5, for percent CO₂ or percent O₂. If excess air is desired, proceed as follows: (1) immediately analyze the sample, as in Sections 4.1.4 and 4.1.5, for percent CO₂, O₂, and CO; (2) determine the percentage of the gas that is N₂ by subtracting the sum of the percent CO₂, percent O₂, and percent CO from 100 percent; and (3) calculate percent excess air as outlined in Section 6.2.

4.1.4 To insure complete absorption of the CO₂, O₂, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.1.5 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis.

NOTE: Since this single-point, grab sampling and analytical procedure is normally conducted in conjunction with a single-point, grab sampling and analytical procedure for a pollutant, only one analysis is ordinarily conducted. Therefore, great care must be taken to obtain a valid sample and analysis. Although in most cases only CO₂ or O₂ is required, it is recommended that both CO₂ and O₂ be measured, and that Section 4.4 be used to validate the analytical data.

4.2 Single-Point, Integrated Sampling and Analytical Procedure.

4.2.1 The sampling point in the duct shall be located as specified in Section 4.1.1.

4.2.2 Leak-check (mandatory) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (mandatory) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum shall remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

4.2.3 Sample at a constant rate, or as specified by the Administrator. The sampling run must be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collect at least 30 liters (1.00 ft³) of sample gas. Smaller volumes may be collected, subject to approval of the Administrator.

4.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. For emission rate correction factor determination, analyze the sample within 4 hours after it is taken for percent CO₂ or percent O₂ (as outlined in Sections 4.2.5 through 4.2.7). The Orsat analyzer must be leak-checked (see Section 5) before the analysis. If excess air is desired, proceed as follows: (1) within 4 hours after the sample is taken, analyze it (as in Sections 4.2.5 through 4.2.7) for percent CO₂, O₂, and CO; (2) determine the percentage of the gas that is N₂ by subtracting the sum of the percent CO₂, percent O₂, and percent CO from 100 percent; (3) calculate percent excess air, as outlined in Section 6.2.

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EPA METHOD 10
DETERMINATION OF CARBON MONOXIDE EMISSIONS
FROM STATIONARY SOURCES

1311R2

METHOD 10—DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

1. Principle and Applicability.

1.1 **Principle.** An integrated or continuous gas sample is extracted from a sampling point and analyzed for carbon monoxide (CO) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent.

1.2 **Applicability.** This method is applicable for the determination of carbon monoxide emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or an integrated sample is to be used.

2. Range and sensitivity.

2.1 **Range.** 0 to 1,000 ppm.
 2.2 **Sensitivity.** Minimum detectable concentration is 20 ppm for a 0 to 1,000 ppm span.

3. **Interferences.** Any substance having a strong absorption of infrared energy will interfere to some extent. For example, discrimination ratios for water (H₂O) and carbon dioxide (CO₂) are 3.5 percent H₂O per 7 ppm CO and 10 percent CO₂ per 10 ppm CO, respectively, for devices measuring in the 1,500 to 3,000 ppm range. For devices measuring in the 0 to 100 ppm range, interference ratios can be as high as 3.5 percent H₂O per 25 ppm CO and 10 percent CO₂ per 50 ppm CO. The use of silica gel and ascarite traps will alleviate the major interference problems. The measured gas volume must be corrected if these traps are used.

4. Precision and accuracy.

4.1 **Precision.** The precision of most NDIR analyzers is approximately ±3 percent of span.

4.2 **Accuracy.** The accuracy of most NDIR analyzers is approximately ±5 percent of span after calibration.

5. Apparatus.

5.1 Continuous sample (Figure 10-1).

5.1.1 **Probe.** Stainless steel or sheathed Pyrex[®] glass, equipped with a filter to remove particulate matter.

5.1.2 **Air-cooled condenser or equivalent.** To remove any excess moisture.

5.2 **Integrated sample (Figure 10-2).**

5.2.1 **Probe.** Stainless steel or sheathed Pyrex glass, equipped with a filter to remove particulate matter.

5.2.2 **Air-cooled condenser or equivalent.** To remove any excess moisture.

5.2.3 **Valve.** Needle valve, or equivalent, to adjust flow rate.

5.2.4 **Pump.** Leak-free diaphragm type, or equivalent, to transport gas.

5.2.5 **Rate meter.** Rotameter, or equivalent, to measure a flow range from 0 to 1.0 liter per min. (0.038 cfm).

5.2.6 **Flexible bag.** Tedlar, or equivalent, with a capacity of 60 to 80 liters (2 to 3 ft³). Leak-test the bag in the laboratory before using by evacuating bag with a pump fol-

¹Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

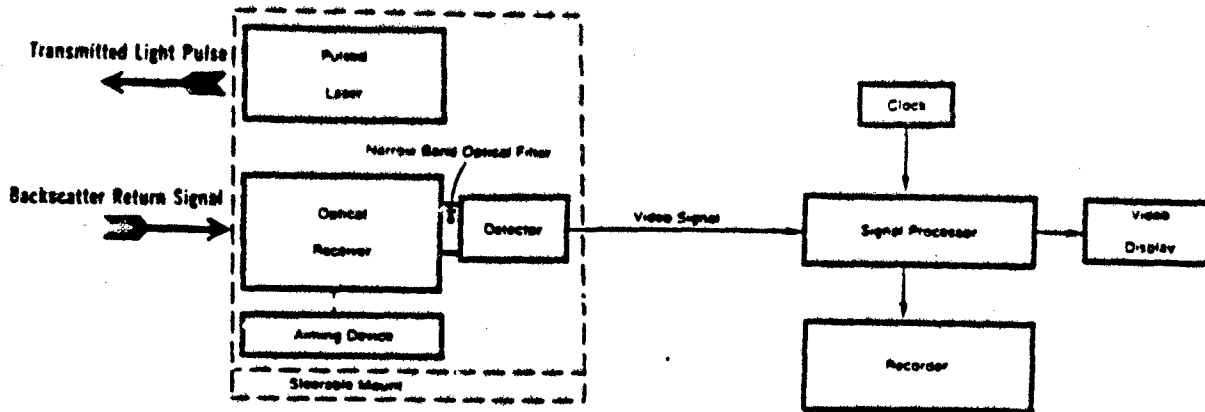


Figure 10-1. Functional Block Diagram of a Basic Lidar System

owed by a dry gas meter. When evacuation is complete, there should be no flow through the meter.

5.2.7 *Pitot tube.* Type S, or equivalent, attached to the probe so that the sampling rate can be regulated proportional to the stack gas velocity when velocity is varying with the time or a sample traverse is conducted.

5.3 *Analysis (Figure 10-3).*

5.3.1 *Carbon monoxide analyzer.* Nondispersive infrared spectrometer, or equivalent. This instrument should be demonstrated, preferably by the manufacturer, to meet or exceed manufacturer's specifications and those described in this method.

5.3.2 *Drying tube.* To contain approximately 200 g of silica gel.

5.3.3 *Calibration gas.* Refer to paragraph 1.1.

5.3.4 *Filter.* As recommended by NDIR manufacturer.

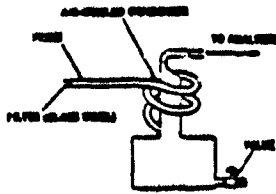


FIGURE 10-1. CONTINUOUS SAMPLING SYSTEM.

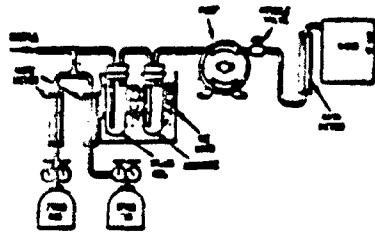


FIGURE 10-2. INTEGRATED SAMPLING SYSTEM.

6.2 *Silica gel.* Indicating type, 6 to 16 mesh, dried at 175° C (347° F) for 2 hours.

6.3 *Ascarite.* Commercially available.

7. *Procedure.*

7.1 *Sampling.*

7.1.1 *Continuous sampling.* Set up the equipment as shown in Figure 10-1 making sure all connections are leak free. Place the probe in the stack at a sampling point and purge the sampling line. Connect the analyzer and begin drawing sample into the analyzer. Allow 5 minutes for the system to stabilize, then record the analyzer reading as required by the test procedure. (See 7.2 and 8). CO₂ content of the gas may be determined by using the Method 3 integrated sample procedure (36 FR 34886), or by weighing the ascarite CO₂ removal tube and computing CO₂ concentration from the gas volume sampled and the weight gain of the tube.

7.1.2 *Integrated sampling.* Evacuate the flexible bag. Set up the equipment as shown in Figure 10-2 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are leak free. Sample at a rate proportional to the stack velocity. CO₂ content of the gas may be determined by using the Method 3 integrated sample procedure (36 FR 34886), or by weighing the ascarite CO₂ removal tube and computing CO₂ concentration from the gas volume sampled and the weight gain of the tube.

7.2 *CO Analyzer.* Assemble the apparatus as shown in Figure 10-3, calibrate the instrument, and perform other required operations as described in paragraph 3. Purge analyzer with N₂ prior to introduction of each sample. Direct the sample stream through the instrument for the test period, recording the readings. Check the zero and span again after the test to assure that any drift or malfunction is detected. Record the sample data on Table 10-1.

8. *Calibration.* Assemble the apparatus according to Figure 10-3. Generally an instrument requires a warm-up period before stability is obtained. Follow the manufacturer's instructions for specific procedure. Allow a minimum time of 1 hour for warm-up. During this time check the sample conditioning apparatus, i.e., filter, condenser, drying tube, and CO₂ removal tube, to ensure that each component is in good operating condition. Zero and calibrate the instrument according to the manufacturer's procedures using, respectively, nitrogen and the calibration gases.

5.3.5 *CO₂ removal tube.* To contain approximately 500 g of ascarite.

5.3.6 *Ice water bath.* For ascarite and silica gel tubes.

5.3.7 *Valve.* Needle valve, or equivalent, to adjust flow rate.

5.3.8 *Rate meter.* Rotameter or equivalent to measure gas flow rate of 0 to 1.0 liter per min. (0.035 cfm) through NDIR.

5.3.9 *Recorder (optional).* To provide permanent record of NDIR readings.

6. *Reagents.*

6.1 *Calibration gases.* Known concentration of CO in nitrogen (N₂) for instrument span, prepurified grade of N₂ for zero, and two additional concentrations corresponding approximately to 60 percent and 30 percent span. The span concentration shall not exceed 1.5 times the applicable source performance standard. The calibration gases shall be certified by the manufacturer to be within ±2 percent of the specified concentration.

TABLE 10-1—FIELD DATA

Comments	
Location	_____
Time	_____
Date	_____
Operator	_____
Check time	Rotameter setting, flow rate removed (enter test gas removed)

9. *Calculation—Concentration of carbon monoxide.* Calculate the concentration of carbon monoxide in the stack using equation 10-1.

$$C_{CO} = C_{CO} \text{ (measured)} (1 - F_{CO_2})$$

where:

C_{CO} = CO concentration of CO in stack, ppm by volume (dry basis).

C_{CO} = CO concentration of CO measured by NDIR analyzer, ppm by volume (dry basis).

F_{CO_2} = volume fraction of CO₂ in sample, i.e., percent CO₂ from Orsat analysis divided by 100.

10. *Bibliography.*

10.1 McElroy, Frank. The Intertech NDIR-CO Analyzer. Presented at 11th Methods Conference on Air Pollution, University of California, Berkeley, Calif., April 2, 1970.

10.2 Jacobs, M. R., et al. Continuous Determination of Carbon Monoxide and Hydrocarbons in Air by a Modified Infrared Analyzer. J. Air Pollution Control Association, 12: 119-114, August 1969.

10.3 MSA LIRA Infrared Gas and Liquid Analyzer Instruction Book, Mine Safety Appliances Co., Technical Products Division, Pittsburgh, Pa.

10.4 Models 218A, 318A, and 418A Infrared Analyzers, Beckman Instruments, Inc., Beckman Instructions 1635-B, Fullerton, Calif., October 1967.

10.5 Continuous CO Monitoring System, Model AS611, Intertech Corp., Princeton, N.J.

10.6 UNOP Infrared Gas Analyzers, Bendix Corp., Ronovora, West Virginia.

APPENDIX—A. PERFORMANCE SPECIFICATIONS FOR NDIR CARBON MONOXIDE ANALYZERS.

Range (pressure)	0-1000 ppm
Output (pressure)	0-100V
Minimum detectable concentration	20 ppm
Flow rate, 90 percent (maximum)	30 cc/min
Flow rate, 50 percent (minimum)	30 cc/min
Zero drift (pressure)	10% in 8 hours
Span drift (pressure)	10% in 8 hours
Precision (pressure)	±2% of full scale
Repeatability (pressure)	±1% of full scale
Linearity (pressure deviation)	2% of full scale
Interference (pressure ratio)	CO—1000 to 1, H ₂ O—500 to 1

B. Definitions of Performance Specifications

Range—The minimum and maximum measurement limits.

Output—Electrical signal which is proportional to the measurement; intended for connection to recorder or data processing devices. Usually expressed as millivolts or milliamperes full scale at a given impedance.

Full scale—The maximum measuring limit for a given range.

Minimum detectable sensitivity—The smallest amount of input concentration that can be detected as the concentration approaches zero.

Accuracy—The degree of agreement between a measured value and the true value; usually expressed as \pm percent of full scale.

Time to 90 percent response—The time interval from a step change in the input concentration at the instrument inlet to a reading of 90 percent of the ultimate recorded concentration.

Rise Time (90 percent)—The interval between initial response time and time to 90 percent response after a step increase in the inlet concentration.

Fall Time (90 percent)—The interval between initial response time and time to 90 percent response after a step decrease in the inlet concentration.

Zero Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is zero; usually expressed as percent full scale.

Span Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is a stated upscale value; usually expressed as percent full scale.

Precision—The degree of agreement between repeated measurements of the same concentration, expressed as the average deviation of the single results from the mean.

Noise—Spontaneous deviations from a mean output not caused by input concentration changes.

Linearity—The maximum deviation between an actual instrument reading and the reading predicted by a straight line drawn between upper and lower calibration points.

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EPA METHOD 4
DETERMINATION OF MOISTURE CONTENT IN STACK GASES

1311R2

METHOD 4—DETERMINATION OF MOISTURE CONTENT IN STACK GASES

1. Principle and Applicability

1.1 Principle. A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically.

1.2 Applicability. This method is applicable for determining the moisture content of stack gas.

Two procedures are given. The first is a reference method for accurate determinations of moisture content (such as are needed to calculate emission data). The second is an approximation method, which provides estimates of percent moisture to aid in setting isokinetic sampling rates prior to a pollutant emission measurement run. The approximation method described herein is only a suggested approach; alternative means for approximating the moisture content, e.g., drying tubes, wet bulb-dry bulb techniques, condensation techniques, stoichiometric calculations, previous experience, etc., are also acceptable.

The reference method is often conducted simultaneously with a pollutant emission measurement run; when it is, calculation of percent isokinetic, pollutant emission rate, etc., for the run shall be based upon the results of the reference method or its equivalent; these calculations shall not be based upon the results of the approximation method, unless the approximation method is shown, to the satisfaction of the Administrator, U.S. Environmental Protection Agency, to be capable of yielding results within 1 percent H₂O of the reference method.

NOTE: The reference method may yield questionable results when applied to saturated gas streams or to streams that contain water droplets. Therefore, when these conditions exist or are suspected, a second determination of the moisture content shall be made simultaneously with the reference method, as follows: Assume that the gas stream is saturated. Attach a temperature sensor (capable of measuring to $\pm 1^\circ\text{C}$ (2°F)) to the reference method probe. Measure the stack gas temperature at each traverse point (see Section 2.2.1) during the reference method traverse; calculate the average stack gas temperature. Next, determine the moisture percentage, either by: (1) using a psychrometric chart and making appropriate corrections if stack pressure is different from that of the chart, or (2) using saturation vapor pressure tables. In cases where the psychrometric chart or the saturation vapor pressure tables are not applicable (based on evaluation of the process), alternate methods, subject to the approval of the Administrator, shall be used.

2. Reference Method

The procedure described in Method 5 for determining moisture content is acceptable as a reference method.

2.1 Apparatus. A schematic of the sampling train used in this reference method is shown in Figure 4-1. All components shall be maintained and calibrated according to the procedure outlined in Method 5.

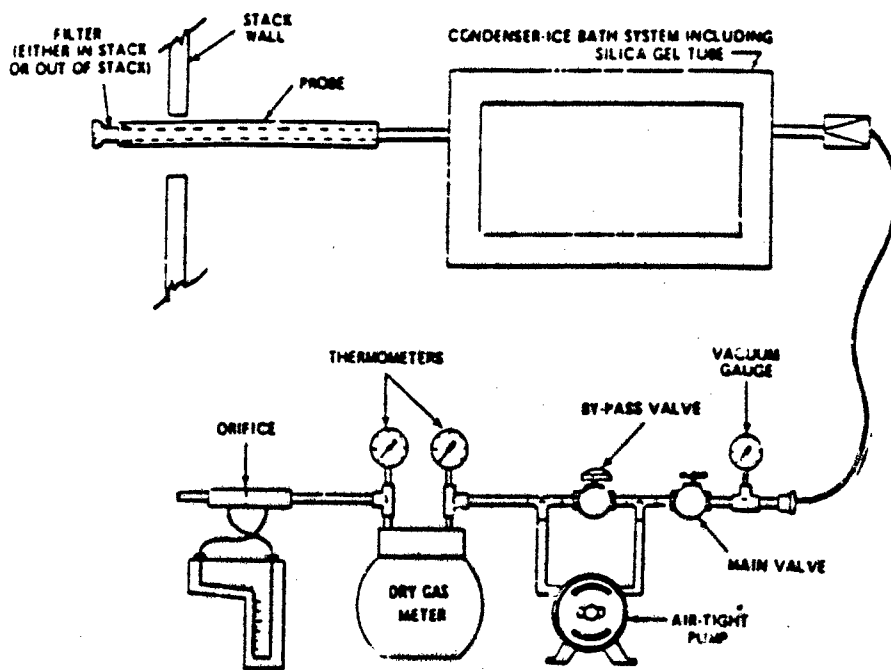


Figure 4-1. Moisture sampling train-reference method

2.1.1 Probe. The probe is constructed of stainless steel or glass tubing, sufficiently heated to prevent water condensation, and is equipped with a filter, either in-stack (e.g., a plug of glass wool inserted into the end of the probe) or heated out-stack (e.g., as described in Method 5), to remove particulate matter.

When stack conditions permit, other metals or plastic tubing may be used for the probe, subject to the approval of the Administrator.

2.1.2 Condenser. The condenser consists of four impingers connected in series with ground glass, leak-free fittings or any similarly leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3 centimeter ($\frac{1}{2}$ inch) ID glass tube extending to about 1.3 cm ($\frac{1}{2}$ in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator.

The first two impingers shall contain known volumes of water, the third shall be empty, and the fourth shall contain a known weight of 6- to 18-mesh indicating type silica gel, or equivalent desiccant. If the silica gel has been previously used, dry at 175°C (350°F) for 2 hours. New silica gel may be used as received. A thermometer, capable of measuring temperature to within 1°C (2°F), shall be placed at the outlet of the fourth impinger, for monitoring purposes.

Alternatively, any system may be used (subject to the approval of the Administrator) that cools the sample gas stream and allows measurement of both the water that has been condensed and the moisture leaving the condenser, each to within 1 ml or 1 g. Acceptable means are to measure the condensed water, either gravimetrically or volumetrically, and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures, or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap, with exit gases kept below 20°C (68°F), and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump, to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

quired on the example data sheet shown in Figure 4-2. Be sure to record the dry gas meter reading at the beginning and end of each sampling time increment and whenever sampling is halted. Take other appropriate readings at each sample point, at least once during each time increment.

2.2.5 To begin sampling, position the probe tip at the first traverse point. Immediately start the pump and adjust the flow to the desired rate. Traverse the cross section, sampling at each traverse point for an equal length of time. Add more ice and, if necessary, salt to maintain a temperature of less 20° C (68° F) at the silica gel outlet.

2.2.6 After collecting the sample, disconnect the probe from the filter holder (or from the first impinger) and conduct a leak check (mandatory) as described in Section 2.2.3. Record the leak rate. If the leakage rate exceeds the allowable rate, the tester shall either reject the test results or shall correct the sample volume as in Section 6.3 of Method 5. Next, measure the volume of the moisture condensed to the nearest ml. Determine the increase in weight of the silica gel (or silica gel plus impinger) to the nearest 0.5 g. Record this information (see example data sheet, Figure 4-3) and calculate the moisture percentage, as described in 2.3 below.

2.2.7 A quality control check of the volume metering system at the field site is suggested before collecting the sample following the procedure in Method 5, Section 4.4.

2.3 Calculations. Carry out the following calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

FIGURE 4-3—ANALYTICAL DATA—REFERENCE METHOD

	Impinger volume, ml	Silica gel weight, g
Final		
Initial		
Difference		

2.3.1 Nomenclature.

- B_w = Proportion of water vapor, by volume, in the gas stream.
- M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).
- P_a = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).
- P_s = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
- R = Ideal gas constant, 0.08206 (mm Hg)(m³)/(g-mole)(°K) for metric units and 21.85 (in. Hg)(ft³)/(lb-mole)(°R) for English units.
- T_a = Absolute temperature at meter, °K (°R).
- T_s = Standard absolute temperature, 293 K (528°R).
- V_x = Dry gas volume measured by dry gas meter, dcm (dcf).
- ΔV_x = Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (scf).
- $V_{x,scm}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).
- $V_{w,scm}$ = Volume of water vapor condensed corrected to standard conditions, scm (scf).

$V_{w,scm}$ = Volume of water vapor collected in silica gel corrected to standard conditions, scm (scf).

V_f = Final volume of condenser water, ml.
 V_i = Initial volume, if any, of condenser water, ml.
 W_f = Final weight of silica gel or silica gel plus impinger, g.
 W_i = Initial weight of silica gel or silica gel plus impinger, g.
 Y = Dry gas meter calibration factor.

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

2.3.2 Volume of water vapor condensed.

$$V_{w,scm} = \frac{(V_f - V_i)\rho_w RT_s}{P_a M_w}$$

$$= K_1(V_f - V_i)$$

Equation 4-1

where:
 $K_1 = 0.001333 \text{ m}^3/\text{ml}$ for metric units
 $= 0.04707 \text{ ft}^3/\text{ml}$ for English units

2.3.3 Volume of water vapor collected in silica gel.

$$V_{w,scm} = \frac{(W_f - W_i)RT_s}{P_a M_w}$$

$$= K_2(W_f - W_i)$$

Equation 4-2

where:
 $K_2 = 0.001333 \text{ m}^3/\text{g}$ for metric units
 $= 0.04715 \text{ ft}^3/\text{g}$ for English units

2.3.4 Sample gas volume.

$$V_{x,scm} = V_x Y \frac{(P_a)(T_s)}{(P_s)(T_a)}$$

$$= K_3 Y \frac{V_x P_a}{T_a}$$

Equation 4-3

where:
 $K_3 = 0.3858 \text{ }^\circ\text{K}/\text{mm Hg}$ for metric units
 $= 17.64 \text{ }^\circ\text{R}/\text{in. Hg}$ for English units

NOTE: If the post-test leak rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_x in Equation 4-3, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content.

$$B_w = \frac{V_{w,scm} - V_{w,scm}'}{V_{x,scm} + V_{w,scm} + V_{w,scm}'}$$

Equation 4-4

NOTE: In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and

another based upon the results of the impinger analysis. The lower of these two values of B_w shall be considered correct.

2.3.6 Verification of constant sampling rate. For each time increment, determine the ΔV_x . Calculate the average. If the value for any time increment differs from the average by more than 10 percent, reject the results and repeat the run.

3. Approximation Method

The approximation method described below is presented only as a suggested method (see Section 1.2).

3.1 Apparatus.

3.1.1 Probe. Stainless steel glass tubing, sufficiently heated to prevent water condensation and equipped with a filter (either in-stack or heated out-stack) to remove particulate matter. A plug of glass wool, inserted into the end of the probe, is a satisfactory filter.

3.1.2 Impingers. Two midget impingers, each with 30 ml capacity, or equivalent.

3.1.3 Ice Bath. Container and ice, to aid in condensing moisture in impingers.

3.1.4 Drying Tube. Tube packed with new or regenerated 6- to 16-mesh indicating-type silica gel (or equivalent desiccant), to dry the sample gas and to protect the meter and pump.

3.1.5 Valve. Needle valve, to regulate the sample gas flow rate.

3.1.6 Pump. Leak-free, diaphragm type, or equivalent, to pull the gas sample through the train.

3.1.7 Volume Meter. Dry gas meter, sufficiently accurate to measure the sample volume within 2%, and calibrated over the range of flow rates and conditions actually encountered during sampling.

3.1.8 Rate Meter. Rotameter, to measure the flow range from 0 to 3 lpm (0 to 0.11 cfm).

3.1.9 Graduated Cylinder. 25 ml.

3.1.10 Barometer. Mercury, aneroid, or other barometer, as described in Section 2.1.5 above.

3.1.11 Vacuum Gauge. At least 760 mm Hg (30 in. Hg) gauge, to be used for the sampling leak check.

3.2 Procedure.

3.2.1 Place exactly 5 ml distilled water in each impinger.

Leak check the sampling train as follows: Temporarily insert a vacuum gauge at or near the probe inlet; then, plug the probe inlet and pull a vacuum of at least 250 mm Hg (10 in. Hg). Note, the time rate of change of the dry gas meter dial; alternatively, a rotameter (0-40 cc/min) may be temporarily attached to the dry gas meter outlet to determine the leakage rate. A leak rate not in excess of 2 percent of the average sampling rate is acceptable.

NOTE: Carefully release the probe inlet plug before turning off the pump.

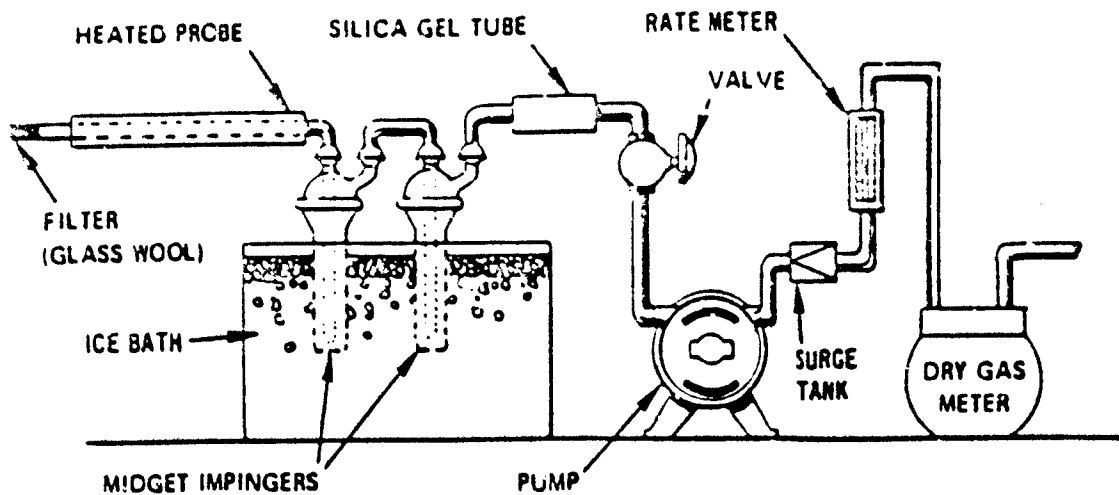


Figure 4-4. Moisture-sampling train - approximation method.

FIGURE 4-5—FIELD MOISTURE DETERMINATION—APPROXIMATION METHOD

Location _____	Comments _____
Date _____	
Case _____	
Operator _____	
Barometric pressure _____	

Check time	Gas volume through meter, (V ₁), ml (cc)	Flow meter reading, (V ₂), ml (cc)	Water temperature, (C) (F)

3.2.2 Connect the probe, insert it into the stack, and sample at a constant rate of 2 lpm (0.071 cfm). Continue sampling until the dry gas meter registers about 30 liters (1.1 ft³) or until visible liquid droplets are carried over from the first impinger to the second. Record temperature, pressure, and dry gas meter readings as required by Figure 4-5.

3.2.3 After collecting the sample, combine the contents of the two impingers and measure the volume to the nearest 0.5 ml.

3.3 Calculations. The calculation method presented is designed to estimate the moisture in the stack gas; therefore, other data, which are only necessary for accurate moisture determinations, are not collected. The following equations adequately estimate the moisture content, for the purpose of determining isokinetic sampling rate settings.

3.3.1 Nomenclature.

E_{wv} - Approximate proportion, by volume, of water vapor in the gas stream leaving the second impinger, 0.025.

B_w - Water vapor in the gas stream, proportion by volume.

M_w - Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_a - Absolute pressure (for this method, same as barometric pressure) at the dry gas meter.

P_{std} - Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R - Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft³)/(lb-mole) (°R) for English units.

T_a - Absolute temperature at meter, °K (°R).

T_{std} - Standard absolute temperature, 293° K (528° R).

V_1 - Final volume of impinger contents, ml.

V_2 - Initial volume of impinger contents, ml.

V_{dgm} - Dry gas volume measured by dry gas meter, dcm (def).

$V_{dgm, std}$ - Dry gas volume measured by dry gas meter, corrected to standard conditions, dcm (dscf).

$V_{wv, std}$ - Volume of water vapor condensed, corrected to standard conditions, scm (scf).

ρ_w - Density of water, 0.9982 g/ml (0.002201 lb/ml).

Y - Dry gas meter calibration factor.

3.3.2 Volume of water vapor collected, where:

$$V_{wv} = \frac{(V_1 - V_2) B_w A T_{std}}{\rho_w M_w}$$

$$= K_1 (V_1 - V_2)$$

Equation 4-5

$K_1 = 0.001333$ m³/ml for metric units
 $= 0.04707$ ft³/ml for English units.

3.3.3 Gas volume.

$$V_{dgm, std} = V_{dgm} \left(\frac{P_a}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)$$

$$= K_2 \frac{V_{dgm} P_a}{T_a}$$

Equation 4-6

where:

$K_2 = 0.3858$ °K/mm Hg for metric unit
 $= 17.64$ °R/in. Hg for English units

3.3.4 Approximate moisture content

$$B_w = \frac{V_{wv}}{V_{dgm, std} + V_{wv}} + E_{wv}$$

$$= \frac{V_{wv}}{V_{dgm, std} - V_{wv}} + E_{wv}$$

Equation 4-7

4. Calibration

4.1 For the reference method, use equipment as specified in the following: Method 3; Section 5.3 (meter system); Section 5.5 (temperature gage and Section 5.7 (barometer). The mandated leak check of the metering system (Section 5.6 of Method 3) also applies reference method. For the approximate method, use the procedures outlined in Section 3.2.1 of Method 6 to calibrate the metering system, and the procedure of Method 3, Section 5.7 to calibrate the barometer.

5. Bibliography

1. Air Pollution Engineering Manual (Second Edition), Danielson, J. A. (ed), Environmental Protection Agency, Office of Air Quality Planning and Standard Research Triangle Park, N.C. Publication AP-46, 1973.

2. Devorkin, Howard, et al. Air Pollution Source Testing Manual, Air Pollution Control District, Los Angeles, Calif. Nov 1963.

3. Methods for Determination of Volume Dust and Mist Content of Western Precipitation Division of Joy Manufacturing Co., Los Angeles, Calif. WP-50, 1967.

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EPA WIPE SAMPLING TECHNIQUE

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SECTION 13

SPECIALIZED SAMPLING TECHNIQUES

13.0 GENERAL

This section discusses several specialized sampling techniques that have been used by contractors on hazardous waste sites. The reader may develop other techniques for specific site needs. In those cases and in cases where the techniques listed here are modified for use on a specific site, careful documentation of the exact procedures used should be provided. This section does not discuss analytical techniques, since analytical methods would vary depending on the data quality objectives, the compounds of concern, the media, and the exact sampling technique. The Contract Laboratory Program plans to issue a "Field Methodology Catalog" in the summer of 1987 that will contain field analytical techniques suitable for analyses of the samples collected by using the techniques in this section.

13.1 WIPE SAMPLING

13.1.1 Scope and Purpose

This guideline discusses the steps required for obtaining a wipe sample. Wipe samples may be used to document the presence of carcinogenic substances or other toxic materials. In addition, wipe sampling is commonly used to ascertain that site or equipment decontamination has been acceptably effective.

13.1.2 Definitions

Site Manager (SM)

The individual responsible for the successful completion of a work assignment within budget and schedule. This person is also referred to as the Site Project Manager or the Project Manager and is typically a contractor's employee (see Subsection 1.1).

Wipe Sample

A sample used to assess surface contamination. The terms "wipe sample," "swipe sample," and "smear sample" have all been used synonymously. For purposes of this section, the sample will be termed "wipe sample."

13.1.3 Applicability

This guideline is applicable when a sample of the substances on a surface is needed. Surfaces may include walls, floors, ceilings, desk tops, equipment, or other large objects that are potentially contaminated.

13.1.4 Responsibilities

The SM or designee is responsible for deciding when wipe sampling is needed.

Field personnel are responsible for performing the actual sampling, maintaining sample integrity, and preparing the proper chain-of-custody forms.

13.1.5 Records

Records of wipe sampling include completed chain-of-custody forms and appropriate entries in the field logbook. If the sample collected is to be analyzed using the National Contract Laboratory Program (CLP), then CLP forms must be completed as discussed in Section 5.

13.1.6 Procedures

Wipe sampling can be an integral part of the overall sampling program. Wipe sampling can help to provide a picture of contaminants that exist on the surface of drums, tanks, equipment, or buildings on a hazardous waste site or that exist in the homes of a populace at risk.

Wipe sampling consists of rubbing a moistened filter paper over a measured area of 100 cm² to 1 m². The paper is then sent to the laboratory for analysis. The results are related back to the known area of the sample. A proper sampling procedure is essential to ensure a representative, uncontaminated sample.

13.1.6.1 Equipment Required

The following equipment is needed for wipe sampling:

- Whatman 541 filter paper or equivalent, 15 cm
- Disposable, chemical-protective gloves
- Solvent to wet filter paper

13.1.6.2 Wipe Sampling Steps

The steps involved in obtaining a wipe sample are listed below:

- Using a clean, impervious disposable glove, such as a surgeon's glove, remove a filter paper from the box. (Note: Although it is necessary to change the glove if it touches the surface being wiped, a new glove should be used for each sample to avoid cross contamination of samples. A new glove should always be used when collecting a new sample.)
- Moisten the filter with a collection medium selected to dissolve the contaminants of concern as specified in the sampling plan. Typically, organic-free water or the solvent used in analysis is used. The filter should be wet but not dripping.
- Thoroughly wipe approximately 1 m² of the area with the moistened filter. Using a 1 m² stencil will help in judging the size of the wipe area. If a different size area is wiped, record the change in the field logbook. If the surface is not flat, be sure to wipe any crevices or depressions.

- Without allowing the filter to contact any other surface, fold it with the exposed side in, and then fold it over to form a 90-degree angle in the center of the filter.
- Place the filter (angle first) into a clean glass jar, replace the top, seal the jar according to quality assurance requirements, and send the sample to the appropriate laboratory.
- Prepare a blank by moistening a filter with the collection medium. Place the blank in a separate jar, and submit it with the other samples.
- Document the sample collection in the field logbook and on appropriate forms, and ship samples per procedures listed in Section 6.

13.1.7 Region-Specific Variances

No region-specific variances have been identified; however, all future variances will be incorporated in subsequent revision to this compendium. Information on variances may become dated rapidly. Thus, users should contact the regional EPA RPM for full details on current regional practices and requirements.

13.1.8 Information Sources

EBASCO. "Dioxin Sampling." *REM III Program Guidelines*. Prepared for U.S. Environmental Protection Agency. 28 February 1986.

NUS Corporation. "Site-Specific Site Operations Plans." REM/FIT Contract.

13.2 HUMAN HABITATION SAMPLING

13.2.1 Scope and Purpose

This subsection provides general guidance for the planning, method selection, and implementation of sampling activities used to determine the potential for human exposure to contaminants that are present in residential environment.

13.2.2 Definitions

Human Habitation Areas

Any place people may spend extended periods of time, such as their homes or offices.

13.2.3 Applicability

This subsection discusses sampling techniques that are similar in collection methodology to other types of samples, such as environmental soil and water, but are biased to emphasize potential human exposure to contaminants moving into the residential environment.

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MODIFIED METHOD I.W02
ANALYSIS OF EXPLOSIVES IN SOIL, WIPE, AND
RINSATE SAMPLES

1311R2

ANALYSIS OF EXPLOSIVES IN SOIL, WIPE, AND RINSATE SAMPLES

I. SUMMARY

A. Analytes:

HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
RDX	Hexahydro-1,3,5-trinitro-s-triazine
NB	Nitrobenzene
1,3-DNB	1,3-Dinitrobenzene
1,3,5-TNB	1,3,5-Trinitrobenzene
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
2,4,6-TNT	2,4,6-Trinitrotoluene
Tetryl	2,4,6-Trinitrophenylmethylnitramine

B. Matrix: Extracts from soil, wipe, or rinsate samples.

C. General Method: Sample matrix is extracted with acetonitrile. The extract is diluted with methanol and water, and the resultant solution is injected onto the HPLC for analysis.

D. This method is based on USATHAMA Method LW02, Explosives in Soil.

II. SAFETY INFORMATION

Work in well ventilated areas. Wear adequate protective clothing to avoid skin contact. Wash skin with soap and water thoroughly immediately after contact.

TNB, HMX, RDX, Tetryl, and TNTs are classified as Explosives A by DOT. Avoid extreme temperatures and pressures.

III. APPARATUS AND CHEMICALS

A. Glassware/Hardware

1. Syringes: 10 μ L, 50 μ L, 100 μ L, 1 mL syringe (Hamilton 1005 TEFL).
2. Vials with teflon-lined caps or septa. Nominal volume of 1.8 mL, 4.0 mL, and 12 mL.
3. B-D Glaspak disposable syringes, 5 mL, with frosted tip.
4. 0.2 micron fluorocarbon filters.

5. Micropipettes, 200 uL.
6. Hypo needles.
7. 2 mL and 20 mL pipette.
8. Whatman #42 ashless 9 cm filter paper.

B. Instrumentation

1. Perkin-Elmer Series 4 High Performance Liquid Chromatograph (HPLC) equipped with a Perkin-Elmer ISS100 Auto-Injector and Micromeritics Model 786 UV/VIS variable wavelength detector. Hewlett-Packard 3390 recording integrator in peak height mode was used to record data output. Equivalent instrumentation may be substituted.

2. Analytical Balance

Capable of weighing 0.01 gram for sample preparation and 0.1 mg for standard preparation. Mettler AE 163 or equivalent.

3. Parameters

- a. Columns:

- 1) DuPont Zorbax^R ODS 4.6 mm i.d. x 25 cm HPLC column with a particle size of 5 to 6 microns.
- 2) DuPont Permaphase^R ODS guard column (optional).

- b. Mobile Phase:

50% water
34% methanol
16% acetonitrile

- c. Flow: 1.6 mL/min with a pressure of approximately 2860 psig.

- d. Detector: 250 nm

- e. Injection Volume: 50 uL

C. Reagents and SARMS:

1. Acetonitrile, distilled in glass for HPLC use.

2. Methanol, distilled in glass for HPLC use.
3. Water, distilled in glass for HPLC use.
4. USATHAMA Standard Soil.
5. SARMS

HMX SARM No. 1217 (PA 1303)
RDX SARM No. 1130 (PA 1302)
NB SARM No. (PA 1306)
1,3-DNB SARM No. 2250 (PA 1305)
1,3,5-TNB SARM No. 1154 (PA 1300)
2,4-DNT SARM No. 1147 (PA 1298)
2,6-DNT SARM No. 1148 (PA 1299)
2,4,6-TNT SARM No. 1129 (PA 1297)
Tetryl SARM No. 1149 (PA 1301)

IV. CALIBRATION

A. Initial Calibration

1. Preparation of Standards

- a. Stock calibration solutions containing approximately 10,000 mg/L of a nitro-compound are prepared by accurately weighing ca. 50 mg of a SARM into a 5-mL serum bottle and dissolving the nitro-compound in 5 mL of acetonitrile pipetted into the bottle. All stock solutions prepared in this manner and stored in a freezer (0°C to -4°C) have remained stable for a period of 6 months.
- b. Intermediate Calibration Standards: All compounds appear to be stable for at least 3 months.
 - 1) Intermediate Calibration Standard A (high level): Combine the appropriate volumes of stock calibration standard as shown below. Dilute to 10 mL with acetonitrile and seal with a teflon-lined cap. Store in the dark at 4°C. The resulting solution will have the concentrations indicated in the following table.

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<u>Nitro-compound</u>	<u>uL of Stock Cal Std.</u>	<u>Resulting Concentration (ug/mL)</u>
HMX	127	127
RDX	98	98
NB	42	42
1,3-DNB	59	59
1,3,5-TNB	209	209
2,4-DNT	42	42
2,6-DNT	40	40
2,4,6-TNT	192	192
Tetryl	500	500

- 2) Intermediate Calibration Standard B (low level): 1:10 dilution of the Intermediate Calibration Standard A is made in acetonitrile. Seal with a teflon-lined cap and store in the dark at 4°C. The resulting solution will have the following concentrations:

<u>Nitro-compound</u>	<u>Resulting conc. (ug/mL)</u>
HMX	12.7
RDX	9.80
NB	4.20
1,3-DNB	5.90
1,3,5-TNB	20.9
2,4-DNT	4.20
2,6-DNT	4.00
2,4,6-INT	19.2
Tetryl	50.0

- c. Working Calibration Standards: Using the following table, prepare a series of nine calibration standards. Place the mobile phase into a 1-mL serum vial. Inject the indicated volumes of Intermediate Calibration Standard A or B into the acetonitrile with a microliter syringe. Seal the vial with a teflon-lined septum and cap. Mix well. These solutions are prepared fresh daily and kept in the dark.

WORKING CALIBRATION STANDARDS

<u>Concentration</u>	<u>Intermediate Cal Std A (μL)</u>	<u>Intermediate Cal Std B (μL)</u>	<u>Mobile Phase (μL)</u>
0X	0	0	1,000
0.5X	-	6.25	994
1X	-	12.5	988
2X	-	25	975
5X	-	62.5	938
10X	12.5	-	988
20X	25	-	975
50X	62.5	-	938
100X	125	-	875

2. Daily Calibration

- a. Set up the instrument according to Section IV, Instrumental Analysis.
- b. Analyze mobile phase as a blank to verify a stable baseline.
- c. Analyze the medium calibration standard (10X) to verify peak separation and retention times.
- d. Analyze the calibration standards prepared in Section IV-A-1.

3. Analysis of Calibration Data

- a. Tabulate the calibration standard concentration versus the peak height response for each calibration standard.
- b. Perform a linear regression analysis on the calibration data plotting peak height vs. concentration in μ g/mL.
- c. Use the liner regression to obtain analyte concentration for sample response.

4. Calibration Checks

- a. After completion of analyses of samples, a calibration standard at the 10X concentration is analyzed. The response must agree within 25 percent with the daily calibration 10X standard.

- b. No certified calibration check standards are available for these compounds.

V. SAMPLE HANDLING STORAGE FOR SOIL, WIPE, AND RINSATE SAMPLES

- A. Sampling Procedure: The stability of explosives in soil is not truly known. Precautions should be taken to avoid prolonged exposure to light and heat.
- B. Containers: Wide-mouth amber glass bottles with teflon-lined lids.
- C. Storage Conditions: Samples should be maintained at 4°C from the time of collection to the time of analysis. No chemical preservatives are necessary.
- D. Holding Time Limits: 7 days to extraction; 40 days to analysis from the time of extraction.
- E. Solution Verification: No certified check standards are available.

VI PROCEDURE

A. Soil Analysis

1. Method

- a. Accurately weigh 1 gm of soil into a 5-mL serum vial and pipet 2 mL of acetonitrile onto the soil.
- b. Place a septum and cap on the vial and shake the vial thoroughly by hand for 2 to 3 minutes.
- c. The extract is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a fluoro-carbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC.
- d. Preparation of sample extracts and spikes for injection is performed the day of analysis.

- i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.
 - ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.
2. Daily Quality Control
- a. Perform a spike at 10X the detection limit daily as follows.
 - i. Accurately weight approximately 1 gm of USATHAMA standard soil into a 5-mL serum vial.
 - ii. Spike with 100 uL Standard A.
 - iii. Proceed as in VI-A-1, above.
3. Instrumental Analysis
- a. Proceed to Section VII, Instrumental Analysis. The working range for soil samples is listed below.

Calibration Range for Soil Analysis (1X - 100X)

HMX	1.27 - 127	ug
RDX	0.98 - 98.0	ug
NB	0.42 - 42.0	ug
1,3-DNB	0.59 - 59.0	ug
1,3,5-TNB	2.09 - 209	ug
2,4-DNT	0.42 - 42.0	ug
2,6-DNT	0.40 - 40.0	ug
2,4,6-TNT	1.92 - 192	ug
Tetryl	5.00 - 500	ug

- b. Samples with analyte concentration exceeding the calibration range will require dilution as necessary.

B. Wipe Analysis

1. Method

- a. Add the filter to a 40-mL vial and pipet 20 mL acetonitrile into the vial.
- b. Place a cap on the vial and shake the vial thoroughly by hand for 2 to 3 minutes.
- c. The extract is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a fluoro-carbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC. The remaining extract is disposed as waste.
- d. Preparation of sample extracts and spikes for injection is performed the day of analysis.
 - i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.
 - ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.

2. Daily Quality Control

- a. Perform a spike at 10X the detection limit daily as follows.
 - i. Place 1/10 of a filter paper into a 5-mL serum vial.
 - ii. Add 2 mL acetonitrile.
 - iii. Spike with 100 uL Standard A.
 - iv. Proceed as in VI-B-1-b, above.

3. Instrumental Analysis

- a. Proceed to Section VII, Instrumental Analysis. The working range for wipe samples is listed below.

Calibration Range for Wipe Samples

HMX	12.7 - 1270	total ug/wipe
RDX	9.8 - 980	total ug/wipe
NB	4.2 - 420	total ug/wipe
1,3-DNB	5.9 - 590	total ug/wipe
1,3,5-TNB	20.9 - 2090	total ug/wipe
2,4-DNT	4.2 - 420	total ug/wipe
2,6-DNT	4.0 - 400	total ug/wipe
2,4,6-TNT	19.2 - 1920	total ug/wipe
Tetryl	50.0 - 5000	total ug/wipe

- b. Samples with analyte concentration exceeding the calibration range will require dilution as necessary.

C. Rinsate Analysis

1. Method

- a. Acetonitrile rinsate is collected from equipment.
- b. Measure volume of rinsate.
- c. The rinsate is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a fluoro-carbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC. The remaining rinsate is disposed as waste.
- d. Preparation of sample extracts for injection is performed the day of analysis.
- i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.

ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.

2. Daily Quality Control

a. Perform a spike at 10X the detection limit daily as follows:

i. Add 2 mL acetonitrile to a 5-mL serum bottle.

ii. Spike with 100 uL of Standard A.

iii. Proceed as in VI-C-1-c.

3. Instrumental Analysis

a. Proceed to Section VII, Instrumental Analysis. The working range for rinsate samples is described below.

Calibration Range for Rinsate Samples

HMX	0.635 - 63.5	total mg/sample
RDX	0.49 - 49.0	total mg/sample
NB	0.21 - 21.0	total mg/sample
1,3-DNB	0.295 - 29.5	total mg/sample
1,3,5-TNB	1.05 - 105	total mg/sample
2,4-DNT	0.21 - 21.0	total mg/sample
2,6-DNT	0.20 - 20.0	total mg/sample
2,4,6-TNT	0.96 - 96.0	total mg/sample
Tetryl	2.50 - 250	total mg/sample

b. Samples with analyte concentration exceeding the calibration range will require dilution as necessary.

VII. INSTRUMENTAL ANALYSIS

A. Set the chromatographic conditions as follows:

	Time (minutes)	Flow (mL/min.)	Acetonitrile (percent)	Methanol (percent)	Water (Percent)
Equilibrium	3	1.6	16	34	50
Analysis Run	15	1.6	16	34	50

B. Using the auto-injector manufacturer's recommended procedure, introduce 50 uL of the medium level calibration standard into the chromatographic system.

Check the chromatogram to ensure separation of the nitrated toluenes and separation of the nitrobenzene and tetryl. If necessary, adjust the water/methanol ratio of the mobile phase until separate peaks are distinguished. As the column ages, less methanol is required. Generally, the column ages rapidly the first 24 hours, after which it is fairly stable.

- C. Once good peak separation is obtained, introduce 50 uL of each working calibration standard and sample into the chromatographic system using the auto-injector manufacturer's recommended procedure.

VIII. CALCULATIONS

A. Soil Samples

1. The diluted extract concentration is read or calculated from the instrument calibration curve.

2. Sample concentration (ug/g) = $\frac{B \times D}{A \times C}$

$$\frac{\text{extract conc (ug/mL)} \times 4 \times B}{A}$$

where:

A = sample weight (dry weight)
B = mL acetonitrile

B. Wipe Samples

$$\text{Sample Concentration (total ug)} = \text{extract conc (ug/mL)} \times 20 \text{ mL} \times 4$$

where:

20 mL = total volume
4 = dilution in method

C. Rinse

$$\text{Sample concentration (total ug)} = \text{extract conc (ug/mL)} \times V \times 4$$

where:

V = total volume
4 = dilution in method

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**MODIFIED METHOD FOR NITROCELLULOSE,
NITROGLYCERIN, AND PETN IN WATER**

1311R2

MODIFIED METHOD OF NITROCELLULOSE, NITROGLYCERIN, AND PETN IN WATER

1. APPLICATION

This method is used to qualitatively determine the concentration of nitrocellulose (NC), nitroglycerine (NG), and PETN in water samples.

- A. Tested Concentration Range - Response is linear from 5 to 100 mg/liter in water.
- B. Sensitivity Limits - Response for 5 ug of compound is: NC = 0.89, NG = 0.17, PETN = 0.15 absorbance units.
- C. Detection Limits -

<u>Compound</u>	<u>Water (ug/L)</u>
NC	9000
NG	5000
PETN	5000

- D. Interferences - Nitrite ion will interfere, NC, NG, and PETN cannot be distinguished from each other.
- E. Analysis Rate - Approximately 20 samples can be analyzed by one worker in an eight hour day.

2. CHEMISTRY:

Nitrite ion is cleaved from the nitrate ester in basic solution, which diazotizes procaine, in acidic solution, which in turn couples with N, N-dimethyl-1-naphthylamine to produce an azo-dye. This dye is determined from its absorbance at 510 um.

$C_3N_3O_9$ - Trinitrolycerine; glyceryl trinitrate;
CAS RN-55-63-0 mp - 13°C, decomposition pt = 145°C;

$C_5N_8O_{12}$ - Pentaerythritol tetranitrate CAS
RN-78-11-5 mp - 140°C; explosive decomposition pt.
210°C;

$(C_6N_{12}O_{16})_x$ - nitrocellulose, soluble gun cotton,
CAS RN-9004-70-0 mp - decomposes on heating.

Handling Hazards: Explosives hazard, avoid heat, shock or open flame. Toxic inhalation and skin absorption hazards exist. Do not handle NG except as a dilute solution.

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3. APPARATUS:

A. Instrumentation - Absorbance measurements are made at 510 nm on a Perkin Elmer Lambda 3 UV/UVS spectrometer equipped with a super sipper.

B. Parameters - N/A

C. Hardware/Glassware

- 1) 0.1-, 1-, and 2-mL
- 2) 13 x 100 mm glass test tubes
- 3) 10-mL volumetric flasks
- 4) 100-mL volumetric flasks
- 5) 1-cm spectrometer cell (glass)
- 6) water bath
- 7) hot plate
- 8) 25-uL graduated syringe
- 9) 8-ounce glass bottle
- 10) 2 dram glass vials

D. Chemicals

- 1) KOH, Analytical reagent grade
- 2) Glacial acetic acid, ACS grade
- 3) Acetone, ACS grade
- 4) N,N-dimethyl-1-naphthylamine
- 5) Procaine

E. Reagents

- 1) 10 percent KOH: Weigh 10.0 g of reagent grade potassium hydroxide into a 100-mL volumetric flask and dilute slowly with deionized water (nitrite free).
- 2) 20 percent KOH: Same as above except use 20.0 g of KOH.
- 3) 10 percent acetic acid: Pipette 10.0 mL of glacial acetic acid into a 100-mL volumetric flask that is partially filled with deionized water (nitrite free). Dilute to volume with deionized water.
- 4) 50 percent acetic acid: Same as above except use 50 mL of glacial acetic acid.
- 5) Color Developing Reagent: Weigh 0.35 g each of procaine and N,N-dimethyl-1-naphthylamine into a 100-mL volumetric flask and dilute to volume with 50 percent acetic acid-water.

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- 6) Working Solution of Color Reagent: Pipette 20 mL of the color developing reagent into a 100-mL volumetric flask. Dilute to volume with deionized water (nitrite free).

4. STANDARDS

A. Calibration Standards

- 1) Stock - Weigh 10.0 mg of NC, PETN, or 1 mL of a 1 percent NC in acetone SARM into a 10.0-mL volumetric flask and dilute to volume with acetone to obtain a 1 ug/uL solution. This solution is refrigerated when not in use.
- 2) Working - Prepare standard curve daily by adding 0.0, 2.5, 5, 10, 25, and 50 uL of 1 ug/uL stock solution, in duplicate, into 13 mm by 100 mm test tubes, using a 25-uL syringe. Add 0.5 mL of deionized water to each tube and mix thoroughly. This yields concentrations of 0, 5, 10, 20, 50, and 100 ug/mL.

- B. Control Spikes - For water samples spike as indicated for the working standards.

5. PROCEDURE:

- A. Water Sample Handling/Preparation - Refrigerate the samples until ready for analysis. Prior to analysis, filter through a 0.45 micron Millipore filter and store refrigerated in a 2 dram glass vial.

B. Analysis of Samples

- 1a) Water - Pipette 0.50 mL of water into a 13 x 100 mm test tube and add 0.50 mL of 20 percent potassium hydroxide solution.
- b) Soil - 5 g of air-dried soil is shaken with 5 mL of acetone. The acetone is separated by filtration through a 0.45 u membrane filter (teflon). A 0.5-mL portion of the acetone solution is mixed with 0.5 mL of water and 0.5 mL of 20 percent potassium hydroxide solution.
- 2) Mix sample well and place in boiling water bath for 30 minutes.
- 3) Cool the sample; add 2.0 mL of 10 percent acetic acid, and mix.
- 4) Add 1.0 mL of color developing reagent working solution and mix well.

5) Allow color to develop for 1.5 hours; transfer the solution to a clean, dry spectrophotometer cell and read the absorbance at 510 nm.

6. CALCULATIONS:

Construct a calibration curve of absorbance vs. concentration (ug/L) of the compound of interest (differing response will be observed for NC, FETN, and NG). Determine concentration of compound in samples by interpolating from the calibration curve.

7. REFERENCE:

None.

July 1990
Revision: Final

**AMMONIUM PICRATE IN WATER AND WIPE SAMPLES BY
HIGH PERFORMANCE LIQUID CHROMATOGRAPHY**

1311R2

AMMONIUM PICRATE IN WATER AND WIPE SAMPLES
BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

1. Application

This method is suitable for the determination of ammonium picrate in water and wipe samples. Ammonium picrate is converted to picric acid and quantified in that form.

2. Summary of method

Ammonium picrate is extracted from water or wipe samples with solvent. The extract is concentrated and subjected to high performance liquid chromatography (HPLC) analysis using a reverse phase column and a dual channel ultraviolet detector.

3. Interferences

Any compounds that exhibit chemical and/or physical properties similar to the compounds of interest can interfere.

4. Apparatus

4.1 Concentrator apparatus, a Kuderna-Danish (K-D) concentrator, 500-mL capacity with a 3-ball Snyder column and a 10-mL graduated receiver tube and a 500-mL flask fitted with a 1-ball Snyder column.

4.2 Erlenmeyer flask, 500-mL with a ground glass stopper.

4.3 Evaporative concentrator, Organomation N-Evap, or equivalent.

4.4 Liquid chromatograph, Waters Associates ALC/GPC 204 liquid chromatograph equipped with a dual channel, variable wavelength detector, a model 6000A solvent-delivery system, a model 660 solvent flow programmer, model WISP 710A microprocessor and data module, or equivalents.

4.5 Liquid chromatographic column, a 3.9 mm i.d. by 300 mm long stainless steel column packed with 10 um particle size reverse phase material. Waters Associates μ -Bonapak C₁₈ column packing or equivalent.

4.6 Separatory funnels, Squibb form, 1-L capacity, or equivalent.

4.7 Solvent clarification kit, Waters Associates 85113, or equivalent.
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4.8 Shaker, a mechanical wrist action shaker.

4.9 Steam bath, a constant temperature steam bath set at 85°C.

5. Reagents

5.1 Acetonitrile, HPLC quality.

5.2 Hydrochloric acid, ACS reagent grade.

5.3 Mobile phase solutions: Prepare the ion pairing, tetrabutylammonium-phosphate solutions for the mobile phase using Waters Associates PIC Reagent A, or equivalent.

5.3.1 Solution A: Add one bottle of PIC reagent A to 1,000 mL of Milli-Q water. Stir for 5 min and then filter through a 0.45-micron filter, type HAWP for aqueous solvents.

5.3.2 Solution B: Add one bottle of PIC reagent A to 1,000 mL acetonitrile. Stir for 5 min and then filter through a 0.45-micron filter type FHUP for organic solvents.

5.4 Picric acid standards, analytical reference grade or highest purity available. These may be obtained from chemical specialty suppliers or from military sources. Prepare standards at concentrations sufficient to cover the analytical range.

5.5 Separatory funnels, Squibb form, 1-L capacity, or equivalent.

5.6 Solvents, acetone, diethylether, methylene chloride, acetonitrile, pesticide residue quality, distilled in glass, Burdick and Jackson, or equivalent.

5.7 Water, organic-free, HPLC-grade, or water from a Millipore Milli-Q system or equivalent.

6. Procedure

6.1 Procedure for water (rinse) samples: Samples should be collected according to the recommended practice for the collection of samples for organic analysis (Goerlitz and Brown, 1972). Mercuric chloride (40 ppm) is added as a preservative.

6.1.1 Pour 500 mL water into a 1-L separatory funnel.

6.1.2 Add 3 mL concentrated HCl to the sample contained in the separatory funnel. Check pH to ensure acidity.

6.1.3 Add 75 mL methylene chloride to the sample in the separatory funnel. Stopper and shake for 1 minute. Vent the pressure often. Allow the layers to separate and draw off the methylene chloride layer into a 250-mL Erlenmeyer flask.

6.1.4 Repeat the extraction of the water sample two more times, using 50-mL methylene chloride volumes each time. Combine all the organic extracts in the 250-mL Erlenmeyer, which contains the first extract.

6.1.5 Quantitatively transfer the extract to a 500-mL K-D apparatus fitted with a 3-ball Snyder column and a 20-mL receiver. Add a micro boiling chip and 4 mL of acetonitrile.

6.1.6 Place the apparatus on a hot-water bath (approximately 85°C). Reduce the volume of the extract to about 4 mL. Remove the K-D from the heat and allow it to cool.

6.1.7 Use the evaporative concentrator to reduce the volume of solvent to 0.8 to 0.9 mL by directing a stream of nitrogen onto the surface of the liquid while gently warming the receiver in a water bath.

6.1.8 Perform one method blank and three sample spikes at 40 ppb, 200 ppb, and 200 ppb with each batch of 20 samples.

6.1.9 Proceed to HPLC analysis (6.3).

6.2 Procedure for wipe samples

6.2.1 Add wipe sample to 40-mL vial.

6.2.2 Add 20 mL distilled water.

6.2.3 Shake 15 minutes using wrist-action shaker.

6.2.4 Decant water into 500-mL separatory funnel.

6.2.5 Repeat extraction twice, using 20 mL distilled water each time.

6.2.6 Add 440 mL distilled water to separator funnel.

6.2.7 Perform one method blank and three sample spikes of 20 ug, 100 ug, and 100 ug with each batch.

6.2.8 Proceed as in 6.1.2 under "Procedure for Water (Rinsate) Samples."

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6.3 Analysis by high pressure liquid chromatography.

6.3.1 The following chromatographic conditions have been found to be suitable for this analysis:

Mobile Phase: The separation is made under isocratic conditions. Combine 36 percent solution A with 64 percent solution B by using the solvent programmer.

Isocratic 36 percent acetonitrile + PIC reagent A + PICA/64 percent H₂O + PIC reagent A.

Flow Rate: 1.10 mL/min

Detector Sensitivity:

UV 254 nm 0.005 A units full scale

6.3.3 Daily calibration is performed over the following range of concentrations using picric acid as the standard material.

Standard Concentration (ng/uL)	Corresponding Ammonium Picrate in Water (ug/L)	Corresponding Ammonium Picrate in Wipe (total ug)
10	20	10
20	40	20
50	100	50
100	200	100
200	400	200
500	1000	500
1000	2000	1000

6.3.4 Add 0.1 mL of PIC reagent A to the samples, mix and make up to a volume of 1.0 mL; allow samples to stand 10 minutes and inject 10 uL into the liquid chromatographic system. Record the volume injected. Identify the peaks by retention time. Dilute any extract containing an identifiable component above the calibration range to bring it within that range.

7. Calculations

7.1 Determine sample concentration from daily calibration curve using Least Squares Fit (LSF).

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7.2 Water sample concentration is calculated as follows:

$$\text{ng/uL} \times \text{EV} \times \frac{1 \text{ ug}}{1000 \text{ ng}} + \text{SV} = \text{ug/L}$$

where:

ng/uL = picric acid concentration in extract, from LSF.

EV = extract volume, in uL.

SV = sample volume, in Liters.

Note that picric acid concentration must be converted to ammonium picrate concentration by using the ratios of molecular weights.

7.3 Wipe sample concentration (total ug) is calculated as follows:

$$\text{ng/uL} \times \text{EV} \times \frac{1 \text{ ug}}{1000 \text{ ng}} = \text{total ug}$$

where:

ng/uL = picric acid concentration in extract, from LSF.

EV = extract volume.

Note that picric acid concentration must be converted to ammonium picrate concentration by using the ratios of molecular weights.

References

Goerlitz, D.F. and Law, L.M., Gas chromatographic method for the analysis of TNT and RDX explosives contaminating water and soil-core material, U.S. Geological Survey open file report 75-182.

Goerlitz, D.F., 1978, Direct analysis of RDX and TNT in water by high-pressure liquid chromatography, U.S. Geological Survey open file report 79--.

Goerlitz, D.F., 1978, High-performance liquid chromatography method for the analysis of picric acid in water, U.S. Geological Survey open file report.

July 1990
Revision: Final

**EPA MODIFIED METHOD 5
MODIFIED METHOD 5 SAMPLING TRAIN**

1311R2

METHOD 0010

MODIFIED METHOD 5 SAMPLING TRAIN

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to the determination of Destruction and Removal Efficiency (DRE) of semivolatile Principal Organic Hazardous Compounds (POHCs) from incineration systems (PHS, 1967). This method also may be used to determine particulate emission rates from stationary sources as per EPA Method 5 (see References at end of this method).

2.0 SUMMARY OF METHOD

2.1 Gaseous and particulate pollutants are withdrawn from an emission source at an isokinetic sampling rate and are collected in a multicomponent sampling train. Principal components of the train include a high-efficiency glass- or quartz-fiber filter and a packed bed of porous polymeric adsorbent resin. The filter is used to collect organic-laden particulate materials and the porous polymeric resin to adsorb semivolatile organic species. Semivolatile species are defined as compounds with boiling points $>100^{\circ}\text{C}$.

2.2 Comprehensive chemical analyses of the collected sample are conducted to determine the concentration and identity of the organic materials.

3.0 INTERFERENCES

3.1 Oxides of nitrogen (NO_x) are possible interferents in the determination of certain water-soluble compounds such as dioxane, phenol, and urethane; reaction of these compounds with NO_x in the presence of moisture will reduce their concentration. Other possibilities that could result in positive or negative bias are (1) stability of the compounds in methylene chloride, (2) the formation of water-soluble organic salts on the resin in the presence of moisture, and (3) the solvent extraction efficiency of water-soluble compounds from aqueous media. Use of two or more ions per compound for qualitative and quantitative analysis can overcome interference at one mass. These concerns should be addressed on a compound-by-compound basis before using this method.

4.0 APPARATUS AND MATERIALS

4.1 Sampling train:

4.1.1 A schematic of the sampling train used in this method is shown in Figure 1. This sampling train configuration is adapted from EPA Method 5 procedures, and, as such, the majority of the required equipment

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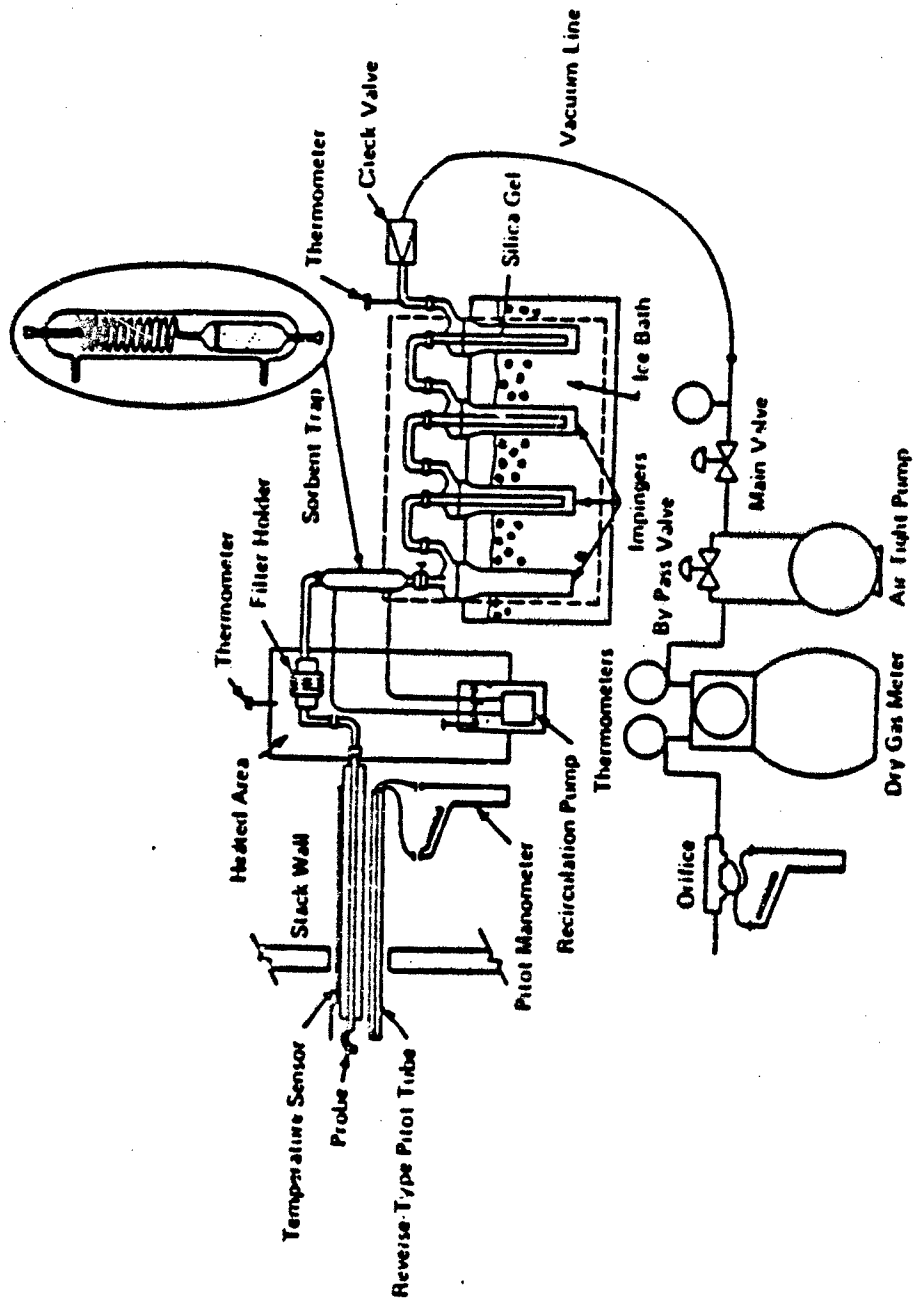


Figure 1. Modified Method 5 Sampling Train.

complete organic module are not currently available, but may be assembled from commercially available laboratory glassware and a custom-fabricated sorbent trap. Details of two acceptable designs are shown in Figures 2 and 3 (the thermocouple well is shown in Figure 2).

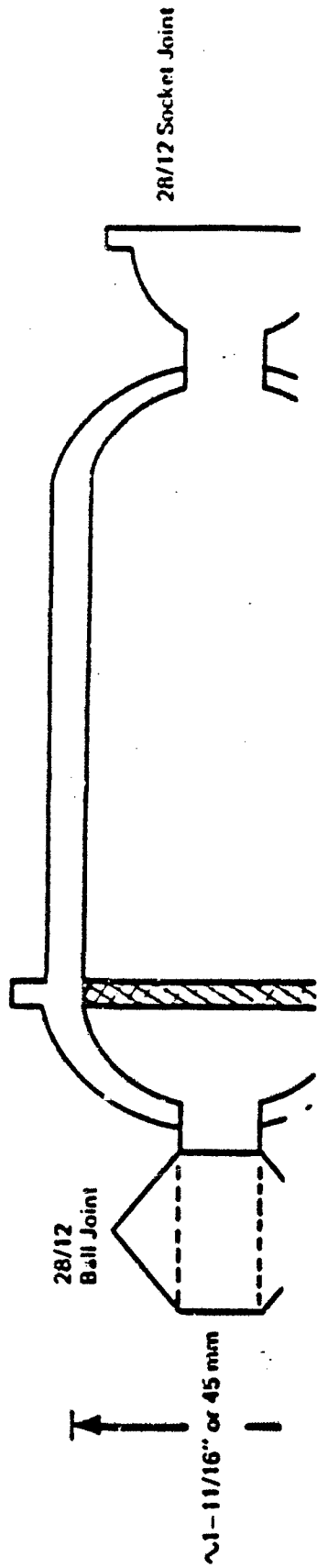
4.1.3.8 Impinger train: To determine the stack-gas moisture content, four 500-mL impingers, connected in series with leak-free ground-glass joints, follow the knockout trap. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3-cm (1/2-in.) I.D. glass tube extending about 1.3 cm (1/2 in.) from the bottom of the outer cylinder. The second impinger shall be of the Greenburg-Smith design with the standard tip. The first and second impingers shall contain known quantities of water or appropriate trapping solution. The third shall be empty or charged with a caustic solution, should the stack gas contain hydrochloric acid (HCl). The fourth shall contain a known weight of silica gel or equivalent desiccant.

4.1.3.9 Metering system: The necessary components are a vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (5.4°F), dry-gas meter capable of measuring volume to within 1%, and related equipment, as shown in Figure 1. At a minimum, the pump should be capable of 4 cfm free flow, and the dry-gas meter should have a recording capacity of 0-999.9 cu ft with a resolution of 0.005 cu ft. Other metering systems capable of maintaining sampling rates within 10% of isokineticity and of determining sample volumes to within 2% may be used. The metering system must be used in conjunction with a pitot tube to enable checks of isokinetic sampling rates. Sampling trains using metering systems designed for flow rates higher than those described in APTD-0581 and APTD-0576 may be used, provided that the specifications of this method are met.

4.1.3.10 Barometer: Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) is requested and an adjustment for elevation differences between the weather station and sampling point is applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30-m (100 ft) elevation increase (vice versa for elevation decrease).

4.1.3.11 Gas density determination equipment: Temperature sensor and pressure gauge (as described in Sections 2.3 and 2.4 of EPA Method 2), and gas analyzer, if necessary (as described in EPA Method 3). The temperature sensor ideally should be permanently attached to the pitot tube or sampling probe in a fixed configuration such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal.

~6.5 in.
or
168 mm



is identical to that used in EPA Method 5 determinations. The new components required are a condenser coil, and a sorbent module, which are used to collect semivolatile organic materials that pass through the glass- or quartz-fiber filter in the gas phase.

4.1.2 Construction details for the basic train components are given in APTD-0581 (see Martin, 1971, in Section 13.0, References); commercial models of this equipment are also available. Specifications for the sorbent module are provided in the following subsections. Additionally, the following subsections list changes to APTD-0581 and identify allowable train configuration modifications.

4.1.3 Basic operating and maintenance procedures for the sampling train are described in APTD-0576 (see Rom, 1972, in Section 13.0, References). As correct usage is important in obtaining valid results, all users should refer to APTD-0576 and adopt the operating and maintenance procedures outlined therein unless otherwise specified. The sampling train consists of the components detailed below.

4.1.3.1 Probe nozzle: Stainless steel (316) or glass with sharp, tapered (30° angle) leading edge. The taper shall be on the outside to preserve a constant I.D. The nozzle shall be buttonhook or elbow design and constructed from seamless tubing (if made of stainless steel). Other construction materials may be considered for particular applications. A range of nozzle sizes suitable for isokinetic sampling should be available in increments of 0.16 cm (1/16 in.), e.g., 0.32-1.27 cm (1/8-1/2 in.), or larger if higher volume sampling trains are used. Each nozzle shall be calibrated according to the procedures outlined in Paragraph 9.1.

4.1.3.2 Probe liner: Borosilicate or quartz-glass tubing with a heating system capable of maintaining a gas temperature of $120 \pm 14^\circ\text{C}$ ($248 \pm 25^\circ\text{F}$) at the exit end during sampling. (The tester may opt to operate the equipment at a temperature lower than that specified.) Because the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) are considered acceptable. Either borosilicate or quartz-glass probe liners may be used for stack temperatures up to about 480°C (900°F). Quartz liners shall be used for temperatures between 480 and 900°C (900 and 1650°F). (The softening temperature for borosilicate is 820°C (1508°F), and for quartz 1500°C (2732°F .) Water-cooling of the stainless steel sheath will be necessary at temperatures approaching and exceeding 500°C .

4.1.3.3 Pitot tube: Type S, as described in Section 2.1 of EPA Method 2, or other appropriate devices (Vollaro, 1976). The pitot tube shall be attached to the probe to allow constant monitoring of the stack-gas velocity. The impact (high-pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see EPA Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of EPA Method 2.

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4.1.3.4 Differential pressure gauge: Inclined manometer or equivalent device as described in Section 2.2 of EPA Method 2. One manometer shall be used for velocity-head (ΔP) readings and the other for orifice differential pressure (ΔH) readings.

4.1.3.5 Filter holder: Borosilicate glass, with a glass frit filter support and a sealing gasket. The sealing gasket should be made of materials that will not introduce organic material into the gas stream at the temperature at which the filter holder will be maintained. The gasket shall be constructed of Teflon or materials of equal or better characteristics. The holder design shall provide a positive seal against leakage at any point along the filter circumference. The holder shall be attached immediately to the outlet of the cyclone or cyclone bypass.

4.1.3.6 Filter heating system: Any heating system capable of maintaining a temperature of $120 \pm 14^\circ\text{C}$ ($248 \pm 25^\circ\text{F}$) around the filter holder during sampling. Other temperatures may be appropriate for particular applications. Alternatively, the tester may opt to operate the equipment at temperatures other than that specified. A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

4.1.3.7 Organic sampling module: This unit consists of three sections, including a gas-conditioning section, a sorbent trap, and a condensate knockout trap. The gas-conditioning system shall be capable of conditioning the gas leaving the back half of the filter holder to a temperature not exceeding 20°C (68°F). The sorbent trap shall be sized to contain approximately 20 g of porous polymeric resin (Rohm and Haas XAD-2 or equivalent) and shall be jacketed to maintain the internal gas temperature at $17 \pm 3^\circ\text{C}$ ($62.5 \pm 5.4^\circ\text{F}$). The most commonly used coolant is ice water from the impinger ice-water bath, constantly circulated through the outer jacket, using rubber or plastic tubing and a peristaltic pump. The sorbent trap should be outfitted with a glass well or depression, appropriately sized to accommodate a small thermocouple in the trap for monitoring the gas entry temperature. The condensate knockout trap shall be of sufficient size to collect the condensate following gas conditioning. The organic module components shall be oriented to direct the flow of condensate formed vertically downward from the conditioning section, through the adsorbent media, and into the condensate knockout trap. The knockout trap is usually similar in appearance to an empty impinger directly underneath the sorbent module; it may be oversized but should have a shortened center stem (at a minimum, one-half the length of the normal impinger stems) to collect a large volume of condensate without bubbling and overflowing into the impinger train. All surfaces of the organic module wetted by the gas sample shall be fabricated of borosilicate glass, Teflon, or other inert materials. Commercial versions of the

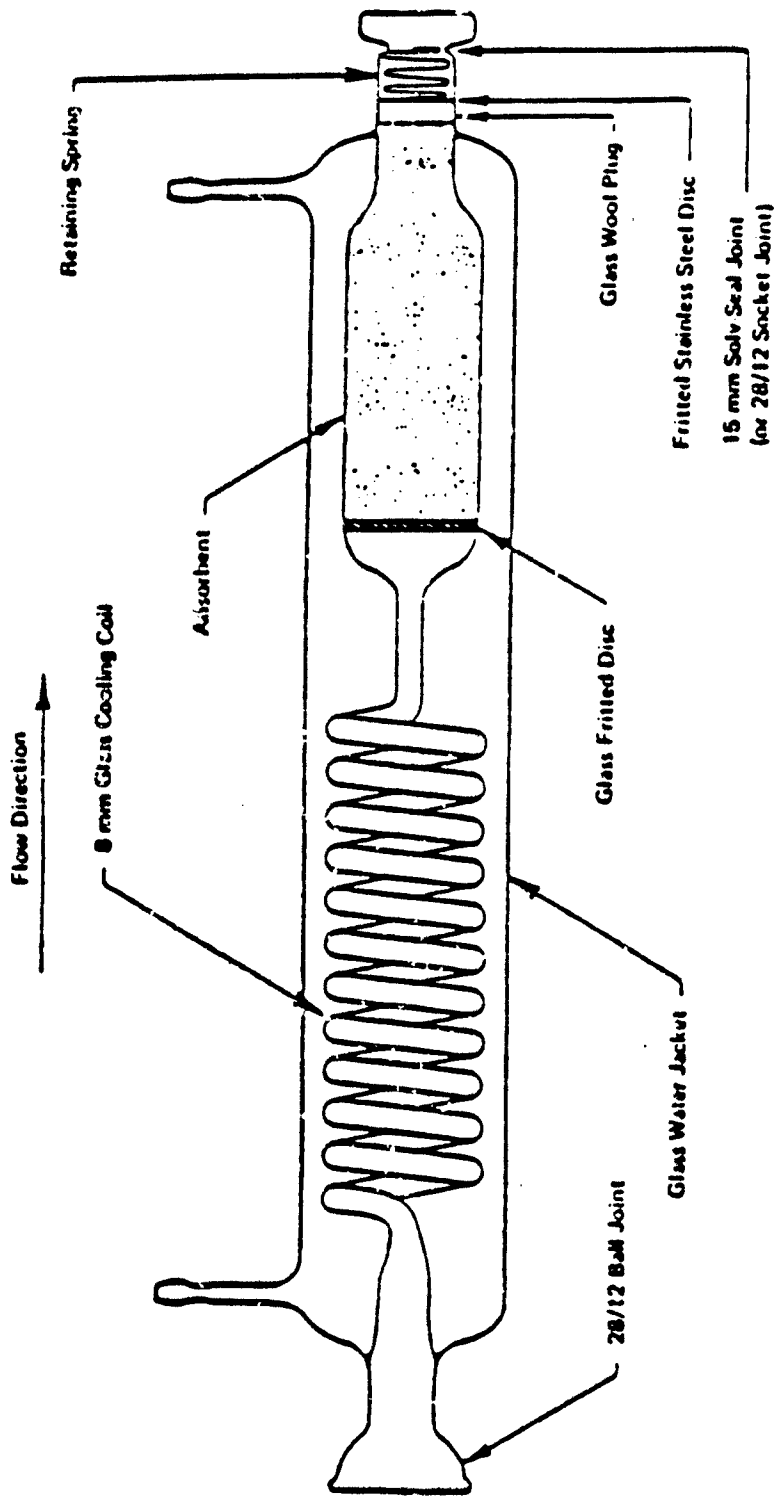


Figure 3. Adsorbent Sampling System.

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Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see EPA Method 2, Figure 2-7). As a second alternative, if a difference of no more than 1% in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube.

4.1.3.12 Calibration/field-preparation record: A permanently bound laboratory notebook, in which duplicate copies of data may be made as they are being recorded, is required for documenting and recording calibrations and preparation procedures (i.e., filter and silica gel tare weights, clean XAD-2, quality assurance/quality control check results, dry-gas meter, and thermocouple calibrations, etc.). The duplicate copies should be detachable and should be stored separately in the test program archives.

4.2 Sample Recovery:

4.2.1 Probe liner: Probe nozzle and organic module conditioning section brushes; nylon bristle brushes with stainless steel wire handles are required. The probe brush shall have extensions of stainless steel, Teflon, or inert material at least as long as the probe. The brushes shall be properly sized and shaped to brush out the probe liner, the probe nozzle, and the organic module conditioning section.

4.2.2 Wash bottles: Three. Teflon or glass wash bottles are recommended; polyethylene wash bottles should not be used because organic contaminants may be extracted by exposure to organic solvents used for sample recovery.

4.2.3 Glass sample storage containers: Chemically resistant, borosilicate amber and clear glass bottles, 500-mL or 1,000-mL. Bottles should be tinted to prevent action of light on sample. Screw-cap liners shall be either Teflon or constructed so as to be leak-free and resistant to chemical attack by organic recovery solvents. Narrow-mouth glass bottles have been found to exhibit less tendency toward leakage.

4.2.4 Petri dishes: Glass, sealed around the circumference with wide (1-in.) Teflon tape, for storage and transport of filter samples.

4.2.5 Graduated cylinder and/or balances: To measure condensed water to the nearest 1 mL or 1 g. Graduated cylinders shall have subdivisions not >2 mL. Laboratory triple-beam balances capable of weighing to ± 0.5 g or better are required.

4.2.6 Plastic storage containers: Screw-cap polypropylene or polyethylene containers to store silica gel.

4.2.7 Funnel and rubber policeman: To aid in transfer of silica gel to container (not necessary if silica gel is weighed in field).

4.2.8 Funnels: Glass, to aid in sample recovery.

4.3 Filters: Glass- or quartz-fiber filters, without organic binder, exhibiting at least 99.95% efficiency (<0.05% penetration) on 0.3- μ m dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D2986-71. Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO₂ or SO₃, the filter material must be of a type that is unreactive to SO₂ or SO₃. Reeve Angel 934 AH or Schleicher and Schuell #3 filters work well under these conditions.

4.4 Crushed ice: Quantities ranging from 10-50 lb may be necessary during a sampling run, depending on ambient air temperature.

4.5 Stopcock grease: Solvent-insoluble, heat-stable silicone grease. Use of silicone grease upstream of the module is not permitted, and amounts used on components located downstream of the organic module shall be minimized. Silicone grease usage is not necessary if screw-on connectors and Teflon sleeves or ground-glass joints are used.

4.6 Glass wool: Used to plug the unfritted end of the sorbent module. The glass-wool fiber should be solvent-extracted with methylene chloride in a Soxhlet extractor for 12 hr and air-dried prior to use.

5.0 REAGENTS

5.1 Adsorbent resin: Porous polymeric resin (XAD-2 or equivalent) is recommended. These resins shall be cleaned prior to their use for sample collection. Appendix A of this method should be consulted to determine appropriate precleaning procedure. For best results, resin used should not exhibit a blank of higher than 4 mg/kg of total chromatographable organics (TCO) (see Appendix B) prior to use. Once cleaned, resin should be stored in an airtight, wide-mouth amber glass container with a Teflon-lined cap or placed in one of the glass sorbent modules tightly sealed with Teflon film and elastic bands. The resin should be used within 4 wk of the preparation.

5.2 Silica gel: Indicating type, 6-16 mesh. If previously used, dry at 175°C (350°F) for 2 hr before using. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

5.3 Impinger solutions: Distilled organic-free water (Type II) shall be used, unless sampling is intended to quantify a particular inorganic gaseous species. If sampling is intended to quantify the concentration of additional species, the impinger solution of choice shall be subject to Administrator approval. This water should be prescreened for any compounds of interest. One hundred mL will be added to the specified impinger; the third impinger in the train may be charged with a basic solution (1 N sodium hydroxide or sodium acetate) to protect the sampling pump from acidic gases. Sodium acetate should be used when large sample volumes are anticipated because sodium hydroxide will react with carbon dioxide in aqueous media to form sodium carbonate, which may possibly plug the impinger.

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5.4 Sample recovery reagents:

5.4.1 Methylene chloride: Distilled-in-glass grade is required for sample recovery and cleanup (see Note to 5.4.2 below).

5.4.2 Methyl alcohol: Distilled-in-glass grade is required for sample recovery and cleanup.

NOTE: Organic solvents from metal containers may have a high residue blank and should not be used. Sometimes suppliers transfer solvents from metal to glass bottles; thus blanks shall be run prior to field use and only solvents with low blank value (<0.001%) shall be used.

5.4.3 Water: Water (Type II) shall be used for rinsing the organic module and condenser component.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 Because of complexity of this method, field personnel should be trained in and experienced with the test procedures in order to obtain reliable results.

6.2 Laboratory preparation:

6.2.1 All the components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified.

6.2.2 Weigh several 200- to 300-g portions of silica gel in airtight containers to the nearest 0.5 g. Record on each container the total weight of the silica gel plus containers. As an alternative to preweighing the silica gel, it may instead be weighed directly in the impinger or sampling holder just prior to train assembly.

6.2.3 Check filters visually against light for irregularities and flaws or pinhole leaks. Label the shipping containers (glass Petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

6.2.4 Desiccate the filters at $20 \pm 5.6^\circ\text{C}$ ($68 \pm 10^\circ\text{F}$) and ambient pressure for at least 24 hr, and weigh at intervals of at least 6 hr to a constant weight (i.e., <0.5-mg change from previous weighing), recording results to the nearest 0.1 mg. During each weighing the filter must not be exposed for more than a 2-min period to the laboratory atmosphere and relative humidity above 50%. Alternatively (unless otherwise specified by the Administrator), the filters may be oven-dried at 105°C (220°F) for 2-3 hr, desiccated for 2 hr, and weighed.

6.3 Preliminary field determinations:

6.3.1 Select the sampling site and the minimum number of sampling points according to EPA Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and range of velocity heads using EPA Method 2. It is recommended that a leak-check of the pitot lines (see EPA Method 2, Section 3.1) be performed. Determine the stack-gas moisture content using EPA Approximation Method 4 or its alternatives to establish estimates of isokinetic sampling-rate settings. Determine the stack-gas dry molecular weight, as described in EPA Method 2, Section 3.6. If integrated EPA Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the sample run.

6.3.2 Select a nozzle size based on the range of velocity heads so that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of EPA Method 2).

6.3.3 Select a suitable probe liner and probe length so that all traverse points can be sampled. For large stacks, to reduce the length of the probe, consider sampling from opposite sides of the stack.

6.3.4 A minimum of 3 dscm (105.9 dscf) of sample volume is required for the determination of the Destruction and Removal Efficiency (DRE) of POHCs from incineration systems. Additional sample volume shall be collected as necessitated by analytical detection limit constraints. To determine the minimum sample volume required, refer to sample calculations in Section 10.0.

6.3.5 Determine the total length of sampling time needed to obtain the identified minimum volume by comparing the anticipated average sampling rate with the volume requirement. Allocate the same time to all traverse points defined by EPA Method 1. To avoid timekeeping errors, the length of time sampled at each traverse point should be an integer or an integer plus one-half min.

6.3.6 In some circumstances (e.g., batch cycles) it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas-sample volumes. In these cases, the Administrator's approval must first be obtained.

6.4 Preparation of collection train:

6.4.1 During preparation and assembly of the sampling train, keep all openings where contamination can occur covered with Teflon film or aluminum foil until just prior to assembly or until sampling is about to begin.

6.4.2 Fill the sorbent trap section of the organic module with approximately 20 g of clean adsorbent resin. While filling, ensure that the trap packs uniformly, to eliminate the possibility of channeling. When freshly cleaned, many adsorbent resins carry a static charge, which will cause clinging to trap walls. This may be minimized by filling the trap in the presence of an antistatic device. Commercial antistatic devices include Model-204 and Model-210 manufactured by the 3M Company, St. Paul, Minnesota.

6.4.3 If an impinger train is used to collect moisture, place 100 mL of water in each of the first two impingers, leave the third impinger empty (or charge with caustic solution, as necessary), and transfer approximately 200-300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

6.4.4 Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

6.4.5 When glass liners are used, install the selected nozzle using a Viton-A O-ring when stack temperatures are $<260^{\circ}\text{C}$ (500°F) and a woven glass-fiber gasket when temperatures are higher. See APTD-0576 (Rom, 1972) for details. Other connecting systems utilizing either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above, or by a leak-free direct mechanical connection. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

6.4.6 Set up the train as in Figure 1. During assembly, do not use any silicone grease on ground-glass joints that are located upstream of the organic module. A very light coating of silicone grease may be used on all ground-glass joints that are located downstream of the organic module, but it should be limited to the outer portion (see APTD-0576) of the ground-glass joints to minimize silicone-grease contamination. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and the filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack. The organic module condenser must be maintained at a temperature of $17 \pm 3^{\circ}\text{C}$. Connect all temperature sensors to an appropriate potentiometer/display unit. Check all temperature sensors at ambient temperature.

6.4.7 Place crushed ice around the impingers and the organic module condensate knockout.

6.4.8 Turn on the sorbent module and condenser coil coolant recirculating pump and begin monitoring the sorbent module gas entry temperature. Ensure proper sorbent module gas entry temperature before proceeding and again before any sampling is initiated. It is extremely important that the XAD-2 resin temperature never exceed 50°C (122°F), because thermal decomposition will occur. During testing, the XAD-2 temperature must not exceed 20°C (68°F) for efficient capture of the semivolatile species of interest.

6.4.9 Turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize.

6.5 Leak-check procedures

6.5.1 Pre-test leak-check:

6.5.1.1 Because the number of additional intercomponent connections in the Semi-VOST train (over the M5 Train) increases the possibility of leakage, a pre-test leak-check is required.

6.5.1.2 After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 381-mm Hg (15-in. Hg) vacuum.

(NOTE: A lower vacuum may be used, provided that it is not exceeded during the test.)

6.5.1.3 If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first attaching a carbon-filled leak-check impinger (shown in Figure 4) to the inlet of the filter holder (cyclone, if applicable) and then plugging the inlet and pulling a 381-mm Hg (15-in. Hg) vacuum. (Again, a lower vacuum may be used, provided that it is not exceeded during the test.) Then, connect the probe to the train and leak-check at about 25-mm Hg (1-in. Hg) vacuum; alternatively, leak-check the probe with the rest of the sampling train in one step at 381-mm Hg (15-in. Hg) vacuum. Leakage rates in excess of 4% of the average sampling rate or $>0.00057 \text{ m}^3/\text{min}$ (0.02 cfm), whichever is less, are unacceptable.

6.5.1.4 The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with fine-adjust valve fully open and coarse-adjust valve completely closed. Partially open the coarse-adjust valve and slowly close the fine-adjust valve until the desired vacuum is reached. Do not reverse direction of the fine-adjust valve; this will cause water to back up into the organic module. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check, as shown below, and start over.

CROSS SECTIONAL VIEW
Leak Testing Apparatus

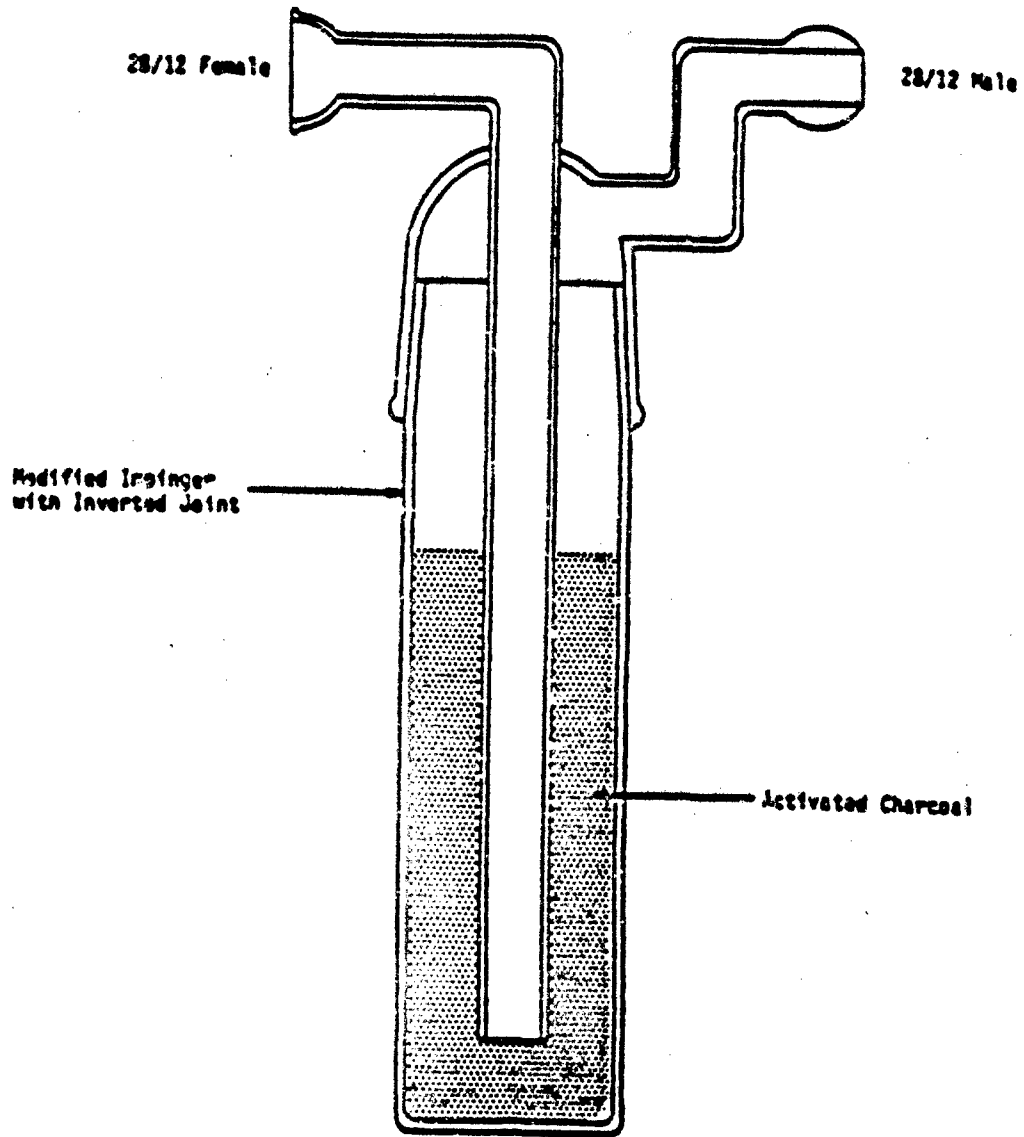


Figure 4. Leak-check impinger.

6.5.1.5 When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable). When the vacuum drops to 127 mm (5 in.) Hg or less, immediately close the coarse-adjust valve. Switch off the pumping system and reopen the fine-adjust valve. Do not reopen the fine-adjust valve until the coarse-adjust valve has been closed. This prevents the water in the impingers from being forced backward into the organic module and silica gel from being entrained backward into the third impinger.

6.5.2 Leak-checks during sampling run:

6.5.2.1 If, during the sampling run, a component (e.g., filter assembly, impinger, or sorbent trap) change becomes necessary, a leak-check shall be conducted immediately after the interruption of sampling and before the change is made. The leak-check shall be done according to the procedure outlined in Paragraph 6.5.1, except that it shall be done at a vacuum greater than or equal to the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than $0.00057 \text{ m}^3/\text{min}$ (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered. If a higher leakage rate is obtained, the tester shall void the sampling run. (It should be noted that any "correction" of the sample volume by calculation by calculation reduces the integrity of the pollutant concentrations data generated and must be avoided.)

6.5.2.2 Immediately after a component change, and before sampling is reinitiated, a leak-check similar to a pre-test leak-check must also be conducted.

6.5.3 Post-test leak-check:

6.5.3.1 A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done with the same procedures as those with the pre-test leak-check, except that it shall be conducted at a vacuum greater than or equal to the maximum value reached during the sampling run. If the leakage rate is found to be no greater than $0.00057 \text{ m}^3/\text{min}$ (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate, correct the sample volume (as shown in the calculation section of this method), and consider the data obtained of questionable reliability, or void the sampling run.

6.6 Sampling-train operation:

6.6.1 During the sampling run, maintain an isokinetic sampling rate to within 10% of true isokinetic, unless otherwise specified by the Administrator. Maintain a temperature around the filter of $120 \pm 14^\circ\text{C}$ ($248 \pm 25^\circ\text{F}$) and a gas temperature entering the sorbent trap at a maximum of 20°C (68°F).

6.6.2 For each run, record the data required on a data sheet such as the one shown in Figure 5. Be sure to record the initial dry-gas meter reading. Record the dry-gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made before and after each leak-check, and when sampling is halted. Take other readings required by Figure 5 at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity-head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

6.6.3 Clean the stack access ports prior to the test run to eliminate the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are at the specified temperature, and verify that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point, with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations, are available. These nomographs are designed for use when the Type S pitot-tube coefficient is 0.84 ± 0.02 and the stack-gas equivalent density (dry molecular weight) is equal to 29 ± 4 . APTD-0576 details the procedure for using the nomographs. If the stack-gas molecular weight and the pitot-tube coefficient are outside the above ranges, do not use the nomographs unless appropriate steps (Shigehara, 1974) are taken to compensate for the deviations.

6.6.4 When the stack is under significant negative pressure (equivalent to the height of the impinger stem), take care to close the coarse-adjust valve before inserting the probe into the stack, to prevent water from backing into the organic module. If necessary, the pump may be turned on with the coarse-adjust valve closed.

6.6.5 When the probe is in position, block off the openings around the probe and stack access port to prevent unrepresentative dilution of the gas stream.

6.6.6 Traverse the stack cross section, as required by EPA Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the access port, in order to minimize the chance of extracting deposited material.

6.6.7 During the test run, make periodic adjustments to keep the temperature around the filter holder and the organic module at the proper levels; add more ice and, if necessary, salt to maintain a temperature of $<20^{\circ}\text{C}$ (68°F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

6.6.8 If the pressure drop across the filter or sorbent trap becomes too high, making isokinetic sampling difficult to maintain, the filter/sorbent trap may be replaced in the midst of a sample run. Using another complete filter holder/sorbent trap assembly is recommended, rather than attempting to change the filter and resin themselves. After a new filter/sorbent trap assembly is installed, conduct a leak-check. The total particulate weight shall include the summation of all filter assembly catches.

6.6.9 A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

6.6.10 Note that when two or more trains are used, separate analysis of the front-half (if applicable) organic-module and impinger (if applicable) catches from each train shall be performed, unless identical nozzle sizes were used on all trains. In that case, the front-half catches from the individual trains may be combined (as may the impinger catches), and one analysis of front-half catch and one analysis of impinger catch may be performed.

6.6.11 At the end of the sample run, turn off the coarse-adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry-gas meter reading, and conduct a post-test leak-check. Also, leak-check the pitot lines as described in EPA Method 2. The lines must pass this leak-check in order to validate the velocity-head data.

6.6.12 Calculate percent isokineticity (see Section 10.8) to determine whether the run was valid or another test run should be made.

7.0 SAMPLE RECOVERY

7.1 Preparation:

7.1.1 Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over the tip to prevent losing or gaining particulate matter. Do not cap the probe tip tightly while the sampling train is cooling down because this will create a vacuum in the filter holder, drawing water from the impingers into the sorbent module.

7.1.2 Before moving the sample train to the cleanup site, remove the probe from the sample train and cap the open outlet, being careful not to lose any condensate that might be present. Cap the filter inlet.

Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the organic module and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the organic module.

7.1.3 Cap the filter-holder outlet and the inlet to the organic module. Separate the sorbent trap section of the organic module from the condensate knockout trap and the gas-conditioning section. Cap all organic module openings. Disconnect the organic-module knockout trap from the impinger train inlet and cap both of these openings. Ground-glass stoppers, Teflon caps, or caps of other inert materials may be used to seal all openings.

7.1.4 Transfer the probe, the filter, the organic-module components, and the impinger/condenser assembly to the cleanup area. This area should be clean and protected from the weather to minimize sample contamination or loss.

7.1.5 Save a portion of all washing solutions (methanol/methylene chloride, Type II water) used for cleanup as a blank. Transfer 200 mL of each solution directly from the wash bottle being used and place each in a separate, prelabeled glass sample container.

7.1.6 Inspect the train prior to and during disassembly and note any abnormal conditions.

7.2 Sample containers:

7.2.1 Container no. 1: Carefully remove the filter from the filter holder and place it in its identified Petri dish container. Use a pair or pairs of tweezers to handle the filter. If it is necessary to fold the filter, ensure that the particulate cake is inside the fold. Carefully transfer to the Petri dish any particulate matter or filter fibers that adhere to the filter-holder gasket, using a dry nylon bristle brush or sharp-edged blade, or both. Label the container and seal with 1-in.-wide Teflon tape around the circumference of the lid.

7.2.2 Container no. 2: Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components first with methanol/methylene chloride (1:1 v/v) into a glass container. Distilled water may also be used. Retain a water and solvent blank and analyze in the same manner as with the samples. Perform rinses as follows:

7.2.2.1 Carefully remove the probe nozzle and clean the inside surface by rinsing with the solvent mixture (1:1 v/v methanol/methylene chloride) from a wash bottle and brushing with a nylon bristle brush. Brush until the rinse shows no visible particles; then make a final rinse of the inside surface with the solvent mix. Brush and rinse the inside parts of the Swagelok fitting with the solvent mix in a similar way until no visible particles remain.

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7.2.2.2 Have two people rinse the probe liner with the solvent mix by tilting and rotating the probe while squirting solvent into its upper end so that all inside surfaces will be wetted with solvent. Let the solvent drain from the lower end into the sample container. A glass funnel may be used to aid in transferring liquid washes to the container.

7.2.2.3 Follow the solvent rinse with a probe brush. Hold the probe in an inclined position and squirt solvent into the upper end while pushing the probe brush through the probe with a twisting action; place a sample container underneath the lower end of the probe and catch any solvent and particulate matter that is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the solvent or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above-prescribed manner at least six times (metal probes have small crevices in which particulate matter can be entrapped). Rinse the brush with solvent and quantitatively collect these washings in the sample container. After the brushing, make a final solvent rinse of the probe as described above.

7.2.2.4 It is recommended that two people work together to clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

7.2.2.5 Clean the inside of the front half of the filter holder and cyclone/cyclone flask, if used, by rubbing the surfaces with a nylon bristle brush and rinsing with methanol/methylene chloride (1:1 v/v) mixture. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone and cyclone flask (if applicable). Brush and rinse any particulate material adhering to the inner surfaces of these components into the front-half rinse sample. After all solvent washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that solvent will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to identify its contents.

7.2.3 Container no. 3: The sorbent trap section of the organic module may be used as a sample transport container, or the spent resin may be transferred to a separate glass bottle for shipment. If the sorbent trap itself is used as the transport container, both ends should be sealed with tightly fitting caps or plugs. Ground-glass stoppers or Teflon caps may be used. The sorbent trap should then be labeled, covered with aluminum foil, and packaged on ice for transport to the laboratory. If a separate bottle is used, the spent resin should be quantitatively transferred from the trap into the clean bottle. Resin that adheres to the walls of the trap should be recovered using a rubber policeman or spatula and added to this bottle.

7.2.4 Container no. 4: Measure the volume of condensate collected in the condensate knockout section of the organic module to within +1 mL by using a graduated cylinder or by weighing to within +0.5 g using a triple-beam balance. Record the volume or weight of liquid present and note any discoloration or film in the liquid catch. Transfer this liquid to a pre-labeled glass sample container. Inspect the back half of the filter housing and the gas-conditioning section of the organic module. If condensate is observed, transfer it to a graduated or weighing bottle and measure the volume, as described above. Add this material to the condensate knockout-trap catch.

7.2.5 Container no. 5: All sampling train components located between the high-efficiency glass- or quartz-fiber filter and the first wet impinger or the final condenser system (including the heated Teflon line connecting the filter outlet to the condenser) should be thoroughly rinsed with methanol/methylene chloride (1:1 v/v) and the rinsings combined. This rinse shall be separated from the condensate. If the spent resin is transferred from the sorbent trap to a separate sample container for transport, the sorbent trap shall be thoroughly rinsed until all sample-wetted surfaces appear clean. Visible films should be removed by brushing. Whenever train components are brushed, the brush should be subsequently rinsed with solvent mixture and the rinsings added to this container.

7.2.6 Container no. 6: Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere strongly to the impinger wall. Because the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, weigh the container and its contents to 0.5 g or better.

7.3 Impinger water:

7.3.1 Make a notation of any color or film in the liquid catch. Measure the liquid in the first three impingers to within +1 mL by using a graduated cylinder or by weighing it to within +0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

7.3.2 Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Paragraph 4.1.3.7). Amber glass containers should be used for storage of impinger catch, if required.

7.3.3 If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

7.4 Sample preparation for shipment: Prior to shipment, recheck all sample containers to ensure that the caps are well secured. Seal the lids of all containers around the circumference with Teflon tape. Ship all liquid samples upright on ice and all particulate filters with the particulate catch facing upward. The particulate filters should be shipped unrefrigerated.

8.0 ANALYSIS

8.1 Sample preparation:

8.1.1 General: The preparation steps for all samples will result in a finite volume of concentrated solvent. The final sample volume (usually in the 1- to 10-mL range) is then subjected to analysis by GC/MS. All samples should be inspected and the appearance documented. All samples are to be spiked with surrogate standards as received from the field prior to any sample manipulations. The spike should be at a level equivalent to 10 times the MDL when the solvent is reduced in volume to the desired level (i.e., 10 mL). The spiking compounds should be the stable isotopically labeled analog of the compounds of interest or a compound that would exhibit properties similar to the compounds of interest, be easily chromatographed, and not interfere with the analysis of the compounds of interest. Suggested surrogate spiking compounds are: deuterated naphthalene, chrysene, phenol, nitrobenzene, chlorobenzene, toluene, and carbon-13-labeled pentachlorophenol.

8.1.2 Condensate: The "condensate" is the moisture collected in the first impinger following the XAD-2 module. Spike the condensate with the surrogate standards. The volume is measured and recorded and then transferred to a separatory funnel. The pH is to be adjusted to pH 2 with 6 N sulfuric acid, if necessary. The sample container and graduated cylinder are sequentially rinsed with three successive 10-mL aliquots of the extraction solvent and added to the separatory funnel. The ratio of solvent to aqueous sample should be maintained at 1:3. Extract the sample by vigorously shaking the separatory funnel for 5 min. After complete separation of the phases, remove the solvent and transfer to a Kuderna-Danish concentrator (K-D), filtering through a bed of pre-cleaned, dry sodium sulfate. Repeat the extraction step two additional times. Adjust the pH to 11 with 6 N sodium hydroxide and reextract combining the acid and base extracts. Rinse the sodium sulfate into the K-D with fresh solvent and discard the desiccant. Add Teflon boiling chips and concentrate to 10 mL by reducing the volume to slightly less than 10 mL and then bringing to volume with fresh solvent. In order to achieve the necessary detection limit, the sample volume can be further reduced to 1 mL by using a micro column K-D or nitrogen blow-down. Should the sample start to exhibit precipitation, the concentration step should be stopped and the sample redissolved with fresh solvent taking the volume to some finite amount. After adding a standard (for the purpose of quantitation by GC/MS), the sample is ready for analysis, as discussed in Paragraph 8.2.

8.1.3 Impinger: Spike the sample with the surrogate standards; measure and record the volume and transfer to a separatory funnel. Proceed as described in Paragraph 8.1.2.

8.1.4 XAD-2: Spike the resin directly with the surrogate standards. Transfer the resin to the all-glass thimbles by the following procedure (care should be taken so as not to contaminate the thimble by touching it with anything other than tweezers or other solvent-rinsed mechanical holding devices). Suspend the XAD-2 module directly over the thimble. The glass frit of the module (see Figure 2) should be in the up position. The thimble is contained in a clean beaker, which will serve to catch the solvent rinses. Using a Teflon squeeze bottle, flush the XAD-2 into the thimble. Thoroughly rinse the glass module with solvent into the beaker containing the thimble. Add the XAD-2 glass-wool plug to the thimble. Cover the XAD-2 in the thimble with a precleaned glass-wool plug sufficient to prevent the resin from floating into the solvent reservoir of the extractor. If the resin is wet, effective extraction can be accomplished by loosely packing the resin in the thimble. If a question arises concerning the completeness of the extraction, a second extraction, without a spike, is advised. The thimble is placed in the extractor and the rinse solvent contained in the beaker is added to the solvent reservoir. Additional solvent is added to make the reservoir approximately two-thirds full. Add Teflon boiling chips and assemble the apparatus. Adjust the heat source to cause the extractor to cycle 5-6 times per hr. Extract the resin for 16 hr. Transfer the solvent and three 10-mL rinses of the reservoir to a K-D and concentrate as described in Paragraph 8.1.2.

8.1.5 Particulate filter (and cyclone catch): If particulate loading is to be determined, weigh the filter (and cyclone catch, if applicable). The particulate filter (and cyclone catch, if applicable) is transferred to the glass thimble and extracted simultaneously with the XAD-2 resin.

8.1.6 Train solvent rinses: All train rinses (i.e., probe, impinger, filter housing) using the extraction solvent and methanol are returned to the laboratory as a single sample. If the rinses are contained in more than one container, the intended spike is divided equally among the containers proportioned from a single syringe volume. Transfer the rinse to a separatory funnel and add a sufficient amount of organic-free water so that the methylene chloride becomes immiscible and its volume no longer increases with the addition of more water. The extraction and concentration steps are then performed as described in Paragraph 8.1.2.

8.2 Sample analysis:

8.2.1 The primary analytical tool for the measurement of emissions from hazardous waste incinerators is GC/MS using fused-silica capillary GC columns, as described in Method 8270 in Chapter Four of this manual. Because of the nature of GC/MS instrumentation and the cost associated

with sample analysis, prescreening of the sample extracts by chromatography/flame ionization detection (GC/FID) or with electron capture (GC/ECD) is encouraged. Information regarding the complexity and concentration level of a sample prior to GC/MS analysis can be enormous help. This information can be obtained by using either capillary columns or less expensive packed columns. However, the prescreen should be performed with a column similar to that used with GC/MS. Keep in mind that GC/FID has a slightly lower detection limit than GC/MS and, therefore, that the concentration of the sample can be adjusted either up or down prior to analysis by GC/MS.

8.2.2 The mass spectrometer will be operated in a full scan (4-450) mode for most of the analyses. The range for which data is acquired in a GC/MS run will be sufficiently broad to encompass the major ions, as listed in Chapter Four, Method 8270, for each of the designated POHCs in an incinerator effluent analysis.

8.2.3 For most purposes, electron ionization (EI) spectra will be collected because a majority of the POHCs give reasonable EI spectra. Also, EI spectra are compatible with the NBS Library of Mass Spectra and other mass spectral references, which aid in the identification process for other components in the incinerator process streams.

8.2.4 To clarify some identifications, chemical ionization (CI) spectra using either positive ions or negative ions will be used to elucidate molecular-weight information and simplify the fragmentation patterns of some compounds. In no case, however, should CI spectra alone be used for compound identification. Refer to Chapter Four, Method 8270 for complete descriptions of GC conditions, MS conditions, and quantitative and qualitative identification.

9.0 CALIBRATION

9.1 Probe nozzle: Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make measurements at three separate places across the diameter and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

9.2 Pitot tube: The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of EPA Method 2, or assigned a nominal coefficient of 0.84 if it is not visibly nicked, dented, or corroded and if it meets design and intercomponent spacing specifications.

9.3 Metering system:

9.3.1 Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry-gas meter dial readings to correspond to the wet-test meter readings, calibration factors may be used to correct the gas meter dial readings mathematically to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: Make a 10-min calibration run at $0.00057 \text{ m}^3/\text{min}$ (0.02 cfm); at the end of the run, take the difference of the measured wet-test and dry-gas meter volumes and divide the difference by 10 to get the leak rate. The leak rate should not exceed $0.00057 \text{ m}^3/\text{min}$ (0.02 cfm).

9.3.2 After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). The vacuum shall be set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet-test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5%, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

9.3.3 Leak-check of metering system: That portion of the sampling train from the pump to the orifice meter (see Figure 1) should be leak-checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 6): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13-18 cm (5-7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for 1 min. A loss of pressure on the manometer indicates a leak in the meter box. Leaks, if present, must be corrected.

NOTE: If the dry-gas-meter coefficient values obtained before and after a test series differ by >5%, either the test series shall be voided or calculations for test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

9.4 Probe heater: The probe-heating system shall be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

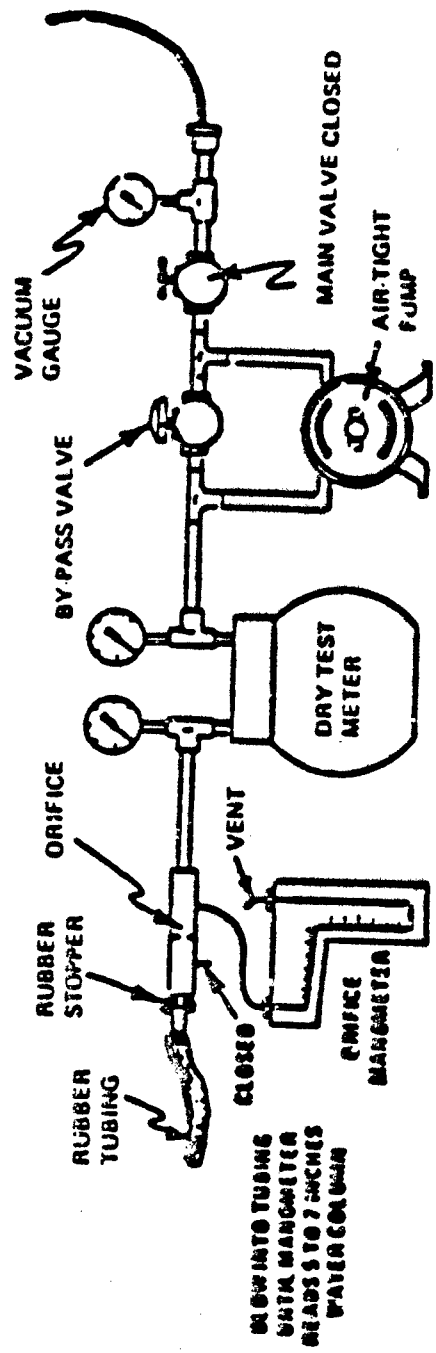


Figure 6. Leak check of meter box.

9.5 Temperature gauges: Each thermocouple must be permanently and uniquely marked on the casting; all mercury-in-glass reference thermometers must conform to ASTM E-1 630 or 63F specifications. Thermocouples should be calibrated in the laboratory with and without the use of extension leads. If extension leads are used in the field, the thermocouple readings at ambient air temperatures, with and without the extension lead, must be noted and recorded. Correction is necessary if the use of an extension lead produces a change $>1.5\%$.

9.5.1 Impinger, organic module, and dry-gas meter thermocouples: For the thermocouples used to measure the temperature of the gas leaving the impinger train and the XAD-2 resin bed, three-point calibration at ice-water, room-air, and boiling-water temperatures is necessary. Accept the thermocouples only if the readings at all three temperatures agree to $+2^{\circ}\text{C}$ (3.6°F) with those of the absolute value of the reference thermometer.

9.5.2 Probe and stack thermocouple: For the thermocouples used to indicate the probe and stack temperatures, a three-point calibration at ice-water, boiling-water, and hot-oil-bath temperatures must be performed; it is recommended that room-air temperature be added, and that the thermometer and the thermocouple agree to within 1.5% at each of the calibration points. A calibration curve (equation) may be constructed (calculated) and the data extrapolated to cover the entire temperature range suggested by the manufacturer.

9.6 Barometer: Adjust the barometer initially and before each test series to agree to within ± 25 mm Hg (0.1 in. Hg) of the mercury barometer or the corrected barometric pressure value reported by a nearby National Weather Service Station (same altitude above sea level).

9.7 Triple-beam balance: Calibrate the triple-beam balance before each test series, using Class-S standard weights; the weights must be within $\pm 0.5\%$ of the standards, or the balance must be adjusted to meet these limits.

10.0 CALCULATIONS

10.1 Carry out calculations. Round off figures after the final calculation to the correct number of significant figures.

10.2 Nomenclature:

A_n = Cross-sectional area of nozzle, m^2 (ft^2).

β_{ws} = Water vapor in the gas stream, proportion by volume.

C_d = type S pitot tube coefficient (nominally 0.84 ± 0.02), dimensionless.

I = Percent of isokinetic sampling.

- L_a = Maximum acceptable leakage rate for a leak-check, either pre-test or following a component change; equal to 0.00057 m³/min (0.0 cfm) or 4% of the average sampling rate, whichever is less.
- L_i = Individual leakage rate observed during the leak-check conducted prior to the "ith" component change (i = 1, 2, 3...n) m³/min (cfm).
- L_p = Leakage rate observed during the post-test leak-check, m³/min (cfm).
- M_d = Stack-gas dry molecular weight, g/g-mole (lb/lb-mole).
- M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).
- P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).
- P_s = Absolute stack-gas pressure, mm Hg (in. Hg).
- P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
- R = Ideal gas constant, 0.06236 mm Hg-m³/K-g-mole (21.85 in. Hg-ft³/°R-lb-mole).
- T_m = Absolute average dry-gas meter temperature (see Figure 6), K (°R).
- T_s = Absolute average stack-gas temperature (see Figure 6), K (°R).
- T_{std} = Standard absolute temperature, 293K (528°R).
- V_{lc} = Total volume of liquid collected in the organic module condensate knockout trap, the impingers, and silica gel, mL.
- V_m = Volume of gas sample as measured by dry-gas meter, dscm (dscf).
- $V_m(std)$ = Volume of gas sample measured by the dry-gas meter, corrected to standard conditions, dscm (dscf).
- $V_w(std)$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).
- v_s = Stack-gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).
- W_a = Weight of residue in acetone wash, mg.
- γ = Dry-gas-meter calibration factor, dimensionless.
- ΔH = Average pressure differential across the orifice meter (see Figure 2), mm H₂O (in. H₂O).

ρ_w = Density of water, 0.9982 g/mL (0.02101 lb/L).

t = Total sampling time, min.

t_1 = Sampling time interval from the beginning of a run until the first component change, min.

t_i = Sampling time interval between two successive component changes, beginning with the interval between the first and second changes, min.

t_p = Sampling time interval from the final (nth) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = sec/min.

100 = Conversion to percent.

10.3 Average dry-gas-meter temperature and average orifice pressure drop: See data sheet (Figure 5, above).

10.4 Dry-gas volume: Correct the sample measured by the dry-gas meter to standard conditions (20°C, 760 mm Hg [68°F, 29.92 in. Hg]) by using Equation 1:

$$V_{m(\text{std})} = V_m \frac{T_{\text{std}}}{T_m} \frac{P_{\text{bar}} + \Delta H/13.6}{P_{\text{std}}} = K_1 V_m \frac{P_{\text{bar}} + \Delta H/13.6}{T_m} \quad (1)$$

where:

$K_1 = 0.3858 \text{ K/mm Hg}$ for metric units, or
 $K_1 = 17.64^\circ\text{R/in. Hg}$ for English units.

It should be noted that Equation 1 can be used as written, unless the leakage rate observed during any of the mandatory leak-checks (i.e., the post-test leak-check or leak-checks conducted prior to component changes) exceeds L_a . If L_p or L_1 exceeds L_a , Equation 1 must be modified as follows:

a. Case I (no component changes made during sampling run): Replace V_m in Equation 1 with the expression:

$$V_m = (L_p - L_a)$$

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- d. Case II (one or more component changes made during the sampling run): Replace V_a in Equation 1 by the expression:

$$V_a = (L_1 - L_2)Q_1 - \sum_{i=2}^n (L_1 - L_2)Q_1 - (L_p - L_2)Q_p$$

and substitute only for those leakage rates (L_1 or L_p) that exceed L_a .

10.5 Volume of water vapor:

$$V_{w(std)} = V_{1c} \frac{P_w}{M_w} \frac{RT_{std}}{P_{std}} = K_2 V_{1c} \quad (2)$$

where:

$K_2 = 0.001333 \text{ m}^3/\text{mL}$ for metric units, or
 $K_2 = 0.04707 \text{ ft}^3/\text{mL}$ for English units.

10.6 Moisture content:

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}} \quad (3)$$

NOTE: In saturated or water-droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 3) and a second from the assumption of saturated conditions. The lower of the two values of B_w shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note to Section 1.2 of Method 4. For the purposes of this method, the average stack-gas temperature from Figure 6 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is $\pm 1^\circ\text{C}$ (2°F).

10.7 Conversion factors:

From	To	Multiply by
scf	m^3	0.02832
g/ft ³	gr/ft ³	15.43
g/ft ³	lb/ft ³	2.205×10^{-3}
g/ft ³	g/m ³	35.31

10.3 Isokinetic variations:

10.3.1 Calculation from raw data:

$$I = \frac{100 T_s [K_3 F_{lc} + (V_d/T_m) (P_{bar} + 3H/13.6)]}{503 V_s P_s A_n} \quad (4)$$

where:

$K_3 = 0.003454 \text{ mm Hg-m}^3/\text{mL-K}$ for metric units, or
 $K_3 = 0.002569 \text{ in. Hg-ft}^3/\text{mL-}^\circ\text{R}$ for English units.

10.3.2 Calculation for intermediate values:

$$I = \frac{T_s V_m(\text{std}) P_{\text{std}}^{100}}{T_{\text{std}} V_s \frac{A_n P_s^{100} (1 - \theta_{ws})}{A_n P_s^{100} (1 - \theta_{ws})}} \quad (5)$$

$$= K_4 \frac{T_s V_m(\text{std})}{P_s V_s A_n (1 - \theta_{ws})}$$

where:

$K_4 = 4.320$ for metric units, or
 $K_4 = 0.09450$ for English units.

10.3.3 Acceptable results: If $90\% \leq I \leq 110\%$, the results are acceptable. If the results are low in comparison with the standard and I is beyond the acceptable range, or if I is less than 90%, the Administrator may opt to accept the results.

10.9 To determine the minimum sample volume that shall be collected, the following sequence of calculations shall be used.

10.9.1 From prior analysis of the waste feed, the concentration of POHCs introduced into the combustion system can be calculated. The degree of destruction and removal efficiency that is required is used to determine the maximum amount of POHC allowed to be present in the effluent. This may be expressed as:

$$\frac{(\dot{W}) (\text{POHC}_1 \text{ conc}) (100 - \text{DRE})}{100} = \text{Max POHC}_1 \text{ Mass} \quad (6)$$

where:

\dot{W} = mass flow rate of waste feed per hr, g/hr (lb/hr).

POHC_1 = concentration of Principal Organic Hazardous Compound (wt %) introduced into the combustion process.

DRE = percent Destruction and Removal Efficiency required.

Max POHC = mass flow rate (g/hr [lb/hr]) of POHC emitted from the combustion source.

10.9.2 The average discharge concentration of the POHC in the effluent gas is determined by comparing the Max POHC with the volumetric flow rate being exhausted from the source. Volumetric flow rate data are available as a result of preliminary Method 1-4 determinations:

$$\frac{\text{Max POHC}_i \text{ Mass}}{DV_{\text{eff}}(\text{std})} = \text{Max POHC}_i \text{ conc} \quad (7)$$

where:

$DV_{\text{eff}}(\text{std})$ = volumetric flow rate of exhaust gas, dscm (dscf).

$\text{POHC}_i \text{ conc}$ = anticipated concentration of the POHC in the exhaust gas stream, g/dscm (lb/dscf).

10.9.3 In making this calculation, it is recommended that a safety margin of at least ten be included:

$$\frac{\text{LDL}_{\text{POHC}} \times 10}{\text{POHC}_i \text{ conc}} = V_{\text{TBC}} \quad (8)$$

where:

LDL_{POHC} = detectable amount of POHC in entire sampling train.

NOTE: The whole extract from an XAD-2 cartridge is seldom if ever, injected at once. Therefore, if aliquoting factors are involved, the LDL_{POHC} is not the same as the analytical (or column) detection limit.

V_{TBC} = minimum dry standard volume to be collected at dry-gas meter.

10.10 Concentration of any given POHC in the gaseous emissions of a combustion process:

1) Multiply the concentration of the POHC as determined in Method 8270 by the final concentration volume, typically 10 mL.

$$C_{\text{POHC}} (\text{ug/mL}) \times \text{sample volume (mL)} = \text{amount (ug) of POHC in sample} \quad (9)$$

where:

C_{POHC} = concentration of POHC as analyzed by Method 8270.

2) Sum the amount of POHC found in all samples associated with a single train.

$$\text{Total (ug)} = \text{XAD-2 (ug)} + \text{condensate (ug)} + \text{rinses (ug)} + \text{impinger (ug)} \quad (10)$$

3) Divide the total ug found by the volume of stack gas sampled (m³).

$$(\text{Total ug}) / (\text{train sample volume}) = \text{concentration of POHC (ug/m}^3) \quad (11)$$

11.0 QUALITY CONTROL

11.1 Sampling: See EPA Manual 600/4-77-027b for Method 5 quality control.

11.2 Analysis: The quality assurance program required for this study includes the analysis of field and method blanks, procedure validations, incorporation of stable labeled surrogate compounds, quantitation versus stable labeled internal standards, capillary column performance checks, and external performance tests. The surrogate spiking compounds selected for a particular analysis are used as primary indicators of the quality of the analytical data for a wide range of compounds and a variety of sample matrices. The assessment of combustion data, positive identification, and quantitation of the selected compounds are dependent on the integrity of the samples received and the precision and accuracy of the analytical methods employed. The quality assurance procedures for this method are designed to monitor the performance of the analytical method and to provide the required information to take corrective action if problems are observed in laboratory operations or in field sampling activities.

11.2.1 Field Blanks: Field blanks must be submitted with the samples collected at each sampling site. The field blanks include the sample bottles containing aliquots of sample recovery solvents, unused filters, and resin cartridges. At a minimum, one complete sampling train will be assembled in the field staging area, taken to the sampling area, and leak-checked at the beginning and end of the testing (or for the same total number of times as the actual test train). The filter housing and probe of the blank train will be heated during the sample test. The train will be recovered as if it were an actual test sample. No gaseous sample will be passed through the sampling train.

11.2.2 Method blanks: A method blank must be prepared for each set of analytical operations, to evaluate contamination and artifacts that can be derived from glassware, reagents, and sample handling in the laboratory.

11.2.3 Refer to Method 8270 for additional quality control considerations.

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12.0 METHOD PERFORMANCE

12.1 Method performance evaluation: Evaluation of analytical procedure for a selected series of compounds must include the sample-preparation procedures and each associated analytical determination. The analytical procedures should be challenged by the test compounds spiked at appropriate levels and carried through the procedures.

12.2 Method detection limit: The overall method detection limits (lower and upper) must be determined on a compound-by-compound basis because different compounds may exhibit different collection, retention, and extraction efficiencies as well as instrumental minimum detection limit (MDL). The method detection limit must be quoted relative to a given sample volume. The upper limits for the method must be determined relative to compound retention volumes (breakthrough).

12.3 Method precision and bias: The overall method precision and bias must be determined on a compound-by-compound basis at a given concentration level. The method precision value would include a combined variability due to sampling, sample preparation, and instrumental analysis. The method bias would be dependent upon the collection, retention, and extraction efficiency of the train components. From evaluation studies to date using a dynamic spiking system, method biases of -13% and -16% have been determined for toluene and 1,1,2,2-tetrachloroethane, respectively. A precision of 19.9% was calculated from a field test data set representing seven degrees of freedom which resulted from a series of paired, unspiked Semivolatile Organic Sampling trains (Semi-VOST) sampling emissions from a hazardous waste incinerator.

13.0 REFERENCES

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4. Rom, J.J., Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment, Research Triangle Park, NC, U.S. Environmental Protection Agency, March 1972, PB-209 022/BE, APTD-6576, 39 pp.
5. Schlickerrieder, L.M., Adams, J.W., and Thrun, K.E., Modified Method 5 Train and Source Assessment Sampling System: Operator's Manual, U.S. Environmental Protection Agency, EPA/600/8-85/003, (1985).

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METHOD 0010, APPENDIX A

PREPARATION OF XAD-2 SORBENT RESIN

1.0 SCOPE AND APPLICATION

1.1 XAD-2 resin as supplied by the manufacturer is impregnated with a bicarbonate solution to inhibit microbial growth during storage. Both the salt solution and any residual extractable monomer and polymer species must be removed before use. The resin is prepared by a series of water and organic extractions, followed by careful drying.

2.0 EXTRACTION

2.1 Method 1: The procedure may be carried out in a giant Soxhlet extractor. An all-glass thimble containing an extra-coarse frit is used for extraction of XAD-2. The frit is recessed 10-15 mm above a crenellated ring at the bottom of the thimble to facilitate drainage. The resin must be carefully retained in the extractor cup with a glass-wool plug and stainless steel screen because it floats on methylene chloride. This process involves sequential extraction in the following order.

<u>Solvent</u>	<u>Procedure</u>
Water	Initial rinse: Place resin in a beaker, rinse once with Type II water, and discard. Fill with water a second time, let stand overnight, and discard.
Water	Extract with H ₂ O for 8 hr.
Methyl alcohol	Extract for 22 hr.
Methylene chloride	Extract for 22 hr.
Methylene chloride (fresh)	Extract for 22 hr.

2.2 Method 2:

2.2.1 As an alternative to Soxhlet extraction, a continuous extractor has been fabricated for the extraction sequence. This extractor has been found to be acceptable. The particular canister used for the apparatus shown in Figure A-1 contains about 500 g of finished XAD-2. Any size may be constructed; the choice is dependent on the needs of the sampling programs. The XAD-2 is held under light spring tension between a pair of coarse and fine screens. Spacers under the bottom screen allow for even distribution of clean solvent. The three-necked flask should be of sufficient size (3-liter in this case) to hold solvent

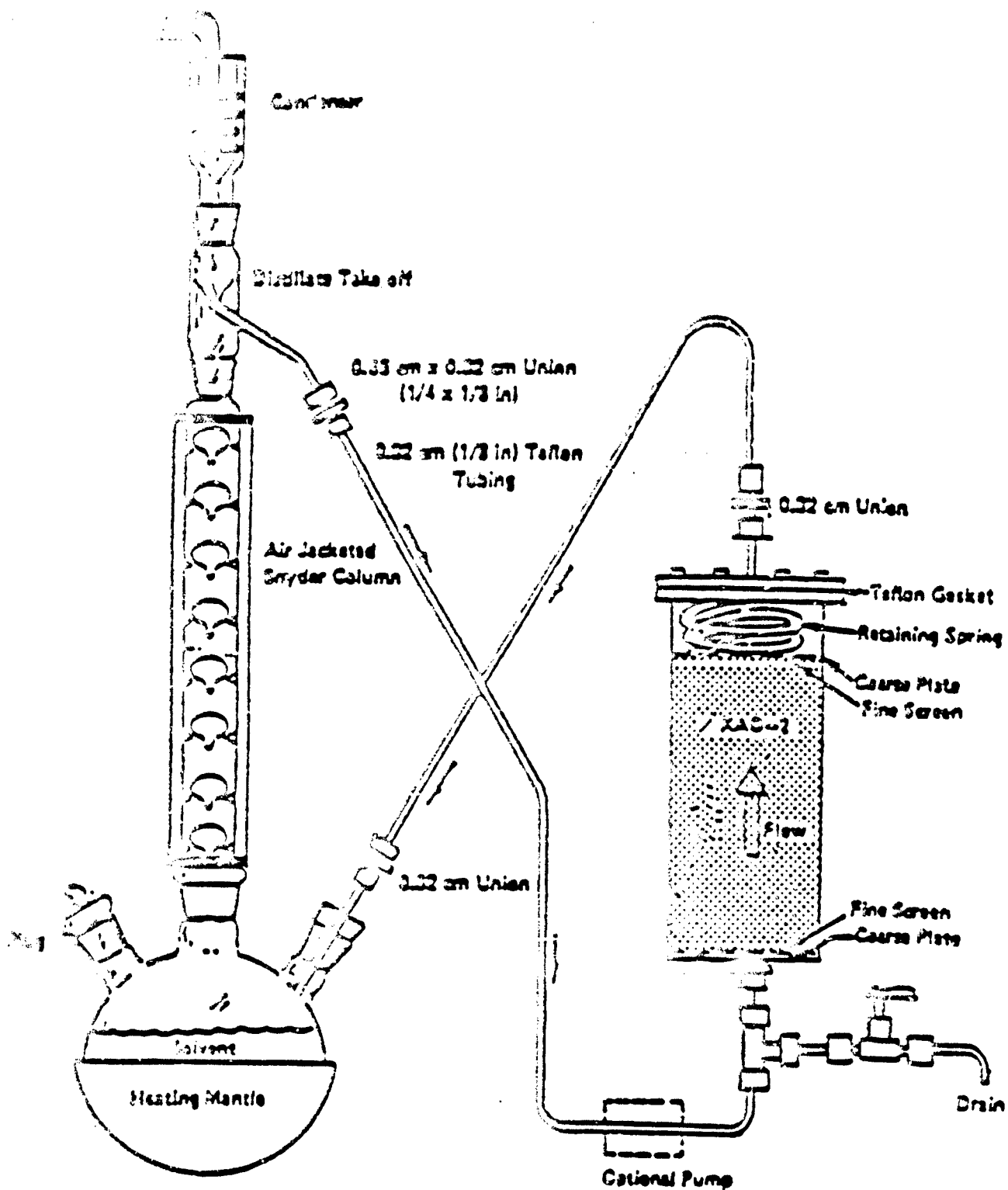


Figure A-1. XAD-2 cleanup extraction apparatus.

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equal to twice the dead volume of the XAD-2 canister. Solvent is refluxed through the Snyder column, and the distillate is continuously cycled up through the XAD-2 for extraction and returned to the flask. The flow is maintained upward through the XAD-2 to allow maximum solvent contact and prevent channeling. A valve at the bottom of the canister allows removal of solvent from the canister between changes.

2.2.2 Experience has shown that it is very difficult to cycle sufficient water in this mode. Therefore the aqueous rinse is accomplished by simply flushing the canister with about 20 liters of distilled water. A small pump may be useful for pumping the water through the canister. The water extraction should be carried out at the rate of about 20-40 mL/min.

2.2.3 After draining the water, subsequent methyl alcohol and methylene chloride extractions are carried out using the refluxing apparatus. An overnight or 10- to 20-hr period is normally sufficient for each extraction.

2.2.4 All materials of construction are glass, Teflon, or stainless steel. Pumps, if used, should not contain extractable materials. Pumps are not used with methanol and methylene chloride.

3.0 DRYING

3.1 After evaluation of several methods of removing residual solvent, a fluidized-bed technique has proved to be the fastest and most reliable drying method.

3.2 A simple column with suitable retainers, as shown in Figure A-2, will serve as a satisfactory column. A 10.2-cm (4-in.) Pyrex pipe 0.6 m (2 ft) long will hold all of the XAD-2 from the extractor shown in Figure A-1 or the Soxhlet extractor, with sufficient space for fluidizing the bed while generating a minimum resin load at the exit of the column.

3.3 Method 1: The gas used to remove the solvent is the key to preserving the cleanliness of the XAD-2. Liquid nitrogen from a standard commercial liquid nitrogen cylinder has routinely proved to be a reliable source of large volumes of gas free from organic contaminants. The liquid nitrogen cylinder is connected to the column by a length of pre-cleaned 0.95-cm (3/8-in.) copper tubing, coiled to pass through a heat source. As nitrogen is bled from the cylinder, it is vaporized in the heat source and passes through the column. A convenient heat source is a water bath heated from a steam line. The final nitrogen temperature should only be warm to the touch and not over 40°C. Experience has shown that about 500 g of XAD-2 may be dried overnight by consuming a full 160-liter cylinder of liquid nitrogen.

3.4 Method 2: As a second choice, high-purity tank nitrogen may be used to dry the XAD-2. The high-purity nitrogen must first be passed through a bed

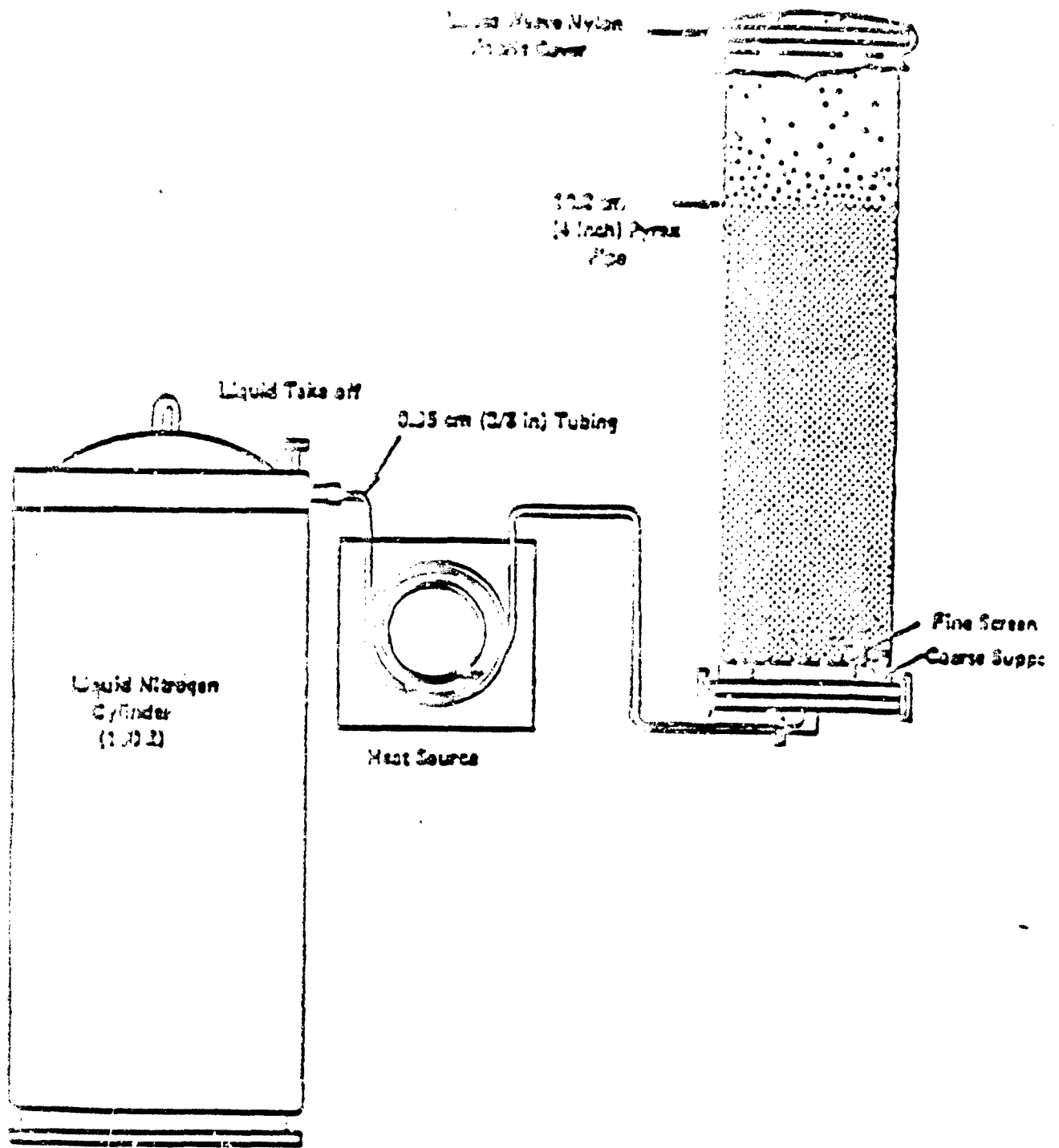


Figure A-2. XAD-2 fluidized-bed drying apparatus.

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of activated charcoal approximately 150 mL in volume. With either type of drying method, the rate of flow should gently agitate the bed. Excessive fluidization may cause the particles to break up.

3.0 QUALITY CONTROL PROCEDURES

4.1 For both Methods 1 and 2, the quality control results must be reported for the batch. The batch must be reextracted if the residual extractable organics are >20 ug/mL by TCO analysis or the gravimetric residue is >0.5 mg/20 g XAD-2 extracted. (See also section 5.1, Method 0010.)

4.2 Four control procedures are used with the final XAD-2 to check for (1) residual methylene chloride, (2) extractable organics (TCO), (3) specific compounds of interest as determined by GC/MS, as described in Section 4.5 below, and (4) residue (GRAV).

4.3 Procedure for residual methylene chloride:

4.3.1 Description: A 1 ± 0.1 -g sample of dried resin is weighed into a small vial, 3 mL of toluene are added, and the vial is capped and well shaken. Five uL of toluene (now containing extracted methylene chloride) are injected into a gas chromatograph, and the resulting integrated area is compared with a reference standard. The reference solution consists of 2.5 uL of methylene chloride in 100 mL of toluene, simulating 100 ug of residual methylene chloride on the resin. The acceptable maximum content is 1,000 ug/g resin.

4.3.2 Experimental: The gas chromatograph conditions are as follows:

6-ft x 1/8-in. stainless steel column containing 10% OV-101 on 100/120 Supelcoport;

Helium carrier at 30 mL/min;

FID operated on 4×10^{-11} A/mV;

Injection port temperature: 250°C;

Detector temperature: 305°C;

Program: 30°C(4 min) 40°C/min 250°C (hold); and

Program terminated at 1,000 sec.

4.4 Procedure for residual extractable organics:

4.4.1 Description: A 20 ± 0.1 -g sample of cleaned, dried resin is weighed into a precleaned alundum or cellulose thimble which is plugged with cleaned glass wool. (Note that 20 g of resin will fill a thimble, and the

resin will float out unless well plugged.) The thimble containing the resin is extracted for 24 hr with 200-mL of pesticide-grade methylene chloride (Burdick and Jackson pesticide-grade or equivalent purity). The 200-mL extract is reduced in volume to 10-mL using a Kuderna-Danish concentrator and/or a nitrogen evaporation stream. Five uL of that solution are analyzed by gas chromatography using the TCO analysis procedure. The concentrated solution should not contain >20 ug/mL of TCO extracted from the XAD-2. This is equivalent to 10 ug/g of TCO in the XAD-2 and would correspond to 1.3 mg of TCO in the extract of the 130-g XAD-2 module. Care should be taken to correct the TCO data for a solvent blank prepared (200 mL reduced to 10 mL) in a similar manner.

4.4.2 Experimental: Use the TCO analysis conditions described in the revised Level 1 manual (EPA 600/7-78-201).

4.5 GC/MS Screen: The extract, as prepared in paragraph 4.4.1, is subjected to GC/MS analysis for each of the individual compounds of interest. The GC/MS procedure is described in Chapter Four, Method 8270. The extract is screened at the MDL of each compound. The presence of any compound at a concentration >25 ug/mL in the concentrated extract will require the XAD-2 to be recleaned by repeating the methylene chloride step.

4.5 Methodology for residual gravimetric determination: After the TCO value and GC/MS data are obtained for the resin batch by the above procedures, dry the remainder of the extract in a tared vessel. There must be <0.5 mg residue registered or the batch of resin will have to be extracted with fresh methylene chloride again until it meets this criterion. This level corresponds to 25 ug/g in the XAD-2, or about 3.25 mg in a resin charge of 130 g.

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TOTAL CHROMATOGRAPHABLE ORGANIC MATERIAL ANALYSIS

1.0 SCOPE AND APPLICATION

1.1 In this procedure, gas chromatography is used to determine the quantity of lower boiling hydrocarbons (boiling points between 90° and 300°C) in the concentrates of all organic solvent rinses, XAD-2 resin and LC fractions - when Method 1 is used (see References, Method 0010) - encountered in Level 1 environmental sample analyses. Data obtained using this procedure serve a twofold purpose. First, the total quantity of the lower boiling hydrocarbons in the sample is determined. Then whenever the hydrocarbon concentrations in the original concentrates exceed 75 ug/m³, the chromatography results are reexamined to determine the amounts of individual species.

The extent of compound identification is limited to representing all materials as normal alkanes based upon comparison of boiling points. Thus the method is not qualitative. In a similar manner, the analysis is semiquantitative; calibrations are prepared using only one hydrocarbon. They are replicated but samples routinely are not.

1.2 Application: This procedure applies solely to the Level 1 C7-C16 gas chromatographic analysis of concentrates of organic extracts, neat liquids, and of LC fractions. Throughout the procedure, it is assumed the analyst has been given a properly prepared sample.

1.3 Sensitivity: The sensitivity of this procedure, defined as the slope of a plot of response versus concentration, is dependent on the instrument and must be verified regularly. TRW experience indicates the nominal range is of the order of 77 uV·V·sec·uL/ng of n-heptane and 79 uV·sec·uL/ng of n-hexadecane. The instrument is capable of perhaps one hundredfold greater sensitivity. The level specified here is sufficient for Level 1 analysis.

1.4 Detection limit: The detection limit of this procedure as written is 1.3 ng/uL for a 1 uL injection of n-decane. This limit is arbitrarily based on defining the minimum detectable response as 100 uv·sec. This is an easier operational definition than defining the minimum detection limit to be that amount of material which yields a signal twice the noise level.

1.5 Range: The range of the procedure will be concentrations of 1.3 ng/uL and greater.

1.6 Limitations

1.6.1 Reporting limitations: It should be noted that a typical environmental sample will contain compounds which: (a) will not elute in the specified boiling ranges and thus will not be reported, and/or (b)

will not elute from the column at all and thus will not be reported. Consequently, the organic content of the sample as reported is a lower bound and should be regarded as such.

1.6.2 Calibration limitations: Quantitation is based on calibration with n-decane. Data should therefore be reported as, e.g., mg C₈/m³ as n-decane. Since response varies linearly with carbon number (over a wide range the assumption may involve a 20% error), it is clear that heptane (C₇) detected in a sample and quantitated as decane will be overestimated. Likewise, hexadecane (C₁₆) quantitated as decane will be underestimated. From previous data, it is estimated the error involved is on the order of 6-7%.

1.6.3 Detection limitations: The sensitivity of the flame ionization detector varies from compound to compound. However, n-alkanes have a greater response than other classes. Consequently, using an n-alkane as a calibrant and assuming equal responses of all other compounds tends to give low reported values.

2.0 SUMMARY OF METHOD

2.1 A μ L aliquot of all 10-mL concentrates is disbursed for GC-TCO analysis. With boiling point-retention time and response-amount calibration curves, the data (peak retention times and peak areas) are interpreted by first summing peak areas in the ranges obtained from the boiling point-retention time calibration. Then, with the response-amount calibration curve, the area sums are converted to amounts of material in the reported boiling point ranges.

2.2 After the instrument is set up, the boiling point-retention time calibration is effected by injecting a mixture of n-C₇ through n-C₁₆ hydrocarbons and operating the standard temperature program. Response-quantity calibrations are accomplished by injecting n-decane in n-pentane standards and performing the standard temperature program.

2.3 Definitions

2.3.1 GC: Gas chromatography or gas chromatograph.

2.3.2 C₇-C₁₆ n-alkanes: Heptane through hexadecane.

2.3.3 SCA temperature program: 4 min isothermal at 60°C, 10°C/min from 60° to 220°C.

2.3.4 TRV temperature program: 5 min isothermal at room temperature, then program from 30°C to 250°C at 15°C/min.

3.0 INTERFERENCES

Not applicable.

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4.0 APPARATUS AND MATERIALS

4.1 Gas chromatograph: This procedure is intended for use on a Varian 1360 gas chromatograph, equipped with dual flame ionization detectors and a linear temperature programmer. Any equivalent instrument can be used provided that electrometer settings, etc., be changed appropriately.

4.2 Gases:

4.2.1 Helium: Minimum quality is reactor grade. A 4A or 13X molecular sieve drying tube is required. A filter must be placed between the trap and the instrument. The trap should be recharged after every third tank of helium.

4.2.2 Air: Zero grade is satisfactory.

4.2.3 Hydrogen: Zero grade.

4.3 Syringe: Syringes are Hamilton 701N, 10 uL, or equivalent.

4.4 Septa: Septa will be of such quality as to produce very low bleed during the temperature program. An appropriate septum is Supelco Microsep 133, which is Teflon-backed. If septum bleed cannot be reduced to a negligible level, it will be necessary to install septum swingers on the instrument.

4.5 Recorder: The recorder of this procedure must be capable of not less than 1 mV full-scale display, a 1-sec time constant and 0.5 in. per min chart rate.

4.6 Integrator: An integrator is required. Peak area measurement by hand is satisfactory but too time-consuming. If manual integration is required, the method of "height times width at half height" is used.

4.7 Columns:

4.7.1 Preferred column: 6 ft x 1/8 in. O.D. stainless steel column of 10% OV-101 on 100/120 mesh Supelcoport.

4.7.2 Alternate column: 6 ft x 1/8 in. O.D. stainless steel column of 10% OV-1 (or other silicon phase) on 100/120 mesh Supelcoport.

4.8 Syringe cleaner: Hamilton syringe cleaner or equivalent connected to a suitable vacuum source.

5.0 REAGENTS

5.1 Pentane: "Distilled-in-Glass" (reg. trademark) or "Nanograde" (reg. trademark) for standards and for syringe cleaning.

5.2 Methylene chloride: "Distilled-in-Glass" (reg. trademark) or "Anagrade" (reg. trademark) for syringe cleaning.

6.0 SAMPLING HANDLING AND PRESERVATION

6.1 The extracts are concentrated in a Kuderna-Danish evaporator to a volume less than 10 mL. The concentrate is then quantitatively transferred to a 10-mL volumetric flask and diluted to volume. A 1-mL aliquot is taken for both this analysis and possible subsequent GC/MS analysis and set aside in the sample bank. For each GC-TCO analysis, obtain the sample sufficiently in advance to allow it to warm to room temperature. For example, after one analysis is started, return that sample to the sample bank and take the next sample.

7.0 PROCEDURES

7.1 Setup and checkout: Each day, the operator will verify the following:

7.1.1 That supplies of carrier gas, air and hydrogen are sufficient, i.e., that each tank contains > 100 psig.

7.1.2 That, after replacement of any gas cylinder, all connections leading to the chromatograph have been leak-checked.

7.1.3 That the carrier gas flow rate is 30 ± 2 mL/min, the hydrogen flow rate is 30 ± 2 mL/min, and the air flow rate is 300 ± 20 mL/min.

7.1.4 That the electrometer is functioning properly.

7.1.5 That the recorder and integrator are functioning properly.

7.1.6 That the septa have been leak-checked (leak-checking is effected by placing the soap bubble flow meter inlet tube over the injection port adaptors), and that no septum will be used for more than 20 injections.

7.1.7 That the list of samples to be run is ready.

7.2 Retention time calibration:

7.2.1 To obtain the temperature ranges for reporting the results of the analyses, the chromatograph is given a normal boiling point-retention time calibration. The n-alkanes, their boiling points, and data reporting ranges are given in the table below:

	<u>ISP, °C</u>	<u>Reporting Range, °C</u>	<u>Report As</u>
n-heptane	98	90-110	C7
n-octane	126	110-140	C8
n-nonane	151	140-160	C9
n-decane	174	150-180	C10
n-undecane	194	180-200	C11
n-dodecane	214	200-220	C12
n-tridecane	234	220-240	C13
n-tetradecane	252	240-260	C14
n-pentadecane	270	260-280	C15
n-hexadecane	298	280-300	C16

7.2.2 Preparation of standards: Preparing a mixture of the C7-C16 alkanes is required. There are two approaches: (1) use of a standards kit (e.g., Polyscience Kit) containing bottles of mixtures of selected n-alkanes which may be combined to produce a C7-C16 standard; or (2) use of bottles of the individual C7-C16 alkanes from which accurately known volumes may be taken and combined to give a C7-C16 mixture.

7.2.3 Procedure for retention time calibration: This calibration is performed at the start of an analytical program; the mixture is chromatographed at the start of each day. To attain the required retention time precision, both the carrier gas flow rate and the temperature program specifications must be observed. Details of the procedure depend on the instrument being used. The general procedure is as follows:

7.2.3.1 Set the programmer upper limit at 250°C. If this setting does not produce a column temperature of 250°C, find the correct setting.

7.2.3.2 Set the programmer lower limit at 30°C.

7.2.3.3 Verify that the instrument and samples are at room temperature.

7.2.3.4 Inject 1 µL of the n-alkane mixture.

7.2.3.5 Start the integrator and recorder.

7.2.3.6 Allow the instrument to run isothermally at room temperature for five min.

7.2.3.7 Shut the oven door.

7.2.3.8 Change the mode to Automatic and start the temperature program.

7.2.3.9 Repeat Steps 1-9 a sufficient number of times so that the relative standard deviation of the retention times for each peak is <5%.

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7.3 Response calibration:

7.3.1 For the purposes of a Level 1 analysis, response-quantity calibration with n-decane is adequate. A 10- μ L volume of n-decane is injected into a tared 10 mL volumetric flask. The weight injected is obtained and the flask is diluted to the mark with n-pentane. This standard contains about 730 ng n-decane per μ L n-pentane. The exact concentration depends on temperature, so that a weight is required. Two serial tenfold dilutions are made from this standard, giving standards at about 730, 73, and 7.3 ng n-decane per μ L n-pentane, respectively.

7.3.2 Procedure for response calibration: This calibration is performed at the start of an analytical program and monthly thereafter. The most concentrated standard is injected once each day. Any change in calibration necessitates a full calibration with new standards. Standards are stored in the refrigerator locker and are made up monthly.

7.3.2.1 Verify that the instrument is set up properly.

7.3.2.2 Set electrometer at 1×10^{-10} A/mV.

7.3.2.3 Inject 1 μ L of the highest concentration standard.

7.3.2.4 Run standard temperature program as specified above.

7.3.2.5 Clean syringe.

7.3.2.6 Make repeated injections of all three standards until the relative standard deviations of the areas of each standard are 5%.

7.4 Sample analysis procedure:

7.4.1 The following apparatus is required:

7.4.1.1 Gas chromatograph set up and working.

7.4.1.2 Recorder, integrator working.

7.4.1.3 Syringe and syringe cleaning apparatus.

7.4.1.4 Parameters: Electrometer setting is 1×10^{-10} A/mV; recorder is set at 0.5 in./min and 1 mV full-scale.

7.4.2 Steps in the procedure are:

7.4.2.1 Label chromatogram with the data, sample number, etc.

7.4.2.2 Inject sample.

7.4.2.3 Start integrator and recorder.

7.4.2.4 After isothermal operation for 5 min, begin temperature program.

7.4.2.5 Clean syringe.

7.4.2.6 Return sample; obtain new sample.

7.4.2.7 When analysis is finished, allow instrument to cool. Turn chromatogram and integrator output and data sheet over to data analyst.

7.5 Syringe cleaning procedure:

7.5.1 Remove plunger from syringe.

7.5.2 Insert syringe into cleaner; turn on aspirator.

7.5.3 Fill pipet with pentane; run pentane through syringe.

7.5.4 Repeat with methylene chloride from a separate pipet.

7.5.5 Flush plunger with pentane followed by methylene chloride.

7.5.6 Repeat with methylene chloride.

7.6 Sample analysis decision criterion: The data from the TCO analyses of organic extract and rinse concentrates are first used to calculate the total concentration of C7-C16 hydrocarbon-equivalents (Paragraph 7.7.3) in the sample with respect to the volume of air actually sampled, i.e., $\mu\text{g}/\text{m}^3$. On this basis, a decision is made both on whether to calculate the quantity of each n-alkane equivalent present and on which analytical procedural pathway will be followed. If the total organic content is great enough to warrant continuing the analysis -- $>500 \mu\text{g}/\text{m}^3$ -- a TCO of less than $75 \mu\text{g}/\text{m}^3$ will require only LC fractionation and gravimetric determinations and IR spectra to be obtained on each fraction. If the TCO is greater than $75 \mu\text{g}/\text{m}^3$, then the first seven LC fractions of each sample will be reanalyzed using this same gas chromatographic technique.

7.7 Calculations:

7.7.1 Boiling Point - Retention Time Calibration: The required data for this calibration are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.1.1 Average the retention times and calculate relative standard deviations for each n-hydrocarbon.

7.7.1.2 Plot average retention times as abscissae versus normal boiling points as ordinates.

7.7.1.3 Draw in calibration curve.

7.7.1.4 Locate and record retention times corresponding to boiling ranges 90-100, 110-140, 140-160, 160-180, 180-200, 200-220, 220-240, 240-260, 260-280, 280-300°C.

7.7.2 Response-amount calibration: The required data for this calibration are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.2.1 Average the area responses of each standard and calculate relative standard deviations.

7.7.2.2 Plot response (uV-sec) as ordinate versus ng/uL as abscissa.

7.7.2.3 Draw in the curve. Perform least squares regression and obtain slope (uV-sec·uL/ng).

7.7.3 Total C7-C16 hydrocarbons analysis: The required data for this calculation are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.3.1 Sum the areas of all peaks within the retention time range of interest.

7.7.3.2 Convert this area (uV-sec) to ng/uL by dividing by the weight response for n-decane (uV-sec·uL/ng).

7.7.3.3 Multiply this weight by the total concentrate volume (10 mL) to get the weight of the C7-C16 hydrocarbons in the sample.

7.7.3.4 Using the volume of gas sampled or the total weight of sample acquired, convert the result of Step 7.7.3.3 above to $\mu\text{g}/\text{m}^3$.

7.7.3.5 If the value of total C7-C16 hydrocarbons from Step 7.7.3.4 above exceeds $75 \mu\text{g}/\text{m}^3$, calculate individual hydrocarbon concentrations in accordance with the instructions in Paragraph 7.7.5.5 below.

7.7.4 Individual C7-C16 n-Alkane Equivalent Analysis: The required data from the analyses are on the chromatogram and on the data sheet. The data reduction is performed as follows:

7.7.4.1 Sum the areas of peaks in the proper retention time ranges.

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7.7.4.2 Convert areas ($\mu\text{V}\cdot\text{sec}$) to $\text{ng}/\mu\text{L}$ by dividing by the proper weight response ($\mu\text{V}\cdot\text{sec}\cdot\mu\text{L}/\text{ng}$).

7.7.4.3 Multiply each weight by total concentrate volume (10 μL) to get weight of species in each range of the sample.

7.7.4.4 Using the volume of gas sampled on the total weight of sample acquired, convert the result of Step 7.7.4.3 above to $\mu\text{g}/\text{m}^3$.

8.0 QUALITY CONTROL

8.1 Appropriate QC is found in the pertinent procedures throughout the method.

9.0 METHOD PERFORMANCE

9.1 Even relatively comprehensive error propagation analysis is beyond the scope of this procedure. With reasonable care, peak area reproducibility of a standard should be of the order of 1% RSD. The relative standard deviation of the sum of all peaks in a fairly complex waste might be of the order of 5-10%. Accuracy is more difficult to assess. With good analytical technique, accuracy and precision should be of the order of 10-20%.

10.0 REFERENCES

1. Emissions Assessment of Conventional Stationary Combustion Systems: Methods and Procedure Manual for Sampling and Analysis, Interagency Energy/Environmental R&D Program, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711, EPA-600/7-79-C29a, January 1979.

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July 1980
Revision: Final

EPA METHOD 5
DETERMINATION OF PARTICULATE EMISSIONS
FROM STATIONARY SOURCES

1311R2

METHOD 5—DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1. Principle and Applicability

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120±14° C (248±25° F) or such other temperature as specified by an applicable subpart of the standards or approved by Administrator, U.S. Environmental Protection Agency, for a particular application. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources.

2. Apparatus

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTD-0581 (Citation 2 in Bibliography); commercial models of this train are also available. For changes from APTD-0581 and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576 (Citation 3 in Bibliography). Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The sampling train consists of the following components:

2.1.1 Probe Nozzle. Stainless steel (316) or glass with sharp, tapered leading edge. The angle of taper shall be 30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tubing; other materials of construction may be used, subject to the approval of the Administrator.

A range of nozzle sizes suitable for isokinetic sampling should be available, e.g., 0.32 to 1.27 cm (1/8 to 1/2 in.)—or larger if higher volume sampling trains are used—inside diameter (ID) nozzles in increments of 0.18 cm (3/16 in.). Each nozzle shall be calibrated according to the procedures outlined in Section 5.

2.1.2 Probe Liner. Borosilicate or quartz glass tubing with a heating system capable of maintaining a gas temperature at the exit end during sampling of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. (The tester may opt to operate the equipment at a temperature lower than that specified.) Since the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable.

Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480° C (900° F). Quartz liners shall be used for temperatures between 430 and 900° C (800 and 1,650° F). Both types of liners may be used at higher temperatures than specified for short periods of time, subject to the approval of the Administrator. The softening temperature for borosilicate is 820° C (1,508° F), and for quartz it is 1,500° C (2,732° F).

Whenever practical, every effort should be made to use borosilicate or quartz glass probe liners. Alternatively, metal liners (e.g., 316 stainless steel, Incoloy 825,¹ or other corrosion resistant metals) made of seamless tubing may be used, subject to the approval of the Administrator.

2.1.3 Pitot Tube. Type S, as described in Section 2.1 of Method 2, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1) to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of Method 2.

¹Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

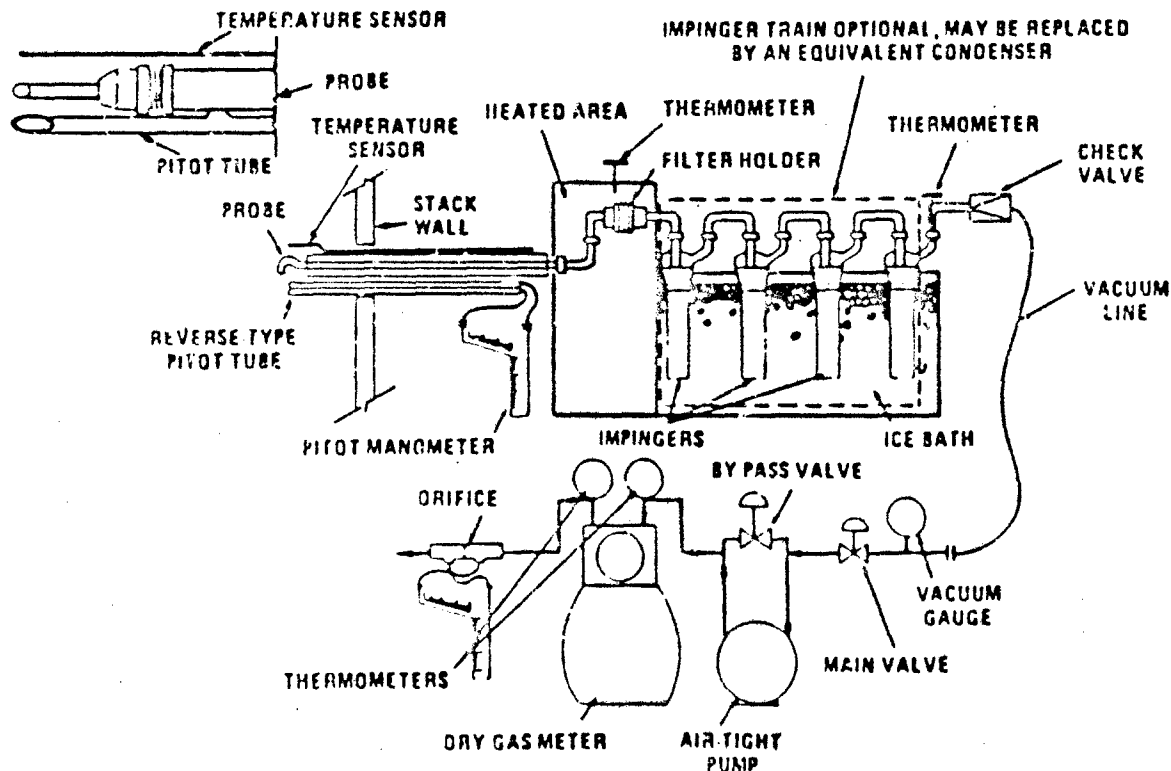


Figure 5-1. Particulate sampling train.

2.1.4 **Differential Pressure Gauge.** Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used for velocity (2a) readings, and the other, for orifice differential pressure readings.

2.1.5 **Filter Holder.** Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

2.1.6 **Filter Heating System.** Any heating system capable of maintaining a temperature around the filter holder during sampling of $120 \pm 14^\circ \text{C}$ ($248 \pm 25^\circ \text{F}$), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

2.1.7 **Condenser.** The following system shall be used to determine the stack gas moisture content: Four impingers connected in series with leak-free ground glass fittings or any similar leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with 0.3 cm ($1/4 \text{ in.}$) ID glass tube extending to about 1.3 cm ($1/2 \text{ in.}$) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard lip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator. The first and second impingers shall contain known quantities of water (Section 4.1.3), the third shall be empty, and the fourth shall contain a known weight of silica gel, or equivalent desiccant. A thermometer, capable of measuring temperature to within 1°C (2°F) shall be placed at the outlet of the fourth impinger for monitoring purposes.

Alternatively, any system that cools the sample gas stream and allows measurement of the water condensed and moisture leaving the condenser, each to within 1 ml or 1 g may be used, subject to the approval of the Administrator. Acceptable means are to measure the condensed water either gravimetrically or volumetrically and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures; or (2) passing the sample gas stream through a tared silica gel or equivalent desiccant trap with exit lines kept below 20°C (68°F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

NOTE: If a determination of the particulate matter collected in the impingers is desired in addition to moisture content, the impinger system described above shall be used, without modification. Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impinger contents.

2.1.8 **Metering System.** Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (5.4°F), dry gas meter capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that described in APTD-0581 or APDT-0378 may be used provided that the specifications of this method are met.

2.1.9 **Barometer.** Mercury aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.10 **Gas Density Determination Equipment.** Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-7). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

2.2 **Sample Recovery.** The following items are needed.

2.2.1 **Probe-Liner and Probe-Nozzle Brushes.** Nylon bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) of stainless steel, Nylon, Teflon, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

2.2.2 **Wash Bottles—Two.** Glass wash bottles are recommended; polyethylene wash bottles may be used at the option of the tester. It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 **Glass Sample Storage Containers.** Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1000 ml . Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemical attack by acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 **Petri Dishes.** For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 **Graduated Cylinder and/or Balance.** To measure condensed water to within 1 ml or 1 g . Graduated cylinders shall have subdivisions no greater than 2 ml . Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable for use here and in Section 2.3.4.

2.2.6 **Plastic Storage Containers.** Airtight containers to store silica gel.

2.2.7 **Funnel and Rubber Policeman.** To aid in transfer of silica gel to container; not

2.2.8 **Funnel.** Glass or polyethylene, to aid in sample recovery.

2.3 **Analysis.** For analysis, the following equipment is needed.

2.3.1 **Glass Weighing Dishes.**

2.3.2 **Desiccator.**

2.3.3 **Analytical Balance.** To measure to within 0.1 mg .

2.3.4 **Balance.** To measure to within 0.5 g .

2.3.5 **Beakers.** 250 ml .

2.3.6 **Hygrometer.** To measure the relative humidity of the laboratory environment.

2.3.7 **Temperature Gauge.** To measure the temperature of the laboratory environment.

3. Reagents

3.1 **Sampling.** The reagents used in sampling are as follows:

3.1.1 **Filters.** Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (<0.05 percent penetration) on 0.3-micron diethyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D2986-71 (Reapproved 1978) (Incorporated by reference—see § 60.17). Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO_2 or SO_3 , the filter material must be of a type that is unreactive to SO_2 or SO_3 . Citation 16 in Section 7 Bibliography, may be used to select the appropriate filter.

3.1.2 **Silica Gel.** Indicating type, # 16 mesh, if previously used, dry at 175°C (350°F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 **Water.** When analysis of the material caught in the impingers is required, distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

3.1.4 **Crushed Ice.**

3.1.5 **Stopcock Grease.** Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 4.3 of this method, or shall void the sampling run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.2 Post-test Leak-Check. A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done in accordance with the procedure outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered.

If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 4.3 of this method, or shall void the sampling run.

4.1.5 Particulate Train Operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120 ± 16° C (248 ± 25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator.

For each run, record the data required on a data sheet such as the one shown in Figure 5-2. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted.

Take other readings required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85 ± 0.02, and the stack gas equivalent density (dry molecular weight) is equal to 20 ± 4. APTD-0876 details the procedure for using the nomographs. If C_v and M_v are outside the above stated ranges do not use the nomographs unless appropriate steps (see Citation 7 in Bibliography) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross-section, as required by Method 1 or as specified by the Administrator, being careful not to bury the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes; this minimizes the chance of extracting deposited material.

During the test run, make periodic adjustments to keep the temperature around the filter holder at the proper level; add more ice and, if necessary, salt to maintain a temperature of less than 20° C (68° F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes too high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. Before a new filter assembly is installed, conduct a leak-check (see Section 4.1.4.2). The total particulate weight shall include the summation of all filter assembly catches.

A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

FIGURE 5-2—PARTICULATE FIELD DATA

Plant	.....	Ambient temperature	.....
Location	.....	Barometric pressure	.....
Company	.....	Absolute pressure	.....
Date	.....	Assumed pressure, %	.....
Run No.	.....	Probe length, m (ft.)	.....
Sample size No.	.....	Nozzle identification No.	.....
Motor size No.	.....	Average corrected nozzle diameter, cm (in.)	.....
Motor 1/110	.....	Probe heater setting	.....
C factor	.....	Leak rate, m ³ /min (cfm)	.....
Plant name containing Co.	.....	Probe flow (actual)	.....
		Stack pressure, mm Hg (in. Hg)	.....
		Filter No.	.....

SCHEMATIC OF STACK CROSS SECTION

Traverse point number	Sampling time (M. min.)	Vacuum (mm Hg (in. Hg))	Stack temperature (T _d °C (°F))	Velocity head (Δ P _v , mm (in.) H ₂ O)	Pressure differential across orifice meter (mm H ₂ O (in. H ₂ O))	Gas velocity (m ³ (ft ³))	Gas sample temperature at dry gas meter		Filter holder temperature (°C (°F))	Temperature of gas leaving condenser or wet impinger (°C (°F))
							Wet (°C (°F))	Outlet (°C (°F))		
Total							Avg.	Avg.		
Average							Avg.			

3.2 Sample Recovery. Acetone-reagent grade, 99.991 percent residue, in glass bottles is required. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers; thus, acetone blanks shall be run prior to field use and only acetone with low blank values (<0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analytes. Two reagents are required for the analytes:

3.3.1 Acetone. Same as 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. Procedure

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. It is suggested that sampling equipment be maintained according to the procedures described in APTD-0578.

Weigh several 200 to 300 g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in the impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper diameter on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at $23 \pm 5^\circ \text{C}$ ($68 \pm 10^\circ \text{F}$) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., 0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 108°C (230°F) for 3 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2. It is recommended that a leak-check of the pilot lines (see Method 2, Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack

gas dry molecular weight, as described in Method 2, Section 3.6; if Integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 min (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors. The sampling time at each point shall be the same.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzle using a Viton A O-ring when stack temperatures are less than 260°C (500°F) and an asbestos string gasket when temperatures are higher. See APTD-0578 for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0578) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 μg or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum.

Note: A lower vacuum may be used, provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm Hg (15 in. Hg) vacuum (see Note immediately above). Then connect the probe to the train and leak-check at about 25 mm Hg (1 in. Hg) vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm Hg (15 in. Hg) vacuum. Leakage rates in excess of 4 percent of the average sampling rate or $0.00057 \text{ m}^3/\text{min}$ (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0578 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve, completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Do not reverse direction of bypass valve; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check as shown below and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica gel from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes necessary, a leak-check shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than $0.00067 \text{ m}^3/\text{min}$ (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered.

Note that when two or more trains are used, separate analyses of the front-half and (if applicable) impinger catches from each train shall be performed, unless identical nozzle sizes were used on all trains. In which case, the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of front-half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2, Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry Nylon

bristle crush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank and follow the Administrator's directions on analysis. Perform the acetone rinses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a Nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid on transferring liquid wastes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe; hold a sample container underneath the lower end of the probe, and catch any acetone and particulate matter which is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Rinse the brush with acetone, and quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a Nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether or not leakage occurred during transport. Label the container to clearly identify its contents.

Container No. 3. Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger; it is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows: Make a notation of any color or film in the liquid catch. Measure the liquid which is in the first three impingers to within ± 1 ml by using a graduated cylinder or by weighing it to within ± 0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Note, Section 2.1.7).

If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet such as the one shown in Figure 3-3. Handle each sample container as follows:

FIGURE 3-3—ANALYTICAL DATA

Plant _____
 Date _____
 Run No. _____
 Filter No. _____
 Amount liquid lost during transport _____
 Acetone blank volume, ml _____
 Acetone wash volume, ml _____
 Acetone blank concentration, mg/mg (equation 3-4) _____
 Acetone wash blank, μ g (equation 3-3) _____

Container number	Weight of particulate collected, mg		
	Pre-rinse	Tare weight	Weight gain
1			
2			
Total _____			
Loss acetone blank _____			
Weight of particulate matter _____			

	Volume of Liquid water collected	
	Impinger volume, ml	Silica gel weight, g
Pre-rinse _____		
Wash _____		
Liquid collected _____		
Total volume collected _____		g

*Convert weight of water to volume by dividing total weight increase by density of water (1 g/ml).

$$\frac{\text{Increase, g}}{(1 \text{ g/ml})} = \text{Volume water, ml}$$

Container No. 1. Leave the contents in the shipping container or transfer the liter and any loose particulate from the sample container to a tared glass weighing can. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 3 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at 105° C (220° F) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at 105° C (220° F) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

NOTE: At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

4.4 Quality Control Procedures. The following quality control procedures are suggested to check the volume metering system calibration values at the field test site prior to sample collection. These procedures are optional for the tester.

4.4.1 Meter Orifice Check. Using the calibration data obtained during the calibration procedure described in Section 3.3, determine the ΔH_0 for the metering system orifice. The ΔH_0 is the orifice pressure differential in units of in. H₂O that correlates to 0.75 cfm of air at 32°R and 29.92 in. Hg. The ΔH_0 is calculated as follows:

$$\Delta H_0 = 0.0219 \frac{T_a}{P_a} \frac{\Theta^3}{YV^3}$$

Eq. 3-9

Where:

ΔH - Average pressure differential across the orifice meter, in. H₂O.

T_a - Absolute average dry gas meter temperature, °R.

P_a - Barometric pressure, in. Hg.

Θ - Total sampling time, min.

Y - Dry gas meter calibration factor, dimensionless.

V_a - Volume of gas sample as measured by dry gas meter, ccf.

0.0319 = (0.0567 in. Hg/°R) x (0.75 cfm)³

Before beginning the field test (a set of three runs usually constitutes a field test), operate the metering system (i.e., pump, volume meter, and orifice) at the ΔH_0 pressure differential for 10 minutes. Record the volume collected, the dry gas meter temperature, and the barometric pressure. Calculate a dry gas meter calibration check value, Y_c , as follows:

$$Y_c = \frac{10}{V_c} \left[\frac{0.0319 T_a}{P_a} \right] \Theta$$

Eq. 3-10

Where:

Y_c - Dry gas meter calibration check value, dimensionless.

10 - 10 minutes of run time.

Compare the Y_c value with the dry gas meter calibration factor Y to determine that:

0.97Y < Y_c < 1.03Y

If the Y_c value is not within this range, the volume metering system should be investigated before beginning the test.

4.4.2 Calibration Critical Orifice. A

calibrated critical orifice, calibrated against a wet test meter or spirometer and designed to be inserted at the inlet of the sampling meter box, may be used as a quality control check by following the procedure of Section 7.2.

5. Calibration

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of Method 2.

5.3 Metering System. Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0378. Instead of physically adjusting the dry gas meter dial readings to correspond to the wet test meter readings, calibration factors may be used to mathematically correct the gas meter dial readings to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases

the following leak-check procedure is suggested: make a 10-minute calibration run at 0.0057 m³/min (0.02 cfm); at the end of the run, take the difference of the measure wet test meter and dry gas meter volume, divide the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). With the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0378.

Alternative procedures, e.g., using the orifice meter coefficients, may be used, subject to the approval of the Administrator.

NOTE: If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.3.1 Calibration Prior to Use. Before its initial use in the field, the metering system shall be calibrated as follows: Connect the metering system inlet to the outlet of a wet test meter that is accurate to within 1 percent. Refer to Figure 5.5. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev). A spirometer of 400 liters (14 ft³) or more capacity, or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should be periodically calibrated with a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained. Run the metering system pump for about 15 minutes with the orifice manometer indicating a median reading as expected in field use to allow the pump to warm up and to permit the interior surface of the wet test meter to be thoroughly wetted. Then, at each of a minimum of three orifice manometer settings, pass an exact quantity of gas through the wet test meter and note the gas volume indicated by the dry gas meter. Also note the barometric pressure, and the temperatures of the wet test meter, the inlet of the dry gas meter, and the outlet of the dry gas meter. Select the highest and lowest orifice settings to bracket the expected field operating range of the orifice. Use a minimum volume of 0.15 m³ (5 cf) at all orifice settings. Record all the data on a form similar to Figure 5.6, and calculate Y_c , the dry gas meter calibration factor, and ΔH_0 , the orifice calibration factor, at each orifice setting as shown on Figure 5.6. Allowable tolerances for individual Y_c and ΔH_0 values are given in Figure 5.6. Use the average of the Y_c values in the calculations in Section 6.

Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057 m³/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divided the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

3.3.2 Calibration After Use. After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, inset a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the dry gas meter calibration factor. If the value has changed by more than 5 percent,

recalibrate the meter over the full range of orifice settings, as previously detailed.

Alternative procedures, e.g., rechecking the orifice meter coefficient may be used, subject to the approval of the Administrator.

3.3.3 Acceptable Variation in Calibration. If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field.

Use a heat source to generate air heated to selected temperatures that approximate those expected to occur in the sources to be sampled. Pass this air through the probe at a typical sample flow rate while measuring the probe inlet and outlet temperatures at various probe heater settings. For each air temperature generated, construct a graph of probe heating system setting versus probe outlet temperature. The procedure outlined in APTD-0578 can also be used. Probes constructed according to APTD-0381 need not be calibrated if the calibration curves in APTD-0578 are used. Also, probes with outlet temperature monitoring capabilities do not require calibration.

5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The follow-

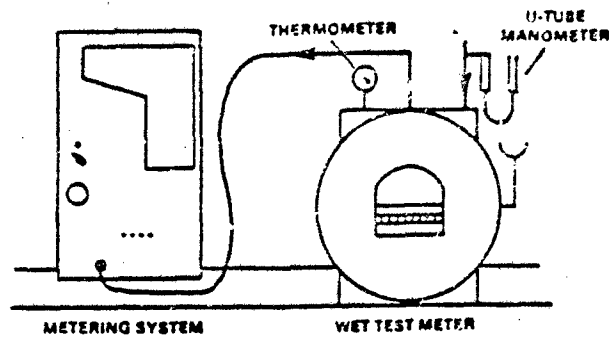


Figure 5.5 Equipment arrangement for metering system calibration.

Date _____ Metering System Identification: _____
 Barometric pressure, P_b _____ in. Hg

Orifice manometer setting in. H ₂ O	Spirometer (wet meter) gas volume (V _w) ft ³	Dry gas meter volume (V _d) ft ³	Temperatures			Time (t) min
			Spirometer (wet meter) (t _w) °F	Inlet (t _i) °F	Outlet (t _o) °F		Average (t_{a}) °F

Calculations

in. H ₂ O	Y	ΔHg
		$\frac{V_w P_b (t_w + 460)}{V_d (P_b + 13.6) (t_w + 460)}$
Average		

Y = Ratio of reading of wet test meter to dry test meter; tolerance for individual values ±0.02 from average.

ΔHg = Orifice pressure differential that equates to 0.75 cfm of air @ 68°F and 29.92 inches of mercury, in. H₂O; tolerance for individual values ±0.20 from average.

Figure 5.6. Example data sheet for calibration of metering system (English units).

ing procedure is suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.7 Barometer. Calibrate against a mercury barometer.

6. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

6.1 Nomenclature

- A_n = Cross-sectional area of nozzle, m^2 (ft^2).
- B_m = Water vapor in the gas stream, proportion, by volume.
- C_m = Acetone blank residue concentration, mg/l .
- c_m = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, $g/dscm$ ($g/dscf$).
- I = Percent of isokinetic sampling.
- L_m = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to $0.0037 m^3/min$ ($0.02 cfm$) or 4 percent of the average sampling rate, whichever is less.
- L_n = Individual leakage rate observed during the leak check conducted prior to the " n " component change ($n=1, 2, 3, \dots$), m^3/min (cfm).
- L_p = Leakage rate observed during the post-test leak check, m^3/min (cfm).
- m_p = Total amount of particulate matter collected, mg .
- M_w = Molecular weight of water, $18.0 g/g\text{-mole}$ ($18.0 lb/lb\text{-mole}$).
- m_r = Mass of residue of acetone after evaporation, mg .
- P_m = Barometric pressure at the sampling site, $mm\ Hg$ ($in.\ Hg$).

- P_s = Absolute stack gas pressure, $mm\ Hg$ (Hg).
- P_{std} = Standard absolute pressure, $760\ mm\ Hg$ ($29.92\ in.\ Hg$).
- R = Ideal gas constant, $0.06236\ mm\ Hg\text{-}K\text{-}g\text{-}mole$ ($21.85\ in.\ Hg\text{-}ft^3\text{-}R\text{-}lb\text{-}mole$).
- T_m = Absolute average dry gas meter temperature (see Figure 5-2), $^{\circ}K$ ($^{\circ}R$).
- T_s = Absolute average stack gas temperature (see Figure 5-2), $^{\circ}K$ ($^{\circ}R$).
- T_{std} = Standard absolute temperature, 293° ($528^{\circ}\ R$).
- V_m = Volume of acetone blank, ml .
- V_{wa} = Volume of acetone used in wash, ml .
- V_{tot} = Total volume of liquid collected in impingers and silica gel (see Figure 5-3), ml .
- V_{gs} = Volume of gas sample as measured dry gas meter, $dscm$ ($dscf$).
- $V_{gs, std}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, $dscm$ ($dscf$).
- V_{wv} = Volume of water vapor in the gas sample, corrected to standard conditions, $dscm$ ($dscf$).
- v_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).
- W_r = Weight of residue in acetone wash, mg .
- Y = Dry gas meter calibration factor.
- ΔH = Average pressure differential across the orifice meter (see Figure 5-2), $mm\ H_2O$ ($in.\ H_2O$).
- ρ_a = Density of acetone, mg/ml (see label on bottle).

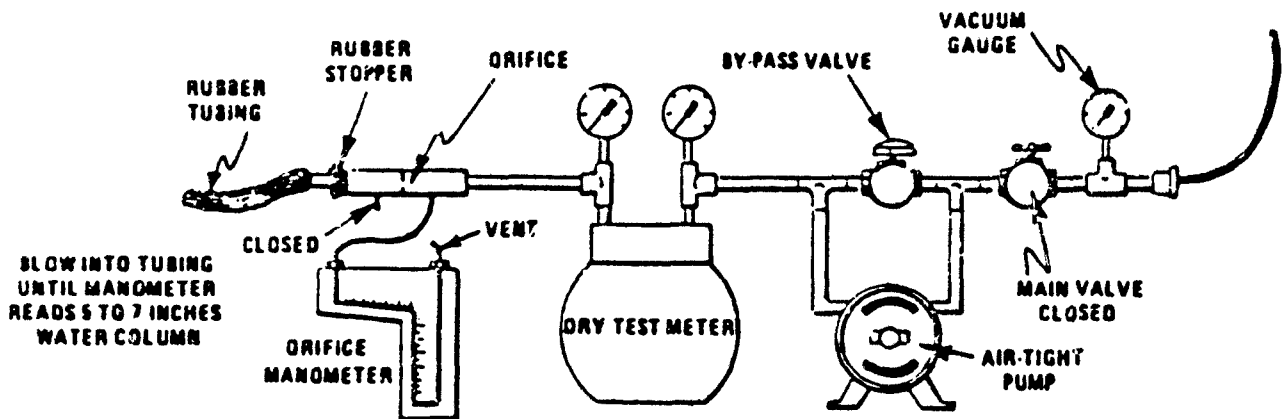


Figure 5-4. Leak check of meter box.

- ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).
- θ = Total sampling time, min.
- θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.
- θ_2 = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.
- θ_n = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.
- 13.6 = Specific gravity of mercury.
- 60 = Sec/min.
- 100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C; 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

$$V_{n, (std)} = V_n Y \left(\frac{T_{std}}{T_n} \right) \left[\frac{P_{std} + \frac{\Delta H}{13.6}}{P_{std}} \right]$$

$$= K_1 V_n Y \frac{P_{std} + (\Delta H/13.6)}{T_n}$$

Equation 5-1

where:

- $K_1 = 0.3358 \text{ } ^\circ\text{K}/\text{mm Hg}$ for metric units
- $= 17.34 \text{ } ^\circ\text{R}/\text{in. Hg}$ for English units

NOTE: Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_n . If L_n or L_n exceeds L_n , Equation 5-1 must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_n in Equation 5-1 with the expression:

$$V_n = (L_n - L_n)\theta$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_n in Equation 5-1 by the expression:

$$V_n = (L_n - L_n)\theta_1$$

$$- \sum_{i=2}^n (L_n - L_n)\theta_i - (L_n - L_n)\theta_n$$

and substitute only for those leakage rates (L_n or L_n) which exceed L_n .

6.4 Volume of water vapor.

$$V_{n, (std)} = V_{n, (std)} \left(\frac{P_{std}}{P_n} \right) \left(\frac{RT_{std}}{P_{std}} \right) = K_2 V_{n, (std)}$$

Equation 5-2

where:

- $K_2 = 0.001333 \text{ m}^3/\text{m}^3$ for metric units
- $= 0.04707 \text{ (l}^3/\text{ml)}$ for English units.

6.5 Moisture Content.

$$B_n = \frac{V_{n, (std)}}{V_{n, (std)} - V_{n, (std)}}$$

Equation 5-3

NOTE: In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of B_n shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 1. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is $\pm 1^\circ\text{C}$ (2°F).

6.6 Acetone Blank Concentration.

Equation 5-4

$$C_n = \frac{m_n}{V_n \rho_n}$$

6.7 Acetone Wash Blank.

$$W_n = C_n V_n \rho_n \quad \text{Equation 5-5}$$

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from containers 1 and 2 less the acetone blank (see Figure 5-3).

NOTE: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$$C_n = (0.001 \text{ g/mg}) (m_n / V_n) \quad \text{Equation 5-6}$$

6.10 Conversion Factors:

From	To	Multiply by
cc	m ³	0.02832
g/m ³	g/m ³	15.43
g/m ³	lb/m ³	2.205 x 10 ⁻³
g/m ³	g/m ³	35.31
g	mg	0.001

6.11 Isokinetic Variation.

6.11.1 Calculation From Raw Data.

$$I = \frac{V_n Y}{100 T_n [K_1 V_{n, (std)} + (1/T_n)(P_{std} - \Delta H/13.6)]}$$

$$609 P_n A_n \quad \text{Equation 5-7}$$

where:

- $K_1 = 0.003454 \text{ mm Hg} \cdot \text{m}^3/\text{ml} \cdot ^\circ\text{K}$ for metric units.
- $= 0.002568 \text{ in. Hg} \cdot (\text{l}^3/\text{ml}) \cdot ^\circ\text{R}$ for English units.

6.11.2 Calculation From Intermediate Values.

$$I = \frac{T_n V_{n, (std)} P_{std} 100}{T_{n, (std)} \theta A_n P_n 60 (1 - B_n)}$$

$$= K_1 \frac{T_n V_{n, (std)}}{P_n V_{n, (std)} (1 - B_n)}$$

Equation 5-8

where:

- $K_1 = 4.320$ for metric units
- $= 0.09450$ for English units.

6.12 Acceptable Results. If 90 percent $< I < 110$ percent, the results are acceptable. If the particulate results are low in comparison to the standard, and I is over 110 percent or less than 90 percent, the Administrator may accept the results. Citation 4 in the bibliography section can be used to make acceptability judgments. If I is judged to be unacceptable, reject the particulate results and repeat the test.

6.13 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in Sections 5.2 and 5.3 of Method 2.

7. Alternative Procedures

7.1 Dry Gas Meter as a Calibration Standard. A dry gas meter may be used as a calibration standard for volume measurements in place of the wet test meter specified in Section 5.3, provided that it is calibrated initially and recalibrated periodically as follows:

7.1.1 Standard Dry Gas Meter Calibration.

7.1.1.1 The dry gas meter to be calibrated and used as a secondary reference meter should be of high quality and have an appropriately sized capacity, e.g., 3 liters/rev (0.1 ft³/rev). A spirometer (400 liters or more capacity), or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev) and capable of measuring volume to within ± 1.0 percent; wet test meters should be checked against a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

7.1.1.2 Set up the components as shown in Figure 5.7. A spirometer, or equivalent, may be used in place of the wet test meter in the system. Run the pump for at least 5 minutes at a flow rate of about 10 liters/min (0.35 cfm) to condition the interior surface of the wet test meter. The pressure drop indicated by the manometer at the inlet side of the dry gas meter should be minimized (no greater than 100 mm H₂O (4 in. H₂O) at a flow rate of 30 liters/min (1 cfm)). This can be accomplished by using large diameter tubing connections and straight pipe fittings.

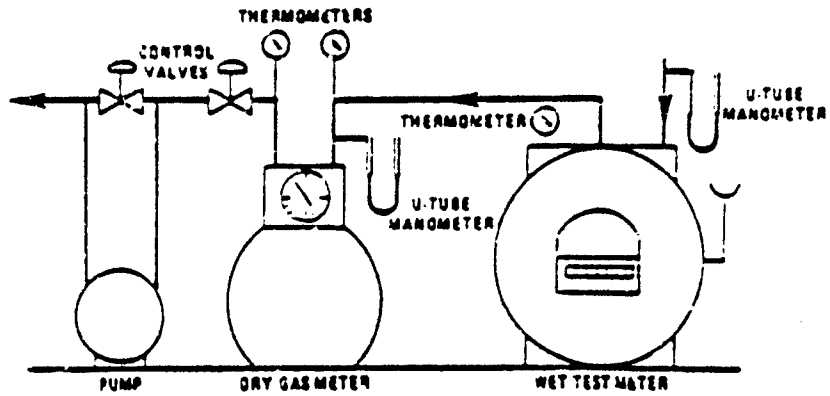


Figure 5.7. Equipment arrangement for dry-gas meter calibration.

7.1.1.3 Collect the data as shown in the example data sheet (see Figure 5-8). Make triplicate runs at each of the flow rates and at no less than five different flow rates. The

range of flow rates should be between 10 and 34 liters/min (0.25 and 1.2 cfm) or over the expected operating range.

DATE: _____
 DRY GAS METER IDENTIFICATION: _____
 BAROMETRIC PRESSURE (P_b): _____ in. Hg

APPROXIMATE FLOW RATE (Q) cfm	SPIROMETER (WET METER) GAS VOLUME (V _w) ft ³	DRY GAS METER VOLUME (V _{dg}) ft ³	TEMPERATURES				DRY GAS METER PRESSURE (ΔP) in. H ₂ O	TIME (t) min.	FLOW RATE (Q) cfm	METER COEFFICIENT (V _{dc})	AVERAGE METER COEFFICIENT (V _{dc})
			SPIROMETER (WET METER) (T _w) °F	DRY GAS METER							
				INLET (T _i) °F	OUTLET (T _o) °F	AVERAGE (T _a) °F					
0.40											
0.60											
0.80											
1.00											
1.20											

$$Q = 17.28 \cdot \frac{V_w}{t} \cdot \frac{P_b}{(P_b + \Delta P)}$$

$$V_{dc} = \frac{V_w}{V_{dg}} \cdot \frac{(T_a + 460)}{(T_i + 460)} \cdot \frac{P_b}{P_b + \Delta P}$$

Figure 5.8. Example data sheet for calibration of a standard dry gas meter for method 5 sampling equipment (English units).

7.1.1.4 Calculate flow rate, Q, for each run using the wet test meter gas volume, V_w , and the run time, θ . Calculate the dry gas meter coefficient, Y_m , for each run. These calculations are as follows:

$$Q = K \frac{P_w V_w}{t_w + t_m \theta}$$

$$Y_m = \frac{V_w}{V_m} \frac{(t_w + t_m)}{(t_w + t_m)} \frac{P_w}{\left(P_w + \frac{\Delta P}{13.6} \right)}$$

Where:

K = 0.3858 for international system of units (SI); 17.64 for English units.

V_w = Wet test meter volume, liters (ft³).

V_m = Dry gas meter volume, liters (ft³).

t_w = Average dry gas meter temperature, °C (°F).

t_m = 273° C for SI units; 460° F for English units.

t_w = Average wet test meter temperature, °C (°F).

P_w = Barometric pressure, mm Hg (in. Hg).

ΔP = Dry gas meter inlet differential pressure, mm H₂O (in. H₂O).

θ = Run time, min.

7.1.1.5 Compare the three Y_m values at each of the flow rates and determine the maximum and minimum values. The difference between the maximum and minimum values at each flow rate should be no greater than 0.030. Extra sets of triplicate runs may be made in order to complete this requirement. In addition, the meter coefficients should be between 0.95 and 1.05. If these specifications cannot be met in three sets of successive triplicate runs, the meter is not suitable as a calibration standard and should not be used as such. If these specifications are met, average the three Y_m values at each flow rate resulting in five average meter coefficients, \bar{Y}_m .

7.1.1.6 Prepare a curve of meter coefficient, \bar{Y}_m , versus flow rate, Q, for the dry gas meter. This curve shall be used as a reference when the meter is used to calibrate other dry gas meters and to determine whether recalibration is required.

7.1.2 Standard Dry Gas Meter Recalibration.

7.1.2.1 Recalibrate the standard dry gas meter against a wet test meter or spirometer annually or after every 200 hours of operation, whichever comes first. This require-

ment is valid provided the standard dry gas meter is kept in a laboratory and, if transported, cared for as any other laboratory instrument. Abuse to the standard meter may cause a change in the calibration and will require more frequent recalibrations.

7.1.2.2 As an alternative to full recalibration, a two-point calibration check may be made. Follow the same procedure and equipment arrangement as for a full recalibration, but run the meter at only two flow rates (suggested rates are 14 and 34 liters/min (0.5 and 1.0 cfm)). Calculate the meter coefficients for these two points, and compare the values with the meter calibration curve. If the two coefficients are within ± 1.5 percent of the calibration curve values at the same flow rates, the meter need not be recalibrated until the next date for a recalibration check.

7.2 Critical Orifices As Calibration Standards. Critical orifices may be used as calibration standards in place of the wet test meter specified in Section 5.3, provided that they are selected, calibrated, and used as follows:

7.2.1 Section of Critical Orifices.

7.2.1.1 The procedure that follows describes the use of hypodermic needles or stainless steel needle tubings which have been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices; i.e., a critical vacuum can be obtained, as described in Section 7.2.2.3. Select five critical orifices that are appropriately sized to cover the range of flow rates between 10 and 34 liters/min or the expected operating range. Two of the critical orifices should bracket the expected operating range.

A minimum of three critical orifices will be needed to calibrate a Method 5 dry gas meter (DGM); the other two critical orifices can serve as spares and provide better selection for bracketing the range of operating flow rates. The needle sizes and tubing lengths shown below give the following approximate flow rates:

Configuration	Flow rate (liters/min)	Gauge/cm	Flow rate (liters/min)
12/7.8	32.96	14/2.5	19.54
12/10.2	30.02	14/3.1	17.27
13/2.5	25.77	14/7.8	14.14
13/5.1	23.50	15/3.2	14.16
13/7.8	23.27	15/7.3	11.81
13/10.2	0.67	15/7.2	10.46

7.2.1.2 These needles can be adapted to a Method 5 type sampling train as follows: Insert a serum bottle stopper, 13- by 20-mm silicone type, into a 1/2-inch Swagelok quick connect. Insert the needle into the stopper as shown in Figure 5-6.

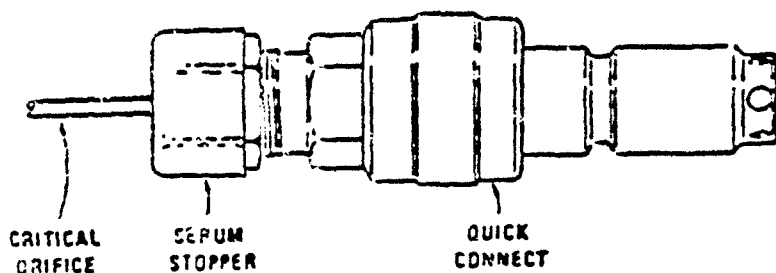


Figure 5-9. Critical orifice adaptation to Method 5 metering system.

7.2.2 Critical Orifice Calibration. The procedure described in this section uses the Method 5 meter box configuration with a DGM as described in Section 2.1.8 to calibrate the critical orifice. Other schemes may be used, subject to the approval of the Administrator.

7.2.2.1 Calibration of Meter Box. The critical orifices must be calibrated in the same configuration as they will be used. I.e., there should be no connections to the inlet of the orifice.

7.2.2.1.1 Before calibrating the meter box, leak check the system as follows: Fully open the coarse adjust valve, and completely close the by-pass valve. Plug the inlet. Then turn on the pump, and determine whether there is any leakage. The leakage rate shall be zero; i.e., no detectable movement of the DGM dial shall be seen for 1 minute.

7.2.2.1.2 Check also for leakage in that portion of the sampling train between the pump and the orifice meter. See Section 3.6 for the procedure; make any corrections, if necessary. If leakage is detected, check for

cracked gaskets, loose fittings, worn O-rings, etc., and make the necessary repairs.

7.2.2.1.3 After determining that the meter box is leakless, calibrate the meter box according to the procedure given in Section 5.3. Make sure that the wet test meter meets the requirements stated in Section 7.1.1.1. Check the water level in the wet test meter. Record the DGM calibration factor, Y.

7.2.2.2 Calibration of Critical Orifices. Set up the apparatus as shown in Figure 5-10. SMALL CODE 6489-02-1

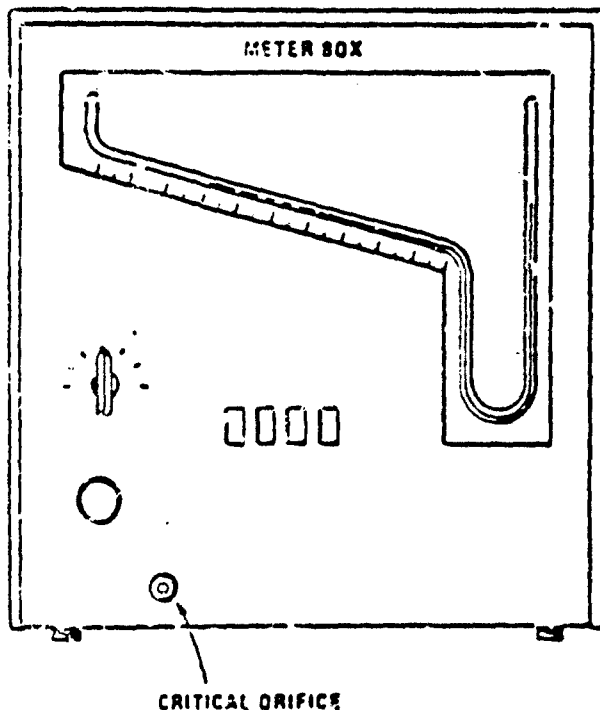


Figure 5-10. Apparatus setup.

7.2.2.1 Allow a warm-up time of 15 minutes. This step is important to equilibrate the temperature conditions through the DGM.

7.2.2.2 Leak check the system as in Section 7.2.2.1. The leakage rate shall be zero.

7.2.2.3 Before calibrating the critical orifice determine its suitability and the appropriate operating vacuum as follows: Turn on the pump, fully open the coarse adjust valve, and adjust the by-pass valve to give a vacuum reading corresponding to about half of atmospheric pressure. Observe the meter box critical manometer reading, H. Slowly increase the vacuum reading until a stable reading is obtained on the meter box orifice manometer. Record the critical vacuum for each orifice.

Orifices that do not reach a critical value shall not be used.

7.2.2.4 Obtain the barometric pressure using a barometer as described in Section 2.1.9. Record the barometric pressure, P_{amb} , in mm Hg (in. Hg).

7.2.2.5 Conduct duplicate runs at a vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. The runs shall be at least 5 minutes each. The DGM volume readings shall be in increments of 0.00283 m³ (0.1 ft³) or in increments of complete revolutions of the DGM. As a guideline, the times should not differ by more than 5.0 seconds (this includes allowance for changes in the DGM temperatures) to achieve ± 0.5 percent in K'. Record the information listed in Figure 5-11.

7.2.2.6 Calculate K' using Equation 5-8.

$K' =$ Critical orifice coefficient.

T_{amb} = Absolute ambient temperature, °K (°R).

Average the K' values. The individual K' values should not differ by more than ± 0.5 percent from the average.

$$K' = \frac{K_1 V_{std} Y (P_{amb} + \Delta H / 13.6) \sqrt{T_{amb}}}{P_{amb} T_{amb}} \quad \text{Eq. 5-8}$$

$$\frac{(m^3(K) \text{ min})}{(mm. Hg) (min)} \left[\frac{(ft^3(R) \text{ min})}{(in. Hg) (min)} \right]$$

Sections 7.2.2.1 to 7.2.2.3. Record the information listed in Figure 5-12.

7.2.3 Using the Critical Orifices as Calibration Standards.

7.2.3.1 Record the barometric pressure.

Date _____ Train ID _____ DGM cal. factor _____ Critical orifice ID _____

Dry gas meter	Run No.	
	1	2
Final reading _____	m ³ (ft ³)	
Initial reading _____	m ³ (ft ³)	
Difference, V_{std} _____	m ³ (ft ³)	
Inlet/Outlet temperatures:		
Initial _____	°C (°F)	/ /
Final _____	°C (°F)	/ /
Avg. _____	°C (°F)	
Temperature, T_{amb} _____		
Time, Θ _____	min/sec	/ /
_____	min	
Orifice man. rdg., ΔH _____	mm (in.)	
_____	H ₂ O	
Bar. pressure, P_{amb} _____	mm (in.) Hg	
Ambient temperature, T_{amb} _____	°C (°F)	
Pump vacuum _____	mm (in.) Hg	
K' factor _____		
Average _____		

Figure 5-11. Data sheet for determining K' factor.

7.2.3.2 Calibrate the metering system according to the procedure outlined in

7.2.3.3 Calculate the standard volume of air passed through the DGM and the critical orifice, and calculate the DGM calibration factor, Y, using the equations below:

$$V_{std} = K_1 V_{DGM} \frac{P_{amb} + (\Delta H / 13.6)}{T_{amb}} \quad \text{Eq. 5-10}$$

$$V_{std} = K' \frac{P_{amb} \Theta}{T_{amb}} \quad \text{Eq. 5-11}$$

$$Y = \frac{V_{std}}{V_{DGM}} \quad \text{Eq. 5-12}$$

where:

V_{std} = Volume of gas sample passed through the critical orifice, corrected to standard conditions, dm³ (scf).

K_1 = 0.2856 °K/mm Hg for metric units = 17.04 °R/in. Hg for English units.

7.2.3.4 Average the DGM calibration values for each of the flow rates. The calibration factor, Y, at each of the flow rates should not differ by more than ± 2 percent from the average.

7.2.3.5 To determine the need for recalibrating the critical orifices, compare the DGM Y factors obtained from two adjacent orifices each time a DGM is calibrated; for example, when checking 13/2.5, use orifices 12/10.5 and 13/5.1. If any critical orifice yields a DGM Y factor differing by more than 2 percent from the others, recalibrate the critical orifice according to Section 7.2.2.

Date _____ Train ID _____ Critical orifice ID _____ Critical orifice K' factor _____

Dry gas meter	Run No.	
	1	2
Final reading _____	m ³ (ft ³)	
Initial reading _____	m ³ (ft ³)	
Difference, V_{std} _____	m ³ (ft ³)	
Inlet/Outlet temperatures:		
Initial _____	°C (°F)	/ /
Final _____	°C (°F)	/ /
Avg. _____	°C (°F)	
Temperature, T_{amb} _____		
Time, Θ _____	min/sec	/ /
_____	min	
Orifice man. rdg., ΔH _____	mm (in.)	
_____	H ₂ O	
Bar. pressure, P_{amb} _____	mm (in.) Hg	
Ambient temperature, T_{amb} _____	°C (°F)	
Pump vacuum _____	mm (in.) Hg	
V_{std} _____	m ³ (ft ³)	
V_{DGM} _____	m ³ (ft ³)	
DGM cal. factor, Y _____		

Figure 5-12. Data sheet for determining DGM Y factor

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July 1990
Revision: Final

EPA METHOD 3A

**DETERMINATION OF OXYGEN AND CARBON DIOXIDE
CONCENTRATIONS IN EMISSIONS FROM STATIONARY SOURCES**

Method 3A—Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. Applicability and Principle.

1.1 **Applicability.** This method is applicable to the determination of oxygen (O₂) and carbon dioxide (CO₂) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 **Principle.** A sample is continuously extracted from the effluent stream; a portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O₂ and CO₂ concentration(s). Performance specifications and test procedures are provided to ensure reliable data.

2. Range and Sensitivity.

Same as Method 6C, Sections 2.1 and 2.2, except that the span of the monitoring system shall be selected such that the average O₂ or CO₂ concentration is not less than 20 percent of the span.

3. Definitions.

3.1 **Measurement System.** The total equipment required for the determination of the O₂ or CO₂ concentration. The measurement system consists of the same major subsystems as defined in Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.2 **Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, Response Time, and Calibration Curve.** Same as Method 6C, Sections 3.2 through 3.4 and 3.10.

3.3 **Interference Response.** The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. Measurement System Performance Specifications.

Same as Method 6C, Sections 4.1 through 4.4.

5. Apparatus and Reagents.

5.1 **Measurement System.** Any measurement system for O₂ or CO₂ that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 **Sample Probe.** A leak-free probe, of sufficient length to traverse the sample points.

5.1.2 **Sample Line.** Tubing to transport the sample gas from the probe to the moisture removal system. A heated sample line is not required for systems that measure the O₂ or CO₂ concentration on a dry basis, or transport dry gases.

5.1.3 **Sample Transport Line, Calibration Value Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder.** Same as Method 6C, Sections 5.1.3 through 5.1.8, and 5.1.11, except that the requirements to use stainless steel, Teflon, and nonreactive glass filters do not apply.

5.1.4 **Gas Analyzer.** An analyzer to determine continuously the O₂ or CO₂ concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate

and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. The requirements for measuring and controlling the analyzer flow rate are not applicable if data are presented that demonstrate the analyzer is insensitive to flow variations over the range encountered during the test.

5.2 **Calibration Gases.** The calibration gases for CO₂ analyzers shall be CO₂ in N₂ or CO₂ in air. Alternatively, CO₂/SO₂, O₂/SO₂, or O₂/CO₂/SO₂ gas mixtures in N₂ may be used. Three calibration gases, as specified Section 5.3.1 through 5.3.3 of Method 6C, shall be used. For O₂ monitors that cannot analyze zero gas, a calibration gas concentration equivalent to less than 10 percent of the span may be used in place of zero gas.

6. Measurement System Performance Test Procedures.

Perform the following procedures before measurement of emissions (Section 7).

6.1 **Calibration Concentration Verification.** Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 3 and change the acceptance criteria for agreement among Method 3 results to 3 percent (or 0.2 percent by volume, whichever is greater).

6.2 **Interference Response.** Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the type of gas detector). Conduct the interference response in accordance with Section 5.4 of Method 2B.

6.3 **Measurement System Preparation, Analyzer Calibration Error, and Sampling System Bias Check.** Follow Sections 6.2 through 6.4 of Method 6C.

7. Emission Test Procedure.

7.1 **Selection of Sampling Site and Sampling Points.** Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 3.

7.2 **Sample Collection.** Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias check. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as for tests conducted using Method 3 plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration.

7.3 **Zero and Calibration Drift Test.** Follow Section 7.4 of Method 6C.

8. Quality Control Procedures.

The following quality control procedures are recommended when the results of this method are used for an emission rate correction factor, or excess air determination. The tester should select one of the following options for validating measurement results:

8.1 If both O₂ and CO₂ are measured using Method 3A, the procedures described in Section 4.4 of Method 3 should be followed to validate the O₂ and CO₂ measurement results.

8.2 If only O₂ is measured using Method 3A, measurements of the sample stream CO₂ concentration should be obtained at the sample by-pass vent discharge using an Orsat or Fyrite analyzer, or equivalent. Duplicate samples should be obtained concurrently with at least one run. Average the duplicate Orsat or Fyrite analysis results for each run. Use the average CO₂ values for comparison with the O₂ measurements in accordance with the procedures described in Section 4.4 of Method 3.

8.3 If only CO₂ is measured using Method 3A, concurrent measurements of the sample stream O₂ concentration should be obtained using an Orsat or Fyrite analyzer as described in Section 8.2. For each run, differences greater than 0.5 percent between the Method 3A results and the average of the duplicate Fyrite analysis should be investigated.

9. Emission Calculation.

For all CO₂ analyzers, and for O₂ analyzers that can be calibrated with zero gas, follow Section 9 of Method 6C, except express all concentrations as percent, rather than ppm.

For O₂ analyzers that use a low-level calibration gas in place of a zero gas, calculate the effluent gas concentration using Equation 3A-1.

$$C_{\text{em}} = \frac{C_{\text{cal}} - C_{\text{cal}}}{C_{\text{cal}} - C_0} (C - C_0) + C_{\text{cal}}$$

Eq. 3A-1

where:

C_{em} = Effluent gas concentration, dry basis, percent.

C_{cal} = Actual concentration of the upscale calibration gas, percent.

C₀ = Actual concentration of the low-level calibration gas, percent.

C_{av} = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent.

C_{0av} = Average of initial and final system calibration bias check responses for the low-level gas, percent.

C = Average gas concentration indicated by the gas analyzer, dry basis, percent.

10. Bibliography.

Same as bibliography of Method 6C.

4.2.5 To insure complete absorption of the CO₂, O₂, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.

4.2.6 Repeat the analysis until the following criteria are met:

4.2.6.1 For percent CO₂, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when CO₂ is greater than 4.0 percent or (b) 0.2 percent by volume when CO₂ is less than or equal to 4.0 percent. Average the three acceptable values of percent CO₂ and report the results to the nearest 0.1 percent.

4.2.6.2 For percent O₂, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when O₂ is less than 15.0 percent or (b) 0.2 percent by volume when O₂ is greater than or equal to 15.0 percent. Average the three acceptable values of percent O₂ and report the results to the nearest 0.1 percent.

4.2.6.3 For percent CO, repeat the analytical procedure until the results of any three analyses differ by no more than 0.3 percent. Average the three acceptable values of percent CO and report the results to the nearest 0.1 percent.

4.2.7 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before an after the analysis.

NOTE: Although in most instances only CO₂ or O₂ is required, it is recommended that both CO₂ and O₂ be measured, and that Section 4.4.1 be used to validate the analytical data.

4.3 Multi-Point, Integrated Sampling and Analytical Procedure.

4.3.1 Both the minimum number of sampling points and the sampling point location shall be as specified in Section 3.3.1 of this method. The use of fewer points than specified is subject to the approval of the Administrator.

4.3.2 Follow the procedures outlined in Sections 4.2.2 through 4.2.7, except for the following: Traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4.4 Quality Control Procedures.

4.4.1 Data Validation When Both CO₂ and O₂ Are Measured. Although in most instances, only CO₂ or O₂ measurement is required, it is recommended that both CO₂ and O₂ be measured to provide a check on the quality of the data. The following quality control procedure is suggested.

NOTE: Since the method for validating the CO₂ and O₂ analyses is based on combustion of organic and fossil fuels and dilution of the gas stream with air, this method does not apply to sources that (1) remove CO₂ or O₂ through processes other than combustion, (2) add O₂ (e.g., oxygen enrichment) and N₂ in proportions different from that of air, (3) add CO₂ (e.g., cement or lime kilns), or (4) have no fuel factor, F_u, values obtainable (e.g., extremely variable waste mixtures). This method validates the measured proportions of CO₂ and O₂ for the fuel type, but the method does not detect sample dilution resulting from leaks during or after sample collection. The method is applicable

for samples collected downstream of most lime or limestone flue-gas desulfurization units as the CO₂ added or removed from the gas stream is not significant in relation to the total CO₂ concentration. The CO₂ concentrations from other types of scrubbers using only water or basic slurry can be significantly affected and would render the F_u check minimally useful.

4.4.1.1 Calculate a fuel factor, F_u, using the following equation:

$$F_u = \frac{20.9 - \%O_2}{\%CO_2}$$

Eq. 3-3

Where:

%O₂ = Percent O₂ by volume (dry basis).

%CO₂ = Percent CO₂ by volume (dry basis).

20.9 = Percent O₂ by volume in ambient air.

If CO is present in quantities measurable by this method, adjust the O₂ and CO₂ values before performing the calculation for F_u, as follows:

$$\%CO_2(\text{adj}) = \%CO_2 + \%CO$$

$$\%O_2(\text{adj}) = \%O_2 - 0.5 \%CO$$

Where: %CO = Percent CO by volume (dry basis).

4.4.1.2 Compare the calculated F_u factor with the expected F_u values. The following table may be used in establishing acceptable ranges for the expected F_u if the fuel being burned is known. When fuels are burned in combination, calculate the combined fuel F_u and F_u factors (as defined in Method 19) according to the procedure in Method 19 Section 5.2.3. Then calculate the F_u factor as follows:

$$F_u = \frac{0.209 F_u}{F_u}$$

Eq. 3-4

Fuel type	F _u range	
Coal	Aerobic and lignite	1.018-1.130
	Subbituminous	1.083-1.220
Oil	Crude oil	1.280-1.413
	Residual	1.210-1.370
Gas	Natural	1.800-1.838
	Propane	1.434-1.588
	Butane	1.405-1.583
Wood	Wood	1.000-1.120
	Wood bark	1.000-1.130

Calculated F_u values beyond the acceptable ranges shown in this table should be investigated before accepting the test results. For example, the strength of the solutions in the gas analyzer and the analyzing technique should be checked by sampling and analyzing a known concentration, such as air; the fuel factor should be reviewed and verified. An acceptability range of ±12 percent is appropriate for the F_u factor of mixed fuels with variable fuel ratios. The level of the emission rate relative to the compliance level should be considered in determining if a retest is appropriate, i.e., if the measured emissions are much lower or much greater than the compliance limit, repetition of the test would not significantly change the compliance status of the source and would be unnecessarily time-consuming and costly.

5. Leak-Check Procedure for Orsat Analyzer

Moving an Orsat analyzer frequently causes it to leak. Therefore, an Orsat analyzer should be thoroughly leak-checked site before the flue gas sample is introduced into it. The procedure for leak-checking an Orsat analyzer is:

5.1.1 Bring the liquid level in each pipette up to the reference mark on the delivery tubing and then close the pipette cock.

5.1.2 Raise the leveling bulb sufficiently to bring the confining liquid meniscus to the graduated portion of the burette then close the manifold stopcock.

5.1.3 Record the meniscus position.

5.1.4 Observe the meniscus in the bulb and the liquid level in the pipette for a moment over the next 4 minutes.

5.1.5 For the Orsat analyzer to pass leak-check, two conditions must be met:

5.1.5.1 The liquid level in each pipette must not fall below the bottom of the delivery tubing during this 4-minute interval.

5.1.5.2 The meniscus in the burette must not change by more than 0.2 ml during 4-minute interval.

5.1.6 If the analyzer fails the leak-check procedure, all rubber connections and cocks should be checked until the cause of the leak is identified. Leaking stops must be disassembled, cleaned, and greased. Leaking rubber connections should be replaced. After the analyzer is repaired, the leak-check procedure must be repeated.

6. Calculations

6.1 Nomenclature.

M_w = Dry molecular weight, g/g-mole (lb/mole).

%EA = Percent excess air.

%CO₂ = Percent CO₂ by volume (dry basis).

%O₂ = Percent O₂ by volume (dry basis).

%CO = Percent CO by volume (dry basis).

%N₂ = Percent N₂ by volume (dry basis).

0.284 = Ratio of O₂ to N₂ in air, v/v.

0.280 = Molecular weight of N₂ or CO₂, divided by 100.

0.320 = Molecular weight of O₂, divided by 100.

0.440 = Molecular weight of CO, divided by 100.

6.2 Percent Excess Air. Calculate the percent excess air (if applicable), by substituting the appropriate values of percent CO₂ and N₂ (obtained from Section 4.1.4.2.4) into Equation 3-1.

% EA =

$$\frac{\%O_2 - 0.5 \%CO}{0.284 \%N_2 - (\%O_2 - 0.5 \%CO)} \times$$

Equation:

NOTE: The equation above assumes ambient air is used as the source of O₂ that the fuel does not contain appreciable amounts of N₂ (as do coke oven or blast furnace gases). For those cases when appreciable amounts of N₂ are present (coal, oil, natural gas do not contain appreciable amounts of N₂) or when oxygen enrichment is used, alternate methods, subject to approval of the Administrator, are required.

6.3 Dry Molecular Weight. Use Equation 3-2 to calculate the dry molecular weight of the stack gas:

$$M_w = 0.440(\%CO_2) + 0.320(\%O_2) + 0.280(\%N_2 + \%CO)$$

NOTE: The above equation does not consider argon in air (about 0.9 percent, molecular weight of 39.9). A negative error of about 0.4 percent is introduced. The tester may opt to include argon in the analysis using procedures subject to approval of the Administrator.

7. Bibliography

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EPA METHOD 7E
DETERMINATION OF NITROGEN OXIDE EMISSIONS
FROM STATIONARY SOURCES

Method 7E—Determination of Nitrogen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. Applicability and Principle

1.1 Applicability. This method is applicable to the determination of nitrogen oxides (NO_x) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A gas sample is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental chemiluminescent analyzer for determination of NO_x concentration. Performance specifications and test procedures are provided to ensure reliable data.

2. Range and Sensitivity

Same as Method 6C, Sections 2.1 and 2.2.

3. Definitions

3.1 Measurement System. The total equipment required for the determination of NO_x concentration. The measurement system consists of the following major subsystems:

3.1.1 Sample Interface, Gas Analyzer, and Data Recorder. Same as Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.1.2 NO_x to NO Converter. A device that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO).

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, and Response Time. Same as Method 6C, Sections 3.2 through 3.4.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. Measurement System Performance Specifications

Same as Method 6C, Sections 4.1 through 4.4.

5. Apparatus and Reagents

5.1 Measurement System. Any measurement system for NO_x that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe, Sample Line, Calibration Valve Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.1 through 5.1.9, and 5.1.11.

5.1.2 NO_x to NO Converter. That portion of the system that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO). An NO_x to NO converter is not necessary if data are presented to

demonstrate that the NO_2 portion of the exhaust gas is less than 5 percent of the total NO_x concentration.

5.1.3 NO_x Analyzer. An analyzer based on the principles of chemiluminescence, to determine continuously the NO_x concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer.

5.2 NO_x Calibration Gases. The calibration gases for the NO_x analyzer shall be NO in N_2 . Three calibration gases, as specified in Sections 5.3.1 through 5.3.3, of Method 6C, shall be used. Ambient air may be used for the zero gas.

6. Measurement System Performance Test Procedures

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Gas Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 7, and change all 5 percent performance values to 10 percent (or 10 ppm, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sample System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

6.4 NO_x to NO Conversion Efficiency. Unless data are presented to demonstrate that the NO_2 concentration within the sample stream is not greater than 5 percent of the NO_x concentration, conduct an NO_x to NO conversion efficiency test in accordance with Section 5.8 of Method 20.

7. Emission Test Procedure

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 7.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate used during the system calibration drift test. Maintain constant rate sampling (i.e., ± 10 percent) during the entire run. The sampling time per run shall be the same as the total time required to perform a run using Method 7, plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed, to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.

8. Emission Calculation. Follow Section 8 of Method 6C.

9. Bibliography

Same as bibliography of Method 6C.

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APPENDIX C
DESCRIPTION OF CEM SYSTEM

C.0 DESCRIPTION OF CONTINUOUS EMISSION MONITORING SAMPLING SYSTEM

The CEM system used for gaseous pollutant monitoring by EPA Methods 3A, 7E, 10, and 25A is shown in Figure C-1. The sample gas handling system is shown in Figure C-2.

C.1 Sampling system. Exhaust gas is drawn from the duct or stack through a heated stainless steel (S.S.) probe that is inserted into the duct or stack through one of the test ports. A S.S. valve is located at the probe exit to permit introduction of certified zero and calibration span gases. A heated teflon line is used to transport the sample or zero/calibration gases to the Continuous Emission Monitoring (CEM) trailer. Temperatures are monitored at the exit of each section of line to ensure temperatures are above the sample dew point. Once inside the CEM trailer, the sample line enters a heated junction box where the sample is split into three fractions, and each fraction is directed to one of the following:

- (a) Charleton Model SC-14 Sample Conditioner.
- (b) Thermo Electron Model 900 Sample Conditioner.
- (c) Direct Connection to Total Hydrocarbon Analyzers.

The Charleton Model SC-14 unit is an extractive sample conditioner that removes particulates and moisture from the sample gas. The extracted sample gas is passed through a sintered stainless bypass filter, which removes particulates down to 1 micron or less by an internal filtration technique. The filter is maintained at a temperature above the dew point of the sample gases.

The clean, filtered sample is then introduced to a permeation dryer where moisture is removed without condensation or dilution to achieve a sample dew point well below that of the ambient temperature. The clean, dried sample is then directed to the carbon monoxide (CO), carbon dioxide (CO₂), oxygen (O₂), and nitrous oxides (NO_x) analyzers using a teflon-headed sample pump.

The dilution ratio of the Thermo Electron Model 900 sample conditioner is a function of sample/dilution air pressure and capillary tube size. Once set, the dilution ratio is a constant. Sample concentrations are determined by multiplying the analyzer output times the dilution ratio. Nominal dilution ratio for the Thermo Electron Model 900 is 10 to 1.

In the J.U.M. Engineer VE-7 Total Hydrocarbon Analyzer, a S.S. sample filter and detector are contained in a temperature controlled oven. This permits the direct analysis of total hydrocarbons on a wet basis without condensation or loss of sample.

C.2 CEM system calibration procedures. Calibrations are conducted on a daily basis. The following procedures are performed each day of testing:

- (a) Analyzer calibration error (pretest).
- (b) Sampling system bias check (pretest).
- (c) Sampling system bias check (post-test).

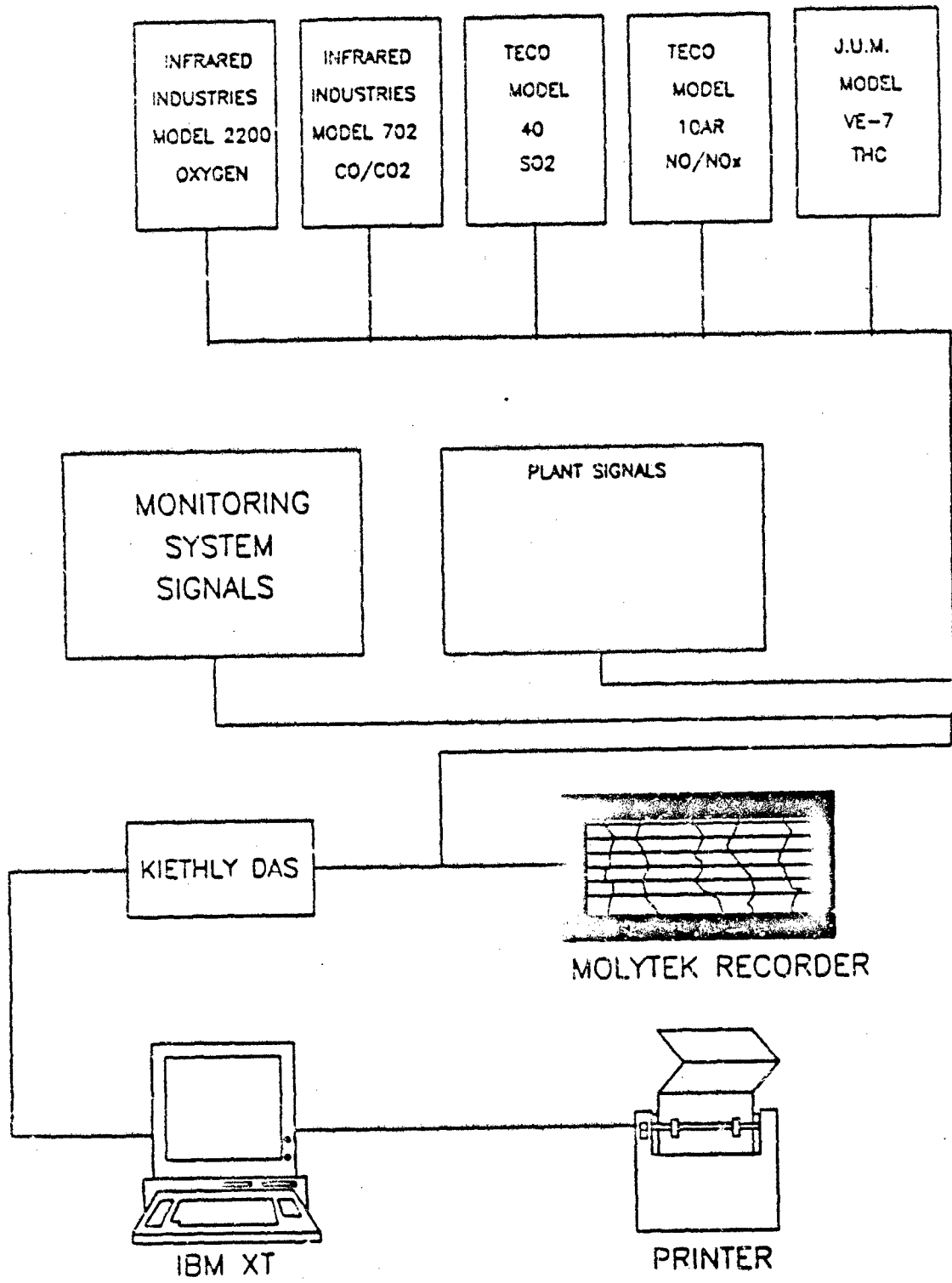


FIGURE C-1. CEM System

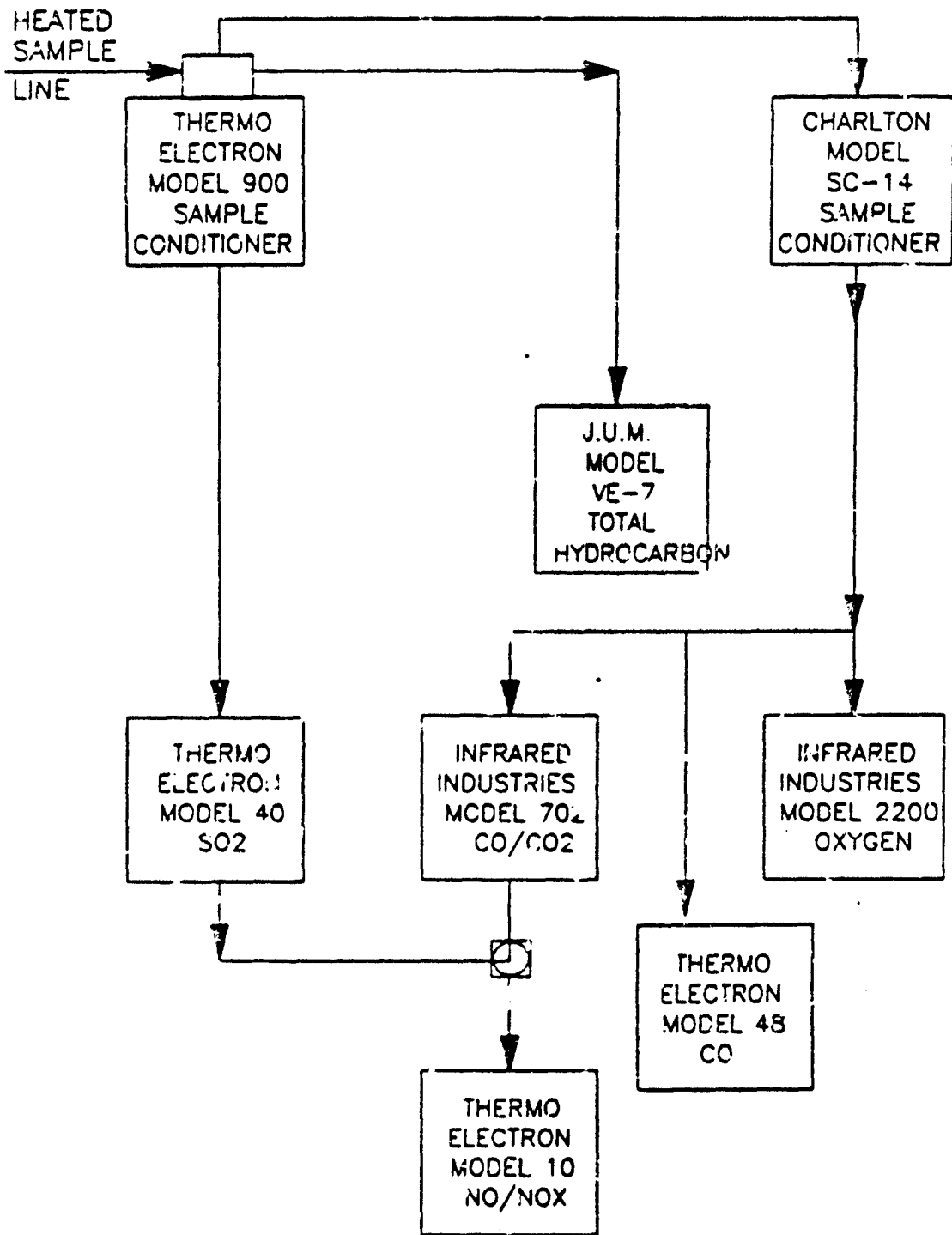


FIGURE C-2. CEM Sample Gas Flow Path

Calibrations used cylinder gas standards prepared according to EPA Protocol 1, where available. All other calibration gases are traceable to National Bureau of Standards (NBS) standards.

C.3 CEM system data collection. Signals from the CEM sampling system are recorded on two devices. Data are available in hard copy from a Molytek strip chart recorder/data logger. In addition, data are recorded in 10-second increments using the Kiethly DAS/IBM PC-XT acquisition system. Data are summarized as one minute averages and are available onsite using the PC-XT system.

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APPENDIX D
RAW OPERATIONAL DATA SHEETS

Appendix D presents raw operational data collected from process equipment and test items. For each test run, four types of data sheets are enclosed.

The first data sheet (Data Sheet 1) provides information on the physical characteristics of test items evaluated in each test run. The following information is provided:

- Equipment type.
- Contaminants evaluated.
- Dimensions of test item.
- Initial weight of test item.
- Final weight of test item.
- Type of sample collected (rinsate, wipe or solid).
- An indication of type of contaminant spiked to test item (TNT or ammonium picrate).
- Initial and final contaminant concentration (since these items were not known at the time of testing, these columns are generally left blank).
- Thermocouple number.
- Observations (pre- and post-test).

A schematic of the rail cart is included; locations of each type of test item are provided. The following abbreviations are applicable:

- PE - Powder Box.
- SHR - Steam Heated Riser.
- SSR - Shell Support Rack.
- SHV - Steam Heated Discharge Valve.
- CP - Clay Pipe.
- SM - Ship Mine.
- SP - Steel Pipe.
- AP - Aluminum Pipe.

- 1 - denotes test items designated for post-test sampling and analysis.

- 2 - denotes test items designated as spares; items were sampled for analysis only in the event of field or laboratory contamination.

- 0 - Diameter.
- F - Flush.
- R - Rinsate.
- W - Wipe.
- S - Side (thermocouple location).
- I - Inside (thermocouple location).

For the first few test runs, the procedures used to record data were still being developed; therefore, some of the information provided on the data sheets is not complete (i.e., contaminants evaluated, sample type, initial/final contaminant concentration, and thermocouple number).

The second data sheet (Data Sheet 2) provides information collected from the following process equipment items:

- Main Control Panel
 - Air preheater inlet damper position (H1C-201)
 - Air preheater inlet air flow (PI-202)
 - Air preheater exit gas temperature (TIC-304)
 - Afterburner inlet air temperature (TI-224)
 - Building (Flash Chamber) Pressure (PIC-201)
 - Afterburner exit gas temperature (TIC-324)
- Air Preheater
 - Gas Pressure (PI-303)
 - Burner Pressure (PI-310)
- Afterburner
 - Gas Pressure (PI-323)
 - Burner Pressure (PI-330)
- Propane Gas Supply Tank
 - Tank Capacity Remaining
 - Tank Temperature
 - Line Pressure
 - Line Temperature

The following discharge emissions were monitored by the Continuous Emissions Monitor (CEM) System and recorded by WESTON personnel:

- Air Preheater Discharge
 - Total Hydrocarbons (THC)
- Flash Chamber Discharge
 - Total Hydrocarbons (THC)
- Afterburner Discharge
 - Total Hydrocarbons (THC)
 - Carbon Dioxide (CO)
 - Carbon Monoxide (CO₂)
 - Oxygen (O₂)
 - Nitrous Oxides (NO_x)

The following key of abbreviations is applicable:

- PSIG = Pounds per Square Inch Gauge.
- PPM/V = Parts Per Million based on Volume.
- % = Percentage.

The following information was monitored and recorded by WESTON personnel:

- Dry bulb temperature of ambient air.
- Wet bulb temperature of ambient air.
- Moisture content of ambient air (as determined using a psychrometric chart).

The collection times correspond to real time beginning with 0000 hrs and running through 2300 hrs. A separate data sheet is included for each operational day.

Monitoring data were collected and recorded every hour beginning with the firing of the afterburner and continuing until the flash chamber reached the steady state target temperature. After reaching steady state temperature, personnel were not required to be present on the test site. The team left the site and the system operated automatically. During unmanned operation, no data were recorded (except for data recorded during "spot" checks and CEM system data). Data gaps, therefore, exist in the data sheets.

WESTON personnel recorded notes regarding the operation of the system along the sides of the data sheets. These notes usually reflect times when the system reached steady state, and cases where the system shut down, the air preheater started, etc.

The third data sheet (Data Sheet 3) provides temperatures monitored by thermocouples placed on test items within and various locations in the flash chamber. Collection times correspond to real time beginning with 0030 hours and continuing to 2330 hours. Each thermocouple was tagged with an identification number. The thermocouple number is provided across the top of the data sheet (numbers 1 through 20). The test item and flash chamber location monitored are listed below the thermocouple number (i.e., thermocouple 1 monitored the temperature of the diffuser support, etc.). The location of the thermocouple on the test items is provided and is listed as an (I) for internal surfaces or (S or E) for side and external surface areas.

Following the raw data sheets are computer-generated summary sheets (Data Sheet 4). Two data summary sheets are provided for each test. The first sheet contains data collected from the process equipment; the second sheet contains the temperatures collected from the test items and flash chamber. The elapsed time is provided and represents the total number of hours data were collected during a test period. At the end of each summary sheet are values for the mean, maximum, and minimum of the data over the following three time periods: (1) steady state operation, (2) heatup and steady state operation, and (3) total test operation. The averages generated by the computer were used to generate summary tables in Section 8 of the report.

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TEST RUN 2
400°F/24 HOURS

1311R2

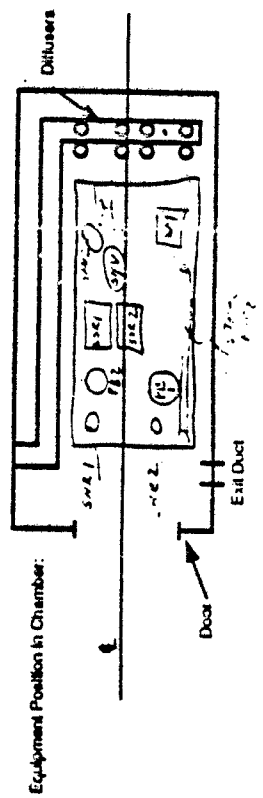
DATA SHEET 1
PAGE 1 OF 1

Test Run T2
 Test Duration 24 hrs
 Heat Up Rate 50/hr
 Flash Chamber Temperature 400 °F

IC: INSIDE
 S: SIDE

Equipment Type	Contaminant(s)	Dimensions L x H x W	Initial Wt. (lbs.)	Final Wt. (lbs.)	Sample Type	Equipment Spike	Initial Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. PBI	TNT	16" x 14"	12	7	F	TNT			12.5		
2. PBR	"	15" x 14"	6	6	F				15.1		
3. SHR-1	"	7" x 9"	13	12	R						
4. SHR-2	"	7" x 9"	13	12	R						
5. SSR-1	explosive	3.2 x 2.2"	85	80	W						
6. SSR-2	"	3.2 x 2.2"	87	87	W						
7. SHV-1	"	3.5 x 1.5"	210	210	R				11.5		
8. SHV-2	"	3.5 x 1.5"	190	190	R				16.1	no samples	
9. CP			88	81					20 I 18s		
10. SM			728	721					19 I 17s		
11. SP									14.5		
12.											
13.											
14.											
15.											

- 1 - DIFFUSER SUMP
- 2 - REAR FLOW
- 3 - ROOF WALL
- 4 - FLOOR IN FRONT
- 5 - DIFFUSER
- 6 - LEFT WALL
- 7 - EXIT GALS
- 8 - FLOOR AT THE CAP
- 9 - ROOF



182

LB 1100 / 11 JA

.0112

Date 24 July 89 Test Number T-2 400°F 24hr test

Time	Main Panel						Alter Panel			Propose Tank			Propose Tank			Afterburner Discharge		
	HC-101	HC-102	HC-103	HC-104	HC-105	HC-106	HC-107	HC-108	HC-109	HC-110	HC-111	HC-112	HC-113	HC-114	HC-115	HC-116	HC-117	HC-118
0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.200 0.200 0.200
0.112 0.112 0.112

28/30

Date 25 July 89 T-2 400 F / 24 hr Test.

1111

Time	Main Period						Air Inlets			Alum. Sample	Process Tank			Air Heater Discharge (LIGHT ON)	Flash Chamber Discharge	Alkylbenzene Discharge		
	At Heater Inlet P-201	At Heater Inlet P-202	At Heater Inlet P-203	At Heater Inlet P-204	At Heater Inlet P-205	At Heater Inlet P-206	At Inlet P-201	At Inlet P-202	At Inlet P-203		Cond %	Temp	Flow			TIC	PM10	TIC	CO	CO2	NOx
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

0800 - stable
 Alkylbenzene
 Discharge
 Temp Alarm
 2040 - HIGH PRESS.
 Alarm.

1430 - (M/S) 10
 2335

1730 -
 1730 -
 1730 -
 1730 -
 1730 -

2335 - 2335 STACK TEST COMPLETE

AP 1210 6:15
 1210
 1210

DATA SHEET 2
PAGE 3 OF 3

Date 7/26/89 Test Number T-2 400°F/24 hrs

Time	Main Panel						Propane Tank			Propane Tank			Alkylarner Discharge			
	Atmospheric Pressure	Atmospheric Temperature	Atmospheric Humidity	Atmospheric Dew Point	Atmospheric Wind Speed	Atmospheric Wind Direction	Temp	Pressure	Flow	Temp	Pressure	Flow	HC	CO	CO ₂	NO _x
0000	29.3	117	67				50	15.5	94				0.2	4.3	0.1	11.3
0100																
0200																
0300																
0400																
0500																
0600																
0700																
0800																
0900																
1000																
1100																
1200																
1300																
1400																
1500																
1600																
1700																
1800																
1900																
2000																
2100																
2200																
2300																

0100
A-15
0115
0130
0145
0160
0175
0190
0205
0220
0235
0250
0265
0280
0295
0310
0325
0340
0355
0410
0425
0440
0455
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0610
0625
0640
0655
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0840
0855
0910
0925
0940
0955
1010
1025
1040
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1110
1125
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1855
1910
1925
1940
1955
2010
2025
2040
2055
2110
2125
2140
2155
2210
2225
2240
2255
2310
2325
2340
2355

28 32

1/8/2

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
6030	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	
0130	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
0230																															
0330	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
0430																															
0530	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
0630	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
0830	201	110	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	
1130	375	178	207	196	187	178	169	160	151	142	133	124	115	106	97	88	79	70	61	52	43	34	25	16	7						
1230	378	201	231	261	291	321	351	381	411	441	471	501	531	561	591	621	651	681	711	741	771	801	831	861	891	921	951	981	1011	1041	
1330	405	222	246	270	294	318	342	366	390	414	438	462	486	510	534	558	582	606	630	654	678	702	726	750	774	798	822	846	870	894	
1430	416	231	256	281	306	331	356	381	406	431	456	481	506	531	556	581	606	631	656	681	706	731	756	781	806	831	856	881	906	931	
1530	427	230	267	304	341	378	415	452	489	526	563	600	637	674	711	748	785	822	859	896	933	970	1007	1044	1081	1118	1155	1192	1229	1266	
1630																															
1730	473	247	282	317	352	387	422	457	492	527	562	597	632	667	702	737	772	807	842	877	912	947	982	1017	1052	1087	1122	1157	1192	1227	
1830	438	247	271	295	319	343	367	391	415	439	463	487	511	535	559	583	607	631	655	679	703	727	751	775	799	823	847	871	895	919	
1930	448	247	271	295	319	343	367	391	415	439	463	487	511	535	559	583	607	631	655	679	703	727	751	775	799	823	847	871	895	919	
2030	448	247	271	295	319	343	367	391	415	439	463	487	511	535	559	583	607	631	655	679	703	727	751	775	799	823	847	871	895	919	
2130	448	247	271	295	319	343	367	391	415	439	463	487	511	535	559	583	607	631	655	679	703	727	751	775	799	823	847	871	895	919	
2230	448	247	271	295	319	343	367	391	415	439	463	487	511	535	559	583	607	631	655	679	703	727	751	775	799	823	847	871	895	919	
2330	448	247	271	295	319	343	367	391	415	439	463	487	511	535	559	583	607	631	655	679	703	727	751	775	799	823	847	871	895	919	

77-6576

1126/87 1es1 - 1-2 400 r / 4 hr.

2.12

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	
0130	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	
0230																															
0330	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	
0430	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	
0530																															
0630	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	
0730	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	
0830	500	327	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	
0930	701	317	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	
1030	716	320	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	
1130	702	331	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	
1230	902	328	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	
1330																															
1430																															
1530																															
1630	327	297	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	
1730																															
1830	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
1930																															
2030	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
2130	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	
2230																															
2330	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	

Key:
 FOM-508
 Boxes - FS
 Shell Support
 Rack - SSR
 Clay Pipe
 - CP
 Ship Mine
 - SM
 Steam
 Heated
 Riser - SHR
 Steel Pipe
 - SP
 Aluminum
 Pipe
 - AP
 Motor with
 Gear
 Reducer
 -M
 Steam
 Heated
 Discharge
 Valve - SDV

11 Jan 88

Test Number	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.10	7.11	7.12	7.13	7.14	7.15	7.16	7.17	7.18	7.19	7.20	
Temperature	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	400 Deg F	
Time	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	
State of Test	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	Steady State	
Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	
Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	
Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	
External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External
Material	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	
Dimensions	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	10" x 10" x 10"	

Steady State 7.1-7.20
Data Range 11

July 1990
Revision: Final

TEST RUN 3
500°F/36 HOURS

(13)

Test Run T3 Date 7/15/89
 Test Duration 3 hr 45 Time _____
 Heat Up Run _____

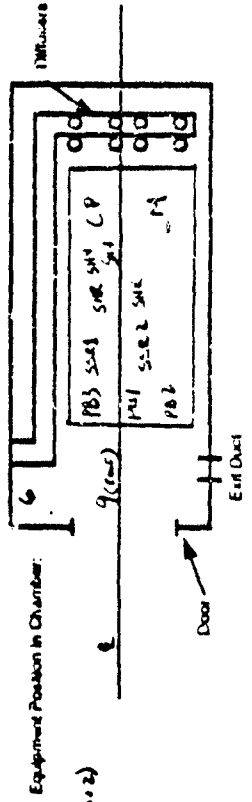
Flash Chamber Temp 500 of _____
 Flash Chamber Temp 500 of _____

Equipment Type	Coordinates	Dimensions L x H x W	Head Wt (lbs)	Equip Wt (lbs)	Equip Wt (lbs)	Test Sample Type	Equipment Spilled	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Pie Test	Observations
1. TB	TNT	5 1/2 x 11 x 11	10	10	10	---	---	---	---	---	---	---
2. PB1		5 1/2 x 11 x 11	10	10	10	---	---	---	---	---	---	---
3. PB2		5 1/2 x 11 x 11	10	10	10	---	---	---	---	---	---	---
4. SHV 1		7 1/2 x 11 x 11	11	11	11	---	---	---	---	---	---	---
5. SHV 2		5 1/2 x 11 x 11	10	10	10	---	---	---	---	---	---	---
6. SR1		5 1/2 x 11 x 11	10	10	10	---	---	---	---	---	---	---
7. SR2		5 1/2 x 11 x 11	10	10	10	---	---	---	---	---	---	---
8. CP		2 1/2 x 11 x 11	40	40	40	---	---	---	---	---	---	---
9. SM		2 1/2 x 11 x 11	730	730	730	---	---	---	---	---	---	---
10. SHV 1		2 1/2 x 11 x 11	250	250	250	---	---	---	---	---	---	---
11. SHV 2		2 1/2 x 11 x 11	270	270	270	---	---	---	---	---	---	---
12. RT. side wall						---	---	---	---	---	---	---
13. FLOOR						---	---	---	---	---	---	---

MECHANICAL DEBITS

OF SIZE OF FLAME

CHAIN WT = 745
 CLATA WGT = 2185



108 + Chain WT = 745 (SP. SHV 1, SHV 2)
 and up to 1000 WT = 2185 (CP)

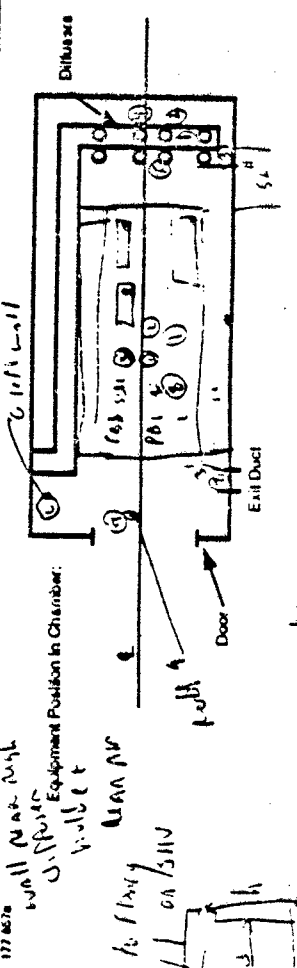
* NOTE: SCALE WAS OFF, DUE TO A MISSING LOCK NUT. FINAL WT. MAY NOT BE 100% ACCURATE

DATA SHEET 1
PAGE 2 OF 2

945-5407
JIM REERE

Test Run T3 Date 7/15/89
 Test Duration 36 hours Time _____
 Heat-Up Rate _____
 Flash Chamber Temperature 500°F

Equipment Type	Container (t)	Dimensions L x W x H	Initial Vol (ft ³)	Final Vol (ft ³)	Pic Sample Type	Equipment Spiked	Initial Concentration	Final Concentration	Thermocouple	Pre-Test	Outgassing Post-Test
1 PB	TNF	15" x 10" x 10"	10	10	N	-			10	None	None
2 PB1		15" x 10" x 10"	10	10	4X	10g			105	Small dust	Small dust
3 PB2		15" x 10" x 10"	10	10	4X	10g			105	Small dust	Small dust
4 SHR1		7" x 5" x 11"	11	12	4X	10g			105	Small dust	Small dust
5 SHR2		7" x 5" x 11"	11	12	4X	10g			105	Small dust	Small dust
6 SR1		15" x 10" x 10"	10	10	W/W	1g			105	Small dust	Small dust
7 SR2		15" x 10" x 10"	10	10	W/W	1g			105	Small dust	Small dust
8 SCP		12" x 5" x 9"	90	75	W/W	1g			105	Small dust	Small dust
9 ESM		12" x 5" x 9"	90	75	W/W	1g			105	Small dust	Small dust
10 SHV1		9" x 10" x 25"	250	250	W/W	10g			205	Small dust	Small dust
11 SHV2		9" x 10" x 25"	250	250	W/W	10g			205	Small dust	Small dust
12											
13											
14											
15											



Height = 2' 10"

Distance from floor to top of equipment = 2' 10"

Distance from floor to top of equipment = 2' 10"

Distance from floor to top of equipment = 2' 10"

Distance from floor to top of equipment = 2' 10"

Distance from floor to top of equipment = 2' 10"

Distance from floor to top of equipment = 2' 10"

Distance from floor to top of equipment = 2' 10"

handle placed in (Auto)

No I.P.

Off

Flux and

Course weight slats

Chain Weight = 7 lbs

Equipment Position in Chamber:

15" x 10" x 10"

9" x 10" x 25"

9" x 10" x 25"

1878

-0.05

Date 7/17/89 (A1034) Test Number 73

Time	Main Panel						Air		Abstr.		Propane Tank			Air Heater Discharge		Flue Gas Discharge		CEM					
	NO ₂	NO _x	CO	CO ₂	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	NO _x	CO	CO ₂	Temp	
0000	0	0.02	86	101	0.55	0	174	0	187	0	187	15	118	107	1.5	1.5	1.5	1.5	1.4	5.6	5.6	1.4	11.5
0100	0	0.01	27	112	0.11	0	205	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0200	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0300	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0400	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0500	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0600	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0700	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0800	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
0900	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1000	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1100	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1200	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1300	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1400	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1500	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1600	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1700	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1800	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
1900	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
2000	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
2100	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
2200	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5
2300	0	0.02	87	101	0.08	0	174	16	187	16	187	74	111	101	1.2	1.2	1.2	1.2	1.1	7.7	7.7	1.1	11.5

Other - unheated
increase out for
to 30 seconds
I worked on
in the
to 11.5
ready

ready

1015 AL
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1515 - started to spill. A.H. Temp (TIC-204) from 1100
1900 system shut down
2055 - T.O up to 2000 F. A.H. burner
shut off

NOTES:

0030 - have been at
shutty state a total
of 12 hrs. during
any mis-taps 36 hr.
should be at 2130
on wed. 7/18/89.

wall switches
1430 since test #3
begins

WAL continue to work

out of town
36 hrs of shutty state
to be at 2130 per
Cosmo & Johnson.

Date 7-18-89 (Tue.) Test Number T3

Time	Main Panel						Air Temp PSK	Ambi. Temp PSK	Prepare Tank			Flash Chamber Discharge TIC PPHM	A/Burner Discharge			
	1 PSK	2 PSK	3 PSK	4 PSK	5 PSK	6 PSK			1 PSK	2 PSK	3 PSK		4 PSK	INC	CO	O ₂	H_{2}
0000	68.3	71.2	76.7	476	476	0.025	150	150	75	19.3	79	58.9	2.8	5.0	11.2	14.6
0100	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0200	69.3	72.0	78.7	479	479	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0300	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0400	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0500	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0600	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0700	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0800	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
0900	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1000	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1100	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1200	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1300	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1400	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1500	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1600	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1700	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1800	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
1900	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2000	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2100	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2200	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2300	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2400	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2500	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2600	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2700	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2800	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
2900	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6
3000	67.3	71.0	77.4	477	477	0.025	147	147	75	19.2	77	59.7	2.8	5.0	11.2	14.6

2135 - Start Part 3 ends

2152 → A.H. burner shut down, leave fan running for cool down
reduce A.H. tank dumper setting

08:30

DATA SHEET 2
PAGE 4 OF 4

Date 7/12/89 Test Number T3 Cool Down

Time	Main Panel				Air Handling				Propose Test			Propose Test			Airbarnet Discharge					
	MC-207 Air Handler Heat Discharge	MC-201 Air Handler Heat Air Flow	TC-204 Air Handler Temperature	TC-204 T.O. Heat Air Temperature T1204	MC-221 Bag Pressure	MC-222 Bag Pressure	MC-223 Bag Pressure	MC-224 Bag Pressure	MC-202 Dry Bag Temperature	MC-203 Dry Bag Temperature	MC-204 Dry Bag Temperature	MC-205 Dry Bag Temperature	MC-206 Dry Bag Temperature	MC-207 Dry Bag Temperature	MC-208 Dry Bag Temperature	MC-209 Dry Bag Temperature	MC-210 Dry Bag Temperature	MC-211 Dry Bag Temperature	MC-212 Dry Bag Temperature	
6:50																				
7:00																				
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1320 - Legend
S 112

D23 Tag 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Char. / #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0030 - O	405	105	109	120	109	120	120	113	113	104	117	105	111	115	115	117	111	111	117	117										
0130	348	132	238	326	444	276	177	259	175	152	159	170	130	131	132	153	153	153	205	137										
0230	468	165	331	148	457	376	378	208	137	214	165	165	224	196	167	189	167	167	200	310										
0330	465	171	352	162	424	350	350	276	311	278	182	110	203	245	242	214	249	249	245	337										
0430	443	309	350	172	416	354	348	256	337	291	192	197	279	268	265	280	277	395	269	346										
0530	514	226	399	183	457	406	406	332	322	337	208	215	327	276	272	278	277	262	200	395										
0630	519	251	404	198	500	420	416	467	405	360	223	224	351	333	331	349	347	477	355	418										
0730	446	250	401	201	465	379	402	345	384	355	221	224	320	323	328	297	352	434	133	370										
0830	580	273	453	213	504	456	450	392	478	350	244	254	381	359	355	341	370	558	27	424										
0930	21	310	515	251	607	515	502	444	445	456	264	281	440	425	425	442	385	473	473	50										
1030	644	337	535	257	605	514	514	444	515	462	202	245	404	410	416	431	350	677	430	50										
1130	673	34	47	271	626	524	523	470	530	474	245	30	473	458	458	410	501	611	474	300										
1230	603	30	50	292	626	544	537	445	540	441	311	308	485	478	473	382	510	631	443	500										
1330	615	46	604	206	631	553	541	441	540	42	317	327	424	411	411	413	513	603	502	500										
1430	680	410	469	321	637	624	624	400	544	441	328	346	497	489	488	502	511	628	510	575										
1530	678	410	544	325	637	637	637	441	544	441	344	355	501	444	444	510	525	638	515	571										
1630	655	411	508	272	617	655	647	503	559	501	320	320	420	394	394	445	512	524	613	513	567									
1730	649	421	500	310	613	613	613	490	531	440	345	347	497	492	492	508	521	622	515	564										
1830	650	421	551	344	610	535	535	449	535	445	345	345	444	440	440	508	519	614	510	562										
1930	452	204	430	335	493	343	410	417	432	352	322	337	553	442	444	441	472	411	475	420										
2030	455	338	426	295	455	404	435	376	427	358	300	301	382	381	380	415	401	440	408	414										
2130	515	214	472	301	544	440	471	411	481	350	316	316	401	376	372	444	411	514	417	440										
2230	641	210	52	303	607	518	518	451	518	471	327	335	459	418	418	418	510	410	410	506										
2330	640	594	330	337	601	517	518	478	519	478	351	346	475	460	457	458	486	600	477	544										

DATA SHEET 3
Page 2 of 3

S = SURFACE
I = INTERIOR
Date: 7/18/07
TAXI: #T3

026 TR4 2 3 1 4 5 7 9 8 6 10 13 11 14 15 12 18 17 16 20 19

Channel #	Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23	24	25	26	27	28	29	30	
0030		412	519	348	307	589	535	481	529	501	340	315	481	474	471	478	478	599	484	599											
0130		420	516	353	611	523	525	479	542	861	780	478	479	485	502	606	492	555													
0230		610	425	350	606	526	535	485	532	494	349	367	487	481	483	470	507	600	497	555											
0330		638	424	577	606	538	535	478	529	510	351	372	497	487	488	496	577	510	502	558											
0430		534	433	552	370	600	538	536	500	530	497	353	374	492	488	499	512	601	504	558											
0530		637	437	550	372	605	535	535	479	531	505	355	376	491	491	501	513	611	506	560											
0630		636	431	550	374	603	539	540	502	533	502	357	381	492	493	504	515	607	507	561											
0730		632	441	555	376	611	537	539	502	535	506	361	382	497	494	504	514	618	507	564											
0830		644	448	555	374	600	542	541	500	532	514	364	385	495	497	490	507	612	512	515											
0930		647	447	553	374	599	531	539	504	530	516	363	388	498	498	508	520	611	513	515											
1030		635	477	552	382	603	539	541	506	535	516	369	389	499	497	504	520	609	512	511											
1130		630	440	554	380	598	530	538	500	530	510	360	387	492	495	508	511	604	511	511											
1230		630	445	552	381	599	536	538	501	532	503	369	386	496	495	505	507	605	510	510											
1330		630	446	551	381	597	533	535	501	527	503	369	389	494	494	504	517	603	504	514											
1430																															
1530		718	440	547	387	598	530	536	502	533	507	370	387	491	493	505	517	602	510	517											
1630		629	441	555	387	600	536	538	502	535	505	371	391	495	496	495	507	602	510	510											
1730		628	449	555	385	602	540	542	501	537	508	373	382	497	496	495	507	600	510	510											
1830		629	449	551	380	601	540	535	503	537	505	376	382	496	495	496	508	601	510	511											
1930		629	453	555	402	602	541	540	504	533	509	376	385	499	498	498	508	604	512	511											
2030		629	455	553	403	600	550	542	508	539	510	377	396	491	491	499	510	611	514	513											
2130		631	455	554	405	600	545	541	508	535	510	376	396	497	498	498	510	601	515	510											
2230																															
2330																															

Key:
Powder Boxes - PB
Steel Support Rack - SSR
Clay Pipe - CP
Slip Line - SL
Steam Heated Riser - SHR
Steel Pipe - SP
Aluminum Pipe - AP
Motor with Gear Reducer - M
Steam Heated Discharge Valve - SDV

1120101

Page 3 of 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Key:					
Equip.	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL	WALL						
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Test Run 1		Run 2		Run 3		Run 4		Run 5		Run 6		Run 7		Run 8		Run 9		Run 10		Run 11		Run 12																					
Temp	Humidity	Pressure	Flow	Temp	Humidity	Pressure	Flow	Temp	Humidity	Pressure	Flow	Temp	Humidity	Pressure	Flow	Temp	Humidity	Pressure	Flow	Temp	Humidity	Pressure	Flow																				
25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0	25.0	65.0	101.3	10.0

12 Jan 88

Test Name	Temp. (deg F)	Start		End		Start		End		Start		End		Start		End		Ship	Steam	Ship
		10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88	10-Jul-88			
Shallow	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deep	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shallow	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deep	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Shallow Area Balance
Data Range 11

Shallow Area Balance
Data Range 12

Shallow Area Balance
Data Range 13

Shallow Area Balance
Data Range 14

Shallow Area Balance
Data Range 15

July 1990
Revision: Final

TEST RUN 5
500°F/24 HOURS

1311R2

11/25/89

DATA SHEET 1
PAGE 1 OF 2

End of Test T-5 8/2/89

Date 7/25/89
Time 2:30

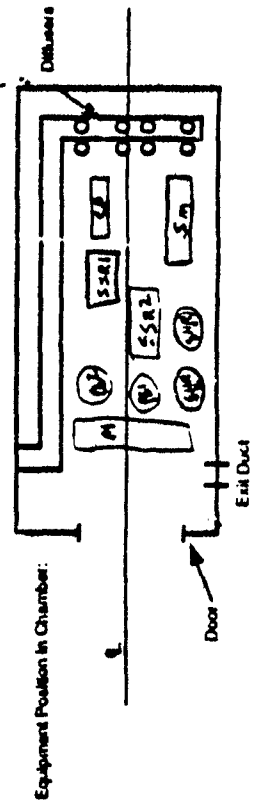
Test Run TEST T-5
Test Duration 2.4 hrs
Heat Up Rate →
Flash Chamber Temperature 500 °F

Flash Chamber Interior

Equipment Type	Contaminant(s)	Dimensions L x H x W	Initial Wt (lbs)	Final Wt (lbs)	Sample Type	Equipment Spilled	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. PB 1		15" x 15" x 15"	5	6					12	NO LIP. SIZE HAS BEEN SIDE CENTER.	
2. PB 2		15" x 15" x 15"	8	10					15	1.25	
3. SHR 1		7" x 7" x 7"	11	12					2		
4. SHR 2		7" x 7" x 7"	10	12							
5. SSR 1		15" x 15" x 15"	8.6	86.5					11	16.5	
6. SSR 2		15" x 15" x 15"	8.4	85.5					12	17.5	
7. SM		35" x 27" x 35"	72.5	72.2					9	9.5	
8. CP			100	85.5					7		
9. Motor			922	919							OIL STAINED
10. Motor											
11. Wall											
12. Wall											
13. Roof											
14. Floor											
15.											

OIL LEAKING OUT OF MOTOR CLEAN PLUG

SAMPLING TEMPLATE SIZE = 5" X 5"
POST TEST T-5 MOTOR SOAK - 2000
104 LITERS OF ACETONITRILE PLACED IN 55 gal drum. DRUM HT. = 35"
Solvent depth = 24"



177 876

Powder Box #1 - No Lip on top of Box. Lid does not close all the way.

Powder Box #2 - Rounded lip. Lacks in diameter than PB#1

Steam Heated Riser #1 - Good shape, both handles in tact.

SHR #2 - ORANGE PAINT ON SIDE of RISER. GOOD SHAPE

Shell Support Riser #1 - Larger in size. Several stained areas on bottom of Rack

SSR #2 - Smaller in height than SSR#1. Minimal bottom staining

Steel Pipe - 6 ft. in length. Black color. Purchased in West Chester, PA.

Clay Pipe - Flange end broken - 8" x 11 1/2" - Large amt of dirt



Ship Mine - Green in color. Same as all other ship mines

Date 23 July 81 Fa. Test Number T-5

Time	Main Panel							Air Heater				Air Heater				Propene Tank			Air Heater Discharge			Flash Chamber Discharge			Afterburner Discharge													
	MC-21 Air Heater Vent Air Flow	MC-22 Air Heater Vent Air Flow	MC-23 Air Heater Temperature	MC-24 T.O. main Air Temperature T-24	MC-25 Bag Pressure	MC-26 Back Air Valve Position	MC-27 T.O. Temperature	MC-28 Gas Pressure	MC-29 Burner Pressure	MC-30 Gas Pressure	MC-31 Burner Pressure	MC-32 Gas Pressure	MC-33 Dry Bulb Temperature and Relative Humidity	MC-34 Air Heater Discharge	MC-35 T.O. Temperature	MC-36 T.O. Pressure	MC-37 T.O. Temperature	MC-38 T.O. Pressure	MC-39 T.O. Temperature	MC-40 T.O. Pressure	MC-41 T.O. Temperature	MC-42 T.O. Pressure	MC-43 T.O. Temperature	MC-44 T.O. Pressure	MC-45 T.O. Temperature	MC-46 T.O. Pressure	MC-47 T.O. Temperature	MC-48 T.O. Pressure	MC-49 T.O. Temperature	MC-50 T.O. Pressure	MC-51 T.O. Temperature	MC-52 T.O. Pressure	MC-53 T.O. Temperature	MC-54 T.O. Pressure				
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1805 P. ...

Date 7/29/89 Test Number T-5

Time	Main Panel						Air	Alarm	Propane Tank				Propane Tank			Afterburner Discharge		
	At Temp	At Temp	At Temp	At Temp	At Temp	At Temp			Cal	PSIG	F	PSIG	F	THC	CO	O ₂	THC	CO	O_{2}
0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

0940 - START PREHEAT
1045
0950 - OFF
wind off

1730 - Steady State

Date 7/20/89 Summary Test Number TS

Time	Main Panel						Air			Propane Tank			Propane Tank			Air			Flash Chamber Discharge			Afterburner Discharge		
	HC	CO	CO2	HC	CO	CO2	HC	CO	CO2	Temp	Pressure	Temp	Pressure	Temp	Pressure	HC	CO	CO2	HC	CO	CO2	HC	CO	CO2
0000	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0100	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0200	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0300	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0400	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0500	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0600	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0700	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0800	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0900	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1000	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1100	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1200	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1300	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1400	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1500	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1600	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1700	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1800	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1900	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2000	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2100	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2200	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2300	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2400	71.5	17.2	0.0	347	392	0.0	24.2	2.5	15.2	15.2	74	19	127	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

MAUS WOODMAN

0130 - END STACK TEST 2

STACK TEST #3 Begins at 1215 hrs

1715 - STACK TEST #3 COMPLETE.

1730 - End T-5.

DEJIN COOL DOWN

7/20/89 Afterburner shut down @ 0130 hrs. Maybe on auto @ 0245 hrs to attempt a restart of T.O. system would NOT START.

- 0940, 7/31/89 - afterburner system running

15

AREN BURNER RE-LIT AT 9:40 AM AFTER BURNING 15 MIN.

DATA SHEET 2
PAGE 4 OF 5

4

DATE 7/31/89 Test Number 15 (Cool Down)

Time	Main Panel				Propose Tank				Propose Tank				Alterbacter Discharge					
	At Heater Vent Center PC 20	At Heater Vent Air Flow PC 21	At Heater Temperature TC 20A	TC Air In TC 21A	Temp. Gas TC 22	Gas Pressure PC 23	Head Air Vent Pressure PC 24	TC 1 Temperature TC 25	TC 2 Temperature TC 26	TC 3 Temperature TC 27	TC 4 Temperature TC 28	TC 5 Temperature TC 29	TC 6 Pressure PC 30	TC 7 Pressure PC 31	TC 8 Pressure PC 32	TC 9 Pressure PC 33	TC 10 Pressure PC 34	
02:30																		
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100 T.O. AT 5:00 PM
1020 P.W. 3:15 PM

REC'D 9/20/89
PROPANA 1200 HRS
7/31/89

REMOVED 17:00 F
8:30 PM
17:00 P.T.O. M
8:45 PM

*

17:00

Date: 5/1/89 Test Number: TS

Time	Main Panel							Propane Tank			Air Heater Discharge			Flash Chamber Discharge			Afterburner Discharge			
	HC-21 Air Heater Inlet Discharge	HC-21 Air Heater Inlet Air Flow	HC-21 Air Heater Temperature	TC-204 Air Heater Temperature	TC-204 T O Heat Air Temperature T1-204	HC-21 Bag Pressure	HC-21 Bag Pressure	HC-21 Bag Air Flow	HC-21 T.O. Temperature	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	HC-21 HC-21	
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27 July 84 Sub. by T-5 30157 / 20 1100

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1130	34	22	257	312	336	303	327	321	312	320	357	339	389	356	360	297	322	359	292	226	274	226	274	226	274	226	274	226	274	226	274
1230	353	191	211	165	374	356	373	271	242	382	400	311	281	111	274	350	243	291	291	291	291	291	291	291	291	291	291	291	291	291	291
1330	382	215	223	178	359	371	333	311	308	373	205	320	305	200	202	310	315	312	312	312	312	312	312	312	312	312	312	312	312	312	312
1430	710	235	276	304	471	370	394	335	325	430	22	352	327	11	324	315	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
1530	443	257	271	270	400	437	447	361	360	450	257	391	229	354	408	370	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371
1630	464	273	287	271	474	451	469	371	371	464	20	378	241	375	443	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371
1730	715	301	315	150	505	483	465	415	410	494	270	415	407	260	405	375	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410
1830	304	320	333	204	514	507	502	447	421	512	210	427	270	404	470	470	470	470	470	470	470	470	470	470	470	470	470	470	470	470	470
1930	305	327	370	275	222	302	307	440	433	510	213	447	212	450	478	478	478	478	478	478	478	478	478	478	478	478	478	478	478	478	478
2030	317	311	353	247	325	304	305	455	445	500	301	405	412	271	470	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460
2130	312	303	303	215	230	310	319	470	467	520	314	460	422	350	449	511	478	478	478	478	478	478	478	478	478	478	478	478	478	478	478
2230	331	308	375	305	304	327	324	461	460	510	306	478	460	311	463	520	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460
2330	35	319	303	313	310	350	321	485	475	526	334	482	470	317	461	524	469	505	477	477	477	477	477	477	477	477	477	477	477	477	477

Key:
Powder Boxes - PB
Shell Support Rack - SSR
Clay Pipe - CP
Ship Mine - SM
Steam Heated Riser - SHR
Steel Pipe - SP
Aluminum Pipe - AP
Motor with Gear Reducer - M
Steam Heated Discharge Valve - SDV

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
0030	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571		
0130	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541		
0230																																
0330	110	70	70	70	110	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70		
0430	110	70	70	70	110	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
0530	110	70	70	70	110	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
0630	110	70	70	70	110	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
0730	110	70	70	70	110	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
0830																																
0930	110	70	70	70	110	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
1030	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1130	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1230	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1330	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1430	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1530	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1630	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1730	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1830	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
1930	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
2030	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
2130	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
2230	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	
2330	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	

Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SIRR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

THIS IS THE
 PARTS LIST

7/31/87 15

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130																															
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1030	203	198	213	221	189	227	177	266	209	253	208	205	202	196	201	203	206	200	204	197											
1130																															
1230																															
1330																															
1430																															
1530	170	187	205	210	179	191	168	194	170	217	190	192	180	184	170	172	173	187	192	186											
1630	180	186	204	207	177	189	167	192	167	215	174	170	187	182	187	177	172	187	190	184											
1730	183	184	198	206	175	176	166	177	185	212	192	187	185	180	185	191	187	184	187	182											
1830	183	182	196	205	173	177	167	187	183	207	170	185	187	183	187	187	183	185	185	180											
1930	185	183	197	205	177	184	163	186	181	207	188	184	181	177	181	187	185	181	184	178											
2030	178	179	193	201	169	180	160	183	178	204	186	181	179	175	180	183	180	182	174												
2130																															
2230																															
2330																															

Key:

- Powder Boxes - PB
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- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SHR
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- Motor with Gear Reducer M
- Steam Heated Discharge Valve - SDV

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip. PB																														
0050																														
0130																														
0230																														
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1930																														
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2130																														
2230																														
2330																														

Test Number	1-5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Temperature	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Humidity	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Moisture	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Flow	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Pressure	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Velocity	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Concentration	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Flow Rate	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Temperature	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Humidity	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Moisture	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Flow	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Pressure	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Velocity	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Concentration	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Flow Rate	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

General Notes:
1. All data are approximate.
2. All measurements are in feet unless otherwise noted.

DATA SHEET 4
PAGE 1 OF 7

12-Jan-80

Tank Number	Temp	Temp		Temp		Flow	Flow			Flow			Inlet	Outlet	Shell	Support	
		25-Jul-79	28-Jul-79	31-Jul-79	3-1-Aug-79		5-Aug-79	8-Aug-79	11-Aug-79	14-Aug-79	17-Aug-79	20-Aug-79					23-Aug-79
1075	6007	6432	6279	6112	5442	5279	5112	5442	5279	5112	5442	5279	5112	5442	5279	5112	5442
1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099
1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117
1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137
1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167
1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197
1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237

July 1990
Revision: Final

TEST RUN 8
400°F/36 HOURS

1311R2

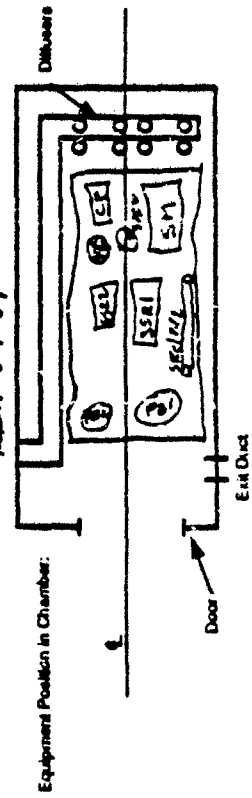
DATA SHEET 1
PAGE 1 OF 1

Test Run T-B Date 8/3/89
 Test Duration 36 Mins Time _____
 Heat Up Rate _____
 Flash Chamber Temperature 400°F

Flash Chamber Inlet

Equipment Type	Contaminant(s)	Dimensions (L x H x W)	Initial Wt (lbs.)	Final Wt (lbs.)	Sample Type	Equipment Label	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. SHR 1		9 1/4 x 7 1/2	11	11.5					10 (150)		
2. SHR 2		9 1/4 x 7 1/2	11.5	11.5					10		
3. PB 1		11 1/2 x 11 1/2	8.5	8.5					11		
4. PB 2		11 1/2 x 11 1/2	8.5	10.5							
5. SS R 1		15 1/2 x 15 1/2	7	70.5							
6. SS F 2		15 1/2 x 15 1/2	85.5	85.0					6 (150)		
7. SHR Dye		2 1/2 x 2 1/2	20.5	20.5							
8. SHR Shell		8 3/4 x 2 1/2	719	719					20 (100)		
9. SHR		11 1/2									
10. CLM 10E		19 1/2 x 19 1/2	191	19.5							
11.		2 1/2 x 2 1/2									
12.											
13.											
14.											
15.											

NOTES: ① All Equipment weighed on SCALE PROVIDED BY DEB
 ② AT SSR SKED w/ 4" x 4" TEMPLATE



5
204015
204015
204015

①

180

TEST

DATA SHEET 2
PAGE 1 OF 6

Date 3 Aug 89 Test Number TX 400 F / 36 hrs

Time	Main Panel								Propane Tank				Airborne Discharge					
	At 1800 F	At 1800 F	At 1800 F	At 1800 F	At 1800 F	At 1800 F	At 1800 F	At 1800 F	Gas	Temp	Pressure	Flow	Temp	Pressure	Flow	Temp	Pressure	Flow
0000																		
0120																		
0200																		
0300																		
0400																		
0500																		
0600																		
0700																		
0800																		
0900																		
1000																		
1100																		
1200																		
1300																		
1400																		
1500																		
1600																		
1700																		
1800																		
1900																		
2000																		
2100																		
2200																		
2300																		
2400																		

2315 hrs - PRE HEATED
 AT 1800 F
 1300 - T.O @ 2000 F
 2315 hrs - PRE HEATED
 STARTED - (T.O. Temp)
 AT 1800 F

2

DATA SHEET 2
PAGE 2 OF 6

Friday

Date 4 AUG. 89 Test Number T-8 400°F/36hrs

Time	Main Panel						Air Inlet			Air Filter			Propene Tank			Air Heater Discharge			Flash Chamber Discharge			Afterburner Discharge										
	Temp °C	Temp °F	Pressure PSI	Flow L/min	Flow SCFM	Flow GPM	Temp °C	Temp °F	Pressure PSI	Flow L/min	Flow SCFM	Flow GPM	Temp °C	Temp °F	Pressure PSI	Flow L/min	Flow SCFM	Flow GPM	Temp °C	Temp °F	Pressure PSI	Flow L/min	Flow SCFM	Flow GPM	Temp °C	Temp °F	Pressure PSI	Flow L/min	Flow SCFM	Flow GPM		
0000	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0100	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0200	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0300	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0400	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0500	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0600	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0700	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0800	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
0900	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1000	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1100	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1200	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1300	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1400	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1500	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1600	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1700	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1800	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
1900	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
2000	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
2100	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
2200	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348
2300	120	248	1.07	530	184	0.05	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348	1.07	184	348

S. 90 AM
STEADY STATE
ACHIEVED.
→ Max temp of 400F
Temperature 310
LP flow 500
0.14 at 950
0.14 at 950
8:18

1000 - (Bal Latin from Calk
Gus here to check tank
78% full. Wants us to
let him or his office know
when we are running & shut
in to don't have to come &

2059 hrs - in to check on system.
running okay. High building
press. clean going off but
nothing shut down. Looks okay
exit gas temp high - lowered

building ok...

(3)

2-230 City records with 2000-01 AS follows:
 All in 2000 40%
 Right out " 21%
 T.O. 1800's P. (75% Run)

Sub.
 Date 5 Aug 89 Test Number 78 400°/36 hrs

Time	Main Panel				Air Pressure	Air Temp	Propane Tank				Propane Tank											
	Pressure	Temp	Flow	Level			Pressure	Temp	Flow	Level	Pressure	Temp	Flow	Level								
0030																						
0100	127	413	267	0.05	0.16	106	70	19	34	5.4	402											
0200	127	374	247	0.05	106	106	70	17	48	7.8	36											
0300	127	374	247	0.05	106	106	70	17	48	7.8	36											
0400	127	374	247	0.05	106	106	70	17	48	7.8	36											
0500	127	374	247	0.05	106	106	70	17	48	7.8	36											
0600	127	374	247	0.05	106	106	70	17	48	7.8	36											
0700	127	374	247	0.05	106	106	70	17	48	7.8	36											
0800	127	374	247	0.05	106	106	70	17	48	7.8	36											
0900	127	374	247	0.05	106	106	70	17	48	7.8	36											
1000	127	374	247	0.05	106	106	70	17	48	7.8	36											
1100	127	374	247	0.05	106	106	70	17	48	7.8	36											
1200	127	374	247	0.05	106	106	70	17	48	7.8	36											
1300	127	374	247	0.05	106	106	70	17	48	7.8	36											
1400	127	374	247	0.05	106	106	70	17	48	7.8	36											
1500	127	374	247	0.05	106	106	70	17	48	7.8	36											
1600	127	374	247	0.05	106	106	70	17	48	7.8	36											
1700	127	374	247	0.05	106	106	70	17	48	7.8	36											
1800	127	374	247	0.05	106	106	70	17	48	7.8	36											
1900	127	374	247	0.05	106	106	70	17	48	7.8	36											
2000	127	374	247	0.05	106	106	70	17	48	7.8	36											
2100	127	374	247	0.05	106	106	70	17	48	7.8	36											
2200	127	374	247	0.05	106	106	70	17	48	7.8	36											
2300	127	374	247	0.05	106	106	70	17	48	7.8	36											
2400	127	374	247	0.05	106	106	70	17	48	7.8	36											

0830 AM
 City and Paul
 Arrive - Exit Gas
 ~480° @ 600 RPM
 on Air Monitor
 because of 12.6

Leaving site
 12:15 with
 All over power of 570
 On-site 1735
 Exit Gas 1/4
 at 5700
 1735 started
 Run, 2300 to
 end 36 hours
 Run

2030 (on from secondary control)
 2050 (on from secondary control)
 2100 (on from secondary control)
 2130 (on from secondary control)

1835 - T.O. Temp out over to low temp. 41700
 Pressure to 1070 Below Page Controller and
 following. Data up to 1735 at 1830. Later

(4)

DATA SHEET 2
PAGE 4 OF 6

Sundul
Date 6 Aug 1989 Test Number TB 400 / 36 hrs

0915 high peak
ringing in gas
line? Is this
normal?
- no TIC reading
Paul Calibrating.

Time	Main Period						After			Propene Tank			Propene Tank			Alteburner Discharge				
	R Heater P-201 T-201	R Heater P-202 T-202	R Heater P-203 T-203	R Heater P-204 T-204	R Heater P-205 T-205	R Heater P-206 T-206	Pressure P-207	Pressure P-208	Pressure P-209	Temp T-210	Temp T-211	Temp T-212	Temp T-213	Temp T-214	Temp T-215	Temp T-216	Temp T-217	Temp T-218	Temp T-219	
0500																				
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DATA SHEET 2
PAGE 5 OF 6

11-17-78
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Monday
 Date 7 AUG 89 Test Number 78 400°/36 hrs

Time	Main Panel										Propose Test			Flame Characteristics		Air Heater Discharge		Flue Gas Discharge	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0020	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0030	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0035	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0040	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0045	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0050	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0055	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0140	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0155	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0225	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0230	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0235	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0240	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0245	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0250	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0255	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

0000 - T.O. Temp 1000°
 1000° - Fuel valve at 100% - ramp on 1000°
 & not running yet

0655 - leave site (yuh) 10:18
 0518 - T.O. burner ignited up & running.
 0526 - T.O. Temp 1000°

0515 - mistake as I was getting into the truck to leave I noticed the building lights go out. I thought it strange that the electric eyes would shut off so early (yuh)

0137 - Burner began exit off - system down
 0203 - RTS on-site. Floor failed, with warning alarm. low temp.
 0206 - got T.O. burner going. T.O. Temp 1000°

(6)

DATA SHEET 2
PAGE 6 OF 6

Tuesday
Date 8 Aug 1989 Test Number T 8 400/36 hrs.

Time	Main Period						Air Preheater			Propane Tank			Air Heater Discharge		Flash Chamber Discharge			Afterburner Discharge			
	HC-201 Air Heater Inlet Air Flow	P-202 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	HC-201 Air Heater Inlet Air Temp	
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1600																					
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2200																					
2300																					

0600 SYSTEM TRIPPED DUE TO POWER SURGE
0625 CITY AND P.S. ONSTAY ALL EQUIP. $\angle 120^\circ$
SO SHUT SYSTEM (I.E. AND AMU) DOWN.

0715 - MATHEX FAILED IN REVERSE SURGE
0930-1000 CITY AND P.S. OFFLINE FLASH CHAMBER
Received thru...

8/3/89 Afterburner Ignition 12:05 PM

T8

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130																															
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Key:
 Powder Boxes - PB
 Shell Support Rack - SSR
 Clay Pipe - CP
 Ship Mine - SM
 Steam Heated Riser - SHR
 Steel Pipe - SP
 Aluminum Pipe - AP
 Motor with Gear Reducer - M
 Steam Heated Discharge Valve - SDV

Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130																															
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DATA SHEET 3
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(58) 5 Aug 89 78 400/36hrs

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030 31	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
0130 36																															
0230 31	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
0330	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
0430 31																															
0530 415	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
0630 41	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
0730 41																															
0830 413	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
0930 411	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1030 415	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1130 416	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1230 417																															
1330 418	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1430 419	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1530 511	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1630 11																															
1730 11	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1830 11	90	65	65	70	36	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
1930 11																															
2030 11																															
2130 11	237	244	262	277	289	197	223	231	211	172	159	215	211	178	210	219	214	225	185	245											
2230 510	237	244	262	277	289	197	223	231	211	172	159	215	211	178	210	219	214	225	185	245											
2330 510	237	244	262	277	289	197	223	231	211	172	159	215	211	178	210	219	214	225	185	245											

Key:
Powder Boxes - PB
Shell Support Rack - SSR
Clay Pipe - CP
Slap Mine - SM
Steam Heated Riser - SHR
Steel Pipe - SP
Aluminum Pipe - AP
Motor with Gear Reducer - M
Steam Heated Discharge Valve - SDV

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
0230	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
0330																															
0430	40	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
0530	35	35	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
0630																															
0730	35	35	35	42	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
0830	35	35	35	42	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
0930-0940	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	
1030	164	165	179	194	157	143	176	134	145	143	138	153	157	141	152	157	151	149	154	157	157	157	157	157	157	157	157	157	157	157	
1130																															
1230	35	35	35	40	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
1330	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
1430																															
1530	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
1630	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
1730																															
1830	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
1930	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
2030																															
2130	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
2230	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
2330																															

400°/36 hrs

Test: T8

Date: Mon. 7 Aug 89

Equip.	Key:																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030	PB																														
0130																															
0330																															
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1830																															
1930																															
2030																															
2130																															
2230																															
2330																															

O AUG 1407 700 136 1408.

WEEKLY PAGE 01 00

Equip.	Key:																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
0230	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
0330																															
0430	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
0530																															
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2230																															
2330																															

Powder Boxes - PB
 Shell Support Rack - SSR
 Clay Pipe - CP
 Ship Mine - SM
 Steam Heated Riser - SHR
 Steel Pipe - SP
 Aluminum Pipe - AP
 Motor with Gear Reducer - M
 Steam Heated Discharge Valve - SDV

0715 MOLYBDENE TRAILER IN POWER OUTAGE

11-Jun-80

Test Number		600 Deg F		300 Deg F		200 Deg F		100 Deg F		50 Deg F		25 Deg F	
Temperature		Steady State Start		Steady State Stop		Test Bed		Air After		Propane Line		Flue Gas	
Time		15		30		122		122		122		122	
Date of Test		3-Aug-80		3-Aug-80		3-Aug-80		3-Aug-80		3-Aug-80		3-Aug-80	
Elapsed	Air	Air	After	After	After	After	After	After	After	After	After	After	After
Time	Burner	Burner	Inlet	Outlet	Pressure	Temp	Pressure	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Temp	Pressure	Temp	Pressure	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Inlet	Inlet	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
	Burner	Burner	Temp	Pressure	Pressure	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp

Steady State Values
Data Range 11

Test No	11	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Total	975.70	17.77	9132.00	632.00	-0.81	25317.00	210.60	20.50	185.00	34.70	620.60	225.00	1515.00	1373.20	1195.60	8.00
Flow	63.81	1.27	623.25	232.00	-0.06	1631.21	15.04	1.50	11.54	0.82	70.03	19.00	126.73	40.26	28.26	0.19
Maxima	70.00	1.37	130.20	261.00	-0.05	1015.00	17.00	3.16	15.20	7.10	70.00	20.00	62.10	61.20	6.25	3.00
Minima	65.10	1.24	645.00	257.00	-0.05	1002.00	8.00	0.00	14.20	6.40	60.00	19.00	118.00	0.00	6.00	5.65

11 Jan 88

Test Number	T-4	Box 8	28	34	41	42	43	44	45
Temperature									
Time	600	200	300	400	500	600	700	800	900
Steady State Flow	100	100	100	100	100	100	100	100	100
Test End									
Air	Air	After	After	After	After	After	After	After	After
Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner
Line	Line	Line	Line	Line	Line	Line	Line	Line	Line
Inlet	Inlet	Inlet	Inlet	Inlet	Inlet	Inlet	Inlet	Inlet	Inlet
Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp
Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure
CO	CO	CO	CO	CO	CO	CO	CO	CO	CO
CO2	CO2	CO2	CO2	CO2	CO2	CO2	CO2	CO2	CO2
NOx	NOx	NOx	NOx	NOx	NOx	NOx	NOx	NOx	NOx

(Hours)	10	15	20	25	30	35	40	45	50
200-204	210-214	215-219	220-224	225-229	230-234	235-239	240-244	245-249	250-254
(1000)	(1000)	(1000)	(1000)	(1000)	(1000)	(1000)	(1000)	(1000)	(1000)
Box 8	10	15	20	25	30	35	40	45	50
Total	127.0	25.4	1292.0	3791.0	-1.02	25311.0	292.0	27.5	232.0
Mean	6.3	6.4	26.4	26.7	-0.05	1652.6	15.1	1.5	14.6
Maximum	90.0	1.27	220.0	261.0	-0.03	1621.0	17.0	2.0	15.2
Minimum	65.0	1.87	665.0	183.0	-0.89	1682.0	0.0	0.0	14.2

Box 9	55	60	65	70	75	80	85	90	95
Total	137.0	23.4	1282.0	3791.0	-1.02	25311.0	292.0	27.5	232.0
Mean	6.3	6.4	26.4	26.7	-0.05	1652.6	15.1	1.5	14.6
Maximum	90.0	1.27	220.0	261.0	-0.03	1621.0	17.0	2.0	15.2
Minimum	65.0	1.87	665.0	183.0	-0.89	1682.0	0.0	0.0	14.2

Box 10	100	105	110	115	120	125	130	135	140
Total	137.0	23.4	1282.0	3791.0	-1.02	25311.0	292.0	27.5	232.0
Mean	6.3	6.4	26.4	26.7	-0.05	1652.6	15.1	1.5	14.6
Maximum	90.0	1.27	220.0	261.0	-0.03	1621.0	17.0	2.0	15.2
Minimum	65.0	1.87	665.0	183.0	-0.89	1682.0	0.0	0.0	14.2

Box 11	145	150	155	160	165	170	175	180	185
Total	137.0	23.4	1282.0	3791.0	-1.02	25311.0	292.0	27.5	232.0
Mean	6.3	6.4	26.4	26.7	-0.05	1652.6	15.1	1.5	14.6
Maximum	90.0	1.27	220.0	261.0	-0.03	1621.0	17.0	2.0	15.2
Minimum	65.0	1.87	665.0	183.0	-0.89	1682.0	0.0	0.0	14.2

13 Jan 80

Tank Number	Tank Name	Tank No	Inlet		Outlet		Internal		Surface		Internal		Surface		Internal	
			Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp
0000																
0100																
0200																
0300																
0400																
0500																
0600																
0700																
0800																
0900																
1000																
1100																
1200																
1300																
1400																
1500																
1600																
1700																
1800																
1900																
2000																
2100																
2200																
2300																
2400																
2500																
2600																
2700																
2800																
2900																
3000																

Shandy Plant Station
13 Jan 80

July 1990
Revision: Final

TEST RUN 13
500°F/12 HOURS

1311R2

DATA SHEET 1
PAGE 1 OF 1

1906 - 1350
Mauli & And
Sulphur up to do At-test
Sampling.

Date 8-7-89
Time _____

Test Run 500°/12 hrs
Test Duration _____
Heat-Up Rate _____

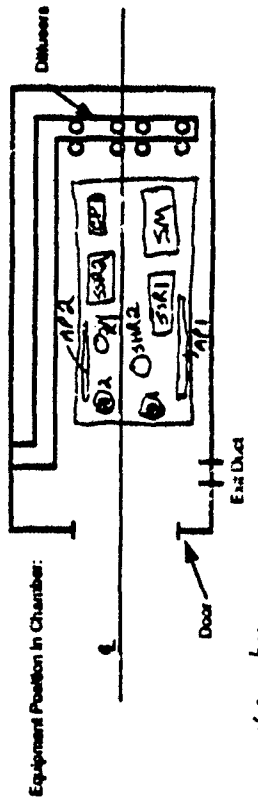
Test 13

Flash Chamber Temp at zero _____
Flash Chamber Interior _____

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt (lbs.)	Final Wt (lbs.)	Final Wt (lbs.)	Sample Type	Equipment Skid	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Our Solutions Pre-Test	Our Solutions Post-Test
1. PBI	TNT	13 1/2" x 14"	8.4	8.4	8.4							
2. PBR	TNT	4 1/2" x 8" x 8"	7.5	8.4	8.4							
3. SHR1	TNT	12" x 9" x 4"	11.5	12.0	12.0							
4. SHR2	TNT	12" x 9" x 4"	11.5	12.0	12.0							
5. SSR1	TNT	30" x 30" x 30"	16.5	16.5	16.5							
6. SSR2	TNT	30" x 30" x 30"	16.5	16.5	16.5							
7. API	TNT	5 1/2" x 5 1/2" x 5 1/2"	5.5	5.5	5.5							
8. APR	TNT	5 1/2" x 5 1/2" x 5 1/2"	5.5	5.5	5.5							
9. CP	TNT	11 1/2" x 11 1/2" x 7 1/2"	7.2	6.5	6.5							
10. SM	TNT	11 1/2" x 11 1/2" x 7 1/2"	7.2	7.1	7.1							
11.												
12.												
13.												
14.												
15.												

← some c. hydration
→ small drop of ethylamine c. 1/2 caught on ric. used ethylamine to put c. 1/2. Some cleared spots looko okay.

↳ Pre-test sampling. OVA readings U in control room, 20.70 in next to the sampling area.



10:15 AM 8-14-89 - open door on Chamber

Air Test - 8-14-89 1:56 PM Chamber Temp 103°F D.C.

Post Test Sampling 8-14-89 RWB hrs - 1630 hrs -

①

Test No.

Date 8/9/89 Test Number T13 500°F/12 hrs

Time	Main Panel				Air Preheater				Propene Tank				Propene Tank				Air Heater Discharge				Flash Chamber Discharge				Aburner Discharge								
	Temp	Pressure	Flow	Level	Temp	Pressure	Flow	Level	Temp	Pressure	Flow	Level	Temp	Pressure	Flow	Level	Temp	Pressure	Flow	Level	Temp	Pressure	Flow	Level	Temp	Pressure	Flow	Level	Temp	Pressure	Flow	Level	
0000																																	
0100																																	
0200																																	
0300																																	
0400																																	
0500																																	
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0700																																	
0800																																	
0900																																	
1000																																	
1100																																	
1200	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11		
1300	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11		
1400	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
1500	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
1600	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
1700	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
1800	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
1900	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
2000	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
2100	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
2200	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
2300	116	0.5	31	57	0.17	0	375	12/68	163	0	11.9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	

NOTE: Problem of the Molytek this test. Some of the thermocouples were bad & replaced with new ones (channel #2 6, 16 & 18) (ISE Channel 6 to monitor chamber temp since channel 8 - Exilgo doesn't seem to be reading correctly.

1233 - limits proved (T.O.) - fan running
 1235 - T.O. burner ignited - system running
 1300 - TIC analysis set on yet due to low amt. of H2
 2014 - all power down for 1.5 sec.
 2020 - T.O. burner re-ignited & 40 sec

→ b.u.s.!

Friday
8/11/89

Date 8/11/89 Test Number T-13 500°F / 12 hrs.

Time	Main Panel				Air Exhaust	Amb. Temp	Propene Tank		Air Heater Discharge	Flash Chamber Discharge	Alkylburner Discharge				
	Temp	Pressure	Flow	Level			HC	CO			CO ₂	HC	CO	CO ₂	
0000	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0100	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0200	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0300	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0400	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0500	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0600	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0700	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0800	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
0900	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1000	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1100	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1200	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1300	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1400	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1500	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1600	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1700	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1800	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
1900	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
2000	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
2100	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
2200	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
2300	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0
2400	10.0	0.11	27	0.08	0	100	0	0	OFF	0	0	0	0	0	0

(Thurs. 8-10 423.5 hrs
Started cool down)

DATA SHEET 2
PAGE 4 OF 5

Start
Date: 8/12/87
Test Number: 713 3rd 12 AM

Time	Main Panel				Air Handler				Propane Tank				Propane Tank													
	HC-301 Air Handler Fuel Air Flow P-302	HC-301 Air Handler Fuel Air Flow P-302	TC-304 Air Handler Temperature	TC-304 10 inch Air Temperature	TC-221 Gas Pressure	TC-221 Gas Pressure	TC-221 Gas Pressure	TC-221 Gas Pressure	TC-304 Dry Bulb Temperature and Relative Humidity	TC-304 Dry Bulb Temperature and Relative Humidity	TC-304 Gas Pressure	TC-304 Gas Pressure	TC-304 Gas Pressure	TC-304 Gas Pressure	TC-304 Gas Pressure	TC-304 Gas Pressure										
8:00																										
9:00																										
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5

DATA SHEET 2
PAGE 5 OF 5

Sunday
Date 8/13/89 Test Number T13 500/126

Time	Main Panel				Air				Alter.		Propose Tank			Propose Tank			Airburner Discharge			
	HC-501 Air Heater Exit Air Flow P-500	HC-501 Air Heater Temperature TC-504	HC-501 T.O. Exit Air Temperature T-504	HC-501 Exit Air Valve Position PC-501	HC-501 T.O. Temperature TC-504	HC-501 Air Pressure P-500	HC-501 Dry Bulb Temperature and Humidity Control	HC-501 Gas Pressure P-500	HC-501 Burner Pressure P-510	HC-501 Gas Pressure P-500	HC-501 Burner Pressure P-510	HC-501 Gas Pressure P-500	HC-501 T.O. Temperature	HC-501 T.O. Pressure	HC-501 T.O. Pressure	HC-501 T.O. Pressure	HC-501 T.O. Pressure	HC-501 T.O. Pressure	HC-501 T.O. Pressure	HC-501 T.O. Pressure
0000																				
0100																				
0200																				
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2000																				
2100																				
2200																				
2300																				
2400																				

8:19
8:40 S.A.F.S. SYSTEM DOWN

12:15 (1.25)

Monday 8/14 8:00 15 21 52 2045 12:15 (1.25)

7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Key: STEAM
STATE AT
10:30

Powder
Boxes - PB

Shell Support
Rack - SSR

Clay Pipe
- CP

Ship Mine
- SM

Steam
Heated
Riser - SHIR

Steel Pipe
- SP

Aluminum
Pipe - AP

Motor with
Gear
Reducer - M

Steam
Heated
Discharge
Valve - SDV

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
0030																																
0130	282	283	537	416	247	477	417	214	159	83	106	120	109	41	744	46	151	203	130	177	117	135										
0230	301	92	144	158	210	510	308	208	208	153	152	155	189	170	57	27	26	219	308	207	205	158	214									
0330	367	371	468	166	575	673	377	376	330	450	223	228	281	253	106	315	384	304	425	22	205	219	204									
0430	328	165	25	145	377	54	46	371	365	346	468	222	305	222	134	383	265	363	457	317	357	317	335									
0530	401	182	220	210	410	675	424	377	381	571	275	341	328	288	65	41	114	141	23	382	367	319	357									
0630	457	210	253	376	482	700	469	467	410	409	300	282	300	344	197	453	467	467	502	207	307	407	400									
0730	450	210	257	187	422	607	100	415	404	372	378	376	425	417	380	322	307	486	484	505	410	425	457									
0830	493	265	207	277	462	781	201	450	451	766	376	425	417	380	322	307	486	484	505	410	425	457	457									
0930	(576)	34	319	271	272	715	535	481	450	481	474	465	487	484	445	262	676	376	572	471	492	483	512									
1030	516	246	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376									
1130	552	440	783	320	511	715	550	506	445	483	453	501	201	413	210	577	563	593	577	521	503	473	527									
1230	551	307	378	377	557	778	570	518	508	471	467	508	511	471	283	577	571	580	606	635	515	466	541									
132695	445	323	345	525	506	711	535	481	453	477	460	453	460	453	440	192	534	523	527	575	477	477	494									
1430	422	307	364	350	678	716	57	478	410	347	455	475	473	476	171	574	557	583	576	574	504	477	534									
1530	468	285	371	347	578	723	570	570	365	349	476	340	477	205	194	574	606	578	630	549	533	513	482									
1630	476	305	347	322	606	787	609	483	557	357	324	277	470	210	214	612	577	603	638	577	549	540	574									
1730	100	30	50	40	100	355	35	35	35	45	45	45	45	45	45	45	45	45	45	45	45	45	45									
1830																																
1930																																
2030																																
2130	508	467	300	155	670	670	422	461	708	472	450	378	472	366	337	609	653	609	666	633	608	623	637									
2230	607	482	35	483	620	822	531	163	415	470	420	507	445	35	455	530	502	587	603	609	603	609	630	646								
2330	465	376	286	470	411	368	493	249	240	261	337	466	309	374	267	484	574	574	669	500	488	483	471									

(2)

1258 - powder outage.
1320 - AH. back up & running
T.O. INLET T. meaning SIE at 1030 P.M. - SHUTDOWN

1770576

SWT 112 hrs.

110

08/11/01 11:00

Equip.	Kcs.																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
0030																																
0130																																
0230	10	50	10	10	50	10	10	50	10	10	50	10	10	50	10	10	50	10	10	50	10	10	50	10	10	50	10	10	50	10	10	
0330																																
0430																																
0530																																
0630																																
0730	30	40	30	50	40	30	40	30	50	40	30	40	30	50	40	30	40	30	50	40	30	40	30	40	30	50	40	30	40	30		
0830																																
0930	203	212	175	241	209	157	201	102	153	153	171	138	167	177	166	223	233	201	130	22	261	206	221									
1030	203	206	175	243	204	153	197	109	142	153	175	144	170	187	178	218	229	217	208	219	257	207	217									
1130	201	204	172	237	201	153	197	117	160	183	170	172	172	174	179	220	214	222	217	257	207	217										
1230	200	201	177	235	198	150	187	104	161	180	171	149	172	186	189	207	217	208	214	207	219	176	200									
1330	197	197	179	228	197	141	186	106	161	180	179	152	173	187	186	205	212	203	209	201	205	193	203									
1430	15	23	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14									
1530																																
1630																																
1730																																
1830																																
1930	14	23	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14									
2030																																
2130																																
2230																																
2330	18	20	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14									

Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Strip Mine - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip.	PB																													
003045	163/167	178/180	187/190	197/200	207/210	217/220	227/230	237/240	247/250	257/260	267/270	277/280	287/290	297/300	307/310	317/320	327/330	337/340	347/350	357/360	367/370	377/380	387/390	397/400						
0130																														
0230																														
0330																														
0430	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
0530																														
0630																														
0730																														
0830																														
0930	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
1030																														
1130																														
1230	194/192	197/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197	198/197
1330	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
1430																														
1530																														
1630																														
1730																														
1830	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
1930																														
2030																														
2130																														
2230																														
2330	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP

5

Start 8/15/87 7:13 500' / 12 hrs.

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130																															
0230																															
0330	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	
0430																															
0530																															
0630																															
0730																															
0830																															
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1030																															
1190 / 1:00	122	121	143	117	76	113	110	112	118	112	118	118	122	130	117	133	118	117	117	117	117	117	117	117	117	117	117	117	117	117	
1230																															
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1830																															
1930																															
2030																															
2130																															
2230																															
2330																															

Key:
 Powder Boxes - PB
 Shell Support Rack - SSR
 Clay Pipe - CP
 Ship Mine - SM
 Steam Heated Riser - SHR
 Steel Pipe - SP
 Aluminum Pipe - AP
 Motor with Gear Reducer - M
 Steam Heated Discharge Valve - SDV

177-8976 112 113 124 121 128 82 107 99 107 104 105 103 102 93 116 107 109 107 107 106 137 104 106

DATA SHEET 4
PAGE 4 OF 8

12-Jun-90

Test Number	9-13	Row #	25		30		35		40		45	
Temperature	100 deg F	Start-up Start	20	25	30	35	40	45	50	55	60	65
Time	12 Hours	Steady State Start	20	30	40	50	60	70	80	90	100	110
% of Test	9-AM-10	Steady State Stop	50	60	70	80	90	100	110	120	130	140
		Test End	111	121	131	141	151	161	171	181	191	201
Blayload Time	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet	Air Inlet
	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet	Burner Inlet
	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet	Chamber Inlet
	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet	Exhaust Inlet
	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure	Propane Line Pressure
	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp	Propane Tank Temp
	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp	Chamber Temp
	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp	Exhaust Temp
	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber	Flash Chamber
	After Burner	After Burner	After Burner	After Burner	After Burner	After Burner	After Burner	After Burner	After Burner	After Burner	After Burner	After Burner
	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO	Exhaust CO
	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2	Exhaust CO2

Station	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00
Station	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00
Station	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00
Station	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00

Total Treatment Volume
Gals Range 13

DATA SHEET 4
PAGE 8 OF 8

11-Mar-69

Test Number	Run 6		Run 7		Run 8		Run 9		Run 10		Run 11		Run 12		Run 13		Run 14		Run 15	
500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F	500 Dig F
12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours	12 Hours
9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97	9-MS-97
Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start	Start
End	End	End	End	End	End	End	End	End	End	End	End	End	End	End	End	End	End	End	End	End
Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell	Shell
Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe	Clay Pipe
Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support
Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1	Rack 2	Rack 1
External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External	External
Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)	(Deg F)
27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
1015	678	452	372	372	1053	1187	1050	655	379	400	608	823	644	518	362	112	61	118	162	112
377	251	248	213	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372
644	482	378	443	488	488	488	488	488	488	488	488	488	488	488	488	488	488	488	488	488
112	77	64	116	117	96	118	162	112	61	106	113	109	111	-14	117	123	118	117	117	117
23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
8764	9250	8764	9250	8764	9250	8764	9250	8764	9250	8764	9250	8764	9250	8764	9250	8764	9250	8764	9250	8764
604	604	604	604	604	604	604	604	604	604	604	604	604	604	604	604	604	604	604	604	604
646	646	646	646	646	646	646	646	646	646	646	646	646	646	646	646	646	646	646	646	646
139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139

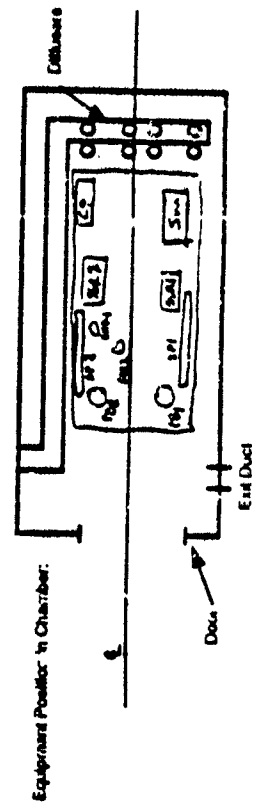
DATA SHEET 1
PAGE 1 OF 1

①

Test Run T114 Test Start Date: 8-15-89 Thurs.
 Test Duration 400° / 12 hrs. Test Stop Date: 8-18-89 Friday
 Heat Up Rate _____
 Flash Chamber Temperature 400° F

Equipment Type	Container(s)	Dimensions L H W	Initial Wt (lbs.)	Final Wt (lbs.)	Sample Type	Equipment Spilled	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouples	Pre-Test Observations	Post-Test Observations
1. P81	Explosives	17.5 x 13.5 x 8.0	8.0	8.0							
2. P82		27.5 x 17.5 x 8.5	8.5	8.5							
3. SHR1		27.0 x 17.5 x 12.0	11.5	11.5							
4. SHR2		27.0 x 17.5 x 11.5	12.0	12.0							
5. SSR1		27.0 x 17.5 x 8.0	8.0	8.0							
6. SSR2		27.0 x 17.5 x 8.5	8.5	8.5							
7. CP		27.0 x 17.5 x 9.0	9.0	9.0							
8. SPI		27.0 x 17.5 x 7.5	7.5	7.5							
9. SPI		27.0 x 17.5 x 8.0	8.0	8.0							
10. SPA		27.0 x 17.5 x 21.0	21.0	21.0							

8-18-89
 NOTE: Found to remove plastic covering on spike can inside the box. Plastic melted on SSR1 & 2. Took 4 test wipos as normal. will decide action after results are back.



8-18-89 0945 - System Shutdown & chamber door opened for and of T114
 Chamber Temp 1002 98° 183 66° 003

CNF started T.O.
 Flaming afterwards

TUES. Date 8-15-89 Test Number TH 400°F / 1/2 hrs.

Time	Main Panel					Air Temp	Temp	Propose Tank		Flue Gas			Alcuburner Discharge				
	Ar Heater Inlet	Ar Heater Outlet	Ar Heater Temp	TO Temp	TO Temp			Temp	Temp	Temp	Temp	Temp	Temp	Temp	Temp		
0000																	
0100																	
0200																	
0300																	
0400																	
0500																	
0600																	
0700																	
0800																	
0900																	
1000																	
1100																	
1200																	
1300																	
1400																	
1500																	
1600																	
1700																	
1800																	
1900																	
2000																	
2100																	
2200																	
2300																	

23:40 PUC BLANK FLAMING. CONTINUED.

23:55 ADVISE REPAIRS BEING MADE FROM BURN-OFF. START DRAW SYSTEM.

24:00 AFTER REPAIRS PROPANE STILL MISSING. RETURN TO NORMAL OPERATIONAL SCHEDULE. SYSTEM BEGAN OPERATING NORMALLY. SET PROPANE GAS VALVE TO 74%.

3

DATA SHEET 2
PAGE 3 OF 4

Thermostat
Date 17 AUG 1989
Total Number T14 100/1200

Time	Main Panel				Air Preheater	Abbr. Model	Propene Tank				Air Heater Discharge		Flash Chamber Discharge		Afterburner Discharge		
	At Heater Inlet Air Temp P-001	At Heater Inlet Air Temp P-002	At Heater Outlet Air Temp P-003	At Heater Outlet Air Temp P-004			CO	TEMP	CO	TEMP	TEMP	TEMP	THC	CO	CO	CO	CO
5:30																	
6:10																	
6:16																	
6:20																	
6:30																	
6:40																	
6:50																	
6:56																	
7:00																	
7:04																	
7:10																	
7:16																	
7:20																	
7:24																	
7:28																	
7:32																	
7:36																	
7:40																	
7:44																	
7:48																	
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9:36																	
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10:16																	
10:20																	
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11:04																	
11:08																	
11:12																	
11:16																	
11:20																	
11:24																	
11:28																	
11:32																	
11:36																	
11:40																	
11:44																	
11:48																	
11:52																	
11:56																	
12:00																	

8:30-8:50 hrs. - major wind storm came through - 70 mph winds high building press. alarm

FRIDAY
Date 12 AUG 89 Test Number T14 400 F / 12 hrs.

Time	Main Panel						Alt. Heater Discharge	Flame Chamber Discharge			Afterburner Discharge						
	TC 211	TC 212	TC 213	TC 214	TC 215	TC 216		THC	CO	CO ₂	THC	CO	CO ₂				
0000																	
0100																	
0200																	
0300																	
0400																	
0500																	
0600																	
0700																	
0800																	
0900																	
1000																	
1100																	
1200																	
1300																	
1400																	
1500																	
1600																	
1700																	
1800																	
1900																	
2000																	
2100																	
2200																	
2300																	

0445 - system shutdown for end of Test T14
opened chamber door.

1005 - Noted that plastic on SSR was left on during 1st test. Plastic melted. Mike Cosmos advised to take 4 Ast-Tact units as usual. I will discuss course of action with Mike.

DATE : 8-15-89 TUES.

TEST : T14 400°F / 12 hrs.

DATA SHEET 3
Page 1 of 4

Expt.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130																															
0230																															
0330																															
0430																															
0530																															
0630																															
0730																															
0830																															
0930																															
1030																															
1130																															
1230																															
1330	109	106	124	118	112	107	114	106	128	119	107	105	107	105	110	112	115	110	113	103											
1430	110	108	104	118	113	109	111	107	124	117	108	106	108	109	111	115	115	115	112	114	105										
1530	110	109	124	117	113	110	110	108	104	117	109	108	109	108	112	113	115	112	112	114	107										
1630	110	109	124	117	113	110	111	108	105	114	110	109	110	109	113	114	115	113	114	113	114	108									
1730	111	107	123	117	113	111	112	108	123	114	111	110	111	110	113	114	116	114	114	115	109										
1830	111	109	123	116	113	111	112	108	123	114	111	110	111	110	114	115	116	114	114	115	110										
1930	111	109	124	117	113	111	112	107	123	114	112	112	112	111	114	115	116	115	116	112											
2030	111	109	124	117	113	111	111	107	122	113	114	112	111	111	114	115	116	116	116	115	114										
2130	112	108	123	117	112	110	111	107	122	113	111	112	111	111	114	115	116	116	116	115	111										
2230	110	128	130	134	265	161	201	222	151	147	128	132	138	130	138	130	131	116	125	119											
2330	276	144	145	155	147	115	253	126	302	188	185	168	161	155	165	126	20	15	111	116											

Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

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also got high building press. alarm at about the same time.

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
0030	374	180	207	267	341	370	352	371	375	237	272	281	267	272	220	354	307	245	272	177														
0130	406	207	205	231	278	341	380	387	407	257	349	341	309	281	262	380	337	366	337	246														
0230	417	277	241	261	285	333	400	413	417	263	346	324	340	309	282	400	357	335	363	290														
0330	453	281	285	287	491	371	425	445	445	285	372	357	371	352	336	405	396	361	383	383														
0430B	466	303	286	326	418	410	436	451	471	308	385	391	393	377	347	478	408	392	408	387														
0530	472	300	300	306	414	414	427	465	471	304	316	310	325	315	306	403	423	412	491	405														
0630 (n.l. line out)	480	335	311	335	517	422	436	467	472	322	421	425	422	400	377	459	431	443	445	471														
0730	408	327	327	322	453	325	430	472	476	321	421	435	437	413	381	419	407	420	444	424														
0830	444	321	312	331	450	347	432	444	462	302	408	422	413	385	341	410	410	412	417	415														
0930	457	333	326	342	483	377	472	482	485	320	421	416	416	400	379	412	413	423	423	444														
1030	458	319	319	326	473	382	433	437	440	324	424	424	424	397	372	437	414	412	418	411														
1130	479	321	321	325	468	378	422	428	441	317	428	417	417	397	378	437	410	411	417	412														
1230	478	327	316	316	465	371	417	424	429	326	405	404	406	385	385	455	467	468	477	469														
1330	442	328	323	332	463	370	415	418	433	381	405	405	404	395	375	435	407	407	414	410														
1430	337	283	283	286	314	308	350	335	357	313	337	337	337	337	337	355	330	372	347	393														
1530	260		260			260	260	260	260	260	260	260	260	260	260	260	260	260	260	260														
1630																																		
1730	250		250			250	240	240	240	240	240	240	240	240	240	240	240	240	240	240														
1830																																		
1930	210		210			210	180	180	180	180	180	180	180	180	180	180	180	180	180	180														
2030	190		190			190	160	160	160	160	160	160	160	160	160	160	160	160	160	160														
2130																																		
2230	175	180	185				185	210	170	170	115	190	165	170	170	180	180	180	180	180														
2330	160	180	155				200	155	140	140	170	155	165	165	170	160	160	160	160	160														

Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Slip Mine - SM
- Steam Heated Riser - SliR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

0200 - Reached "Steady State" Exit Gas Temp 410°F
 1400 - 1410 410 117 m - 5 m/s am pressure

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TANSON 18 AUG 1989 T14 400° / 12 hrs

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
0630 (08:30)	135	135	144	133	116	126	132	116	141	133	129	127	133	126	136	136	132	131	129	125												
0130	155	170							140	150	150	155	160	155	150	150	160	160	160	150												
0230	150	165	155					140	180	155		155	155	155	150	150	150	150	150													
0330																																
0430	140	150	140	140	140	140	140	140	170	135	140	150	140	140	140	140	140	140	140	140	145											
0530								105	130	120	120	135	135	135	130	130	130	130	130	130	120											
0630									160	120	125		125		120	120	120	120	120	110												
0730	125	125	125	125	125	125	125	125	160	130	125	125	125	125	125	125	125	125	125	125	125											
0830	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125											
0930	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125											
1030	134	125	127	135	116	126	125	116	158	134	124	127	133	126	134	135	130	131	129	125												
1130	114	125	146	135	119	126	131	117	155	132	129	127	132	126	134	134	131	131	129	125												
1230	133	134	125	133	119	126	130	117	153	120	128	127	130	124	134	132	130	130	129	125												
1330	132	135	115	152	117	125	130	116	152	131	128	127	130	126	134	131	129	130	128	125												
1430	129	124	141	131	116	127	128	115	150	127	126	126	127	124	124	123	123	122	122	121												
1530																																
1630																																
1730																																
1830	120	120	140	120	120	120	140	120	120	120	120	120	110	110	120	120	120	120	120	120												
1930	115	115	125	115				115	115	115	115	115	115	115	115	115	115	115	115	115												
2030																																
2130	110	110	120	110				110	110	110	110	110	110	110	110	110	110	110	110	110												
2230																																
2330	108	108	125	108				108	108	108	108	108	108	108	108	108	108	108	108	108												

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Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mize - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminium Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Equip.	PB																														
0030		105	105	105	105		115	105	125	105	105	105	105	105	105	105	105	105	105	105											
0130																															
0230		100	110	130			100	110	100	100	100	100	100	100	100	100	100	100	100	100											
0330		95	95	115	95		95	95	115	95	95	95	95	95	95	95	95	95	95	95											
0430																															
0530																															
0630		95	95	115	95		95	95	115	95	95	95	95	95	95	95	95	95	95	95											
0730																															
0830		109	105	123	109		96	103	105	97	105	107	107	107	107	107	107	106	104	100											
0930Z5		110	107	123	110		97	104	107	98	105	107	106	103	110	105	106	106	105	102											
1030																															
1130																															
1230																															
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1430																															
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1830																															
1930																															
2030																															
2130																															
2230																															
2330																															

Test Number	Temp		Flow		Pressure		Leakage		Flow		Temperature		Temperature		Temperature		Temperature	
	1-15	2-15	1-15	2-15	1-15	2-15	1-15	2-15	1-15	2-15	1-15	2-15	1-15	2-15	1-15	2-15	1-15	2-15
138	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
139	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
140	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
141	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
142	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
143	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
144	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
145	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
146	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
147	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
148	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
149	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
150	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
151	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
152	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
153	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
154	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
155	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
156	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
157	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
158	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
159	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
160	125	140	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250

July 1990
Revision: Final

TEST RUN 15
600°F/12 HOURS

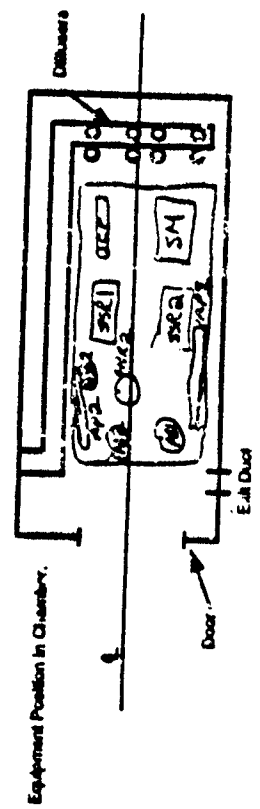
1311R2

Test Start Date Tues.
Date 8/22/89

Test Run T15
Test Duration 19 hrs. - Steady State
Time

Flash Chamber Temperature 600°F
Flash Chamber Inlet

Equipment Type	Component(s)	Dimensions L x H x W	Initial Wt (lbs)	Final Wt (lbs)	Sample Type	Equipment Applied	Inlet Concentration	Flash Chamber Concentration	Thermocouple #	Pre Test	Observations Post Test
1. PBI	Explosive	18" x 18"	10.5	10.5							
2. PBR		18" x 18"	10.5	10.5							
3. SHR1		78" x 78"	11.5	11.5							
4. SHR2		78" x 78"	11.5	11.5							
5. SSR1		24" x 24" x 24"	15.5	15.5							
6. SSR2		24" x 24" x 24"	15.5	15.5							
7. AP1		5" x 5" x 5"	5.5	5.5							
8. AP2		5" x 5" x 5"	5.5	5.5							
9. CP		5" x 5" x 5"	91.5	91.5							
10. SM		730"	730"	730"							



8/21/89 1210 - 1330 - Pre Test Sampling
M16 - initial equipment -
8/22/89 0930 - Chamber loaded & thermal-
cycling wired to equipment.
CEM not calibrated yet - need
at least 1 hr. more.

9/27/89 Flash Chamber was sampled
at the right hand wall,
west of the...

(1)

DATA SHEET 2
PAGE 1 OF 3

Tuesday 8/22/89 Test Number T15 600° F / 12 hrs.

Time	Seam Fused							Air Discharge		Alter. Burner	Propane Tank		Flash Chamber Discharge		Aeroburner Discharge			
	17.5% \pm 0.5%	2.0% \pm 0.1%	7.0% \pm 0.2%	2.0% \pm 0.1%	17.5% \pm 0.5%	2.0% \pm 0.1%	7.0% \pm 0.2%	TIC	Flow		Flow	Flow	TIC	Flow	Flow	TIC	Flow	TIC	Flow
0600																		
0700																		
0800																		
0900																		
1000																		
1100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NOTE: S.C. Subsd
-The Chamber char
of fiberglass. Saw
to be cut before
can hold 850° for
more negative &
still get the temp.
we need.

1100 - T.O. burner ignited
12:00 - 500° T.O. held at 500° for
15:00 - 500° T.O. Temp. 500°

(2)

DATA SHEET 2
PAGE 2 OF 3

Wednesday
Date 8/23/89
Test Number T15
600° F / 12 hrs.

Time	Mass Percent				Air Disturbance	Aberr. Burned	Propose Tank			Propose Tank			Propose Tank				
	HC	CO	CO ₂	H ₂ O			HC	CO	CO ₂	H ₂ O	HC	CO	CO ₂	H ₂ O	HC	CO	CO ₂	H_{2}O
0600	1.02	1.22	11.7	11.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0700	1.03	1.22	11.7	11.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0800	1.01	1.16	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0900	1.01	1.20	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1000	1.01	1.21	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1100	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1300	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1400	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1500	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1600	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1700	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1800	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1900	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2100	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2200	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2300	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2400	1.01	1.18	11.6	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1255 hrs - Flame out on Pro-Lex (High Temp 145°F)
1257 hrs - System Back on

1430 - STEADY STATE CONDITIONS

8/22/89 2329 A.M. burner ignited

0308 - High Fueling Run U.S.M.
CO wet off - pe. h. on 1000°F scale

Date 8/14/69 Test Number T-15 600°F/12 hr.

Time	Main Panel										Propose Tech			Propose Tank			Ableburner Discharge			
	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	At 600°F	
8000																				
8100																				
8200																				
8300																				
8400																				
8500																				
8600																				
8700																				
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12400																				
12500																				
12600																				
12700																				
12800																				
12900																				
13000																				

Date: 8-22-84 TEST: 115 600 F / 12 hrs.

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130																															
0230																															
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1930																															
2030																															
2130																															
2230																															
2330																															

Key:
 Powder Boxes - PB
 Shell Support Rack - SSR
 Clay Pipe - CP
 Ship Mine - SM
 Steam Heated Riser - SHR
 Steel Pipe - SP
 Aluminum Pipe - AP
 Mol. with Gear Reducer - M
 Steam Heated Discharge Valve - SDV

Date: 8/23/89 Test: T15 600°F / 12 hrs.

wednesday

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
PB																																	
Difuser																																	
0030	305	180	264	209	370	348	350	203	361	201	209	207	205	277	202	247	274	162	208	291													
0130	425	345	249	270	461	385	392	278	426	297	336	287	312	357	287	419	450	446	298	363													
0230	466	266	263	319	477	421	429	349	761	350	376	341	305	373	337	462	499	323	465	411													
0330	501	300	249	256	532	453	455	370	441	355	415	382	403	417	367	470	519	477	487	448													
0430	595	368	329	379	566	488	486	424	527	433	452	422	446	447	406	520	557	444	487	477													
0530	570	407	241	410	402	371	514	412	517	413	441	431	480	415	443	547	503	419	504	511													
0630	509	415	587	447	421	536	533	440	551	504	505	488	506	489	466	570	611	507	557	555													
0730	600	455	445	448	428	465	546	508	585	523	521	506	524	446	481	540	617	525	550	544													
0830	614	476	427	411	415	574	560	523	570	545	540	526	528	505	501	600	636	599	667	646													
0930	624	488	441	524	444	581	562	570	602	553	549	536	581	524	512	603	672	603	672	679													
1030	632	507	453	517	451	570	571	553	607	566	558	577	566	525	523	625	625	650	672	684													
1130	645	544	446	624	440	600	584	603	648	590	569	557	575	534	534	634	658	589	602	602													
1230	640	570	440	521	571	609	572	575	628	574	574	565	581	537	559	633	660	640	692	660													
1330	650	523	480	544	656	609	583	564	674	576	584	566	582	570	559	673	667	660	666	697													
1430	657	534	411	551	669	617	602	578	632	596	584	574	573	549	570	641	675	607	615	648													
1530	660	555	503	501	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600													
1630	670	610	505	505	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610													
1730	670	610	505	505	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610													
1830	680	570	570	570	680	680	680	680	680	680	680	680	680	680	680	680	680	680	680	680													
1930																																	
2030	610	60	545	545	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610													
2130	620	620	610	610	620	620	620	620	620	620	620	620	620	620	620	620	620	620	620	620													
2230																																	
2330	625	630	640	640	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625													

Key:
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 Steam Heated Riser - SHR
 Steel Pipe - SP
 Aluminum Pipe - AP
 Motor with Gear Reducer - M
 Steam Heated Discharge Valve - SDV

DATE 8/24/87 1:13 6:00 P / 11:2 A.P.

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0030																															
0130	335	337	339	335											650	650	135	180	235	270											
0230	717	600	605	611	617	618	615	615	618	618	615	615	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618
0330																															
0430	201	444			430	320	320	320	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340
0530																															
0630																															
0730																															
0830	110	110			370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370
0930	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273
1030																															
1130																															
1230																															
1330	150	110	110																												
1430																															
1530																															
1630																															
1730																															
1830	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
1930																															
2030																															
2130																															
2230	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
2330																															

Key:
 Powder Boxes - PB
 Shell Support Rack - SSR
 Clay Pipe - CP
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 Steam Fitted Riser - SHIR
 Steel Pipe - SP
 Aluminum Pipe - AP
 Motor with Gear Hockear - M
 Steam Heated Discharge Valve - SDV

142... End Steam Spike to T-15 T-15 Pool Down Complete @ 0730 hrs 8/27/89

July 1990
Revision: Final

TEST RUN 16
600°F/6 HOURS

1311R2

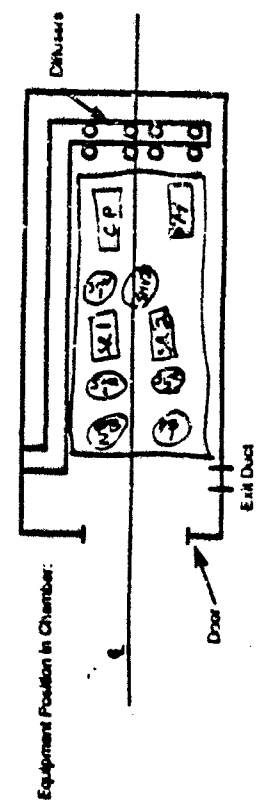
Test Item T-16
 Test Duration 100 F/6 hr
 Date 21 AUG 89
 Time _____

Heat-Up Rate _____
 Flush Chamber Temperature _____
 Flush Chamber Inlet _____

Equipment Type	Container(s)	Dimensions (L x H x W)	Initial Wt (Gm)	Final Wt (Gm)	Sample Type	Equipment Spiked	Initial Concentration	Final Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. SSR 1	UPROXINE	34x11x11	24.5	26.5	71						
2. SSR 2		35x11x11	24.5	27.5	71						
3. PD 1		15x10x11	7.5	8.5	71						
4. PR 2		15x10x11	8.5	9.5	71						
5. SSR 1		4x2x9	7.5	7.5	71						
6. SSR 2		4x2x9	7.0	7.5	71						
7. CP		4x7x11	17.0	12.5	71						
8. SA 1		31x22x11.5	27.0	27.0	71						
9. SHV 1		18x15x11	20.0	20.0	71						
10. SHV 2		18x15x11	18.0	19.0	71						
11											
12											
13											
14											
15											

Pre-Test Notes:

- * PSI + P02 tested with ethylenediamine; No color changes observed
- * Color change noted in bottom of SSR 2, and SSR 1. No color changes observed on the tops.
- * Color change observed in liner of SHV 1
- * CP - Piece M. off of Flanged end.



- * SHV 1 - handle broken
- * SHV 2 - No. 100 missing

CP 16

SUNSHY
8/27/89

①

Date 8/27/89 Test Number T-16 600°F / 6 hrs

Time	Main Period					Air Heater Discharge	Propene Tank			Flash Chamber Discharge			Afterburner Discharge		
	NO ₂ P-20	NO _x P-20	CO P-20	HC P-20	Temp P-20		NO ₂ P-20	NO _x P-20	CO P-20	HC P-20	Temp P-20	NO ₂ P-20	NO _x P-20	CO P-20	HC P-20
5000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1045
1045- SINET AFTERBURNER
FOR T16.

2200 hrs - System oscillating noise then unusual on the AFTERBURNER REACTOR

2330 - AFTERBURNER 2 EARLY PRE HEATER STARTED

Insulation was placed around the chamber door because the chamber reactive

23

DATA SHEET 2
PAGE 2 OF 2

Date 8/28/89 (Mon) Test Number T16 60076 hr

Time	Main Panel										Propane Tank			Afterburner Discharge				
	At Heater Fuel Pressure	At Heater Fuel Temp	At Heater Temperature	At Heater Fuel Flow	At Heater Fuel Temp	At Heater Temperature	At Heater Fuel Flow	At Heater Fuel Temp	At Heater Temperature	At Heater Fuel Flow	At Heater Fuel Temp	At Heater Temperature	Flash Chamber Discharge	Air Heater Discharge	THC	CO	CO ₂	H ₂
0000	2.0	17.8	57.9	210	20.2	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0100	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0200	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0300	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0400	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0500	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0600	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0700	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0800	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
0900	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
1000	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
1100	2.0	17.3	57.9	213	20.5	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
1200																		
1300																		
1400																		
1500	13.0	30.0	20.2	15.4	20.1	0	15.3	1.2	2.4	1.2	2.4	1.2	35.8	30.0	6.1	0.5	0.8	0.0
1600																		
1700																		
1800																		
1900																		
2000																		
2100																		
2200																		
2300																		

Notes: Propane leak found at preheater very loudly when AIRPHEATER TEMP is increased.
 - Propane leak found at preheater ignitor. (Sealed with duct tape).
 1.2 - T16 OVER, Cool Down Begins

0067
7189

TEST: T16 600° F / 6 hrs. DATA SHEET 3
Page 1 of 2

①

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30								
0030																																						
0130																																						
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 Steel Pipe - SP
 Aluminum Pipe - AP
 Motor with Gear Reducer - M
 Steam Heated Discharge Valve - SDV

8/28/89 Mon.

Test: 1 16 600 r 10 hr.

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0030																														
0130																														
0230																														
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Key:

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- Clay Pipe - CP
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- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

POWER OUT TO NOTYTER - A (CEM)

* Lost power to the flytec due to a bad pump in line (SDV)

12-Jan-76

Test Number	7-16	Row 1		Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	
Temperatures	60 Deg F	Start-up Start	37	Steady State Start	37	Page 01 437..443																	
Time	6 Hours	Steady State Stop	41	Steady State Stop	41	Page 02 437..443																	
Air of Test	37-Deg 00	Test End	03	Test End	03	Page 03 437..440																	
Blowdown Time	Air	After Building	After	Air	After	Propane	Propane	Propane	Propane	Air	Flash	After	After	After	After	After	After	After	After	After	After	After	After
	Burner	Burner	Burner	Burner	Burner	Line	Line	Line	Line	Chamber	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner
	Inlet	Inlet	Temp	Temp	Temp	Pressure	Pressure	Pressure	Pressure	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit
	Analyzer	Air Flow	Temp	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	TIC	TIC	TIC	TIC	CO	CO	CO	CO	CO	CO	CO	CO	CO	CO
	Position																						
(Hours)	PT-203	TIC-204	PT-205	PT-206	TIC-210	PT-211	PT-212	PT-213	PT-214	PT-215	PT-216	PT-217	PT-218	PT-219	PT-220	PT-221	PT-222	PT-223	PT-224	PT-225	PT-226	PT-227	
	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	
	400	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	
	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	

Test Number	7-16	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	
Temperatures	60 Deg F	Start-up Start	37	Steady State Start	37	Page 01 437..443																
Time	6 Hours	Steady State Stop	41	Steady State Stop	41	Page 02 437..443																
Air of Test	37-Deg 00	Test End	03	Test End	03	Page 03 437..440																
Blowdown Time	Air	After Building	After	Air	After	Propane	Propane	Propane	Propane	Air	Flash	After	After	After	After	After	After	After	After	After	After	After
	Burner	Burner	Burner	Burner	Burner	Line	Line	Line	Line	Chamber	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner	Burner
	Inlet	Inlet	Temp	Temp	Temp	Pressure	Pressure	Pressure	Pressure	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit	Exit
	Analyzer	Air Flow	Temp	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	TIC	TIC	TIC	TIC	CO	CO	CO	CO	CO	CO	CO	CO	CO
	Position																					
(Hours)	PT-203	TIC-204	PT-205	PT-206	TIC-210	PT-211	PT-212	PT-213	PT-214	PT-215	PT-216	PT-217	PT-218	PT-219	PT-220	PT-221	PT-222	PT-223	PT-224	PT-225	PT-226	PT-227
	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)	(FSC)
	400	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100
	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300

Steady State Exits
Data Range #1

Data Plus

DATA SHEET 4
PAGE 3 OF 6

18 Jun 98

Test Chamber		Test #		Run #															
Y-16		680		37															
Temperature		Steady State Start		Steady State Stop															
Time		0 hours		60															
State of Test		27-Aug-98		03															
		Range #1 (437..443)		Range #2 (437..443)															
		Range #3 (427..433)																	
Elapsed Time	Air		After Building		After Burner		After Boiler		After Flash Chamber		After Burner		After Burner		After Burner		After Burner		
	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	
0.00	0.94	1817.06	-0.20	1990.00	60.70	16.60	67.70	16.60	67.70	64.00	283.70	16.60	67.70	64.00	283.70	16.60	67.70	64.00	283.70
0.10	1.06	1840.00	-0.16	1997.50	15.10	6.55	16.40	6.70	16.40	63.15	19.00	75.15	34.30	28.00	1.13	9.50	0.45	6.28	56.30
0.20	0.90	1877.00	-0.44	2061.00	15.50	6.00	16.50	6.90	16.50	65.00	19.00	67.00	30.70	28.00	1.70	9.60	1.50	6.60	58.00
0.30	1.06	1903.00	-0.87	1955.00	14.90	6.20	16.40	6.70	16.40	63.00	19.00	63.00	32.60	28.00	6.50	9.20	0.10	6.00	61.00

Elapsed Time	Air		After Building		After Burner		After Burner		After Burner		After Burner		After Burner		After Burner		After Burner		
	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	Inlet	Temp	
0.00	0.94	1817.06	-0.20	1990.00	60.70	16.60	67.70	16.60	67.70	64.00	283.70	16.60	67.70	64.00	283.70	16.60	67.70	64.00	283.70
0.10	1.06	1840.00	-0.16	1997.50	15.10	6.55	16.40	6.70	16.40	63.15	19.00	75.15	34.30	28.00	1.13	9.50	0.45	6.28	56.30
0.20	0.90	1877.00	-0.44	2061.00	15.50	6.00	16.50	6.90	16.50	65.00	19.00	67.00	30.70	28.00	1.70	9.60	1.50	6.60	58.00
0.30	1.06	1903.00	-0.87	1955.00	14.90	6.20	16.40	6.70	16.40	63.00	19.00	63.00	32.60	28.00	6.50	9.20	0.10	6.00	61.00

Steady State Values		Range #1		Range #2		Range #3	
Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
0.56	0.18	0.45	0.12	0.55	0.15	0.38	0.10
1830	100	1820	100	1840	100	1810	100
16.6	0.5	16.4	0.5	16.5	0.5	16.4	0.5
67.7	0.5	67.7	0.5	67.7	0.5	67.7	0.5
64.0	0.5	63.1	0.5	65.0	0.5	63.0	0.5
283.7	0.5	19.0	0.5	64.0	0.5	283.7	0.5
16.6	0.5	6.6	0.5	6.7	0.5	6.6	0.5
67.7	0.5	75.1	0.5	34.3	0.5	6.3	0.5
64.0	0.5	28.0	0.5	1.1	0.5	9.6	0.5
283.7	0.5	1.1	0.5	9.6	0.5	6.6	0.5
16.6	0.5	6.5	0.5	9.2	0.5	6.0	0.5
67.7	0.5	6.0	0.5	6.0	0.5	6.0	0.5
64.0	0.5	32.6	0.5	28.0	0.5	6.6	0.5

July 1990
Revision: Final

TEST RUN 17
600°F/48 HOURS

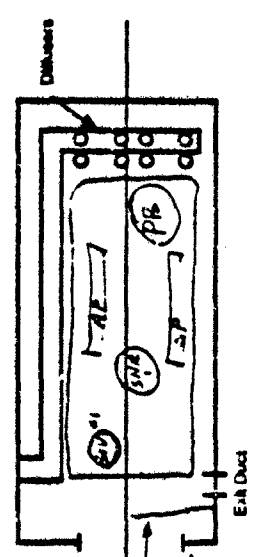
1311R2

Date 8/29/82
Time _____

Test Run T-17
Test Duration 6:00 / 48 hr AMM P.C.ATE
Flash Chamber Temperature _____
Flash Chamber Inlet _____

Equipment Type	Constant(s)	Dimensions L H W	Initial Wt (lbs.)	Final Wt (lbs.)	Sample Type	Equip. not Spilled	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Pre-Test Observations	Post-Test Observations
1. PBI	AMM, PC	1/2"	8.0	8.0						Oral spray	
2. PBI 2		1/2" x 1/2"	8.0	X						Oral spray	
3. PBI 3		1/2" x 1/2"	10.0	X						Oral spray	
4. API		1/2" x 1/2"	13.5	14.0						Oral spray	
5. API 2		1/2" x 1/2"	13.5	X						Oral spray	
6. SP 1		1/2" x 1/2"	20.5	20.5						Oral spray	
7. SP 2		1/2" x 1/2"	20.5	X						Oral spray	
8. SHV 1		1/2" x 1/2"	25.5	25.0						Oral spray	
9. SHV 2		1/2" x 1/2"	25.0	25.0						Oral spray	
10. SHR 1		1/2" x 1/2"	7.5	7.5						Oral spray	
11. SHR 2		1/2" x 1/2"	7.5	X						Oral spray	

NOTE: ALL EQUIPMENT WAS PRE RINSED WITH ACN & MPC WATER.
* ALL PIPE SUPPLIED BY HUNNAP



1/8 O.D. O-RING USED ON ALL EQUIPMENT
POST TEST NOTES: EQUIPMENT FOUND IN CHAMBER:
POST TESTES FROM EQUIPMENT ON FLOOR, OCCURRING AT DOOR. CHECK MARK IN PLEASANT METER IN FURNACE. WIRE OF WASTES WAS AN UNUSUAL MISCELLANEOUS BULKY APPEARANCE

Date 7/4/89 (7:30) Test Number T-17 600°F / 43 lbs AMMON PREHEAT

Time	Main Panel										Propane Tank				Propane Tank				Aberburner Discharge									
	HC-20 Air Heater Exit Temp	HC-20 Air Heater Exit Air Flow	HC-20 Air Heater Temperature	HC-20 Air Heater Temperature	HC-20 Dry Bulb Temperature	HC-20 Wet Bulb Temperature	HC-20 Air Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure	HC-20 Burner Pressure	HC-20 Gas Pressure			
8:00																												
8:10																												
8:20																												
8:30																												
8:40																												
8:50																												
9:00	64.1	117	752	571	600	2.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9:10	64.7	117	752	572	600	2.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:20	63.1	114	739	568	605	2.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30	61.1	114	710	545	600	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:40	64.0	114	740	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:50	63.0	113	730	512	604	2.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	64.0	114	739	508	605	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:10	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:20	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:40	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:50	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:10	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:20	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:40	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:50	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	63.0	113	710	510	600	2.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

System being calibrated. Unable to gather CEM readings

0745 - Flame out on preheater, restarted at 0800 hrs.
2100 - Preheater shut down. T-17 Shutdown Begins.

0245 - Flame out on preheater, restarted at 0300 hrs.

- Concrete walls on outside of chamber are sweating water.

Key:

- Powder Boxes - PB
- Shell Support Hack - SSH
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Risur - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0030	280	113	151	178	201	220	239	259	279	299	319	339	359	379	399	419														
0130	309	345	377	405	429	450	471	491	511	531	551	571	591	611	631															
0230	645	673	701	729	757	785	813	841	869	897	925	953	981	1009	1037															
0330	1059	1087	1115	1143	1171	1199	1227	1255	1283	1311	1339	1367	1395	1423	1451															
0430	1464	1492	1520	1548	1576	1604	1632	1660	1688	1716	1744	1772	1800	1828	1856															
0530	1869	1897	1925	1953	1981	2009	2037	2065	2093	2121	2149	2177	2205	2233	2261															
0630	2274	2302	2330	2358	2386	2414	2442	2470	2498	2526	2554	2582	2610	2638	2666															
0730	2679	2707	2735	2763	2791	2819	2847	2875	2903	2931	2959	2987	3015	3043	3071															
0830	3084	3112	3140	3168	3196	3224	3252	3280	3308	3336	3364	3392	3420	3448	3476															
0930	3489	3517	3545	3573	3601	3629	3657	3685	3713	3741	3769	3797	3825	3853	3881															
1030	3894	3922	3950	3978	4006	4034	4062	4090	4118	4146	4174	4202	4230	4258	4286															
1130	4301	4329	4357	4385	4413	4441	4469	4497	4525	4553	4581	4609	4637	4665	4693															
1230	4708	4736	4764	4792	4820	4848	4876	4904	4932	4960	4988	5016	5044	5072	5100															
1330	5107	5135	5163	5191	5219	5247	5275	5303	5331	5359	5387	5415	5443	5471	5499															
1430	5506	5534	5562	5590	5618	5646	5674	5702	5730	5758	5786	5814	5842	5870	5898															
1530	5907	5935	5963	5991	6019	6047	6075	6103	6131	6159	6187	6215	6243	6271	6299															
1630	6308	6336	6364	6392	6420	6448	6476	6504	6532	6560	6588	6616	6644	6672	6700															
1730	6709	6737	6765	6793	6821	6849	6877	6905	6933	6961	6989	7017	7045	7073	7101															
1830	7112	7140	7168	7196	7224	7252	7280	7308	7336	7364	7392	7420	7448	7476	7504															
1930	7515	7543	7571	7599	7627	7655	7683	7711	7739	7767	7795	7823	7851	7879	7907															
2030	7918	7946	7974	8002	8030	8058	8086	8114	8142	8170	8198	8226	8254	8282	8310															
2130	8313	8341	8369	8397	8425	8453	8481	8509	8537	8565	8593	8621	8649	8677	8705															
2230	8708	8736	8764	8792	8820	8848	8876	8904	8932	8960	8988	9016	9044	9072	9100															
2330	9109	9137	9165	9193	9221	9249	9277	9305	9333	9361	9389	9417	9445	9473	9501															

1 1 1 48 hrs @ 600°F (cont.)

9/3/89

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
PB																														
DIFFUSERS →																														
0030																														
0130																														
0230																														
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2030																														
2130																														
2230																														
2330																														

Key:
 Powder Boxes - PB
 Shell Support Rack - SSR
 Clay Pipe - CP
 Slip Mix - SM
 Steam Heated Riser - SHR
 Steel Pipe - SP
 Aluminum Pipe - AP
 Motor with Gear Reducer - M
 Steam Heated Discharge Valve - SDV

Subial Flameouts Occurred on Preheaters between 1900 & 0930 hrs on 9/3/89

Key:

Powder Boxes - PB

Shell Support Rack - SSR

Clay Pipe - CP

Slip Mine - SM

Steam Heated Riser - SHR

Steel Pipe - SP

Aluminum Pipe - AP

Motor with Gear Reducer - M

Steam Heated Discharge Valve - SDV

Equip. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30								
0030																																						
0130																																						
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1930																																						
2030																																						
2130																																						
2230																																						
2330																																						

Test Number	Temp (deg F)	Time	State of Test	Test End	1 2007 26	1 2	1 3	1 4	1 5	1 6	1 7	1 8	1 9	1 10	1 11	1 12	1 13	1 14	1 15	1 16	1 17	1 18	1 19	1 20	1 21	1 22	1 23	1 24	1 25	1 26	1 27	1 28	1 29	1 30	1 31	1 32	1 33	1 34	1 35	1 36	1 37	1 38	1 39	1 40
<p>Start-up + Steady State Values</p> <p>100-201 P1-201 P1-202 P1-203 P1-204 P1-205 P1-206 P1-207 P1-208 P1-209 P1-210 P1-211 P1-212 P1-213 P1-214 P1-215 P1-216 P1-217 P1-218 P1-219 P1-220</p> <p>100-201 P1-221 P1-222 P1-223 P1-224 P1-225 P1-226 P1-227 P1-228 P1-229 P1-230 P1-231 P1-232 P1-233 P1-234 P1-235 P1-236 P1-237 P1-238 P1-239 P1-240</p>																																												
<p>Steady State Values</p> <p>100-201 P1-241 P1-242 P1-243 P1-244 P1-245 P1-246 P1-247 P1-248 P1-249 P1-250 P1-251 P1-252 P1-253 P1-254 P1-255 P1-256 P1-257 P1-258 P1-259 P1-260</p> <p>100-201 P1-261 P1-262 P1-263 P1-264 P1-265 P1-266 P1-267 P1-268 P1-269 P1-270 P1-271 P1-272 P1-273 P1-274 P1-275 P1-276 P1-277 P1-278 P1-279 P1-280</p>																																												
<p>Final Values</p> <p>100-201 P1-281 P1-282 P1-283 P1-284 P1-285 P1-286 P1-287 P1-288 P1-289 P1-290 P1-291 P1-292 P1-293 P1-294 P1-295 P1-296 P1-297 P1-298 P1-299 P1-300</p>																																												

Task Number	Task Name	Start	End	Duration	Resources	Cost	Notes
001	000 Beg #	1-17	1-17	1		100	
002	001 Beg #	1-17	1-17	1		100	
003	002 Beg #	1-17	1-17	1		100	
004	003 Beg #	1-17	1-17	1		100	
005	004 Beg #	1-17	1-17	1		100	
006	005 Beg #	1-17	1-17	1		100	
007	006 Beg #	1-17	1-17	1		100	
008	007 Beg #	1-17	1-17	1		100	
009	008 Beg #	1-17	1-17	1		100	
010	009 Beg #	1-17	1-17	1		100	
011	010 Beg #	1-17	1-17	1		100	
012	011 Beg #	1-17	1-17	1		100	
013	012 Beg #	1-17	1-17	1		100	
014	013 Beg #	1-17	1-17	1		100	
015	014 Beg #	1-17	1-17	1		100	
016	015 Beg #	1-17	1-17	1		100	
017	016 Beg #	1-17	1-17	1		100	
018	017 Beg #	1-17	1-17	1		100	
019	018 Beg #	1-17	1-17	1		100	
020	019 Beg #	1-17	1-17	1		100	
021	020 Beg #	1-17	1-17	1		100	
022	021 Beg #	1-17	1-17	1		100	
023	022 Beg #	1-17	1-17	1		100	
024	023 Beg #	1-17	1-17	1		100	
025	024 Beg #	1-17	1-17	1		100	
026	025 Beg #	1-17	1-17	1		100	
027	026 Beg #	1-17	1-17	1		100	
028	027 Beg #	1-17	1-17	1		100	
029	028 Beg #	1-17	1-17	1		100	
030	029 Beg #	1-17	1-17	1		100	
031	030 Beg #	1-17	1-17	1		100	
032	031 Beg #	1-17	1-17	1		100	
033	032 Beg #	1-17	1-17	1		100	
034	033 Beg #	1-17	1-17	1		100	
035	034 Beg #	1-17	1-17	1		100	
036	035 Beg #	1-17	1-17	1		100	
037	036 Beg #	1-17	1-17	1		100	
038	037 Beg #	1-17	1-17	1		100	
039	038 Beg #	1-17	1-17	1		100	
040	039 Beg #	1-17	1-17	1		100	
041	040 Beg #	1-17	1-17	1		100	
042	041 Beg #	1-17	1-17	1		100	
043	042 Beg #	1-17	1-17	1		100	
044	043 Beg #	1-17	1-17	1		100	
045	044 Beg #	1-17	1-17	1		100	
046	045 Beg #	1-17	1-17	1		100	
047	046 Beg #	1-17	1-17	1		100	
048	047 Beg #	1-17	1-17	1		100	
049	048 Beg #	1-17	1-17	1		100	
050	049 Beg #	1-17	1-17	1		100	
051	050 Beg #	1-17	1-17	1		100	
052	051 Beg #	1-17	1-17	1		100	
053	052 Beg #	1-17	1-17	1		100	
054	053 Beg #	1-17	1-17	1		100	
055	054 Beg #	1-17	1-17	1		100	
056	055 Beg #	1-17	1-17	1		100	
057	056 Beg #	1-17	1-17	1		100	
058	057 Beg #	1-17	1-17	1		100	
059	058 Beg #	1-17	1-17	1		100	
060	059 Beg #	1-17	1-17	1		100	
061	060 Beg #	1-17	1-17	1		100	
062	061 Beg #	1-17	1-17	1		100	
063	062 Beg #	1-17	1-17	1		100	
064	063 Beg #	1-17	1-17	1		100	
065	064 Beg #	1-17	1-17	1		100	
066	065 Beg #	1-17	1-17	1		100	
067	066 Beg #	1-17	1-17	1		100	
068	067 Beg #	1-17	1-17	1		100	
069	068 Beg #	1-17	1-17	1		100	
070	069 Beg #	1-17	1-17	1		100	
071	070 Beg #	1-17	1-17	1		100	
072	071 Beg #	1-17	1-17	1		100	
073	072 Beg #	1-17	1-17	1		100	
074	073 Beg #	1-17	1-17	1		100	
075	074 Beg #	1-17	1-17	1		100	
076	075 Beg #	1-17	1-17	1		100	
077	076 Beg #	1-17	1-17	1		100	
078	077 Beg #	1-17	1-17	1		100	
079	078 Beg #	1-17	1-17	1		100	
080	079 Beg #	1-17	1-17	1		100	
081	080 Beg #	1-17	1-17	1		100	
082	081 Beg #	1-17	1-17	1		100	
083	082 Beg #	1-17	1-17	1		100	
084	083 Beg #	1-17	1-17	1		100	
085	084 Beg #	1-17	1-17	1		100	
086	085 Beg #	1-17	1-17	1		100	
087	086 Beg #	1-17	1-17	1		100	
088	087 Beg #	1-17	1-17	1		100	
089	088 Beg #	1-17	1-17	1		100	
090	089 Beg #	1-17	1-17	1		100	
091	090 Beg #	1-17	1-17	1		100	
092	091 Beg #	1-17	1-17	1		100	
093	092 Beg #	1-17	1-17	1		100	
094	093 Beg #	1-17	1-17	1		100	
095	094 Beg #	1-17	1-17	1		100	
096	095 Beg #	1-17	1-17	1		100	
097	096 Beg #	1-17	1-17	1		100	
098	097 Beg #	1-17	1-17	1		100	
099	098 Beg #	1-17	1-17	1		100	
100	099 Beg #	1-17	1-17	1		100	

15-Mar-80

Elapsed Time	Stack Rubber Temperature	Flare Rate of Test	Bag # 11			Bag # 12			Bag # 13			Bag # 14			After Burner Exit Temp
			600 Bag #	600 Bag #	600 Bag #	600 Bag #	600 Bag #	600 Bag #	600 Bag #	600 Bag #	600 Bag #	600 Bag #	600 Bag #		
			1300	1200	1100	1200	1100	1000	1100	1000	1100	1000	1100	1000	

Steady State Values	Data Range #1	Internal												
		(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)
Total		1300	1200	1100	1200	1100	1000	1100	1000	1100	1000	1100	1000	1100

Steady State Values	Data Range #2	Internal												
		(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)
Total		1300	1200	1100	1200	1100	1000	1100	1000	1100	1000	1100	1000	1100

Total Trachant Values	Data Range #3	Internal												
		(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)	(Bag #)
Total		1300	1200	1100	1200	1100	1000	1100	1000	1100	1000	1100	1000	1100

July 1990
Revision: Final

TEST RUN 18
500°F/6 HOURS

1311R2

Test Run T-1B Date 9/13/89 Street UP 0825
 Test Duration 6 hrs 2 Time _____
 Heat-Up Rate _____
 Flash Chamber Temperature 500°F

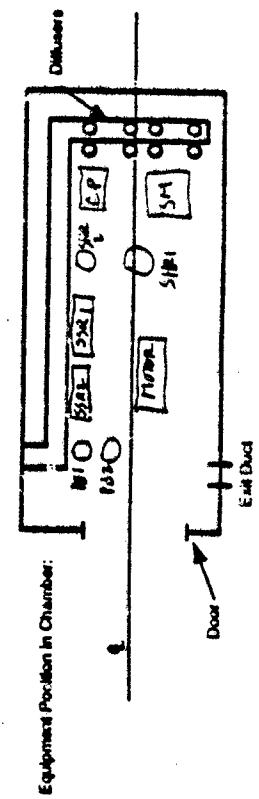
Flash Chamber Interior

Equipment Type	Contaminant(s)	Dimensions L H W	Initial Wt (lbs.)	Final Wt (lbs.)	Sample Type	Equipment Spred	Initial Contaminant Concentration	Final Contaminant Concentration	Thermocouple #	Observations Pre-Test	Observations Post-Test
1. SSR 1		35x18x2	72.5	72.5							
2. SSR 2		35x18x2	85.5	85.5							
3. PB 1		37x18x13	8.5	8.5							
4. PB 2		37x18x13	8.0	8.0							
5. SHR 1		7x4.9"	11.5	11.5							
6. SHR 2		7x4.9"	5.5	7.0							
7. CP		36"	126.5	126.5							
8. SM			769.5	788.0							
9. Motor			940.5	940.5							
10.											
11.											
12.											
13.											
14.											
15.											

NOTES: Ethers damaged applied to equipment, TAP
 AIR ON FOLLOWING: SHR 1
 SSR 1

SHIP MINE - END ALB REMOVED FROM P TEST

MOTOR: LARGE OIL STAIN ON GENE REDUCER.
 MOTOR STAND REMOVED FROM BASE of Motor &
 GENE REDUCER, BUT, was still tested.



①

DATA SHEET 2
PAGE 1 OF 5

252

Date 3/15/89 Test Number T-18 500°/644s.

Time	Main Panel						Propane Tank						Propane Tank						Airtanker Discharge						Airtanker Discharge					
	At Heater Discharge HC-201	At Heater Fuel Air Flow P-202	At Heater Temperature TC-204	T. Fuel Air Temperature TC-204	Bag Pressure PC-221	Blow Air Valve Position HC-22	T.O. Temperature TC-204	Airflow Controller TC-204	Dry Bulb Temperature and Humidity Controller	Gas Pressure P-200	Turn Pressure P-210	Aberr. Bottle	Gas Pressure P-222	Turn Pressure P-222	Gas Pressure P-222	Turn Pressure P-222	Gas Pressure P-222	Turn Pressure P-222	Air Heater Discharge R/C	Flash Chamber Discharge R/C	HC	CO	CO ₂	HC	CO	CO ₂	HC	CO	CO ₂	
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

* sheet
+ 44-40

NOTE: Several attempts were made to ignite the preheated dirt without success.
@ 0200 hrs. Nozzle loaded site. T.O. was left running & operation on dirt

9/15 0820 - AFTERBURNER DOWN.
0800 - AFTERBURNER STARTED
0130 - PRE HEATER STARTED

0815
START T.O.
0825
START
12:30 AND 1:00
1:15 AND 2:00

PROBLEMS (9)

Date 9/14/89 Test Number T-18 500°F/6hr.

Time	Main Panel								Propane Tank			Propane Tank			Flash Chamber Discharge			Afterburner Discharge		
	At Heater Exit Pressure (PSIA)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	At Heater Inlet Pressure (PSIA)	At Heater Inlet Temperature (°F)	
00:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
01:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
02:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
03:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
04:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
05:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
06:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
07:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
08:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
09:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
10:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
11:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
12:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
13:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
14:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
15:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
16:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
17:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
18:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
19:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
20:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
21:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
22:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
23:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
24:00	21.0	21.0	177	20.9	0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	

- Pre heater started @ 1015 hrs this date.
- Received 8000 gallons of propane the date @ ~ 0700 hrs.
- 2000 hrs (9/18/89) steady state condition. 800°F reached.

445 - A.A.
Rising pressure
/ time

Date 9/17/89 Test Number T18 500/6443

Time	Main Panel				Propene Tank				Propene Tank					
	MC-201 Air Heater Test Air Flow	MC-202 Air Heater Test Air Flow	MC-204 Air Heater Temperature	MC-204 T.O. Test Air Temperature	MC-201 Dry Bulb Temperature	MC-201 Wet Bulb Temperature	MC-201 Air Pressure	MC-201 Burner Pressure	MC-201 Air Pressure	MC-201 Burner Pressure	MC-201 Air Pressure	MC-201 Burner Pressure	MC-201 Air Pressure	MC-201 Burner Pressure
0000														
0100														
0200														
0300														
0400														
0500														
0600	1.7	3	74	0	101									
0700														
0800														
0900														
1000														
1100														
1200														
1300														
1400														
1500														
1600														
1700														
1800														
1900														
2000														
2100														
2200														
2300														
2400														

0530 CAN FLOW SECURITY SYSTEM HAS TO ELECTRICAL STATIONS
0530 OFFER AN UNSTABLE EQUIPMENT IS LOW AND WARNING MESSAGE
AND STILL PRESENT IN AREA SO T.O. LINE HAS BEEN LEFT UNCHANGED

9/14/89 778 500°/60ms. AIR-MOTOR STARTED 1015

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0600																															
0130																															
0230																															
0330																															
0430																															
0530																															
0630																															
0730																															
0830																															
0930																															
1030																															
1130	313	123	200	176	217	213	310			212	227		178		266	310	170	253	24	213											
1230	326	164	204	176	225	225	331			285	278		187		254	223	185	207	259	246											
1330	330	140	160				377			333	267		210		312	261	228	217	282	290											
1430	411	248	290	230	301	287	457			407	332		259		371	151	213	127	353	452											
1530	416	265	326	355	327	366	461			444	302		206		428	167	130	173	403	481											
1630	537	361	446	505	401	359	521			478	372		352		481	171	177	157	473	483											
1730	566	381	422	324	423	328	527			566	404		323		493	555	470	519	485	498											
1830	569	405	419	346	416	374	537			520	422		378		511	570	505	537	509	518											
1930	564	417	458	363	452	306	541			531	419		440		524	567	558	534	529	537											
2030																															
2130																															
2230																															
0200	505	417	471	371	441	518	511	511		548	491		470		519	505	507	511	510	510											

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1111 3 2111 1111 1111

1111 107

Equip.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
PB																															
0030	555	110	110	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
0130																															
0230																															
0330																															
0430																															
0530	265	260	150	25	120	35	210	200	155	115	110	100																			
0630																															
0730																															
0830	212	160	202	171	171	181	181	171	171	201	220	238																			
0930	205	162	188	170	167	168	160	170	170	170	170	202																			
1030	190	160	200	165	165	190	195	170	230	185	205	160																			
1130																															
1230																															
1330																															
1430	177	110	125	104	152	162	157	156	170	169																					
1530																															
1630																															
1730																															
1830																															
1930	155	155	155	155	155	155	155	155	155	205	275																				
2030																															
2130																															
2230																															
2330	125	125	115	125	125	125	125	125	125	125	190	150																			

9/16/89 718 500°/644R

④

Equip.	PS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
0030	1/25	110	120	120	120	120	120	110	120	140	140	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120		
0130																																	
0230																																	
0330																																	
0430																																	
0530	1	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	
0630																																	
0730																																	
0830	1	115	115	115	107	107	113	112	111	131	131	111	131	131	111	131	111	131	111	131	111	131	111	131	111	131	111	131	111	131	111	131	
0930																																	
1030																																	
1130																																	
1230																																	
1330		110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	
1430																																	
1530																																	
1630																																	
1730																																	
1830		110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	
1930																																	
2030																																	
2130																																	
2230																																	
2330		105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	

11/19/89

Key:

- Powder Boxes - PB
- Shell Support Rack - SSR
- Clay Pipe - CP
- Ship Mine - SM
- Steam Heated Riser - SHR
- Steel Pipe - SP
- Aluminum Pipe - AP
- Motor with Gear Reducer - M
- Steam Heated Discharge Valve - SDV

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Equip. PB																														
0030	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
0130																														
0230																														
0330																														
0430																														
0530																														
0630	9/17/67	98	57	10	98	93	105	101	98	0	95	76	77	102	78	98	103	87	102											
0730																														
0830	9/18/67	74	56	104	72	92	86	95	63	80	65	67	96	87	97	72	71	100												
0930																														
1030																														
1130																														
1230																														
1330																														
1430																														
1530																														
1630																														
1730																														
1830																														
1930																														
2030																														
2130																														
2230																														
2330																														

Truck Number	Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End
1-10	500	6	11	11	11	500	6	11	11	11	500	6	11	11	11
1-11	450	6	11	11	11	450	6	11	11	11	450	6	11	11	11
1-12	450	6	11	11	11	450	6	11	11	11	450	6	11	11	11
1-13	450	6	11	11	11	450	6	11	11	11	450	6	11	11	11

Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End
500	6	11	11	11	500	6	11	11	11	500	6	11	11	11
450	6	11	11	11	450	6	11	11	11	450	6	11	11	11
450	6	11	11	11	450	6	11	11	11	450	6	11	11	11

Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End
500	6	11	11	11	500	6	11	11	11	500	6	11	11	11
450	6	11	11	11	450	6	11	11	11	450	6	11	11	11
450	6	11	11	11	450	6	11	11	11	450	6	11	11	11

Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End	Temp.	Pressure	Flow	Start	End
500	6	11	11	11	500	6	11	11	11	500	6	11	11	11
450	6	11	11	11	450	6	11	11	11	450	6	11	11	11
450	6	11	11	11	450	6	11	11	11	450	6	11	11	11

July 1990
Revision: Final

APPENDIX E
HOURLY AVERAGES FOR CEM SYSTEM DATA

Appendix E provides hourly averages of data collected by the continuous emissions monitoring (CEM) system. The following information is provided:

- Afterburner Outlet
 - Oxygen (O₂) concentration
 - Carbon Monoxide (CO) concentration
 - Nitrous Oxides (NO_x) concentration
 - Total Hydrocarbons (THC) concentration
 - Carbon Dioxide (CO₂) concentration
- Flash Chamber Inlet
 - Total Hydrocarbons (THC)
- Flash Chamber Outlet
 - Total Hydrocarbons (THC)

Two hydrocarbon analyzers were used to monitor total hydrocarbons: one analyzer continuously monitored emissions from the afterburner outlet; the other analyzer intermittently monitored emissions from the flash chamber inlet and outlet on a time sharing basis.

Several data gaps exist for various time periods in the CEM data presented in this Appendix. These data gaps are a result of power failures (usually from lightning events in the Hawthorne area) to the data logger system used to continuously record instrument readings. The data for these time periods were, however, recorded on a strip chart recorder. A review of the strip chart printout indicated that the data for these time periods are consistent with those presented herein.

July 1990
Revision: Final

TEST RUN 2
400°F/24 HOURS

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/25/69

Test #: 2

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:11-00:59	11.2	5.4	50.8	<0.1	6.2	<0.1	2.1
01:00-01:59	11.2	5.7	49.3	<0.1	6.2	<0.1	2.1
02:00-02:59	11.2	5.6	49.1	<0.1	6.2	<0.1	2.1
03:00-03:59	11.2	5.7	50.4	<0.1	6.2	<0.1	2.1
04:00-04:59	11.2	5.4	51.2	<0.1	6.1	<0.1	2.0
05:00-05:59	11.2	5.4	51.4	<0.1	6.2	<0.1	2.0
06:00-06:59	11.2	5.3	51.2	<0.1	6.1	<0.1	2.0
07:00-07:59	11.3	6.0	51.8	<0.1	6.1	<0.1	2.0
08:00-08:40	11.3	6.8	52.7	<0.1	6.1	<0.1	24.5

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/26/89

Test #: 2

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
15:37-15:59	12.3	6.5	72.6	1.0	5.4	1.0	2.1
16:00-16:59	12.0	6.4	74.0	0.6	5.6	1.3	2.3
17:00-17:59	12.2	6.4	69.6	0.2	5.5	1.0	2.3
18:00-18:59	12.2	6.2	66.0	0.1	5.4	0.6	2.3
19:00-19:59	12.3	5.9	63.7	<0.1	5.4	0.9	1.7
20:00-20:59	12.4	5.5	64.7	<0.1	5.4	0.6	1.6
21:00-21:59	12.5	5.6	63.8	<0.1	5.3	0.7	1.5
22:00-22:59	12.6	5.8	60.6	<0.1	5.2	0.5	1.7
23:00-23:59	12.7	6.0	59.6	<0.1	5.1	0.7	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/27/89

Test #: 2

Test Time	Afterburner Outlet				Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)	
00:00-00:59	12.7	6.0	58.8	<0.1	5.1	0.6	1.5	
01:00-01:59	12.7	6.1	57.0	<0.1	5.1	0.6	1.4	
02:00-02:59	12.9	6.3	55.6	<0.1	5.0	0.5	1.5	
03:00-03:59	13.0	6.6	54.2	<0.1	4.9	0.3	1.7	
04:00-04:59	13.1	6.8	55.7	<0.1	4.8	0.7	1.1	
05:00-05:59	13.1	6.7	54.9	<0.1	4.8	0.5	1.4	
06:00-06:59	13.2	6.8	54.3	<0.1	4.8	0.3	1.5	
07:00-07:59	13.3	7.6	53.3	<0.1	4.7	0.6	1.4	
08:00-08:59	13.4	8.9	52.5	0.2	4.6	0.8	2.1	
09:00-09:28	13.4	9.1	52.6	0.2	4.6	0.5	2.6	
10:37-10:59	13.3	9.1	52.4	0.6	4.5	1.0	2.6	
11:00-11:59	13.4	8.8	53.1	0.4	4.5	0.8	2.9	
12:00-12:59	13.4	8.7	53.8	0.3	4.5	0.6	2.3	
13:00-13:59	13.4	8.7	53.7	0.2	4.4	0.8	2.6	
14:00-14:59	13.4	8.7	54.1	0.2	4.4	1.0	2.4	
15:00-15:59	13.4	8.6	54.0	0.2	4.5	0.5	2.6	
16:00-16:59	13.3	8.4	53.7	0.1	4.5	1.1	2.1	
17:00-17:59	12.9	7.8	55.5	0.1	4.8	0.8	2.2	
18:00-18:59	12.9	7.6	55.1	<0.1	4.8	0.9	2.0	
19:00-19:59	13.2	7.9	52.5	<0.1	4.6	0.6	2.0	
20:00-20:59	13.0	7.4	51.7	<0.1	4.7	0.4	1.8	
21:00-21:59	13.3	7.8	49.1	<0.1	4.5	0.7	1.5	
22:00-22:59	13.3	7.8	51.9	<0.1	4.5	0.4	1.5	
23:00-23:59	13.4	7.7	51.4	<0.1	4.4	0.6	1.4	

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/28/89

Test #: 2

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	13.4	7.6	49.4	<0.1	4.4	0.5	1.6
01:00-01:59	13.4	7.7	48.8	<0.1	4.4	0.3	1.7
02:00-02:59	13.4	7.6	48.7	<0.1	4.4	0.6	1.4
03:00-03:59	13.4	7.4	49.3	<0.1	4.4	0.4	1.5
04:00-04:59	13.5	7.6	50.0	<0.1	4.4	0.6	1.4
05:00-05:59	13.5	7.7	50.2	<0.1	4.4	0.4	1.2
06:00-06:59	13.5	7.5	49.8	<0.1	4.4	0.2	1.2
07:00-07:44	13.5	7.7	50.3	<0.1	4.4	0.9	1.2
08:51-08:59	19.6	6.6	0.3	1.5	0.1	<0.1	1.9
09:00-09:59	19.6	6.9	0.3	1.6	<0.1	1.1	3.1
10:00-10:59	19.6	6.7	0.3	1.3	<0.1	0.7	3.0
11:00-11:59	19.6	6.7	0.2	1.3	<0.1	1.1	2.5
12:00-12:59	19.6	6.6	0.3	1.2	<0.1	1.1	2.4
13:00-13:59	19.6	6.7	0.3	1.2	<0.1	0.7	2.8
14:00-14:59	19.6	6.7	0.2	1.3	<0.1	1.1	2.4
15:00-15:59	19.6	6.5	0.2	1.3	<0.1	0.9	2.4
16:00-16:59	19.6	6.4	0.2	1.2	<0.1	1.0	2.2
17:00-17:59	19.7	6.4	0.2	1.5	<0.1	0.8	2.2
18:00-18:59	19.6	6.3	0.3	17.0	<0.1	0.6	2.5
19:00-19:59	19.1	17.1	3.2	1.7	0.5	0.9	2.1
20:00-20:59	18.2	22.1	8.3	1.1	1.2	0.5	2.0
21:00-21:59	18.0	22.8	9.2	1.0	1.3	0.8	1.6
22:00-22:59	18.0	22.9	9.0	1.1	1.3	0.7	1.7
23:00-23:59	18.0	22.7	8.9	1.0	1.3	0.8	1.6

July 1990
Revision: Final

TEST RUN 3
500°F/36 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/19/89

Test #: 3

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.0	5.8	64.9	<0.1	5.9	0.4	<0.1
01:00-01:59	12.4	6.1	59.6	<0.1	5.6	0.3	<0.1
02:00-02:59	12.5	6.3	58.8	<0.1	5.6	0.2	<0.1
03:00-03:59	12.6	6.1	58.4	<0.1	5.6	0.2	<0.1
04:00-04:59	12.5	5.8	58.4	<0.1	5.7	0.1	<0.1
05:00-05:59	12.4	5.5	57.9	<0.1	5.7	<0.1	<0.1
06:00-06:59	12.5	5.6	56.4	<0.1	5.7	<0.1	<0.1
07:00-07:59	17.8	17.4	12.0	0.8	1.3	0.1	<0.1
08:00-08:59	13.5	9.9	50.4	0.1	5.0	0.2	<0.1
09:00-09:59	13.0	7.8	60.6	0.2	5.3	0.8	8.4
10:00-10:59	12.8	7.7	63.6	0.1	5.5	0.3	3.5
11:00-11:59	12.4	7.6	67.8	<0.1	5.8	0.9	2.1
12:00-12:59	11.7	7.8	75.8	<0.1	6.5	0.4	3.2
13:00-13:59	9.0	17.6	98.5	4.1	4.8	13.5	11.9
14:00-14:59	11.2	8.4	78.1	0.5	6.2	0.9	3.8
15:00-15:59	11.3	8.1	78.6	0.2	6.4	0.6	3.6
16:00-16:59	11.4	7.6	77.7	<0.1	6.5	1.1	2.7
17:00-17:59	11.4	7.5	78.8	<0.1	6.5	0.8	2.3
18:00-18:59	11.3	7.4	79.9	<0.1	6.6	0.5	3.0
19:00-19:59	11.2	6.8	76.4	<0.1	6.6	1.2	2.1

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/23/89

Test #: 3

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
20:49-20:59	17.5	24.7	11.6	1.2	1.6	1.6	6.1
21:00-21:59	17.6	24.1	11.1	0.8	1.5	1.2	2.3
22:00-22:59	17.5	24.0	11.0	0.7	1.5	0.8	2.1
23:00-23:59	17.1	24.7	13.2	0.7	1.8	1.2	1.7

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/24/89

Test #: 3

Test Time	Afterburner Outlet		Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)
00:00-00:59	16.3	24.4	17.0	0.4	2.3	0.8
01:00-01:59	15.4	20.3	22.0	<0.1	3.0	0.9
02:00-02:59	14.5	13.5	28.5	<0.1	3.7	0.9
03:00-03:59	13.4	8.2	38.3	<0.1	4.5	0.7
04:00-04:59	12.2	6.3	51.4	<0.1	5.4	0.8
05:00-05:59	11.1	5.5	64.0	<0.1	6.1	0.7
06:00-06:59	10.0	5.4	78.6	<0.1	7.0	0.7
07:00-06:59	5.7	5.4	83.9	<0.1	7.2	<0.1

July 1990
Revision: Final

TEST RUN 5
500°F/24 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/29/89

Test #:

5

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	17.6	23.4	11.0	1.1	1.5	0.5	1.7
01:00-01:59	16.9	24.3	14.1	1.3	1.9	0.4	1.6
02:00-02:59	16.2	24.4	16.9	1.1	2.5	0.7	1.4
03:00-03:59	15.3	23.2	19.2	0.8	2.7	0.6	1.5
04:00-04:59	14.9	16.5	27.2	0.3	3.4	0.4	1.5
05:00-05:59	14.1	11.7	35.3	0.1	4.0	0.7	1.7
06:00-06:59	13.2	8.1	46.6	<0.1	4.7	0.6	1.5
07:00-07:59	12.2	6.1	63.4	<0.1	5.4	0.6	1.7
08:00-08:29	11.4	6.1	76.3	0.1	5.9	0.5	2.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/30/69

Test #: 5

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
18:18-18:59	12.4	8.8	75.3	0.4	5.3	1.0	2.1
19:00-19:59	12.3	5.7	74.3	0.1	5.4	0.6	2.3
20:00-20:59	12.2	5.5	72.2	<0.1	5.4	0.9	1.7
21:00-21:59	12.3	5.4	66.9	<0.1	5.3	0.9	1.5
22:00-22:59	12.4	5.4	62.8	<0.1	5.2	0.6	1.6
23:00-23:59	12.5	5.7	59.8	<0.1	5.2	0.4	1.7

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 07/31/89

Test #:

5

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:25	12.5	6.6	58.5	<0.1	5.2	1.3	1.3
16:32-16:59	16.3	22.6	18.0	1.2	2.5	2.6	3.7
17:00-17:59	15.7	19.7	22.1	0.7	3.0	0.5	2.1
18:00-18:59	14.9	14.0	29.7	0.2	3.5	0.9	1.7
19:00-19:59	14.0	8.5	41.8	<0.1	4.1	0.9	1.5
20:00-20:59	12.7	5.4	59.3	<0.1	5.1	0.5	1.5
21:00-21:59	13.5	5.8	58.8	<0.1	4.5	0.4	1.4
22:00-22:59	13.5	5.8	57.4	<0.1	4.5	0.6	1.2
23:00-23:59	13.4	5.7	57.4	<0.1	4.6	0.4	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/01/89

Test #:

5

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	13.4	5.6	56.1	<0.1	4.6	0.5	1.2
01:00-01:59	13.5	5.6	55.5	<0.1	4.5	0.3	1.3
02:00-02:59	13.4	5.6	55.6	<0.1	4.6	0.6	1.1
03:00-03:59	13.5	5.7	55.0	<0.1	4.5	0.4	1.2
04:00-04:59	13.5	6.0	55.4	<0.1	4.5	0.5	1.2
05:00-05:59	13.5	6.1	55.3	<0.1	4.5	0.4	1.3
06:00-06:52	13.5	5.9	55.4	<0.1	4.5	0.3	1.1
09:03-09:59	19.3	9.4	2.1	6.7	0.3	0.9	1.9
10:00-10:59	18.3	20.1	8.1	1.0	1.0	0.7	2.0
11:00-11:59	18.1	21.0	9.2	0.9	1.1	0.9	2.0
12:00-12:59	18.1	21.2	9.1	1.0	1.1	0.6	2.3
13:00-13:59	18.1	21.0	9.0	1.2	1.1	1.1	2.0
14:00-14:59	17.9	21.7	10.3	1.2	1.3	1.0	1.5
15:00-15:35	13.3	24.5	60.6	2.6	2.4	1.5	11.9
08:39-08:59	13.6	7.7	33.4	0.1	4.5	0.4	3.1
09:00-09:59	13.6	7.4	0.2	0.1	4.5	0.8	1.7
10:00-10:59	13.0	9.7	22.5	0.2	4.6	0.5	1.9
11:00-11:59	12.1	10.3	80.9	0.6	4.0	1.8	3.4
12:00-12:59	13.7	8.6	53.5	0.4	4.4	1.0	2.2
13:00-13:22	13.7	8.2	53.8	0.3	4.4	0.5	3.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: J8/02/89

Test #:

5

Test Time	Afterburner Outlet		Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)
08:44-08:59	19.6	5.7	0.2	1.3	0.2	0.6
09:00-09:59	13.4	12.9	71.5	4.0	1.5	1.4
10:00-10:59	19.6	5.4	0.3	<0.1	0.2	10.7
11:00-11:59	19.6	5.6	0.3	<0.1	0.2	<0.1
12:00-12:59	19.6	5.7	0.3	<0.1	0.3	<0.1
13:00-13:59	19.6	5.6	0.3	<0.1	0.2	<0.1
14:00-14:59	19.6	5.4	0.3	<0.1	0.2	<0.1
15:00-15:52	19.2	5.5	0.3	<0.1	0.2	<0.1
16:29-16:59	19.6	5.3	0.3	<0.1	0.2	<0.1
17:00-17:59	19.6	5.2	0.4	<0.1	0.2	<0.1
18:00-18:59	19.6	5.2	0.3	<0.1	0.2	<0.1
19:00-19:59	19.6	5.0	0.3	<0.1	0.2	<0.1
20:00-20:59	19.6	4.7	0.3	<0.1	0.2	<0.1
21:00-21:59	19.6	4.6	0.2	<0.1	0.2	<0.1
22:00-22:59	19.6	4.5	0.2	<0.1	0.2	<0.1
23:00-23:59	19.6	4.3	0.2	<0.1	0.2	<0.1

July 1990
Revision: Final

TEST RUN 8
400°F/36 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/03/69

Test #:

8

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	19.6	4.4	0.2	<0.1	0.2	<0.1	<0.1
01:00-01:59	19.6	4.4	0.2	<0.1	0.2	<0.1	<0.1
02:00-02:59	19.6	4.3	0.2	<0.1	0.2	<0.1	<0.1
03:00-03:59	19.6	4.5	0.2	<0.1	0.2	<0.1	<0.1
04:00-04:59	19.6	4.3	0.2	<0.1	0.2	<0.1	<0.1
05:00-05:59	19.6	4.3	0.1	<0.1	0.2	<0.1	<0.1
06:00-06:59	19.6	4.3	<0.1	<0.1	0.2	<0.1	<0.1
07:00-07:59	19.6	4.4	<0.1	<0.1	0.2	<0.1	<0.1
08:11-08:59	10.5	19.1	102.2	8.5	3.0	<0.1	<0.1
09:00-09:59	19.1	7.5	0.3	1.2	0.5	17.8	12.0
10:00-10:59	19.6	5.2	0.3	1.1	0.2	0.9	2.1
11:00-11:59	19.6	5.4	0.2	9.2	0.2	0.7	3.4
12:00-12:59	18.3	21.3	7.1	3.2	0.2	1.0	2.7
13:00-13:59	18.0	23.4	2.1	1.4	1.3	0.8	2.3
14:00-14:59	18.0	23.2	9.1	1.3	1.3	0.9	2.1
15:00-15:59	18.0	22.8	9.0	1.2	1.3	0.6	2.2
16:00-16:59	17.8	23.2	10.1	1.3	1.4	0.9	1.4
17:00-17:59	17.2	24.9	12.8	1.8	1.8	0.7	1.9
18:00-18:59	16.4	26.2	15.3	1.8	2.3	0.5	1.8
19:00-19:59	15.6	23.8	19.4	0.9	2.9	0.7	1.5
20:00-20:59	14.9	16.7	26.9	0.3	3.5	0.7	1.4
21:00-21:59	13.8	9.4	39.1	<0.1	4.2	0.5	1.4
22:00-22:59	12.6	6.1	57.9	<0.1	5.0	0.7	1.3
23:00-23:59	11.0	4.6	54.4	<0.1	6.2	21.4	12.7

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/04/89

Test #: 8

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.0	4.5	57.0	<0.1	6.8	32.8	26.8
01:00-01:59	9.9	4.7	57.0	<0.1	6.9	35.7	28.9
02:00-02:59	10.0	4.8	56.9	<0.1	6.8	38.2	35.6
03:00-03:59	10.0	5.0	58.0	<0.1	6.8	62.1	48.2
04:00-04:59	10.9	5.1	54.0	<0.1	6.2	59.6	43.5
05:00-05:59	11.3	5.1	53.3	<0.1	6.0	61.2	43.5
06:00-06:59	10.5	4.8	59.0	<0.1	6.5	59.8	45.0
07:00-07:59	10.5	5.1	59.8	<0.1	6.5	58.1	44.1
08:00-08:59	10.6	5.8	72.8	<0.1	6.5	55.3	45.3
09:00-09:59	9.8	11.5	86.6	3.4	5.6	49.9	39.5
10:00-10:59	10.8	6.2	55.6	0.2	6.4	48.6	38.8
11:00-11:59	10.8	6.0	55.8	0.1	6.4	47.9	36.6
12:00-12:59	10.9	6.1	55.9	0.1	6.3	46.7	35.8
13:00-13:59	10.9	6.1	55.7	0.1	6.3	45.5	35.3
14:00-14:59	10.9	6.2	56.7	0.1	6.2	44.8	34.2
15:00-15:59	10.9	6.1	57.0	0.1	6.3	43.6	34.0
16:00-16:59	10.9	5.9	56.8	<0.1	6.2	43.9	33.5
17:00-17:59	10.8	5.7	57.0	<0.1	6.3	44.0	34.3
18:00-18:59	10.7	5.8	56.9	<0.1	6.3	45.7	34.7
19:00-19:59	10.7	5.7	56.5	<0.1	6.4	47.2	35.5
20:00-20:59	10.7	5.1	54.7	<0.1	6.4	50.5	38.5
21:00-21:59	10.7	5.0	56.0	<0.1	6.4	51.0	39.0
22:00-22:59	10.6	5.4	56.3	<0.1	6.5	50.0	38.8
23:00-23:59	10.6	5.1	56.1	<0.1	6.4	50.0	38.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 06/05/89

Test #:

8

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	TWC (ppm)
00:00-00:59	10.6	5.0	55.7	<0.1	6.5	51.5	40.4
01:00-01:59	10.5	5.1	54.8	<0.1	6.5	54.6	43.3
02:00-02:59	10.5	5.3	54.3	<0.1	6.5	56.2	44.3
03:00-03:59	10.5	5.3	55.6	<0.1	6.5	56.5	44.7
04:00-04:59	10.5	5.3	56.5	<0.1	6.6	55.4	44.5
05:00-05:59	10.5	5.2	56.1	<0.1	6.6	55.8	44.3
06:00-06:59	10.4	5.0	56.3	<0.1	6.6	56.8	44.8
07:00-07:59	10.5	5.2	56.3	<0.1	6.6	56.3	43.7
08:00-08:59	10.6	5.6	56.9	<0.1	6.5	48.3	37.5
09:00-09:59	9.8	10.9	96.1	3.6	5.2	51.5	40.8
10:00-10:59	11.2	5.2	58.0	<0.1	6.2	45.4	36.5
11:00-11:59	11.2	5.3	58.7	<0.1	6.2	44.0	34.8
12:00-12:59	11.2	5.4	59.5	<0.1	6.2	43.3	33.5
13:00-13:59	11.2	5.5	59.1	<0.1	6.1	42.1	33.1
14:00-14:59	11.2	5.7	59.4	0.1	6.1	42.2	32.1
15:00-15:59	11.2	5.6	59.9	<0.1	6.1	40.6	32.2
16:00-16:59	11.3	5.2	58.8	<0.1	6.1	41.8	32.0
17:00-17:59	11.3	5.0	59.2	<0.1	6.0	40.0	31.2
18:00-18:59	13.5	6.1	63.2	0.2	4.5	1.2	2.1
19:00-19:59	12.4	5.2	67.0	<0.1	5.3	0.9	1.6
20:00-20:04	12.5	5.2	62.1	<0.1	5.2	0.5	6.0

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/06/89
Test #: 8

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
09:32-09:59	13.2	6.2	58.9	0.2	4.8	10.0	23.6
10:00-10:59	11.0	10.1	90.3	4.4	4.1	0.7	2.6
11:00-11:19	13.1	5.9	59.0	<0.1	4.8	0.6	1.5
14:30-14:59	13.3	5.6	47.4	<0.1	4.8	0.9	1.0
15:00-15:59	13.3	5.6	48.1	<0.1	4.8	0.6	1.4
16:00-16:59	13.0	5.0	50.4	<0.1	5.0	0.5	1.3
17:00-17:59	12.2	3.7	58.2	<0.1	5.6	0.6	1.1
18:00-18:59	12.2	3.8	56.1	<0.1	5.6	0.5	1.2
19:00-19:59	12.3	4.0	55.6	<0.1	5.5	0.7	1.1
20:00-20:59	12.3	4.0	56.5	<0.1	5.5	0.5	1.1
21:00-21:59	12.3	4.1	56.2	0.1	5.5	0.4	1.0
22:00-22:59	12.2	4.4	58.5	0.5	5.5	0.6	1.0
23:00-23:59	12.3	4.5	55.4	0.2	5.5	0.7	1.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/07/89

Test #: 8

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.3	4.4	53.6	<0.1	5.5	0.5	1.2
01:00-01:59	12.2	4.3	54.3	<0.1	5.6	0.6	1.3
02:00-02:59	12.1	4.3	54.5	<0.1	5.6	0.6	1.2
03:00-03:59	12.2	4.3	54.5	<0.1	5.6	0.5	1.3
04:00-04:59	12.2	4.4	54.5	<0.1	5.5	0.4	1.4
05:00-05:59	13.3	4.4	46.1	0.2	4.7	0.7	1.2
06:00-06:21	19.6	4.2	<0.1	1.1	0.3	0.7	1.3
09:51-09:53	11.8	4.9	70.0	0.1	5.8	<0.1	7.7
13:58-13:59	11.5	3.4	64.2	0.1	6.2	<0.1	0.8
14:05-14:22	12.1	3.8	60.7	<0.1	5.7	0.8	1.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/08/89

Test #:

8

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
09:37-08:59	19.9	4.4	5.2	5.2	0.4	0.7	2.5
09:00-09:15	17.0	5.0	2.3	23.4	0.4	<0.1	26.5
12:33-12:59	18.1	19.4	5.1	1.0	0.9	<0.1	<0.1
13:00-13:48	17.5	21.3	8.7	0.6	1.3	<0.1	<0.1

July 1990
Revision: Final

TEST RUN 13
500°F/12 HOURS

1311R2

HANTHORNE ARMY AMMUNITION PLANT
HANTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/09/89

Test #:

13

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
20:26-20:59	14.5	18.2	24.4	<0.1	3.4	<0.1	<0.1
21:00-21:59	14.1	13.5	30.4	<0.1	3.7	<0.1	<0.1
22:00-22:59	13.0	7.9	45.2	<0.1	4.5	<0.1	<0.1
23:00-23:59	11.7	4.2	64.2	<0.1	5.3	<0.1	<0.1

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGE

Test Date: 08/10/89

Test #:

13

Test Time	Afterburner Outlet				Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)	
00:00-00:59	10.0	3.8	73.6	<0.1	6.5	4.7	7.9	
01:00-01:59	9.3	3.7	52.8	<0.1	7.0	28.4	26.5	
02:00-02:59	9.0	3.7	52.9	<0.1	7.2	49.4	35.1	
03:00-03:59	7.8	3.6	55.5	<0.1	8.0	71.8	50.8	
04:00-04:59	7.2	3.5	62.2	<0.1	8.5	59.2	42.1	
05:00-05:59	7.1	3.6	55.4	<0.1	8.5	46.0	31.0	
06:00-06:59	7.3	3.8	65.3	<0.1	8.4	44.6	31.5	
07:00-07:59	7.7	4.0	56.6	<0.1	8.1	33.9	24.4	
08:00-08:59	7.5	4.2	52.5	<0.1	8.3	47.0	24.2	
09:00-09:59	8.0	4.7	49.1	<0.1	7.9	53.1	31.9	
10:00-10:59	8.4	4.7	49.0	<0.1	7.6	51.9	26.8	
11:00-11:40	8.0	9.9	72.8	1.5	6.7	43.9	26.2	

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/11/89

Test #:

13

Test Time	Afterburner Outlet		Flash Chamber Inlet		Flash Chamber Outlet		
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	TAC (ppm)
09:59-11:40	9.8	6.6	101.6	38.9	6.6	<0.1	46.5
10:00-11:59	8.6	18.8	119.6	8.1	6.6	<0.1	8.8
11:00-11:59	9.1	4.6	142.2	3.0	5.9	11.7	9.7
12:00-12:59	9.6	3.8	101.8	<0.1	7.2	0.9	2.0
13:00-13:59	9.6	3.9	102.3	<0.1	7.2	1.1	1.8
14:00-14:59	9.6	3.7	104.1	<0.1	7.2	1.1	1.8
15:00-15:59	9.5	3.7	105.7	<0.1	7.2	0.9	1.9
16:00-16:59	9.5	3.7	105.0	<0.1	7.2	0.7	1.6
17:00-17:59	9.5	3.7	105.9	<0.1	7.2	0.9	1.8
18:00-18:59	9.5	3.6	107.4	<0.1	7.2	0.6	1.7
19:00-19:59	9.4	3.3	108.0	<0.1	7.3	0.9	1.4
20:00-20:59	9.4	2.9	108.4	<0.1	7.3	0.5	1.4
21:00-21:59	9.4	2.8	109.3	<0.1	7.3	0.5	1.3
22:00-22:59	9.4	2.9	107.8	<0.1	7.3	0.5	1.3
23:00-23:59	9.4	3.0	104.3	<0.1	7.3	0.5	1.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/12/89

Test #:

13

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	HC _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	9.4	2.9	102.0	<0.1	7.3	0.6	1.1
01:00-01:59	9.5	2.9	101.8	<0.1	7.3	0.5	1.2
02:00-02:59	9.5	2.9	102.2	<0.1	7.2	0.7	1.1
03:00-03:59	9.5	3.0	100.6	<0.1	7.2	0.5	1.2
04:00-04:59	9.5	3.0	101.7	<0.1	7.2	0.5	1.2
05:00-05:59	9.6	2.9	101.8	<0.1	7.2	0.4	1.3
06:00-06:59	9.6	2.8	101.0	<0.1	7.1	0.4	1.2
07:00-07:59	9.7	3.1	100.8	<0.1	7.1	0.5	1.2
08:00-08:59	9.5	3.6	100.0	<0.1	7.0	0.4	1.5
09:00-09:59	10.0	4.6	99.4	<0.1	6.9	0.7	1.6
10:00-10:59	9.7	8.5	107.5	4.4	5.8	8.1	8.3
11:00-11:59	10.0	3.7	98.7	<0.1	7.0	0.6	1.8
12:00-12:51	10.0	3.8	101.1	<0.1	6.9	0.5	1.6

July 1990
Revision: Final

TEST RUN 14
400°F/12 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/15/89

Test #:

14

Test Time	O ₂ (%)	CO (ppm)	Afterburner Outlet		CO ₂ (%)	Flash Chamber Inlet		Flash Chamber Outlet	
			NO _x (ppm)	THC (ppm)		THC (ppm)	THC (ppm)	THC (ppm)	THC (ppm)
07:58-07:59	19.3	4.2	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1
08:00-08:59	13.1	20.6	106.0	7.8	3.6	4.9	4.9	5.2	5.2
09:00-09:59	19.4	5.3	1.4	7.4	0.4	0.7	0.7	2.0	2.0
10:00-10:59	18.5	20.7	5.9	2.6	1.0	10.9	10.9	11.0	11.0
11:00-11:59	18.0	21.9	6.3	2.2	1.3	0.5	0.5	3.4	3.4
12:00-12:59	18.1	21.5	8.2	1.7	1.3	0.4	0.4	2.3	2.3
13:00-13:59	18.1	21.3	8.1	1.4	1.3	0.4	0.4	2.0	2.0
14:00-14:59	17.9	22.1	9.4	1.6	1.4	0.4	0.4	1.9	1.9
15:00-15:59	17.3	24.1	12.0	2.4	1.8	0.4	0.4	1.6	1.6
16:00-16:59	16.5	25.6	14.1	2.4	2.3	0.4	0.4	1.9	1.9
17:00-17:59	15.8	22.5	19.4	1.6	2.8	0.5	0.5	1.9	1.9
18:00-18:59	15.0	16.8	27.8	0.9	3.4	0.5	0.5	1.8	1.8
19:00-19:59	13.9	10.0	41.9	0.3	4.2	0.5	0.5	1.4	1.4
20:00-20:59	12.7	5.3	63.5	<0.1	5.1	0.4	0.4	1.2	1.2
21:00-21:59	11.1	3.4	92.9	<0.1	6.2	4.2	4.2	1.1	1.1
22:00-22:59	10.5	3.7	53.5	<0.1	6.5	10.5	10.5	10.3	10.3
23:00-23:59	10.2	3.6	57.0	<0.1	6.8	23.5	23.5	23.6	23.6

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/16/89

Test #:

14

Test Time	O ₂ (%)	CO (ppm)	Afterburner Outlet		CO ₂ (%)	Flash Chamber Inlet		Flash Chamber Outlet	
			NO _x (ppm)	THC (ppm)		THC (ppm)	THC (ppm)	THC (ppm)	THC (ppm)
00:00-00:59	9.1	3.3	57.4	<0.1	7.6	35.4	26.4	35.4	26.4
01:00-01:59	8.7	3.4	63.2	<0.1	7.9	38.2	28.7	38.2	28.7
02:00-02:59	8.8	3.4	68.9	<0.1	7.8	42.3	29.2	42.3	29.2
03:00-03:59	10.8	3.3	62.1	<0.1	6.4	57.7	44.2	57.7	44.2
04:00-04:59	10.8	3.1	63.1	<0.1	6.3	60.0	42.9	60.0	42.9
05:00-05:59	10.4	3.1	69.5	<0.1	6.6	59.9	43.1	59.9	43.1
06:00-06:59	10.4	3.3	53.2	<0.1	6.6	62.4	44.2	62.4	44.2
07:00-07:59	11.0	3.2	54.2	<0.1	6.3	51.3	37.1	51.3	37.1
08:00-08:59	11.2	9.6	77.7	6.0	5.4	43.4	35.6	43.4	35.6
09:00-09:59	9.5	3.9	63.2	<0.1	7.3	33.5	30.7	33.5	30.7
10:00-10:59	9.2	3.9	65.7	<0.1	7.5	31.8	26.2	31.8	26.2
11:00-11:59	9.2	3.9	67.6	<0.1	7.5	28.8	23.6	28.8	23.6
12:00-12:59	9.4	4.0	59.1	<0.1	7.4	26.0	21.1	26.0	21.1
13:00-13:59	9.4	4.2	70.7	<0.1	7.3	23.1	20.6	23.1	20.6
14:00-14:59	11.7	5.1	104.1	<0.1	5.7	1.4	2.1	1.4	2.1
15:00-15:59	12.1	4.2	89.4	<0.1	5.4	1.1	1.8	1.1	1.8
16:00-16:59	12.4	4.2	82.4	<0.1	5.2	0.7	2.0	0.7	2.0
17:00-17:59	12.4	4.1	76.4	<0.1	5.2	0.9	1.6	0.9	1.6
18:00-18:59	12.4	4.0	73.7	<0.1	5.2	0.8	1.5	0.8	1.5
19:00-19:59	12.5	3.7	70.4	<0.1	5.1	0.5	1.5	0.5	1.5
20:00-20:59	12.5	3.5	69.2	<0.1	5.1	0.4	1.4	0.4	1.4
21:00-21:59	12.6	3.5	67.7	<0.1	5.1	0.5	1.2	0.5	1.2
22:00-22:59	12.7	3.5	67.4	<0.1	5.0	0.6	1.1	0.6	1.1
23:00-23:59	12.7	3.8	66.8	<0.1	5.0	0.4	1.4	0.4	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/17/89

Test #: 14

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.7	4.0	65.4	<0.1	5.0	0.4	1.4
01:00-01:59	12.8	3.8	62.0	<0.1	4.9	0.5	1.2
02:00-02:59	12.8	4.1	62.2	<0.1	4.9	0.6	1.1
03:00-03:59	12.9	3.9	63.1	<0.1	4.8	0.4	1.2
04:00-04:59	13.0	3.9	61.5	<0.1	4.8	0.3	1.1
05:00-05:59	13.0	4.1	61.4	<0.1	4.8	0.5	1.0
06:00-06:59	13.0	3.9	61.0	<0.1	4.8	0.3	1.1
07:00-07:59	13.1	4.2	59.9	<0.1	4.7	0.4	1.0
08:00-08:59	11.5	4.3	78.1	<0.1	5.8	0.4	1.5
09:00-09:59	12.1	11.8	67.9	6.4	6.1	18.6	10.2
10:00-10:59	9.8	7.3	135.3	10.9	4.8	0.6	1.6
11:00-11:59	10.1	4.2	104.6	0.2	6.8	0.5	1.6
12:00-12:59	10.3	3.7	99.3	0.2	6.7	0.7	1.3
13:00-13:59	10.1	3.4	100.9	0.2	6.7	0.4	1.3
14:00-14:59	11.7	3.5	79.6	0.2	5.7	0.4	1.2
15:00-15:59	10.2	3.9	102.6	0.3	6.7	0.6	1.5
16:00-16:59	10.2	3.8	103.0	0.2	6.7	0.7	1.5
17:00-17:59	10.1	3.5	103.0	0.2	6.8	0.4	1.4
18:00-18:59	9.9	3.2	103.3	0.1	6.9	0.4	1.2
19:00-19:59	9.9	3.0	102.7	0.1	6.9	0.4	1.0
20:00-20:59	9.9	2.9	102.2	0.1	6.9	0.5	0.9
21:00-21:59	10.0	2.9	100.7	0.1	6.9	0.3	1.0
22:00-22:59	10.1	2.9	99.6	0.1	6.8	0.3	1.0
23:00-23:59	10.1	3.2	99.9	0.2	6.8	0.5	1.0

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/18/89

Test #:

14

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.1	3.2	98.9	0.2	6.8	0.3	1.1
01:00-01:59	10.1	3.1	98.0	0.2	6.8	0.4	1.0
02:00-02:59	10.2	3.1	97.6	0.2	6.8	0.3	0.9
03:00-03:59	10.2	2.9	96.2	0.1	6.8	0.4	0.8
04:00-04:59	10.2	2.8	95.7	0.1	6.8	0.3	0.9
05:00-05:59	10.2	2.8	94.7	0.1	6.8	0.3	0.9
06:00-06:59	10.3	2.9	94.2	0.1	6.7	0.4	0.9
07:00-07:59	10.3	2.9	93.2	0.1	6.7	0.3	1.0
08:00-08:59	10.4	3.4	91.5	0.2	6.6	7.7	1.1
09:00-09:59	13.6	10.5	75.2	10.1	2.7	2.4	10.5
10:00-10:29	19.6	4.6	0.2	1.1	0.2	0.7	1.0

July 1990
Revision: Final

TEST RUN 15
600°F/12 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/22/89

Test #: 15

Test Time	Afterburner Outlet		Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)	THC (ppm)
08:49-08:59	19.9	3.5	0.2	<0.1	<0.1	<0.1
09:00-09:59	15.6	8.0	1.1	6.0	0.9	9.6
10:00-10:54	14.2	9.4	1.3	3.7	12.3	12.1
11:13-11:59	17.9	20.0	1.2	1.0	0.7	2.4
12:00-12:59	17.6	20.8	1.3	0.9	0.9	1.8
13:00-13:59	17.6	20.6	1.3	0.8	0.8	1.6
14:00-14:59	17.6	20.5	1.3	0.8	0.6	1.6
15:00-15:59	17.3	21.7	1.4	1.1	0.9	1.6
16:00-16:59	17.0	23.3	1.7	1.6	0.6	1.7
17:00-17:59	16.3	24.9	2.1	1.9	0.5	1.8
18:00-18:59	15.4	22.6	2.8	0.9	0.5	1.6
19:00-19:59	14.5	15.6	3.5	0.1	0.6	1.2
20:00-20:59	13.4	10.5	4.2	<0.1	0.6	1.1
21:00-21:59	12.2	5.8	5.1	<0.1	0.5	1.2
22:00-22:59	10.8	3.7	6.1	<0.1	0.5	1.2
23:00-23:59	9.6	3.0	6.9	<0.1	18.7	20.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/23/89

Test #: 15

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	8.8	3.0	56.9	<0.1	7.5	45.0	39.7
01:00-01:59	7.6	3.0	73.3	<0.1	8.4	50.9	43.0
02:00-02:59	7.1	3.0	95.1	<0.1	8.7	54.5	59.1
03:00-03:59	6.8	2.8	82.9	<0.1	8.9	54.4	41.1
04:00-04:59	6.1	3.0	64.0	<0.1	9.4	49.3	32.3
05:00-05:59	6.2	3.2	62.4	<0.1	9.3	37.1	22.2
06:00-06:59	6.7	3.1	63.1	<0.1	9.1	42.1	23.1
07:00-07:59	6.6	3.2	63.3	<0.1	9.1	42.3	23.1
08:00-08:59	6.7	3.1	62.5	<0.1	9.0	39.5	21.5
09:00-09:59	8.1	8.5	90.5	8.9	5.4	34.6	23.1
10:00-10:59	5.4	3.1	109.3	0.9	7.1	36.1	18.6
11:00-11:59	7.0	3.1	56.0	0.3	6.8	34.8	18.7
12:00-12:59	7.5	3.0	57.4	0.3	8.5	32.2	15.7
13:00-13:59	6.9	3.2	58.7	0.5	8.9	34.7	17.0
14:00-14:59	7.1	3.2	57.5	0.4	8.8	34.1	15.7
15:00-15:59	7.0	3.0	58.7	0.4	8.8	34.8	17.1
16:00-16:59	6.9	2.8	58.4	0.3	8.9	37.7	16.7
17:00-17:59	6.8	2.7	58.0	0.3	8.9	39.0	17.8
18:00-18:59	6.8	2.6	57.8	0.3	9.0	40.3	17.6
19:00-19:24	6.8	2.6	56.3	0.4	9.0	46.3	17.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/24/89

Test #: 15

Test Time	O ₂ (%)	CO (ppm)	Afterburner Outlet		CO ₂ (%)	Flash Chamber Inlet		Flash Chamber Outlet	
			HC (ppm)	THC (ppm)		THC (ppm)	THC (ppm)	THC (ppm)	THC (ppm)
09:14-09:55	11.2	2.6	87.2	0.5	5.9	0.5	0.5	1.5	
10:00-10:59	10.8	2.8	92.3	0.5	6.2	0.7	0.7	1.3	
11:00-11:59	9.4	2.9	104.4	0.5	7.2	0.7	0.6	1.4	
12:00-12:59	9.3	3.2	106.5	0.5	7.2	0.6	0.8	1.6	
13:00-13:59	9.4	3.4	106.0	0.5	7.1	0.7	0.7	1.5	
14:00-14:59	9.5	3.3	104.6	0.5	7.1	0.5	0.5	1.5	
15:00-15:59	9.4	3.3	108.2	0.5	7.1	0.7	0.7	1.6	
16:00-16:59	9.4	3.2	106.7	0.5	7.1	0.7	0.5	1.2	
17:00-17:59	9.4	3.0	106.7	0.5	7.1	0.5	0.5	1.4	
18:00-18:59	9.4	2.8	106.3	0.4	7.1	0.7	0.7	1.2	
19:00-19:59	9.3	2.6	107.4	0.4	7.1	0.6	0.5	1.0	
20:00-20:59	9.4	2.6	107.2	0.4	7.1	0.5	0.5	1.1	
21:00-21:59	9.4	2.6	105.7	0.4	7.1	0.5	0.5	1.1	
22:00-22:59	9.3	2.5	107.5	0.4	7.2	0.5	0.5	1.0	
23:00-23:59	9.3	2.6	106.5	0.4	7.2	0.6	0.6	0.9	

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/25/89

Test #:

15

Test Time	O ₂ (%)	CO (Ppm)	Afterburner Outlet		CO ₂ (%)	Flash Chamber Inlet		Flash Chamber Outlet	
			NO _x (ppm)	THC (ppm)		TIC (ppm)	THC (ppm)		
00:00-00:59	9.3	2.6	107.4	0.4	7.2	0.5	1.6	0.5	1.6
01:00-01:59	9.4	2.7	105.8	0.4	7.1	0.5	1.1	0.5	1.1
02:00-02:59	9.4	2.5	104.5	0.4	7.1	0.5	0.9	0.5	0.9
03:00-03:59	9.3	2.5	105.2	0.4	7.2	0.5	0.9	0.5	0.9
04:00-04:59	9.4	2.4	103.7	0.4	7.1	0.4	1.0	0.4	1.0
05:00-05:59	9.4	2.4	103.3	0.4	7.1	0.4	0.9	0.4	0.9
06:00-06:59	9.4	2.5	102.3	0.4	7.1	0.5	0.9	0.5	0.9
07:00-07:59	9.5	2.5	95.4	0.4	7.0	0.5	0.9	0.5	0.9
08:00-08:59	10.2	3.1	87.4	3.4	6.2	6.9	8.0	6.9	8.0
09:00-09:59	8.0	9.7	190.5	1.9	2.5	0.7	2.1	0.7	2.1
10:00-10:59	10.7	3.0	98.9	0.6	6.3	0.6	1.3	0.6	1.3
11:00-11:59	10.7	3.0	99.5	0.5	6.2	0.5	1.4	0.5	1.4
12:00-12:59	10.7	3.1	93.4	0.5	6.2	0.6	1.3	0.6	1.3
13:00-13:59	10.7	3.2	100.0	0.5	6.2	0.5	1.2	0.5	1.2
14:00-14:59	10.7	3.2	104.2	0.5	6.2	0.4	1.4	0.4	1.4
15:00-15:59	10.3	3.0	100.5	0.5	6.4	0.5	1.3	0.5	1.3
16:00-16:59	9.6	3.0	105.5	0.5	6.9	0.4	1.3	0.4	1.3
17:00-17:59	9.5	3.0	105.2	0.5	6.9	0.5	1.2	0.5	1.2
18:00-18:59	9.5	2.9	103.6	0.5	7.0	0.5	1.1	0.5	1.1
19:00-19:59	9.5	2.7	101.4	0.4	7.0	0.4	1.1	0.4	1.1
20:00-20:59	9.4	2.6	102.0	0.4	7.1	0.5	0.9	0.5	0.9
21:00-21:59	9.5	2.6	102.5	0.4	7.0	0.4	1.0	0.4	1.0
22:00-22:59	9.5	2.7	104.3	0.4	7.0	0.4	1.0	0.4	1.0
23:00-23:59	9.5	2.6	103.3	0.4	7.0	0.3	1.0	0.3	1.0

LAANTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/26/89

Test #: 15

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	9.5	2.6	102.7	0.4	7.0	0.5	0.9
01:00-01:59	9.5	2.6	104.4	0.4	7.0	0.3	0.9
02:00-02:59	9.5	2.6	103.2	0.4	7.0	0.4	0.9
03:00-03:59	9.6	2.6	102.3	0.4	7.0	0.3	0.9
04:00-04:59	9.6	2.5	102.0	0.4	7.0	0.4	0.8
05:00-05:59	9.6	2.5	102.6	0.4	7.0	0.3	0.9
06:00-06:59	9.6	2.6	101.9	0.4	6.9	0.4	0.8
07:00-07:59	9.5	6.6	106.6	3.6	5.9	4.7	9.3
08:00-08:59	9.9	3.0	96.5	0.5	6.8	0.4	1.3
09:00-09:59	9.9	3.1	94.4	0.5	6.8	0.5	1.4
10:00-10:59	9.9	3.2	97.0	0.5	6.8	0.5	1.5
11:00-11:59	9.9	3.2	98.6	0.5	6.8	0.6	1.5
12:00-12:59	9.9	3.2	99.4	0.5	6.8	0.5	1.5
13:00-13:59	9.9	3.3	100.2	0.5	6.7	0.7	1.4
14:00-14:59	9.9	3.4	101.1	0.5	6.7	0.7	1.4
15:00-15:59	9.9	3.3	102.3	0.5	6.7	0.5	1.5
16:00-16:59	9.8	3.2	101.5	0.5	6.8	0.7	1.3
17:00-17:59	9.7	3.1	101.3	0.5	6.8	0.6	1.3
18:00-18:59	9.7	3.0	98.9	0.4	6.9	0.4	1.3
19:00-19:59	9.6	2.8	97.0	0.4	6.9	0.5	1.1
20:00-20:59	9.6	2.7	96.7	0.4	6.9	0.5	1.0
21:00-21:59	9.6	2.7	96.0	0.4	6.9	0.4	1.1
22:00-22:59	9.7	2.7	97.1	0.4	6.9	0.6	0.9
23:00-23:59	9.7	2.6	99.4	0.4	6.9	0.4	1.0

July 1990
Revision: Final

TEST RUN 16
600°F/6 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/27/89

Test #: 16

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	9.7	2.6	96.6	0.4	6.9	0.5	0.9
01:00-01:59	9.7	2.7	95.4	0.4	6.9	0.4	1.0
02:00-02:59	9.7	2.7	96.9	0.4	6.9	0.4	1.0
03:00-03:59	9.7	2.7	97.2	0.4	6.9	0.4	1.0
04:00-04:59	9.7	2.6	97.2	0.4	6.9	0.5	0.9
05:00-05:59	9.8	2.8	96.1	0.4	6.9	0.3	0.9
06:00-06:59	9.8	2.5	95.6	0.4	6.9	0.3	1.0
07:00-07:59	11.4	2.8	79.4	0.6	5.7	3.9	3.0
08:00-08:59	11.4	13.1	81.3	9.6	2.1	6.5	41.2
09:00-09:54	9.7	8.3	145.1	3.8	1.0	7.9	9.3
10:35-10:59	18.5	16.5	3.8	3.2	0.8	1.0	5.7
11:00-11:59	17.8	22.4	7.7	2.4	1.3	1.1	3.9
12:00-12:59	17.8	22.3	8.1	2.3	1.3	1.1	2.6
13:00-13:59	17.8	21.4	8.1	1.9	1.3	1.0	2.1
14:00-14:59	17.7	22.0	8.8	1.8	1.4	0.9	2.1
15:00-15:59	17.4	22.8	9.9	1.9	1.6	1.2	1.9
16:00-16:59	16.7	24.9	12.5	2.4	2.0	1.0	1.9
17:00-17:59	15.9	24.2	15.6	1.8	2.6	0.9	1.9
18:00-18:59	15.2	19.7	22.4	1.1	3.1	1.1	1.7
19:00-19:59	14.3	12.5	33.1	0.6	3.8	1.0	1.8
20:00-20:59	12.9	8.2	52.8	0.3	4.9	1.0	1.7
21:00-21:59	11.4	3.3	76.8	0.3	5.9	1.1	1.7
22:00-22:05	10.7	2.8	86.8	0.2	6.5	<0.1	1.4

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/29/59

Test #:

16

Test Time	Afterburner Outlet		Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)
08:27-08:59	10.1	3.5	11.2	<0.1	6.7	1.3
09:00-09:59	10.7	3.3	3.6	<0.1	6.3	1.2
10:00-10:59	10.8	3.3	0.6	<0.1	6.3	1.3
11:00-11:59	10.7	3.4	0.7	<0.1	6.3	1.2
12:00-12:59	10.8	3.5	0.5	<0.1	6.2	1.4
13:00-13:59	10.8	3.6	56.4	<0.1	6.2	1.3
14:00-14:59	10.8	4.1	8.2	<0.1	6.2	1.3
15:00-15:59	11.1	7.5	<0.1	1.7	5.9	10.6
16:00-16:59	10.9	3.6	50.0	<0.1	6.2	3.7
17:00-17:59	10.8	3.6	105.6	<0.1	6.2	1.8
18:00-18:59	10.8	3.3	104.1	<0.1	6.2	1.9
19:00-19:59	10.8	3.1	105.1	<0.1	6.2	1.4
20:00-20:59	10.8	3.2	103.3	<0.1	6.2	1.3
21:00-21:59	10.8	3.0	101.0	<0.1	6.2	1.2
22:00-22:59	10.7	3.1	103.9	<0.1	6.2	1.1
23:00-23:59	10.8	3.2	103.3	<0.1	6.2	0.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 08/30/19

Test #:

16

Test Time	O ₂ (%)	Afterburner Outlet			CO ₂ (%)	Flash Chamber Inlet		Flash Chamber Outlet	
		CO (ppm)	NO _x (ppm)	THC (ppm)		THC (ppm)	THC (ppm)	THC (ppm)	
00:00-00:29	10.8	3.0	100.9	<0.1	6.2	0.3	0.9	0.9	
01:00-01:59	10.8	2.8	101.8	<0.1	6.2	0.4	1.0	1.0	
02:00-02:59	10.8	2.8	103.1	<0.1	6.2	0.5	0.9	0.9	
03:00-03:59	10.8	2.8	103.0	<0.1	6.2	0.3	0.9	0.9	
04:00-04:59	10.7	2.9	105.1	<0.1	6.3	0.2	0.8	0.8	
05:00-05:59	10.7	2.9	104.8	<0.1	6.3	0.4	0.7	0.7	
06:00-06:59	10.7	3.0	103.9	<0.1	6.2	0.2	0.9	0.9	
07:00-07:59	10.7	2.9	103.7	<0.1	6.2	0.2	0.9	0.9	
08:00-08:59	10.8	2.9	99.9	<0.1	6.2	0.3	0.7	0.7	
09:00-09:25	15.0	3.3	52.3	0.1	3.2	0.6	0.7	0.7	

July 1990
Revision: Final

TEST RUN 17
600°F/48 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/01/89

Test #: 17

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
10:20-10:59	19.3	2.9	0.4	8.0	0.2	0.7	11.9
11:00-11:59	18.9	8.5	1.9	6.8	0.4	0.7	10.3
12:00-12:59	17.8	22.3	8.8	5.9	1.2	1.0	7.0
13:00-13:59	17.6	22.8	9.4	4.3	1.3	0.7	6.9
14:00-14:59	17.7	22.4	9.2	3.7	1.3	1.0	5.8
15:00-15:59	17.6	25.2	9.7	5.0	1.4	0.7	11.5
16:00-16:59	17.2	28.3	12.3	7.5	1.6	1.0	12.4
17:00-17:59	16.6	30.7	15.2	5.2	2.0	0.6	8.5
18:00-18:59	15.8	30.8	18.9	2.8	2.6	0.9	6.2
19:00-19:59	15.1	24.3	24.2	1.2	3.1	0.8	4.9
20:00-20:59	14.0	14.6	38.2	0.3	3.9	0.5	3.8
21:00-21:59	12.9	6.8	56.8	<0.1	4.7	0.7	2.6
22:00-22:59	11.6	3.5	79.8	<0.1	5.7	0.6	2.2
23:00-23:59	10.9	3.0	71.2	<0.1	6.3	19.4	20.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/02/89

Test #:

17

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.9	2.6	48.1	<0.1	6.3	39.7	51.7
01:00-01:59	10.5	2.5	52.0	<0.1	6.5	44.2	59.7
02:00-02:59	10.1	2.4	53.7	<0.1	6.8	54.7	53.7
03:00-03:59	9.5	2.3	55.0	<0.1	7.4	50.4	47.6
04:00-04:59	7.9	2.4	54.6	<0.1	8.6	71.2	57.6
05:00-05:59	6.9	2.5	53.6	<0.1	9.3	66.0	55.5
06:00-06:59	6.1	2.5	54.6	<0.1	9.8	45.8	30.2
07:00-07:59	6.6	2.6	56.2	<0.1	9.5	40.3	26.1
08:00-08:59	6.2	3.1	57.9	<0.1	9.8	33.2	21.4
09:00-09:59	8.2	9.6	124.7	9.3	7.1	30.0	21.3
10:00-10:59	6.0	3.4	93.4	2.4	8.8	29.4	19.3
11:00-11:59	6.1	3.1	57.8	0.1	9.9	29.6	18.5
12:00-12:59	6.1	3.2	58.6	0.1	9.9	28.7	17.0
13:00-13:59	6.2	3.3	59.1	0.1	9.8	25.4	16.4
14:00-14:59	6.5	3.2	59.4	0.1	9.5	25.6	16.4
15:00-15:59	6.5	3.2	61.5	0.1	9.5	32.1	17.6
16:00-16:59	6.5	3.2	60.7	0.1	9.5	38.3	19.1
17:00-17:59	6.4	3.1	59.8	0.1	9.6	39.5	19.1
18:00-18:59	6.8	3.2	58.3	<0.1	9.3	45.5	19.7
19:00-19:59	7.1	2.7	56.9	<0.1	9.1	49.1	22.6
20:00-20:59	6.9	2.7	56.2	<0.1	9.3	48.9	21.3
21:00-21:59	7.0	2.7	56.6	<0.1	9.2	58.5	22.7
22:00-22:59	7.0	2.8	58.3	<0.1	9.2	54.1	22.4
23:00-23:59	6.9	2.8	57.9	<0.1	9.3	51.3	22.2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/03/89

Test #: 17

Test Time	O ₂ (%)	CO (ppm)	NO _x (ppm)	Afterburner Outlet		CO ₂ (%)	Flash Chamber Inlet		Flash Chamber Outlet	
				THC (ppm)	THC (ppm)		THC (ppm)	THC (ppm)		
00:00-00:59	6.9	2.9	59.1	<0.1	<0.1	9.3	54.5	23.1		
01:00-01:59	6.9	2.7	59.5	<0.1	<0.1	9.3	54.5	23.3		
02:00-02:59	6.8	2.6	59.2	<0.1	<0.1	9.4	53.7	22.2		
03:00-03:59	6.8	2.7	59.2	0.1	0.1	9.4	58.6	24.0		
04:00-04:59	6.8	2.9	58.7	<0.1	<0.1	9.4	53.9	25.2		
05:00-05:59	6.6	2.7	58.1	0.1	0.1	9.5	55.4	21.6		
06:00-06:59	6.6	2.6	57.8	0.1	0.1	9.6	55.3	24.1		
07:00-07:59	6.7	2.8	58.7	<0.1	<0.1	9.5	60.0	25.0		
08:00-08:59	7.3	7.4	123.8	4.1	4.1	6.9	49.9	20.9		
09:00-09:59	7.9	3.0	70.1	0.1	0.1	8.6	52.6	41.1		
10:00-10:59	7.1	2.9	63.4	<0.1	<0.1	9.3	54.1	43.3		
11:00-11:59	6.9	3.1	63.3	0.1	0.1	9.3	53.5	39.7		
12:00-12:59	7.3	3.1	63.6	0.1	0.1	9.1	52.4	38.5		
13:00-13:59	7.3	3.1	64.5	0.1	0.1	9.1	49.9	33.7		
14:00-14:59	7.3	3.2	65.1	0.1	0.1	9.0	48.2	34.8		
15:00-15:59	7.4	3.2	64.9	0.1	0.1	9.0	47.3	32.4		
16:00-16:59	7.4	3.1	64.6	0.1	0.1	9.0	45.8	31.5		
17:00-17:59	7.3	3.1	64.8	0.1	0.1	9.0	47.2	34.3		
18:00-18:59	7.3	2.9	62.5	<0.1	<0.1	9.1	55.5	40.1		
19:00-19:59	8.3	2.8	81.4	<0.1	<0.1	8.3	40.5	31.5		
20:00-20:59	7.2	2.7	60.3	<0.1	<0.1	9.1	69.2	48.5		
21:00-21:59	7.3	2.8	60.8	<0.1	<0.1	9.1	69.7	50.4		
22:00-22:59	8.2	2.8	76.3	<0.1	<0.1	8.4	55.1	39.4		
23:00-23:59	6.8	3.0	59.3	<0.1	<0.1	9.4	68.9	39.9		

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/04/89

Test #:

17

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	6.9	2.8	60.5	<0.1	9.4	69.8	46.3
01:00-01:59	6.8	2.6	60.4	<0.1	9.4	72.9	45.5
02:00-02:59	8.0	2.8	81.3	<0.1	8.5	64.7	29.9
03:00-03:59	7.4	2.6	60.1	<0.1	9.0	76.3	52.3
04:00-04:59	7.9	2.7	62.0	<0.1	8.7	82.4	61.5
05:00-05:59	8.1	2.8	62.4	<0.1	8.5	83.7	63.9
06:00-06:59	8.4	2.5	63.1	<0.1	8.4	85.2	65.0
07:00-07:59	10.0	2.6	78.2	0.1	7.2	53.4	52.0
08:00-08:59	7.4	3.2	62.0	<0.1	9.1	77.3	66.0
09:00-09:59	8.0	7.8	68.3	2.9	8.2	59.3	52.0
10:00-10:59	7.6	3.3	64.5	0.2	8.9	63.6	53.1
11:00-11:59	7.7	3.3	65.6	0.2	8.8	61.1	50.5
12:00-12:59	7.7	3.3	65.8	0.2	8.8	58.7	47.6
13:00-13:59	7.7	3.4	67.2	0.2	8.8	56.1	44.8
14:00-14:59	7.7	3.5	66.9	0.2	8.8	54.1	43.5
15:00-15:59	7.6	3.6	66.6	0.3	8.8	53.3	42.8
16:00-16:59	7.6	3.5	66.6	0.2	8.8	52.5	41.0
17:00-17:59	7.6	3.4	66.5	0.2	8.9	53.7	41.6
18:00-18:59	7.5	3.2	66.1	0.2	8.9	54.5	43.4
19:00-19:59	7.4	3.0	62.0	0.1	9.0	67.0	58.1
20:00-20:59	8.1	2.9	73.0	<0.1	8.5	71.1	37.3
21:00-21:59	11.8	3.0	103.4	0.1	5.8	1.3	2.9
22:00-22:59	12.0	2.7	101.9	0.2	5.6	0.9	1.9
23:00-23:59	12.0	3.0	96.4	0.1	5.6	0.9	1.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/05/89

Test #: 17

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	12.0	2.9	96.9	0.2	5.6	0.8	1.8
01:00-01:59	12.2	2.9	92.2	0.2	5.5	0.8	1.7
02:00-02:59	12.4	2.6	84.5	0.2	5.3	0.8	1.4
03:00-03:59	12.6	2.5	79.0	0.2	5.1	0.7	1.5
04:00-04:59	12.8	2.8	74.5	0.2	5.0	0.7	1.4
05:00-05:59	13.0	2.6	69.6	0.2	4.9	0.6	1.5
06:00-06:59	13.2	2.7	64.5	0.1	4.7	0.6	1.4
07:00-07:59	13.3	2.9	62.0	0.2	4.6	0.8	1.3
08:00-08:59	11.8	3.2	87.7	0.2	5.7	0.7	1.4
09:00-09:59	9.8	4.3	109.5	2.8	6.7	4.9	7.2
10:00-10:59	10.5	7.1	130.6	5.7	6.1	1.1	2.7
11:00-11:59	9.5	3.4	122.6	0.3	7.5	0.9	2.0
12:00-12:59	9.6	3.4	123.7	0.3	7.4	1.0	1.8
13:00-13:59	9.6	3.5	122.3	0.3	7.4	0.9	1.9
14:00-14:59	9.6	3.6	124.3	0.3	7.4	0.9	2.0
15:00-15:59	9.6	3.7	125.7	0.3	7.4	1.2	2.1
16:00-16:59	9.6	3.6	125.0	0.3	7.3	1.2	1.8
17:00-17:59	9.6	3.6	124.9	0.3	7.4	1.1	1.6
18:00-18:59	9.6	3.7	125.9	0.3	7.4	0.8	1.9
19:00-19:59	9.6	3.0	119.3	0.2	7.3	0.9	1.5
20:00-20:59	9.5	2.7	120.4	0.1	7.4	0.7	1.4
21:00-21:59	9.6	2.9	122.0	0.1	7.3	0.8	1.3
22:00-22:59	9.6	2.9	120.9	0.1	7.3	0.6	1.4
23:00-23:59	9.6	2.8	119.5	<0.1	7.3	0.6	1.3

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/06/89
Test #:

17

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (PPM)	NO _x (PPM)	THC (PPM)	CO ₂ (%)	THC (PPM)	THC (PPM)
00:00-00:59	9.6	2.9	117.2	<0.1	7.3	0.7	1.2
01:00-01:42	9.7	2.8	114.1	<0.1	7.2	0.6	1.5
20:09-20:59	9.8	3.0	127.8	0.2	6.9	1.4	1.3
21:00-21:59	10.0	2.7	112.6	<0.1	6.9	0.5	1.1
22:00-22:59	10.1	2.5	111.0	<0.1	6.9	0.6	0.9
23:00-23:11	10.1	2.4	109.4	0.2	6.8	<0.1	0.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/08/89

Test #: 17

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
10:25-23:11	19.5	3.2	<0.1	<0.1	9.2	<0.1	<0.1

July 1990
Revision: Final

TEST RUN 18
500°F/6 HOURS

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/13/99

Test #:

18

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
08:50-08:59	17.4	13.5	22.5	<0.1	0.6	<0.1	<0.1
09:00-09:59	11.9	31.6	0.5	<0.1	6.6	<0.1	<0.1
10:00-10:59	11.7	18.2	162.8	<0.1	2.5	<0.1	<0.1
11:00-11:59	17.3	27.1	8.8	<0.1	1.2	2.1	15.3
12:00-12:59	13.3	24.5	49.7	<0.1	2.8	8.4	10.7
13:00-13:59	17.2	27.7	10.5	10.0	1.5	15.9	5.7
14:00-14:59	16.4	34.2	14.0	1.8	2.0	1.9	1.9
15:00-15:59	13.1	29.9	8.7	3.6	3.4	11.3	5.0
16:00-16:59	15.8	8.3	59.8	1.1	0.9	30.9	18.3
17:00-17:59	17.8	5.9	11.7	4.4	0.5	0.9	1.9
18:00-18:59	18.8	5.4	4.2	0.4	0.5	0.9	1.5
19:00-19:59	18.6	4.3	6.0	0.3	0.6	0.9	1.5
20:00-20:59	18.5	5.9	7.1	0.3	0.7	20.4	4.3
21:00-21:59	18.6	8.8	5.3	0.5	0.7	29.8	13.9
22:00-22:59	12.9	5.3	61.9	0.3	4.9	6.1	9.4
23:00-23:59	11.0	6.2	61.6	0.2	6.3	24.4	24.8

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/14/89

Test #:

18

Test Time	Afterburner Outlet				Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)	
00:00-00:59	17.7	7.3	15.4	20.4	1.2	0.9	1.4	
01:00-01:59	10.2	8.7	101.5	0.4	6.9	19.2	2.9	
02:00-02:59	9.8	5.3	127.0	0.1	7.2	1.4	1.1	
03:00-03:59	9.9	5.1	124.7	0.1	7.2	0.3	1.0	
04:00-04:59	9.9	5.5	123.9	0.1	7.2	0.8	1.0	
05:00-05:59	9.9	5.5	124.0	0.1	7.2	0.8	0.9	
06:00-06:59	9.9	5.1	121.7	0.1	7.1	0.7	1.0	
07:00-07:59	9.9	5.7	123.2	0.1	7.2	0.7	1.0	
08:00-08:59	9.6	6.4	116.4	0.1	7.4	10.7	7.7	
09:00-09:59	9.8	6.5	124.9	0.2	7.2	10.1	2.6	
10:00-10:59	10.5	6.6	65.3	0.2	6.7	17.6	16.3	
11:00-11:59	11.1	7.6	51.6	0.2	6.2	26.2	23.9	
12:00-12:59	11.1	7.1	55.1	0.2	6.2	20.8	23.3	
13:00-13:59	10.1	7.0	56.7	0.2	7.0	26.1	24.4	
14:00-14:59	8.4	11.9	110.3	3.4	6.2	31.7	32.0	
15:00-15:59	7.6	8.5	224.8	0.2	9.0	39.2	74.3	
16:00-16:59	7.2	6.6	64.0	0.1	9.2	30.2	28.9	
17:00-17:59	7.0	6.7	64.9	0.1	9.3	29.2	26.3	
18:00-18:59	6.7	6.7	64.0	0.1	9.6	32.7	26.9	
19:00-19:59	6.3	6.8	63.2	<0.1	9.8	35.5	27.6	
20:00-20:59	6.2	7.1	64.6	<0.1	9.9	36.5	25.8	
21:00-21:59	7.2	6.8	72.4	0.1	9.2	32.1	26.4	
22:00-22:59	7.2	6.4	71.3	<0.1	9.2	31.9	27.0	
23:00-23:59	7.2	6.3	71.5	<0.1	9.2	32.1	27.1	

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 05/15/89
Test #: 18

Test Time	Afterburner Outlet				Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)	
00:00-00:59	7.2	6.4	70.9	<0.1	9.3	33.1	27.8	
01:00-01:59	7.4	6.5	76.9	<0.1	9.1	32.9	24.0	
02:00-02:59	11.7	5.3	116.8	<0.1	5.9	1.2	4.0	
03:00-03:59	12.1	5.2	93.1	<0.1	5.5	1.1	3.1	
04:00-04:59	12.4	5.1	81.0	<0.1	5.3	0.9	3.0	
05:00-05:59	12.5	5.2	75.9	<0.1	5.2	0.9	4.6	
06:00-06:59	12.6	5.2	72.1	<0.1	5.1	1.0	5.2	
07:00-07:59	12.7	5.3	68.8	<0.1	5.1	0.9	3.6	
08:00-08:59	11.7	11.5	100.0	2.8	4.5	6.6	9.2	
09:00-09:59	11.5	5.5	121.4	0.3	4.7	0.9	1.7	
10:00-10:59	9.7	6.0	112.8	0.2	7.4	1.0	1.7	
11:00-11:59	9.8	6.0	115.5	0.2	7.3	0.8	1.9	
12:00-12:59	9.8	6.1	115.9	0.2	7.3	0.8	1.8	
13:00-13:59	9.8	5.8	115.2	0.2	7.2	0.9	1.6	
14:00-14:59	9.9	5.8	112.2	0.2	7.2	0.7	1.7	
15:00-15:59	9.9	6.0	111.9	0.2	7.1	0.9	1.6	
16:00-16:59	9.9	6.6	109.8	0.2	7.1	0.7	1.9	
17:00-17:59	9.9	6.4	111.4	0.2	7.1	0.7	1.7	
18:00-18:59	9.8	5.8	108.8	0.1	7.2	0.8	1.4	
19:00-19:59	9.8	6.8	106.7	0.1	7.2	0.7	1.4	
20:00-20:59	9.8	5.8	108.8	<0.1	7.2	0.6	1.4	
21:00-21:59	9.9	5.9	108.1	<0.1	7.1	0.7	1.1	
22:00-22:59	10.0	5.4	106.3	<0.1	7.1	0.6	1.2	
23:00-23:59	10.0	5.3	104.5	<0.1	7.0	0.6	1.2	

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/16/89

Test #:

18

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.1	5.3	103.4	<0.1	7.0	0.6	1.2
01:00-01:59	10.1	5.3	102.2	<0.1	7.0	0.5	1.2
02:00-02:59	10.1	5.1	99.5	<0.1	7.0	0.7	1.0
03:00-03:59	10.2	5.1	99.1	<0.1	6.9	0.6	1.0
04:00-04:59	10.2	5.3	97.4	<0.1	6.9	0.6	1.0
05:00-05:59	10.2	5.3	96.0	<0.1	6.9	0.5	0.9
06:00-06:59	10.2	5.8	95.0	<0.1	6.9	0.5	1.0
07:00-07:59	10.3	5.2	93.8	<0.1	6.8	0.5	1.0
08:00-08:59	11.1	8.9	89.3	7.2	3.6	29.1	16.5
09:00-09:59	10.5	5.9	92.7	5.0	6.7	6.8	10.9
10:00-10:59	10.5	6.2	92.8	0.2	6.6	1.0	1.7
11:00-11:59	10.6	5.9	93.3	0.2	6.6	0.8	2.0
12:00-12:59	10.6	5.9	92.5	0.2	6.6	0.8	1.6
13:00-13:59	10.6	5.6	94.5	0.2	6.6	0.9	1.6
14:00-14:59	10.5	5.3	95.0	<0.1	6.6	0.7	1.4
15:00-15:59	10.5	5.4	94.7	<0.1	6.6	0.7	1.4
16:00-16:59	10.4	5.3	94.9	<0.1	6.6	0.9	1.4
17:00-17:59	10.3	5.4	92.7	<0.1	6.7	1.3	1.7
18:00-18:59	10.3	5.7	91.4	<0.1	6.7	1.2	1.6
19:00-19:59	10.3	5.3	89.4	<0.1	6.7	1.0	1.3
20:00-20:59	10.3	5.7	87.6	<0.1	6.7	0.8	1.4
21:00-21:59	10.2	5.8	82.8	<0.1	6.8	0.7	1.3
22:00-22:59	10.2	5.1	76.1	<0.1	6.8	0.7	1.3
23:00-23:59	10.2	5.3	75.4	<0.1	6.8	0.8	1.1

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS
MONITORING DATA - HOURLY AVERAGES

Test Date: 09/17/89

Test #:

18

Test Time	Afterburner Outlet			Flash Chamber Inlet		Flash Chamber Outlet	
	O ₂ (%)	CO (ppm)	NO _x (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:00-00:59	10.2	5.1	75.4	<0.1	6.8	0.7	1.2
01:00-01:59	10.1	4.9	75.0	<0.1	6.8	0.6	1.2
02:00-02:59	10.1	5.2	74.2	<0.1	6.8	0.6	1.1
03:00-03:59	10.1	4.8	73.2	<0.1	6.8	0.7	1.0
04:00-04:59	10.1	4.7	72.8	<0.1	6.8	0.7	1.0
05:00-05:59	14.7	5.0	38.9	0.4	3.5	0.6	1.0

July 1990
Revision: Final

APPENDIX F
RAW ANALYTICAL DATA SHEETS FOR TEST ITEMS

The following information is provided in Appendix F:

- Chain of custody forms (Custody Transfer Record/Lab Work Request).
- Data summaries from onsite analytical laboratory (WESTON Analytics-Explosives).
- Data summaries from offsite analytical laboratories.

Test data are presented for pre-test and post-test sampling events. The onsite laboratory conducted analyses for explosive compounds. The offsite analytical laboratory (WESTON Analytics Division, Lionville, PA) conducted the following analyses:

- Duplicate samples for explosive compounds (to verify analytical procedures of field laboratory).
- Samples collected from test items for smokeless powder.
- Samples collected from test items for ammonium picrate.
- Sample of gear oil from motor for explosives.

Analytical data summaries from the onsite laboratory provide the following information:

- Test Name (Pre-Test 2).
- Sample Matrix (wipe, rinsate, solid).
- Lab Identification Number.
- Sample Description.
- Dilution Factor.
- Sample Volume.
- Units of Reported Contamination.
- Reported Level of Contaminant.

Sample results for wipe samples are reported as total microgram (ug); rinsate samples are reported as microgram per milliliter (ug/mL); solid samples are reported as microgram per gram (ug/g). If the analysis indicated that the compound was present below the method detection limit, the detection limit is provided and is preceded with a less than sign (<).

The detection limits vary based on the sample type (wipe, rinsate or solid) and the dilution factor. For TNT, the following detection limits generally apply:

- Wipe samples - 19.2 mg.
- Rinsate samples - 0.96 mg/mL (concentrations corrected to 1,000 mL sample).
- Solid samples - 1.92 ug/g.

These detection limits are consistent with the limits outlined in the Test Plan (Section 5).

For the remaining analytes, however, some of the detection limits varied, due to high concentrations of TNT and required dilutions. The following example is provided for tetryl:

- The detection limit for tetryl in a rinsate sample was 2.5 ug/mL.
- Due to high concentrations of TNT in the rinsate sample, the sample is diluted by a factor of 1,000 to quantify the concentration of TNT.
- The detection limit of tetryl inadvertently increased to 2,500 ug/mL (2.5 ug/mL x 1,000 mL).

The mass or concentration of some contaminants is reported as a "J Value" (i.e., 3.36J). This indicates that the compound was determined to be present but below the detection level. The mass of contaminant is estimated.

The offsite laboratory data summaries include:

- Inorganic narrative (explosives narrative presented, where applicable).
- Glossary of terms.
- Inorganics data summary report.
- Inorganics quality assurance/quality control (QA/QC) report.

The inorganic narrative is generally a summary of the quality control results and a description of any problems encountered during the analysis of the samples. The glossary of terms defines the data qualifiers used in the report, abbreviations, and a laboratory chronology and holdtime report.

The inorganics data summary presents the actual results of the analysis. In addition, the lab sample number, site ID, analyte tested, result in appropriate units, and the reporting limit are provided.

The inorganics QA/QC report includes the analysis of a method blank, inorganics accuracy report, and an inorganics duplicate spike report.

July 1930
Revision: Final

TEST RUN 2
400°F/24 HOURS

1311R2



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
8907HW006

Client: SATHAMA/HUAP
 Work Order: 2231-08-02
 Sales Mgr.: Stale Dug
 RFW Contact: Nancy Johnson
 Client Contact/Phone: 72

Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Requisition		Received by		Date/Time	
				#/Type Container	Container/Volume	Requisitioned by	Received by	Date	Time
001 P&I Flush IL	IL	7/17/83	PL						
002 P&I Flush IL	IL								
003 SRI Pie-wipe #1	Wipe								
004 " #2									
005 " #3									
006 " #4									
007 " #5									
008 SRI Dixon PU-215									
009 SRI Pie-wipe #1									
010 " #2									
011 " #3									
012 " #4									
013 " #5									
014 SRI Dixon PU-215									
015 Molding PU-215									

Matrix: W - Water DS - Drum Solids O - Oil DL - Drum Liquids
 SS - Sediment A - Air K - Other
 Special Instructions: Combine PATENTS from SRI Pie-wipe #1, #2, #3, #4, #5
2742 gallon 2nd analysis as well. Combine PATENTS from SR2
cells used Pie-wipe #1, #2, #3, #4, #5 and analyze as one

WESTON Analytica
 Used Only
 Samples Were:
 1 Shipped or Hand Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Hacking Times
 Y N
 NOTES:
 COC Taps Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytcs Use Only

8901HW007

Client USATHAMA / HWAAP

Work Order 2201-03-02

Date Rec'd Date Due

SW Contact Nancy Johnson

Client Contact/Phone

WA Use Only Lab ID Client ID/Description

001 SR1 drum APP1

002 SR2 drum APP1

Requisition #	Type Container	Containers/Volume	Presc. vol/ltre	ANALYSES REQUESTED	Date Collected	Matrix	Item/Reason	Requisitioned by	Received by	Date	Time
					7/17/85	ILW	X				
					"	"	X				

WESTON Analytcs Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

Matrix: W - Water DS - Drum Solids Special Instructions:
 S - Sed O - Oil CL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Item/Reason	Requisitioned by	Received by	Date	Time	Item/Reason	Requisitioned by	Received by	Date	Time

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

Units ANALYST - 10/10/83
 Analyst SPM/103
 Reviewed

Analytical Lot: _____
 Date Prepared _____
 Date Analyzed 11/23/89

RFW Batch # 9907H00001007
 Installation HANDMADE
 Matrix: RESIDUE

Note: Data is corrected for dilution.

Comment: T2 P&F TEST

LAB ID #	001	002	006	007	008	009	014	015	001	002
SAMPLE DESCRIPTION	TA 901	TA 902	TA 901	TA 902	TA 901	TA 902	TA 902	TA 902	TA 901	TA 902
DILUTION	1	1	1	1	1	1	1	1	1000	100
SAMPLE VOLUME (mg)	1000	1000	-	-	-	-	-	10000	21	56
UNITS	ug/lb	ug/lb	ug/lb	ug/lb	ug/lb	ug/lb	ug/lb	ug/lb	ug/lb	ug/lb
HMX	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635
RDX	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490
1,3,5-TNB	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
1,3-DNB	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.295
MB	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Tetryl	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
2,4,6-TNT	0.460	0.460	0.460	0.460	0.460	0.460	0.460	0.460	0.460	0.460
2,5-DNT	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2,4-DNT	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210

DATE DATE 7/17 7/17 7/17 7/17 7/17 7/17 7/17 7/17 7/17 7/17 7/17

WESTON Analytics Use Only
 3907HW014

Custody Transfer Record/Lab Work Request



Client: USAMARA/ARMI/9
 Work Order: 2281-08-02
 Date Rec'd: _____
 RFW Contact: MAZELON, CESAR, N. BLANCO
 Client Contact/Phone: 215-430-3117

WA Use Only Lab ID	Client ID/Description
014-001	T2-SHR RI
002	2
003	3
004	4
014-021	T2-SHR1 NIPPLE WIPE

Matrix	Date Collected	Refrigerator #	Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED
AB	7/28		BOAT			
↓	↓					
↓	↓					
↓	↓					
WIPE	7/28					

WESTON Analytics Use Only Samples Were: 1 Shipped or Hand-Delivered NOTES: 2 Ambient or Chilled NOTES: 3 Received Broken/Leaking (Improperly Sealed) Y N NOTES: 4 Properly Preserved Y N NOTES: 5 Received Within Holding Times Y N NOTES:	COC Taps Was: 1 Present or Outer Package Y N 2 Unbroken on Outer Package Y N 3 Present on Sample Y N 4 Unbroken on Sample Y N NOTES:	COC Record Was: 1 Present Upon Receipt of Samples Y N Discrepancies Between Sample Labels and COC Record? Y N NOTES:
---	--	--

Matrix: W - Water DS - Drum Solids Special Instructions: **T-2 POST TEST SAMPLES**
 O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 9907HW014

Client: WESTON/HA/HA/AAP
 Work Order: 22-81-02-02
 Date Rec'd: _____ Date Due: _____
 RFW Contact: MAZELON, NICHOLSON, CRIVELLO
 Client Contact/Phone: 215-430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED
014-005	T2 SHV RINSE 1	AB	7/28	X
006	2	↓	↓	X
007	3	↓	↓	X
008	4	↓	↓	X
009	FLASH CHMD WALL WI	WIPE	7/28	
010	STEEL PIPE WI T2	WIPE	7/28	
011	T2 SM WI	WIPE	7/28	
012	T2 SSR 1 WI TOP	WIPE	7/28	
013	2	↓	↓	
014	3	↓	↓	
015	4	↓	↓	

Matrix: W - Water DS - Drum Solids
 S - Soil O - Oil DL - Drum Liquids
 SS - Sediment A - Air F - Fish
 SO - Solid X - Other

Special Instructions: EX - EXPLOSIVES

POST T-2 SAMPLES

Item/Reason	Reinspected by	Received by	Date	Time	Item/Reason	Reinspected by	Received by	Date	Time

WESTON Analytica Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Taps Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record?
 Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 9907WJ0014 1015

Client: USATHAMA/HRUAP
 Work Order: 2281-08-02
 Date Rec'd: _____ Date Due: _____
 HW Contact: MAZELI COSMIGLI, N. PACSA
 Client Contact/Phone: 215-430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Preservative	Type Container	Containers/Volumes
014-016	T2 5581 WIP 1 Bottom	WIP	7/28				
-017	2						
-018	3						
-019	4						
-020	T2-CP 51	SOLID	7/28				
0015-001	T2 FBI 1						
002	2						
003	3						
004	4						
-005	T2 WIPE BLANK	WIP					
006	T2 Beaker Rinse	AG					

Matrix: W - Water DS - Drum Solids DL - Drum Liquids
 S - Soil G - Oil A - Air F - Fish X - Other
 Special Instructions: **EXP - EXPLOSIVES**

T-2 POST TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RPN Batch # 200700001015
 Installation NAME: HAWTHORNE
 Matrix: SANDWICH PIPE & SOIL

Analytical Lot _____
 Date Prepared _____
 Date Analyzed 7/26/08

Units: SAMPLE - 100gms (1) WIPES - 100gms (2)
 Analyst: [Signature]
 Reviewed: [Signature]

Note: Data is corrected for dilution.

Comment: IN POST TEST

LAB ID / SAMPLE DESCRIPTION	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11
Dilution	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (LMS)	300	300	300	300	1000	1000	1000	1000	-	-	-
WWTZ	weighed	weighed	weighed	weighed	weighed	weighed	weighed	weighed	total	total	total
IHX	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.127	0.127	0.127
RDX	0.440	0.440	0.440	0.440	0.440	0.440	0.440	0.440	0.950	0.950	0.950
1,3,5-TNB	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.209	0.209	0.209
1,3-DNB	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.869	0.869	0.869
NB	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.634	0.634	0.634
Tetryl	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.750	0.750	0.750
2,4,6-TNT	0.960	0.960	0.960	0.960	1.34	2.08	3.34	2.18	0.192	0.192	0.192
2,6-DNT	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.400	0.400	0.400
2,4-DNT	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.420	0.420	0.420
ANALOC	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120

I - present below dilution limit.

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFM Batch 800120101015
 Installation KAMMINGS
 Matrix: GUNNYK WIFE 5 SOL

Analytical Lot
 Date Prepared
 Date Analyzed

Units SUMME-UNGE WIFE - 1000 mg
 Analyst SPAN
 Reviewed

Note: Data is corrected for dilution.

Comments: TA POST TEST

LAB ID #	014-017	014-018	014-019	014-020	014-021	014-022	014-023	014-024	014-025	014-026	014-027	014-028	014-029	014-030	014-031	014-032
SAMPLE DESCRIPTION	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2	TA SRI TOP WIFE 2
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNITS	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
NET WT	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
NET WT	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80
1,3,5-TMB	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9
1,3-DNB	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89	5.89
NB	13.3	8.4	17.8	15.1	9.93	20.1	17.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
Tetryl	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
2,4,6-TNT	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
2,6-DNT	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2,4-DNT	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20
calac error	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125

calac error (1900)

WESTON

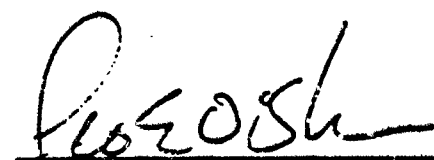
ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-C2

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

7/24/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.

- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

- I* CO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICWTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPCRTII LIMIT
-001	POST T5-FLSK CHMB WA	NITRATED ESTERS	5.0 u	UG	5
-002	POST T2-SHIP MINE	NITRATED ESTERS	5.0 u	UG	5
-003	PRE T5-SHIP MINE	NITRATED ESTERS	5.0 u	UG	5
-005	PRE T5-BLANK WIPE	NITRATED ESTERS	5.0 u	UG	5

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WCRK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L203

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
 WORK ORDER: 2281-08-02-000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99
		NITRATED ESTERS	49.5	2.5 u	50.0	99

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L203

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

July 1990
Revision: Final

TEST RUN 3
500°F/36 HOURS

1311R2

WESTON Analytica Use Only

8907HWOOZ

Client: VSAHAMIA
 Work Order: 2291-08-07 Date Due:
 Date Rec'd: 7/11/09
 Bill To Contact: Mary Williams
 Client Contact/Phone: 202-204-2800

Custody Transfer Record/Lab Work Request



WESTON Analytica Use Only
Samples Were: 1 Shipped or Hand-Delivered NOTES: 2 A-Label CT Checked NOTES: 3 Received Broken/Leaking (Highly Susceptible) Y N NOTES: Properly Preserved Y N NOTES: 6 Received Within Holding Times Y N NOTES: COC Tape Was: 1 Present on Outer Package Y N 2 Unbroken on Outer Package Y N 3 Present on Sample Y N 4 Unbroken on Sample Y N NOTES: COC Record Was: 1 Present Upon Receipt of Samples Y N Discrepancies Between Sample Labels and COC Record? Y N NOTES:

Refrigerator #	Type Container	Container Volume	Preservative	ANALYSES REQUESTED	Quantity	Date Collected	Client ID/Description	Client Contact/Phone
						7/14/09	T3 SR1 Pre-wipe #1	
							T3 SR1 Pre-wipe #2	
							T3 SR1 Pre-wipe #3	
							T3 SR1 Pre-wipe #4	
							T3 SR1 Pre-wipe #5	
							T3 SR1 Green Pre-wipe	
							T3 SR2 Pre-wipe #1	
							T3 SR2 Pre-wipe #2	
							T3 SR2 Pre-wipe #3	
							T3 SR2 Pre-wipe #4	
							T3 SR2 Pre-wipe #5	
							T3 SR2 Java Pre-wipe	
							T3 PA1 Flush	
							T3 PA2 Flush	
Date: 7/15/09								

- Matrix: W - Water DG - Drum Swabs Special Instructions:
 B - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid

Requested by	Date	Time	Received by	Date	Time	Requested by	Date	Time

Page 1 of 2

WESTON Analytica Use Only
 8907 HW 002

Custody Transfer Record/Lab Work Request



WESTON Analytica
 West Oahu

Sample Waive:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Refrigerator #/Type Container Container Volume Preservative	Item/Reason		Received by		Date	
						Time	Reason	Time	Date	Time	Date
015	T3 SRI Juna App	Liq	7/11/08								
016	T3 SRI Juna App	Liq									
017	T3 SRI1 Flush B1										
018	T3 SRI2 Flush B1										
019	T3 SRI1 Flush #2										
020	T3 SRI2 Flush #2										
021	T3 SRI2 Flush #3										
022	T3 SRI1 Flush										
023	T3 SRI2 Flush										
024	T3 CP Pt-pipes	Sol									
025	T3 SM Pt-pipes #1	Wtr									

Pag 2 OF 2

Matrix: W - Water DS - Drum Solids Special Instructions:
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Item/Reason	Reinitiated by	Received by	Date	Time	Item/Reason	Reinitiated by	Received by	Date	Time



Custody Transfer Record/Lab Work Request

WESTON Analytical Use Only
8907 HW004

Client: USAF JAMA HWNAAP
 Work Order: 2251-00-02
 Date Rec'd: 7/16 Day Due:
 R/W Contact: Mary Johnson
 Client Contact/Phone:

WA Lab Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator	M/Type Container	Container/Volume	Preservative	ANALYSES REQUESTED	Matrix	Date
001	13 Chamib Wells Pr-Test Env	W/W	7/16/98					EA/1000		

Matrix: W - Water DB - Drum Solids Special Instructions: T-3 PRE-TEST
 O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solids X - Other

Matrix	Refrigerated by	Received by	Date	Time	Item/Reason	Refrigerated by	Received by	Date	Time

Field Lab T-3 PRE-TEST Samples

WESTON Analytical Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
8907 HW 005

Client LSAT/IMA LAMAR
 Work Order 2221-08-02 - 08-02
 Date Rec'd. _____ Date Due _____
 RFW Contact ALBY WILSON
 Client Contact/Phone _____

WA Use Only
 Lab ID 001 Client ID/Description T3 PR PRE TEST WIP

Refrigerator	#/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Date Collected	Matrix	Date	Time	Received by	Date	Time
	1A	1	2001	NT	7/15/07	WIP					

Special Instructions:

W - Vial DS - Drum Solids
 O - Oil DL - Drum Liquids
 25 - Equipment A - Air P - Fish
 80 - Solid X - Other

T-3 PRE TEST

WESTON Analytica Use Only Samples Were: 1 Shipped or Hand Delivered NOTES: 2 Ambient or Chilled NOTES: 3 Received Broken/Leaking (Improperly Sealed) Y N NOTES: 4 Properly Preserved Y N NOTES: 5 Received Within Holding Time Y N NOTES:	COC Tape Was: 1 Present on Outer Package Y N 2 Unbroken on Outer Package Y N 3 Present on Sample Y N 4 Unbroken on Sample Y N NOTES:	COC Record Was: 1 Present Upon Receipt of Samples Y N Discrepancies Between Sample Labels and COC Record? Y N NOTES:
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Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFM Batch 9907H002/002/002/002/002/002 Analytical Lot _____
 Installation HAMMERSHIRE 000 Date Prepared _____
 Matrix: KANSAS WIPES A SOIL _____ Date Analyzed 11/16/2014
 Units KANSAS-101-2 WIPES-BELLY SOIL-4
 Analyst GPOD LBS
 Reviewed _____

Note: Data is corrected for dilution.

Comment: TEST 3 - PRE TEST

LAB ID #	002-001	002-001	002-002	002-002	002-002	002-003	002-004	002-005	002-005	002-007
SAMPLE DESCRIPTION	T3 SRI PRE #1	T3 SRI PRE #2	T3 SRI PRE #3	T3 SRI PRE #4	T3 SRI PRE #5	T3 SRI PRE #6	T3 SRI PRE #7	T3 SRI PRE #8	T3 SRI PRE #9	T3 SRI PRE #10
Dilution	10	10	10	10	10	10	10	10	10	10
UNITS	644	458	269	1181	266	585	214	513		
HMX	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
RDX	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
1,3,5-TNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
NB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
Tetryl	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
2,4,6-TNT	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
2,6-DNT	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
2,4-DNT	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
QUALC DATE (YYYY)	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17

← POSSIBLE CONTAMINATE

WEBSTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8907
 Installation MACTHOLIST
 Matrix: PUNSHI, WIPE & SOIL

Units: PUNSHI, WIPE & SOIL
 Analyst: J. G. ...
 Reviewed: ...

Note: Data is corrected for dilution.

Comment: TEST 3 - PRE TEST

MATRIX	LAB ID #	002-007	002-008	002-009	002-010	002-011	002-012	002-013	002-014	002-015	002-016	002-017
SAMPLE DESCRIPTION		T3 S2A	T3 S2A	T3 S2A	T3 S2A	T3 S2A	T3 S2A	T3 S2A	T3 S2A	T3 S2A	T3 S2A	T3 S2A
Dilution	10	1	1	1	1	1	1	1	1	1000	1000	1
SAMPLE VOLUME (ml)	-	-	-	-	-	-	-	1000	1000	30	26	1000
UNITS												
HMX		305	321	157	149	25.6	25.6	20.635	20.635	20.635	20.635	1.43
RDX		457	418	327	294	73.2	73.2	20.490	20.490	20.490	20.490	20.490
1,3,5-TNB		220.9	220.9	220.9	220.9	220.9	220.9	220.9	220.9	220.9	220.9	220.9
1,3-DNB		25.90	25.90	25.90	25.90	25.90	25.90	25.90	25.90	25.90	25.90	25.90
NB		4.20	4.20	4.20	4.20	10.04	10.04	20.210	20.210	20.210	20.210	20.210
Tetryl		50.0	50.0	50.0	50.0	50.0	50.0	2.5	2.5	2.5	2.5	2.5
2,4,6-TNT		19.2	19.2	19.2	19.2	19.2	19.2	0.960	0.960	0.960	0.960	0.960
2,6-DNT		4.00	4.00	4.00	4.00	4.00	4.00	2.000	2.000	2.000	2.000	2.000
2,4-DNT		4.20	4.20	4.20	4.20	4.20	4.20	20.210	20.210	20.210	20.210	20.210

DATE: 7/17/07
 TIME: 11:00

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 907H0008000300000 Analytical Lot _____ Units Run/SAFE - 1000 - 10000 - 10000 - 10000
 Installation HAWTHORNE Date Prepared _____ Analyst _____
 Matrix: RUNSAFE WIFE 5 SOLN Date Analyzed 11/10/2002 21:24:10A Reviewed _____

Note: Data is corrected for dilution.

Comment: TEST 2 - PRE TEST

Matrix	002-017	002-018	002-019	002-020	002-021	002-022	002-023	002-024	002-025	004-001
LAB ID #	002-017	002-018	002-019	002-020	002-021	002-022	002-023	002-024	002-025	004-001
SAMPLE DESCRIPTION	T3 SHV2 FLUSH #1	T3 SHV2 FLUSH #1	T3 SHV2 FLUSH #2	T3 SHV2 FLUSH #2	T3 SHV2 FLUSH #3	T3 SHV2 FLUSH #3	T3 SHV2 FLUSH #3	T3 CP PRE SAND	T3 SHV2 PRE #1	T3 PRE TEST
Dilution	10	10	1	1	1	1	1	10,000	1	1
SAMPLE VOLUME (ml)	1000	1000	1000	1000	1000	1000	300	300	300	---
UNIT	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
HMX	<0.635	<0.635	<0.490	<0.635	<0.635	<0.635	<0.635	<12700	<12.7	<17.7
RDX	<0.490	<0.490	<0.490	<0.490	<0.490	1.19	0.785	<9800	<9.80	<9.80
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	20900	<20.9	<20.9
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<5900	<5.90	<5.90
NB	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	4200	8.10M	18.14
Tetryl	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<50000	<50.0	<50.0
2,4,6-TNT	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	153,200	<19.2	<19.2
2,6-DNT	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<4000	<4.00	<4.00
2,4-DNT	41.5	23.5	16.8	9.1	7.7	<0.210	<0.210	<4200	<4.20	<4.20
DATE	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16

* POSSIBLE CONTAMINATE



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8907HW009

Client: VSATHANA / WILSON
 Work Order: 2281-08-02
 Date Rec'd: _____
 RFW Contact: MIKE MERRIN / MARY DOHAN
 Client Contact/Phone: _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerators		Sumi (ANAL)	VOC	ANALYSES REQUESTED	Preservative	Containers/Volume
				Type	Volume					
001	T3 PB1 R1	AG	7/11/00			X			4	VOC
002	T3 PB1 R2					X			1	
003	T3 PB1 R3					X				
004	T3 PB1 R4					X				
005	T3 PB W1					X				
006	T3 SUB1 R1					X				
007	T3 SUB1 R2					X				
008	T3 SUB1 R3					X				
009	T3 SUB1 R4					X				

Special Instructions: T-3 POST TEST SAMPLING

Matrix: W - Water DS - Dross Solids
 S - Soil O - Oil DL - Dross Liquids
 SS - Sediment A - Air F - Fish
 SO - Solid X - Other

Refrigerator	Refrigerated by	Received by	Date	Time	Item/Reason	Refrigerated by	Received by	Date	Time

WESTON Analytica Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Arrived or Chilled
 NOTES:
 3 Received Broken/Leaking (Irregularly Sealed)
 Y N
 NOTES:
 4 Property Preserved
 Y N
 NOTES:
 5 Received Within Huking Time
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Sample Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8907HW010

Client 11 SATYAMA CHUAP
 Work Order Z281-08-02
 Date Rec'd. _____ Date Due _____
 RFW Contact Mike Mazer
 Client Contact/Phone Amey Johnson

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator #/Type Container Containers/Volume Preservative	ANALYSES REQUESTED
001	T3 SHV1 R1	RQ	7/21/09	200L Cool	X
002	T3 SHV1 R2			200L Cool	X
003	T3 SHV1 R3			200L Cool	X
004	T3 SHV1 R4			200L Cool	X
005	T3 CPS1	S	7/21/09		X
006	T3 SM W1	W			X
007	T3 SRI W1	W			X
008	T3 SRI W2				X
009	T3 SRI W3				X
010	T3 SRI W4				X
011	T3 SRI W5				X
012	T3 SRI W6				X
013	T3 SRI W7				X
014	T3 SRI W8	Y	7/21/09		X

Matrix: W - Water DS - Drum Solids Special Instructions:
 S - Sol O - Oil DL - Drum Liquids
 SS - Sediment A - Air P - Fish
 SO - Solid X - Other

T-3 POST TEST SAMPLING

WESTON Analytics Use Only	
Samples Were: 1 Shipped or Hand-Delivered NOTES: 2 Ambient or Chilled NOTES: 3 Received Broken/Leaking (Improperly Sealed) Y N NOTES: 4 Property Preserved Y N NOTES: 5 Received Within Holding Times Y N NOTES: COC Tape Was: 1 Present on Outer Package Y N 2 Unbroken on Outer Package Y N 3 Present on Sample Y N 4 Unbroken on Sample Y N NOTES: COC Record Was: 1 Present Upon Receipt of Sample Y N Discrepancies Between Sample Labels and COC Record? Y N NOTES:	

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch # 00000000000000000000 Analytical Lot 00000000000000000000 Units 00000000000000000000
 Installation XXXXXXXXXXXX Date Prepared XXXXXXXXXXXX Analyst XXXXXXXXXXXX
 Matrix: XXXXXXXXXXXX Date Analyzed XXXXXXXXXXXX Reviewed XXXXXXXXXXXX

Note: Data is corrected for dilution.

Comment: TEST 3 - POST TEST EXCEL FOR 005-001

MATRIX	W	R	R	R	R	W	R	R	R	R	R	R	R	R
LAB ID #	005-001	009-001	009-002	009-003	009-004	009-005	009-006	009-007	009-008	009-009	009-010	009-011	009-012	009-013
SAMPLE DESCRIPTION	T3 PB	T3 PB1	T3 PB1	T3 PB1	T3 PB1	T3 PB	T3 SRI	T3 SRI	T3 SRI	T3 SRI	T3 SRI	T3 SRI	T3 SRI	T3 SRI
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME	1000	1000	1000	1000	1000	300	300	300	300	300	300	300	300	1000
HMZ	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
HB	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K	0.00K
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00
2,4-DNT	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20

IF POSSIBLE CONTAMINATE

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch # 010-003
 Installation # 17-00-000000
 Matrix: 17-00-000000

Analytical Lot # 003
 Date Prepared 11/11/00
 Date Analyzed 11/11/00

Units: mg/kg
 Analyst: J. [unclear]
 Reviewed: [unclear]

Note: Data is corrected for dilution.

Comment: TEST 3 POST TEST

LAB ID #	010-003	010-004	010-005	010-006	010-007	010-008	010-009	010-010	010-011	010-012
SAMPLE DESCRIPTION	TS SHVI	TS SHVI	TS CP	TS SM	TS SRI	TS SRI	TS SRI	TS SRI	TS SRI	TS SRI
Dilution	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (mL)	1000	1000	-	-	-	-	-	-	-	-
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
HMX	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635	0.635
RDX	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490
1,3,5-TMB	1.105	1.105	1.105	1.105	1.105	1.105	1.105	1.105	1.105	1.105
1,3-DNB	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.295	0.295
NB	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Tetryl	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
2,4,6-TNT	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
2,6-DNT	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2,4-DNT	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200

DATE: 11/11/00 11:24 11/11/00 11:24 11/11/00 11:24 11/11/00 11:24 11/11/00 11:24 11/11/00 11:24

RESIDUALS: 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch # 07H4002ALC002005201010 Analytical Lot _____ Units Remaining _____
 Installation NAME: W73SRI Date Prepared _____ Analyst: SPB
 Matrix: RFW31 W73SRI Dilution Analyzed: 1000000201010 Reviewed: _____

Note: Data is corrected for dilution.

Comment: TEST 2 POST TEST

MATRIX	W	U	LAB ID #	W	U
	010-	010-	013	014	
	73SRI	73SRI	W7	W8	
SAMPLE DESCRIPTION					
Dilution	1	1			
SAMPLE VOLUME (mL)					
WTS					
HMX	12.7	12.7			
RDX	9.80	9.80			
1,3,5-TNB	20.9	20.9			
1,3-DNB	5.90	5.90			
NB	13.9	13.9			
Tetryl	50.0	50.0			
2,4,6-TNT	19.2	19.2			
2,6-DNT	4.00	4.00			
2,4-DNT	4.20	4.20			

* POSSIBLE CONTAMINATE

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 2902114200A Analytical Lot _____ Units mg/100g
Installation BS-218050501 Date Prepared _____ Analyst afm
Matrix: SUBSTR Date Analyzed 7/26/26 Reviewed _____

Note: Data is corrected for dilution.

Comment: TS POST TEST

MATRIX	LAB ID #	009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	
		009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	009	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
		TS 001	TS 002	TS 003	TS 004	TS 005	TS 006	TS 007	TS 008	TS 009	TS 010	TS 011	TS 012	TS 013	TS 014	TS 015	TS 016	TS 017	TS 018	
Dilution		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
SAMPLE VOLUME (mg)		300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	
HMX		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
RDX		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
ND		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
2,4,6-TNT		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960	<0.960
2,6-DNT		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
2,4-DNT		ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g	ug/100g
		<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210

CONC DATA (mg)

RSW Batch _____ Analytical Lot _____ Units mg/kg
 Installation _____ Date Prepared _____ Analyst _____
 Matrix: _____ Date Analyzed 7/12/83 Reviewed _____

Notes: Data is corrected for dilution.

Comment: T3 POST TEST

LAB ID #	013 -	008	0321	0321	0321	0321	0321	0321	0321	0321
SAMPLE DESCRIPTION	700									
Dilution	1									
SAMPLE VOLUME	700									
UNITS	ug/g									
HMX	0.035									
RDX	0.440									
1,3,5-TNB	1.05									
1,3-DNB	0.295									
NB	0.210									
Tetryl	2.50									
2,4,6-TMT	0.960									
2,6-DNT	0.200									
2,4-DNT	0.210									

DATE 7/12/83

UNITS ug/g

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA HAWTHORNE
RFW #: 8907L058
W.O.#: 2281-08-07

SAMPLES RECEIVED: 07-19-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of wipe samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.

SSD = Designates sample spiked with target compound.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).
NOTE: Method holding time of seven days was exceeded for sample preparation. This holding time is applicable to soil samples. Although this holding time is exceeded, lab experience with the long term stability of explosives compounds provides an indication that the data obtained is quite likely to be representative of initial explosive concentrations.

WESTON

Data Qualifiers

< = Less than
> = Greater than

Analysis Summary:

Samples Collected: 07-14-89
Samples Prepared: 07-25-89
Samples Analyzed: 08-10-89

Approved By: _____

George Perry
George Perry
HPLC Unit Leader
Lionville Analytical Laboratory

WESTON ANALYTICS
WIPE EXPLOSIVES DATA

RFW Batch Number: 8907L058 CLIENT: USATHAMA-HAWTHORNE

Client T3 SM
ID : REWIPE 3
RFW#: 002
D.F.: 1
Units: Total ug

10XSS
1

2XSS
1

Total ug

Sample Information	Units	Total ug	Total ug
HMX.....	< 12.7	2.36 (92.9%)	11.8 (92.9%)
RDX.....	< 9.80	1.75 (89.2%)	8.95 (91.3%)
1,3,5-TNB.....	< 70.9	3.84 (91.8%)	18.8 (90.0%)
1,3-DNB.....	< 5.90	1.15 (97.4%)	5.66 (95.9%)
NITROBENZENE.....	< 4.20	0.73 (86.9%)	3.55 (84.5%)
TETRYL.....	< 50.0	11.3 (113%)	62.5 (125%)
2,4,6-TNT.....	< 19.2	3.56 (92.7%)	18.2 (94.8%)
2,6-DNT.....	< 4.00	0.75 (93.8%)	3.66 (91.5%)
2,4-DNT.....	< 4.20	0.75 (89.3%)	3.64 (86.7%)

Client T3 SM
ID : REWIPE 3
RFW#: 002
D.F.: 1
Units: Total ug

10XSSD
1

Total ug

Sample Information	Units	Total ug
HMX.....	< 12.2 (96.0%)	12.2 (96.0%)
RDX.....	< 9.24 (94.2%)	9.24 (94.2%)
1,3,5-TNB.....	< 19.4 (92.8%)	19.4 (92.8%)
1,3-DNB.....	< 5.83 (98.8%)	5.83 (98.8%)
NITROBENZENE.....	< 3.59 (85.4%)	3.59 (85.4%)
TETRYL.....	< 66.9 (134%)	66.9 (134%)
2,4,6-TNT.....	< 19.0 (99.0%)	19.0 (99.0%)
2,6-DNT.....	< 3.64 (91.0%)	3.64 (91.0%)
2,4-DNT.....	< 3.68 (87.6%)	3.68 (87.6%)

WESTON


ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,3,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/2/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicates.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.

- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L058

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
001	T3 SM PREWIPE #2	NITRATED ESTERS	10.0	u UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L05

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI LIMIT
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u MG/L	5
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u MG/L	5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 8907L058

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L05

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

ROY F. WESTON INC.
INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L059

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T3 CHAMP WELL PW SP	NITRATED ESTERS	10.0	u UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L056

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTIN LIMIT
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u MG/L	5.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L059

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L05

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L154

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T3SMWC	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L154

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u MG/L	2.
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u MG/L	2.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L154

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99.3
		NITRATED ESTERS	49.5	2.5 u	50.0	99.0

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-J2-0000

WESTON BATCH #: 8907L1!

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

TEST RUN 5
500°F/24 HOURS

1311R2

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
3907HW016

Client USAIRWAYS INADBP
 Work Order 2024-03-03 Date Due _____
 RFW Contact _____
 Client Contact/Phone _____

WA Use Only Lab ID	Client ID/Description
002	Substance Abuse
002	Cherry Pipe

Matrix: W - Water DS - Drum Solids Special Instructions: _____
 S - Soil G - Oil DL - Drum Liquids _____
 SE - Sediment A - Air F - Fish _____
 SU - Solid Y - Other _____

Refrigerator#	Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Date Collected	Matrix	Date Collected	Item/Reason	Time	Date	Time
					7-28-07	WIPE	7-28-07				
					7-28-07	SOIL	7-28-07				

Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

TS PRE TEST

Item/Reason	Received by	Date	Time	Item/Reason	Relinquished by	Date	Time

WEBSTON ANALYTICS EXPLOSIVES

DATA SUMMARY

RFW Batch _____ Analytical Lot _____ Units ~~Sample~~ _____
 Installation _____ Date Prepared _____ Analyst _____
 Matrix: ~~_____~~ Date Analyzed ~~_____~~ Reviewed _____

Note: Data is corrected for dilution, :

Comment: T-5, D-2, Test Post

LAB ID #	SAMPLE DESCRIPTION	DILUTION	OIG		OIG	
			1016	1021	1022	1023
UNITS HMX	MINE	10				
RDX	PIPE	10,000				
1,3,5-TNB						
1,3-DNB						
NB						
Tetryl						
2,4,6-TNT						
2,6-DNT						
2,4-DI.T						

UNITED STATES
 OFFICE OF...
 (133)
 DATE (DATE)
 7/25



Custody Transfer Record/Lab Work Request

WESTON Analyticals Use Only
 8908KW - 018
 V. STEINBERG / H. LAR

Client WESTON Analyticals
 Work Order 2291-08-02
 Date Rec'd. Date Dug
 RFW Contact MARZANO, N. JOHNSON
 Client Contact/Phone 215-450-3117

WESTON Analyticals Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator#	#Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED
001	T5 SHIELD RI POST TEST	AR	8/2/89					X
002	2	↓	↓					X
003	3	↓	↓					X
004	4	↓	↓					X
001	P8 FIELD BLANK	AG	8/2/89					Y
002	CAN PIPE FIELD BLANK	↓	↓					X
003	SUR FIELD BLANK	↓	↓					X

Special Instructions: **T-5 POST TEST SAMPLES**

Matrix: W - Water DS - Drum Solids
 O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SG - Solid X - Other

Item/Result	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

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Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 2908HW-018

Client USATAMA / HWAP
 Work Order 2201-08-02
 Date Rec'd. MM/EE/YY
 RFW Contact M. MATELON, N. JOHNSON
 Client Contact/Phone 215-430-3117

WESTON Analytica Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Property Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tests Via:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerators		ANALYSES REQUESTED	Time	Date	Time	Date	Time
				#Type Contain	Containers/Volume						
005	T-5 SSR 2 W/ TOP ACK	W/PE	8/2	X	X	Exp					
006	2	↓	↓	X	X						
007	3	↓	↓	X	X						
008	4	↓	↓	X	X						
009	T-5 SSR 2 1/5 LWR ACK	W/PE	8/2/19	X	X						
010	6	↓	↓	X	X						
011	7	↓	↓	X	X						
012	8	↓	↓	X	X						

Special Instructions: T-5 TEST SAMPLES

Matrix:
 W - Water DS - Drum Solids
 O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solids X - Other

Item/Reason	Refrigerated by	Received by	Date	Time	Item/Reason	Refrigerated by	Received by	Date	Time

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Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8705HW-016

Client YSAHAMA/HRHAP
 Work Order 2281-08-02
 Date Rec'd _____ Date Due _____
 RFW Contact MARZELON, N. JOHNSON
 Client Contact/Phone 215-427-3117

WESTON Analytica Use Only
 Samples Were:
 1 Filled or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (If applicable Specify Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Time
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Seals Y N
 NOTES:
 Y N
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator		ANALYSES REQUESTED	Matrix	Date	Time	Received by	Date	Time	Received by	Date	Time
				Type Container	Volume										
013	TSSR 2016	SURF	02/01	Exp	Yes	ANALYSES REQUESTED									
014	TSSR 1	AQ	02/02	Exp											
015	TSSR 2														
016	TSSR 3														
017	TSSR 4														
018-001	TSSR 1 SPIKE RINSE	AQ	01/18/89												
018-002	TSSR 2 SPIKE RINSE	AQ	01/18/89												
018	TSSR 1	WIPE	02/02												
019	TSSR 2	WIPE	02/02												
020	TSSR 3														

Matrix: W - Water DS - Drum Solids Special Instructions: **EXP - EXPLOSIVES**
 S - Soil O - Oil CL - Drum Liquids
 SE - Sealed A - Air F - Film
 SO - Solid X - Other

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

TSSR 1-5 TEST SAMPLES
 TSSR 1-5 TEST RINSES



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 9908 HJ 020
 Client USATHIANA / HWAP
 Work Order 2281-08-02
 Date Rec'd. _____
 RFW Contact YONG / N. JOHNSON
 Client Contact/Phone 25 / 930-317

WESTON Analytica Use Only:
Samples Ware:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken Leaking (improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record Y N
 NOTES:

Matrix	Date Collected	ANALYSES REQUESTED	Refrigerators	RT Type Container	Containers/Volume Preservative
	8/4	X			

WA Use Only Lab ID 001 Client ID/Description
T.S. MOTOR RINSE
(26) LITER VOLUME
BOTTLES 104 LITER TOM

Mat's: W - Water DS - Drum Solids
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

POST T-S SAMPLE

Item/Reason	Refrigerated by	Received by	Time	Item/Reason	Refrigerated by	Received by	Time
	<u>RYONG</u>		<u>8/4</u>				

WEBSTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFH Batch 930411000100 Analytical Lot Units
 Installation AN-20251 Date Prepared Analyst
 Matrix: Date Analyzed Reviewed

Note: Data is corrected for dilution.

Comment: T/S POST TEST

MATRIX	LAB ID #	Q15	Q20	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
		015	020	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020
SAMPLE DESCRIPTION		T/S POST TEST																					
DILUTION		1																					
SAMPLE VOLUME (ML)	150	104,000																					
UNITS	UNITS	UNITS																					
HMX	40.335	40.335																					
RDX	40.440	40.440																					
1,3,5-TNB	41.05	41.05																					
1,3-DNB	40.305	40.305																					
NB	40.210	40.210																					
Tetryl	42.5	42.5																					
2,4,6-TNT	40.210	40.210																					
2,6-DNT	40.210	40.210																					
2,4-DNT	40.210	40.210																					

AN-20251 T/S POST TEST 930411000100



ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA HAWTHORNE
RFW #: 8908L203, OIL
W.O.#: 2281-08-07

SAMPLES RECEIVED: 08-01-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of oil samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS = Designates sample spiked with target compound.

MSD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).


Data Qualifiers

< = Less than
> = Greater than

Analysis Summary:

Samples Collected: 07-28-89
Samples Prepared: 08-04-89
Samples Analyzed: 08-10-89

Approved By:


for George Perry
HPLC Unit Leader
Lionville Analytical Laboratory

WESTON ANALYTICS
OIL EXPLOSIVES DATA

RFW Batch Number: 8208L2J3 CLIENT: USATHAMA-HAWTHORNE Page: 1

Sample Information	Client ID	PRE T5 GEAR OIL	PRE T5 GEAR OIL	PRE T5 GEAR OIL	PRF T-5	
					004 MS	004 MSD
	RFW#	004	004 MS	004 MSD	ug/g	ug/g
	D.F.:	1	1	1		
	Units:	ug/g	ug/g	ug/g		
HMX.....		< 144	2610(98.4%)	2610(96.4%)	<	254
RDX.....		2130G	3750(141%)	500G(NR)	<	196
1,3,5-TNB.....		< 237	4180(95.7%)	4180(95.7%)	<	418
1,3-DNB.....		< 66.8	1230(100%)	1230(100%)	<	118
NITROBENZENE.....		< 47.6	729(83.0%)	729(83.0%)	<	84
TETRYL.....		< 566	15000(144%)	15000(144%)	<	1700
2,4,6-TNT.....		< 217	4180(104%)	4180(104%)	<	381
2,6-DNT.....		< 45.3	800(95.8%)	800(95.8%)	<	80
2,4-DNT.....		< 47.6	840(96.0%)	840(96.0%)	<	84

Blank 1

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20


RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/24/90
Date

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.
- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).
- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).
- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).
- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L203

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	POST T5-FLSH CHMB WA	NITRATED ESTERS	5.0	u UG	5.0
-002	POST T2-SHIP MINE	NITRATED ESTERS	5.0	u UG	5.0
-003	PRE T5-SHIP MINE	NITRATED ESTERS	5.0	u UG	5.0
-005	PRE T5-BLANK WIPE	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L20:

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTII LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u MG/L	2.
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u MG/L	2.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECI
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99
		NITRATED ESTERS	49.5	2.5 u	50.0	99

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L2

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T5 FLASH CHMB WALL	NITRATED ESTERS	5.0	UG	5.0
-002	T5 SMW2 POST TEST	NITRATED ESTERS	5.6	UG	5.0
-003	T-8 SMW2 POST TEST	NITRATED ESTERS	13.0	UG	5.0
-004	T-8 WIPE BLANK PRE-	NITRATED ESTERS	5.8	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L25

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORT LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8008L2

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

July 1990
Revision: Final

TEST RUN 8
400°F/36 HOURS

1311R2

WESTON ANALYTICS
'8:

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
017

Client: USAHAMA/HHWRAP
 Work Order: 2181-03-02
 Date Rec'd: _____ Date Due: _____
 RFW Contact: MAZELAN, CDSAPS, TORRES
 Client Contact/Phone: 215-430-3117

WESTON Analytics Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Type Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

Refrigerator#	3/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Matrix	Date Collect	Matrix	Date Collect	Matrix	Date Collect
	V6A	40ml								
			001							
			Exp							
					AS	7/3				
					AS	7/3/89				
					WIRE	7/3/89				

Special Instructions: **EXP - EXPLOSIVES** **TB**
ALL SAMPLES ARE PRE-TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

Matrix: W - Water DS - Drum Solids
 S - Soil O - Oil DL - Drum Liquide
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

22



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
017

Client: **USATHAMA HYVAAP**
 Work Order: **2201-08-02**
 Date Rec'd: _____
 RFW Contact: **MAHELOH, N. RINSON, OASIA**
 Client Contact/Phone: **315-430-3117**

WESTON Analytica Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Refrigerator #/Type Container	Containers/Volume	Preservative
013	TSSR1 WIPE 5 LUG	WIPE	7/31/08	5-P	109	10ml	
014	6	↓	↓				
015	7	↓	↓				
016	8	↓	↓				
017	TSSR2 WIPE 1 LUG	WIPE	7/31/08				
018	2	↓	↓				
019	3	↓	↓				
020	4	↓	↓				
021	TSSR2 WIPE 5 LUG	WIPE	7/31/08				
022	6	↓	↓				
023	7	↓	↓				
024	8	↓	↓				

Special Instructions: **EXP - EXPLOSIVES T8**

All SAMPLES ARE PRE-TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

Matrix: W - Water U3 - Drum Solids
 S - Soil O - Oil UL - Drum Liquids
 SE - Sediment A - Air P - Fish
 SO - Solids X - Other



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 0908 MW - 019
 Client: USATHIMA / HVC/AP
 Work Order: 2281-CB-02

Date Rec'd: MAZELON N. TRINHEM
 RFW Contact: 215-432-3117
 Client Contact/Phone: PRETEST

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED
001	T-B CP SOLID PRETEST	SOLID	8/3/89	X
002	T-B SM WL PRETEST	WTR	8/3/89	X
003	T-B SM WHITE BLANK PRETEST	WTR	8/3/89	X
004	T-B CP PIPED BLANK PRETEST	AQ	8/3/89	X
005	T-B STEEL PIPE WAY RINSAR	AQ	8/3/89	X
006	T-3 SSRA SPIKE RINSAR	AQ	8/3/89	X
007	T-3 SSRA SPIKE RINSAR	L	8/3/89	X

Matrix: W - Water DS - Drum Solids
 S - Soil O - Oil DL - Urine, Liquids
 SE - Sediment A - Air F - Fish
 SO - Soils X - Other

Special Instructions: ALL SAMPLES are PRE TEST
T-B SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Arrived or Called
 NOTES:
 3 Received Broken/Leaking (improperly Sealed)
 Y N
 NOTES:
 4 Property Preserved
 Y N
 NOTES:
 5 Received With/Holding Times
 Y N
 NOTES:

COC Type Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 3207440719 Analytical Lot _____ Units Analyzed _____
 Installation _____ Date Prepared _____ Analyst _____
 Matrix: _____ Date Analyzed _____ Reviewed _____

Note: Data is corrected for dilution.

Comment: T-S PRE TEST

LAB ID #	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
SAMPLE DESCRIPTION	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
UNITS																		
HMX	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
RDX	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470
1,3,5-TNB	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
1,3-DNB	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245
NB	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Tetryl	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
2,4,6-TNT	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360
2,6-DNT	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2,4-DNT	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210

QUALOC DATE

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 200801000 Analytical Lot _____ Units _____
 Installation _____ Date Prepared _____ Analyst _____
 Matrix: WASTE DATE 1/24/00 Date Analyzed 1/24/00 Reviewed _____

Note: Data is corrected for dilution.

Comment: I-3 PRE ILSI

MATRIX	R	R	R	R	R	R	R
LAB ID /	019-000	019-005	019-010	019-015	019-020	019-025	019-030
SAMPLE DESCRIPTION	10g	10g	10g	10g	10g	10g	10g
Dilution	1	1	10	1000	10000		
SAMPLE VOLUME	10	10	10	10	10	10	10
UNITS	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g
HMX	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
RDX	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,3,5-TNB	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-DNB	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
HB	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Tetryl	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4,6-TNT	<0.005	<0.005	348	1900	1700		
2,6-DNT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4-DNT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010

DATE DATE 1/24/00 1/24/00 1/24/00 1/24/00 1/24/00 1/24/00 1/24/00 1/24/00

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 2008010101 Analytical Lot _____ Units _____
 Installation _____ Date Prepared _____ Analyst _____
 Matrix: RDX/NE SAFR 1.50% Date Analyzed _____ Reviewed _____

Note: Data is corrected for dilution.

Comment: I-S PRE TEST

MATRIX	R	R	R	R	R	R	R
LAB ID #	019-001	019-005	019-010	019-015	019-020	019-025	019-030
SAMPLE DESCRIPTION	PIPE	PIPE	PIPE	PIPE	PIPE	PIPE	PIPE
Dilution	1	1	10	1000	10000		
SAMPLE VOLUME	90	300	300	30	30		
UNITS	units	units	units	units	units		
HMX	0.0000	0.0000	0.0000	0.0000	0.0000		
RDX	0.0000	0.0000	0.0000	0.0000	0.0000		
1,3,5-TNB	0.0000	0.0000	0.0000	0.0000	0.0000		
1,3-DNB	0.0000	0.0000	0.0000	0.0000	0.0000		
NB	0.0000	0.0000	0.0000	0.0000	0.0000		
Tetryl	0.0000	0.0000	0.0000	0.0000	0.0000		
2,4,6-TNT	0.0000	0.0000	0.0000	0.0000	0.0000		
2,6-DNT	0.0000	0.0000	0.0000	0.0000	0.0000		
2,4-DNT	0.0000	0.0000	0.0000	0.0000	0.0000		

019-001 90 300 300 30 30

Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
8908HW022

Client **USATHAMA/FINAP**
 Work Order **2381-08-02**
 Date Rec'd **8-8-81** Date Due
 RFW Contact **N. STEINSON**
 Client Contact Phone **(215) 430-3117**

WESTON

WESTON Analytica
Use Only
Sample Waive:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Cooled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
COC Record Was:
 1 Present Upon Receipt of Samples Y N
Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Material	Date Collected	ANALYSES REQUESTED		Relinquished by	Date	Received by	Date	Relinquished by	Date	Received by	Date
				Maint	Env								
012	T8-SP-R1	ACN	8-8-81		X								
013	1				X								
014	B3				X								
015	B4				X								
016	T8-PB1-R1	ACN	8-8-81		X								
017	R2				X								
018	R3				X								
019	R4				X								
020	T8-SHRI-R1	N	8-8-81		X								
021	R2				X								
022	R3				X								
023	R4				X								
024	T8-CP-SPIL	soil			X								
025	T8-CP-scoop-Fuel/blek/R1	ACN	8-8-81		X								
026	T8-Fuel/blek-beaker/Rinse	ACN	8-8-81		X								

T8 Post Test Samples

W - Wipe
 B - Ball
 CE - Sediment A - Air P - Firm X - Other
 SO - Solid
 Special Instructions:
 1. Do not touch any items until analyzed

Item/ID	Relinquished by	Received by	Date	Item/Reason	Relinquished by	Received by	Date
	<i>[Signature]</i>		8-13-81				



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8908HW023

Client USAMRIID / HLMAP
Work Order 22-P-1-08-02
Date Rec'd. 8/9/09 **Date Due**
RFM Contact Nancy Johnson
Client Contact/Phone (251) 930-317

WESTON Analytics Use Only
Samples Were:
 1 Shipped or Hand-Delivered
NOTES:
 2 Ambient or Chilled
NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
NOTES:
 4 Properly Preserved
 Y N
NOTES:
 5 Received Within Holding Times
 Y N
NOTES:
COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
NOTES:
COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

Refrigerator#	#Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Date Collected	Matrix
				ERUPTIVES	8/8/09	HW

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected
001	T8 R1	HW	8/8/09
002	↓ R2	↓	↓
003	↓ R3	↓	↓
004	↓ R4	↓	↓

Matrix: W - Water D9 - Drum Solids
 S - Soil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

T-8 POST TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch GA100-60818A Analytical Lot _____ Units 512518-101-1 2110-101-1
 Installation MANAGERS Date Prepared _____ Analyst AP
 Matrix: SWIPE SOIL Date Analyzed 6/21/02 Reviewed _____

Note: Data is corrected for dilution.

Comment: _____

LAB ID #	R		L		S		S	
	BLANK	SOIL	BLANK	SOIL	BLANK	SOIL	BLANK	SOIL
Dilution	1	1	1	1	1	1	1	1
UNITS	ug/m ²	ug/m ²	ug/m ²	ug/m ²	ug/m ²	ug/m ²	ug/m ²	ug/m ²
MX	<0.635	0.65	<12.7	131	<1.27	12.6	<0.760	12.6
RDX	<0.490	4.70	<9.60	915	<0.760	8.58	<0.760	8.58
1,3,5-TNB	<1.05	7.6	<20.9	189	<2.07	19.0	<2.07	19.0
1,3-DNB	<0.295	2.15	<5.90	521	<0.990	5.44	<0.990	5.44
NB	<0.210	2.03	<4.20	39.6	<0.420	4.15	<0.420	4.15
Tetryl	<2.5	23.2	<50.0	455	<5.0	45.1	<5.0	45.1
2,4,6-TNT	<0.960	7.95	<19.6	160	<1.92	16.0	<1.92	16.0
2,6-DNT	<0.200	2.66	<4.00	39.4	<0.400	4.11	<0.400	4.11
2,4-DNT	<0.210	1.89	<1.20	36.7	<0.420	3.93	<0.420	3.93

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20

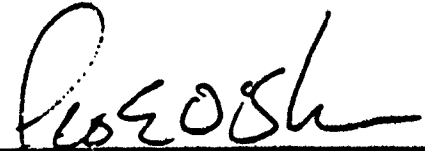
RFW #: 3907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory



Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.
- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).
- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).
- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).
- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T5 FLASH CHMB WALL	NITRATED ESTERS	5.0 u	UG	5.0
-002	T5 SMW2 POST TEST	NITRATED ESTERS	5.6	UG	5.0
-003	T-8 SMW2 POST TEST PRE ¹²	NITRATED ESTERS	13.0	UG	5.0
-004	T-8 WIPE BLANK PRE-	NITRATED ESTERS	5.8	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L25:

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
 WORK ORDER: 2281-03-02-0000

WESTON BATCH #: 6908L258

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNCO10-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNCO10-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA / HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L2

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T-8-SM-W2 POST TEST	NITRATED ESTERS	5.3	UG	5.0
-002	T-8-CHAMBER WALL-W2	NITRATED ESTERS	7.5	UG	5.0
-003	T8-WIPE BLANK W2 POS	NITRATED ESTERS	5.0	u UG	5.0
-004	T13-SM-W-2 PRE TEST	NITRATED ESTERS	12.5	UG	5.0
-005	T13-WIPE BLANK W2 ET	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L31

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECV
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

July 1990
Revision: Final

TEST RUN 13
500°F/12 HOURS

1311R2



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 827340021

Client USAIBAMA/HWAAP
 Work Order 22-EX-CB-02
 Date Rec'd _____ Date Due _____
 RFW Contact YORONG M. JORDAN
 Client Contact/Phone (215) 130-3117

WESTON Analytics Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

Refrigerator#	#/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Matrix	Date Collected
					AEM	8/7/09

Item/Reason	Ratified by	Received by	Item/Reason	Relinquished by	Received by	Time	Date	Time

Matrix: W - Water DS - Drum Solids DL - Drum Liquids
 S - Soil O - Oil A - Air F - Fish X - Other
 SE - Sediment

Special Instructions: **T13 PAE TEST SAMPLES**

Received by: CAYBATA Date: 8/7/09



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8908HW02A

Client: USAMRIID / HANAP
 Work Order: 2281-68-07
 Date Rec'd: YUNWJ / 14 10 15 2017
 RFW Contact: (215) 430-3117
 Client Contact Phone: (215) 430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator #	#Type Container	Container Volume	Preservative	ANALYSES REQUESTED
Q14	T13 SSK1 W1 UPRR	WAF						
Q15	W2			X				
Q16	W3			X				
Q17	W4			X				
Q18	W5 LOWER			X				
Q19	W6			X				
Q20	W7			X				
Q21	W8			X				
Q22	T13 SSK2 W1 UPRR			X				
Q23	W2			X				
Q24	W3			X				
Q25	W4			X				

Matrix: W - Water O3 - Drum Solids Special Instructions:
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SD - Solid X - Other

T13 PRE TEST SAMPLES

Item/Reason	Relinquished by	Received by	Item/Reason	Relinquished by	Received by	Date	Time
	C. Harris					8/14	

WESTON Analytica Use Only
 Samples Were:
 1 Shipped or Hand Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Impermeability Sealed)
 Y N
 NOTES:
 4 Priority Preserved
 Y N
 NOTES:
 5 Received With Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken in Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8908HW021

Client: USAID/USAID/HW/HP
 Work Order: 22PI-08-02
 Date Rec'd: 1/13/03
 RFW Contact: YVES / N. JOHNSON
 Client Contact/Phone: (215) 430-317

WESTON Analytics Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Taps Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerated	#Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Item/Reason	Time	Date	Time
026	T13 SS127 W5 LUMEN	WIPE										
027	W16			X								
028	W17			X								
029	W18			X								
030	T13 WIPE BLANK	WIPE		X								
031	T13 SW	WIPE		X								
032	T13 AP1 SPIES RINSE	ASN										
033	T13 AP2 SPIES RINSE	ACA										

Matrix: W - Water DS - Drum Solids Special instructions:
 O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

T-13 PRE TEST SAMPLES

Item/Reason	Reinjuvated by	Received by	Date	Time	Item/Reason	Reinjuvated by	Received by	Date	Time
	<u>CP/2/2/03</u>		<u>8/2/03</u>						

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFV Batch 22031102021 Analytical Lot _____ Units 22031102021
 Installation WV-110001 Date Prepared _____ Analyst CPA
 Matrix: 22031102021 Date Analyzed 2/22/17 Reviewed _____

Note: Data is corrected for dilution.

Comment: T-12 PRE TEST

LAB ID #	W		R		E		Dilution	Sample Volume	Units
	O21-O30	O31-T13	O21-O32	O33-T13	O21-O32	O33-T13			
1	1	10	100	10	100	100			
2	-	250	250	250	250	250			
3	12.7	57.7	6.35	6.35	6.35	6.35			
4	29.80	29.80	29.80	29.80	29.80	29.80			
5	220.9	220.9	220.9	220.9	220.9	220.9			
6	25.90	25.90	25.90	25.90	25.90	25.90			
7	2.143	2.143	2.143	2.143	2.143	2.143			
8	250.0	250.0	250.0	250.0	250.0	250.0			
9	219.2	219.2	219.2	219.2	219.2	219.2			
10	24.20	24.20	24.20	24.20	24.20	24.20			
11	24.20	24.20	24.20	24.20	24.20	24.20			

WV-110001 - 2/19/17 2/19 2/19 2/19 2/19 2/19 2/19

Custody Transfer Record/Lab Work Request

WESTON Analytix Use Only
808HW005

Client: USATHAMA / HWAAP

Work Order: 2-2-81-08-02

Date Rec'd: _____ Date Dns: _____

RFW Contact: Srikanta / Nancy Johnson

Client Contact/Phone: (215) 430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerators		ANALYSES REQUESTED	Preservative	Containers/Volumes	#Type Containers	VQA
				Containers/Volumes	Preservative					
001	T13 SSRI W1 upper	Wipe	8-14-89	X			COOL			
002	W2			X						
003	W3			X						
004	W4			X						
005	W5 lower			X						
006	W6			X						
007	W7			X						
008	W8			X						
009	T13 SM W1 (ACN)	Wipe	8-14-89	X						
010	T13 Chamber Walls W1 (ACN)	Wipe	8-14-89	X						
011	T13 Wipe Blank W1 (ACN)	Wipe	8-14-89	X						

Matrix: W - Water DS - Drum Solids Special Instructions: T13 Post-TEST SAMPLES
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	<u>A. S. S. S. S.</u>		<u>8/14/89</u>						

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

WESTON Analytix Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:

WESTON 8.3

Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8903 H W O R S
 Client U.S. FISH AND WILDLIFE
 Work Order 2281-08-02

Date Rec'd. _____
 RFW Contact S. Jackson
 Client Contact/Phone (215) 430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Preservative	Containers/Volume	#Type Container	Refrigerator
012	T13 CP - 5011	Soil	8-14-89	EXPANDED	500ml			
013	T13 Field Blank Rinse-BI	ACN	8-14-89					
014	T13 PBA BI Post	ACN	8-14-89					
015	B3							
016	B3							
017	B4							
019	T13 PA-Field Blank BI	ACN	8-14-89					
020	T13 API BI Post	ACN	8-14-89					
021	B3							
022	B4							

Matrix: W - Water D3 - Drum Solids
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Special Instructions:

T13 Post Test Samples

Rein/Reason	Relinquished by	Received by	Date	Time	Item/Version	Relinquished by	Received by	Date	Time
	<u>S. Jackson</u>		<u>8/14/89</u>						

WESTON Analytica Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

303



Custody Transfer Record/Lab Work Request

WESTON Analyticals Use Only
 8908 H20025
 Client: USATHAMA / HWAAP
 Work Order: 4281-08-02
 Date Rec'd.: Date Due:
 RFW Contact: SABACKA / M. JOHNSON
 Client Contact/Phone: (215) 430-3117

Client ID/Description	Matrix	Date Collected	Refrigerator #	#Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Special Instructions
023 T13 SHRI R1 Post	KN	8-14-81		Tube	50ml	COOL		
024 R2 Post		↓						
025 R3 ↓		↓						
026 R4 ↓		↓						
027 T13 SHRI Field BUREL	KN	8-14-81						

T13 Post Test Samples

WESTON Analyticals Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Handling Times
 Y M
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Seals Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record?
 Y N
 NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 28052000025 Analytical Lot _____ Units 001-002-003-004-005-006-007-008-009-010-011
 Installation ADWITROLINE Date Prepared _____ Analyst _____
 Matrix: GUNSAFE WIPE & SOIL Date Analyzed 8/14/04 Reviewed _____

Note: Data is corrected for dilution, ' _____

Comment: I-13 POST TEST

MATRIX	025-001	025-002	025-003	025-004	025-005	025-006	025-007	025-008	025-009	025-010	025-011
LAB ID #	025-001	025-002	025-003	025-004	025-005	025-006	025-007	025-008	025-009	025-010	025-011
SAMPLE DESCRIPTION	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES	T13 SSRI WIPES
DILUTION	1	1	1	1	1	1	1	1	1	1	1
SAMPLE VOLUME (LIMS)	-	-	-	-	-	-	-	-	-	-	-
UNITS	Net Wt	Net Wt	Net Wt	Net Wt	Net Wt	Net Wt	Net Wt	Net Wt	Net Wt	Net Wt	Net Wt
HHX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80	<9.80
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
NB	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	<19.2	<19.2	<19.2	<19.2	<19.2	17.45	<19.2	<19.2	<19.2	<19.2	<19.2
2,6-DNT	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00	<4.00
2,4-DNT	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20	<4.20

ANALYST: E114 E114 E114 E114 E114 E114 E114 E114 E114 E114 E114 E114

I - PRESENT, LESS THAN DETECTION LIMITS.

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFM Batch 530RH20RS Analytical Lot _____
 Installation HAUSTHORNE Date Prepared _____
 Matrix: BLINSTE WIFE 1501L Date Analyzed 8/14/89

Units BLINSTE - 11500 WIFE - 115000 SOW-1
 Analyst QAD
 Reviewed _____

Note: Data is corrected for dilution.

Comment: I-13 POST TEST

MATRIX	R	F	R	R	R
LAB ID #	025-023	025-024	025-025	025-026	025-027
SAMPLE DESCRIPTION	T13 SARI R1	T13 SARI R2	T13 SARI R3	T13 SARI R4	T13 SARI R5
Dilution	1	1	1	1	1
SAMPLE VOLUME (mL)	300	300	300	300	300
UNITS	ug/mg	ug/mg	ug/mg	ug/mg	ug/mg
HMX	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.490	<0.490	<0.490	<0.490	<0.490
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<0.760	<0.760	<0.760	<0.760	<0.760
2,6-DNT	<0.200	<0.200	<0.200	<0.200	<0.200
2,4-DNT	<0.210	<0.210	<0.210	<0.210	<0.210

- QAD:ac DMTC - 8/14 - 8/14 8/14 8/14 8/14

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8307L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/2/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable; result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.

- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WGRK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORT LIMIT
-001	T-8-SM-W2 POST TEST	NITRATED ESTERS	5.3	UG	!
-002	T-8-CHAMBER WALL-W2	NITRATED ESTERS	7.5	UG	!
-003	T8-WIPE BLANK W2 POS	NITRATED ESTERS	5.0 u	UG	!
-004	T13-SM-W-2 PRE TEST	NITRATED ESTERS	12.5	UG	!
-005	T13-WIPE BLANK W2 ET	NITRATED ESTERS	5.0 u	UG	!

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%R
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	1
		NITRATED ESTERS	51.8	2.5 u	50.0	1

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORT LIMIT
-001	POST T13 SM WS (ETOH)	NITRATED ESTERS	5.0	u UG	
-002	POST T13FC CH WAL W2	NITRATED ESTERS	5.0	u UG	
-003	POST T13 WIPE BL W2	NITRATED ESTERS	7.5	UG	
-004	PRE T14 SMW2 (ETOH)	NITRATED ESTERS	5.0	u UG	
-005	PRE T14 WIPE BL W2	NITRATED ESTERS	5.0	u UG	

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L398

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5	u MG/L	2.5
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5	u MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RI
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	9
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	10
		NITRATED ESTERS	51.8	2.5 u	50.0	10

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L398

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

July 1990
Revision: Final

TEST RUN 14
400°F/12 HOURS

1311R2

WESTON Analytica Use Only
2008H0024

Custody Transfer Record/Lab Work Request



Client: USATHAMA ZHWAAP
 Work Order: 2281-08-02
 Date Rec'd: _____
 RFW Contact: Salacke, Nancy Johnson
 Client Contact/Phone: (605) 430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator #/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED
001	T14 S5R1 W1 upper	wpe	8-14-81	VFA			
002	W2						
003	W3						
004	W4						
005	W5 lower						
006	W6						
007	W7						
008	W8						
009	T14 S5R3 W1 upper	wipe	8-14-81				
010	W2						
011	W3						
012	W4						
013	W5 lower						
014	W6						
015	W7						

Matrix: W - Water DS - Drum Solids
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Special Instructions:

T14 Pre-test samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
		<u>N. Salacke</u>	<u>8-14-81</u>						

WESTON Analytica Use Only
 Samples Were: 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed) Y N
 NOTES:
 4 Properly Pressured Y N
 NOTES:
 5 Received Within Holding Times Y N
 NOTES:
 CCC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

283



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8708 WLD 234
 Client USA THAMA / HWAAP
 Work Order 2281-08-02

Date Rec'd. _____
 RFW Contact SA JACKO / N. JOHNSON
 Client Contact/Phone (215) 430-3117

WESTON Analytical Use Only
 Samples Were: 1 Shipped or Hand Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (improperly Sealed) Y N
 NOTES:
 4 Properly Preserved Y N
 NOTES:
 5 Received With/ Missing Tapes Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator #/Type Container	Containers/Vol./no	Preservative	ANALYSES REQUESTED
017	T14 SSB2 W8 IANER	Wipe	8-14-89	NDA Amber	500ml	Coc1 Coc1	
019	SM W1 (ACAD)	Wipe	8-14-89				
019	T14 Wipe Blank W1(ACN)	Wipe	8-14-89				
019	T14 CP Soil	Soil	8-14-89				
020	T14 Field Blank Rinse-Soye ACN	ACN	8-14-89				
021	T14 PBI R'	ACN	8-14-89				
022	B3						
023	B3						
024	B4						

Matrix: W - Water DS - Drum Solids
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

T14 Pre-Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	SA T. Johnson		8-14-89						

WESTON 383

Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only

Client: USAHAMA / HWAMP

Work Order: 2381-08-02

Date Rec'd: 8/14/89

RFW Contact: SOJAKA / N. JOHNSON

Client Contact/Phone: (215) 430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Preservative	Container Volume	Type Container	Relinquished
026	T14 PBA B1	ACN	8-14-89	↓	COOL	500ml	500ml	
027	B2	↓	↓	↓	ENHANCING			
028	B3							
029	B4							
030	T14 PB FIA Blank B1	ACN	8-14-89	X				
031	SPI Spike Binsak	ACN	8-14-89	X				
032	SP2 Spike Binsak	ACN	8-14-89	X				
033	SSR1 Spike Binsak	ACN	8-14-89	X				
034	SSR2 Spike Binsak	ACN	8-14-89	X				

Matrix: W - Water D3 - Drum Solids
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

T14 Pre Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	S. J. Salack		8/14/89						

WESTON Analytica Use Only

Samples Were: 1 Gipped or Hand Delivered

NOTES:

2 Ambient or Chilled

NOTES:

3 Received Broken/Leaking (Improperly Sealed)

Y N

NOTES:

4 Property Preserved

Y N

NOTES:

5 Received Within Holding Times

Y N

NOTES:

COC Taps Was:

1 Present on Outer Package Y N

2 Unbroken on Outer Package Y N

3 Present on Sample Y N

4 Unbroken on Sample Y N

NOTES:

COC Record Was:

1 Present on Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N

NOTES:

WESTON ANALYTICAL EXPLOSIVES DATA SUMMARY

RFW Batch 8908HLS024 Analytical Lot _____ Units CONSTANT - 4.90 WIDE - 1.70 5010 - 1.70
 Installation WASTINGLINE Date Prepared _____ Analyst QAD
 Matrix: MINUTE WASTE 1 2010 Date Analyzed 8/14/88 Reviewed _____

Note: Data is corrected for dilution.

Comment: T-14 PRE TEST

MATRIX LAB ID #	R		R		R		R		R	
	024- 030	024- 030	024- 031	024- 032	024- 033	024- 033	024- 033	024- 033	024- 033	024- 033
SAMPLE DESCRIPTION	SSR 1 SPIKE RATE	SSR 1 SPIKE RATE	SSR 2 SPIKE RATE	SSR 1 SPIKE RATE	SSR 2 SPIKE RATE	SSR 2 SPIKE RATE	SSR 2 SPIKE RATE	SSR 2 SPIKE RATE	SSR 2 SPIKE RATE	SSR 2 SPIKE RATE
Dilution	10	100	1000	1000	10	100	100	100	100	100
SAMPLE VOLUME (mls)	250	250	30	30	250	250	250	250	250	250
UNITS	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
HMX	< 6.35	< 6.35	< 6.35	< 6.35	< 6.35	< 6.35	< 6.35	< 6.35	< 6.35	< 6.35
RDX	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90
1,3,5-TNB	< 10.5	< 10.5	< 10.5	< 10.5	< 10.5	< 10.5	< 10.5	< 10.5	< 10.5	< 10.5
1,3-DNB	< 2.95	< 2.95	< 2.95	< 2.95	< 2.95	< 2.95	< 2.95	< 2.95	< 2.95	< 2.95
NB	< 2.10	< 2.10	< 2.10	< 2.10	< 2.10	< 2.10	< 2.10	< 2.10	< 2.10	< 2.10
Tetryl	< 25	< 25	< 2500	< 2500	< 25	< 25	< 25	< 25	< 25	< 25
2,4,6-TNT	305	305	18100	11600	1420	1420	1420	1420	1420	1420
2,6-DNT	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00
2,4-DNT	0.670	0.670	< 2.10	< 2.10	1.78	1.78	1.78	1.78	1.78	1.78

CONSTANT (1988) 1.70 1.70 1.70 1.70 1.70 1.70 1.70 1.70 1.70 1.70 1.70

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch QA/GC 9/14/99 Analytical Lot _____ Units RAMMIE-1000 Wipe - Soil by _____
 Installation HAWTHORNE Date Prepared _____ Analyst CAW
 Matrix: RAMMIE-1000 Wipe & Soil Date Analyzed 9/14/99 Reviewed _____

Notes: Data is corrected for dilution.

Comment: _____

MATRIX LAB ID #	R		L		W		S	
	BLANK ION	BLANK WIPE	BLANK ION	BLANK WIPE	BLANK ION	BLANK WIPE	BLANK ION	BLANK WIPE
Dilution	1	1	1	1	1	1	1	1
UNITS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MAX	<0.635	0.85	<12.7	142	<1.27	13.2	<1.27	13.2
RDX	<0.490	4.81	<9.80	99.3	<0.980	9.15	<0.980	9.15
1,3,5-TNB	<1.05	9.95	<20.9	206	<2.09	19.4	<2.09	19.4
1,3-DNB	<0.295	2.77	<5.50	57.3	<0.550	5.39	<0.550	5.39
HB	<0.210	2.02	<4.20	42.2	<0.420	4.19	<0.420	4.19
Tetryl	<2.5	23.5	<50.0	487	<5.0	43.4	<5.0	43.4
2,4,6-TNT	<0.960	8.26	<19.2	172	<1.92	15.9	<1.92	15.9
2,6-DNT	<0.200	2.11	<4.00	43.2	<0.400	4.07	<0.400	4.07
2,4-DNT	<0.210	1.95	<4.20	40.2	<0.420	3.91	<0.420	3.91

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only

8908HW026

Client: USATHAMA / HWIAP

Work Order: 2281-08-02

Date Rec'd: 2/18/11

RFW Contact: S. Locka / N. Johnson

Client Contact/Phone: (214) 430-3117

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator #/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED
001	TH 5581 W1 wipe	Wipe	8-18-11	WA			
002	W3						
003	W3						
004	W4						
005	W5						
006	W6						
007	W7						
008	W8						
009	TH SM W1 ACN	Wipe	8-18-11				
010	TH EC Wells W1 ACN	Wipe	8-18-11				
011	TH Wipe Blank W1	Wipe	8-18-11				

Matrix: W - Wax DS - Drum Solids Special Instructions: TH Post Test Samples

O - Oil DL - Drum Liquids

SS - Sediment A - Air F - Fish

SO - Solid X - Other

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	S. Locka		2/18/11						

WESTON Analytics Use Only

Samples Were: 1 Shipped or Hand-Delivered

NOTES: 2 Ambient or Chilled

3 Received Broken/Leaking (Inappropriate Sealed) Y N

NOTES: 4 Properly Preserved Y N

5 Received Within Holding Times Y N

NOTES: COC Tape Was: 1 Present on Outer Package Y N

2 Unbroken on Outer Package Y N

3 Present on Sample Y N

4 Unbroken on Sample Y N

NOTES: COC Record Was: 1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N

NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytix Use Only
 8908HWO26

Client: USATHAMA / HWAAP
 Work Order: 2081-08-02
 Date Rec'd.: _____ Date Due: _____
 RSW Contact: Salacko / N. Johnson
 Client Contact Phone: (215) 430-3119

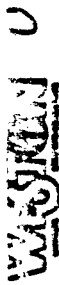
REF ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Preservative	Containers/Volume	#Type Container	Refrigerator
012	TH CP Soil	Soil	8-18-99			200.1	Amber	
013	TH CP Field Blank Run	ACN	8-18-99					
014	TH PBI R1	ACN	8-18-99					
015	R3							
016	R3							
017	R4							
018	TH PBI Field Blank R1	ACN	8-18-99					
019	TH SPI R1	ACN	8-18-99					
020	R2							
021	R3							
022	R4							

Matrix: W - Water DS - Drum Solids Special Instructions:
 S - Soil O - Oil DL - Drum Liquid
 SS - Sediment A - Air F - Fish
 SO - Solid X - Other

TH Past Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	<i>S. F. Salacko</i>								

WESTON Analytix Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record?
 Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8908HW026

Client: USATHAMA/HWAAP
 Work Order: 2381-08-02
 Date Rec'd: [blank]
 RFW Contact: Salacke, NI: Johnson
 Client Contact/Phone: (615) 430-3117

WA Use Only Lab ID	Client ID/Description	Date Collected	Analyses Requested	Preservative	#Type Container	Refrigerator
023	TIH SHB RI	ACN 8-18-97	X	ACN	1	Ambox
024	BA	↓	X	↓	1	↓
025	R3	↓	X	↓	1	↓
026	R4	↓	X	↓	1	↓
027	TIH SHB Field Blank RI	ACN 8-18-97	X	ACN	1	Ambox

Subs: W - Waste, DS - Drum Solids, Special Instructions: TIH Post Test Samples
 S - Soil, O - Oil, DL - Drum Liquids
 SE - Sediment, A - Air, F - Fish
 SO - Solid, X - Other

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	Salacke		8/18/97						

WESTON Analytics Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Airtight or Chilled
 NOTES:

3 Received Broken/Leaking (improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Taps Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WESTON ANALYTICS EXPLOSIVES

DATA SUMMARY

RFV Batch 9908 HWS C26- Analytical Lot _____ Units Rinsalt µg/ml, Wipe Test, Soil µg/g
 Installation HAZARDOUS Date Prepared _____ Analyst -AJS
 Matrix: Rinsalt, Wipe, & Soil Date Analyzed 5/15/54 Reviewed _____

Note: Data is corrected for dilution.

Comment: T-14 Post Test Samples

MATRIX	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		
LAB ID #	C26-012	C26-013	T14 CP Field Blk R1	T14 PBI R1	C26-014	C16	T14 PBI R2	T14 PBI R3	C26-015	C17	T14 PBI R4	T14 PBI R1	C26-016	C18	T14 PBI R2	T14 PBI R3	C26-019	C20	C21	C22
Sample Descrip:	S11	Field Blk	Field Blk	Field Blk	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R1	R2	R3	R4	T14 S1
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sample vol/wt	1 gm	250 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml	250 ml	250 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml	1000 ml
Units	µg/g	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml
HMX	<0.27	<0.35	<0.49	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
RDX	<0.98	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	<2.69	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DHB	<0.589	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215
NB	<0.419	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Tetryl	<5.0	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<1.92	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
2,6-DNT	<0.4	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.42	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21

DATE: 5/15/54 8/18 5/18

(1954)

WESTON ANALYTICALS EXPLOSIVES

DATA SUMMARY

RFW Batch 9108 HW 026-
 Installation HAUSHERNE
 Matrix: Rinside, Wipe, & Soil

Analytical Lot _____
 Date Prepared _____
 Date Analyzed 8/19/88

Units Rinside $\mu\text{g/ml}$, Wipe-Tri-Sur, Soil $\mu\text{g/g}$
 Analyst _____
 Reviewed _____

Note: Data is corrected for dilution.

Comment: T14 Post Test Samples 7

MATRIX	R	R	R	R	R	R	R
LAB ID #	026-	026-	026-	026-	026-	026-	026-
	023	024	025	026	026	027	027
Sample Description:	T14 SUR	T14 SUR	T14 SUR	T14 SUR	T14 SUR	T14 SUR	T14 SUR
Dilution	R1	R2	R3	R4	R4	FRSH BK	
Sample vol/ct	1	1	1	1	1	1	
$\mu\text{g/ml}$	200 ml	300 ml	300 ml	300 ml	300 ml	250 ml	
HMX	2.44	2.40	1.50	0.98	0.98	0.635	
RDX	21.9	22.9	8.65	2.9	2.9	0.49	
1,3,5-TNB	2.23	2.24	1.23	1.05	1.05	1.05	
1,3-DNB	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	
NB	<0.216	<0.210	<0.210	<0.210	<0.210	<0.210	
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	
2,4,6-TNT	273	282	170	11.37	11.37	0.96	
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	
2,4-DNT	0.36	0.39	0.465	0.25	0.25	0.21	

8/18 8/18 8/18 8/18 8/18 8/18 8/18

(1988)

WESTON

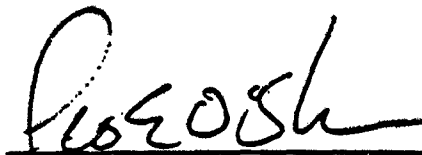
ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/24/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.
- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).
- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).
- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).
- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L398

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	POST T13 SM WS (ETOH)	NITRATED ESTERS	5.0	u UG	5.0
-002	POST T13FC CH WAL W2	NITRATED ESTERS	5.0	u UG	5.0
-003	POST T13 WIPE BL W2	NITRATED ESTERS	7.5	UG	5.0
-004	PRE T14 SMV2 (ETOH)	NITRATED ESTERS	5.0	u UG	5.0
-005	PRE T14 WIPE BL W2	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 8908L39

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #. 8908L398

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

ROY F. WESTON INC.
INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC010-MB2	NITRATED ESTERS	106	104	2.2

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T14 SM W2 ETOH (POST	NITRATED ESTERS	5.0	u UG	5.0
-002	T14 FC WALLS W2 ETOH	NITRATED ESTERS	20.3	UG	5.0
-003	T14 POST WIPE BLANK	NITRATED ESTERS	5.0	u UG	5.0
-004	T15 PRE SM W2 ETOH	NITRATED ESTERS	6.6	UG	5.0
-005	T15 PRE WIPE BLANK	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02 0000

WESTON BATCH #: 8908L4

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORT LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u MG/L	
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u MG/L	

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 3908L

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RI
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	10
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	50
		NITRATED ESTERS	48.8	2.5 u	50.0	50

July 1990
Revision: Final

TEST RUN 15
600°F/12 HOURS

1311R2



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8908HV027
 Client: USATHAMA / HW/AAP
 Work Order: 2281-08-02
 Date Rec'd: _____ Date Due: _____
 RFW Contact: Surokko / A. Johnson
 Client Contact/Phone (215) 430-3117

WESTON Analytica Use Only
 Samples Were: 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator#	#Type Container Containers/Volume Preservative	ANALYSES REQUESTED
001	T15 SSR1 W1 UPPER	wipe	8-21-87	VOA		
002	W2					
003	W3					
004	W4					
005	W5 lower					
006	W6					
007	W7					
008	W8					
009	T15 SSR2 W1 upper	wipe	8-21-87			
010	W2					
011	W3					
012	W4					
013	W5 lower					
014	W6					
015	W7					

Special Instructions: T15 PRE TEST SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	S. Surokko		8/21/87						

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Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8908HW0217
 Client: USATHAMA / HWAAP
 Work Order: 2281-08-02
 Date Rec'd: _____ Date Due: _____
 RFW Contact: Solacka / N. Johnson
 Client Contact/Phone: (215) 730-3117

WESTON Analytica Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Retrigrators #/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED
016	T15 SSR2 W8 1600C	Wipe	8-21-89	VGA Amber	900ml	COOL COOL	EXPENSIVE
017	T15 SIM WI ACN	Wipe	8-21-89				
018	T15 Wipe Blank WI ACN	Wipe	8-21-89				
019	T15 CP Soil	Soil	8-21-89				
020	T15 CP Field Blank Rinse	ACN	8-21-89				
021	T15 PBI R1	ACN	8-21-89				
022	R3						
023	R3						
024	R4						

Special Instructions: T15 Pre Test Samples

Item/Reason	Relinquished by	Date	Time	Item/Reason	Relinquished by	Date	Time
	<u>A. T. Solacka</u>	<u>8/21/89</u>					



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8908HW027

Client: KAITHAMA / HWVAP
 Work Order: 2281-05-02
 Date Rec'd: _____
 RFW Contact: SALUKA / N. JOHNSON
 Client Contact Phone: (252) 430-3117

WA Use Only Lab ID	Client ID/Description	Multiplex	Date Collected	Refrigerator #	#Type Container	Corrainers/Volume	Preservative	ANALYSES REQUESTED
025	T15 PB2 RI	AKN	8/21/89		AKN	FEOML	COOL	EXPDSI VPO
026	B3	↓	↓					
027	B3	↓	↓					
028	B4	↓	↓					
029	T15 PB Field Blank RI	AKN	8/21/89					
030	T15 API Spike Rinsate	AKN	8/21/89					
031	T15 APA Spike Rinsate	AKN	8/21/89					
032	T15 SSR1 Spike Rinsate	AKN	8/21/89					
033	T15 SSR2 Spike Rinsate	AKN	8/21/89					

Matrix: W - Water DS - Drum Solids Special Instructions:
 O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solids X - Other

T15 Pre Test Samples

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record Y N
 NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch: 55038 413 027- Analytical Lot: _____
 Installation: MAINTENANCE Date Prepared: _____
 Matrix: UNSAFE Date Analyzed: 5/21/84 Units: 2500g
 Analyst: _____
 Reviewed: _____

Note: Data is corrected for dilution, if applicable.
 Comment: T15 Pre Test Samples

LAB ID	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13	U14	U15	U16	U17	U18
1,3,5-TNB	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
1,3-DNB	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
NB	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Tetryl	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
2,4,6-TNT	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
2,6-DNT	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
2,4-DNT	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2

Sample Description: _____
 Dilution: _____
 Sample Volume: _____

Units: _____
 RDX: _____
 1,3,5-TNB: _____
 1,3-DNB: _____
 NB: _____
 Tetryl: _____
 2,4,6-TNT: _____
 2,6-DNT: _____
 2,4-DNT: _____

WESTON ANALYTICALS EXPLOSIVES DATA SUMMARY

RFW Batch 8708-410-007 - Analytical Lot _____ Units Rinsed: 0.9 ml, 100µl Delutaf, Soil 10/8
 Installation: WAREHOUSE DATE PREPARED _____ Analyst _____
 Matrix: Rinsed, 100µl, 100µl Date Analyzed: 01/29/99 Reviewed _____

Note: Data is corrected for dilution.

Comment: T15 Pre Test Samples

MATRIX	R	R	R	R	R	R	R	R	R	R	R	R	R
LAB ID #	007-030	007-031	007-032	007-033	007-034	007-035	007-036	007-037	007-038	007-039	007-040	007-041	007-042
Sample Description	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample	T15 Pre Test Sample
Dilution	1	10	100	100	100	100	100	100	100	100	100	100	100
Sample Vol/wt	250µl	250µl	250µl	250µl	250µl	250µl	250µl	250µl	250µl	250µl	250µl	250µl	250µl
Unit	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml
HMX	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
RDX	<0.119	0.146 J	0.96 J	3.9 J	3.9 J	3.9 J	3.9 J	3.9 J	3.9 J	3.9 J	3.9 J	3.9 J	3.9 J
1,3,5-TNB	<0.05	0.13 J	<0.105	0.875 J	0.875 J	0.875 J	0.875 J	0.875 J	0.875 J	0.875 J	0.875 J	0.875 J	0.875 J
1,3-DNB	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
NB	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Tetryl	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-TNT	<0.06	1225 J	2050 J	10850 J	10850 J	10850 J	10850 J	10850 J	10850 J	10850 J	10850 J	10850 J	10850 J
2,6-DNT	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-DNT	<0.01	1.98 J	3.25 J	15.0 J	15.0 J	15.0 J	15.0 J	15.0 J	15.0 J	15.0 J	15.0 J	15.0 J	15.0 J

100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl, 100µl

(100µl)



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8708HW-029 -

Client: UETHAMA / HURAP
 Work Order: 2281-03-02
 Date Rec'd: _____
 RFW Contact: N. JOHNSON, M. MAZELON
 Client Contact/Phone: _____

WESTON Analytica Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Refrigerator #/Type Container Containers/Volume Preservative	SEALED	EXP	EXP
001	T15 SSR1 W1 TOP	WATER	8/21/89					
002	T15 SSR1 W2 TOP					X		
003	T15 SSR1 W3 TOP					X		
004	T15 SSR1 W4 TOP					X		
005	T15 SSR1 W5 BOTTOM					X		
006	T15 SSR1 W6 BOTTOM					X		
007	T15 SSR1 W7 BOTTOM					X		
008	T15 SSR1 W8 BOTTOM					X		
009	T15 SSR FIELD Blank					X		
010	T15 API R1 Post Test	AQ	8/21/89				X	
011	T15 API R2						X	
012	T15 API R3						X	
013	T15 API R4						X	
014	T15 AP FIELD Blank						X	

Special Instructions: T-15 POST TEST SAMPLES
 600°F/12 hrs

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

EXP = EXPLOSIVES



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
8908 HW-C09 -

Client USATAMA / HWAAF
 Work Order 2281-08-02
 Date Rec'd. _____ Date Due _____
 RFW Contact N. Johnson M. Malczon
 Client Contact/Phone _____

MA Use Only Lab ID	Client ID/Description
015	T15 PARI R1 Post Test
016	T15 PBI R2 Post Test
017	T15 PBI R3 Post Test
018	T15 PBI R4 Post Test
019	T15 PB FIBRO Blank Post
020	T15 SHRI R1 Post Test
021	T15 SHRI R2 Post Test
022	T15 SHRI R3 Post Test
023	T15 SHRI R4 Post Test
024	T15 SHRI FIBRO Blank Post
025	T15 CP Soil Post Test
026	T15 CP Field Blank Post

Matrix: W - Water DS - Drum Solids Special Instructions: **T-15 Post Test SAMPLES**
 O - Oil OL - Drum Liquids **600°F / 12 hrs.**
 SB - Sediment A - Air F - Fish
 SO - Solid X - Other

Refrigerator#	# of Containers	Container Volume	Preservative	ANALYSES REQUESTED	Matrix	Date Collected	Relinquished by	Date	Time
					AG	8/27/89			

WESTON Analytica Use Only	<p>Samples Were: 1 Shipped or Hand-Delivered NOTES:</p> <p>2 Ambient or Chilled NOTES:</p> <p>3 Received Broken/Leaking (Impurity Sealed) Y N NOTES:</p> <p>4 Properly Preserved Y N NOTES:</p> <p>5 Received Within Holding Time Y N NOTES:</p> <p>COC Tape Was: 1 Present on Outer Package Y N 2 Unbroken on Outer Package Y N 3 Present on Sample Y N 4 Unbroken on Sample Y N NOTES:</p> <p>COC Record Was: 1 Present Upon Receipt of Samples Y N Discrepancies Between Sample Labels and COC Record? Y N NOTES:</p>
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Custody Transfer Record/Lab Work Request

WESTON Analytix Use Only

Client USAFAMA / HULLAP
 Work Order 2201-08-02
 Date Rec'd. _____ Date Due _____
 RFW Contact N. JORANSEN, M. MARCINA
 Client Contact/Phone _____

WESTON Analytix Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	ANALYSES REQUESTED		Date Collected	Matrix	Refrigerator#	#/Type Container	Containers/Volume	Preservative	Date	Time	Received by	Date	Time	Relinquished by	Date	Time	Received by	Date	Time																													
		Matrix	Date																																														
027	TTS SM WALL POST TEST	WIRE	8/27/89	8/27/89	WIRE		NA																																										
028	TTS SM FIELD BLEND WATER	WIRE	8/27/89	8/27/89	WIRE																																												
029	TTS Flash Chmb. Walls W1	WIRE	8/27/89	8/27/89	WIRE																																												
030	TTS Flash Chmb. Walls Blank	WIRE	8/27/89	8/27/89	WIRE																																												

Matrix: W - Water D9 - Drum Solids Special Instructions: **T-15 POST TEST SAMPLES**
 S - Soil O - Oil DL - Drum Liquids **600°F/12 hrs**
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

EXP - EXPLOSIVES

WESTON ANALYTICALS EXPLOSIVES DATA SUMMARY

RFW Batch 5/27/89 Analytical Lot _____ Units Rinsed MS/mg Wipe total MF, Seal M/L
 Installation SAWTHORNE Date Prepared _____ Analyst _____
 Matrix: Rinsate, Wipe, Seal Date Analyzed 5/27/89 Reviewed _____

Note: Data is corrected for dilution.
 Comment: T-15 Post test Sample / Sec

MATRIX LAB ID #	R		W		S		S	
	Rinsate Blank	10r Rinsate	wipe Blank	10r Wipe	Seal Blank	Seal 10r	Seal Blank	Seal 10r
Dilution	1	1	1	1	1	1	1	1
Units	ug/ml	ug/ml	total ug	total ug	ug/g	ug/g	ug/g	ug/g
HMX	<0.533	98.24	<12.7	127	<1.27	12.67	95.0	95.0
RDX	<0.49	86.61	<9.8	88.5	<0.98	8.14	82.6	82.6
1,3,5-TNB	<1.05	89.5	<20.9	184	<2.09	18.2	87.3	87.3
1,3-DNB	<0.295	87.04	<0.54	52.6	<0.54	5.21	88.5	88.5
NB	<0.210	87.6	1.19	98.7	<0.419	37.6	87.7	87.7
Tetryl	<2.5	55.34	<50.0	443	<5.0	47.2	56.3	56.3
2,4,6-TNT	<0.96	78.24	<19.2	157	<1.92	15.4	80.0	80.0
2,6-DNT	<0.20	90.84	<4.0	37.5	<0.40	3.69	92.3	92.3
2,4-DNT	<0.21	74.64	<4.2	347	<0.42	33.7	81.1	81.1

WESTON ANALYTICS EXPLOSIVES

DATA SUMMARY

RFW Batch 5908-H10-039- Analytical Lot _____ Units Rinsidi MS/m, wipe total 80.0 ug / 8.0 ug / 8.0 ug

Installation HASINORNE Date Prepared _____ Analyst ---

Matrix: Rinsidi, waste, soil Date Analyzed 8/27/99, 8/28/99 Reviewed _____

Note: Data is corrected for dilution, '
 Comment: T15 Peist Test Samples.

MATRIX	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20
LAB ID #	039-001	039-002	039-003	039-004	039-005	039-006	039-007	039-008	039-009	039-010	039-011	039-012	039-013	039-014	039-015	039-016	039-017	039-018	039-019	039-020
Sample Description	T15 SSRI W3 Top	T15 SSRI W2 Top	T15 SSRI W3 Top	T15 SSRI W4 Top	T15 SSRI W5 Bot	T15 SSRI W6 Bot	T15 SSRI W7 Bot	T15 SSRI W8 Bot	T15 SSRI W9 Bot	T15 SSRI W10 Bot	T15 SSRI W11 Bot	T15 SSRI W12 Bot	T15 SSRI W13 Bot	T15 SSRI W14 Bot	T15 SSRI W15 Bot	T15 SSRI W16 Bot	T15 SSRI W17 Bot	T15 SSRI W18 Bot	T15 SSRI W19 Bot	T15 SSRI W20 Bot
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sample Vol./Lot	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)	(mls)
Units	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89	<5.89
NB	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19	<4.19
Tetryl	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2,4,6-TNT	4.83	1.53	1.43	1.83	6.63	2.53	2.93	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
2,6-DNT	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
2,4-DNT	1.33	1.2	<4.2	<4.2	1.83	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
total	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0

8/27/99 J. J. Weston

1999

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908110-029- Analytical Lot _____ Units Rinsate, wipe, label, seal MS/8
 Installation ALACRABINE Date Prepared _____ Analyst _____
 Matrix: Rinsate, wipe, soil Date Analyzed 8/27/89, 8/28/89 Reviewed _____

Note: Data is corrected for dilution.

Comment: TIS Post Test Samples

MATRIX	LAL ID #	029-012	029-013	029-014	029-015	029-016	029-017	029-018	029-019	029-020	029-021	029-022	029-023
Sample Description	R3	TIS-AP R4	TIS-AP Field 5K R1	TIS-AP R1	TIS-AP R2	TIS-AP R2	TIS-AP R3	TIS-AP R4	TIS-AP Field 5K R1	TIS-AP R1	TIS-AP R2	TIS-AP R2	TIS-AP R3
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1
Sample Vol: lot	1000ml	1000ml	250ml	1000ml	1000ml	1000ml	1000ml	1000ml	250ml	250ml	250ml	250ml	250ml
Units	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml	15µ/ml
NIHX	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
NB	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21

8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89 8/27/89

1989

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFM Batch SQCS-116-029
 Installation HAUSHERDE
 Matrix: Rinse, wipe, soil

Analytical Lot
 Date Prepared
 Date Analyzed 8/27/89, 9/28/89

Units Rinse 15 ml, wipe total wt, soil 15/8
 Analyst AIS
 Reviewed

Note: Data is corrected for dilution.

Comment: Tis Post test Samples

MATRIX	R	R	S	R	W	W	W	W	W
LAB ID #	029-023	029-024	029-025	029-026	029-027	029-028	029-029	029-030	
Sample Description	TIS SHR RV	TIS SHR FICH BK	TIS CP Soil	TIS FICH BK	TIS SM Wt	TIS SM FICH BK	TIS FRESH CHMB WITH WY CHMB WILLS BLANK	TIS FRESH CHMB WILLS BLANK	
Dilution	1	1	1	1	1	1	1	1	
Sample Vol: /wt	300ml	300ml	19ml	250ml					
Units	ug/ml	ug/ml	ug/gm	ug/ml	total ug	total ug	total ug	total ug	
HMX	<0.635	<0.635	<1.27	<0.635	<12.7	<12.7	<12.7	<12.7	
RDX	<0.49	<0.49	<0.98	<0.49	<9.8	<9.8	<9.8	<9.8	
1,3,5-TNB	<1.05	<1.05	<2.09	<1.05	<20.9	<20.9	<20.9	<20.9	
1,3-DNB	<0.295	<0.295	<0.589	<0.295	<5.89	<5.89	<5.89	<5.89	
NB	<0.210	<0.210	<0.419	<0.210	<4.19	<50.0	<50.0	<50.0	
Tetryl	<2.5	<2.5	<5.0	<2.5	<50.0	<50.0	<50.0	<50.0	
2,4,6-TNT	<0.96	<0.96	<1.92	<0.96	1.3 J	1.2 J	1.9 J	5.0 J	
2,6-DNT	<0.20	<0.20	<0.40	<0.20	<4.0	<4.0	<4.0	<4.0	
2,4-DNT	<0.21	<0.21	<0.42	<0.21	1.7 J	1.4 J	1.6 J	1.5 J	

SA/OC Date 8/27, 9/27, 8/27, 8/27, 8/27, 8/27
 (1989)

WESTON

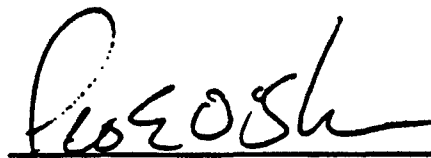
ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804
W.O. #: 2281-08-02

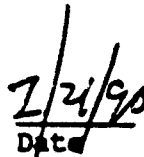
INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory


Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.

- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2331-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTIN LIMIT
-----	-----	-----	-----	-----	-----
-001	T14 SM W2 ETOH (POST	NITRATED ESTERS	5.0 u	UG	5.
-002	T14 FC WALLS W2 ETOH	NITRATED ESTERS	20.3	UG	5.
-003	T14 POST WIPE BLANK	NITRATED ESTERS	5.0 u	UG	5.
-004	T15 PRE SM W2 ETOH	NITRATED ESTERS	6.6	UG	5.
-005	T15 PRE WIPE BLANK	NITRATED ESTERS	5.0 u	UG	5.

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u MG/L	2.5
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u MG/L	2.5

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L46

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.
INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	48.8	2.5 u	50.0	97.6

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/21/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L53

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T15SMW2 POST TEST	NITRATED ESTERS	5.0	u UG	5
-002	T15SM FB POST TEST	NITRATED ESTERS	5.0	u UG	5
-003	T15 FLSH CHMB WALLW2	NITRATED ESTERS	7.9	UG	5
-004	T15 FLSH CHMB WALLBL	NITRATED ESTERS	5.0	u UG	5

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/21/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L534

<u>SAMPLE</u>	<u>SITE ID</u>	<u>ANALYTE</u>	<u>RESULT</u>	<u>UNITS</u>	<u>REPORTING LIMIT</u>
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/21/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 22B1-08-02-0000

WESTON BATCH #: 8908L5:

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	100
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95
		NITRATED ESTERS	48.8	2.5 u	50.0	97

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/21/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L534

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

July 1990
Revision: Final

TEST RUN 16
600°F/6 HOURS

1311R2



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
 8908 HW-028

Client: USATHALIA / KUHAPP
 Work Order: 2281-08-02
 Date Rec'd: _____ Date Due: _____
 RFW Contact: AREDA, JOHNSON
 Client Contact/Phone: _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Preservative	Containers/Volume	#Type Container	Refrigerator#
001	T16 SSR1 W1 TOP PEE	WATER	8/23/89	EXP/SH			10A	
002	T16 SSR1 W2 TOP							
003	T16 SSR1 W3 TOP							
004	T16 SSR1 W4 TOP							
005	T16 SSR1 W5 BOTTOM PEE	WATER	8/24/89					
006	T16 SSR1 W6 BOTTOM PEE							
007	T16 SSR1 W7 BOTTOM PEE							
008	T16 SSR1 W8 BOTTOM PEE							
009	T16 SSR2 W1 TOP PEE	WATER	8/23/89					
010	T16 SSR2 W2							
011	T16 SSR2 W3							
012	T16 SSR2 W4							

Matrix: V - Water DS - Drum Solids
 S - Soil O - Oil SA - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Special Instructions: T-16 PRE TEST SAMPLES
600°F/16 hr.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytica Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analyticals Use Only

Client: CATHAMIA HUWARD

Work Order: 220108-02

Date Rec'd: _____

RFW Contact: MARILYN JOHNSON

Client Contact/Phone: _____

WESTON Analyticals Use Only

Samples Were:
1 Shipped or Hand-Delivered

NOTES:

2 Ambient or Chilled

NOTES:

3 Received Broken/Leaking (Imprecise Sealed)

Y N

NOTES:

4 Properly Preserved

Y N

NOTES:

5 Received Within Hiding Times

Y N

NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N

NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record?

Y N

NOTES:

WA Use Only Lab ID	Client ID/Description	Refrigerator		ANALYSES REQUESTED	Date Collected	Matrix	Date	Received by	Relinquished by	Item/Reason	Date	Time	Received by	Relinquished by	Date	Time	
		#Type Container	Containers/Volume														
013	T16 SSR2 W5 BIT PRE	16A			8/24/08	WIPE											
014	T16 SSR2 W6 BIT PRE					WIPE											
015	T16 SSR2 W7 BIT PRE					WIPE											
016	T16 SSR2 W8 BIT PRE					WIPE											
017	T16 SSR FIELD BLANK					WIPE											

Special Instructions: T-16 PRE TEST SAMPLES
600' F / 6 hrs

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time



Custody Transfer Record/Lab Work Request

WESTON Analyticals Use Only

Client: VALENTIA / HUBBARD
 Work Order: 2281-08-02
 Date Rec'd: _____ Date Due: _____
 RFW Contact: WARRIOR, Johnson
 Client Contact/Phone: _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator#		ANALYSES REQUESTED	Preservative	Containers/Volume	#Type Container
				#Type Container	Containers/Volume				
020	T16 PB1 R1 PRE TEST	AQ	8/23/89	X					
021	T16 PB2 R2 PRE "	AQ		X					
022	T16 PB1 R3 PRE "	AQ		X					
023	T16 PB1 R4 PRE "	AQ		X					
024	T16 PB2 R1 PRE TEST	AQ	8/24/89	X					
025	T16 PB2 R2 PRE TEST	AQ		X					
026	T16 PB2 R3 PRE TEST	AQ		X					
027	T16 PB2 R4 PRE TEST	AQ		X					
028	T16 PB3 FIELD BLANK PRE TEST	AQ	8/24/89	X					
029	T16 CP S1 PRE TEST	S	8/24/89	X					
030	T16 CP FIELD BLANK PRE	AQ	8/24/89	X					

Matrix: W - Water DS - Drum Solids Special Instructions: T-16 PRE TEST SAMPLES
 S - Soil O - Oil DL - Drum Liquids 600°F/6hrs.
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analyticals Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8908 HW-028 -
USAMA/HVAP
 Client 22B1-08-02
 Work Order

Date Rec'd _____ Date Due _____
 RFW Contact N. Johnson, M. MAREL
 Client Contact: _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED
031	<u>THE SPIKE APPLICATION RINSE FOR SSR 1</u>	<u>AQ</u>	<u>8/25/02</u>	<u>EXP</u>
032	<u>THE SPIKE APPLICATION RINSE FOR SSR 2</u>	<u>AQ</u>	<u>8/25/02</u>	<u>X</u>

Matrix: W - Water DS - Drum Solids Special Instructions: PRE-TIG SPIKE APPLICATION
 S - Soil O - Oil DL - Drum Liquids Rinse.
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

<p>WESTON Analytics Use Only</p> <p>Samples Were: 1 Shipped or Hand-Delivered</p> <p>NOTES: 2 Ambient or Chilled</p> <p>3 Received Broken/Leaking (Improperly Sealed) Y N</p> <p>NOTES: 4 Properly Preserved Y N</p> <p>NOTES: 5 Received With Holding Times Y N</p> <p>NOTES:</p> <p>COC Tape Was: 1 Present on Outer Package Y N</p> <p>2 Unbroken on Outer Package Y N</p> <p>3 Present on Sample Y N</p> <p>4 Unbroken on Sample Y N</p> <p>NOTES:</p> <p>COC Record Was: 1 Present Upon Receipt of Samples Y N</p> <p>Discrepancies Between Sample Labels and COC Record? Y N</p> <p>NOTES:</p>	
--	--

Refrigerator?	B/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED	Date Collected	Item/Reason	Relinquished by	Received by	Date	Time

WESTON ANALYTICALS EXPLOSIVES DATA SUMMARY

RPM Batch GA/OC 9/25/84 Analytical Lot _____ U. Its Rinse/OC-DE(m), wipe-tel/mg, soil mg/g
 Installation LAURENCE Date Prepared _____ Analytic _____
 Matrix: Rinse/OC, Wipe @ Soil Date Analyzed 9/25/89 Reviewed _____

Note: Data is corrected for dilution, ✓

Comment: TIC Pre Test GA/OC 1

MATRIX LAB ID #	R		W		W		S		SE	
	Rinse/OC @ Blank	10x Rinse/OC	Wipe Blank	10x Wipe	Total mg TGMAY	10x Wipe	Soil Blank	10x Soil	10x Wipe	10x Soil
Dilution	1	1	1	1	1	1	1	1	1	1
Units	ng/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
IMX	<0.635	6.55	<12.7	127	99.9%	<1.27	12.5	98.4%		
RDX	<0.49	4.56	<9.8	98.7	98.6%	<0.98	9.42	98.6%		
1,2,5-TNB	<1.05	9.6	<20.9	196	99.0%	<2.09	19.5	98.1%		
1,3-DNB	<0.295	2.71	<5.89	52.0	98.1%	<0.589	5.52	93.7%		
MB	<0.210	2.03	<4.19	39.7	94.7%	<0.419	4.11	98.1%		
Tetryl	<2.5	22.2	<50.0	436	85.9%	1.50	43.6	87.1%		
2,4,6-TNT	<0.96	7.65	<19.2	156	81.0%	<1.92	15.5	80.6%		
2,6-DNT	<0.20	2.00	<4.0	336	96.5%	<0.40	4.02	101%		
2,4-DNT	<0.21	1.90	<4.2	371	89.3%	<0.42	3.81	96.9%		

RPN Batch 8908-HLS-028- Analytical Lot _____ Units Rinsed-usf, wipetol 2/15/84
 Installation KAUTHORNE Date Prepared _____ Analyst _____
 Matrix: Rinsed, wipet, 9 Set 1 Date Analyzed 8/25/84, 5/25/84 Reviewed _____

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

Note: Data is corrected for dilution.
 Comment: T16 Pre-Test Samples

MATRIX	LAB ID #	W	W	W	W	W	W	W	W	W	W	R	R
	028- CEL-04 TIG 5501 W1-034	028- 059-7012 W1-024	028- 019-7016 W1-024	028- 013-7016 W1-024	028- 016- W1-024	028- 017- W1-024	028- 015- W1-024	028- 015- W1-024	028- 015- W1-024	028- 015- W1-024	028- 015- W1-024	028- 028-7033 TIG PBI RI-024	028- 024-7033 TIG PBI RI-024
Units	Wt/ug	Wt/ug	Wt/ug	Wt/ug	Wt/ug	Wt/ug	Wt/ug	Wt/ug	Wt/ug	Wt/ug	Wt/ug	ug/ml	ug/ml
HMZ	12.7	38.4	<12.7	3789									
RDX	9.8	240.9	9.8	16105									
1,3,5-TNB	6.1 J	17.6 J	20.9										
1,3-DNB	<5.89	3.1 J	<5.89										
NB	<4.19	19.4	<4.19										
Tetryl	<50.0	<50	<50.0										
2,4,6-TNT	4.7 J	54.9	0.9 J	92.7									
2,6-DNT	<4.0	<4.0	<4.0										
2,4-DNT	4.2 9	5.0 9	3.8 J	2.7 J									
DAE (data)	-8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25	8/25

(1989)

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFH Batch 8908 HJ-028- Analytical Lot _____ Units Rinscdt-us/ml, wipe-totd us, scil us/sw
 Installation HAUTHERNE Date Prepared _____ Analyst _____
 Matrix: Rinscdt uspc, soil Date Analyzed 5/25/98 Reviewed _____

Note: Data is corrected for dilution.
 Comment: T-16 - Pre Test samples

MATRIX	R	S	R	R	R	R	R	R	R
LAB ID #	028-028	029	028-030	028-031	028-032	028-032	028-032	028-032	028-032
Sample Description	TIG PB	TIG	TIG CP	TIG SHI	TIG SHI	TIG SHI	TIG SHI	TIG SHI	TIG SHI
Dilution	1	1000	1	100	100	100	100	100	1000
Sample Vol./wt	250ml	19m	250ml	30	30	30	30	30	30
Units	ug/ml	ug/gm	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
IMX	<0.035	<12700	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
RDX	<0.49	<9800	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	<1.05	<20900	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.215	<5890	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215
NB	<0.210	<4190	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210
Tetryl	<2.5	<50000	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
2,4,6-TNT	<0.96	195000	<0.96	4985	5500	5500	5500	5500	5500
2,6-DNT	<0.20	<4000	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.21	<4200	<0.21	155 J	20.0 J	20.0 J	20.0 J	20.0 J	20.0 J

0A/00 Date: 5/25/98



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
8908 HW 030 -

Client **USATHAMA/HWAAP**

Work Order **2291-64-02**

Date Rec'd. _____

RFW Contact **N. Johnson / M. Mazelon**

Client Contact Phone **315-430-3117**

XXXXXX

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator# #/Type Container Containers/Volume Preservative
001	Powder Box T16 FBI RI Post	ACN	9/31/99	
002	R2			
003	R3			
004	R4			
005	Field Blank			
006	Heated Riser T16 SHU RI Post			
007	R2			
008	R3			
009	R4			
010	Field Blank			
011	Support Rack T16 SSR/WI Post Wips			
012	W2			
013	W3			
014	W4			
015	W5			

Matrix: W - Water D3 - Drum Solids Special Instructions: **T16 POST-TEST 1 CHRS. @ 600°F**

S - Soil O - Oil DL - Drum Liquids

SE - Sediment A - Air F - Fish

SO - Solid X - Other

Item/Reason	Relinquished by	Received by	Date	Time	Signature	Relinquished by	Received by	Date	Time

WESTON Analytica Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y M
 NOTES:

5 Received within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Sample Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:



Custody Transfer Record/Lab Work Request

WESTON Analytes Use Only
 800-4W-030-

Client: USATHAMA/HVAAP
 Work Order: 2281-08-02
 Date Rec'd: _____
 RFW Contact: N. Johnson / M. Mazzolen
 Client Contact/Phone: 215-430-3117

MA Use Only Lab ID	Client ID Description	Matrix	Date Collected
016	Support Rack T16 SWING Post	Wipe	9/21/95
017	W7		
018	W9		
019	Field Blank		
020	Slay Pipe T16 CP Soil Post	Soil	
021	" " " Field Blank	ACN	
022	Ship Mine T16 SM WI Post	Wipe	
023	" " " Field Blank	"	
024	Heated Valve T16 SHVIRI Post	ACN	
025	R7		
026	R3		
027	R4		
028	Field Blank		
029	Chamber Walls T16 WI Post	Wipe	
030	" " " Field Blank		

Matrix: W - Water DS - Drum Solids Special Instructions:
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air X - Other

T16 POST-TEST 6 HRS. @ 600°F

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytes Use Only

1 Samples Were: Shipped or Hand-Delivered
 NOTES: _____

2 Ambient or Cooled
 NOTES: _____

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES: _____

4 Properly Preserved
 Y N
 NOTES: _____

5 Received Within Holding Times
 Y N
 NOTES: _____

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES: _____

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES: _____

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch QA/QC 9/1/89 Analytical Lot _____ Units Remedial Wipe, Wipe Soil Soil
 Installation HASTHORNE Date Prepared _____ Analyst _____
 Matrix: _____ Date Analyzed 8/21/89 Reviewed _____

Note: Data is corrected for dilution.

Comment: T16 - Post Test 600F @ 6hr / Or Samples

MATRIX	R	R	W	S	S	S
LAB ID #	Rinse/Blank	1cc Wipe/Blank	1cc Wipe/Blank	Soil Blank	10% Soil	10% Soil
Dilution	1	1	1	1	1	1
Units	µg/ml	µg/ml	Total µg	µg/g	µg/g	µg/g
HMX	<0.035	6.55	<12.7	<12.7	12.2	96.2%
RDX	<0.119	4.96	<9.8	<0.98	8.97	91.6%
1,3,5-TNB	<1.05	10.5	<20.9	<2.09	20.8	91.7%
1,3-DNB	<0.295	2.89	<5.90	<0.59	5.71	97.0%
NB	<0.210	2.0	<4.20	<0.42	3.87	92.4%
Tetryl	<2.5	26	<50.0	<5.0	49.2	98.4%
2,4,6-TNT	<0.96	10.3	<19.2	<1.92	21.8	113%
2,6-DNT	<0.20	1.87	<4.0	<0.40	3.62	90.6%
2,4-DNT	<0.21	1.94	<4.20	<0.42	3.87	92.2%

MESTON ANALYTICALS EXPLOSIVES DATA SUMMARY

RFW Batch 9908 H10-C20
 Installation ASUBURNE
 Matrix: Rinsate, w/pc, foil

Analytical Lot _____
 Date Prepared _____
 Date Analyzed 8/21/89, 9/1/89

Units Rinsate w/pc, wipe total ug, foil ug
 Analyst AS
 Reviewed _____

Note: Data is corrected for dilution.

Comment: T16 - Post Test GOLF @ 6 hour.

MATRIX LAB ID #	R		R		R		R		R		R		R		R		W							
	020	001	020	002	020	003	020	004	020	005	020	006	020	007	020	008	020	009	020	010	011			
Sample Description	PB-T16 PB1-R1	PB-T16 PB1-R2	PB-T16 PB1-R3	PB-T16 PB1-R4	PB-T16 PB1-R1	PB-T16 PB1-R2	PB-T16 PB1-R3	PB-T16 PB1-R4	PB-T16 PB1-R1	PB-T16 PB1-R2	PB-T16 PB1-R3	PB-T16 PB1-R4	PB-T16 PB1-R1	PB-T16 PB1-R2	PB-T16 PB1-R3	PB-T16 PB1-R4	PB-T16 PB1-R1	PB-T16 PB1-R2	PB-T16 PB1-R3	PB-T16 PB1-R4	PB-T16 PB1-R1	PB-T16 PB1-R2		
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Sample Vol./mat (ml)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
Units	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	
HMX	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<12.7	
RDX	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<0.449	<9.8	
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<20.9	
1,3-DNB	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<0.215	<5.90	
NB	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<0.210	<4.20	
Tetryl	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<50
2,4,6-TNT	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	12.1 J
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<4.0
2,4-DNT	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<4.2

EXPLO - Post - 9/1 - 8/21
 (1989)

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 890340-020 Analytical Lot _____ Units Rinsoff us/m, wipe total us, Soil us/g
 Installation HAUTHERNE Date Prepared _____ Analyst AIS
 Matrix: Rinsoff, wipe, Soil Date Analyzed 9/11/89 Reviewed _____

Note: Data is corrected for dilution.

Comment: TIC - Post Test Sample 600F @ 6 hours

MATRIX	W		W		W		W		W		W		R		W	
	020-012	020-013	030-014	030-015	030-016	030-017	030-018	030-019	030-020	030-021	030-022	030-023	030-024	030-025	030-026	030-027
Sample Description	SRTIC SSRI W2	SRTIC SSRI W3	SRTIC SSRI W4	SRTIC SSRI W5	SRTIC SSRI W6	SRTIC SSRI W7	SRTIC SSRI W8	SRTIC SSRI W9	SRTIC SSRI W10	SRTIC SSRI W11	SRTIC SSRI W12	SRTIC SSRI W13	SRTIC SSRI W14	SRTIC SSRI W15	SRTIC SSRI W16	SRTIC SSRI W17
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sample vol: <u>10</u> ml	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Units	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us	Total us
HMX	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7	<12.7
RDX	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8	<9.8
1,3,5-TNB	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9	<20.9
1,3-DNB	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90	<5.90
NB	<4.20	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2
Tetryl	<50.0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4,6-TNT	8.7 J	10.3 J	8.6 J	8.7 J	13.2 J	10.3 J	10.2 J	12.3 J	12.3 J	12.3 J	12.3 J	12.3 J	12.3 J	12.3 J	12.3 J	12.3 J
2,6-DNT	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
2,4-DNT	<4.2	<4.2	1.0 J	<4.2	<4.2	1.0 J	<4.2	1.0 J	<4.2	<4.2	1.0 J	<4.2	1.0 J	<4.2	<4.2	2.3 J

20/10/89 (988)

WESTON

**ROY F. WESTON, INC.
Lionville Laboratory**

**CLIENT: USATHAMA - HWAAP
RFW #: 8909L597 - RINSATES
W.C. #: 2281-08-02**

SAMPLES RECEIVED: 09-02-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02 modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLX = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.
SSD = Designates sample spiked with target compound in duplicate.
D = Indicates duplicate analysis of a sample.
NS = Not spiked.
DL = Diluted below calibration range.
G = Indicates elevated detection limit due to sample interference.
NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than
> = Greater Than

Analysis Summary

**Samples Collected: 08-31-89
Samples Prepared: 09-07-89
Samples Analyzed: 09-22-89**

C. Carter Nulton

**Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory**

10-13-89

Date

WESTON ANALYTICS
EXPLOSIVES IN RINSATE DATA SUMMARY

RFW Batch Number: 8909L597 CLIENT: USATHAMA HWAAP Page: 1

Sample Information	T16SHV1		T16SHR1		T16PB1		BLANK		2XSS	
	ID	R1 DUP	R1 DUP	R1 DUP	R1 DUP	R1 DUP				
	RFW#	001	002	003	003	003	1	1	1	1
	D.F.:	1	1	1	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX.....		< 254	< 254	< 254	< 254	< 254	< 1.27	< 1.27	< 3.09 (120%)	
RDX.....		< 196	< 196	< 196	< 196	< 196	< 0.98	< 0.98	< 2.22 (112%)	
1,3,5-TNB.....		< 418	< 418	< 418	< 418	< 418	< 2.09	< 2.09	< 4.45 (105%)	
1,3-DNB.....		< 118	< 118	< 118	< 118	< 118	< 0.59	< 0.59	< 1.25 (105%)	
NITROBENZENE.....		< 84	< 84	< 84	< 84	< 84	< 0.42	< 0.42	< 0.84 (99.2%)	
TETRYL.....		< 1000	< 1000	< 1000	< 1000	< 1000	< 5.00	< 5.00	< 7.18 (71.1%)	
2,4,6-TNT.....		< 384	< 384	< 384	< 384	< 384	< 1.92	< 1.92	< 3.95 (75.8%)	
2,6-DNT.....		< 80	< 80	< 80	< 80	< 80	< 0.40	< 0.40	< 0.88 (108%)	
2,4-DNT.....		< 84	< 84	< 84	< 84	< 84	< 0.42	< 0.42	< 0.87 (103%)	

Sample Information	10XSS		10XSSD	
	ID	R1 DUP	R1 DUP	R1 DUP
	RFW#	1	1	1
	D.F.:	1	1	1
	Units:	Total ug	Total ug	Total ug
HMX.....		15.2 (118%)	15.0 (117%)	15.0 (117%)
RDX.....		10.9 (111%)	10.7 (109%)	10.7 (109%)
1,3,5-TNB.....		22.2 (105%)	22.1 (105%)	22.1 (105%)
1,3-DNB.....		6.20 (105%)	6.22 (105%)	6.22 (105%)
NITROBENZENE.....		4.17 (98.9%)	4.22 (100%)	4.22 (100%)
TETRYL.....		49.3 (97.7%)	47.7 (94.4%)	47.7 (94.4%)
2,4,6-TNT.....		17.9 (92.7%)	17.1 (88.4%)	17.1 (88.4%)
2,6-DNT.....		4.28 (106%)	4.41 (109%)	4.41 (109%)
2,4-DNT.....		4.16 (98.3%)	4.31 (102%)	4.31 (102%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20

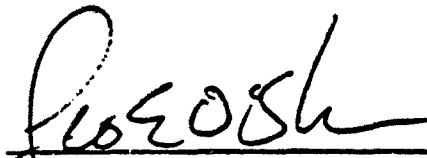
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595
8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/24/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.
- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).
- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).
- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).
- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L524

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T16SMW2 PRE TEST	NITRATED ESTERS	5.0	u UG	5.0
-002	T16SM WIPE BL PRTEST	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L52

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5	u MG/L	2
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5	u MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L524

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	48.8	2.5 u	50.0	97.6

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-IWAA?
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L5

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-M32	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L595

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-019	T16SMWIPOST	NITRATED ESTERS	5.0 u	UG	5.0
-020	T16SM FIELD BLANK	NITRATED ESTERS	5.0 u	UG	5.0
-021	T16 CHAMBER WELL W1	NITRATED ESTERS	5.0 u	UG	5.0
-022	T16 CHAMBER WELL BLA	NITRATED ESTERS	5.0 u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L59

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5 u	MG/L	2

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L595

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	48.8	2.5 u	50.0	97.6

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L59

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	97.6	2.5

July 1990
Revision: Final

TEST RUN 17
600°F/48 HOURS

1311R2



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8908 462 031

Client USAMIAMA / HIKETAP
 Work Order 2581-08-02
 Date Rec'd. _____
 RFW Contact N. JOHNSON / M. MAZELON
 Client Contact/Phone (215) 430-1117

WESTON Analytics

Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES: Y N

COC Record Was:
 1 Present Upon Receipt of Samples N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Refrigerator#		Date Collected	Matrix	ANALYSES REQUESTED
		#Type Container	Con:ainers/Volume Preservative			
014	Aluminum pipe TITAP R1			8/31/08	ACN	
015						
016						
017						
018	TITAP R1					
019	R2					
020	R3					
021	R4					
022	TITAP Field Blank					
023	STED Pipe (2)					
024	TIT SPI R1					
025	R2					
026	R3					
	R4					

Matrix: W - Water DS - Drum Solids Special Instructions:
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

T17 Pre Test 600F @ 48 hours.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time



Custody Transfer Record/Lab Work Request

WESTON Analytica Use Only
84108-HW-031

Client USATHAMA/HWASAP
 Work Order 2281-08-02
 Date Rec'd. _____
 RFW Contact M. JIMINSON / M. MAZELEN
 Client Contact/Phone (215) 430 3117

MA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Refrigeration	W/Type Container	Containers/Volume	Preservative
027	SHELL PIPE (2)	AEN	8/28/08					
028	T17 SP2 R1							
029	T17 SP2 R2							
030	T17 SP2 R3							
031	T17 SP2 R4							
032	T17 SP Field Blank							

Matrix: W - Water GS - Drum Solids Special Instructions:
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

T17 Pre Test 600F @ 48 hours.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

Use Only Samples Were: 1 Shipped or Hand-Delivered NOTES: 2 Ambient or Chilled NOTES: 3 Received Broken/Leaking (Improperly Sealed) Y N NOTES: 4 Properly Preserved Y N NOTES: 5 Received Within Holding Times Y N NOTES: COC Tape Was: 1 Present on Outer Package Y N 2 Unbroken on Outer Package Y N 3 Present on Sample Y N 4 Unbroken on Sample Y N NOTES: COC Record Was: 1 Present Upon Receipt of Samples Y N Discrepancies Between Sample Labels and COC Record? Y N NOTES:
--



Custody Transfer Record/Lab Work Request

WESTON Analyticals Use Only
 8002 HW-031
 USATHAMA/HWIAAF

Client: USATHAMA/HWIAAF
 Work Order: 3281-08-02
 Date Rec'd: [blank]
 RFW Contact: N. JOHNSON / M. MAZELON
 Client Contact/Phone: (215) 430 3117

WESTON Analyticals Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record Y N
 NOTES:

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator #	#/Type Container	Containers/Volume	Preservative	ANALYSES REQUESTED
032	Steam Heated RISIS	AEN	Elect					
033	T17 SHR R1							
034	R2							
035	R3							
036	R4							
037	T17 SHR R1							
038	R2							
039	R3							
040	R4							
041	Y T17 SHR Field Blank							
042	Steam heated Valves T17SHR R1							
043	R2							
044	R3							
045	R4							
046	T17 SHV Field Blank							
047								

Matrix: W - Water D8 - Drum Solids
 S - Soil O - Oil DL - Urine Liquids
 SE - Sediment A - Air F - Fish
 SO - Other X - Other

Special Instructions:
 T17 Pre Test 600F @ 48 hours.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 890840-031

Client: WATHANA HALLAP
 Work Order: 2281-02-02
 Date Rec'd: _____ Date Due: _____
 RFW Contact: N. THASAN, M. MAZELEN
 Client Contact/Phone: _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED	Refrigerator		Preservative
					#Type Container	Containers/Volume	
046	T17 SHV 2 R1 PREBT AP	AP	8/30/02	Exp			
047	| R2	|	|	X			
048	| R3	|	|	X			
049	| R4	|	|	X			

Matrix: W - Water DS - Drum Solids
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solids X - Other

T17 PRE TEST
 SAMPLES

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics Use Only

Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFB Batch 8908 4W-031 Analytical Lot Rinsok 48 ml
 Installation HAUTIERNE Date Prepared ---
 Matrix: Rinsok Date Analyzed 9/1/89 Reviewed ---

Note: Data is corrected for dilution.

Comment: T17 Pre Test Samples 600F @ 48 hours.

MATRIX	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
LAB ID #	031	031	031	031	031	031	031	031	031	031	031	031	031	031	031	031	031
Sample Description	001-004	005-008	009-012	013-016	017-020	021-024	025-028	029-032	033-036	037-040	041-044	045-048	049-052	053-056	057-060	061-064	065-068
Dilution	1	1	1	1	10	1	1	1	1	1	1	1	1	1	1	1	1
Sample Vol (ml)	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
UnitB	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml	µg/ml
HMX	<0.635	<0.635	<0.635	<0.635	5.49	<0.635	<0.635	6.75	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	<0.49	0.10 J	0.11 J	<0.49	36.3	<0.49	<0.49	17.3	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	4.05	4.05	4.05	4.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295	<0.295
NE	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	0.11 J	<0.96	<0.96	<0.96	7.2	<0.96	<0.96	0.545 J	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21

Explosives (1989)

WESTON ANALYTICS EXPLOSIVES DATA SUMMARY

RFW Batch 8908 HRW 031 Analytical Lot _____ Units Rinsalt MS ml
 Installation HAMMERNE Date Prepared _____ Analyst _____
 Matrix: Rinsalt Date Analyzed 9/1/89 Reviewed _____

Note: Data is corrected for dilution.
 Comment: T17 Pre Test Samples 6007 @ 48 hours

LAB ID #	031	032	040	041	042	043	044	045	046	047	048	049	050
Sample Description	032-035 SUBSTRATE: R1 → R4	035-038 SUBSTRATE: R1 → R4	040-043 SUBSTRATE: R1 → R4	041-044 SUBSTRATE: R1 → R4	042-045 SUBSTRATE: R1 → R4	043-046 SUBSTRATE: R1 → R4	044-047 SUBSTRATE: R1 → R4	045-048 SUBSTRATE: R1 → R4	046-049 SUBSTRATE: R1 → R4	047-050 SUBSTRATE: R1 → R4	048-051 SUBSTRATE: R1 → R4	049-052 SUBSTRATE: R1 → R4	050-053 SUBSTRATE: R1 → R4
Dilution	1	1	1	1	1	1	1	1	1	1	1	1	1
Sample Vol. (ml)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Unit	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml	μg/ml
HMX	<0.635	0.20J	<0.635	<0.635	0.10 J	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635	<0.635
RDX	0.14J	2.71	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49	<0.49
1,3,5-TNB	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
1,3-DNB	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205	<0.205
NB	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Tetryl	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-TNT	<0.96	0.15J	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
2,6-DNT	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	<0.21	<0.21	<0.21	<0.21	2.64	<0.21	<0.21	<0.21	<0.21	<0.21	1.77	<0.21	<0.21

9/1/89
 (1989)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
RFT #: 8909L679 - WIPES
W.O. #: 2281-08-02

SAMPLES RECEIVED: 09-11-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to U.S.G.S. methodology for picric acid.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS = Designates sample spiked with target compounds at 10x detection limit.

BSD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Samples have been analyzed for picric acid and results converted mathematically to ammonium picrate.

NOTE: Spike recoveries for these analysis ranged from 18% to 38%. Reported detection limits take these low recoveries into account.

Data Qualifiers

< = Less Than and > = Greater Than

Analysis Summary

Samples Collected: 09-08-89
Samples Prepared: 09-13-89
Samples Analyzed: 09-29-89

Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

10-11-89
Date

WESTON ANALYTICS
EXPLOSIVES IN WIPE SAMPLES

RFW Batch Number: 8909L679

CLIENT: USATHAMA-HMAAP

Page: 1

Sample Information	Client ID	T17FC	WALLS	W1	T17FC	WALLS	BLK	BLANK	BS 1	BS 2	BS 3	Total ug	Total ug	Total ug
	RFW#:	026	1	1	027	1	1	1	1	1	1	1	1	1
	D.F.:	1	1	1	1	1	1	1	1	1	1	1	1	1
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug

Ammonium Picrate..... < 10 < 10 < 9.3(113t) 45(110t) 41(95t)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
RFW #: 8909L679 - WIPES
W.O. #: 2281-08-02

SAMPLES RECEIVED: 09-11-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to U.S.G.S. methodology for picric acid.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLK - Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS - Designates sample spiked with target compounds at 10x detection limit.

BSD - Designates sample spiked with target compound in duplicate.

D - Indicates duplicate analysis of a sample.

NS - Not spiked.

DL - Diluted below calibration range.

G - Indicates elevated detection limit due to sample interference.

NR - Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Samples have been analyzed for picric acid and results converted mathematically to ammonium picrate.

NOTE: Spike recoveries for these analysis ranged from 18% to 38%. Reported detection limits take these low recoveries into account.

Data Qualifiers

< = Less Than and > = Greater Than

Analysis Summary

Samples Collected: 09-08-89
Samples Prepared: 09-13-89
Samples Analyzed: 09-29-89

Chuck Hill
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

10-13-89
Date

WESTON ANALYTICS
EXPLOSIVES IN RINSATES DATA SUMMARY

RFW Batch Number: 8909L679

CLIENT: USATHAMA-HWAAP

Page: 1

Client T17PB1R1 T17PB1R2 T17PB1R3 T17PB1R4 T17PB1R5 T17SHV1R
 ID : POST TEST POST TEST POST TEST POST TEST POST TEST POST TEST POST TEST
 RFW#: 001 002 003 004 005 006
 D.F.: 1 1 1 1 1 1
 Units: Total ug Total ug Total ug Total ug Total ug Total ug Total ug Total ug
 Ammonium Picrate..... < 10 < 10 < 10 < 10 < 10 < 10 < 10 < 10

Client T17SHV1R2 T17SHV1R3 T17SHV1R4 T17SHV1R5 T17SHR1R1 T17SHR1R2
 ID : POST TEST POST TEST POST TEST POST TEST POST TEST POST TEST POST TEST
 RFW#: 007 008 009 010 011 012
 D.F.: 1 1 1 1 1 1
 Units: Total ug Total ug Total ug Total ug Total ug Total ug Total ug Total ug
 Ammonium Picrate..... < 10 < 10 < 10 < 10 < 10 < 10 < 10

Client T17SHR1R3 T17SHR1R4 T17SHR1R5 T17API1 T17API2 T17API3
 ID : POST TEST POST TEST POST TEST POST TEST POST TEST POST TEST
 RFW#: 013 014 015 016 017 018
 D.F.: 1 1 1 1 1 1
 Units: Total ug Total ug Total ug Total ug Total ug Total ug Total ug Total ug
 Ammonium Picrate..... < 10 < 10 < 10 < 10 < 10 < 10 < 10

WESTON ANALYTICS
EXPLOSIVES IN RINSATES DATA SUMMARY

RFW Batch Number: 8909L679

CLIENT: USATHAMA-HWAAP

Page: 2

Client	T17AP1	T17AP	T17SP1R1	T17SP1R2	T17SP1R3	T17SP1R4
ID :	R4	FIELD BLK	POST TEST	POST TEST	POST TEST	POSTTEST
RFW#:	019	020	021	022	023	024
D.F.:	1	1	1	1	1	1
Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug

Ammonium Picrate..... < 10 < 10 < 10 < 10 < 10 < 10

Client	T17SP	858	858	858	858	857
ID :	FIELD BLK	BLANK	BS1	BS2	BS3	BLANK
RFW#:	025	1	1	1	1	1
D.F.:	1	1	1	1	1	1
Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug

Ammonium Picrate..... < 10 < 10 < 2.4(30%) 7.3(18%) 10.4(25%) < 10

Client	857	857	857	857	857	857
ID :	BS1	BS2	BS1	BS2	BS3	BS3
RFW#:	1	1	1	1	1	1
D.F.:	1	1	1	1	1	1
Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug

Ammonium Picrate..... 3.1(38%) 12.6(31%) 13.1(32%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
RTW #: 8909L595 - RINSATES
W.O. #: 2281-08-02

SAMPLES RECEIVED: 09-02-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02 modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS = Designates sample spiked with target compound.
BSD = Designates sample spiked with target compound in duplicate.
D = Indicates duplicate analysis of a sample.
NS = Not spiked.
DL = Diluted below calibration range.
G = Indicates elevated detection limit due to sample interference.
NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Samples have been analyzed for picric acid and results converted mathematically to ammonium picrate.

NOTE: Spike recoveries for these analysis ranged from 18% to 29%. Reported detection limits take these low recoveries into account.

Data Qualifiers

< = Less Than and > = Greater Than

Analysis Summary

Samples Collected: 08-30-89
Samples Prepared: 09-06-89
Samples Analyzed: 09-29-89

Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

10-13-89
Date

WESTON ANALYTICS
EXPLOSIVES IN RINSATES DATA SUMMARY

RFW Batch Number: 8909L595

CLIENT: USATHAHA-HWAAP

Page: 1

Sample Information	Client	T17SHR1	T17SHV1	WR	WR1	BLANK	BS 1	BS 2	BS 3	Total ug	Total ug	Total ug	Total ug
	ID :	WR	WR1										
	RFW#:	001	010				1	1	1	1	1	1	1
	D.F.:	1	100										
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug

Ammonium Picrate..... < 10 25.1 < 10.0 < 1.5(18%) 12.1(29%) 12.0(29%)

July 1980
Revision: Final

TEST RUN 18
500°Y/6 HOURS

1311R2



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8999 HW 032

Client: USATEMA / HWMP
 Work Order: 2281-08-02
 Date Rec'd: _____
 RFW Contact: N. JOHNSON / MIKE MARZINI
 Client Contact/Phone: _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator #	#/Type Container	Volume	Preservative	ANALYSES REQUESTED
001	T18 PB1 R1 PRE TEST	AG	9/6/89					Exp
002	R2							
003	R3							
004	R4							
005	T18 PB FIELD Blank PRE TEST							
006	T18 PB2 R1 PRE TEST							
007	R2							
008	R3							
009	R4							
010								
011	T18 CP Soil PRE TEST	S	9/6/89					
012	T18 CP Field Blank	AG	9/6/89					
013								

Special Instructions: T-18 PRE TEST SAMPLES
500°F / 6hr

Matrix:	W - Water	D5 - Drum Solids	X - Other
S - Soil	G - Oil	DL - Drum Liquids	
SE - Sediment	A - Air	F - Fish	
SO - Solid	WI - Wipe	L - EP/CLP Leachate	

WESTON Analytics Use Only
Samples Were: 1 Shipped or Hand-Delivered NOTES:
2 Ambient or Chilled NOTES:
3 Received Broken/Leaking (Improperly Sealed) Y N NOTES:
4 Properly Preserved Y N NOTES:
5 Received Within Holding Times Y N NOTES:
COC Tape Was: 1 Present on Outer Package Y N 2 Unbroken on Outer Package Y N 3 Present on Sample Y N 4 Unbroken on Sample Y N NOTES:
COC Record Was: 1 Present Upon Receipt of Samples Y N Discrepancies Between Sample Labels and COC Record? Y N NOTES:

EXP = EXPOSIVES

1083

Custody Transfer Record/Lab Work Request

WESTGATE Analyticals Use Only
 5909 HWS-C 32

Client USATHAMA / KAVAMP

Work Order 2281-06-02

Date Rec'd. Date Due

RFW Contact M. Johnson / M. MERRILL

Client Contact/Phone

Lab ID	Client ID/Description	Matrix	Date Collected	Analyses Requested	Preservative	Volume	#Type Container	Multiplification
012	TIBSSR 1 W1 PRE-EST	W1	9/14/19	Y			None	
013	W2			X				
014	W3			X				
015	W4			X				
016	W5			X				
017	W6			X				
018	W7			X				
019	W8			X				
020	TIBSSR FIELD BLOW	W8	9/14/19	X				

Special Instructions: T-18 PRE TEST SAMPLES
 500°F / 6hr.

Item/Reason	Received by	Date	Time	Item/Reason	Relinquished by	Date	Time

WESTGATE Analyticals

Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Air-Nert or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

EXD - EXPANDING



Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only
 8909 hrs 032

Client USATHAMA/HWAAP
 Work Order 2281-03-02
 Date Rec'd _____ Date Due _____
 RFW Contact M. JOHNSON/M. MAZELON
 Client Contact/Phone _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	Refrigerator#	#Type Container	Volume	Preservative	ANALYSES REQUESTED
				10A			Exp	
021	T18 SSR 2 W1 TOP R: 50	WIFE	9/6/89					X
022	W2							X
023	W3							X
024	W4							X
025	W5 Buffer							X
026	W6							X
027	W7							X
028	W8							X

Special Instructions: **F-18 PRE-TEST SAMPLES**
500°F/6hr.

Matrix: W - Water DS - Drum Solids X - Other
 S - Soil O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid W - Wipe L - EPTCLP Leachate

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

WESTON Analytics
 Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:
 2 Ambient or Chilled
 NOTES:
 3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:
 4 Properly Preserved
 Y N
 NOTES:
 5 Received Within Holding Times
 Y N
 NOTES:
 COC Tape Was:
 1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:
 COC Record Was:
 1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

EXP = EXPLOSIVES

323

WESTON ANALYTICS EXPLOSIVES

DATA SUMMARY

RFW Batch 8909 HRO SED Analytical Lot _____ Units Rinsate 100 ml, Wipe tests 10, Soil 10/10
 Installation HAZARDOUS Date Prepared _____ Analyst _____
 Matrix: Rinsate / Wipe / Soil Date Analyzed 9/15/89 Reviewed _____

Note: Data is corrected for dilution.

Comment: T-18 Pre Test Samples 500°F @ 6 hours

MATRIX	LAB ID #	Sample Description	Dilution	Sample Vol/wt	Units	HMX	RDX	1,3,5-TNB	1,3-DNB	NB	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
W	632-1005-208	1005-208	1	—	Total	<12.7	<9.8	<20.9	<5.90	30.56	<50.0	<19.2	<4.0	<4.20

Date 9/16/89
 (1989)

WESTON ANALYTICALS EXPLOSIVES DATA SUMMARY

NEW Batch 06/02 9/6/89 Analytical Lot _____ Units Recede 45/100 Wipe 100/100 Soil 100/100
 Installation RAWBACRE Date Prepared _____ Analyst _____
 Matrix: Recede, Wipe, Soil Date Analyzed 9/6/89 Reviewed _____

Note: Data is corrected for dilution.
 Comment: T-18 Pre-Test Samples 500°F @ 6 hours / On/Off Set!

MATRIX LAB ID #	R		W		S		S	
	Blank Recede	10X Recede	Blank Wipe	10X Wipe	Blank Soil	10X Soil		
Dilution	1	1	1	1	1	1		
Units	45/100	45/100	100/100	100/100	100/100	100/100		
10X	<0.635	6.7	<12.7	145	<1.27	12.7	100%	100%
RDX	<0.49	5.1	<9.8	110	<0.98	9.21	94%	
1,3,5-TNB	<1.05	11.0	<20.9	240	<2.09	21.1	101%	
1,3-DNB	<0.295	3.04	<5.90	65.8	<0.59	5.70	96.8%	
NB	<0.210	2.13	<4.20	42.9	<0.42	3.70	89.4%	
Tetryl	<2.5	25.7	<50.0	562	<5.0	49.1	98.2%	
2,4,6-TNT	<0.96	7.75	<19.2	214	<1.92	18.1	94.3%	
2,6-DNT	<0.20	2.1	<4.0	45.1	<0.40	3.42	85.6%	
2,4-DNT	<0.21	2.19	<4.20	47.1	<0.42	3.66	85.7%	

WESTON ANALYTICS USE ONLY

8909440 033
 Client LEATHERMAN INDUSTRIAL
 Work Order 2281-08-02
 Date Rec'd. _____ Date Due _____
 AFW Contact M. Johnson / M. MAZZERIN
 Client Contact/Phone _____

WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ANALYSES REQUESTED
001	TIB SM HILL BRCTEST	WIPE	9/7/09	X
002	TIB SM FIELD Blank	WIPE	9/7/09	X
003	TIB SSR1 SPIKE RINSATE	AQ	9/7/09	X
004	TIB SSR2 SPIKE RINSATE	AQ	9/7/09	X

Matrix: W - Water DS - Drum Solids
 O - Oil DL - Drum Liquids
 SE - Sediment A - Air F - Fish
 SO - Solid X - Other

Special Instructions: T-18 RE TEST SAMPLES
500°F/GHR.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time

AFW 21-21-001/A-5/03

EXP = EXPLOSIVES

7-115



WESTON Analytics
 Use Only
 Samples Were:
 1 Shipped or Hand-Delivered
 NOTES:

2 Ambient or Chilled
 NOTES:

3 Received Broken/Leaking (Improperly Sealed)
 Y N
 NOTES:

4 Properly Preserved
 Y N
 NOTES:

5 Received Within Holding Times
 Y N
 NOTES:

COC Tape Was:

1 Present on Outer Package Y N
 2 Unbroken on Outer Package Y N
 3 Present on Sample Y N
 4 Unbroken on Sample Y N
 NOTES:

COC Record Was:

1 Present Upon Receipt of Samples Y N
 Discrepancies Between Sample Labels and COC Record? Y N
 NOTES:

WESTON ANALYTICALS EXPLOSIVES DATA SUMMARY

REV Batch QA/SC 9/7/89 Analytical Lot Units Rinsed at 1 case Albany
 Installation WASTWATER Date Prepared Analyst
 Matrix: Rinsate / Wipe Date Analyzed 9/7/89 Reviewed _____

Notes: Data is corrected for dilution, *

Comment: T-18 Pre Test Samples DC Roof @ 6 hours

MATRIX	R	R	W	W
LAB ID #	Blank Rinsate	10X Rinsate	Blank Wipe	10X Wipe
Dilution	1	1	1	1
Units	μg/ml	μg/ml	Total μg	Total μg
HDX	<0.635	7.35	<12.7	815.1
RDX	<0.49	5.35	<9.8	76.54
1,3,5-TNB	<1.05	11.5	<20.9	78.97
1,3-DNB	<0.285	2.11	<5.90	74.7
HB	<0.210	1.26	<4.20	45.37
Tetryl	<2.50	35.1	<50.0	356
2,4,6-TNB	<0.96	2.65	<19.2	63.57
2,6-DNT	<0.20	2.18	<4.0	75.47
2,4-DNT	<0.21	2.02	<4.20	66.57

DATA SUMMARY

MISSION ANALYTICS EXPLOSIVES

RFW Batch 8409 HW-033 Analytical Lot _____ Units 21.5 µS/ml, wipe Total of _____
 Installation HUMMERONE Date Prepared _____ Analyst AS
 Matrix: KHSALE, WIP Date Analyzed 9/7/87 Reviewed _____

Notes: Data is corrected for dilution.

Comment: T-18 Pre Test Sample 500°F @ 6 hours

MATRIX	W1	W2	W3	W4	W5	R	R
LAB ID #	033 001	033 001	033 001	033 002	033 004	033 003	033 004
Sample Description							
Dilution	1	10	1000	1	100	100	100
Sample Vol. ml							
Units	Total µg	Total µg	Total µg	Total µg	Total µg	Total µg	Total µg
HMX	4430			<12.7	<63.5	<63.5	<63.5
RDX			29300	<5.75	<49.0	<49.0	<49.0
1,3,5-TNB	30.5			<20.9	<105	<105	<105
1,3-DNB	<5.90			<5.90	<29.5	<29.5	<29.5
NB	21.1			<426	<21.0	<21.0	<21.0
Tetryl	<9.0			<50.0	<250	<250	<250
2,4,6-TNT			4920	<19.2	1500	3785	3785
2,6-DNT	<4.0			<4.0	<20	<20	<20
2,4-DNT	39.1			<4.2	708	8.0	8.0

9/7/87 9/7 9/7 9/7 9/7 9/7 9/7 9/7

WESTERN

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
REF #: 8909L304 - WIPES
T.C. #: 2231-08-02

SAMPLES RECEIVED: 09-20-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02. Explosives in Soil, modified for the analysis of wipe samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLX = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

- 33 = Designates sample spiked with target compound.
- 3SD = Designates sample spiked with target compound in duplicate.
- D = Indicates duplicate analysis of a sample.
- NS = Not spiked.
- DL = Diluted below calibration range.
- G = Indicates elevated detection limit due to sample interference.
- NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

- < = Less Than
- > = Greater Than

Analysis Summary

Samples Collected: 09-18-89
Samples Prepared: 09-22-89
Samples Analyzed: 09-22-89

for Robert H. J.

Cartar Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

10-12-89
Date

WESTON ANALYTICS
EXPLOSIVES IN HIPE SAMPLES DATA SUMMARY

Rfw Batch Number: 8909L804

CLIENT: USATHAMA-HWAAP

Page: 2

Sample Information	Client T18SH		FIELD BL		BLANK		2XSS		10XSS	
	ID :	RFW#:	D.F.:	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	
HMX.....	<	12.7	<	1.27	1.91(74.2%)	9.37(73.1%)				
RDX.....	<	9.80	<	9.80	1.62(81.6%)	7.68(77.7%)				
1,3,5-TNB.....	<	39.6	<	2.09	3.19(75.2%)	16.4(77.4%)				
1,3-DNB.....	<	5.90	<	0.59	0.98(82.2%)	4.84(82.5%)				
NITROBENZENE.....	<	4.20	<	0.42	0.74(87.7%)	3.69(87.7%)				
TETRYL.....	<	50.0	<	5.00	6.82(67.6%)	37.1(73.4%)				
2,4,6-TNT.....	<	19.2	<	1.92	3.25(83.6%)	14.8(76.3%)				
2,6-DNT.....	<	4.00	<	0.40	0.59(72.9%)	2.95(73.1%)				
2,4-DNT.....	<	4.20	<	0.42	0.68(80.7%)	3.42(80.9%)				

Sample Information	Client		10XSSD	
	ID :	RFW#:	D.F.:	Units:
HMX.....				Total ug
RDX.....				8.14(63.5%)
1,3,5-TNB.....				6.94(70.2%)
1,3-DNB.....				14.8(70.0%)
NITROBENZENE.....				4.44(74.9%)
TETRYL.....				3.47(82.2%)
2,4,6-TNT.....				30.9(61.2%)
2,6-DNT.....				13.1(67.6%)
2,4-DNT.....				2.75(68.4%)
				3.10(73.2%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
RPT #: 8909L803 - RINSATES
W.O. #: 2281-08-02

SAMPLES RECEIVED: 09-20-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

- SS = Designates sample spiked with target compound.
- SSD = Designates sample spiked with target compound in duplicate.
- D = Indicates duplicate analysis of a sample.
- NS = Not spiked.
- DL = Diluted below calibration range.
- G = Indicates elevated detection limit due to sample interference.
- NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

- < = Less Than
- > = Greater Than

Analysis Summary

Samples Collected: 09-18-89
Samples Prepared: 09-22-89
Samples Analyzed: 09-22-89

C. Carter Nulton
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

10-13-89
Date

WESTON ANALYTICS
EXPLOSIVES IN KINSEATE DATA SUMMARY

RW Batch Number: 89091803

CLIENT: USAMARSA HWAAP

Page: 2

Sample Information	Client		2XSS		10XSS	
	ID :	BLANK	Total ug	Total ug	Total ug	Total ug
	RFW#:	1				
	D.F.:	1				
	Units:					
HMX.....	<	1.27	2.31(89.7%)	11.1(86.4%)		
RDX.....	<	0.98	1.89(95.1%)	8.74(88.4%)		
1,3,5-TNB.....	<	2.09	3.63(85.6%)	18.7(88.6%)		
1,3-DNB.....	<	0.59	1.10(92.4%)	5.44(91.7%)		
NITROBENZENE.....	<	0.42	0.83(97.6%)	4.11(97.4%)		
TETRYL.....	<	5.00	8.15(82.7%)	44.8(88.8%)		
2,4,6-TNT.....	<	1.92	3.77(97.1%)	17.6(90.6%)		
2,6-DNT.....	<	0.40	0.68(83.4%)	3.42(84.5%)		
2,4-DNT.....	<	0.42	0.78(91.9%)	3.97(93.8%)		

Sample Information	Client		10XSSD	
	ID :	BLANK	Total ug	Total ug
	RFW#:	1		
	D.F.:	1		
	Units:			
HMX.....	<	10.4(81.1%)		
RDX.....	<	8.19(82.9%)		
1,3,5-TNB.....	<	17.6(83.1%)		
1,3-DNB.....	<	5.15(86.8%)		
NITROBENZENE.....	<	3.97(94.0%)		
TETRYL.....	<	41.6(82.3%)		
2,4,6-TNT.....	<	16.4(84.7%)		
2,6-DNT.....	<	3.29(81.5%)		
2,4-DNT.....	<	3.77(84.0%)		

WESTERN

ROY P. HESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HWAAP
API #: 8909L303 - SOIL
M.O. #: 2231-08-02

SAMPLES RECEIVED: 09-20-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLX = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.

ESD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than

> = Greater Than

Analysis Summary

Samples Collected: 09-18-89

Samples Prepared: 09-22-89

Samples Analyzed: 09-22-89

C. Carter Nulton
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

10-13-89
Date

WESTON ANALYTICS
EXPLOSIVES IN SOIL DATA SUMMARY

RW Batch Number: 8909L803

CLIENT: USKIHADA-HWAAP

Page: 2

Sample Information	Client	T19CP	BLANK		2XSS	10XSS
	ID :	SOLID	Total ug	1	Total ug	Total ug
	RWF#:	001		1		
	D.F.:	1		1		
	Units:	ug/g	Total ug	Total ug	Total ug	Total ug
HMX.....	<	1.27	<	1.27	2.88 (113%)	11.8 (92.8%)
RDX.....	<	0.98	<	0.98	2.18 (111%)	8.89 (90.7%)
1,3,5-TNB.....	<	2.09	<	2.09	4.58 (110%)	20.4 (97.5%)
1,3-DNB.....	<	0.59	<	0.59	1.36 (115%)	5.85 (99.3%)
NITROBENZENE.....	<	0.42	<	0.42	0.92 (110%)	4.12 (98.4%)
TETRYL.....	<	5.00	<	5.00	11.3 (113%)	48.8 (97.5%)
2,4,6-TNT.....	<	1.92	<	1.92	4.63 (120%)	15.6 (97.1%)
2,6-DNT.....	<	0.40	<	0.40	0.90 (112%)	3.91 (97.7%)
2,4-DNT.....	<	0.42	<	0.42	0.94 (112%)	4.11 (97.8%)

Sample Information	Client	T19CP	BLANK		2XSS	10XSS
	ID :	SOLID	Total ug	1	Total ug	Total ug
	RWF#:	001		1		
	D.F.:	1		1		
	Units:	ug/g	Total ug	Total ug	Total ug	Total ug
HMX.....	<	13.4 (105%)	<	13.4 (105%)	13.4 (105%)	13.4 (105%)
RDX.....	<	10.0 (102%)	<	10.0 (102%)	10.0 (102%)	10.0 (102%)
1,3,5-TNB.....	<	22.5 (108%)	<	22.5 (108%)	22.5 (108%)	22.5 (108%)
1,3-DNB.....	<	6.48 (110%)	<	6.48 (110%)	6.48 (110%)	6.48 (110%)
NITROBENZENE.....	<	4.56 (109%)	<	4.56 (109%)	4.56 (109%)	4.56 (109%)
TETRYL.....	<	55.5 (111%)	<	55.5 (111%)	55.5 (111%)	55.5 (111%)
2,4,6-TNT.....	<	20.8 (108%)	<	20.8 (108%)	20.8 (108%)	20.8 (108%)
2,6-DNT.....	<	4.31 (108%)	<	4.31 (108%)	4.31 (108%)	4.31 (108%)
2,4-DNT.....	<	4.50 (107%)	<	4.50 (107%)	4.50 (107%)	4.50 (107%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 09-22-89
MTY #: 3909L351, RINSATES
D.O. #: 2281-03-02

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

- SS = Designates sample spiked with target compound.
- SSD = Designates sample spiked with target compound in duplicate.
- D = Indicates duplicate analysis of a sample.
- NS = Not spiked.
- DL = Diluted below calibration range.
- G = Indicates elevated detection limit due to sample interference.
- NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less Than > = Greater Than

Analysis Summary

Samples Collected: 09-20-89
Samples Prepared: 09-26-89
Samples Analyzed: 10-24-89

Carter Nulton (RN)
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

10/24/89
Date

WESTON ANALYTICS
EXPLOSIVES IN KINSATE DATA SUMMARY

RFP Batch Number: 8909L851

CLIENT: USATHAMA-HAWTHORNE

Client T18 MOTOR

ID : SOAK TEST

RFP#: 001

D.F.: 1409

Units: Total ug

10XSS

1

Total ug

Sample Information	Units	Total ug	Total ug
HMX.....	< 220	2.43 (94.4%)	13.1 (102%)
RDX.....	< 170	1.82 (92.0%)	10.1 (102%)
1,3,5-TNB.....	< 370	4.02 (94.8%)	21.6 (102%)
1,3-DNB.....	< 100	1.14 (95.8%)	6.05 (102%)
Nitrobenzene.....	74	0.79 (94.5%)	4.35 (103%)
Tetryl.....	880	6.47 (64.0%)	46.4 (91.9%)
2,4,6-TNT.....	340	2.72 (69.9%)	17.4 (89.9%)
2,6-DNT.....	70	0.85 (106%)	4.24 (105%)
2,4-DNT.....	70	0.82 (96.4%)	4.34 (103%)

Client

ID :

RFP#: 10XSSD

D.F.: 1

Units: Total ug

BLANK

1

Total ug

Sample Information	Units	Total ug	Total ug
HMX.....	< 12.5 (97.2%)	< 1.27	< 1.27
RDX.....	9.74 (98.6%)	< 0.98	< 0.98
1,3,5-TNB.....	21.1 (99.6%)	< 2.09	< 2.09
1,3-DNB.....	5.90 (99.5%)	< 0.59	< 0.59
Nitrobenzene.....	4.25 (101%)	< 0.42	< 0.42
Tetryl.....	42.8 (84.8%)	< 5.00	< 5.00
2,4,6-TNT.....	15.5 (79.9%)	< 1.92	< 1.92
2,6-DNT.....	4.16 (103%)	< 0.40	< 0.40
2,4-DNT.....	4.23 (100%)	< 0.42	< 0.42

WIPES

ROY F. WESSON, INC.
Lionville Laboratory

CLIENT: EPAAP
LPT #: 2001L325-Wipes
M.O. #: 2231-03-02

SAMPLES RECEIVED: 01-25-90

ENCLOSURE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Modified for the analysis of wipe samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

- SS = Designates sample spiked with target compound.
- SSD = Designates sample spiked with target compound in duplicate.
- D = Indicates duplicate analysis of a sample.
- NS = Not spiked.
- DL = Diluted below calibration range.
- G = Indicates elevated detection limit due to sample interference.
- NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

- < = Less Than
- > = Greater Than

Analysis Summary

Samples Collected: 01-26-90
Samples Prepared: 01-30-90
Samples Analyzed: 01-30-90

Carter Nulton, Ph.D.
Vice President
Lionville Analytical Laboratory

2/12/90
Date

Roy F. Weston, Inc. - Lionville Laboratory
EXP ANALYTICAL DATA PACKAGE FOR
USATHAMA-SWAAP

DATE RECEIVED: 01/26/90

RFW LOT # :9001L326

<u>CLIENT ID</u>	<u>RFW #</u>	<u>MTX</u>	<u>PREP #</u>	<u>COLLECTION</u>	<u>EXTR/PREP</u>	<u>ANALYSIS</u>
T12 CLAY PIPE POST T	001	WI		01/26/90		

WESTON ANALYTICS
NIPE EXPLOSIVES DATA

RFP Batch Number: 5001L326

CLIENT: HWAAP

Page: 1

Client	T 18	---	---	---
Sample Information	CLAYPIPE			
ID:	POST T			
RFP#:	001	BLANK	2XSS	10XSS
D.F.:	10	1	1	NA
Units:	Total ug	Total ug	Total ug	Total ug

MAX.....	< 12.7	< 1.27	2.18(86.8%)	11.6(90.1%)
NDX.....	< 9.80	< 0.98	1.71(87.1%)	8.86(90.3%)
1,3,5-TNB.....	< 20.9	< 2.09	3.63(91.2%)	19.8(94.3%)
1,3-DNB.....	< 5.90	< 0.59	1.07(96.7%)	5.86(99.3%)
NITROBENZENE.....	< 55.4	< 0.42	1.08(93.7%)	4.83(115%)
TRINYL.....	< 50.0	< 5.00	8.94(94.6%)	49.5(98.9%)
2,4,6-TNT.....	< 19.2	< 1.92	3.63(98.3%)	19.7(120%)
2,6-DNT.....	< 4.00	< 0.40	0.73(89.2%)	3.90(97.5%)
2,4-DNT.....	< 4.20	< 0.42	0.72(89.9%)	4.00(95.3%)

Client

Sample Information

ID:	10XSSD
RFP#:	1
D.F.:	1
Units:	Total ug

MAX.....	11.7(91.2%)
NDX.....	9.00(91.2%)
1,3,5-TNB.....	20.1(95.9%)
1,3-DNB.....	5.86(99.3%)
NITROBENZENE.....	4.55(108%)
TRINYL.....	49.0(98.0%)
2,4,6-TNT.....	19.3(118%)
2,6-DNT.....	3.77(94.1%)
2,4-DNT.....	3.93(93.9%)

20
2-13

WESTEN

ROY F. WESTEN, INC.
Lionville Laboratory

CLIENT: HMAAP
REF #: 9001L328-Soil
I.O. #: 2231-08-02

SAMPLES RECEIVED: 01-26-90

EXPLOSIVE INDICATIVE

Samples have been prepared and analyzed according to JSATHAMA Method LW02, Explosives in soil.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLX = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

- SS = Designates sample spiked with target compound.
- SSD = Designates sample spiked with target compound in duplicate.
- D = Indicates duplicate analysis of a sample.
- NS = Not spiked.
- DL = Diluted below calibration range.
- G = Indicates elevated detection limit due to sample interference.
- NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Soil results are reported in a dry weight basis.

Data Qualifiers

< = Less Than > = Greater Than

Analysis Summary

Samples Collected: 01-26-90
Samples Prepared: 01-30-90
Samples Analyzed: 01-30-90

Carter Nulton, Ph.D.
Vice President
Lionville Analytical Laboratory

2-12-90
Date

Roy F. Weston, Inc. - Lionville Laboratory
REP ANALYTICAL DATA PACKAGE FOR
STATSAMA-SWAAP

DATE RECEIVED: 01/26/90

REP LOT # 190011325

<u>CLIENT ID</u>	<u>REP #</u>	<u>MLL</u>	<u>PREP #</u>	<u>COLLECTION</u>	<u>EXTR/PREP</u>	<u>ANALYSIS</u>
213 CLAYPIPE GROUND	002	WI		01/26/90		

WESTCH ANALYTICS
SOIL EXPLOSIVES DATA

RFW Batch Number: 9001L326

CLIENT: HWARP

Page 1

Client T 18

Sample Information

CLAYPIPE
2ROUND

Sample Information	XD:	RFW#:	D.F.:	Units:	Total ug	BLANK	Total ug	2XSS	Total ug	10XSS	Total ug
RDX.....					< 1.27	< 1.27	< 1.27	2.20(86.8%)	2.20(86.8%)	10.6(63.5%)	10.6(63.5%)
1,3,5-TNB.....					< 0.98	< 0.98	< 0.98	1.70(87.1%)	1.70(87.1%)	7.82(79.8%)	7.82(79.8%)
1,3-DNB.....					< 0.59	< 0.59	< 0.59	3.82(91.2%)	3.82(91.2%)	18.9(89.9%)	18.9(89.9%)
NITROBENZENE.....					< 0.42	< 0.42	< 0.42	1.14(96.7%)	1.14(96.7%)	5.56(94.3%)	5.56(94.3%)
TETRYL.....					< 5.00	< 5.00	< 5.00	0.784(93.7%)	0.784(93.7%)	3.73(90.3%)	3.73(90.3%)
2,4,6-TNT.....					< 1.92	< 1.92	< 1.92	9.46(94.6%)	9.46(94.6%)	47.1(94.1%)	47.1(94.1%)
2,6-DNT.....					< 0.40	< 0.40	< 0.40	3.77(98.3%)	3.77(98.3%)	18.2(111%)	18.2(111%)
2,4-DNT.....					< 0.42	< 0.42	< 0.42	0.71(89.2%)	0.71(89.2%)	3.55(88.7%)	3.55(88.7%)
								0.75(89.9%)	0.75(89.9%)	3.68(87.7%)	3.68(87.7%)

Client

Sample Information

ID: 10XSSD

RFW#: 1

D.F.: 1

Units: Total ug

RDX.....	10.6(83.3%)
RDX.....	7.82(79.7%)
1,3,5-TNB.....	18.86(89.9%)
1,3-DNB.....	5.61(95.5%)
NITROBENZENE.....	3.84(91.5%)
TETRYL.....	46.6(93.1%)
2,4,6-TNT.....	18.0(110%)
2,6-DNT.....	3.56(88.9%)
2,4-DNT.....	3.71(88.4%)

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,15,20,22,29, 9-2,11,20

RFV #: 8907L058,059,154 8908L203,253,315,393,462,524,534,595

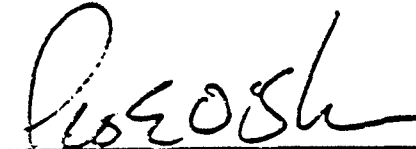
8909L595,679,804

W.O. #: 2231-08-02

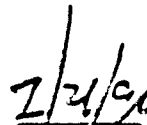
INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory



Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.

- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L679

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-028	T18SMW2 PRE TEST	NITRATED ESTERS	27.5	UG	20.0
-029	T18SM FIELD BLANK	NITRATED ESTERS	5.0 u	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L679

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC012-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L679

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95
		NITRATED ESTERS	48.8	2.5 u	50.0	97

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 3909L679

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC012-M82	NITRATED ESTERS	95.2	97.6	2.5

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 8909L304

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T18 SMW2	NITRATED ESTERS	5.0	u UG	5.0
-002	T18 SM FIELD BLANK	NITRATED ESTERS	5.0	u UG	5.0
-003	T18 FLSH CHMB WA W2	NITRATED ESTERS	5.0	u UG	5.0
-004	T18 FLSH CHMB WA BLN	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 8909L804

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC014-MB1	NITRATED ESTERS	2.5	u MG/L	2.5
BLANK20	89LNC014-MB2	NITRATED ESTERS	2.5	u MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HNAAP
 WORK ORDER: 2231-03-02-0000

WESTON BATCH #: 3909L30

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LNC014-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNC014-MB2	NITRATED ESTERS	49.3	2.5 u	50.0	99
		NITRATED ESTERS	43.9	2.5 u	50.0	97

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 3909L304

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNCO14-MB2	NITRATED ESTERS	99.5	97.7	1.8

APPENDIX G

ANALYTICAL DATA SUMMARY TABLES FOR STACK TEST PROGRAM

1311R2

APPENDIX G

Appendix G contains data collected from stack testing that was conducted during T2, T3, and T5. Two types of data are included. The first type consists of raw operational data from the flash chamber inlet, flash chamber outlet, and the afterburner outlet. These data were used to generate Tables 3-6, 3-7, and 3-8 in the main report. The following information is included:

- Flash chamber inlet
 - Test data.
 - Inputs for calculations.
 - CEM report data for total hydrocarbons.
- Flash Chamber Outlet (sheet 1, explosives data)
 - Test data.
 - Inputs for calculations.
 - Laboratory report data for explosives.
- Flash Chamber Outlet (sheet 2, smokeless powder data)
 - Test data.
 - Inputs for calculations.
 - Smokeless powder results from sample train.
 - CEM report data for total hydrocarbons.
- Afterburner Outlet (sheet 1, explosives data)
 - Test data.
 - Inputs for calculations.
 - Laboratory report data for explosives.
- Afterburner Outlet (sheet 2, smokeless powder and particulate data)
 - Test data.
 - Inputs for calculations.
 - Laboratory report data.
 - Particulate catch.
 - Smokeless powder catch.
 - CEM report data for NOx and total hydrocarbons.

The second type of data consists of analytical data summaries generated by the offsite laboratory (WESTON Analytics Division, Lionville, Pennsylvania). The analytical data summaries provide the following information:

- Inorganic narrative (explosives narrative presented, where applicable).

- Glossary of terms.
- Inorganics data summary report.
- Inorganics quality assurance/quality control (QA/QC) report.
- Explosives narrative.
- Explosives data summary.

The inorganic narrative is generally a summary of the quality control results and a description of any problems encountered during the analysis of the samples. The glossary of terms defines the data qualifiers used in the report, abbreviations, and laboratory chronology and holdtime report codes.

The inorganics data summary presents the actual results of the analysis. In addition, the lab sample number, site ID, analyte tested, and the reporting limit are provided.

The inorganics QA/QC report includes the analysis of a method blank, inorganics accuracy report, and an inorganics duplicate spike report.

July 1990
Revision: Final

STACK TEST 2
400°F/24 HOURS
RAW OPERATIONAL DATA

1311R2

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	T2-1	T2-2	T2-3
Run Number		FLASH CHAMBER	INLET
Location			
Date	07-25-89	07-25-89	07-26-89
Time period	0340-1345	1720-2200	0950-1400
Operator	JOO	JOO	JOO
Inputs For Calc.			
Sq. ft. delta P	0.130120	0.441590	0.158260
Delta H	0.75000	0.75000	0.75000
Stack temp. (deg.F)	330.75	311.37	743.00
Meter temp. (deg.F)	100.30	97.30	99.30
Sample volume (act.)	164.255	143.065	125.522
Barometric press. (in.Hg)	26.44	26.44	26.40
Volume H2O imp. (ml)	75.30	50.30	25.00
Weight chnge sil. gel (g)	37.30	39.30	34.00
% CO2	1.900	1.900	1.800
% O2	17.300	17.300	17.500
ppm CO	131.300	175.100	200.300
% N	81.100	81.100	80.900
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	305.00	280.00	250.00
Static pressure (in.H2O)	0.06	0.06	0.06
Nozzle dia. (in.)	NA	NA	NA
Meter box cal.	0.9991	0.9991	0.9991
Cp of pitot tube	0.34	0.34	0.34
Com Report Data			
Total Hydrocarbon PPM	29.6	39.8	45.6

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	EXPLOSIVES TEST		
Run number	T2-1	T2-2	T2-3
Location	FLASH CHAMBER OUTLET		
Date	7-25-89	7-25-89	7-26-89
Time period	0830-1536	1558-2331	0945-1414
Operator	JDO/SK	SK/WS	SK/WS

Inputs For Calcs.			
Sq. ft. delta P	0.434755	0.510594	0.506651
Delta H	1.10647	1.40764	1.35625
Stack temp. (deg.F)	345.42	405.99	424.35
Meter temp. (deg.F)	105.74	102.26	106.34
Sample volume (act.)	233.731	324.082	171.536
Barometric press. (in.Hg)	26.44	26.31	26.40
Volume H2O imp. (ml)	72.00	116.00	35.00
Weight chnge sil. gel (g)	57.00	64.35	37.00
% CO2	1.200	1.100	1.100
% O2	16.200	18.400	18.300
CO ppm	86.700	92.300	122.700
% N	82.600	80.600	80.600
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	360.00	445.00	240.00
Static pressure (in.H2O)	-0.44	-0.56	-0.54
Nozzle dia. (in.)	0.300	0.300	0.300
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug

HMX	<	3180.00	<	3180.00		4.18
RDX	<	2450.00	<	2450.00	<	2.45
Trinitrobenzene (1 3 5 TNB)	<	5230.00	<	5230.00	<	5.23
Dinitrobenzene (1 3 DNB)	<	1480.00	<	1480.00		4.46
Nitrobenzene	<	1050.00	<	1050.00	<	1.05
Tetryl	<	12500.00	<	12500.00	<	12.50
2 4 6 Trinitrotoluol (TNT)		70400.00		39600.00		93.50
2 4 Dinitrotoluene (2 4 DNT)	<	1050.00	<	1050.00	<	1.05
2 6 Dinitrotoluene (2 6 DNT)	<	1000.00	<	1000.00	<	1.00

SMITHSONIAN ENVIRONMENTAL PLANT
 LAS VEGAS, NEVADA

Test Data	PARTICULATE TEST		
	T2-1	T2-2	T2-3
Run Number			
Location	FLASH CHAMBER OUTLET		
Date	7-25-89	7-25-89	7-25-89
Time period	0330-1526	1629-2331	0945-1644
Operator	JKO/CK	JK/S	CK/S
Inputs for Calc.			
Co. wt. Delta P	0.140399	0.201035	0.199036
Delta H	1.12442	1.10774	1.10563
Stack temp. (deg.F)	343.89	403.76	423.33
Water temp. (deg.F)	113.08	103.62	114.74
Sample volume (act.)	248.742	315.669	130.476
Barometric press. (in.Hg)	26.44	26.31	26.40
Volume H2O imp. (ml)	12.00	109.00	32.00
Weight chnge sil. gel (g)	45.00	66.00	37.00
% CO2	1.200	1.100	1.100
% O2	16.200	15.400	15.300
CO ppm	26.700	92.000	122.700
% H	32.600	30.500	30.600
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	260.00	420.00	240.00
Static pressure (in.H2O)	-0.50	-0.57	-0.57
Nozzle dia. (in.)	0.310	0.310	0.310
Neter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.34	0.34	0.34
Smokeless powder			
Total Nitrated Esters, ug	30003.5	13601.49	1591.88
Com Report Data			
Total Hydrocarbon PPM	23.9	28.9	34.3

WANTONNE ARMY AMMUNITION PLANT
WANTONNE, NEVADA

Test Data	EXPLOSIVES TEST		
Run number	T2-1	T2-2	T2-3
Location	AFTERSURNER TUNNEL		
Date	7-25-69	7-25-69	7-25-69
Time period	0800-1537	1540-2340	0945-1444
Operator	CM/SK	CM/NS	CM/SK

Inputs For Calcs.			
St. rt. delta P	0.069896	0.103104	0.092647
Delta H	0.33191	1.01125	0.955208
Stack temp. (deg.F)	1725.68	1790.24	1721.35
Water temp. (deg.F)	112.41	108.92	114.34
Sample volume (act.)	157.991	224.444	144.556
Barometric press. (in.Hg)	29.44	26.31	29.40
Volume H2O imp. (ml)	280.00	320.00	175.00
Weight chge sil. gel (g)	43.00	55.00	31.00
% CO2	7.100	6.500	5.000
% O2	9.300	10.700	11.500
PPM CO	7.500	6.000	7.000
% H	83.000	82.800	82.500
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	340.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.750	0.300	0.300
Water box cal.	0.9953	0.9953	0.9953
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug

IMX		12.52	2.16 <	1.27
SDX	<	0.98 <	0.98	2.92
Trinitrobenzene (1 3 5 TNB)		5.90 <	2.09 <	2.09
Dinitrobenzene (1 3 DNB)		0.50	0.24	0.87
Nitrobenzene	<	0.42 <	0.42 <	0.42
Tetryl	<	5.00 <	5.00 <	5.00
2 4 5 Trinitrotoluol (TNT)	<	1.92 <	1.92 <	1.92
2 4 Dinitrotoluene (2 4 DNT)	<	0.42 <	0.42 <	0.42
2 5 Dinitrotoluene (2 6 DNT)	<	0.40 <	0.40 <	0.40

ANTHROME ARMY AMMUNITION PLANT
ANTHROME, NEVADA

Test Data	SMOKELESS POWDER AND PARTICULATE TEST		
	T2-1	T2-2	T2-3
Run Number			
Location	AFTERBURNER OUTLET		
Date	7-25-89	7-25-89	7-25-89
Time period	0830-1237	1640-2340	0945-1414
Operator	JM/SK	JM/WS/SK	JM/WS

Inputs For Calcs.

Dg. rt. Delta P	0.099753	0.101708	0.104104
Delta H	1.45147	1.52653	1.19458
Stack temp. (deg.F)	1663.93	1703.97	1639.71
Aeter temp. (deg.F)	109.50	105.31	110.25
Sample volume (act.)	235.949	256.203	151.315
Barometric press. (in.Hg)	28.44	28.31	28.40
Volume H2O imp. (ml)	339.00	340.00	198.00
Weight chnge sil. gel (g)	50.00	56.00	35.00
% CO2	7.10	6.50	6.00
% O2	9.20	10.70	11.50
PPM CO	7.50	6.20	7.00
% H	33.00	32.30	32.50
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	340.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.360	0.360	0.310
Meter box cal.	1.0030	1.0030	1.0030
Cp of pitot tube	0.34	0.34	0.34

Laboratory Report Data

Front half acetone, g.	0.0049	0.0018	0.0024
Filter catch, g.	0.0025	0.0018	0.0020
Total particulate catch, g.	0.0074	0.0036	0.0044

Smokeless powder

Nitrated Esters	< 1805 <	1660 <	1447
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Cam Report Data

NOx PPM	58.9	54.6	54.8
Total Hydrocarbon PPM	0.2	0.0	0.3

July 1990
Revision: Final

STACK TEST 3
500°F/36 HOURS
RAW OPERATIONAL DATA

1311R2

PAINTS/CORNE MILK AMMUNITION PLANT
PAINTS/CORNE, NEVADA

Test Data

Run number	T3-1	T3-2	T3-3
Location		FLASH CHAMBER	INLET
Date	07-17-89	07-17-89	07-13-89
Time period	0450-1206	1449-1900	1440-2100
Operator	JDO	JDO	JDO

Inputs For Calcs.

Sq. ft. Delta P	0.489600	0.529150	0.524400
Delta H	1.30000	0.75000	0.70000
Stack temp. (deg.F)	1123.00	1050.00	935.00
Water temp. (deg.F)	110.00	100.00	103.00
Sample volume (act.)	238.741	127.621	190.899
Barometric press. (in.Hg)	26.48	25.04	25.97
Volume H2O imp. (ml)	115.00	80.00	50.00
Weight chngc sil. gel (g)	20.00	23.00	47.00
% CO2	2.400	2.200	1.300
% O2	15.300	16.600	16.700
ppm CO	9.200	55.600	113.600
% N	81.300	81.300	81.500
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	436.00	251.00	380.00
Static pressure (in.H2O)	0.06	0.06	0.06
Nozzle dia. (in.)	NA	NA	NA
Meter box cal.	0.9991	0.9991	0.9991
Cp of pitot tube	0.34	0.34	0.84

Gen Report Data

Total Hydrocarbon PPM	49.0	33.1	38.2
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HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	EXPLOSIVES TEST		
Run number	T3-1	T3-2	T3-3
Location	FLASH CHAMBER OUTLET		
Date	7-17-89	7-17-89	7-18-89
Time period	0445-1226	1439-2221	1433-2134
Operator	JDO/MS	JDC/SK	JDO/MS

Inputs For Calcs.			
Sq. ft. delta P	0.461140	0.442933	0.502224
Delta H	1.03269	0.92759	1.20219
Stack temp. (deg.F)	440.22	510.21	512.69
Peter temp. (deg.F)	86.24	113.48	111.32
Sample volume (act.)	229.737	146.367	243.277
Barometric press. (in.Hg)	25.48	25.34	25.37
Volume H2O imp. (ml)	100.00	74.00	124.00
Weight chnge sil. gel (g)	56.00	31.00	49.00
% CO2	1.400	1.300	1.130
% O2	17.200	17.500	17.500
PPH CO	19.000	100.400	169.000
% H	81.400	81.200	81.300
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	360.00	240.00	360.00
Static pressure (in.H2O)	-0.48	-0.48	-0.56
Nozzle dia. (in.)	0.300	0.300	0.300
Peter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug

HMX	<	3180.00 <	31.80 <	12.70
RDX	<	2450.00 <	24.50 <	9.80
Trinitrobenzene (1 3 5 TNB)	<	5230.00 <	52.30	21.70
Dinitrobenzene (1 3 DNB)	<	1480.00 <	14.80 <	5.90
Nitrobenzene	<	1050.00 <	10.50	22.00
Tetryl	<	12500.00 <	125.00 <	50.07
2 4 6 Trinitrotoluol (TNT)		89200.00	64.20	171.00
2 4 Dinitrotoluene (2 4 DNT)	<	1056.00 <	10.50 <	4.20
2 6 Dinitrotoluene (2 6 DNT)	<	1000.00 <	10.00 <	4.00

AMTICORNE ARMY POLLUTION PLANT
AMTICORNE, NEVADA

Test Data	PARTICULATE TEST		
	TS-1	TS-2	TS-3
Run Number			
Location	FLUSH CHANGER OUTLET		
Date	7-17-79	7-17-79	7-18-79
Time period	0445-1223	1441-2221	1424-2124
Operator	JOC/VS	JM/SK	JM/VS
Inputs For Calcs.			
Sq. ft. delta P	0.466053	0.447826	0.460654
Delta H	1.40324	1.20092	1.20877
Stack temp. (deg.F)	440.59	507.05	498.24
Meter temp. (deg.F)	103.47	119.51	113.28
Sample volume (act.)	240.263	156.530	240.406
Barometric press. (in.Hg)	26.48	25.94	25.87
Volume H2O imp. (ml)	107.00	79.00	128.00
Weight change sil. gel (g)	40.50	33.00	46.00
% CO2	1.400	1.300	1.100
% O2	17.000	17.500	17.600
PPM CO	19.000	100.400	169.000
% H	81.400	81.200	81.200
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	370.00	240.00	360.00
Static pressure (in.H2O)	-0.48	-0.50	-0.52
Nozzle dia. (in.)	0.310	0.310	0.310
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.34	0.34	0.34
Smokeless powder			
Nitrated Esters	35692.58	3099.38	7703.13
Chem Report Data			
Total Hydrocarbon PPM	33.9	27.8	27.9

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	EXPLOSIVES TEST		
Run number	T3-1	T3-2	T3-3
Location	AFTERBURNER OUTLET		
Date	7-17-89	7-17-89	7-18-89
Time period	0445-1226	1440-2221	1433-2134
Operator	JM/WS	JM/SK	JM/WS

Inputs For Calcs.			
Sq. ft. Delta P	0.090423	0.084823	0.096900
Delta H	0.30397	0.54542	0.72431
Stack temp. (deg.F)	1818.47	1802.19	1806.30
Meter temp. (deg.F)	88.33	116.21	118.50
Sample volume (act.)	174.486	112.964	191.591
Barometric press. (in.Hg)	25.48	25.94	25.97
Volume H2O imp. (ml)	275.00	185.00	310.00
Weight chnge sil. gel (g)	42.00	25.00	43.00
% CO2	6.500	6.700	6.200
% O2	10.300	11.000	11.200
% H2O	4.900	1.300	6.600
% N	83.200	82.300	82.500
Area of stal. (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	360.00	240.00	360.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.760	0.760	0.760
Meter box cal.	0.9953	0.9953	0.9953
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug

HMX	<	1.27 <	1.27 <	1.27
RDX		3.81	3.82	2.80
Trinitrobenzene (1 3 5 TNB)	<	2.09	3.46	2.78
Dinitrobenzene (1 3 DNB)		5.60	8.40	5.17
Nitrobenzene	<	0.42	20.20 <	0.42
Tetryl	<	5.00 <	5.00 <	5.00
2 4 6 Trinitrotoluol (TNT)	<	1.92 <	1.92 <	1.92
2 4 Dinitrotoluene (2 4 DNT)	<	0.42 <	0.42 <	0.42
2 5 Dinitrotoluene (2 6 DNT)	<	0.40 <	0.40 <	0.40

SANTICRUZE ARMY AMMUNITION PLANT
SANTICRUZE, NEVADA

Test Data	PARTICULATE TEST		
	TS-1	TS-2	TS-3
Run number			
Location	AFTERBURNER OUTLET		
Date	7-17-39	7-17-39	7-13-39
Time period	0445-1226	1440-2221	1404-2134
Operator	JH/WS	JH/GK	JH/WS
Inputs For Calc.			
Sq. ft. Delta P	0.073102	0.034311	0.037440
Delta H	0.33597	1.07917	1.12131
Stack temp. (deg.F)	1747.29	1300.35	1739.20
Water temp. (deg.F)	78.10	113.51	114.58
Sample volume (act.)	191.334	142.223	221.776
Barometric press. (in.Hg)	26.48	25.74	25.97
Volume H2O imp. (ml)	328.00	252.00	376.00
Weight change sil. gel (g)	40.00	31.00	46.00
% CO2	6.300	6.700	6.200
% O2	10.300	11.000	11.200
PPM CO	4.200	1.300	6.600
% H	33.200	32.300	32.500
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	360.00	240.00	360.00
Static pressure (in.H2O)	-0.09	-0.10	-0.10
Nozzle dia. (in.)	0.360	0.360	0.360
Water box cal.	1.0030	1.0030	1.0030
Cp of pitot tube	0.34	0.34	0.34
Laboratory Report Data			
Front half acetone, g.	0.0009	0.0030	0.0033
Filter catch, g.	0.0016	0.0019	0.0024
Total particulate catch, g.	0.0025	0.0049	0.0057
Smokeless powder			
Nitrated Esters	3184.97	2237.525	5774.47
Gas Report Data			
NOx PPM	55.4	48.8	47.4
Total Hydrocarbon PPM	0.1	0.3	0.1

July 1990
Revision: Final

STACK TEST 5
300°F/24 HOURS
RAW OPERATIONAL DATA

1311R2

SAATCHI ARMY AMMUNITION PLANT
 BARTONVILLE, NEVADA

Test Data	T5-1	T5-2	T5-3
Run number			
Location		FLASHCHAMBER	INLET
Date	07-29-89	07-29-89	07-30-89
Time period	1017-1630	1900-2100	1230-1630
Operator	JDO	JDO	JDO

Inputs For Calcs.	T5-1	T5-2	T5-3
Sq. ft. delta P	0.424260	0.489900	0.415890
Delta P	0.75000	0.75000	0.75000
Stack temp. (deg.F)	373.30	1025.00	397.50
Meter temp. (deg.F)	98.30	92.00	101.50
Sample volume (act.)	183.074	143.753	130.243
Barometric press. (in.Hg)	26.41	26.41	26.38
Volume H2O imp. (ml)	50.00	55.00	44.00
Weight chnge sil. gel (u)	34.00	33.00	23.00
% O2	1.00	2.20	2.00
% CO2	17.40	16.50	16.70
ppm CO	136.00	261.00	206.10
% N	81.00	81.30	81.30
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	373.00	300.00	240.00
Static pressure (in.H2O)	0.05	0.05	0.05
Nozzle dia. (in.)	NA	NA	NA
Meter box cal.	0.9991	0.9991	0.9991
Cp of pivot tube	0.34	0.34	0.34

Com Report Data

Total Hydrocarbon PPM	32.2	50.8	45.8
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HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	EXPLOSIVES TEST		
	T5-1	T5-2	T5-3
Run number			
Location	FLASH CHAMBER OUTLET		
Date	7-20-89	7-20-89	7-30-89
Time period	0955-1720	1320-0129	1221-1719
Operator	SK/WS	HS/SK	SK/WS
Inputs For Calcs.			
Sq. ft. delta P	0.13205	0.528697	0.502866
Delta H	1.78249	1.37347	1.22000
Stack temp. (deg.F)	153.35	479.84	521.23
Water temp. (deg.F)	106.33	99.28	103.00
Sample volume (act.)	254.112	256.323	161.335
Barometric press. (in.Hg)	25.11	25.41	26.37
Volume H2O imp. (ml)	60.00	73.00	50.00
Weight chng. sil. gel (g)	49.00	66.00	34.00
% CO2	1.200	1.500	1.600
% O2	18.100	17.400	17.500
PPM CO	106.000	171.200	188.500
% N	60.700	31.000	30.300
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.49	-0.58	-0.57
Nozzle dia. (in.)	0.300	0.300	0.300
Water box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.84	0.84	0.84

Laboratory Report Data, Total ug

HMX	< 2380.00 <	127.00 <	12.70
RDX	< 1840.00 <	98.00 <	9.80
Trinitrobenzene (1 3 5 TNB)	< 3920.00 <	209.00 <	20.90
Dinitrobenzene (1 3 DNB)	< 1110.00 <	59.00 <	5.90
Nitrobenzene	< 788.00 <	42.00 <	4.20
Tetryl	< 9380.00 <	500.00 <	50.00
2 4 6 Trinitrotoluol (TNT)	76800.00	677.00	184.00
2 4 Dinitrotoluene (2 4 DNT)	< 780.00 <	42.00 <	4.20
2 6 Dinitrotoluene (2 6 DNT)	< 750.00 <	40.00 <	4.00

LAURENCE GUY POLLUTION PLANT
 CARLSBOME, NEVADA

Test Data	PARTICULATE TEST		
	TS-1	TS-2	TS-3
Run Number	15-1	15-2	15-3
Location	FLASH CHAMBER OUTLET		
Date	7-19-69	7-19-69	7-20-69
Time period	0955-1720	1324-0129	1221-1719
Operator	JK/S	MS/SK	JK/S
Inputs For Calcs.			
Sq. ft. Delta P	0.455045	0.505283	0.504881
Delta H	1.51256	1.50542	1.54229
Stack temp. (deg.F)	379.26	477.57	519.83
Meter temp. (deg.F)	114.70	107.35	116.51
Sample volume (act.)	278.342	247.516	172.069
Barometric press. (in.Hg)	28.41	28.41	28.37
Volume H2O (sp. (ml)	77.00	97.00	62.00
Weight chnge sil. gel (g)	48.00	52.00	24.00
% O2	1.200	1.200	1.600
% CO2	18.100	17.400	17.500
PPM CO	106.000	171.000	188.500
% H	30.700	31.000	30.900
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.50	-0.57	-0.58
Nozzle dia. (in.)	0.310	0.310	0.310
Meter box cal.	1.0020	1.0020	1.0020
Cp of pitot tube	0.34	0.34	0.34
Nitrated Esters	23326.00	1041.31	4389.53
Cam Report Data			
Total Hydrocarbon PPM	25.0	34.7	30.5

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Test Data	EXPLOSIVES TEST		
	TS-1	TS-2	TS-3
Run number			
Location	AFTERBURKER OUTLET		
Date	7-29-89	7-29-89	7-30-89
Time period	0955-1720	1824-0129	1221-1718
Operator	JM/WS	JM/SK	JM/SK

Inputs For Calcs.	TS-1	TS-2	TS-3
Sq. ft. delta P	0.099307	0.100790	0.096163
Delta H	0.06603	1.30944	0.927500
Stack temp. (deg.F)	1692.26	1703.71	1713.36
Merer temp. (deg.F)	117.94	105.44	119.55
Sample volume (act.)	239.435	219.521	142.886
Barometric press. (in.Hg)	26.41	26.41	26.37
Volume H2O imp. (ml)	358.00	301.00	180.00
Weight chnge sil. gel (g)	46.50	63.00	36.00
% CO2	6.800	6.200	6.100
% O2	10.300	11.000	11.200
PPM CO	6.900	5.800	6.900
% N	83.100	82.300	82.700
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.300	0.300	0.300
Water box cal.	0.9953	0.9953	0.9953
Cp of pitot tube	0.34	0.34	0.34

Laboratory Report Data, Total ug

HMX	12.70	1.47 <	1.27
RDX	2.76	2.57	2.84
Trinitrobenzene (1 3 5 TNB) <	2.09	2.19	7.62
Dinitrobenzene (1 3 DNB)	2.63	7.60	1.90
Nitrobenzene <	0.42	1.56	1.91
Tetryl <	5.00 <	5.00 <	5.00
2 4 6 Trinitrotoluol (TNT) <	1.92 <	1.92 <	1.92
2 4 Dinitrotoluene (2 4 DNT) <	0.42 <	0.42 <	0.42
2 6 Dinitrotoluene (2 6 DNT) <	0.40 <	0.40 <	0.40

WITCOMB ARMY AMMUNITION PLANT
 LAWRENCE, NEVADA

Test Data

NITRATED ESTERS AND PARTICULATE TEST

Run Number	TS-1	TS-2	TS-3
Location	AFTERBURNER OUTLET		
Date	7-29-89	7-29-89	7-30-89
Time period	0955-1720	1824-0129	1221-1713
Operator	JM/WS	JM/GK	JM/WS

Inputs for Calc.

sq. ft. Delta P	0.028273	0.107720	0.101726
Delta H	1.12949	1.25056	1.25958
Stack temp. (deg.F)	1697.56	1712.46	1719.36
Water temp. (deg.F)	111.27	102.35	111.29
Sample volume (act.)	243.418	242.749	156.510
Barometric press. (in.Hg)	25.41	25.41	25.37
Volume H2O imp. (ml)	316.00	339.00	204.00
Weight chng sil. gel (g)	53.00	59.00	32.00
% CO2	6.00	6.00	6.10
% O2	10.00	11.00	11.20
PPM CO	6.90	5.50	6.20
% N	83.10	82.30	82.70
Area of stack (sq.ft.)	17.10	17.10	17.10
Secale time (min.)	390.00	360.00	240.00
Static pressure (in.H2O)	-0.10	-0.10	-0.10
Nozzle dia. (in.)	0.310	0.310	0.310
Meter box cal.	1.0030	1.0030	1.0030
Cp of pitot tube	0.34	0.34	0.34

Laboratory Report Data

Front half acetone, g.	0.0029	0.0012	0.0000
Filter catch, g.	0.0015	0.0005	0.0000
Total particulate catch, g.	0.0044	0.0017	0.0000

Nitrated Esters	1847.5 <	2575 <	1413
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Can Report Data

NOx PPM	57.3	48.7	51.7
Total Hydrocarbon PPM	0.6	0.3	0.4

July 1990
Revision: Final

STACK TEST 2
400°F/24 HOURS
ANALYTICAL DATA SUMMARY

1311R2

WESTON


ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-19, 20, 8-1
REF#: 8907L060,073,153, 137
8908L202
W.O.#: 0291-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

7/24/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.
- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).
- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).
- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).
- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 3907L158

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-015	UH-FCO-PART-BHW T2-1	NITRATED ESTERS	29700	UG	1400
-016	UH-FCO-PART-BHA T2-1	NITRATED ESTERS	743	UG	388
-017	UH-AO-PART-FHA T2-1	PARTICULATE	0.0061	grams	0.0000
-018	UH-AO-PART-FILT-T2-1	PARTICULATE	0.0026	grams	0.0000
-019	UH-AO-PART-BHW-T2-1	NITRATED ESTERS	1550	u UG	1550
-020	UH-AO-PART-BHA-T2-1	NITRATED ESTERS	250	u UG	250
-035	UH-FCO-PART-BHW T2-2	NITRATED ESTERS	12600	UG	1250
-036	UH-FCO-PART-BHA T2-2	NITRATED ESTERS	1420	UG	425
-037	UH-AO-PART-FHA T2-2	PARTICULATE	0.0031	grams	0.0000
-038	UH-AO-PART-FILT T2-2	PARTICULATE	0.0018	grams	0.0000
-039	UH-AO-PART-BHW T2-2	NITRATED ESTERS	1480	u UG	1480
-040	UH-AO-PART-BHA T2-2	NITRATED ESTERS	175	u UG	175
-051	COMP FLO PT T2-1	NITRATED ESTERS	5.0	u UG	5.0
-052	COMP AO PT T2-1	NITRATED ESTERS	5.0	u UG	5.0
-053	COMP FLO PT T2-2	NITRATED ESTERS	11.1	UG	5.0
-054	COMP AO PT T2-2	NITRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHANA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 8907L158

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5 u	MG/L	2.
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5 u	MG/L	2.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 3907L158

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.3	2.5 u	10.0	108
BLANK20	89LNC008-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99.3
		NITRATED ESTERS	49.5	2.5 u	50.0	99.3

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 3907L11

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	39LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/15/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2291-08-04-0000

WESTON BATCH #: 8907L187

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-016	UH-FCO-PART-BHW T2-3	NTRATED ESTERS	1330	UG	1150
-017	UH-FCO-PART-BHA T2-3	NTRATED ESTERS	650	u UG	650
-018	UH-AO-PART-FHA T2-3	PARTICULATE	0.0037	grams	0.0000
-019	UH-AO-PART FLT-T2-3	PARTICULATE	0.0020	grams	0.0000
-020	UH-AO-PART-BHW T2-3	NTRATED ESTERS	1180	u UG	1180
-021	UH-AO-PART-BHA T2-3	NTRATED ESTERS	262	u UG	252
-024	COMP FCO PART T2-3	NTRATED ESTERS	6.4	UG	5.0
-025	COMP AO PART T2-3	NTRATED ESTERS	5.0	u UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2291-08-04-0000

WESTON BATCH #: 8907L137

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTIN LIMIT
BLANK10	89LNC008-MB1	NTRATED ESTERS	2.5	u MG/L	2.5
BLANK20	89LNC008-MB2	NTRATED ESTERS	2.5	u MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATH MA-HWAAP
WORK ORDER: 2281-03-04-0000

WESTON BATCH #: 39071187

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	39LN008-MB1	NTRATED ESTERS	10.3	2.5 u	10.0	103
BLANK20	39LN008-MB2	NTRATED ESTERS	49.5	2.5 u	50.0	99.3
		NTRATED ESTERS	49.5	2.5 u	50.0	99.0

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2291-08-04-0000

WESTON BATCH #: 8907L18

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC008-MB2	NTRATED ESTERS	99.3	99.0	0.20

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE
RFV #: 3907L153, Air
W.O.#: 2231-08-04

SAMPLES RECEIVED: 07-27-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MI-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.
SSD = Designates sample spiked with target compound in duplicate.
D = Indicates duplicate analysis of a sample.
NS = Not spiked.
DL = Diluted below calibration range.
G = Indicates elevated detection limit due to sample interference.
NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less than
> = Greater than

Analysis Summary:

Samples Collected: 07-25-89
Samples Prepared: 07-28,31-89
Samples Analyzed: 08-07-89

George Pison
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

8/2/89
DATE

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L158

CLIENT: USATHAMA-HAWTHORNE

Page: 1

Sample Information	T2-1		T2-2		T2-1		T2-2		T2-2		Total ug	Total ug	Total ug
	Client ID	FCO	AO	FCO	AO	FCO	AO	FCO	AO				
		047	048	049	050	055	BLANK	BLANK	BLANK	BLANK			
	RFW#:	2500	1.0	2500	1.0	1.0	1.0	1.0	1.0	1.0			BLANK
	D.F.:	2500	1.0	2500	1.0	1.0	1.0	1.0	1.0	1.0			1.0
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug			Total ug
HMX.....		< 3180	16.6G	< 3180	6.24G	< 3180	4.08G	< 3180	6.24G	4.08G	< 1.27	< 1.27	< 1.27
RDX.....		< 2450	< 0.98	< 2450	< 0.98	< 2450	< 0.98	< 2450	< 0.98	< 0.98	< 0.98	< 0.98	< 0.98
1,3,5-TNB.....		< 5230	5.90G	< 5230	< 2.09	< 5230	< 2.09	< 5230	< 2.09	< 2.09	< 2.09	< 2.09	< 2.09
1,3-DNB.....		< 1480	2.78G	< 1480	2.42G	< 1480	2.18G	< 1480	2.42G	2.18G	< 0.59	< 0.59	< 0.59
NITROBENZENE.....		< 1050	< 0.42	< 1050	< 0.42	< 1050	< 0.42	< 1050	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42
TETRYL.....		< 12,500	< 5.00	< 12,500	< 5.00	< 12,500	< 5.00	< 12,500	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
2,4,6-TNT.....		70,400	< 1.92	39,500	< 1.92	39,500	< 1.92	39,500	< 1.92	< 1.92	< 1.92	< 1.92	< 1.92
2,6-DNT.....		< 1000	< 0.40	< 1000	< 0.40	< 1000	0.42G	< 1000	< 0.40	0.42G	< 0.40	< 0.40	< 0.40
2,4-DNT.....		< 1050	< 0.42	< 1050	< 0.42	< 1050	< 0.42	< 1050	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42

Sample Information	20XSS		100XSS		100XSSD	
	Client ID	FCO	FCO	FCO	FCO	FCO
		1.0	1.0	1.0	1.0	1.0
	D.F.:	1.0	1.0	1.0	1.0	1.0
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug
HMX.....		21.9(86.2%)	106(83.4%)	111(87.4%)	111(87.4%)	111(87.4%)
RDX.....		17.3(88.3%)	81.6(83.3%)	85.6(87.3%)	85.6(87.3%)	85.6(87.3%)
1,3,5-TNB.....		31.0(74.2%)	158(75.6%)	162(77.5%)	162(77.5%)	162(77.5%)
1,3-DNB.....		7.68(65.1%)	42.3(71.5%)	42.6(72.2%)	42.6(72.2%)	42.6(72.2%)
NITROBENZENE.....		< 0.42(0.0%)	3.24(7.71%)	3.19(7.57%)	3.19(7.57%)	3.19(7.57%)
TETRYL.....		55.0(55.0%)	330(66.0%)	349(69.8%)	349(69.8%)	349(69.8%)
2,4,6-TNT.....		26(67.7%)	130(67.7%)	129(67.1%)	129(67.1%)	129(67.1%)
2,6-DNT.....		3.09(38.6%)	19.6(49.0%)	18.5(46.3%)	18.5(46.3%)	18.5(46.3%)
2,4-DNT.....		5.36(63.8%)	28.2(67.1%)	26.9(64.0%)	26.9(64.0%)	26.9(64.0%)

G=Elevated



ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE
RFN #: 8907L137, Air
W.O. #: 2281-08-04

SAMPLES RECEIVED: 07-29-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

- SS = Designates sample spiked with target compound.
- SSD = Designates sample spiked with target compound in duplicate.
- D = Indicates duplicate analysis of a sample.
- NS = Not spiked.
- DL = Diluted below calibration range.
- G = Indicates elevated detection limit due to sample interference.
- NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

- < = Less than
- > = Greater than

Analysis Summary:

Samples Collected: 07-26-89
Samples Prepared: 07-29,31-89
Samples Analyzed: 08-07-89

Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

8/21/89
DATE

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L187

CLIENT: USATHAMA-HAWTHORNE

Page: 1

Sample Information	Client		T2-3		T2-3		AO		20XSS
	ID :	FCO	Total ug	Total ug	Total ug	Total ug	BLANK	Total ug	
HMX.....			8.26G	< 1.27	< 1.27	< 1.27		20.8(81.5%)	
RDX.....			< 2.45	2.92G	< 0.98	< 0.98		15.8(80.6%)	
1,3,5-TNB.....			< 5.23	< 2.09	< 2.09	< 2.09		29.1(69.6%)	
1,3-DNB.....			6.64G	3.05G	< 0.59	< 0.59		6.24(52.9%)	
NITROBENZENE.....			< 1.05	< 0.42	< 0.42	< 0.42		< 0.42(0.0%)	
TETRYL.....			< 12.5	< 5.00	< 5.00	< 5.00		53.4(53.4%)	
2,4,6-TNT.....			93.6	< 1.92	< 1.92	< 1.92		21.0(54.7%)	
2,6-DNT.....			< 1.00	< 0.40	< 0.40	< 0.40		2.56(32.0%)	
2,4-DNT.....			< 1.05	< 0.42	< 0.42	< 0.42		4.41(52.5%)	

Sample Information	Client		100XSS		100XSSD	
	ID :	RFW#:	Total ug	Total ug	Total ug	Total ug
HMX.....			99.2(78.1%)	109(85.8%)	109(85.8%)	109(85.8%)
RDX.....			80.8(82.4%)	84.0(85.7%)	84.0(85.7%)	84.0(85.7%)
1,3,5-TNB.....			158(75.6%)	157(75.1%)	157(75.1%)	157(75.1%)
1,3-DNE.....			41.7(70.6%)	39.4(66.8%)	39.4(66.8%)	39.4(66.8%)
NITROBENZENE.....			1.26(3.00%)	4.27(10.2%)	4.27(10.2%)	4.27(10.2%)
TETRYL.....			322(64.4%)	330(66.0%)	330(66.0%)	330(66.0%)
2,4,6-TNT.....			126(65.6%)	124(64.5%)	124(64.5%)	124(64.5%)
2,6-DNT.....			17.7(44.2%)	16.3(40.6%)	16.3(40.6%)	16.3(40.6%)
2,4-DNT.....			26.6(63.3%)	24.6(58.6%)	24.6(58.6%)	24.6(58.6%)

G=Elevated

STACK TEST 3
500°F/36 HOURS
ANALYTICAL DATA SUMMARY

1311R2

WILSTEN

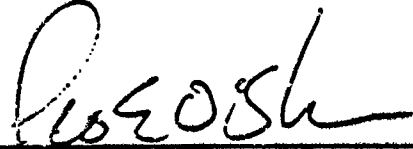
ROY F. TESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-19, 20, 8-1
RFW#: 3907L060, 078, 153, 137
3908L202
W.O.#: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

2/24/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.
- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).
- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).
- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).
- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/90

CLIENT: US:THAMA-HWAAP
WORK ORDER: 2291-08-04-0000

WESTON BATCH #: 390/L060

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-027	UH-PART-FCO-BHW-T3-1	NITRATED ESTERS	26200	UG	5250
-028	UH-PART-FCO-BHA-T3-1	NITRATED ESTERS	9980	UG	1720
-029	UH-PART-AO-FHA-T3-L1	PARTICULATE	0.0009	grams	0.0000
-030	UH-PART-AO-FILT-T3-1	PARTICULATE	0.0016	grams	0.0000
-031	UH-PART-AO-BHW-T3-1	NITRATED ESTERS	3650	UG	3500
-032	UH-PART-AO-BHA-T3-1	NITRATED ESTERS	300	u UG	800
-035	UH-PART-FCO-BHW-T3-2	NITRATED ESTERS	8330	UG	1900
-036	UH-PART-FCO-BHA-T3-2	NITRATED ESTERS	1860	u UG	1880
-037	UH-PART-AO-FHA-T3-2	PARTICULATE	0.0030	grams	0.0000
-038	UH-PART-AO-FLT-T3-2	PARTICULATE	0.0019	grams	0.0000
-039	UH-PART-AO-BHW-T3-2	NITRATED ESTERS	2670	UG	2620
-040	UH-PART-AO-BHA-T3-2	NITRATED ESTERS	500	u UG	500
-045	UH-BLK-FILT-PART	PARTICULATE	0.0001	grams	0.0000
-046	UH-BLK-ACETONE-PART	PARTICULATE	0.0000	grams	0.0000
-047	UH-BLK-PART-WATER	NITRATED ESTERS	975	u UG	975
-053	COMP FCO PART T3-1	NITRATED ESTERS	12.7	UG	10.0
-054	COMP AO PART T3-1	NITRATED ESTERS	12.9	UG	10.0
-055	COMP FCO PART T3-2	NITRATED ESTERS	10.0	u UG	10.0
-056	COMP AO PART T3-2	NITRATED ESTERS	11.4	UG	10.0
-057	COMP OF PART BLANK	NITRATED ESTERS	10.0	u UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/15/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 3907L061

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC004-MB1	NITRATED ESTERS	5.0	u MG/L	5.
BLANK20	89LNC004-MB2	NITRATED ESTERS	5.0	u MG/L	5.
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u MG/L	5.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-RVAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 8907LC50

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC004-MB1	NITRATED ESTERS	10.9	5.0 u	10.0	109
BLANK20	89LNC004-MB2	NITRATED ESTERS	47.8	5.0 u	50.0	95.5
		NITRATED ESTERS	47.9	5.0 u	50.0	95.9
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/15/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 8907106

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC004-MB2	NITRATED ESTERS	95.5	95.9	0.30
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.5

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/50

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 3907L078

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-015	UH-FCO-PART-BHW-T3-3	NITRATED ESTERS	8080	UG	3120
-016	UH-FCO-PART-BHA-T3-3	NITRATED ESTERS	1120	u UG	1120
017	UH-AO-PART-FHA-T3-3	PARTICULATE	0.0033	grams	0.0000
-018	UH-AO-PART-FILT-T3-3	PARTICULATE	0.0024	grams	0.0000
-019	UH-AO-PART-BHW-T3-3	NITRATED ESTERS	6200	UG	3450
-020	UH-AO-PART-BHA-T3-3	NITRATED ESTERS	1200	u UG	1200
-021	UH-PT-FCO-PRE-H2O	NITRATED ESTERS	725	u UG	725
-022	UH-PT-FCO-PRE-ACE	NITRATED ESTERS	1250	u UG	1250
-023	UH-PT-AO-PRE-H2O	NITRATED ESTERS	600	u UG	600
-024	UH-PT-AO-PRE-ACE	NITRATED ESTERS	975	u UG	975
-031	COMP FLO PT T3-3	NITRATED ESTERS	11.5	UG	10.0
-032	COMP AO PT T3-3	NITRATED ESTERS	10.0	u UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/15/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 3907L078

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC004-MB1	NITRATED ESTERS	5.0	u MG/L	5.
BLANK20	89LNC004-MB2	NITRATED ESTERS	5.0	u MG/L	5.
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0	u MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0	u MG/L	5.

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HVAAP
 WORK ORDER: 2291-03-04-0000

WESTON BATCH #: 8907L078

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	89LNC004-MB1	NITRATED ESTERS	10.9	5.0 u	10.0	109
BLANK20	89LNC004-MB2	NITRATED ESTERS	47.3	5.0 u	50.0	95.5
		NITRATED ESTERS	47.9	5.0 u	50.0	95.9
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-03-04-0000

WESTON BATCH #: 3907L01

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	89LNC004-MB2	NITRATED ESTERS	95.5	95.3	0.30
BLANK26	39LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE
RFW #: 3907L060, Air
W.O.#: 2281-08-04

SAMPLES RECEIVED: 07-19-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.
SSD = Designates sample spiked with target compound in duplicate.
D = Indicates duplicate analysis of a sample.
NS = Not spiked.
DL = Diluted below calibration range.
G = Indicates elevated detection limit due to sample interference.
NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less than
> = Greater than

Analysis Summary:

Samples Collected: 07-17-89
Samples Prepared: 07-20-89
Samples Analyzed: 08-07-89

George Perry Jr
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

8/2/89
DATE

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L060

CLIENT: USAYHAMA-HAWTHORNE

Page: 1

Sample Information	T3-1		T3-2		T3-2		T3-2		BLANK	
	Client ID	FCO	AO	FCO	AO	FCO	AO	FCO	AO	FCO
		048	049	050	051	052				
	RFW#:	2500	1.0	25	1.0	1.0				
	D.F.:									
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
HMX		< 3180	< 1.27	< 31.8	< 1.27	< 1.27	< 1.27	< 1.27	< 1.27	< 1.27
RDX		< 2450	< 3.81G	< 24.5	< 3.82G	< 0.98	< 0.98	< 0.98	< 0.98	< 0.98
1,3,5-TNB		< 5230	< 2.09	< 52.3	< 3.46G	< 2.09	< 2.09	< 2.09	< 2.09	< 2.09
1,3-DNB		< 1480	< 5.60G	< 14.8	< 8.40G	< 0.59	< 0.59	< 0.59	< 0.59	< 0.59
NITROBENZENE		< 1050	< 0.42	< 10.5	< 20.2G	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42
TETRYL		< 12,500	< 5.00	< 125	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
2,4,6-TNT		< 89,200	< 1.92	< 64.2	< 1.92	< 1.92	< 1.92	< 1.92	< 1.92	< 1.92
2,6-DNT		< 1000	< 0.40	< 10.0	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
2,4-DNT		< 1050	< 0.42	< 10.5	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42

Sample Information	20XSS		100XSS		100XSSD	
	Client ID	RFW#	D.F.	Units	Total ug	Total ug
HMX		26.7 (105%)			124 (97.6%)	130 (102%)
RDX		20.2 (103%)			99.2 (101%)	100 (102%)
1,3,5-TNB		44.9 (107%)			213 (102%)	210 (100%)
1,3-DNB		11.4 (96.6%)			58.3 (98.8%)	53.4 (90.5%)
NITROBENZENE		< 0.42 (0.0%)			16.2 (38.6%)	< 0.42 (0.0%)
TETRYL		94.4 (94.4%)			475 (95.0%)	472 (94.4%)
2,4,6-TNT		35.7 (92.9%)			185 (96.3%)	187 (97.4%)
2,6-DNT		7.46 (93.2%)			40 (100%)	35.7 (89.3%)
2,4-DNT		7.96 (94.8%)			40.3 (96.0%)	38.3 (91.1%)

G=Elevated



ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE
RFW #: 9907L073, Air
W.O. #: 2281-08-04

SAMPLES RECEIVED: 07-19-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

- SS = Designates sample spiked with target compound.
- SSD = Designates sample spiked with target compound in duplicate.
- D = Indicates duplicate analysis of a sample.
- NS = Not spiked.
- DL = Diluted below calibration range.
- G = Indicates elevated detection limit due to sample interference.
- NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

- < = Less than
- > = Greater than

Analysis Summary:

Samples Collected: 07-18-89
Samples Prepared: 07-21-89
Samples Analyzed: 08-07-89

George Perry Jr
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

8/21/89
DATE

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS
AIR EXPLOSIVES DATA

R#W Batch Number: 3907L078

CLIENT: USATHAMA-HAWTHORNE

Page: 1

Client T3-3 T3-3 ---
 ID : FCO AO
 RFW#: 1-6 COM. 7-12 COM. BLANK
 D.Y.: 10 1.0
 Units: Total ug Total ug Total ug

20XSS
1.0
Total ug

HMX.....	< 12.7	< 1.27	< 1.27	28.4(111%)
RDX.....	< 9.80	2.80G	< 0.98	23.5(120%)
1,3,5-TNB.....	21.7G	2.78G	< 2.09	47.9(115%)
1,3-DNB.....	< 5.90	5.37G	< 0.59	10.4(38.1%)
NITROBENZENE.....	22.0G	< 0.42	< 0.42	0.42(0.0%)
TETRYL.....	< 50.0	< 5.00	< 5.00	111(111%)
2,4,6-TNT.....	171	< 1.92	< 1.92	40.1(104%)
2,6-DNT.....	< 4.00	< 0.40	< 0.40	6.49(81.1%)
2,4-DNT.....	< 4.20	< 0.42	< 0.42	7.79(92.7%)

Client
 ID :
 RFW#:
 D.F.:
 Units:

100XSS
1
Total ug

100XSS
1
Total ug

HMX.....	< 135(106%)	135(106%)	131(103%)
RDX.....	110(112%)	110(112%)	105(107%)
1,3,5-TNB.....	226(108%)	226(108%)	213(102%)
1,3-DNB.....	61.3(104%)	61.3(104%)	55.4(93.5%)
NITROBENZENE.....	8.80(21.0%)	8.80(21.0%)	6.00(14.3%)
TETRYL.....	528(106%)	528(106%)	495(99.2%)
2,4,6-TNT.....	195(102%)	195(102%)	178(97.2%)
2,6-DNT.....	40.1(100%)	40.1(100%)	35.8(89.5%)
2,4-DNT.....	42.0(100%)	42.0(100%)	38.5(91.7%)

G=Elevated

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 07-19-89
RFW #: 8907L060, GC/MS SEMIVOLATILE
W.O.#: 2281-08-02

NARRATIVE

The set of samples consisted of three HPLC extracts prepared on 07-28-89.

The samples were analyzed by GC/MS for HSL Semivolatile target compounds on 09-06-89.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

1. The reported results should be considered qualitative only. Concentrations are not reported for the Tentatively Identified Compounds (TIC's).
2. The samples contained a variety of unknowns and a large unresolved complex of hydrocarbons and fatty acids (C14 and greater). Sample FCO-T3-1 contained higher levels than sample AO-T3-1.

C. Nulton
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

9/13/89
DATE

Roy F. Weston, Inc. - Lionville Laboratory
DNA ANALYTICAL DATA PACKAGE FOR
USATHAMA-HWAAP

DATE RECEIVED: 07/19/89

RFW LOT # :3907L060

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
COMP-FCO-EXP-T3-1	048	AI	89LE0826	07/18/89	07/28/89	09/06/89
COMP AO-EXP-T3-1	049	AI	89LE0825	07/17/89	07/29/89	09/06/89
COMP BLK-EXP	052	AI	89LE0826	07/18/89	07/28/89	09/06/89

Sample Information RWF#: 048 049 052
 Matrix: AIR AIR AIR
 D.F.: 1.00 1.00 1.00
 Units: total ug total ug total ug

Sample Information	RWF#: 048	049	052
Matrix:	AIR	AIR	AIR
D.F.:	1.00	1.00	1.00
Units:	total ug	total ug	total ug
Nitrobenzene-d5	NS	NS	NS
2-Fluorobiphenyl	NS	NS	NS
p-Terphenyl-d14	NS	NS	NS
Phenol-d5	NS	NS	NS
2-Fluorophenol	NS	NS	NS
2,4,6-Tribromophenol	NS	NS	NS
Phenol	64	3	20
bis(2-Chloroethyl)ether	20	20	20
2-Chlorophenol	20	20	20
1,3-Dichlorobenzene	20	20	20
1,4-Dichlorobenzene	20	20	20
Benzyl alcohol	20	20	20
1,2-Dichlorobenzene	20	20	20
2-Methylphenol	20	20	20
bis(2-Chloroisopropyl)ether	20	20	20
4-Methylphenol	20	20	20
N-Nitroso-Di-n-propylamine	20	20	20
Hexachloroethane	20	20	20
Nitrobenzene	20	20	20
Isophorone	20	20	20
2-Nitrophenol	20	20	20
2,4-Dimethylphenol	20	20	20
benzoic acid	E	E	100
bis(2-Chloroethoxy)methane	20	20	20
2,4-Dichlorophenol	20	20	20
1,2,4-Trichlorobenzene	20	20	20
naphthalene	42	15	20
4-Chloroaniline	20	20	20
Hexachlorobutadiene	20	20	20
4-Chloro-3-methylphenol	20	20	20
2-Methylnaphthalene	11	20	20
Hexachlorocyclopentadiene	20	20	20

* Outside of EPA CLP GC Limits.

Chemical Name	046	049	052
2,4,6-Trichlorophenol	20 U	20 U	20 U
2,4,5-trichlorophenol	100 U	100 U	100 U
2-Chloronaphthalene	20 U	20 U	20 U
2-Nitroaniline	100 U	100 U	100 U
Dimethylphthalate	20 U	20 U	20 U
Acenaphthylene	20 U	20 U	20 U
2,6-Dinitrotoluene	20 U	20 U	20 U
3-Nitroaniline	100 U	100 U	100 U
Acenaphthene	20 U	20 U	20 U
2,4-Dinitrophenol	100 U	100 U	100 U
4-Nitrophenol	100 U	100 U	100 U
Dioxacofuran	20 U	20 U	20 U
2,4-Dinitrotoluene	270	20 U	20 U
Diethylphthalate	20 U	140	4 J
4-Chlorophenyl-phenylether	20 U	20 U	20 U
Fluorene	20 U	20 U	20 U
4-Nitroaniline	20 U	20 U	20 U
4,6-Dinitro-2-Ethylphenol	100 U	100 U	100 U
N-Nitrosodiphenylamine (1)	100 U	100 U	100 U
4-Bromophenyl-phenylether	20 U	20 U	20 U
Hexachlorobenzene	20 U	20 U	20 U
Pentachlorophenol	100 U	100 U	100 U
Phenanthrene	20 U	20 U	20 U
Anthracene	20 U	20 U	20 U
Di-n-Butylphthalate	82	68	7 J
Fluoranthene	20 U	20 U	20 U
Pyrene	20 U	20 U	20 U
Butylbenzylphthalate	20 U	5 J	2 J
2,3'-Dichlorobenzidine	40 U	40 U	40 U
Benzo(a)anthracene	20 U	20 U	20 U
Chrysene	20 U	20 U	20 U
Bis(2-ethylhexyl)phthalate	29	40	11 J
Di-n-Octyl phthalate	2 J	4 J	20 U
Benzo(b)fluoranthene	20 U	20 U	20 U
Benzo(k)fluoranthene	20 U	20 U	20 U
Benzo(a)pyrene	20 U	20 U	20 U
Indeno(1,2,3-cd)pyrene	20 U	20 U	20 U
Dibenzo(a,h)anthracene	20 U	20 U	20 U
Benzo(g,h,i)perylene	20 U	20 U	20 U

(1) - Cannot be separated from Diphenylamine. * = Outside of EPA CLP QC limits.

17
 SEMI-VOLATILE ORGANIC ANALYSIS SHEET
 POSITIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

COMP-PCO-KIP-F3-1

Lab Name: ROY Z. WESTON, Inc. Work Order: 2291-08-02-0000

Client: BRACHMA-HECAP

Matrix: AIR Lab Sample ID: 9907L060-048

Sample wt/vol: (g/mL) Lab File ID: 8090605

Level: (low/med) LOW Date Received: 07/19/89

% Moisture: not dec. dec. Date Extracted: 07/28/89

Extraction: (SepF/Cont/Sonc) Date Analyzed: 09/06/89

GPC Cleanup: (Y/N) N pH: Dilution Factor: 1.00

CONCENTRATION UNITS:
 (ug/L or ug/Kg) total ug

Number TICs found: 22

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	TNT	16.35	NA	
2.	TNT	16.53	NA	
3.	UNKNOWN	18.18	NA	
4.	FATTY ACID	18.60	NA	
5.	PHTHALATE	18.73	NA	
6.	UNKNOWN	19.00	NA	
7.	UNKNOWN	19.17	NA	
8.	FATTY ACID	19.58	NA	
9.	UNKNOWN	19.65	NA	
10.	UNKNOWN	19.72	NA	
11.	UNKNOWN	19.85	NA	
12.	FATTY ACID	2 NAO	NA	
13.	UNKNOWN	20.17	NA	
14.	UNKNOWN	20.37	NA	
15.	UNKNOWN	21.00	NA	
16.	UNKNOWN	21.33	NA	
17.	UNKNOWN	21.45	NA	
18.	ALKANE	22.03	NA	
19.	UNKNOWN	22.58	NA	
20.	ALKANE	24.83	NA	
21.	UNKNOWN	25.38	NA	
22.	UNKNOWN	25.77	NA	

17
 SEMI-VOLATILE ORGANICS ANALYSIS REPORT
 TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

CCMP AO-ZXP-T3-1

Lab Name: Ray T. Weston, Inc. Work Order: 2281-08 JA-0000

Client: NEATHAMA-SWAAP

Matrix: AIR Lab Sample ID: 3907L060-049

Sample wt/vol: (g/mL) Lab File ID: 3090604

Level: (low/med) LOW Date Received: 07/19/89

% Moisture: not dec. dec. Date Extracted: 07/28/89

Extraction: (SepF/Cont/Sonc) Date Analyzed: 09/06/89

GPC Cleanup: (Y/N) N pH: Dilution Factor: 1.00

CONCENTRATION UNITS:

Number TICs found: 21

(ug/L or ug/Kg) total ug

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	6.82	NA	
2.	UNKNOWN	7.28	NA	
3.	C6 BENZENE	7.72	NA	
4.	UNKNOWN	8.95	NA	
5.	UNKNOWN	9.23	NA	
6.	UNKNOWN	10.25	NA	
7.	UNKNOWN	10.43	NA	
9.	BENZAMIDE	11.38	NA	
9.	ETHYLBENZOIC ACID	11.55	NA	
10.	ETHYLBENZOIC ACID	11.72	NA	
11.	UNKNOWN	17.58	NA	
12.	FATTY ACID	18.50	NA	
13.	UNKNOWN	19.22	NA	
14.	UNKNOWN	19.90	NA	
15.	FATTY ACID ESTER	19.98	NA	
16.	UNKNOWN	21.47	NA	
17.	UNKNOWN	22.18	NA	
18.	UNKNOWN	22.32	NA	
19.	UNKNOWN	23.15	NA	
20.	UNKNOWN	24.47	NA	
21.	UNKNOWN	25.37	NA	

17
MULTI-RESIDUE ORGANICS ANALYSIS REPORT
POTENTIALLY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

COMP BLX-EXP

Lab Name: Ray F. Weston, Inc. Work Order: 2281-08-02-0000

Client: SEATEMA-SWAAP

Matrix: AIR Lab Sample ID: 89071060-052

Sample wt/vol: _____ (g/mL) _____ Lab File ID: 3090603

Level: (low/med) LOW Date Received: 07/19/89

% Moisture: not dec. _____ dec. Date Extracted: 07/28/89

Extraction: (SepF/Cont/Sonc) _____ Date Analyzed: 09/06/89

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.00

CONCENTRATION UNITS:

Number TICs found: 12 (ug/L or ug/Kg) total ug

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	14.20	NA	
2.	UNKNOWN	19.77	NA	
3.	UNKNOWN	22.53	NA	
4.	UNKNOWN	23.40	NA	
5.	UNKNOWN	23.48	NA	
6.	UNKNOWN	23.55	NA	
7.	UNKNOWN	23.73	NA	
8.	UNKNOWN	23.82	NA	
9.	UNKNOWN	23.93	NA	
10.	UNKNOWN	24.45	NA	
11.	UNKNOWN	24.48	NA	
12.	UNKNOWN	24.78	NA	

July 1990
Revision: Final

STACK TEST 5
500°F/24 HOURS
ANALYTICAL DATA SUMMARY

1311R2

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: USATHAMAHWAAP
SAMPLES RECEIVED: 7-19, 20, 8-1
RW#: 3907L060,073,158, 187
3908L202
W.O.#: 2231-08-02

INORGANIC NITRATES

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The methodology used to analyze these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.



Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

7/24/90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CIP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

- MB - Method or preparation blank.
- MS - Matrix Spike.
- MSD - Matrix Spike Duplicate.
- REP - Sample Replicate.
- LC - Indicates a method LCS or Blank Spike.
- NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

- MAAW - Metals prep test for AA digestion, water matrix.
- MAAS - Metals prep test for AA digestion, soil matrix.
- MICW - Metals prep test for ICP digestion, water matrix.
- MICS - Metals prep test for ICP digestion, soil matrix.

- M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

- M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

- M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

- I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/90

CLIENT: USATHAMA-NHAAP
 WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8903L202

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-003	UH-FCO-PART-BHW T5-1	NITRATED ESTERS	17800	UG	1120
-004	UH-FCO-PART-BHA T5-1	NITRATED ESTERS	6050	UG	950
-005	UH-FCO-PART-FHA T5-1	PARTICULATE	0.0043	grams	0.0000
-006	UH-AO-PART-FILT T5-1	PARTICULATE	0.0015	grams	0.0000
-007	UH-AO-PART-BHW T5-1	NITRATED ESTERS	2240	UG	1550
-008	UH-AO-PART-BHA T5-1	NITRATED ESTERS	238	u UG	288
-023	UH-FCO-PART-BHW T5-2	NITRATED ESTERS	1340	UG	1180
-024	UH-FCO-PART-BHA T5-2	NITRATED ESTERS	238	u UG	238
-025	UH-AO-PART-FHA T5-2	PARTICULATE	0.0025	grams	0.0000
-026	UH-AO-PART-FILT T5-2	PARTICULATE	0.0005	grams	0.0000
-027	UH-AO-PART-BHW T5-2	NITRATED ESTERS	1820	u UG	1820
-028	UH-AO-PART-BHA T5-2	NITRATED ESTERS	750	u UG	750
-029	UH-BLK TRAIN FHA T5-	PARTICULATE	0.0007	grams	0.0000
-030	UH BLK TRAIN BHAT5-	PARTICULATE	0.0001	grams	0.0000
-031	UHBLK TRAIN BHW T5-2	NITRATED ESTERS	688	u UG	588
-032	UHBLK TRAIN BHA T5-2	NITRATED ESTERS	225	u UG	225
-047	UH-FCO-PART-BHW T5-3	NITRATED ESTERS	4660	UG	1080
-048	UH-FCO-PART-BHA T5-3	NITRATED ESTERS	462	u UG	462
-049	UH-AO-PART-FHA T5-3	PARTICULATE	0.0016	grams	0.0000
-050	UH-AO-PART-FILT T5-3	PARTICULATE	0.0000	grams	0.0000

ROY F. NESTON INC.

INORGANICS DATA SUMMARY REPORT 02/16/00

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

NESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORT LIMIT
-051	UH-AO-PART-BHW T5-3	NITRATED ESTERS	1220	u UG	1220
-052	UH-AO-PART-BHA T5-3	NITRATED ESTERS	138	u UG	138
-065	COMP-FLO-PT-T5-1	NITRATED ESTERS	5.0	u UG	5.
-066	COMP-AO-PT-T5-1	NITRATED ESTERS	5.0	u UG	5.
-069	COMP FLO-PT-T5-2	NITRATED ESTERS	5.0	u UG	5.
-070	COMP AO-PT-T5-2	NITRATED ESTERS	5.0	u UG	5.
-071	COMP-BT-PT	NITRATED ESTERS	5.0	u UG	5.
-074	COMP FLO-PT-T5-3	NITRATED ESTERS	5.0	u UG	5.
-075	COMP AO-PT-T5-3	NITRATED ESTERS	5.0	u UG	5.

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-04-0000

WESTON BATCH #: 8908LE02

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5	u MG/L	2.5
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5	u MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
 WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8908L20

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%REC
BLANK10	89LN009-MB1	NITRATED ESTERS	10.3	2.5 u	10.0	100
BLANK20	89LN009-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99
		NITRATED ESTERS	49.5	2.5 u	50.0	99

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8902L202

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK20	69LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20



ROY F. WESTON, INC.
Lisnville Laboratory

CLIENT: USATHAMA -- HAWTHORNE
RFW #: 8907L202, Air
W.O.#: 2231-08-04

SAMPLES RECEIVED: 03-01-89

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.

SSD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Results for T5-1 FCO represent a minimum value as the front half XAD sample was broken during sample preparation. Observations indicate that the majority of explosives have been contained in the front half solvent rinse for Hawthorne MM-5 explosives in air samples.

Data Qualifiers

< = Less than
> = Greater than

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

Analysis Summary:

Samples Collected: 07-29,30-89
Samples Prepared: 08-02-89
Samples Analyzed: 08-10-89

Carter Nulton
Carter Nulton, Ph.D.
Vice President/Laboratory Manager
Lionville Analytical Laboratory

8/31/89
DATE

WESTON ANALYTICS
AIR EXPLOSIVES DATA

RFW Batch Number: 8907L202

CLIENT: USATHAMA-HAWTHORNE

Page: 1

Sample Information	Client ID	T5-1		T5-2		T5-2		T5-3		Total ug	Total ug	
		FCO	Total ug	FCO	Total ug	FCO	Total ug	FCO	Total ug			
HMX.....		2380	<	127	<	127	<	1.47G	<	12.7	<	1.27
RDX.....		1840	<	98.0	<	98.0	<	2.57G	<	9.80	<	2.84G
1,3,5-TNB.....		3920	<	2.09	<	209	<	2.19G	<	20.9	<	7.62G
1,3-DNB.....		1110	<	2.63G	<	59.0	<	7.60G	<	5.90	<	1.90G
NITROBENZENE.....		788	<	0.42	<	42.0	<	1.56G	<	4.20	<	1.91G
TETRYL.....		9380	<	5.00	<	500	<	5.00	<	50.0	<	5.00
2,4,6-TNT.....		76,800	<	1.92	<	677	<	1.92	<	184	<	1.92
2,6-DNT.....		750	<	0.40	<	40	<	0.40	<	4.00	<	0.40
2,4-DNT.....		780	<	0.42	<	42	<	0.42	<	4.20	<	0.42

Sample Information	Client ID	BLANK		20XSS		100XSS		100XSSD	
		Total ug	Total ug	Total ug	Total ug	Total ug	Total ug		
HMX.....		1.27	<	24.2(95.3%)	<	126(99.2%)	<	126(99.2%)	
RDX.....		0.98	<	20.2(103%)	<	106(108%)	<	108(110%)	
1,3,5-TNB.....		2.09	<	43.6(104%)	<	230(110%)	<	233(111%)	
1,3-DNB.....		0.59	<	3.32(70.5%)	<	57.9(98.1%)	<	54.4(92.2%)	
NITROBENZENE.....		0.42	<	0.42(0.0%)	<	0.42(0.0%)	<	0.42(0.0%)	
TETRYL.....		5.00	<	102(102%)	<	565(113%)	<	582(116%)	
2,4,6-TNT.....		1.92	<	39.4(103%)	<	215(112%)	<	213(111%)	
2,6-DNT.....		0.40	<	4.78(59.8%)	<	37.6(94.0%)	<	33.2(83.0%)	
2,4-DNT.....		0.42	<	6.40(76.1%)	<	43.5(104%)	<	42.2(100%)	

G=Elevated

APPENDIX H

ANALYTICAL DATA SUMMARY TABLES FOR TEST ITEMS

COMPUTER GENERATED ANALYTICAL DATA SUMMARY TABLES

Appendix H contains computer-generated analytical data summary tables. The tables have been prepared for pre-test and post-test sampling events.

The tables provide the following information:

- Equipment (test item) type.
- Sample matrix (wipe, rinsate or solid).
- Units.
- Contaminant mass or concentration.
- Total explosives concentration (sum of individual explosives contaminants (excludes nitrocellulose and nitroglycerin)).

A key of the sample identification conventions is provided in Table H-1.

Sample results exceeding the method detection limit (or estimated as J values) are shown in bold print.

If the analysis indicated that the compound was present below the method detection limit, the detection limit is shown with the classification U (e.g., 635U signifies that the contaminant was not present above the detection level of 635 ug).

Detection limits vary by matrix and dilution factor. In some cases, if the TNT concentration in a particular sample was high, a dilution was required to bring the concentration within the calibration range. The detection limits for the remainder of explosives analytes (e.g., tetryl) were increased proportionately.

In some cases, the mass of some contaminants is shown as a "J" value (i.e., 3.35J). This indicates that the compound was determined to be present but below the detection level. The value is estimated.

The presence of nitrobenzene in many of the wipe samples is attributable to field/laboratory contamination as discussed in Section 8 of the main report. Table 8-9 summarizes all of the nitrobenzene results.

The concentrations of some contaminants, specifically TNT in the sediment from the clay pipe, are reported as over one million parts per million (e.g., for pre-Test 15 samples, the concentration of TNT is reported as 1,246,000 ug/g). This anomaly is due to the reporting procedure. Concentrations are reported

Table H-1

Sample Identification Conventions

U	-	Below Detection Limit
J	-	Estimated Concentration
ug	-	Microgram
CP	-	Clay Pipe
PB	-	Powder Box
HN	-	Naip Mine
SSR	-	Shell Support Rack
SP	-	Steel Pipe
AP	-	Aluminum Pipe
FLASH WALL	-	Flash Chamber Wall
SHR	-	Steam-Heated Riser
SHV	-	Steam-Heated Valve
FLD BLNK	-	Field Blank
R	-	Rinsate Sample
W	-	Wipe Sample
SAP	-	Spike Applicator
DUP	-	Duplicate
S	-	Spike Rinsate

as weight of TNT to weight of soil. Apparently, in this case, if the weight of TNT exceeded the weight of soil, the concentration is over 100 percent, as shown for the following hypothetical case:

- Initial TNT mass - 100 grams
- Initial soil mass - 50 grams
- Concentration (ppm) = $\text{mass TNT} / \text{mass soil} \times 100\%$
= $100 \text{ grams} / 50 \text{ grams} \times 100\%$
= 200%

July 1990
Revision: Final

TEST RUN 2
400°/24 HOURS

1311R2

HW/AP - Hot Gas Filtr Study
Pre Test 2 - 400 Deg F, 24 Hrs

TEST ITEM	MATERIAL	UNITS	HMK	FOX	1,3,5- TMS	1,3- E,13	N3	TE13VL	2,4,6- TMT	2,6- DET	2,4- DET	TOTAL PARTICLES
MOTOR SOAK												
PA 1	RAISE	Total U9	655 U	241500 U	113000 U	31900 U	22700 U	270000 U	143000 U	21000 U	127000 U	460000 U
PA 2	RAISE	Total U9	655 U	400 U	1030 U	205 U	210 U	2300 U	900 U	200 U	210 U	0
SSR 1	WIPE	Total U9	127 U	0 U	1000 U	205 U	210 U	2500 U	900 U	200 U	210 U	0
SSR 1 SPK	RAISE	Total U9	1300 U	10300 U	23000 U	6000 U	640 U	60000 U	470 U	400 U	420 U	470
SSR 1 DECON	WIPE	Total U9	127 U	900 U	2000 U	600 U	670	6000 U	192 U	400 U	420 U	870
SSR 2	WIPE	Total U9	127 U	900 U	2000 U	600 U	410	6000 U	192 U	400 U	420 U	410
SSR 2 SPK	RAISE	Total U9	3500 U	2740 U	5000 U	1850 U	1100 U	14000 U	14100 U	1120 U	1180 U	14100 U
SSR 2 DECON	WIPE	Total U9	127 U	900 U	2000 U	600 U	600 U	6000 U	192 U	400 U	420 U	850

July 1980
Revision: Final

TEST RUN 3
500°F/36 HOURS

1311R2

HWAAP - Hot Gas Fillet Study
 Fire Test 3 - 500 Deg F, 3d Fire

TEST ITEM	MATRIX	UNITS	HEAT	NOX	1,3,5- Total	1,3- Total	NB	TEHRA	2,4,6- Total	2,6- Diff	2,4- Diff	Estimated Carbon	TOTAL Particulate
SSR1W1	WIFE	Total U	127 U	950 U	209 U	590 U	840	500 U	192 U	400 U	420 U	N/A (1)	500
SSR1W1	WIFE	Total U	644	634	703 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	1500
SSR1W2	WIFE	Total U	460	960 U	209 U	590 U	810	500 U	192 U	400 U	420 U	N/A (1)	455
SSR1W2	WIFE	Total U	127 U	720	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	720
SSR1W3	WIFE	Total U	260	960 U	209 U	590 U	420 U	500 U	214	400 U	420 U	N/A (1)	293
SSR1W3	WIFE	Total U	127 U	493	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	493
SSR1W4	WIFE	Total U	181	311	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	462
SSR1W5	WIFE	Total U	127 U	645	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	645
SSR1W5	WIFE	Total U	283	960 U	209 U	590 U	420 U	500 U	491	400 U	420 U	N/A (1)	319
SSR2 DECON	WIFE	Total U	26.6	76.2	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	162
SSR2 8PK	FWISE	Total U	16500 U	12700 U	27300 U	7870 U	5490 U	6000 U	13200	5200 U	5400 U	N/A (1)	13300
SSR2 W1	WIFE	Total U	613	960 U	209 U	590 U	720	500 U	192 U	400 U	420 U	N/A (1)	620
SSR2 W1	WIFE	Total U	127 U	676	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	976
SSR2 W2	WIFE	Total U	365	467	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	762
SSR2 W3	WIFE	Total U	221	418	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	659
SSR2 W4	WIFE	Total U	167	327	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	464
SSR2 W5	WIFE	Total U	149	294	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	443
SHR 10.1E V2	WIFE	U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	10.0 U	0
CHR 10.1E V2	WIFE	U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	10.0 U	0

(1) - Furocellulose and Nitrocellulose not Analyzed.

(2) - Explosives Compounds not Analyzed.

HVA-0 - 100% - Pilot Study
Post Test 3 - 5/8/09 - 5/8/09

TEST ITEM	MATRIX	UNIT	FAUX	FOX	1,3,5- TMS	1,4- TMS	TEHVL	2,4,4- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	2,6- TBT	TOTAL CONCENTRATIONS	
PA 1 P1	SOE	Total UG	127 U	0.60 U	2.04 U	0.60 U	5.01 U	1.62 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0
PA 1 P2	FWISE	Total UG	635 U	4.0 U	10.5 U	2.65 U	25.00 U	9.3 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	0
PA 1 P3	FWISE	Total UG	635 U	4.0 U	10.5 U	2.65 U	25.00 U	9.3 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	0
PA 1 P4	FWISE	Total UG	635 U	4.0 U	10.5 U	2.65 U	25.00 U	9.3 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	2.35 U	0
PA 1 W1	WAPI	Total UG	127 U	0.60 U	2.04 U	0.60 U	5.01 U	1.62 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.05
SHIP MUSE W1	WAPI	Total UG	127 U	0.60 U	2.04 U	0.60 U	5.01 U	1.62 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.05
SHIP 1 R1	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R1 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R2	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R2 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R3	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R3 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R4	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R4 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R5	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R5 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R6	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R6 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R7	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R7 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R8	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0
SHIP 1 R8 DUP	FWISE	Total UG	191 U	1.7 U	4.7 U	1.2 U	7.9 U	2.6 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0

(1) - Nondetected Esters not Analyzed
(2) - Nondetected Compounds not Analyzed

**HWAAP - Hot Gas Pilot Study
Post Test 3 - 500 Deg F, 36 Hrs**

TEST ITEM	LOCATION	DATE	TIME	TEMP	HT	2,4-D LIST	2,4-D DNT	W/THINK	TOTAL
SR12R1	FANSE	Total UG	181 U	750 U	268 U	600 U	630 U	N/A (1)	0
SR12R2	FANSE	Total UG	181 U	750 U	268 U	600 U	630 U	N/A (1)	0
SR12R3	FANSE	Total UG	181 U	750 U	268 U	600 U	630 U	N/A (1)	0
SR12R4	FANSE	Total UG	181 U	750 U	268 U	600 U	630 U	N/A (1)	0
SR12R5	FANSE	Total UG	181 U	750 U	268 U	600 U	630 U	N/A (1)	0
SR12R6	FANSE	Total UG	181 U	750 U	268 U	600 U	630 U	N/A (1)	0
SR11R1	FANSE	Total UG	835 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SR11R2	FANSE	Total UG	835 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SR11R3	FANSE	Total UG	835 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SR11R4	FANSE	Total UG	835 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SSR1W1	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	10.7
SSR1W2	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	6.67
SSR1W3	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	6.67
SSR1W4	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	6.33
SSR1W5	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	12.0
SSR1W6	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	14.7
SSR1W7	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	13.9
SSR1W8	W/PE	Total UG	127 U	500 U	192 U	400 U	420 U	N/A (1)	6.23
SRUP MRJE V12	W/PE	Total UG	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)

(1) - Nitrocellulose not Analyzed.

(2) - Explosives Compounds not Analyzed.

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TEST RUN 5
500°F/24 HOURS

1311R2

HWAAP - Hot Gas Pilot Study
 Pre Test 5 - 500 Deg F, 24 Hrs

TEST ITEM	MATRIX	UNITS	MAX	NOX	1,3,5-THF	1,3-GLD	NO	TETRAH	2,4,6-TNT	2,3-DHT	2,4-DHT	INITIATED	TOTAL
CLAY PIPE	SOI	U	12700 U	6500 U	20000 U	5300 U	4500 U	50000 U	830000	4000 U	4500 U	N/A (1)	830000
GEAR OIL	COI	U	144 U	215 U	237 U	633 U	476 U	582 U	217 U	453 U	476 U	N/A (1)	2150
PB 1 R1/R2	RWSE	Total U	835 U	490 U	1050 U	295 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
PB 2 R1/R2	RWSE	Total U	835 U	490 U	1050 U	295 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
SIMP M3/E W1	WIPE	Total U	43 U	86 U	209 U	577 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	43 U
SIMP M3/E W1	WIPE	Total U	157 U	300 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	43 U
SSR 1 SPK	RWSE	Total U	7940 U	0130 U	13100 U	3330 U	2636 U	31300 U	403000	2300 U	133	N/A (1)	133
SSR 1 TOP W	WIPE	Total U	127 U	080 U	202 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	43000
SSR 1 WI/W4	WIPE	Total U	209	080 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 WI/W4	WIPE	Total U	127 U	67	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	218
SSR 2 SPK	RWSE	Total U	12700 U	9600 U	21600 U	5900 U	4200 U	50000 U	340000	4000 U	4200 U	N/A (1)	637
SSR 2 TOP W	WIPE	Total U	127 U	080 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	30000
SSR 2 WI/W4	WIPE	Total U	127 U	080 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SP BLK	WIPE	Total U	127 U	080 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SP BLK	WIPE	Total U	127 U	080 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	453
SIMP M3/E W2	WIPE	Total U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	400 U	420 U	N/A (2)	0
SIMP M3/E W2	WIPE	Total U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	400 U	420 U	N/A (2)	500 U
SIMP M3/E W2	WIPE	Total U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	400 U	420 U	N/A (2)	500 U
SIMP M3/E W2	WIPE	Total U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	400 U	420 U	N/A (2)	500 U

(1) - Nitiated Exces not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
 Post Test 5 - 600 Deg F, 24 Hrs

TEST ITEM	MATRIX	Units	Peak	NDX	1,2,6 Yield	1,3- Loss	MB	TEL:VL	2,4,6- THF	2,6- DHF	2,4- DHF	INITIALS DATE	TOTAL
CHL 3 WALL	WPE	Total Uq	127 U	960 U	20.0 U	560 U	17.8	600 U	19.2 U	400 U	4.20 U	N/A (1)	37.5
CHL 3 WALL BL	WPE	Total Uq	127 U	960 U	20.9 U	570 U	9.29	530 U	19.2 U	400 U	4.20 U	N/A (1)	8.30
CLAY PIPE	SOIL	U/W	127 U	0.50 U	2.09 U	0.390 U	0.42 U	600 U	1.92 U	0.400 U	0.420 U	N/A (1)	0
CP FLD BLK	R/ISE	Total Uq	65.0 U	73.5 U	157.5 U	44.3 U	31.5 U	37.5 U	144 U	30.0 U	31.5 U	N/A (1)	0
MOTOR R/ISE	R/ISE	Total Uq	60.0 U	61.60 U	100.00 U	30.700 U	21.60 U	20.00 U	22.00 U	2.000 U	21.60 U	N/A (1)	0
PB 1 R1	R/ISE	Total Uq	65.5 U	466 U	105.3 U	205 U	210 U	2500 U	560 U	200 U	210 U	N/A (1)	0
PB 1 R2	R/ISE	Total Uq	63.5 U	390 U	105.3 U	295 U	210 U	2500 U	560 U	200 U	210 U	N/A (1)	0
PB 1 R3	R/ISE	Total Uq	63.5 U	400 U	105.3 U	295 U	210 U	2500 U	560 U	200 U	210 U	N/A (1)	0
PB 1 R4	R/ISE	Total Uq	65.5 U	490 U	105.3 U	295 U	210 U	2500 U	560 U	200 U	210 U	N/A (1)	0
PB FLD BLK	R/ISE	Total Uq	114 U	68.2 U	189 U	53.1 U	37.8 U	450 U	172.8 U	58.0 U	37.8 U	N/A (1)	0
SHIP BLK W1	WPE	Total Uq	127 U	960 U	20.9 U	600 U	20.1	500 U	19.2 U	400 U	4.20 U	N/A (1)	30.1
SHR 1 R1	R/ISE	Total Uq	191 U	147 U	315 U	68.5 U	63.0 U	760 U	268 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	R/ISE	Total Uq	191 U	147 U	315 U	64.5 U	63.0 U	750 U	268 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	R/ISE	Total Uq	191 U	147 U	315 U	63.5 U	63.0 U	750 U	265 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	R/ISE	Total Uq	191 U	147 U	315 U	63.5 U	63.0 U	750 U	268 U	60.0 U	63.0 U	N/A (1)	0
SHR FLD BLK	R/ISE	Total Uq	95.3 U	73.5 U	158 U	44.3 U	31.5 U	375 U	144 U	30.0 U	31.5 U	N/A (1)	0
SSR 2 W1	WPE	Total Uq	127 U	960 U	20.9 U	560 U	24.2	500 U	16.2 U	400 U	4.20 U	N/A (1)	24.2
SSR 2 W2	WPE	Total Uq	127 U	960 U	20.9 U	530 U	7.24	500 U	19.2 U	400 U	4.20 U	N/A (1)	7.24
SSR 2 W3	WPE	Total Uq	127 U	280 U	20.9 U	560 U	4.94	600 U	19.2 U	400 U	4.20 U	N/A (1)	4.94
SSR 2 W4	WPE	Total Uq	127 U	960 U	20.9 U	590 U	3.02 J	500 U	19.2 U	400 U	4.20 U	N/A (1)	0
SSR 2 W5	WPE	Total Uq	127 U	960 U	20.9 U	590 U	26.6	500 U	19.2 U	400 U	4.20 U	N/A (1)	23.8
SSR 2 W6	WPE	Total Uq	127 U	960 U	20.9 U	590 U	6.71	500 U	19.2 U	400 U	4.20 U	N/A (1)	6.71
SSR 2 W7	WPE	Total Uq	127 U	960 U	20.9 U	590 U	4.84	500 U	19.2 U	400 U	4.20 U	N/A (1)	4.84
SSR 2 W8	WPE	Total Uq	127 U	960 U	20.9 U	590 U	3.06 J	500 U	19.2 U	400 U	4.20 U	N/A (1)	0
CHL 3 WALL W2	WPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	0
SHIP BLK W2	WPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.60 U	0

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

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TEST RUN 3
400°F/36 HOURS

1311R2

HWAAP - Hot Gas Pilot Study
 Pre Test 8 - 400 Deg F, 30 hrs

TEST ITEM	MATRIX	Units	Max	ROX	1,3,6 Yield	1,2 Load	N3	TETHVL	2,4,6-Tol	2,6 Diff	2,4-Diff	Unk'd Compounds	Total
CLAY PRE	GCAL	Total UG	1270 U	630 U	2000 U	500 U	430 U	5000 U	8000 U	400 U	400 U	N/A (1)	0
CP FLD BLNK	FWISE	Total UG	672 U	441 U	945 U	270 U	160 U	225 U	884 U	180 U	180 U	N/A (1)	0
FB1 RI/R4	FWISE	Total UG	635 U	400 U	1050 U	265 U	210 U	2500 U	900 U	200 U	210 U	N/A (1)	0
FB2 RI/R4	FWISE	Total UG	635 U	400 U	1050 U	265 U	210 U	2500 U	900 U	200 U	210 U	N/A (1)	0
SP2 LAKE W1	WPE	Total UG	618 U	920 U	200 U	211 U	730 U	51 U	348 U	400 U	420 U	N/A (1)	170
SP2 LAKE W1	WPE	Total UG	1270 U	930 U	2000 U	500 U	420 U	5000 U	1020 U	400 U	400 U	N/A (1)	500
SP1 FLD BLNK	WPE	Total UG	127 U	960 U	200 U	695 U	484 U	50 U	192 U	400 U	420 U	N/A (1)	424
SSR1 8PK	FWISE	Total UG	19700 U	15200 U	32500 U	9143 U	6510 U	77500 U	211000 U	6200 U	6510 U	N/A (1)	211000
SSR1 W1/W4	WPE	Total UG	912 U	208 U	200 U	690 U	187 U	60 U	192 U	400 U	420 U	N/A (1)	472
SSR1 Y-S/W8	WPE	Total UG	630 U	960 U	200 U	690 U	187 U	60 U	148 U	400 U	420 U	N/A (1)	723
SSR1 W3/W8	WPE	Total UG	127 U	1470 U	200 U	620 U	420 U	600 U	192 U	400 U	420 U	N/A (1)	1470
SSR2 8PK	FWISE	Total UG	19700 U	15200 U	32500 U	9150 U	6510 U	77500 U	237700 U	6200 U	6510 U	N/A (1)	237700
SSR2 W1/W4	WPE	Total UG	127 U	960 U	200 U	690 U	187 U	60 U	192 U	400 U	420 U	N/A (1)	323
SSR2 W3/W8	WPE	Total UG	127 U	960 U	200 U	690 U	187 U	60 U	428 U	400 U	420 U	N/A (1)	708
SP WAX	FWISE	Total UG	1970 U	1520 U	3250 U	915 U	651 U	7750 U	16500 U	620 U	651 U	N/A (1)	16500
SP WAX	FWISE	Total UG	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	130	130
SP1 FLD BLNK	WPE	Total UG	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	2.85	2.85

(1) - Method Extent not Analyzed
 (2) - Explosives Compounds not Analyzed

**HWAAP - Hot Gas Fillet Study
Post Test 8 - 400 Deg F, 36 Hrs**

TEST ITEM	MATRIX	Units	HBAK	RDX	1,3,5- THB	1,3- DNT	NB	TETRAVL	2,4,6- TNT	2,6- DNT	2,4- DNT	INITIATED G.I.T. (1)	TOTAL Explosives (2)
SSR1 W1	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	5.20 U	N/A (1)	0
SSR1 W2	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR1 W3	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR1 W4	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR1 W5	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR1 W6	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR1 W7	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR1 W8	WIPE	Total U	12.7 U	9.60 U	20.9 U	6.90 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SP R1	RWSE	Total U	635 U	490 U	1050 U	285 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R2	RWSE	Total U	635 U	490 U	1050 U	285 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R3	RWSE	Total U	635 U	490 U	1050 U	285 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
CHAB WALL W2	WIPE	Total U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	210 U	N/A (1)	0
SHIP L2 RE W2	WIPE	Total U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	7.50	N/A (3)
SM FLS B1AK	WIPE	Total U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	8.3	N/A (3)
													5.00 U

(1) - Nitrated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
 Post test 8 - 400 Deg F, 30 Hrs

TEST ITEM	MATRIX	UNITS	MAX	FDX	1,3,5- TPE	1,3- Diox	NA	TETRAH	2,4,6- THT	2,6- DIB	2,4- DIB	ESTIMATED ESTANE	TOTAL CAP. CONC.
BEAKER FRISE	FRISE	Total ug	159 U	129 U	203 U	738 U	52.5 U	62.5 U	240 U	500 U	52.5 U	N/A (1)	0
CHRB WALL	WIPE	Total ug	127 U	980 U	209 U	560 U	420 U	530 U	192 U	400 U	420 U	N/A (1)	0
CHRB WALL BL	WIPE	Total ug	127 U	980 U	209 U	560 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
CLAY PTE	SOIL	ug/g	127 U	0.525 U	209 U	0.550 U	0.420 U	500 U	6.03	0.400 U	0.420 U	N/A (1)	6.03
CFRID BLNK	FRISE	Total ug	159 U	129 U	263 U	733 U	52.5 U	825 U	240 U	500 U	52.5 U	N/A (1)	0
PB 1 R1	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 1 R2	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 1 R3	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 1 R4	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 2 R1	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 2 R2	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 2 R3	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
PB 2 R4	FRISE	Total ug	635 U	460 U	1050 U	263 U	210 U	2500 U	1130	200 U	210 U	N/A (1)	1130
SHIP MATE W1	WIPE	Total ug	127 U	980 U	209 U	560 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SHR 1 F1	FRISE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	268 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 F2	FRISE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	268 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	FRISE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	268 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	FRISE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	268 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 F1R1R2R3R4	FRISE	Total ug	191 U	147 U	315 U	88.5 U	63.0 U	750 U	268 U	60.0 U	63.0 U	N/A (1)	0

(1) - Analyzed Fractions not Analyzed.

(2) - Explosives Components not Analyzed.

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TEST RUN 13
5007/12 HOURS

1311R2

HWAAP - Hot Gas Pilot Study
Post Test 13 - 600 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	HWX	FDX	1,3,6- Tolu	1,3- Xylol	NB	TETRAV	2,4,6- TMT	2,3- DIT	2,4- DIT	UNSATURATED Ethers	TOTAL Ethers
AP R1	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
AP R2	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
AP R3	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
AP R4	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
CHIB WALL	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
CHIB WALL BL	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
CLAY PPE	SOA	Uq/A	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
CP FLD BLNK	RWSE	Total Uq	159 U	123 U	283 U	0.500 U	0.420 U	5.00 U	1.74 J	0.400 U	0.420 U	N/A (1)	0
PB 2 R1	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
PB 2 R2	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
PB 2 R3	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
PB 2 R4	RWSE	Total Uq	635 U	400 U	1050 U	203 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
PB FLD BLNK	RWSE	Total Uq	159 U	123 U	283 U	0.500 U	0.420 U	5.00 U	1.74 J	0.400 U	0.420 U	N/A (1)	0
SRP MINE W1	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SRP 1 R1	RWSE	Total Uq	191 U	147 U	315 U	88.5 U	630 U	750 U	288 U	600 U	630 U	N/A (1)	0
SRP 1 R2	RWSE	Total Uq	191 U	147 U	315 U	88.5 U	630 U	750 U	288 U	600 U	630 U	N/A (1)	0
SRP 1 R3	RWSE	Total Uq	191 U	147 U	315 U	88.5 U	630 U	750 U	288 U	600 U	630 U	N/A (1)	0
SRP 1 R4	RWSE	Total Uq	191 U	147 U	315 U	88.5 U	630 U	750 U	288 U	600 U	630 U	N/A (1)	0
SRP FLD BLNK	RWSE	Total Uq	185 U	127 U	273 U	78.7 U	518 U	650 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W1	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W2	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W3	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W4	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W5	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W6	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W7	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W8	WPE	Total Uq	127 U	90 U	209 U	80 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SRP MINE W2	WPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (1)
CHIB WALL W2	WPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (1)
SM FLD BLNK	WPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	7.50	N/A (2)

(1) - Harmed Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

... Retrievial File: hwaap Nara C-24

July 1990
Revision: Final

TEST RUN 14
400°F/12 HOURS

1311R2

HWAAP - Hot Gas Pilot Study
Pre Test 14 - 400 Deg F, 12 Hrs

TEST ITEM	MATRIX	UMTB	HDX	HDX	RDX	1,3,5-TRB	1,3-Diox	NB	TETRYL	2,4,6-TRT	2,5-DIT	2,4-DIT	INITIATED	TOTAL
CLAYP-E	BOL	127.00 U	127.00 U	630.0 U	2850.0 U	500.0 U	500.0 U	4200 U	50000 U	554000	4000 U	4200 U	N/A (1)	50000
CP FLD. BLANK	RINSE	159 U	159 U	123 U	283 U	73.8 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1 RI/R4	RINSE	635 U	635 U	490 U	1050 U	205 U	205 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
PB 2 RI/R4	RINSE	635 U	635 U	480 U	1050 U	205 U	205 U	210 U	2500 U	630 U	200 U	210 U	N/A (1)	0
SRP MJE V1	WIPE	127 U	127 U	99 U	209 U	59.0 U	59.0 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SR FLD. BLANK	WIPE	127 U	127 U	99 U	209 U	59.0 U	59.0 U	4.20 U	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	0
SSR 1SPK	RINSE	1588 U	1588 U	1230 U	2650 U	733 U	733 U	525 U	6250 U	201000	500 U	188	N/A (1)	50000
SSR 1SPK	RINSE	15200 U	15200 U	12300 U	26300 U	7350 U	7350 U	5250 U	62500 U	643000	5000 U	5200 U	N/A (1)	50000
SSR 1SPK	RINSE	19100 U	19100 U	14700 U	31600 U	8850 U	8850 U	6300 U	75000 U	280000	6000 U	6300 U	N/A (1)	0
SSR 1 W1/W4	WIPE	127 U	127 U	99 U	209 U	59.0 U	59.0 U	18.9	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	16.9
SSR 1 W5/W8	WIPE	127 U	127 U	99 U	209 U	59.0 U	59.0 U	16.6	50.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	16.8
SSR 2 SPK	RINSE	19100 U	19100 U	14700 U	31500 U	8850 U	8850 U	6300 U	75000 U	340000	6000 U	6300 U	N/A (1)	340000
SSR 2 SPK	RINSE	1590 U	1590 U	1090 U	2300 U	738 U	738 U	525 U	6250 U	355000	500 U	415	N/A (1)	355000
SSR 2 SPK	RINSE	1590 U	1590 U	1090 U	2300 U	738 U	738 U	525 U	6250 U	355000	500 U	415	N/A (1)	355000
SSR 2 W1/W4	WIPE	127 U	127 U	99 U	209 U	59.0 U	59.0 U	25.4	80.0 U	19.2 U	4.00 U	4.20 U	N/A (1)	29.4
SSR 2 W5/W8	WIPE	127 U	127 U	99 U	209 U	59.0 U	59.0 U	4.20 U	50.0 U	16.2 U	4.00 U	4.20 U	N/A (1)	0
SRP MJE V2	WIPE	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SR FLD BLANK	WIPE	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitroed Esters not Analyzed

(2) - Explosive Compounds not Analyzed

**HWAAF - Hot Gas Pilot Study
Post Test 14 - 400 Deg F, 12 Hrs**

TEST ITEM	MATRIX	URATS	Flux	ROX	1,3- Tred	1,3- Urad	NA	TEHVL	2,4- Trit	2,6- Drit	2,4- Trit	collected isotopes	TOTAL CPM
CHIB WALLB	WIPE	Total UG	127 U	0.83 U	209 U	630 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
CLAY PIPE	SOIL	UG	127 U	0.83 U	21 U	0.50 U	0.80 U	515 U	192 U	0.400 U	0.400 U	N/A (1)	0
CP FLD BLK	RUNSE	Total UG	150 U	123 U	263 U	738 U	210 U	255 U	240 U	500 U	525 U	N/A (1)	0
FB : R1	RUNSE	Total UG	835 U	490 U	1033 U	225 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R2	RUNSE	Total UG	635 U	480 U	1020 U	205 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R3	RUNSE	Total UG	635 U	480 U	1020 U	205 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB 1 R4	RUNSE	Total UG	635 U	480 U	1020 U	205 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
PB FLD BLK	RUNSE	Total UG	150 U	123 U	263 U	738 U	210 U	255 U	240 U	500 U	525 U	N/A (1)	0
SP MP MIE W1	WIPE	Total UG	127 U	0.80 U	209 U	630 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 R1	RUNSE	Total UG	772	630	669	665 U	630 U	750 U	8150	600 U	166	N/A (1)	0
SSR 1 R2	RUNSE	Total UG	720	630	672	683 U	650 U	750 U	8420	600 U	119	N/A (1)	0
SSR 1 R3	RUNSE	Total UG	450	2030	338	885 U	630 U	750 U	8150	600 U	139	N/A (1)	0
SSR 1 R4	RUNSE	Total UG	284	840	316 U	885 U	630 U	750 U	3380	600 U	73	N/A (1)	0
SM FLD BLK	RUNSE	Total UG	150 U	123 U	263 U	738 U	210 U	255 U	210 U	500 U	525 U	N/A (1)	0
SSR 1 W1	WIPE	Total UG	383	980 U	272	680 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W2	WIPE	Total UG	127 U	0.80 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W3	WIPE	Total UG	127 U	0.80 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W4	WIPE	Total UG	127 U	0.80 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W5	WIPE	Total UG	127 U	0.80 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W6	WIPE	Total UG	127 U	0.80 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W7	WIPE	Total UG	127 U	0.80 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR 1 W8	WIPE	Total UG	127 U	0.80 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SP R1	RUNSE	Total UG	595 U	480 U	1030 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R2	RUNSE	Total UG	605 U	480 U	1020 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R3	RUNSE	Total UG	480 U	480 U	1020 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
SP R4	RUNSE	Total UG	480 U	480 U	1020 U	295 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0
WALL FLD BLK	WIPE	Total UG	127 U	0.90 U	209 U	590 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SHIP MIE W2	WIPE	Total UG	N/A (2)	N/A (2)	N/A (2)	1.50 U	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	1.50 U
CHIB WALL V2	WIPE	Total UG	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	20.3	1.50 U
SM FLD BLK	WIPE	Total UG	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	1.50 U

July 1990
Revision: Final

TEST RUN 15
600°F/12 HOURS

1311R2

**HiWAP - Hot Gas Pilot Study
Fire Test 15 - 60W Dry F, 1E Fire**

TEST ITEM	MATERIAL	Units	MAX	ROK	15.6 TUE	1.3 DND	HA	1ETH01	2.4.6 TUE	2.6 DREF	2.4 DREF	Initiated Count	TOTAL Estimate
AP1 S R/1SE	R/1SE	Total Wg	150 U	116 J	32.5 J	73.8 U	52.5 U	653 U	2.0 U	50.0 U	50.0 U	1.5 (1)	6.5
AP1 S R/1SE	R/1SE	Total Wg	1500 U	1250 U	2000 U	7350.6 U	5250 U	6350 U	3000 U	50.0 U	50.0 U	N/A (1)	3000
AP2 S R/1SE	R/1SE	Total Wg	1500 U	240 J	2000 U	720 U	525 U	6250 U	2400 U	500 U	500 U	N/A (1)	8.5
AP2 S R/1SE	R/1SE	Total Wg	1500 U	1250 U	2000 U	738.0 U	525 U	6250 U	81.5 J	500 U	500 U	N/A (1)	81.5
CLAY PIPE	SOM	Total Wg	12700 U	6000 U	20000 U	84200 U	4200 U	50000 U	887000 U	4000 U	4000 U	N/A (1)	140000
CP FLD B/1K	R/1SE	Total Wg	19 U	123 U	203 U	73.8 U	52.5 U	625 U	240 U	50.0 U	50.0 U	N/A (1)	0
CP FLD B/1K	R/1SE	Total Wg	19 U	123 U	203 U	73.8 U	52.5 U	625 U	240 U	50.0 U	50.0 U	N/A (1)	0
PB1 R/1A	R/1SE	Total Wg	635 U	400 U	700 U	245 U	210 U	2500 U	0.430 J	200 U	200 U	N/A (1)	0
PB2 R/1A	R/1SE	Total Wg	635 U	400 U	700 U	245 U	210 U	2500 U	0.430 J	200 U	200 U	N/A (1)	0
SHIP R/1E	W/1E	Total Wg	127 U	90 U	200 U	270 J	130 J	600 U	106	400 U	400 U	N/A (1)	1.3
SM FLD B/1K	W/1E	Total Wg	127 U	90 U	200 U	270 J	130 J	600 U	106	400 U	400 U	N/A (1)	1.3
SSR1 R/1SE	R/1SE	Total Wg	191 U	116	26.3 J	8.53	6.30 U	750 U	10.1 J	4.20 U	4.20 U	N/A (1)	0
SSR1 R/1SE	R/1SE	Total Wg	1910 U	1470 U	3150 U	8950 U	6300 U	7500 U	32.5 J	600 U	600 U	N/A (1)	12.5
SSR1 R/1SE	R/1SE	Total Wg	1910 U	1470 U	3150 U	8950 U	6300 U	7500 U	32.5 J	600 U	600 U	N/A (1)	12.5
SSR1 W/1A	W/1E	Total Wg	127 U	90 U	200 U	270 J	130 J	600 U	106	400 U	400 U	N/A (1)	1.3
SSR1 W/1A	W/1E	Total Wg	127 U	90 U	200 U	270 J	130 J	600 U	106	400 U	400 U	N/A (1)	1.3
SSR1 W/1A	W/1E	Total Wg	127 U	90 U	200 U	270 J	130 J	600 U	106	400 U	400 U	N/A (1)	1.3
SSR2 R/1SE	R/1SE	Total Wg	1910 U	1470 U	3150 U	8950 U	6300 U	7500 U	32.5 J	600 U	600 U	N/A (1)	12.5
SSR2 R/1SE	R/1SE	Total Wg	1910 U	1470 U	3150 U	8950 U	6300 U	7500 U	32.5 J	600 U	600 U	N/A (1)	12.5
SSR2 R/1SE	R/1SE	Total Wg	1910 U	1470 U	3150 U	8950 U	6300 U	7500 U	32.5 J	600 U	600 U	N/A (1)	12.5
SSR2 W/1A	W/1E	Total Wg	20.8	41.0	20.9 U	5.90 U	4.20 U	50.0 U	10.1 J	4.00 U	4.00 U	N/A (1)	0.24
SSR2 W/1A	W/1E	Total Wg	20.8	41.0	20.9 U	5.90 U	4.20 U	50.0 U	10.1 J	4.00 U	4.00 U	N/A (1)	0.24
SSR2 W/1A	W/1E	Total Wg	20.8	41.0	20.9 U	5.90 U	4.20 U	50.0 U	10.1 J	4.00 U	4.00 U	N/A (1)	0.24
SSR2 W/1A	W/1E	Total Wg	20.8	41.0	20.9 U	5.90 U	4.20 U	50.0 U	10.1 J	4.00 U	4.00 U	N/A (1)	0.24
SHIP R/1E W2	W/1E	Total Wg	526	2445	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	40.0 U	N/A (1)	50.0
SHIP R/1E W2	W/1E	Total Wg	526	2445	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	40.0 U	N/A (1)	50.0
SHIP R/1E W2	W/1E	Total Wg	526	2445	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	40.0 U	N/A (1)	50.0
SHIP R/1E W2	W/1E	Total Wg	526	2445	209 U	59.0 U	42.0 U	500 U	192 U	40.0 U	40.0 U	N/A (1)	50.0
SM FLD B/1K	W/1E	Total Wg	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	6.60	N/A (2)
SM FLD B/1K	W/1E	Total Wg	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitrocellulose not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
Post Test 15 - 600 Deg F, 12 Hrs

TEST ITEM	MATRIX	UNITS	H1RX	HDX	1,3,6- THB	1,3- DIB	NB	TETHYL	2,4,6- TNT	2,6- DIT	2,4- DIT	INITIATED RATINGS	TOTAL EXPLOSIVES
SSR 1W1	WIPE	Total U9	127 U	6.63 U	20.9 U	5.60 U	4.20 U	50.0 U	4.80 J	4.00 U	1.30 J	N/A (1)	0
SSR 1W2	WIPE	Total U9	127 U	9.63 U	20.9 U	5.60 U	4.20 U	50.0 U	2.50 J	1.20 J	4.20 U	N/A (1)	0
SSR 1W3	WIPE	Total U9	127 U	9.63 U	20.9 U	5.60 U	4.20 U	50.0 U	1.40 J	4.00 U	4.20 U	N/A (1)	0
SSR 1W4	WIPE	Total U9	127 U	9.60 U	20.9 U	5.30 U	4.20 U	50.0 U	1.60 J	4.00 U	4.20 U	N/A (1)	0
SSR 1W5	WIPE	Total U9	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	9.60 J	4.00 U	1.30 J	N/A (1)	0
SSR 1W6	WIPE	Total U9	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	2.50 J	4.00 U	1.40 J	N/A (1)	0
SSR 1W7	WIPE	Total U9	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	2.90 J	4.00 U	1.40 J	N/A (1)	0
SSR 1W8	WIPE	Total U9	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	2.30 J	4.00 U	1.40 J	N/A (1)	0
SSR FLD BLNK	WIPE	Total U9	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	2.90 J	4.00 U	1.40 J	N/A (1)	0
WALL FLD BLNK	WIPE	Total U9	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	2.30 J	4.00 U	1.40 J	N/A (1)	0
SHR W/IE V/2	WIPE	Total U9	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 J	4.00 U	1.50 J	N/A (1)	0
SM FLD BLNK	WIPE	Total U9	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CHMB WALL W/2	WIPE	Total U9	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	7.90	N/A (2)
CHMB WALL BLNK	WIPE	Total U9	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Initiated Cases not Analyzed

(2) - Explosives Compounds not Analyzed

HWAAP - Hot Gas Relief Study
 Post Test 15 - 600 Deg F, 12 Hrs

TEST ITEM	MATRIX	Units	MSX	FDK	1.3.4- Total	1.3- Dist	Na	TRINVL	2.4.4- TNT	2.4- Dist	2.4- Dist	Retained Solids	Total Exposures
AP 1 R1	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
AP 1 R2	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
AP 1 R3	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
AP 1 R4	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
AP FLD BLNK	RINSE	Total Uq	159 U	121 U	283 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
CHUB WALL W1	WIPE	Total Uq	127 U	98.0 U	209 U	6.90 U	4.20 U	50.0 U	1.90 J	4.00 U	1.90 J	N/A (1)	0
CLAY PIPE	SOIL Uq	Total Uq	127 U	98.0 U	209 U	0.550 U	0.40 U	5.00 U	1.02 U	0.400 U	0.420 U	N/A (1)	0
CP FLD BLNK	RINSE	Total Uq	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB 1 R1	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
PB 1 R2	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
PB 1 R3	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
PB 1 R4	RINSE	Total Uq	635 U	400 U	1030 U	235 U	210 U	2300 U	600 U	200 U	210 U	N/A (1)	0
PB FLD BLNK	RINSE	Total Uq	159 U	123 U	263 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHR MADE W1	WIPE	Total Uq	127 U	98.0 U	209 U	6.90 U	4.20 U	50.0 U	1.90 J	4.00 U	1.70 J	N/A (1)	0
SHR 1 R1	RINSE	Total Uq	191 U	147 U	315 U	88.5 U	63.0 U	750 U	260 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R2	RINSE	Total Uq	191 U	147 U	315 U	88.5 U	63.0 U	750 U	260 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R3	RINSE	Total Uq	191 U	147 U	315 U	88.5 U	63.0 U	750 U	260 U	60.0 U	63.0 U	N/A (1)	0
SHR 1 R4	RINSE	Total Uq	191 U	147 U	315 U	88.5 U	63.0 U	750 U	260 U	60.0 U	63.0 U	N/A (1)	0
SHR FLD BLNK	RINSE	Total Uq	191 U	147 U	315 U	88.5 U	63.0 U	750 U	260 U	60.0 U	63.0 U	N/A (1)	0
SM FLD BLNK	WIPE	Total Uq	127 U	98.0 U	209 U	6.90 U	4.20 U	50.0 U	1.90 J	4.00 U	1.40 J	N/A (1)	0

(1) - Narrated Exposed not Analyzed.

(2) - Exposures Compounds not Analyzed.

July 1990
Revision: Final

TEST RUN 16
800°/6 HOURS

1311R2

HWAAP - Hot Gas Fillet Study
Pre Test 16 - 600 Deg F, 5 Hrs

TEST ITEM	MATRIX	Units	HLIX	ROX	1,3,6- Tol	1,3- Diox	NB	TEDYL	2,4,6- TBT	2,4- Diox	2,4- Diox	Estimated Leakage	TOTAL Concentration
CLAY F/E	SOE	U/A	127.0 U	6.00 U	26500 U	5630 U	4200 U	50000 U	165000	4600 U	4600 U	N/A (1)	165000
CP FLD BLNK	FW/SE	Total Uq	159 U	123 U	263 U	738 U	52.5 U	625 U	240 U	50.0 U	23.5 U	N/A (1)	0
PB 1 RI/R4	FW/SE	Total Uq	635 U	490 U	1030 U	295 U	210 U	2500 U	600 U	200 U	210 U	N/A (1)	0
PB 2 RI/R4	FW/SE	Total Uq	635 U	490 U	1030 U	295 U	210 U	2500 U	600 U	200 U	210 U	N/A (1)	0
PB FLD BLNK	FW/SE	Total Uq	159 U	123 U	263 U	738 U	52.5 U	625 U	240 U	50.0 U	23.5 U	N/A (1)	0
SHIP MAKE W1	WIPE	Total Uq	127 U	3.20 J	6.20 J	4.60 J	4.20 U	50.0 U	65.2	4.00 U	30.6	N/A (1)	63.6
SM FLD BLNK	WIPE	Total Uq	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	1.30 J	4.00 U	1.30 J	N/A (1)	0
SSR 1 SPK	FW/SE	Total Uq	1910 U	1470 U	3150 U	885 U	630 U	7500 U	2600 U	600 U	485 J	N/A (1)	0
SSR 1 SPK	FW/SE	Total Uq	1910 U	1470 U	3150 U	885 U	630 U	7500 U	2600 U	600 U	485 J	N/A (1)	0
SSR 1 W1/W4	WIPE	Total Uq	127 U	9.60 U	6.10 J	5.60 U	4.20 U	50.0 U	4.70 J	4.00 U	4.20	N/A (1)	165000
SSR 1 W1/W4	WIPE	Total Uq	34.4	2.40	17.6 J	3.10 J	19.4	50.0 U	8.16	4.00 U	6.00	N/A (1)	4.20
SSR 2 SPK	FW/SE	Total Uq	1910 U	1470 U	3150 U	885 U	630 U	7500 U	2600 U	600 U	485 J	N/A (1)	0
SSR 2 SPK	FW/SE	Total Uq	1910 U	1470 U	3150 U	885 U	630 U	7500 U	2600 U	600 U	485 J	N/A (1)	0
SSR 2 W1/W4	WIPE	Total Uq	127 U	9.60 U	23.9 U	5.90 U	4.20 U	50.0 U	0.600 J	4.00 U	3.60 J	N/A (1)	0
SSR 2 W1/W4	WIPE	Total Uq	127 U	9.60 U	23.9 U	5.90 U	4.20 U	50.0 U	0.600 J	4.00 U	3.60 J	N/A (1)	0
SSR 2 W5/W8	WIPE	Total Uq	378	1610	203 U	590 U	420 U	500 U	92.7	4.00 U	2.70 J	N/A (1)	97.0
SSR 2 W5/W8	WIPE	Total Uq	378	1610	203 U	590 U	420 U	500 U	92.7	4.00 U	2.70 J	N/A (1)	97.0
SSR FLD BLNK	WIPE	Total Uq	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	1.20 J	4.00 U	1.20 J	N/A (1)	0
SHIP MAKE W2	WIPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SHIP FLD BLNK	WIPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Nitated Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
 Post Test 16 - 600 Deg F, 6 Hrs

TEST ITEM	MATRIX	INITS	HEAT	ROX	1,3,6 T.D.	1,3 Deg	NB	TELHVL	2,4,6 THT	2,6 DHT	2,4 DHT	Estimated cellulose	TOTAL Explosives
CLAY/PE	SOIL	UW	127 U	0.60 U	2.00 U	0.60 U	0.42 U	5.00 U	1.82 U	0.400 U	0.420 U	N/A (1)	0
CP FLD BLK	RUISE	Total Uq	159 U	123 U	233 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
FC FLD BLK	WIPE	Total Uq	127 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	10.8 J	4.00 U	1.16 J	N/A (1)	0
FL CHAB WALL	WIPE	Total Uq	127 U	9.60 U	20.9 U	5.90 U	4.20 U	50.0 U	14.8 J	4.00 U	2.39 J	N/A (1)	0
PE 1 DWP	RUISE	Total Uq	254 U	108 U	418 U	118 U	84.0 U	1000 U	384 U	80.0 U	84.0 U	N/A (1)	0
PB FLD BLK	RUISE	Total Uq	150 U	123 U	253 U	73.8 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
PB1R1	RUISE	Total Uq	635 U	450 U	1050 U	285 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
PB1R2	RUISE	Total Uq	635 U	450 U	1050 U	285 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
PB1R3	RUISE	Total Uq	635 U	450 U	1050 U	285 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
PB1R4	RUISE	Total Uq	635 U	450 U	1050 U	285 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
SHIP W/ALUE W1	WIPE	Total Uq	127 U	9.80 U	20.9 U	5.90 U	4.20 U	50.0 U	7.99 J	4.00 U	2.39 J	N/A (1)	0
SHR1 DUP	RUISE	Total Uq	254 U	108 U	418 U	118 U	84.0 U	1000 U	384 U	80.0 U	84.0 U	N/A (1)	0
SHR FLD BLK	RUISE	Total Uq	159 U	123 U	263 U	73.6 U	52.5 U	625 U	240 U	50.0 U	52.5 U	N/A (1)	0
SHR1R1	RUISE	Total Uq	635 U	450 U	1050 U	275 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
SHR1R2	RUISE	Total Uq	635 U	450 U	1050 U	275 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
SHR1R3	RUISE	Total Uq	635 U	450 U	1050 U	275 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0
SHR1R4	RUISE	Total Uq	635 U	450 U	1050 U	275 U	210 U	2500 U	950 U	200 U	210 U	N/A (1)	0

(1) - Nitrated Esters not Analyzed.
 (2) - Explosives Compounds not Analyzed.

NW/AAP - Hot Gas Pilot Study
 Post Test 16 - 600 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	Wt %	RDY	13.5- TINT	1.3- Dist	NO	TEHRVL	2.4.9- TINT	2.6- Dist	2.4- TINT	W/Filtered L. Exp.	Total Explosives
SH1 DAP	RIUSE	Total Uq	254 U	1.2 U	418 U	118 U	840 U	10.0 U	364 U	8.0 U	4.0 U	N/A (1)	0
SH1 FLD. BLNK	RIUSE	Total Uq	159 U	123 U	263 U	738 U	525 U	635 U	240 U	200 U	52.0 U	N/A (1)	0
SH1 R1	RIUSE	Total Uq	635 U	450 U	1085 U	295 U	210 U	2500 U	7.3 U	210 U	210 U	N/A (1)	0
SH1 R2	RIUSE	Total Uq	635 U	490 U	1050 U	295 U	210 U	2500 U	9.6 U	210 U	210 U	N/A (1)	0
SH1 R3	RIUSE	Total Uq	635 U	490 U	1050 U	295 U	210 U	2500 U	9.6 U	210 U	210 U	N/A (1)	0
SH1 R4	RIUSE	Total Uq	635 U	490 U	1050 U	295 U	210 U	2500 U	9.6 U	210 U	210 U	N/A (1)	0
SH1 FLD. BLNK	WIPE	Total Uq	127 U	98 U	209 U	590 U	420 U	500 U	10.5 U	4.0 U	1.20 J	N/A (1)	0
SSR FLD. BLNK	WIPE	Total Uq	127 U	580 U	209 U	590 U	420 U	500 U	17.3 U	4.0 U	1.60 J	N/A (1)	0
SSR W1	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	12.1 U	4.0 U	4.20 U	N/A (1)	0
SSR W2	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	0.70 J	4.0 U	4.20 U	N/A (1)	0
SSR W3	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	10.3 U	4.0 U	4.20 U	N/A (1)	0
SSR W4	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	8.65 J	4.0 U	1.00 J	N/A (1)	0
SSR W5	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	0.70 J	4.0 U	4.20 U	N/A (1)	0
SSR W6	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	13.2 J	4.0 U	4.20 U	N/A (1)	0
SSR W7	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	1.3 J	4.0 U	1.00 J	N/A (1)	0
SSR W8	WIPE	Total Uq	127 U	980 U	209 U	690 U	420 U	500 U	10.2 J	4.0 U	4.20 U	N/A (1)	0
SHIP WALL W2	WIPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
SM FLD BLNK	WIPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CRIB WALL W2	WIPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)
CRIB WALL BL	WIPE	Total Uq	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	5.00 U	N/A (2)

(1) - Noted Esters not Analyzed.

(2) - Explosives Compounds not Analyzed.

July 1980
Revision: Final

TEST RUN 17
600°F/26 HOURS

1311R2

HWAAP - Hot Gas Pilot Study
 Pre Test 17 - 600 Deg F, 46 Hrs

EQUIPMENT	MATHX	UNITS	HMIX	ROX	1,3,5 TMS	1,3 DMS	MS	TETRAH	2,4,6 TMT	2,6 DIT	2,4 DIT	Unkntd Estnd	Total Enrichment
AP 1	Raise Total Uq	840	450 U	1050 U	235 U	210 U	2500 U	7250	200 U	210 U	N/A (1)	12700	
AP 1	Raise Total Uq	6350 U	30300	10560 U	2050 U	2100 U	25000 U	5600 U	2000 U	2100 U	N/A (1)	52000	
AP 2	Raise Total Uq	6780	17300	10560 U	205 U	210 U	2500 U	848 J	200 U	210 U	N/A (1)	24100	
AP FID BLNK	Raise Total Uq	155 U	125 U	265 U	738 U	525 U	625 U	240 U	500 U	525 U	N/A (1)	0	
PB FID BLNK	Raise Total Uq	159 U	123 U	283 U	38 U	525 U	625 U	240 U	500 U	525 U	N/A (1)	0	
PB 1	Raise Total Uq	635 U	490 U	1050 U	265 U	210 U	2500 U	110 J	200 U	210 U	N/A (1)	0	
PB 2	Raise Total Uq	635 U	100 J	1050 U	265 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0	
PB 3	Raise Total Uq	635 U	110 J	1050 U	265 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0	
SHR 1	Raise Total Uq	722 U	0.14 J	1260 U	354 U	252 U	3000 U	1150 U	240 U	252 U	N/A (1)	0	
SHR 2	Raise Total Uq	290 J	3250	1260 U	354 U	252 U	3000 U	180 J	240 U	252 U	N/A (1)	3400	
SHR FID BLNK	Raise Total Uq	180 U	123 U	263 U	738 U	525 U	625 U	240 U	500 U	525 U	N/A (1)	0	
SHV 1	Raise Total Uq	100 J	490 U	1056 U	205 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0	
SHV 2	Raise Total Uq	635 U	490 U	1056 U	205 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0	
SHV FID BLNK	Raise Total Uq	159 U	123 U	263 U	738 U	525 U	625 U	240 U	500 U	525 U	N/A (1)	1770	
SP FID BLNK	Raise Total Uq	159 U	123 U	263 U	738 U	525 U	625 U	240 U	500 U	525 U	N/A (1)	0	
SP 1	Raise Total Uq	635 U	490 U	1050 U	265 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0	
SP 2	Raise Total Uq	635 U	490 U	1050 U	265 U	210 U	2500 U	960 U	200 U	210 U	N/A (1)	0	

(2) - Explosives Compounds Not Analyzed

(1) - Nitrited Esters Not Analyzed

HWAAP - Hot Gas Pilot Study
 Post Test 17 - 800 Deg F, 48 Hrs

EQUIPMENT	MATRIX	UNITS	AMMONIUM PICRATE
AP 1 R1	RINSE	Total ug	10000 U
AP 1 R2	RINSE	Total ug	10000 U
AP 1 R3	RINSE	Total ug	10000 U
AP 1 R4	RINSE	Total ug	10000 U
AP FLD BLNK	RINSE	Total ug	10000 U
CHMB WALL BLK	WIPE	Total ug	10.0 U
CHMB WALL W1	WIPE	Total ug	10.0 U
PB 1 R1	RINSE	Total ug	10000 U
PB 1 R2	RINSE	Total ug	10000 U
PB 1 R3	RINSE	Total ug	10000 U
PB 1 R4	RINSE	Total ug	10000 U
PB FLD BLNK	RINSE	Total ug	10000 U
SHR 1 R1	RINSE	Total ug	10000 U
SHR 1 R2	RINSE	Total ug	10000 U
SHR 1 R3	RINSE	Total ug	10000 U
SHR 1 R4	RINSE	Total ug	10000 U
SHR FLD BLK	RINSE	Total ug	10000 U
SHV 1 R1	RINSE	Total ug	10000 U
SHV 1 R2	RINSE	Total ug	10000 U
SHV 1 R3	RINSE	Total ug	10000 U
SHV 1 R4	RINSE	Total ug	10000 U
SHV FLD BLK	RINSE	Total ug	10000 U
SP FLD BLNK	RINSE	Total ug	10000 U
SP R1	RINSE	Total ug	10000 U
SP R2	RINSE	Total ug	10000 U
SP R3	RINSE	Total ug	10000 U
SP R4	RINSE	Total ug	10000 U

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TEST RUN 13
500°F/6 HOURS

1311R2

HWAAP - Hot Gas Pilot Study
Pre Test 18 - 500 Deg F, 6 hrs

TEST ITEM	MATRIX	UNITS	HDX	NOX	1,3,6- Toluene	1,3- Dioxin	H6	YESTER Supplies	2,4,6- TNT	2,6- DIBP	2,4- DIBP	Estimated Estimate	TOTAL Estimate
CLAY W/PE	SOIL	Wt	12700 U	6000 U	20700 U	5000 U	4200 U	5000 U	10500 U	4000 U	4200 U	N/A (1)	0
CLAY P/PE	SOIL	Wt	127 U	50 U	209 U	500 U	420 U	500 U	0	400 U	420 U	N/A (1)	4500
CP FLD BLK	RNISE	Total Wt	159 U	123 U	283 U	738 U	525 U	625 U	0	500 U	525 U	N/A (1)	0
PB FLD BLK	RNISE	Total Wt	159 U	123 U	283 U	738 U	525 U	625 U	0	500 U	525 U	N/A (1)	0
P3 1	RNISE	Total Wt	635 U	143 J	1650 U	295 U	210 U	2500 U	0	200 U	210 U	N/A (1)	0
P3 2	RNISE	Total Wt	635 U	143 U	1650 U	295 U	210 U	2500 U	0	200 U	210 U	N/A (1)	0
SNIP M/PE	W/PE	Total Wt	127 U	960 U	305	500 U	211 U	500 U	192 U	400 U	397	N/A (1)	896
SNIP M/PE	W/PE	Total Wt	4430	800 U	209 U	500 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	4430
SNIP M/PE	W/PE	Total Wt	12700 U	2950 U	20500 U	5000 U	4200 U	5000 U	4820	4000 U	4200 U	N/A (1)	37100
SNIP FLD BLK	W/PE	Total Wt	127 U	960 U	209 U	500 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR1 FLD BLK	W/PE	Total Wt	127 U	209 U	209 U	500 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	0
SSR1 FLD BLK	RNISE	Total Wt	635 U	493 U	105 U	295 U	210 U	2500 U	0	200 U	210 U	N/A (1)	0
SSR1 W/VA	W/PE	Total Wt	210 J	143	209 U	500 U	420 U	500 U	1500	200 U	700	N/A (1)	1310
SSR1 W/VA	W/PE	Total Wt	481	960 U	209 U	500 U	420 U	500 U	192 U	400 U	420 U	N/A (1)	249
SSR1 W/VA	W/PE	Total Wt	127 U	1000	209 U	500 U	420 U	500 U	216	400 U	420 U	N/A (1)	667
SSR2 SP/PE H	RNISE	Total Wt	635 U	493 U	105 U	295 U	210 U	2500 U	192 U	400 U	420 U	N/A (1)	1630
SSR2 W/VA	W/PE	Total Wt	127 U	360 J	209 U	500 U	420 U	500 U	3750	200 U	600	N/A (1)	3600
SSR2 W/VA	W/PE	Total Wt	127 U	960 U	209 U	500 U	420 U	500 U	130 J	400 U	420 U	N/A (1)	657
SNIP M/PE W2	W/PE	Total Wt	127 U	960 U	209 U	500 U	420 U	500 U	305 J	400 U	420 U	N/A (1)	0
SNIP M/PE W2	W/PE	Total Wt	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	279	N/A (2)
SNIP FLD BLK	W/PE	Total Wt	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	500 U	N/A (2)

(1) - Nitrocellulose not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Pilot Study
 Post Test 18 - 600 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	HMX	RDX	1,3,5- TriD	1,3- DiD	NS	TETRA	2,4,6- TNT	2,6- DNT	2,4- DNT	INITIATED CONTENTS	TOTAL EXPLOSIVES
CHMB WALL BL	WIPE	Total Wt	127 U	560 U	208 U	560 U	430 U	500 U	192 U	400 U	420 U	N/A (1)	0
CHMB WALL WI	WIPE	Total Wt	127 U	960 U	208 U	560 U	430 U	500 U	192 U	470 U	420 U	N/A (1)	0
CLAY PIPE	LOW	Wt/A	127 U	0.560 U	2.08 U	0.560 U	0.430 U	5.00 U	1.92 U	0.400 U	0.420 U	N/A (1)	0
CLAY PIPE BL	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	997	460 U	100 U	105 U	N/A (1)	0
PB 1 R1	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB 1 R2	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB 1 R3	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB 1 R4	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
PB FLD BULK	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
GRAP MATE WI	WIPE	Total Wt	127 U	960 U	208 U	560 U	430 U	500 U	192 U	400 U	420 U	N/A (1)	0
SHR 1 R1	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHR 1 R2	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHR 1 R3	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHR 1 R4	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SHR FLD BULK	FWISE	Total Wt	318 U	245 U	523 U	148 U	105 U	1250 U	480 U	100 U	105 U	N/A (1)	0
SM FLD BULK	WIPE	Total Wt	127 U	960 U	208 U	560 U	430 U	500 U	192 U	400 U	420 U	N/A (1)	0

(1) - Initiated Explosives not Analyzed.
 (2) - Explosive Components not Analyzed.

HWAAP - Hot Gas Filter Study
 Fuel Test 18 - 800 Deg F, 6 Hrs

TEST ITEM	MATRIX	UNITS	HMW	ROX	1.3E- DWT	1.3- DWT	kg	1.3E- DWT	2.4E- DWT	2.4- DWT	2.4- DWT	2.4- DWT	2.4- DWT	2.4- DWT	2.4- DWT	TOTAL
SSR1W1	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR1W2	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR1W3	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR1W4	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR1W5	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR1W6	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR1W7	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR1W8	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SSR FLD BLNK	WIPE	Total Wt	127 U	9.60 U	20.9 U	5.90 U	4.20 U	5.00 U	19.2 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	0	
SMPL MINE W2	WIPE	Total Wt	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	0	
SM FLD BLNK	WIPE	Total Wt	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	0	
CHIB WALL W2	WIPE	Total Wt	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	0	
CHIB WALL BL	WIPE	Total Wt	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	0	
MOTOR SOAK	WIPE	Total Wt	20 U	170 U	370 U	160 U	75 U	600 U	340 U	70 U	70 U	70 U	70 U	70 U	0	

(1) - Normal Esters not Analyzed.

(2) - Explosive Compounds not Analyzed.

APPENDIX I
EXAMPLE CALCULATIONS

1311R2

Appendix I contains the following calculations:

- Calculations to determine time for slab to reach temperature.
- Heat balance calculations for Test Runs T2, T3, and T5.

**CALCULATIONS TO
DETERMINE TIME FOR SLAB
TO REACH TEMPERATURE**

1311R2



SHEET 1 of 6

CLIENT/SUBJECT _____	W.O. NO. _____
TASK DESCRIPTION <u>Time For Slab To Reach Temperature</u>	TASK NO. _____
PREPARED BY <u>NPS</u> DEPT <u>1311</u> DATE _____	APPROVED BY _____
MATH CHECK BY _____ DEPT _____ DATE _____	
METHOD REV. BY _____ DEPT _____ DATE _____	
DEPT _____	DATE _____

The following calculations have been prepared to determine the time required for items to reach target temperature.

ASSUMPTIONS:

- 1) Rectangular slab will be evaluated
- 2) Length = 1 FT
- 3) Height = 1 FT
- 4) MATERIAL OF CONSTRUCTION - STEEL

Calculations will be prepared for 4 separate cases:

- 500 lb slab
- 1000 lb slab
- 1500 lb slab
- Slab that is as large as permissible in chamber (6 FT H x 20 FT L x 6 FT E)

Unsteady-state conditions exist. Slab will be placed at front of chamber (near door) in vicinity of air discharge duct (i.e., worst case - lowest air temperatures).

The heat transfer coefficient for the system was calculated to be 1.44 BTU/hr Ft² °F (see worksheet - insulation calculations for flash chamber).

DATA:

$$\begin{aligned}k_{\text{steel}} &= 25.9 \text{ BTU/hr Ft}^2 (\text{°F/Ft}) @ 212\text{°F} \text{ (Bennett; Myers, 2nd Ed, Page 773)} \\C_{\text{steel}} &= 0.12 \text{ BTU/lb °F} \text{ (Bennett; Myers, 2nd Ed, Page 733)} \\P_{\text{steel}} &= 489 \text{ lb/Ft}^3 \text{ (Bennett; Myers, 2nd Ed, Page 773)}\end{aligned}$$

CLIENT/SUBJECT _____	W.O. NO _____
TASK DESCRIPTION <u>Time for Slab to Reach Temperature</u>	TASK NO _____
PREPARED BY <u>NJS</u> DEPT <u>IS11</u> DATE _____	APPROVED BY DEPT _____ DATE _____
MATH CHECK BY _____ DEPT _____ DATE _____	
METHOD REV. BY _____ DEPT _____ DATE _____	

To estimate time, the "Chart for determining the temperature history of points at the centers of rectangular shapes" was utilized (Process Heat Transfer, Kern, p. 650). A copy of the chart is shown on Figure 18-11.

In chart,
$$Y = \frac{T_s - t_{1/2}}{T_s - t_0}$$

where T_s = temperature of surrounding (air)
 $t_{1/2}$ = temperature of the center plane
 t_0 = initial temperature

In this application:

$$\begin{aligned} T_s &= 550^\circ\text{F} \quad (\text{during heat-up}) \\ t_{1/2} &= 500^\circ\text{F} \\ t_0 &= 70^\circ\text{F} \end{aligned}$$

In chart,
$$X = \frac{hL}{2k}$$

where h = heat transfer coefficient
 L = principal depth
 k = thermal conductivity

For illustration, 4 masses of steel are evaluated.

$$L = \frac{m}{\rho A t}$$

where h = height of slab (1 FT in cases 1, 2, 3; 6 FT in case 4)
 l = length of slab (1 FT in cases 1, 2, 3; 6 FT in case 4)

CLIENT/SUBJECT _____	W.O. NO. _____
TASK DESCRIPTION <u>Time for Slab to Reach Temperature</u>	TASK NO. _____
PREPARED BY <u>NDS</u> DEPT. <u>1911</u> DATE _____	APPROVED BY DEPT. _____ DATE _____
MATH CHECK BY _____ DEPT. _____ DATE _____	
METHOD REV. BY _____ DEPT. _____ DATE _____	

Therefore,

$$X = \frac{h L}{2k}$$

$$= \frac{h m}{2k \rho h t u}$$

On chart, curve = $\frac{4 \alpha b}{L^2}$

where: $\alpha = \frac{k}{Cp}$

Cp = Specific Heat
 t = time

Therefore, curve = $\frac{4 k t}{Cp (m \rho h t u)^2}$

Case 1 $m = 500 \text{ lb}$

$$Y = \frac{T_s - t_{1/2}}{T_s - t_s} = \frac{550^\circ\text{F} - 500^\circ\text{F}}{550^\circ\text{F} - 70^\circ\text{F}} = 0.10$$

$$X = \frac{h m}{2k \rho h t u}$$

$X = \frac{1.44 \text{ BTU}}{\text{hr Ft}^2 \text{ }^\circ\text{F}}$	500 lb	$\text{hr Ft}^2 \text{ }^\circ\text{F}$	Ft^3		
		$2 \mid 25.9 \text{ BTU Ft}^2$	489 lb	1 Ft	1 Ft

$$X = 0.028$$

CLIENT/SUBJECT _____ W.O. NO. _____

TASK DESCRIPTION Time for Slab to Reach Temperature TASK NO. _____

PREPARED BY NPS DEPT. 1811 DATE _____ APPROVED BY _____

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____ DEPT. _____ DATE _____

At $x = 0.028$ and $y = 0.10$ there is no curve.

Extrapolating (For $x = 0.028$)

$$\text{Curve} = \frac{0.046 - 0.057}{50 - 45} = \frac{0.046 - 0.028}{50 - \text{curve}}$$

Curve = 61

$$61 = \frac{4 \times 0}{C_p \left(\frac{m}{\rho h_c} \right)^2} = \frac{4 \left| \frac{25.9 \text{ BTU}}{\text{hr Ft}^2 \text{ }^\circ\text{F}} \right| \times 0 \left| \frac{16 \text{ }^\circ\text{F}}{0.12 \text{ BTU}} \right| \left| \frac{\left(\frac{489 \text{ lb/Ft}^3 \right) (100)}{500 \text{ lb}} \right|^2}{}$$

$\theta = 0.074 \text{ hr} \quad (4.4 \text{ min})$

Case 2 $m = 1000 \text{ lb}$

$y = 0.10$

$$X = \frac{h m}{2 \rho h_c} = \frac{1.44 \text{ BTU}}{2 \times 25.9 \text{ BTU Ft}^2 \text{ }^\circ\text{F}} \left| \frac{1000 \text{ lb}}{\text{hr Ft}^2 \text{ }^\circ\text{F}} \right| \left| \frac{\text{hr Ft}^2 \text{ }^\circ\text{F}}{2} \right| \left| \frac{\text{Ft}^3}{489 \text{ lb}} \right| \left| \frac{1 \text{ Ft}}{1 \text{ Ft}} \right|$$

$x = 0.057$

At $x = 0.057$ and $y = 0.10$

Curve = 42



SHEET 5 of 6

CLIENT/SUBJECT _____ W.C. NO. _____
 TASK DESCRIPTION Time For Slab to Reach Temperature TASK NO. _____
 PREPARED BY NPS DEPT ISU DATE _____ APPROVED BY _____
 MATH CHECK BY _____ DEPT _____ DATE _____
 METHOD REV. BY _____ DEPT _____ DATE _____ DEPT _____ DATE _____

$$42 = \frac{4 \sqrt{\theta}}{C_p \left(\frac{m}{\rho h_c V} \right)^2} = \frac{4 \left| \frac{25.9 \text{ BTU Ft}}{\text{hr Ft}^2 \text{ } ^\circ\text{F}} \right| \sqrt{\theta} \left| \frac{16 \text{ } ^\circ\text{F}}{0.12 \text{ BTU}} \right| \left[\frac{(499 \text{ lb/ft}^3)(1 \text{ Ft})(1 \text{ Ft})}{(1000 \text{ lb})^2} \right]^{1/2}}$$

$\theta = 0.20 \text{ hr (12 minutes)}$

CASE 3 $m = 1500 \text{ lb}$

$y = 0.10$

$$x = \frac{hm}{2k \rho h_c L} = \frac{1.44 \text{ BTU} \left| \frac{1500 \text{ lb}}{\text{hr Ft}^2 \text{ } ^\circ\text{F}} \right|}{2 \left| \frac{25.9 \text{ BTU Ft}}{\text{hr Ft}^2 \text{ } ^\circ\text{F}} \right| \left| \frac{499 \text{ lb}}{\text{Ft}^3} \right| \left| \frac{1 \text{ Ft}}{1 \text{ Ft}} \right|}$$

$x = 0.085$

AT $y = 0.10$ and $x = 0.085$, CURVE = 40

$$40 = \frac{4 \sqrt{\theta}}{C_p \left(\frac{m}{\rho h_c V} \right)^2} = \frac{4 \left| \frac{25.9 \text{ BTU Ft}}{\text{hr Ft}^2 \text{ } ^\circ\text{F}} \right| \sqrt{\theta} \left| \frac{16 \text{ } ^\circ\text{F}}{0.12 \text{ BTU}} \right| \left[\frac{(499 \text{ lb/ft}^3)(1 \text{ Ft})(1 \text{ Ft})}{(1500 \text{ lb})^2} \right]^{1/2}}$$

$\theta = 0.43 \text{ hr (26 min)}$

CASE 4 SLAB = 6 FT H x 20 FT L x 6 FT D

$$m = \frac{(6 \text{ Ft} \times 20 \text{ Ft} \times 6 \text{ Ft}) \left| \frac{499 \text{ lb}}{\text{Ft}^3} \right|}{1} = 352,080 \text{ lb}$$

$y = 0.10$

$$x = \frac{hm}{2k \rho h_c L} = \frac{1.44 \text{ BTU} \left| \frac{352,080 \text{ lb}}{\text{hr Ft}^2 \text{ } ^\circ\text{F}} \right|}{2 \left| \frac{25.9 \text{ BTU Ft}}{\text{hr Ft}^2 \text{ } ^\circ\text{F}} \right| \left| \frac{499 \text{ lb}}{\text{Ft}^3} \right| \left| \frac{6 \text{ Ft}}{20 \text{ Ft}} \right|}$$

$x = 0.17$

AT $y = 0.10$ and $x = 0.17$, CURVE = 20 = $\frac{4 \left| \frac{25.9 \text{ BTU Ft}}{\text{hr Ft}^2 \text{ } ^\circ\text{F}} \right| \sqrt{\theta} \left| \frac{16 \text{ } ^\circ\text{F}}{0.12 \text{ BTU}} \right| \left[\frac{(499 \text{ lb/ft}^3)(6 \text{ Ft})}{(6 \text{ Ft})^2} \right]^{1/2}}$

$\theta = 0.83 \text{ hr (50 min)}$

Time for Slab to Reach Temperature
 NPS 18:11

Sheet 6 of 6

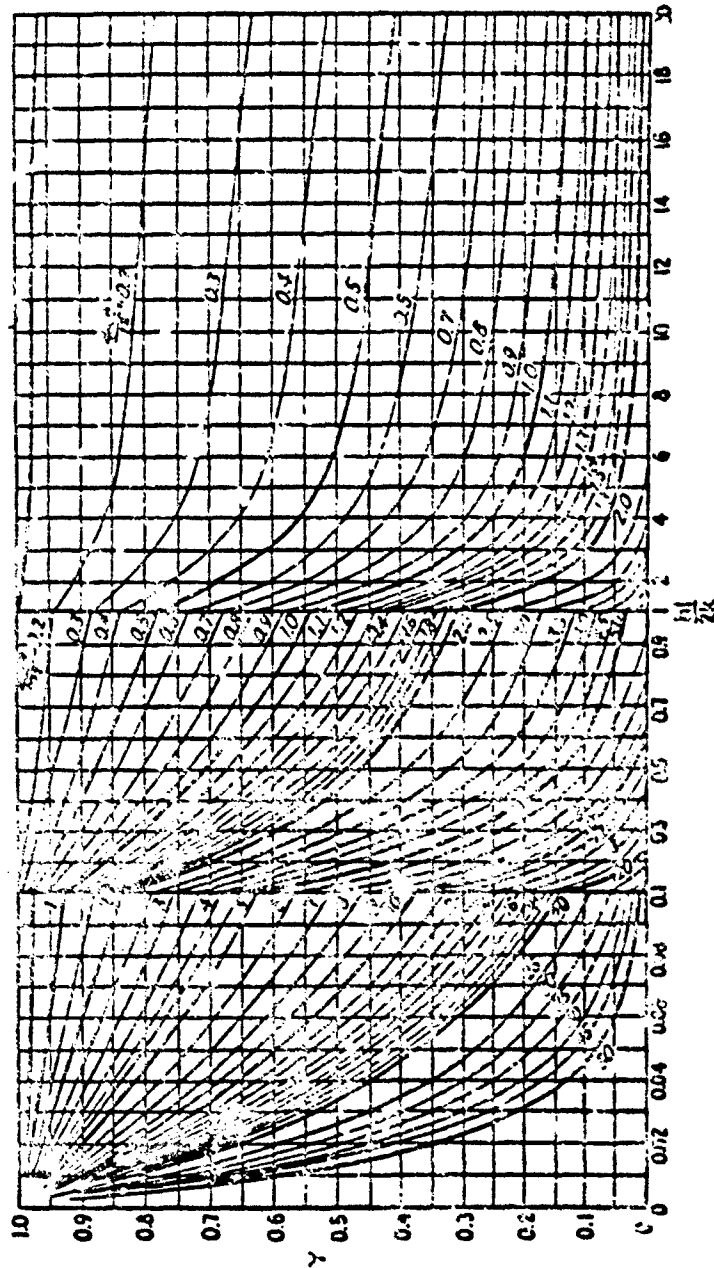


Fig. 1811. Chart for determining the temperature history of points at the centers of rectangular slabs. (Norman, Industrial Engng. Society Chemical Engng. Trans.)

July 1969
Revision: Final

HEAT BALANCE CALCULATIONS

TEST RUNS

2, 3, & 5

1311R2

WILSON

SHEET 1 of 20

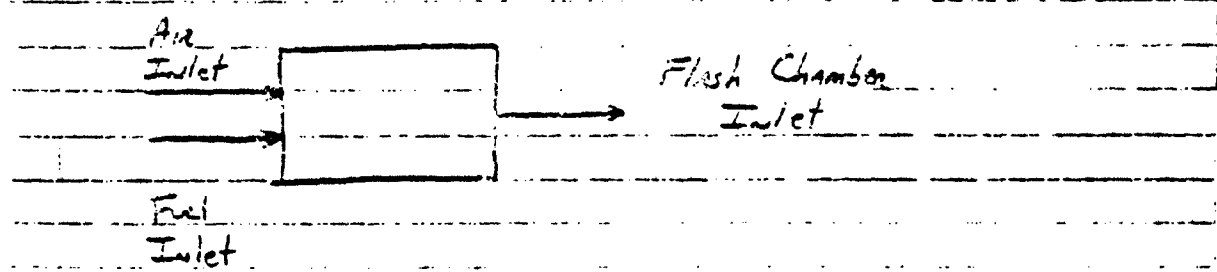
CLIENT/SUBJECT USATHAMA W.D. NO. 7000-00-24

TASK DESCRIPTION Test Run # 2 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT. 1711 DATE 14 Feb 70 APPROVED BY _____

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____ DEPT. _____ DATE _____



Average Inlet Air Flow PI-202 $1.05 \text{ inHg} \approx .18$
 Test Elapsed Time 1400-4400

Average Fuel Gas Pressure PI 310 $1.70 \text{ psig} \approx .14$
 Test Elapsed Time 1400-4400

Average Flash Chamber Inlet measured data

$1566 \text{ dscfm} \approx 74\%$
 $312 \text{ }^\circ\text{F}$ ($733 \text{ }^\circ\text{F}$ on process thermocouple)
 4400 wacfm
 $1.8\% \text{ CO}_2$ by volume dry basis
 17.22 O_2
 80.22 N_2
 $3.2\% \text{ H}_2\text{O}$ by volume

$$\text{CO}_2 (1566 \text{ dscfm}) (.018 \text{ CO}_2) (.11378 \text{ lb/scf}) = 3.21 \text{ lb/min}$$

$$\text{O}_2 (1566 \text{ dscfm}) (.1720) (.09275 \text{ lb/scf}) = 22.28 \text{ lb/min}$$

$$\text{N}_2 (1566 \text{ dscfm}) (.802 \text{ N}_2) (.07246 \text{ lb/scf}) = 91.50 \text{ lb/min}$$

$$\text{H}_2\text{O} \quad x = .032$$

$$\frac{x}{1566 + x}$$

$$x = (.032) (1566 + x) \quad = 2.41 \text{ lb/min}$$

113.40 lb/min



SHEET 2 of 12

CLIENT SUBJECT USATHAMA W.D. NO. 7602-00-24TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. 2PREPARED BY M. Colross DEPT. 1811 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

Correction to gas flow for altitude

$$\text{corr} = e^{(.000036024(4500\text{ft}))} = 1.176$$

$$\text{Design location} = e^{(.000036024(1750\text{ft}))} = 1.066$$

$$\text{Density ratios} = 1.176 / 1.066 = 1.103$$

$$P_{\text{scat}} = (P_{\text{act}} / \rho_{\text{scat}}) (\rho_{\text{act}})$$

$$= 1.103 (1.70 \text{ psig})$$

$$= 1.875 \text{ psig}$$

From Vendor Graph 802 1.875 psig = 1.75 mm²/hr
LHV

$$(1,750,000 \text{ BTU/hr}) / (2316 \text{ BTU/scf}) = 753$$

$$756 \text{ scf/hr} = 12.6 \text{ scfm propane}$$

$$(12.59 \text{ scfm}) (0.1196 \text{ lb/scf}) = 1.51 \text{ lb/min}$$

Combustion Air Flow by

$$\text{Flow} = 1433 + 406 (\ln(1.05 \text{ mm})) = 1453 \text{ scfm}$$

$$(1450 \text{ scfm}) (0.775 \text{ lb/scf}) = 105 \text{ lb/min}$$

Moisture load under worst conditions

$$60^\circ\text{F} = 0.01 \text{ lb}^2/\text{lb air}$$

WILSON

SHEET 3 of 90

CLIENT/SUBJECT USATHAMA P.O. NO. 7000-00-24
TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. 2
PREPARED BY M. Cosmos DEPT 1811 DATE 16 Feb 90
MATH CHECK BY _____ DEPT _____ DATE _____
METHOD REV. BY _____ DEPT _____ DATE _____

APPROVED BY
DEPT _____ DATE _____

Maximum water Load

$$(105 \text{ lb/min}) (0.01 \text{ }^{15}\text{H}_2\text{O/lb air}) = 1.05 \text{ }^{15}\text{lb/min}$$

Mass Balance Check

$$\frac{119.40 \text{ }^{15}\text{lb/min} - [1.51 \text{ }^{15}\text{lb/min} + 105 \text{ }^{15}\text{lb/min} + 1.05 \text{ }^{15}\text{lb/min}]}{117.4 \text{ }^{15}\text{lb/min}}$$

= 9.92 % closure within
measurement
errors

Combustion of Propane 1 lb basis

CO₂ 2.99 lb/lb
H₂O 1.63 lb/lb
N₂ 12.07 lb/lb

$$\text{Total } 15.69 \text{ lb/lb} - 1 \text{ }^{15}\text{lb} = 15.69 \text{ }^{15}\text{lb comb air}$$

Combustion of Fuel

$$\begin{aligned} \text{CO}_2 & (1.51 \text{ }^{15}\text{lb/min}) (2.99 \text{ lb/lb}) = 4.51 \text{ }^{15}\text{lb/min} \\ \text{H}_2\text{O} & (1.51 \text{ }^{15}\text{lb/min}) (1.63 \text{ lb/lb}) + (1.05 \text{ }^{15}\text{lb/min}) = 3.51 \text{ }^{15}\text{lb/min} \\ \text{N}_2 & (1.51 \text{ }^{15}\text{lb/min}) (12.07 \text{ lb/lb}) = 18.23 \text{ }^{15}\text{lb/min} \end{aligned}$$

Excess Air = inlet air - combustion air

$$(105 \text{ }^{15}\text{lb/min}) - (1.51 \text{ }^{15}\text{lb/min}) (15.69 \text{ lb/lb}) = 81.31 \text{ }^{15}\text{lb/min}$$

$$\text{O}_2 = (81.31 \text{ }^{15}\text{lb/min}) (0.21 \text{ }^{15}\text{O}_2) = 17.07 \text{ }^{15}\text{lb/min}$$

WILSON

SHEET 4 of 10

CLIENT/SUBJECT Unlabeled W.D. NO. 7000-00-27
TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. 2
PREPARED BY M. Cosmos DEPT. 1911 DATE 16 Feb 70 APPROVED BY _____
WITH CHECK BY _____ DEPT _____ DATE _____
METHOD REV. BY _____ DEPT _____ DATE _____ DEPT _____ DATE _____

Heat Balance

Heat Released by Fuel

$$(1.51 \text{ lb/min}) (19,944 \text{ BTU/lb}) = 30,115 \text{ BTU/min}$$

Heat Absorbed by Combustion Products

$$\text{CO}_2 (4.51 \text{ lb/min}) (0.225 \text{ BTU/lb}^\circ\text{F}) (812 - 70^\circ\text{F}) = 753 \text{ BTU/min}$$

$$\text{H}_2\text{O} (3.51 \text{ lb/min}) (0.478 \text{ BTU/lb}^\circ\text{F}) (812 - 70^\circ\text{F}) = 1,244 \text{ BTU/min}$$

$$\text{N}_2 (18.23 \text{ lb/min}) (0.25 \text{ BTU/lb}^\circ\text{F}) (812 - 70^\circ\text{F}) = 3,382 \text{ BTU/min}$$

Heat Absorbed by X3 Air

$$(81.31 \text{ lb/min}) (0.24 \text{ BTU/lb}^\circ\text{F}) (812 - 70^\circ\text{F}) = 14,480 \text{ BTU/min}$$

19,852 BTU/min

Radiation Loss

Surface Area

$$\pi (20 \text{ inch}) \left(\frac{\pi}{4} \text{ inch}\right) (6.5 \text{ ft} + 24.5 \text{ ft}) = 162 \text{ ft}^2$$

$$(162 \text{ ft}^2) (2.8 \text{ BTU/hr ft}^2 \text{ }^\circ\text{F}) (200^\circ\text{F} - 70^\circ\text{F}) \left(\frac{\text{hr}}{60 \text{ min}}\right) = 1,742 \text{ BTU/min}$$

Heat Balance Comparison

$$(30,115 \text{ BTU/min}) - (19,852 \text{ BTU/min} + 1,742 \text{ BTU/min}) = 2,239 \text{ BTU/min}$$

30,115 BTU/min

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run # 2 Heat Balance TASK NO. 2

PREPARED BY M. Cosmos DEPT. 1511 DATE 16 Feb 73

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

APPROVED BY	
DEPT. _____	DATE _____

Average Flash Chamber Outlet

2067 dscfm \pm 5%
 391 °F \pm 37°F
 3917 wacfm
 1.13 % CO₂
 15.97 % O₂
 81.25 % N₂
 2.87 % H₂O

$$\text{CO}_2 \quad (2067 \text{ dscfm})(0.0113)(0.11378^{15}/\text{scf}) = 2.66^{15}/\text{min}$$

$$\text{O}_2 \quad (2067 \text{ dscfm})(0.1597)(0.0827^{15}/\text{scf}) = 27.30^{15}/\text{min}$$

$$\text{N}_2 \quad (2067 \text{ dscfm})(0.8125)(0.07240^{15}/\text{scf}) = 121.59^{15}/\text{min}$$

$$\text{H}_2\text{O} \quad \frac{x}{2067+x} = 0.0287$$

$$x = (61.08 \text{ scfm})(0.04654^{15}/\text{scf}) = 2.84^{15}/\text{min}$$

Total Exit Gas Flow 154.39 ¹⁵/min

Leakage Estimate

$$\frac{154.39^{15}/\text{min} - 119.40^{15}/\text{min}}{154.39^{15}/\text{min}} = 22.67\%$$

Leakage Volume

$$(154.39^{15}/\text{min} - 119.40^{15}/\text{min}) = 34.99^{15}/\text{min}$$

WESTERN

SHEET 6 of 15

CLIENT/SUBJECT USATHAMA W.O. NO. 7600-00-24
TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. 2
PREPARED BY M. Cosmos DEPT 1811 DATE 16 Feb 99
MATH CHECK BY _____ DEPT _____ DATE _____
METHOD REV. BY _____ DEPT _____ DATE _____

APPROVED BY	
DEPT _____	DATE _____

Heat Balance Around Test Chamber

Heat Lost by Process Gas

$$CO_2 \left(\frac{2.21 + 2.66}{2} \right) (0.225 \text{ gm/lb} \cdot \text{F}) (812 - 391 \text{ }^\circ\text{F}) = 278 \frac{\text{BTU}}{\text{min}}$$

$$H_2O \left(\frac{2.41 + 2.84}{2} \right) (0.478 \text{ gm/lb} \cdot \text{F}) (812 - 391 \text{ }^\circ\text{F}) = 528 \frac{\text{BTU}}{\text{min}}$$

$$N_2 \left(\frac{91.50 + (121.59 - .79(34.99))}{2} \right) (0.25) (812 - 391 \text{ }^\circ\text{F}) = 9,759 \frac{\text{BTU}}{\text{min}}$$

$$O_2 \left(\frac{23.28 + (27.30 - .71(34.99))}{2} \right) (0.24) (812 - 391 \text{ }^\circ\text{F}) = 2,134 \frac{\text{BTU}}{\text{min}}$$

Total Heat Lost by Hot Gas 12,599 $\frac{\text{BTU}}{\text{min}}$

Heat Absorbed by Leak Air

$$(34.99 \text{ lb/min}) (0.24 \text{ gm/lb} \cdot \text{F}) (391 - 70 \text{ }^\circ\text{F}) = 2,696 \frac{\text{BTU}}{\text{min}}$$

Heat Lost Through Walls

$$(12,599 \frac{\text{BTU}}{\text{min}}) - (2,696 \frac{\text{BTU}}{\text{min}}) = 9,903 \frac{\text{BTU}}{\text{min}}$$
$$= 594,202 \frac{\text{Btu}}{\text{hr}}$$



CLIENT/SUBJECT USATRUMA W.O. NO 7060-00-24

TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. _____

PREPARED BY M. Cosmos DEPT 1311 DATE _____ APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

Average Fuel Gas Pressure 6.34 psig

Average T.O. Exit Gas

2467 dscfm \pm 5.5%

1718 °F (

12,500 wscfm

6.5 % CO₂

10.7 % O₂

32.8 % N₂

8.6 % H₂O

$$\text{CO}_2 (2467 \text{ dscfm}) (.065 \text{ CO}_2) (.11378 \text{ }^{15}/\text{scf}) = 18.2 \text{ }^{15}/\text{min}$$

$$\text{O}_2 (2467 \text{ dscfm}) (.107 \text{ O}_2) (.08275 \text{ }^{15}/\text{scf}) = 21.8 \text{ }^{15}/\text{min}$$

$$\text{N}_2 (2467 \text{ dscfm}) (.328 \text{ N}_2) (.07240 \text{ }^{15}/\text{scf}) = 147.9 \text{ }^{15}/\text{min}$$

$$\text{H}_2\text{O} \quad \frac{x}{2467 + x} = .086$$

$$x = (232 \text{ scfm}) (.0464 \text{ }^{15}/\text{scf}) = 10.80 \text{ }^{15}/\text{min}$$

198.7 ¹⁵/min

GAS FLOW

$$P_{\text{stack}} = (1.103) (6.34 \text{ psia})$$

$$= 6.99 \text{ psia} = 4.5 \text{ mm BTU/hr}$$



SHEET 3 of 10

CLIENT/SUBJECT USATH 4M1 W.O. NO. 7000-00-24
 TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. _____
 PREPARED BY M. Cosmos DEPT 1811 DATE _____ APPROVED BY _____
 MATH CHECK BY _____ DEPT _____ DATE _____
 METHOD REV. BY _____ DEPT _____ DATE _____ DEPT _____ DATE _____

$$(4,570,000 \text{ Btu/hr}) / 2316 \text{ }^{\circ}\text{F/sf} = 1943 \text{ scfh}$$

$$= 32.4 \text{ scfm}$$

$$(32.4 \text{ scfm})(0.1196 \text{ }^{\circ}\text{F/sf}) = 3.87 \text{ }^{\circ}\text{F/min}$$

Air Leakage

$$198.7 \text{ }^{\circ}\text{F/min} - (154.4 \text{ }^{\circ}\text{F/min} + 3.87 \text{ }^{\circ}\text{F/min}) = 40.4 \text{ }^{\circ}\text{F/min}$$

$$20.3\%$$

Combustion Product

$$\text{CO}_2 (3.87 \text{ }^{\circ}\text{F/min})(2.99 \text{ }^{\circ}\text{F/lb}) = 11.57 \text{ }^{\circ}\text{F/min}$$

$$\text{H}_2\text{O} (3.87 \text{ }^{\circ}\text{F/min})(1.63 \text{ }^{\circ}\text{F/lb}) = 6.31 \text{ }^{\circ}\text{F/min}$$

$$\text{N}_2 (3.87 \text{ }^{\circ}\text{F/min})(12.07 \text{ }^{\circ}\text{F/lb}) = 46.71 \text{ }^{\circ}\text{F/min}$$

$$\text{Air Consumed} (3.87 \text{ }^{\circ}\text{F/min})(15.69 \text{ }^{\circ}\text{F/lb}) = 60.72 \text{ }^{\circ}\text{F/min}$$

Mass Balance Check

$$\text{CO}_2 \quad 18.2 \text{ }^{\circ}\text{F/min} - (11.57 \text{ }^{\circ}\text{F/min} + 2.99 \text{ }^{\circ}\text{F/min}) = 20.3\%$$

$$18.2 \text{ }^{\circ}\text{F/min}$$

$$\text{H}_2\text{O} \quad 10.80 \text{ }^{\circ}\text{F/min} - (6.31 \text{ }^{\circ}\text{F/min} + 2.62 \text{ }^{\circ}\text{F/min}) = 17.3\%$$

$$10.9 \text{ }^{\circ}\text{F/min}$$

$$\text{N}_2 \quad 147.9 \text{ }^{\circ}\text{F/min} - (421.59 + .79(40.4 \text{ }^{\circ}\text{F/min})) = -3.8\%$$

$$147.9 \text{ }^{\circ}\text{F/min}$$

CLIENT/SUBJECT USATHAMA M.O. NO. 7000-00-24

TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. _____

PREPARED BY M. Cosmos DEPT. 1311 DATE 24 Feb 90

APPROVED BY

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

DEPT. _____	DATE _____
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$$O_2 \quad \frac{(21.8^{lb/min}) - (27.30^{lb/min} + 21(40.4^{lb/min}) - 21(60.72))}{21.8^{lb/min}} = -5.66\%$$

Heat Balance Check

Heat released by Fuel

$$(3.87^{lb/min})(19,944^{BTU/lb}) = 77,183^{BTU/min}$$

Heat Absorbed by F.C. Exit Gases

$$CO_2 \quad (2.94^{lb/min})(0.225^{BTU/lb \cdot F})(1718-391^{\circ}F) = 87.8^{BTU/min}$$

$$H_2O \quad (2.62^{lb/min})(0.478^{BTU/lb \cdot F})(1718-391^{\circ}F) = 1662^{BTU/min}$$

$$N_2 \quad (121.59^{lb/min})(.25^{BTU/lb \cdot F})(1718-391^{\circ}F) = 40337^{BTU/min}$$

$$O_2 \quad (27.30 - 21(60.72))(.22^{BTU/lb \cdot F})(1718-391^{\circ}F) = 4,247^{BTU/min}$$

$$\underline{46,334^{BTU/min}}$$

Heat Absorbed by Combustion Products

$$CO_2 \quad (11.57^{lb/min})(0.225^{BTU/lb \cdot F})(1718-391^{\circ}F) = 3455^{BTU/min}$$

$$H_2O \quad (6.31^{lb/min})(0.478^{BTU/lb \cdot F})(1718-391^{\circ}F) = 4002^{BTU/min}$$

$$\underline{7457^{BTU/min}}$$

Heat Absorbed by Leak Air

$$Air \quad (40.4^{lb/min})(0.24^{BTU/lb \cdot F})(1787-73^{\circ}F) = 16,648^{BTU/min}$$

CLIENT/SUBJECT USATYAMA W.O. NO. 7000-00-27

TASK DESCRIPTION Test Run #2 Heat Balance TASK NO. _____

PREPARED BY M. Cosmas DEPT. 1811 DATE 24 Feb 90

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

APPROVED BY	
DEPT. _____	DATE _____

Radiation Losses

Surface Area

$$7 (5 \text{ ft}) (20 \text{ ft}) = 314 \text{ ft}^2$$

Heat Loss

$$(314 \text{ ft}^2) (2.8 \text{ BTU/hr ft}^2 \text{ }^\circ\text{F}) (300 - 70 \text{ }^\circ\text{F}) (\frac{1}{60 \text{ min}}) = 3370 \frac{\text{BTU}}{\text{min}}$$

Total Losses

$$(46,334 \frac{\text{BTU}}{\text{min}} + 745 \frac{\text{BTU}}{\text{min}} + 16,648 \frac{\text{BTU}}{\text{min}} + 3370 \frac{\text{BTU}}{\text{min}}) = 73,809 \frac{\text{BTU}}{\text{min}}$$

Close Balance

$$\frac{(77,193 \frac{\text{BTU}}{\text{min}} - 73,809 \frac{\text{BTU}}{\text{min}})}{77,193 \frac{\text{BTU}}{\text{min}}} = 4.42$$

CLIENT/SUBJECT USATHAMA W.O. NO. 7200-20-24

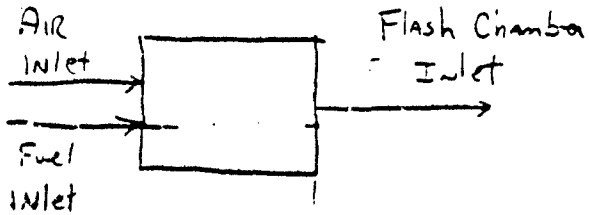
TASK DESCRIPTION Test Run #3 Heat Balance TASK NO. _____

PREPARED BY M. Cosgrove DEPT. 1811 DATE 20 Sep 89

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

APPROVED BY
DEPT. _____ DATE _____



Average Inlet Air flow PI202 1.11 inwg ±

Average Fuel Gas Pressure PI310 2.8 lpsg ±

Average Flash Chamber Inlet measured data

- 1633 dscfm ± 7%
- 1031 °F (959°F on process thermometer)
- 5533 wactfm
- 2.1 % CO₂ by Volume d. basis
- 16.3 % O₂ by Volume d. basis
- 31.5 % N₂ by Volume d. basis
- 3.2 % H₂O by Volume

$$CO_2 (1633 \text{ dscfm}) (.021 \text{ } CO_2) (.11378 \text{ } \frac{\text{lb}}{\text{scf}}) = 3.90 \text{ } \frac{\text{lb}}{\text{min}}$$

$$O_2 (1633 \text{ dscfm}) (.163 \text{ } O_2) (.08275 \text{ } \frac{\text{lb}}{\text{scf}}) = 22.03 \text{ } \frac{\text{lb}}{\text{min}}$$

$$N_2 (1633 \text{ dscfm}) (.815 \text{ } N_2) (.07210 \text{ } \frac{\text{lb}}{\text{scf}}) = 96.36 \text{ } \frac{\text{lb}}{\text{min}}$$

$$H_2O \quad \frac{x}{1633 \text{ scfm} + x} = .032$$

$$x = (53.98 \text{ cfm}) (.04654 \text{ } \frac{\text{lb}}{\text{scf}}) = 2.51 \text{ } \frac{\text{lb}}{\text{min}}$$

124.80 lb/min

CLIENT/SUBJECT <u>USATHAMA</u>			W.O. NO. <u>7000-CO-24</u>	
TASK DESCRIPTION <u>Test Run #3 Heat Balance</u>			TASK NO. _____	
PREPARED BY <u>M. P. Smith</u>	DEPT. <u>1811</u>	DATE <u>20 Sep 89</u>	APPROVED BY _____ DEPT. _____ DATE _____	
MATH CHECK BY _____	DEPT. _____	DATE _____		
METHOD REV. BY _____	DEPT. _____	DATE _____		

Correction to gas flows for altitude

$$\text{corr} = e^{(.0000360286(4500\text{ft}))} = 1.176$$

$$\text{design location} = e^{(.0000360286(1700\text{ft}))} = 1.066$$

$$\text{Density ratios} = 1.176 / 1.066 = 1.103$$

$$\begin{aligned} P_{\text{graph}} &= (P_{\text{act}} / P_{\text{norm}})(P_{\text{act}}) \\ &= 1.103 (2.81 \text{ psig}) \\ &= 3.10 \text{ psig} \end{aligned}$$

From vendor graph 802 $3.10 \text{ psig} = 2.15 \text{ MM BTU/hr}$
LHV

$$2,150,000 \text{ BTU/hr} / (2316 \text{ BTU/scf}) =$$

$$928 \text{ scfh} = 15.47 \text{ scfm propane}$$

$$(15.47 \text{ scfm})(0.1196 \text{ lb/scf}) = 1.85 \text{ lb/min}$$

Combustion Airflow by correlation curve

$$\text{Flow} = 1433 \pm 40.6 (\ln(1.11 \text{ mag})) = 1475 \text{ scf}$$

$$(1475 \text{ scfm})(.075 \text{ lb/scf}) = 108.7 \text{ lb/min}$$

Moisture loading under worst observed

$$\text{Conditions } 60^\circ\text{F} = .01 \text{ lb H}_2\text{O/lb DA}$$

CLIENT/SUBJECT USATHAMA

W.O. NO. 7000-00-24

TASK DESCRIPTION _____

TASK NO. _____

PREPARED BY _____

DEPT _____

DATE _____

APPROVED BY

MATH CHECK BY _____

DEPT _____

DATE _____

METHOD REV. BY _____

DEPT _____

DATE _____

DEPT _____

DATE _____

Maximum water load

$$(108.7 \text{ lb/min}) (0.01 \text{ lb}_{\text{H}_2\text{O}}/\text{lb}_{\text{DA}}) = 1.1 \text{ lb/min H}_2\text{O}$$

Mass Balance Check out-in/out =

$$\frac{124.80 \text{ lb/min} - (1.85 \text{ SA} + 108.7 \text{ Air} + 1.1 \text{ H}_2\text{O})}{124.8 \text{ lb/min}} =$$

10.5% closure within measurement errors

Combustion of Propane one lb bases

CO₂ 2.99 lb/lb
H₂O 1.63 lb/lb
N₂ 12.07 lb/lb

$$\text{Total } 16.69 \text{ lb/lb} - 1 \text{ lb/lb} = 15.69 \text{ lb/lb}$$

Combustion of Fuel

$$\begin{aligned} \text{CO}_2 &= (1.85)(2.99 \text{ lb/lb}) = 5.53 \text{ lb/min} \\ \text{H}_2\text{O} &= (1.85)(1.63 \text{ lb/lb}) = 3.02 + 1.1 = 4.12 \text{ lb/min} \\ \text{N}_2 &= (1.85)(12.07 \text{ lb/lb}) = 22.33 \end{aligned}$$

Excess Air

$$(108.7 \text{ lb/min} - (1.85 \text{ lb/min} (15.69 \text{ lb/min}))) = 79.57 \text{ lb/min}$$

$$\text{O}_2 = (79.57 \text{ lb/min}) (.21) = 16.73 \text{ lb/min}$$



CLIENT/SUBJECT USATAMA P.O. NO. 7000-00-24

TASK DESCRIPTION Test Run #3 - Heat Balance TASK NO. _____

PREPARED BY M. Casanova DEPT 1811 DATE 2/5/59 APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

Heat Balance

Heat Released by Fuel

$$(1.85 \text{ lb/min})(19,944 \text{ BTU/lb}) = 36,896 \text{ BTU/min}$$

Heat Absorbed by Combustion Products

$$\text{CO}_2 (5.53 \text{ lb/min})(0.225 \text{ BTU/lb}^\circ\text{F})(1031-70^\circ) = 1,195 \text{ BTU/min}$$

$$\text{H}_2\text{O} (4.12 \text{ lb/min})(0.478 \text{ BTU/lb}^\circ\text{F})(1031-70) = 1,893 \text{ BTU/min}$$

$$\text{N}_2 (22.33 \text{ lb/min})(0.25 \text{ BTU/lb}^\circ\text{F})(1031-70) = 5,365 \text{ BTU/min}$$

$$\bar{x} \text{ Air} (79.67 \text{ lb/min})(0.24 \text{ BTU/lb}^\circ\text{F})(1031-70) = 18,375 \text{ BTU/min}$$

$$26,829 \text{ BTU/min}$$

Radiation Losses

Surface Area

$$\pi (20 \text{ inch}) \left(\frac{1 \text{ ft}}{12}\right) (6.5 \text{ ft} + 24.5 \text{ ft}) = 162 \text{ ft}^2$$

$$(162 \text{ ft}^2)(23 \text{ BTU/hr}^\circ\text{F}^2)(300^\circ\text{F} - 70^\circ\text{F}) \left(\frac{1 \text{ hr}}{60 \text{ min}}\right) = 1,742 \text{ BTU/min}$$

Heat Balance Comparison

$$\frac{(36,896 \text{ BTU/min}) - (26,829 + 1,742)}{36,896 \text{ BTU/min}} = 22.6\% \text{ close}$$

CLIENT/SUBJECT USATHAMA V.O. NO. 2000-00-24

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO. _____

PREPARED BY M. Correas DEPT. 1811 DATE 21 Sep 89 APPROVED BY _____

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

Average Flash Chamber Outlet

1833 dscfm \pm 3%
 482 °F = 37 °F
 3700 wacfm
 1.26 % CO₂ by vol
 17.43 % O₂ by vol
 81.30 % N₂ by vol
 3.83 % H₂O by vol

$$\text{CO}_2 (1833 \text{ dscfm}) (0.0126 \text{ CO}_2) (0.11378 \text{ }^{\text{lb}}/\text{scf}) = 2.63 \text{ }^{\text{lb}}/\text{min}$$

$$\text{O}_2 (1833 \text{ dscfm}) (0.1743 \text{ O}_2) (0.0827 \text{ }^{\text{lb}}/\text{scf}) = 26.42 \text{ }^{\text{lb}}/\text{min}$$

$$\text{N}_2 (1833 \text{ dscfm}) (0.8130 \text{ N}_2) (0.0724 \text{ }^{\text{lb}}/\text{scf}) = 107.89 \text{ }^{\text{lb}}/\text{min}$$

$$\text{H}_2\text{O} \frac{x}{1833 + x} = 0.0283$$

$$x = (72.00 \text{ cfm}) (0.04654 \text{ }^{\text{lb}}/\text{scf}) = 3.40 \text{ }^{\text{lb}}/\text{min}$$

Total exit mass flow 140.34 ^{lb}/min

Leakage Estimate

$$\frac{140.34 \text{ }^{\text{lb}}/\text{min} - 124.80 \text{ }^{\text{lb}}/\text{min}}{140.34} = 11.2\%$$

Leakage Volume

$$140.34 - 124.80 = 15.54 \text{ }^{\text{lb}}/\text{min}$$

WESTERN

SHEET 6 of 11

CLIENT/SUBJECT USATHAMA W.D. NO. 7000-00-24
TASK DESCRIPTION Test Run #3 Heat Balance TASK NO. _____
PREPARED BY M. Calmes SEPT. 1911 DATE 21 Sep 89 APPROVED BY _____
MATH CHECK BY _____ DEPT. _____ DATE _____
METHOD REV. BY _____ DEPT. _____ DATE _____ DEPT. _____ DATE _____

Heat Balance Around Test Chamber

Heat Lost by Process Gas

$$\text{CO}_2 \left(\frac{2.40 + 2.63}{2} \text{ lb/min} \right) (0.225 \text{ BTU/lb}^\circ\text{F}) (1031 - 482^\circ\text{F}) = 403 \text{ BTU/min}$$

$$\text{H}_2\text{O} \left(\frac{2.51 + 3.40}{2} \text{ lb/min} \right) (0.478 \text{ BTU/lb}^\circ\text{F}) (1031 - 482^\circ\text{F}) = 775 \text{ BTU/min}$$

$$\text{N}_2 \left(\frac{95.36 + (102.89 - 27(15.54))}{2} \right) (.25 \text{ BTU/lb}^\circ\text{F}) (1031 - 482^\circ\text{F}) = 13,174 \text{ BTU/min}$$

$$\text{O}_2 \left(\frac{32.03 + (26.72 - .21(15.54))}{2} \right) (.22 \text{ BTU/lb}^\circ\text{F}) (1031 - 482^\circ\text{F}) = 2,729 \text{ BTU/min}$$

Total Heat Lost 17,081 BTU/min

Heat Absorbed by Leak Air

$$(15.54 \text{ lb/min}) (0.24 \text{ BTU/lb}^\circ\text{F}) (482 - 70^\circ\text{F}) = 1,537 \text{ BTU/min}$$

Heat Lost Through Walls

$$(17,081 \text{ BTU/min}) - (1,537 \text{ BTU/min}) = 15,544 \text{ BTU/min}$$

932,664 BTU/hr

CLIENT/SUBJECT USATHAM4 W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO. _____

PREPARED BY <u>M. Campos</u>	DEPT. <u>1811</u>	DATE <u>21 Sep 89</u>	APPROVED BY
MATH CHECK BY _____	DEPT. _____	DATE _____	
METHOD REV. BY _____	DEPT. _____	DATE _____	DEPT. _____ DATE _____

Average Fuel Gas Pressure 6.58 psig

Average T.O. exit Gas

2000 dscfm ± 5%
 1787 °F
 10,700 wacfm
 6.47% CO₂ by vol
 10.83% O₂ by vol
 82.70% N₂ by vol
 10.07% H₂O by volume

$$CO_2 (2000 \text{ dscfm}) (.0647 \text{ CO}_2) (.11378 \text{ }^{\circ}\text{scf}) = 14.72 \text{ }^{\circ}\text{lb/min}$$

$$O_2 (2000 \text{ dscfm}) (.1083 \text{ O}_2) (.0822 \text{ }^{\circ}\text{scf}) = 17.92 \text{ }^{\circ}\text{lb/min}$$

$$N_2 (2000 \text{ dscfm}) (.8270 \text{ N}_2) (.07246 \text{ }^{\circ}\text{scf}) = 119.75 \text{ }^{\circ}\text{lb/min}$$

$$H_2O \frac{x}{2000 + x} = .1007$$

$$x = (224 \text{ scfm}) (.0465 \text{ }^{\circ}\text{scf}) = 10.42 \text{ }^{\circ}\text{lb/min}$$

$$162.81 \text{ }^{\circ}\text{lb/min}$$

GAS Flow

$$P_{graph} = (1.103)(6.58 \text{ psig})$$

$$= 7.25 \text{ psig} = 4.3 \text{ mm BTU/hr}$$

WILSON

SHEET 3 of 11

CLIENT/SUBJECT <u>USATYAMA</u>			W.D. NO. <u>7000-00-27</u>	
TASK DESCRIPTION <u>Test Run #3</u>			Hac - Balance	
PREPARED BY <u>M. Cousins</u>			DEPT <u>181</u>	DATE <u>2/5/89</u>
MATH CHECK BY _____			DEPT _____	DATE _____
METHOD REV. BY _____			DEPT _____	DATE _____
			APPROVED BY _____	
			DEPT _____ DATE _____	

$$(4,800,000 \text{ min}^3/\text{hr}) / (2316 \text{ in}^3/\text{ft}^3) = 2073 \text{ scfm}$$

$$= 34.5 \text{ scfm}$$

$$(34.5 \text{ scfm})(0.1196 \text{ lb}/\text{scf}) = 4.13 \text{ lb}/\text{min}$$

Air In Leakage

$$\frac{162.8 \text{ lb}/\text{min} - (140.3 \text{ lb}/\text{min} + 4.13 \text{ lb}/\text{min})}{11.32} = 18.37 \text{ lb}/\text{min}$$

Combustion Product from propane

$$\text{CO}_2 (4.13 \text{ lb}/\text{min})(2.99 \text{ lb}/\text{lb}) = 12.35 \text{ lb}/\text{min}$$

$$\text{H}_2\text{O} (4.13 \text{ lb}/\text{min})(1.63 \text{ lb}/\text{lb}) = 6.73 \text{ lb}/\text{min}$$

$$\text{N}_2 (4.13 \text{ lb}/\text{min})(12.07 \text{ lb}/\text{lb}) = 49.85 \text{ lb}/\text{min}$$

$$\text{Air Consumed} (4.13 \text{ lb}/\text{min})(15.69 \text{ lb}/\text{min}) = 64.80 \text{ lb}/\text{min Air}$$

Mass Balance Check

$$\text{CO}_2 \frac{14.72 \text{ lb}/\text{min} - (12.35 \text{ lb}/\text{min} + 2.63)}{14.72 \text{ lb}/\text{min}} = -1.7\%$$

$$\text{H}_2\text{O} \frac{10.42 \text{ lb}/\text{min} - (6.73 \text{ lb}/\text{min} + 3.40)}{10.42} = 2.8\%$$

$$\text{N}_2 \frac{119.75 - (107.89 \text{ lb}/\text{min} + 79(14.22))}{119.75} = 2.2\%$$

CLIENT/SUBJECT <u>USATAMA</u>	N.O. NO. <u>2000-00-24</u>
TASK DESCRIPTION <u>Test Run #3 Heat Balance</u>	TASK NO. _____
PREPARED BY <u>M. Colman</u> DEPT <u>1911</u> DATE <u>21 Sep 84</u>	APPROVED BY _____ DEPT _____ DATE _____
MATH CHECK BY _____ DEPT _____ DATE _____	
METHOD REV. BY _____ DEPT _____ DATE _____	

$$O_2 \quad \frac{(17.92 \text{ lb/min}) - (26.42 + 21(18.27) - 21(64.30))}{17.92 \text{ lb/min}} = 7.0\%$$

Heat Balance Check

Heat Released by Fuel

$$(4.13 \text{ lb/min}) (19,944 \text{ Btu/lb}) = 82,369 \text{ Btu/min}$$

Heat Absorbed by F.C. exit gases

$$CO_2 \quad (2.63 \text{ lb/min}) (0.225 \text{ Btu/lb}^\circ F) (1787 - 482^\circ F) = 772 \text{ Btu/min}$$

$$H_2O \quad (3.46 \text{ lb/min}) (0.478 \text{ Btu/lb}^\circ F) (1787 - 482^\circ F) = 2121 \text{ Btu/min}$$

$$N_2 \quad (107.9 \text{ lb/min}) (0.25 \text{ Btu/lb}^\circ F) (1787 - 482^\circ F) = 35,202 \text{ Btu/min}$$

$$O_2 \quad \frac{(26.42 - 21(64.30))}{(2.31 \text{ lb/min})} (0.22 \text{ Btu/lb}^\circ F) (1787 - 482^\circ F) = 3,678 \text{ Btu/min}$$

41,773 Btu/min

Heat Absorbed by Combustion Products

$$CO_2 \quad (12.35 \text{ lb/min}) (0.225 \text{ Btu/lb}^\circ F) (1787 - 70) = 4,771 \text{ Btu/min}$$

$$H_2O \quad (1.63 \text{ lb/min}) (.478 \text{ Btu/lb}^\circ F) (1787 - 70) = 1,338 \text{ Btu/min}$$

6,109 Btu/min

Heat Absorbed by Leak Air

$$Air \quad (18.37 \text{ lb/min}) (0.24 \text{ Btu/lb}^\circ F) (1787 - 70) = 7,570 \text{ Btu/min}$$



SHEET 10 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run #3 Heat Balance TASK NO. _____

PREPARED BY M. Gomas DEPT. 1811 DATE 21 Sep 89 APPROVED BY _____

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____ DEPT. _____ DATE _____

Penetration Losses

Surface Area

$$\pi (5 \text{ ft})(20 \text{ ft}) = 314 \text{ ft}^2$$

Heat Lost

$$(314 \text{ ft}^2)(2.8 \text{ Btu/hr ft}^2 \text{ F})(300 \text{ F} - 70 \text{ F})(\% \text{ air}) = 3,372 \text{ Btu/hr}$$

Total Losses

$$(41,773 \text{ Btu/hr} + 6,109 + 7570 + 3,372) = 58,824 \text{ Btu/hr}$$

Closure Balance

$$\frac{(82,369 - 58,824)}{82,369} = 28.6\%$$



SHEET 1 of 11

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24TASK DESCRIPTION Test Run #3 Heat Balance TASK NO. _____PREPARED BY M. Cosmas DEPT 1211 DATE 20 Sep 89 APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____ DEPT _____ DATE _____

Gas Velocity in Air Preheater

$$(18") (\pi/12 \text{ inch}) = 1.5 \text{ ft}$$

$$\pi/4 (1.5 \text{ ft})^2 = 1.767 \text{ ft}^2$$

$$(5533 \text{ acfm}) / 1.767 \text{ ft}^2 = 3131 \text{ fpm}$$

Gas Velocity in After Burner

$$\pi/4 (5 \text{ ft})^2 = 19.63 \text{ ft}^2$$

$$(10,700 \text{ acfm}) / 19.63 \text{ ft}^2 = 545 \text{ fpm}$$

Assuming same size

$$5533 \text{ acfm} / 545 \text{ fpm} = 10 \text{ ft}^2$$

$$10 \text{ ft}^2 = (\pi/4) (x \text{ ft})^2$$

$$x = 3.6 \text{ ft } \phi$$



SHEET 1 of 10

CLIENT/SUBJECT USA THAM A

W.O. NO. 2000-00-27

TASK DESCRIPTION Test Run #5 Heat Balance

TASK NO. _____

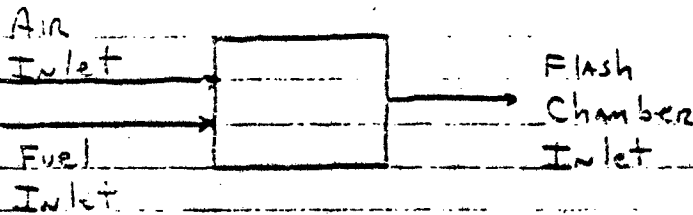
PREPARED BY M. Collins DEPT. 1911 DATE 16 Feb 90

APPROVED BY _____

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

DEPT. _____ DATE _____



Average Inlet Air Flow P_{I202} $1.11 \pm .16$ mwg

Average Gas Pressure P_{I310} $2.47 \pm .61$ psig

Average Flash Chamber Inlet

1533 dscfm $\pm 3.3\%$

936 °F (

4700 acfm

1.9 % CO₂

16.9 % O₂

81.2 % N₂

3.0 % H₂O

$$\text{CO}_2 (1533 \text{ dscfm}) (0.019) (.1137 \text{ }^{15}/\text{ft}^3) = 3.31 \text{ }^{15}/\text{min}$$

$$\text{O}_2 (1533 \text{ dscfm}) (.0169) (.08275 \text{ }^{15}/\text{ft}^3) = 2.14 \text{ }^{15}/\text{min}$$

$$\text{N}_2 (1533 \text{ dscfm}) (.812) (.07240 \text{ }^{15}/\text{ft}^3) = 90.12 \text{ }^{15}/\text{min}$$

$$\text{H}_2\text{O} \quad x \quad .030$$

$$1533 + x$$

$$x = (47.41 \text{ acfm}) (.04654 \text{ }^{15}/\text{scf}) = 2.21 \text{ }^{15}/\text{min}$$

$$117.08 \text{ }^{15}/\text{min}$$

WESTERN

SHEET 2 of 16

CLIENT/SUBJECT USATHAMAW.O. NO. 7000-00-24TASK DESCRIPTION Test Run T-5 Heat BalanceTASK NO. 2PREPARED BY M. Cosmos DEPT 1311 DATE 16 Feb 96

APPROVED BY

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

DEPT _____ DATE _____

Correction to Gas Flow for altitude

$$\text{correction} = e (0.0000360286 (4500 \text{ ft})) = 1.176$$

$$\text{design loc.} = e (0.0000360286 (1750 \text{ ft})) = 1.066$$

$$\text{density ratio} = 1.176 / 1.066 = 1.103$$

$$P_{\text{graph}} = (\text{Density ratio}) (P_{\text{act}})$$

$$= 1.103 (2.47 \text{ psig}) =$$

$$= 2.72 \text{ psig}$$

From vendor graph 802 $2.72 \text{ psig} = 2.0 \text{ min air/lin}$

$$(2,000,000 \text{ scfm/lin}) / 2316 \text{ scf} =$$

$$863 \text{ scfh} = 14.39 \text{ scfm of propane}$$

$$(14.39 \text{ scfm}) (0.1196 \text{ lb/scf}) = 1.72 \text{ lb/min}$$

Combustion Air flow

$$\text{Flow} = 1433 + 406 (\text{in } (1.11 \text{ mos})) = 1475 \text{ scfm}$$

$$(1475 \text{ scfm}) (0.075 \text{ lb/scf}) = 108.7 \text{ lb/min}$$

moisture loadings under worst observed

$$\text{conditions } 60^\circ \text{F} = 0.01 \text{ lb}_{\text{H}_2\text{O}} / \text{lb}_{\text{d.a.}}$$



SHEET 3 of 10

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24
 TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO. 2
 PREPARED BY M. Cosmos DEPT. 1311 DATE 16 Feb 90 APPROVED BY _____
 MATH CHECK BY _____ DEPT. _____ DATE _____
 METHOD REV. BY _____ DEPT. _____ DATE _____ DEPT. _____ DATE _____

Maximum water Load

$$(108.7 \text{ lb/min}) (.01 \text{ lb H}_2\text{O/lb air}) = 1.08 \text{ lb H}_2\text{O}$$

Mass Balance Check

$$\frac{117.08 \text{ lb/min} - (1.72 \text{ lb/min gas} + 108.7 \text{ lb/min} + 1.08 \text{ lb/min})}{117.08 \text{ lb/min}}$$

4.77% closure with measured error

Combustion of Propane

CO ₂	2.99	lb/lb gas	
H ₂ O	1.63	lb/lb gas	
N ₂	12.07	lb/lb gas	
Total	16.69	lb/lb gas	= 15.69 $\frac{\text{lb air}}{\text{lb gas}}$

Combustion of Fuel

$$\begin{aligned} \text{CO}_2 & (1.72 \text{ lb/min}) (2.99 \text{ lb/lb}) = 5.14 \text{ lb/min} \\ \text{H}_2\text{O} & (1.72 \text{ lb/min}) (1.63 \text{ lb/lb}) + 1.08 \text{ lb/min} = 3.88 \text{ lb/min} \\ \text{N}_2 & (1.72 \text{ lb/min}) (12.07 \text{ lb/lb}) = 20.76 \text{ lb/min} \end{aligned}$$

Excess Air

$$(108.7 \text{ lb/min}) - (1.72 \text{ lb/min}) (15.69 \text{ lb/lb}) = 81.71 \text{ lb/min XS Air}$$

$$\text{O}_2 \text{ in XS Air} = (81.71 \text{ lb/min}) (.21) = 17.16 \text{ lb/min}$$

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24

TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO. 2

PREPARED BY M. Casmas DEPT. 1911 DATE 16 Feb 90

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

APPROVED BY	
DEPT. _____	DATE _____

Heat Balance

Heat Released by Fuel

$$(1.72 \text{ lb/min}) (19,944 \text{ BTU/lb}) = 34,303 \text{ BTU/min}$$

Heat Absorbed by Combustion Products

$$\text{CO}_2 (5.14 \text{ lb/min}) (0.225 \text{ BTU/lb}^\circ\text{F}) (936^\circ\text{F} - 70^\circ) = 1002 \frac{\text{BTU}}{\text{min}}$$

$$\text{H}_2\text{O} (3.88 \text{ lb/min}) (0.478 \text{ BTU/lb}^\circ\text{F}) (936 - 70^\circ\text{F}) = 1,606 \frac{\text{BTU}}{\text{min}}$$

$$\text{N}_2 (20.76 \text{ lb/min}) (0.25 \text{ BTU/lb}^\circ\text{F}) (936 - 70^\circ\text{F}) = 4495 \frac{\text{BTU}}{\text{min}}$$

$$\text{xs Air} (81.71 \text{ lb/min}) (0.24 \text{ BTU/lb}^\circ\text{F}) (936 - 70^\circ\text{F}) = 16,983 \frac{\text{BTU}}{\text{min}}$$

Total 24,086 BTU/min

Radiation Losses

$$\pi (20 \text{ inches}) \left(\frac{1}{12} \text{ inch}\right) (6.5 \text{ ft} + 24.5 \text{ ft}) = 162 \text{ ft}^2$$

$$(162 \text{ ft}^2) (2.8 \frac{\text{BTU}}{\text{hr ft}^2 \text{ }^\circ\text{F}}) (300 - 70^\circ\text{F}) \left(\frac{\text{hr}}{60 \text{ min}}\right) = 1,742 \frac{\text{BTU}}{\text{min}}$$

Heat Balance Comparison

$$\frac{(34,303 \text{ BTU/min}) - (24,086 \text{ BTU/min} + 1,742)}{34,303 \text{ BTU/min}} = 24.7\%$$



SHEET 5 of 10

CLIENT/SUBJECT USATHAMA W.O. NO. 7000-00-24TASK DESCRIPTION Test Run T-5 Heat Balance TASK NO. 2PREPARED BY M. Cosmos DEPT. 1711 DATE 16 Feb 90

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____

APPROVED BY	
DEPT. _____	DATE _____

Average Flash Chamber Outlet

2033 dscfm $\pm 5\%$

45% °F = 70°F

4133 acfm

1.52 CO₂17.72 O₂80.97 N₂2.92 H₂O

$$\text{CO}_2 (2033 \text{ dscfm}) (.015 \text{ CO}_2) (.11378 \text{ }^{15}/\text{cf}) = 3.47 \text{ }^{15}/\text{min}$$

$$\text{O}_2 (2033 \text{ dscfm}) (.177 \text{ O}_2) (.0827 \text{ }^{15}/\text{cf}) = 29.76 \text{ }^{15}/\text{min}$$

$$\text{N}_2 (2033 \text{ dscfm}) (.809 \text{ N}_2) (.072 \text{ }^{15}/\text{cf}) = 118.42 \text{ }^{15}/\text{min}$$

$$\text{H}_2\text{O} \frac{x}{2033 + x} = .029$$

$$x = (60.71 \text{ scfm}) (.04654 \text{ }^{15}/\text{scf}) = 2.83 \text{ }^{15}/\text{min}$$

Total Exit Gas Mass Flow 154.48 ¹⁵/min

Leakage Estimate

$$\frac{154.48 \text{ }^{15}/\text{min} - 117.08 \text{ }^{15}/\text{min}}{154.48 \text{ }^{15}/\text{min}} = 24.2\%$$

Leakage Volume

$$154.48 \text{ }^{15}/\text{min} - 117.08 \text{ }^{15}/\text{min} = 37.4 \text{ }^{15}/\text{min}$$

CLIENT/SUBJECT USATYAMA W.O. NO. 2000-00-27

TASK DESCRIPTION Test Run T-5 Heat Balance TANK NO. 2

PREPARED BY M. Cosmos DEPT 1811 DATE 16 Feb 90 APPROVED BY

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

Heat Balance Around Flash Chamber

Heat Lost by Process Gas

$$CO_2 \left(\frac{3.31 + 3.47}{2} \right) (0.225 \frac{SCFM}{lb \cdot F}) (936 - 456 \cdot F) = 366 \frac{BTU}{min}$$

$$H_2O \left(\frac{2.21 + 2.23}{2} \right) (0.478 \frac{SCFM}{lb \cdot F}) (936 - 456 \cdot F) = 578 \frac{BTU}{min}$$

$$N_2 \left(\frac{20.12 + (119.42 - 79(37.7))}{2} \right) (0.25 \frac{SCFM}{lb \cdot F}) (936 - 456 \cdot F) = 10,740 \frac{BTU}{min}$$

$$O_2 \left(\frac{21.44 + (29.76 - 21(37.7))}{2} \right) (0.24 \frac{SCFM}{lb \cdot F}) (936 - 456) = 2,497 \frac{BTU}{min}$$

$$\text{Total Heat Lost by Gas} = 14,181 \frac{BTU}{min}$$

Heat Absorbed by Leak Air

$$(37.4 \frac{lb}{min}) (0.24 \frac{SCFM}{lb \cdot F}) (456 - 70 \cdot F) = 3465 \frac{BTU}{min}$$

Heat Lost Through Walls

$$(14,181 \frac{BTU}{min}) - 3465 \frac{BTU}{min} = 10,716 \frac{BTU}{min}$$

$$\approx 642,976 \frac{BTU}{hr}$$

SHEET 7 of 13CLIENT/SUBJECT USATITAMAH.O. NO. 7000-00-24TASK DESCRIPTION Test Run T-5 Heat Balance

TASK NO. _____

PREPARED BY M. Cosmos DEPT 1811 DATE 24 Feb 90

APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

DEPT _____ DATE _____

Average Fuel Gas Pressure 6.26 psig ± .59

Average T.O. Exit Gas

2467 dscfm1706 °F12,617 actfm6.3 % CO₂10.8 % O₂82.9 % N₂8.7 % H₂O

$$\text{CO}_2 (2467 \text{ dscfm})(.063)(.11378 \text{ lb/dscf}) = 17.7 \text{ lb/min}$$

$$\text{O}_2 (2467 \text{ dscfm})(.108 \text{ O}_2)(.08275 \text{ lb/dscf}) = 22.0 \text{ lb/min}$$

$$\text{N}_2 (2467 \text{ dscfm})(.829 \text{ N}_2)(.07276 \text{ lb/dscf}) = 148.1 \text{ lb/min}$$

$$\text{H}_2\text{O} \quad \frac{x}{2467 + x} = .084$$

$$x = (226 \text{ cfm})(.04654 \text{ lb/dscf}) = 10.53 \text{ lb/min}$$

198.3 lb/min

Gas Flow

$$P_{\text{graph}} = (1.103)(6.26 \text{ psig})$$

$$= 6.90 \text{ psig} = 4,500,000 \text{ BTU/hr}$$

WASTEN

SHEET 9 of 10

CLIENT/SUBJECT <u>US AIR FORCE</u>	W.O. NO. <u>7400-00-27</u>
TASK DESCRIPTION <u>Test Run F-5 Heat Balance</u>	TASK NO. _____
PREPARED BY <u>M. Casimiro</u> DEPT <u>1811</u> DATE <u>24 Feb 90</u>	APPROVED BY _____
MATH CHECK BY _____ DEPT _____ DATE _____	DEPT _____ DATE _____
METHOD REV. BY _____ DEPT _____ DATE _____	DEPT _____ DATE _____

$$(4,500,000 \text{ BTU/hr}) / (2316 \text{ STU/scf}) = 1943 \text{ scfh}$$

$$= 32.4 \text{ scfm}$$

$$(32.4 \text{ scfm})(0.1196 \text{ lb/scf}) = 3.87 \text{ lb/min}$$

Air Leakage

$$198.3 \text{ lb/min} - (154.5 \text{ lb/min} + 3.87 \text{ lb/min}) = 39.9 \text{ lb/min}$$

$$= 20.1 \%$$

Combustion Products

$$\text{CO}_2 (3.87 \text{ lb/min})(2.99 \text{ lb/lb}) = 11.57 \text{ lb/min}$$

$$\text{H}_2\text{O} (3.87 \text{ lb/min})(1.63 \text{ lb/lb}) = 6.31 \text{ lb/min}$$

$$\text{N}_2 (3.87 \text{ lb/min})(12.07 \text{ lb/lb}) = 46.71 \text{ lb/min}$$

$$\text{Air Consumed} (3.87 \text{ lb/min})(15.69 \text{ lb/lb}) = 60.72 \text{ lb/min}$$

Mass Balance check

$$\text{CO}_2 \frac{17.7 \text{ lb/min} - (11.57 \text{ lb/min} + 3.47 \text{ lb/min})}{17.7 \text{ lb/min}} = 15.6 \%$$

$$\text{H}_2\text{O} \frac{20.53 \text{ lb/min} - (6.31 \text{ lb/min} + 2.53 \text{ lb/min})}{20.53 \text{ lb/min}} = 13.2 \%$$

$$\text{N}_2 \frac{148.1 \text{ lb/min} - (11.812 \text{ lb/min} + 79.39 \text{ lb/min})}{148.1} = -1.2 \%$$

SHEET 9 of 13CLIENT/SUBJECT USATHAMA W.O. NO. 7030-100-24TASK DESCRIPTION Test Run #5 Heat Balance TASK NO. _____

PREPARED BY <u>M. Cosmos</u>	DEPT. <u>1811</u>	DATE <u>24 Feb 90</u>	APPROVED BY	
MATH CHECK BY _____	DEPT. _____	DATE _____		
METHOD REV. BY _____	DEPT. _____	DATE _____	DEPT. _____	DATE _____

$$O_2 \quad \frac{22.0 \text{ lb/min} - (29.76 \text{ lb/min} + .21(39.9 \text{ lb/min}) - .21(60.72 \text{ lb/min}))}{22.0 \text{ lb/min}} = -15.4\%$$

Heat Balance Check

Heat Released by Fuel

$$(3.87 \text{ lb/min})(19,994 \text{ BTU/lb}) = 77,378 \text{ BTU/min}$$

Heat Absorbed by F.C. Exit Gases

$$CO_2 \quad (3.47 \text{ lb/min})(0.225 \text{ BTU/lb}^\circ F)(1706 - 456^\circ F) = 976 \frac{\text{BTU}}{\text{min}}$$

$$H_2O \quad (2.83 \text{ lb/min})(0.478 \text{ BTU/lb}^\circ F)(1706 - 456^\circ F) = 1691 \frac{\text{BTU}}{\text{min}}$$

$$N_2 \quad (118.42 \text{ lb/min})(0.25 \text{ BTU/lb}^\circ F)(1706 - 456^\circ F) = 37,006$$

$$O_2 \quad (29.76 \text{ lb/min} - .21(60.72))(0.22 \text{ BTU/lb}^\circ F)(1706 - 456^\circ F) = 4677$$

44,350

Heat Absorbed by Combustion Products

$$CO_2 \quad (11.57 \text{ lb/min})(0.225 \text{ BTU/lb}^\circ F)(1706 - 456^\circ F) = 3254 \frac{\text{BTU}}{\text{min}}$$

$$H_2O \quad (6.31 \text{ lb/min})(0.478 \text{ BTU/lb}^\circ F)(1706 - 456^\circ F) = 3776 \frac{\text{BTU}}{\text{min}}$$

7024

Heat Balance

$$Air \quad (39.9 \text{ lb/min})(0.24 \text{ BTU/lb}^\circ F)(1706 - 70^\circ F) = 15,666 \frac{\text{BTU}}{\text{min}}$$

WESTERN

SHEET 10 of 10

CLIENT/SUBJECT USPH/AMA N.O. NO. 7000-00-24TASK DESCRIPTION Test Run #5 Heat Balance TASK NO. _____PREPARED BY M. Casares DEPT. 124 DATE 24 Feb 90 APPROVED BY _____

MATH CHECK BY _____ DEPT. _____ DATE _____

METHOD REV. BY _____ DEPT. _____ DATE _____ DEPT. _____ DATE _____

Radiation Losses

$$\text{Surface Area } \pi(5\text{ft})(20\text{ft}) = 314\text{ft}^2$$

Heat Losses

$$(314\text{ft}^2)(2.8\text{ Btu/hr ft}^2\text{ }^\circ\text{F})(300-70\text{ }^\circ\text{F})(\text{hr/min}) = 3370\text{ Btu/min}$$

Total Heat Losses

$$(44,350\text{ Btu/min} + 7024 + 15,666 + 3370) = 70,410\text{ Btu/min}$$

 Closure Balance

$$(77,183\text{ Btu/min} - 70,410\text{ Btu/min}) = 852$$

$$77,183\text{ Btu/min}$$



SHEET _____ of _____

CLIENT/SUBJECT _____ W.O. NO. _____

TASK DESCRIPTION _____ TASK NO. _____

PREPARED BY _____	DEPT _____	DATE _____	APPROVED BY _____
MATH CHECK BY _____	DEPT _____	DATE _____	DEPT _____
METHOD REV. BY _____	DEPT _____	DATE _____	DATE _____

Heat Transfer Calculations

Test Runs 1

2, 3, 4 5



SHEET 1 of 5

CLIENT/SUBJECT USATHAMA

W.O. NO. 7000-00-24

TASK DESCRIPTION Insulation Calculations for Flash Chamber TASK NO. Set II

PREPARED BY M. Cosmos DEPT 1811 DATE _____

APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

DEPT _____ DATE _____

Calculated Heat Losses from chamber Test 3

$T_{gas\ inlet} = 947.3$ data from thermocouples

$T_{gas\ outlet} = 527.7$

Average Gas Temperature = $737.5\ ^\circ F$

Wall Temperatures

Rear Wall 416.5

Rear Floor 350.8

Roof 527.7

Left Wall 524.6

Floor 335.7

Middle Wall 361.9

Average $419.5 \pm 87\ ^\circ F$

Heat Transfer from Gas to Wall = Q_{GW}

$$Q_{GW} = U_g A \Delta T_{GW}$$

Heat Transfer in Wall = Q_w

$$Q_w = U_w A \Delta T_w$$



SHEET 2 of 5

CLIENT/SUBJECT USATHAMA

W.O. NO. 7000-00-24

TASK DESCRIPTION Insulation Calculations

TASK NO. _____

PREPARED BY M. Campos DEPT 1811 DATE 24 Feb 90

APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

DEPT _____ DATE _____

$$A = \pi D L + 2 \left[\pi \frac{D^2}{4} \right]$$

$$= \pi (12.5 \text{ ft})(35 \text{ ft}) + 2 \left[\pi \frac{(12.5 \text{ ft})^2}{4} \right]$$

$$= 1620 \text{ ft}^2 \text{ inside surface AREA}$$

$$Q = 932,664 \frac{\text{BTU}}{\text{hr}} = U_o (1620 \text{ ft}^2)(737 - 420 \text{ }^\circ\text{F})$$

$$U_{ow} = 1.82 \text{ BTU/hr ft}^2 \text{ }^\circ\text{F}$$

Calculations Composite Bldg Resistance

$$Q = 932,664 \frac{\text{BTU}}{\text{hr}} = \frac{h_o A_m}{L_a} (420 - 70 \text{ }^\circ\text{F})$$

$$A_m = \pi D_{avg} L + 2 \left[\pi \frac{D^2}{4} \right]$$

$$= \pi \left[\frac{(12.5 + 21.0)}{2} \right] (35 \text{ ft}) + 2$$

$$= 1842 \text{ ft}^2 + 245 \text{ ft}^2$$

$$= 2087 \text{ ft}^2$$

$$L_a = \frac{(D_o + D_i)}{2}$$

$$= \frac{(21.0 + 12.5 \text{ ft})}{2} = 4.25 \text{ ft}$$

$$932,664 \frac{\text{BTU}}{\text{hr}} = \frac{h_o (2087 \text{ ft}^2)(420 - 70 \text{ }^\circ\text{F})}{4.25 \text{ ft}}$$

$$h_o = 5.43 \text{ BTU/hr ft}^2 \text{ (F/A)}$$

combine conductivity of building



SHEET 3 of 5

CLIENT/SUBJECT USATHAMA

W.O. NO. 7000-00-27

TASK DESCRIPTION Insulation Calculation

TASK NO. _____

PREPARED BY M. Cosmos DEPT 1811 DATE 24 Feb 90

APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

DEPT _____ DATE _____

Calculated Heat Losses from Flash Chamber Test 2

T_{gas inlet} = 733 °F

T_{gas outlet} = 391 °F

Average Gas Temperature = $\frac{733+391}{2} = 562$ °F

Wall Temperatures

Rear Wall 267

Rear Floor 255

Roof 314

Left Wall 397

Right Floor 212

Front Wall 271

Average 286 ± 63 °F

Heat Transfer To Wall from Gas

$Q = U_{gas} A_{wall} (\Delta T)$

$594,202 \text{ BTU/hr} = U (1620 \text{ ft}^2) (562 \text{ °F} - 216 \text{ °F})$

$U = 1.33 \text{ BTU/hr ft}^2 \text{ °F}$

$594,202 \text{ BTU/hr} = h_c (2087 \text{ ft}^2) (286 - 70 \text{ °F})$

425 ft²

$h_c = 5.60 \text{ BTU/hr ft}^2 \text{ (°F/ft)}$

CLIENT/SUBJECT USATHAMAW.O. NO. 7000-00-27TASK DESCRIPTION Insulation Calculation

TASK NO. _____

PREPARED BY M. Gismos DEPT 1611 DATE 24 Feb 90

APPROVED BY _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

DEPT _____ DATE _____

Calculated Heat Losses from Flash Chamber T-5

 $T_{\text{gas Inlet}} = 893 \text{ }^{\circ}\text{F}$ $T_{\text{gas Outlet}} = 535 \text{ }^{\circ}\text{F}$ $\text{Average Gas Temperature} = 714 \text{ }^{\circ}\text{F}$

Wall Temperatures

Rear Floor 392 F

Rear wall 408

Right Floor 340

Left Wall 540

Roof 548

Middle Wall 361

Front Wall 343

 $\text{Average} = 376 \pm 163 \text{ }^{\circ}\text{F}$

Heat Transfer To Wall From Gas

$$Q = U_{\text{gas}} A_{\text{wall}} \Delta T$$

$$642,976 \text{ BTU/hr} = U_{\text{gas}} (1620 \text{ ft}^2) (714 - 376 \text{ }^{\circ}\text{F})$$

$$U_{\text{gas}} = 1.17 \text{ BTU/hr ft}^2 \text{ }^{\circ}\text{F}$$

$$642,976 \text{ BTU/hr} = h_a (2087 \text{ ft}^2) (376 - 70 \text{ }^{\circ}\text{F})$$

4.25 ft^2

$$h_a = 4.28 \text{ BTU/hr ft}^2 \text{ (OF/ft}^2)$$

CLIENT/SUBJECT USATHAMAW.O. NO. 7000-00-24TASK DESCRIPTION Insulation Calculations

TASK NO. _____

PREPARED BY M. Cosmas DEPT 1871DATE 24 Feb 90

APPROVED BY _____

MATH CHECK BY _____ DEPT _____

DATE _____

METHOD REV. BY _____ DEPT _____

DATE _____

DEPT _____ DATE _____

Test T-2

Gas Velocity in Chamber

$$(4400 \text{ wacfm} + 3917 \text{ wacfm})/2 = 4159 \text{ wacfm}$$

$$\text{Area} = \pi D^2 / 4 = \pi (12.5 \text{ ft})^2 / 4 = 123 \text{ ft}^2$$

$$\text{velocity} = 4159 / 123 \text{ ft}^2 = 33.9 \text{ fpm}$$

Test T-3

$$(5532 \text{ wacfm} + 3900 \text{ wacfm})/2 = 4717 \text{ wacfm}$$

$$\text{velocity} = 4717 \text{ wacfm} / 123 \text{ ft}^2 = 38.3 \text{ fpm}$$

Test T-5

$$(4700 \text{ wacfm} + 4133 \text{ wacfm})/2 = 4417 \text{ wacfm}$$

$$\text{velocity} = 4417 \text{ wacfm} / 123 \text{ ft}^2 = 35.9 \text{ fpm}$$