

AIR TOXICS EMISSION FACTORS FOR COMBUSTION SOURCES USING PETROLEUM-BASED FUELS

VOLUME 3 DEVELOPMENT OF EMISSION FACTORS USING API/WSPA APPROACH

Health and Environmental Affairs Department
Publication Number 348

DEVELOPMENT OF TOXICS EMISSION FACTORS FOR PETROLEUM INDUSTRY COMBUSTION SOURCES

**Draft Final Report
Volume 3 - Supporting Information**

Prepared for

**Scott Folwarkow
Western States Petroleum Association
2300 Clayton Road, Suite 1440
Concord, Ca 94520**

and

**Karen Ritter
American Petroleum Institute
2020 L Street, N.W.
Washington, DC 20005**

Prepared by

**Energy and Environmental Research
18 Mason
Irvine, CA 92718**

June 14, 1997

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ACRONYMS

4D 2378	Same as 2,3,7,8-Tetrachlorodibenzo-p-dioxin.
4D Other	Same as Tetrachlorodibenzo-p-dioxin other.
4D Total	Same as Tetrachlorodibenzo-p-dioxin total.
4F 2378	Same as 2,3,7,8-Tetrachlorodibenzofuran.
4F Other	Same as Tetrachlorodibenzofuran other.
4F Total	Same as Tetrachlorodibenzofuran total.
5D 12378	Same as 1,2,3,7,8-Pentachlorodibenzo-p-dioxin.
5D Other	Same as Pentachlorodibenzo-p-dioxin other.
5D Total	Same as Pentachlorodibenzo-p-dioxin total.
5F 12378	Same as 1,2,3,7,8-Pentachlorodibenzofuran.
5F 23478	Same as 2,3,4,7,8-Pentachlorodibenzofuran.
5F Other	Same as Pentachlorodibenzofuran other.
5F Total	Same as Pentachlorodibenzofuran total.
6D 123478	Same as 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin.
6D 123678	Same as 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin.
6D 123789	Same as 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin.
6D Other	Same as Hexachlorodibenzo-p-dioxin other.
6D Total	Same as Hexachlorodibenzo-p-dioxin.
6F 123478	Same as 1,2,3,4,7,8-Hexachlorodibenzofuran.
6F 123678	Same as 1,2,3,6,7,8-Hexachlorodibenzofuran.
6F 123789	Same as 1,2,3,7,8,9-Hexachlorodibenzofuran.
6F 234678	Same as 2,3,4,6,7,8-Hexachlorodibenzofuran.
6F Other	Same as Hexachlorodibenzofuran other.
6F Total	Same as Hexachlorodibenzofuran total.
7D 1234678	Same as 1,2,3,4,7,8-Heptachlorodibenzo-p-dioxin.
7D Other	Same as Heptachlorodibenzo-p-dioxin other.
7D Total	Same as Heptachlorodibenzo-p-dioxin total.
7F 1234678	Same as 1,2,3,4,6,7,8-Heptachlorodibenzofuran.
7F 1234789	Same as 1,2,3,4,7,8,9-Heptachlorodibenzofuran.
7F Other	Same as Heptachlorodibenzofuran other.
7F Total	Same as Heptachlorodibenzofuran total.
8D	Same as Octachlorodibenzo-p-dioxin.
8F	Same as Octachlorodibenzofuran.
AB2588	Air Toxics "Hot Spots" Information and Assessment Act of 1987
AB	Afterburner
APC	Air Pollution Control
API	American Petroleum Institute
APS	Air Pollution Control System
ATEDS	Air Toxic Emission Data System
B	Benzene
BAAQMD	Bay Area Air Quality Management District
BD	Blank Data
BF	Baffle Filter
BTX	Benzene, Toluene, and Xylene
C	Cyclone or Carbon
CD	Calibration Data
CARB	California Air Resources Board
CO	Carbon Monoxide
COC	Carbon Monoxide Oxidation Catalyst

CVAAS	Cold Vapor Atomic Absorption Spectrometry
CVR	Case Vapors Recovered
Cr	Chromium
D	Dioxins
DD	Device Description
DM	Demister
dscfm	Dry Standard Cubic Feet per Minute
dscf	Dry Standard Cubic Feet
EER	Energy and Environmental Research Corporation
EF	Emission Factor
EPA	Environmental Protection Agency
USG	United States Government
F	Formaldehyde
GFAAS	Graphite Furnace Atomic Absorption Spectrometry
H ₂ S	Hydrogen Sulfide
HC	Hexavalent Chromium
HCHO	Formaldehyde
HCl	Hydrogen Chloride
HF	Hydrogen Fluoride
HI	Hydrogen Chloride
HNO ₃	Nitric acid
HO	Halogenated Organics
Hp	Horse Power
HS	Hydrogen Sulfide
ICAP	Inductively Coupled Argon Plasma
ICE	Internal Combustion Engine
IS	Internal Standards
LD	Laboratory Data or Location Data
lbs/MMcf	Pounds per Million Cubic Feet
lbs/Mgal	Pounds per Thousand Gallons
lbs/ton coke	Pounds per Ton Coke
lbs/1000 Barrels	Pounds per Thousand Barrels
LP	Liquid Petroleum
M	Metals
MMBtu	Million British Thermal Units
MMcf	Million Cubic Feet
MD	Method Description
MDL	Method Detection Limit
Mgal	Thousand Gallons
MMT	Multiple Metals Train
Ni	Nickel
NIOSH	National Institute of Occupation Safety and Hazard
NO _x	Nitrogen oxides
O ₂	Oxygen
O	Oxygen
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCDD	Polychlorinated Dibenzo-p-dioxin
PCDF	Polychlorinated Dibenzofuran
PH	Polycyclic Aromatic Hydrocarbons
ppbv	Parts per Billion Volume

PQL	Practical Quantitation Limit
PR	Process Rate
QA/QC	Quality Assurance/Quality Control
QD	Quality Assurance/Quality Control Data
RFG	Refinery Fuel Gas
ROC	Reactive Organic Compound
RSD	Relative Standard Deviation
S	Strokes per Cycle
SCAQMD	South Coast Air Quality Management District
SCC	Source Classification Code
SCR	Selective Catalytic Reduction
SD	Sample Data or Spray Dryer
SG	Steam Generator
SIC	Standard Industrial Classification
SO ₂	Sulfur Dioxide
SVOC	Semi-Volatile Organic Compounds
THC	Total Hydrocarbons
Ti	Titanium
TO	Thermal Oxidizer
VC	Vinyl Chloride
VOC	Volatile Organic Compound
WSPA	Western States Petroleum Association

SECTION 2
LISTING OF TEST DOCUMENTATION INFORMATION, AND SUBSTANCES
QUANTIFIED IN THE FUEL AND AIR EMISSIONS

ATTACHMENT 2. LISTING OF TEST DOCUMENTATION INFORMATION AND SUBSTANCES QUANTIFIED IN THE FUEL AND AIR EMISSIONS (a).

Device	Material	Search Case	Number of Tests	Control Device Used	Report ID	Report Information										Report Year	Sample Location	Substance Group																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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ASPHALT RECOVERY INCINERATOR BOILER	?	7	2	N	2369A	N	Y	Y	Y	Y	Y	Y	N	N	N	1990	STACK	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y</

Report Information: DD-Device Description, MD-Method Description, SD-Sample Data, LD-Lab Data, QD-QA/QC Data, CD-Calibration Data, LD-Location Data, BD-Blank Data, PR-Process Rate, EF-Emission Factor
 Substance Group: M-Metals, HI-HCl, PH-PAH, D-Dioxins, F-Formaldehyde, B-Benzene, VC-Vinyl Chloride, PB-PCB, HO-Halogenated Organics, HS-H2S, HC-Hex, Chromium, O-Other

Other Comments: NR - Not required, Y - Yes, N - No, Blank - No, ? - Additional investigation required.
 (a) Table described in Section 3.3.

ATTACHMENT 2. LISTING OF TEST DOCUMENTATION INFORMATION AND SUBSTANCES QUANTIFIED IN THE FUEL AND AIR EMISSIONS (a).

Device	Material	Search Case	Number of Tests	Control Device Used	Report ID	Report Information										Report Year	Sample Location	Substance Group																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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Report Information: DD-Device Description, MD-Method Description, SD-Sample Data, LD-Lab Data, QD-QA/QC Data, CD-Calibration Data, BD-Blank Data, PR-Process Rate, EF-Emission Factor
Substance Group: M-Metals, HI-HCl, PH-PAH, D-Dioxins, F-Formaldehyde, B-Benzene, VC-Vinyl Chloride, PB-PCB, HO-Halogenated Organics, HS-H2S, HC-Hex Chromium, O-Other

Other Comments: NR - Not required, Y - Yes, N - No, Blank - No, ? - Additional investigation required.
(a) Table described in Section 3.3.

SECTION 3

METHOD VALIDATION FORMS AND CALCULATION SPREADSHEETS



Description of Forms

Each method validation procedure includes a description of the method, quality assurance/control checks, blank correction procedure if applicable, and other comments. The method description is used to check the procedures followed in the source test report. The quality assurance/control checks are provided in a table. This table includes a series of questions. If the answer to a question is yes, then the user circles the code which includes the character "a". For example, if a swirl check was not conducted for Method 12, the code sc1a would be circled. If the test report does not provide enough information to answer the question, then the user circles the code which includes the character "b". For example, if the test report did not indicate the variation in probe diameter for Method 12, the code nz2b is circled. For some checks, more than one "a" code is provided. In these instances, each code refers to a different run. For example, if the Method 12 leak check was greater than 0.02 cfm for the second run, the second lc3a code is circled. It should be noted that all questions are phrased to indicate failures of key method criteria. Therefore, any mark on the table indicates either the information in the report was missing or a key parameter was not satisfied. If the table contains no marks, the test was conducted within guidelines of the method. All of the circled codes are transferred to a database. In addition to verifying key method parameters, calculation checks are conducted for each isokinetic method using the spreadsheets provided in this attachment. One calculation check is conducted per report per method per substance. For example, if a report presented results from methods 428 and 436, two calculation checks are conducted.

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 11 - June, 1983

Substance: Hydrogen Sulfide

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of hydrogen sulfide content of fuel gas streams at petroleum refineries. Hydrogen sulfide (H₂S) is collected from a source in a series of midjet impingers and absorbed in pH 3.0 cadmium sulfate (CdSO₄) solution to form cadmium sulfide (CdS). The latter compound is then measured iodometrically.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table. If the statements are true, circle "a"s or the corresponding run numbers; and if they are not reported, circle "b"s.

Other Comments

Revised: May 3, 1995

Device ID:

SAMPLING EQUIPMENT			
<i>* Field Dry Gas Meter</i>			
1.) Not checked pre- and post-test?		gm1a	gm1b
2.) Pre- and post-test Y not within (+/-) 5%?		gm2a	gm2b
SAMPLING PROCEDURES			
<i>*Sample Time</i>			
NR	1.) Runs < 10 minutes	sd1a	sd1a
<i>*Leak Check</i>			
1.) Not conducted?		lc1a	lc1b
2.) Indication of leaks?		lc2a	lc2b
<i>*Reagent Blank</i>			
1.) Not conducted daily?		fb1a	fb1b
<i>*Impinger Solution</i>			
1.) Hydrogen peroxide (H ₂ O ₂) not used?		im1a	im1b
2.) Cadmium sulfate (CdS) not used?		im2a	im2b
ANALYSIS			
<i>*Method</i>			
1.) 0.01N Sodium thiosulfate solution not used for titration?		mt1a	mt1b
2.) Iodine solution not used?		mt2a	mt2b

M-Method a-True
 R-Run b-Not reported
 S-Substance

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 12 - March, 1986
Substance: Inorganic Lead

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of inorganic lead emissions from stationary sources. Particulate and gaseous Pb emissions are withdrawn isokinetically and collected on a filter and/or in dilute nitric acid. The samples are then digested and analyzed by atomic absorption spectrometry using an air acetylene flame.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in attached Table. If the statements are true, circle "a"s or the corresponding run numbers; and if they are not reported, circle "b"s. In addition to completing the checklist please answer the following questions:

- 1.) What digestion method was used? _____
- 2.) Enter the digestion date(s). _____
- 3.) Number of Impingers: 0.1 HNO₃ (2) __ Empty (1) __ Silica Gel (1) __

Blank Procedure

Please be sure that the blank data was applied and considered correctly. For this particular method, the absorbance reading from the sample needs to be corrected for the absorbance readings from the filter and nitric blanks. There is no criteria for the blank levels, they just need to be performed and corrected for in the sample values.

Other Comments

Revised: November 14, 1994

Device ID:

SAMPLE LOCATION				
<i>* Swirl Check</i>				
1.) Not conducted?	sc1a	sc1b	M	
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M	
<i>* Stack Size</i>				
1.) Enter stack diameter (inches).			M	
2.) Stack diameter < 12 inch ? or	st2a	st2b	M	
3.) Area <113 inch squared?	st3a	st3b	M	
<i>* Number of Sample Points</i>				
1.) Enter total number of points.			M	
2.) Method 1 not used?	ns2a	ns2b	M	
SAMPLING EQUIPMENT				
<i>* Nozzle Size Check</i>				
1.) Not conducted prior to test?	nz1a	nz1b	M	
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M	
<i>* Field Gas Dry Meter</i>				
1.) Not checked pre- and post-test?	gm1a	gm1b	M	
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M	
<i>* Pitot Tube</i>				
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M	
SAMPLING PROCEDURES				
<i>* Leak Check</i>				
1.) Not conducted?	lc1a	lc1b	M	
2.) Values not reported?	lc2a		M	
3.) Pretest >0.02 cfm or 4% of average?	lc3a	lc3a	lc3a	R
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	lc4a	R
<i>* Isokinetic Variation</i>				
1.) Sample not taken isokinetically?	is1a	is1b	M	
2.) Isokinetic variation not reported?	is2a		M	
3.) Isokinetic <90 or >110%?	is3a	is3a	is3a	R
<i>* Field Reagent Blank</i>				
1.) Not conducted for two filters and 0.1N HNO3?	rb1a	rb1b	M	
2.) Not used to correct samples?	rb2a	rb2b	M	
ANALYSIS				
<i>* Method</i>				
1.) Atomic absorption spectrometry (AAS) not used?	mt1a	mt1b	M	
2.) Not conducted in triplicate?	mt2a	mt2b	M	

M-Method a-True
R-Run b-Not reported
S-Substance

CALCULATION CHECK FOR CARB METHOD 12

Device ID:

DATA ENTRY-SAMPLING	SYMBOL	UNITS	DATA
RUN NUMBER	-	-	
ROUND STACK, DIAMETER	ds	inches	
RECTANGULAR STACK, LENGTH	L	inches	
WIDTH	W	inches	
NOZZLE DIAMETER	dn	inches	
AVERAGE STACK TEMPERATURE	Fs	degrees F	
AVERAGE METER TEMPERATURE	Fm	degrees F	
BAROMETRIC PRESSURE	Pbar	in. Hg	
STACK STATIC PRESSURE	Pg	in. H2O	
AVG. DELTA H	dH	in. H2O	
AVG. RMS VELOCITY HEAD	dP	in. H2O	
PITOT COEFFICIENT	Cp	-	
GAS SAMPLE VOLUME	Vm	cubic ft.	
METER CALIBRATION FACTOR	Y	-	
TOTAL SAMPLING TIME	min	minutes	
STACK GAS OXYGEN CONTENT	Co2,m	%	
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	
CALCULATED DATA-SAMPLING			
RUN NUMBER	-	-	
NOZZLE AREA, $A_n = 3.14(dn)^2/4$	An	sq. in.	0.000
STACK AREA, $A_s = 3.14(ds)^2/576$ (ROUND) $= L * W/144$ (RECTANGULAR)	As	sq. feet	0.000
AVG. STACK TEMPERATURE, $T_s = F_s + 460$	Ts	degrees R	460.0
AVG. METER TEMPERATURE, $T_m = F_m + 460$	Tm	degrees R	460.0
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, $V_{mStd} = 17.64 * Y * (V_m/T_m) * (P_{bar} + dH/13.6)$	VmStd	dscf	0.0
VOLUME OF WATER VAPOR, $V_{wStd} = 0.04707 * W_w$	VwStd	scf	0.0
MOISTURE FRACTION, $B_{ws} = V_{wStd}/(V_{mStd} + V_{wStd})$	Bws	-	#DIV/0!
DRY STACK GAS MOL. WEIGHT, $M_d = 0.32(Co_{2,m}) + 0.44(Cco_{2,m}) + 0.28(100 - (Co_{2,m}) - (Cco_{2,m}))$	Md	g/g-mole	28.00
WET STACK GAS MOLECULAR WEIGHT, $M_w = M_d(1 - B_{ws}) + 18.0(B_{ws})$	Mw	g/g-mole	#DIV/0!
ABSOLUTE STACK PRESSURE, $P_s = P_{bar} + P_g/13.6$	Ps	in. Hg	0.00
STACK GAS VELOCITY $v_s = 85.49 C_p [\sqrt{(dP * T_s) / (P_s * M_w)}]$	vs	ft/s	#DIV/0!
ACTUAL STACK GAS FLOW RATE, $Q = 60 * v_s * A_s$	Q	acf/min	#DIV/0!
DRY GAS STACK FLOW RATE (DRY, STP) $Q_{sd} = 17.64 * Q * (1 - B_{ws}) * (P_s/T_s)$	Qsd	dscf/min	#DIV/0!
ISOKINETIC RATE, $I = 13.61 * T_s * V_{mStd} / [P_s * v_s * A_n * \min * (1 - B_{ws})]$	I	%	#DIV/0!
DATA ENTRY-ANALYTICAL			
TOTAL MASS OF LEAD IS SAMPLE TRAIN	Mpb	mg	
CALCULATED DATA-OVERALL			
CONCENTRATION OF LEAD $MC_{pb} = (35.31 * M_{pb}) / V_{mstd}$	MCpb	mg/dscm	#DIV/0!

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 15 - June, 1983

Substance: Hydrogen Sulfide

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the measurement of hydrogen sulfide, carbonyl sulfide, and carbon disulfide from tail gas control units of sulfur recovery plants. A gas sample is extracted from the emission source and diluted with clean dry air. An aliquot of the sample is then analyzed by gas chromatographic separation and flame photometric detection (GC/FPD).

Quality Assurance/Quality Control Checks

Due to the difficulty in performing on-site GC testing, CARB has often allowed contractors to collect sample in Tedlar Bags and submit the bags to the laboratory for analysis. If this was done on the source test, prior approval from CARB must be obtained. Along with approval, CARB adds additional quality assurance checks and samples to ensure accurate measurements. Determine if samples were collected with a bag sample or if on-site GC analysis was performed. If the sample was collected using a bag, please answer the following questions.

- 1) Was this modification discussed in the text? YES NO
- 2) Did the discussion include prior approval and additional requirements by CARB? YES NO
- 3) Were the additional requirements completed and did they pass criteria? YES NO

Revised: November 14, 1994

If the bag collection technique was used, some of the parameters listed in Table 1 might not be applicable. **The Table 1 applies strictly to the method, which specifies on-site GC analysis.** Please complete the detailed checklist provided in the attached Table . Please complete the detailed checklist provided in attached Table. If the statements are true, circle "a"s or the corresponding run numbers; and if they are not reported, circle "b"s.

Other Comments

Revised: November 14, 1994

Device ID:

This table applies only to on-site GC analysis.

SAMPLING PROCEDURES			
<i>* Leak Check</i>			
1.) Not conducted?	lc1a	lc1b	M
2.) Indication of leaks?	lc2a	lc2b	M
<i>* Sample line loss</i>			
1.) Not conducted for post-test?	sl1a	sl1b	M
2.) Sample not corrected for <20% loss?	sl2a	sl2b	M
3.) Sample corrected for >20% loss?	sl3a	sl3b	M
ANALYSIS			
<i>* Method</i>			
1.) GC/FPD not used?	mt1a	mt1b	M

M-Method

a-True

R-Run

b-Not reported

S-Substance

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method:- CARB 101A - March, 1986

Substance: Mercury

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of mercury emissions from stationary sources. Particulate and gaseous mercury emissions are withdrawn isokinetically from the source and collected in acidic potassium permanganate (KMnO₄) solution. The Hg collected (in the mercuric form) is reduced to elemental Hg which is then aerated from the solution into an optical cell and measured by atomic absorption spectrometry.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "a"s. In addition to completing the checklist please answer the following questions:

- 1.) What digestion method was used? _____
- 2.) Enter the digestion date(s). _____
- 3.) Number of Impingers: 50 ml 4% KMnO₄ (1) __ 100 ml 4% KMnO₄ (1) __
Empty (1 optional) __ Silica Gel (1) __

Blank Procedure

Please be sure that the blank data was applied and considered correctly. For this particular method, the average peak height (or peak area) of the blank should have been subtracted from the average peak height of the aliquot standards.

Revised: May 3, 1995

Other Comments

Revised: May 3, 1995

Device ID:

SAMPLE LOCATION				
<i>* Swirl Check</i>				
1.) Not conducted?	sc1a	sc1b	M	
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M	
<i>* Stack Size</i>				
1.) Enter stack diameter (inches).			M	
2.) Stack diameter < 12 inch ? or	st2a	st2b	M	
3.) Area <113 inch squared?	st3a	st3b	M	
<i>* Number of Sample Points</i>				
1.) Enter total number of points.			M	
2.) Method 1 not used?	ns2a	ns2b	M	
SAMPLING EQUIPMENT				
<i>* Nozzle Size Check</i>				
1.) Not conducted prior to test?	nz1a	nz1b	M	
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M	
<i>* Field Gas Dry Meter</i>				
1.) Not checked pre- and post-test?	gm1a	gm1b	M	
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M	
<i>* Pitot Tube</i>				
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M	
SAMPLING PROCEDURES				
<i>* Leak Check</i>				
1.) Not conducted?	lc1a	lc1b	M	
2.) Values not reported?	lc2a		M	
3.) Pretest >0.02 cfm or 4% of average?	lc3a	lc3a	lc3a	R
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	lc4a	R
<i>* Isokinetic Variation</i>				
1.) Sample not taken isokinetically?	is1a	is1b	M	
2.) Isokinetic variation not reported?	is2a		M	
3.) Isokinetic <90 or >110%?	is3a	is3a	is3a	R
<i>* Field Reagent Blank</i>				
1.) Not conducted once per test?	rb1a	rb1b	M	
2.) Not used to correct sample?	rb2a	rb2b	M	
<i>* Temperature</i>				
1.) Filter temperature not between 106 and 134 degrees?	tm1a	tm1b	M	
<i>* Flow Rate</i>				
1.) Flow rate not reported?	fr1a		M	
2.) Flow rate > 28 liter per minute (1 cfm)?	fr2a	fr2a	fr2a	R
ANALYSIS				
<i>* Method</i>				
1.) Atomic absorption spectrometry (AAS) not used?	mt1a	mt1b	M	
2.) Combined analysis used ?	mt2a	mt2b	M	

M-Method

a-True

R-Run

b-Not reported

S-Substance

CALCULATION CHECK FOR CARB METHOD 101A

Device ID:

DATA ENTRY-SAMPLING	SYMBOL	UNITS	DATA
RUN NUMBER	-	-	
ROUND STACK, DIAMETER	ds	inches	
RECTANGULAR STACK, LENGTH	L	inches	
WIDTH	W	inches	
NOZZLE DIAMETER	dn	inches	
AVERAGE STACK TEMPERATURE	Fs	degrees F	
AVERAGE METER TEMPERATURE	Fm	degrees F	
BAROMETRIC PRESSURE	Pbar	in. Hg	
STACK STATIC PRESSURE	Pg	in. H2O	
AVG. DELTA H	dH	in. H2O	
AVG. RMS VELOCITY HEAD	dP	in. H2O	
PITOT COEFFICIENT	Cp	-	
GAS SAMPLE VOLUME	Vm	cubic ft.	
METER CALIBRATION FACTOR	Y	-	
TOTAL SAMPLING TIME	min	minutes	
STACK GAS OXYGEN CONTENT	Co2,m	%	
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	
CALCULATED DATA-SAMPLING			
RUN NUMBER	-	-	0
NOZZLE AREA, $A_n = 3.14(dn)^2/4$	An	sq. in.	0.000
STACK AREA, $A_s = 3.14(ds)^2/576$ (ROUND) $= L * W/144$ (RECTANGULAR)	As	-sq. feet	0.000
AVG. STACK TEMPERATURE, $T_s = F_s + 460$	Ts	degrees R	460.0
AVG. METER TEMPERATURE, $T_m = F_m + 460$	Tm	degrees R	460.0
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, $V_{mStd} = 17.64 * Y * (V_m / T_m) * (P_{bar} + dH/13.6)$	VmStd	cubic ft.	0.0
VOLUME OF WATER VAPOR, $V_{wStd} = 0.04707 * W_w$	VwStd	cubic ft.	0.0
MOISTURE FRACTION, $B_{ws} = V_{wStd} / (V_{mStd} + V_{wStd})$	Bws	-	#DIV/0!
DRY STACK GAS MOL. WEIGHT, $M_d = 0.32(Co_{2,m}) + 0.44(Cco_{2,m}) + 0.28[100 - (Co_{2,m}) - (Cco_{2,m})]$	Md	g/g-mole	28.00
WET STACK GAS MOLECULAR WEIGHT, $M_w = M_d(1 - B_{ws}) + 18.0(B_{ws})$	Mw	g/g-mole	#DIV/0!
ABSOLUTE STACK PRESSURE, $P_s = P_{bar} + P_g/13.6$	Ps	in. Hg	0.00
STACK GAS VELOCITY $vs = 85.49 C_p \{ \sqrt{dP * T_s} / (P_s * M_w) \}$	vs	ft/s	#DIV/0!
ACTUAL STACK GAS FLOW RATE, $Q = 60 * vs * A_s$	Q	acf/min	#DIV/0!
DRY GAS STACK FLOW RATE (DRY,STP) $Q_{sd} = 17.64 * Q * (1 - B_{ws}) * (P_s / T_s)$	Qsd	dscf/min	#DIV/0!
ISOKINETIC RATE, $I = 13.61 * T_s * V_{mStd} / [P_s * vs * A_n * \min(1 - B_{ws})]$	I	%	#DIV/0!
DATA ENTRY-ANALYTICAL			
TOTAL MASS OF MERCURY IN SAMPLE TRAIN	Mhg	mg	
CALCULATED DATA-OVERALL			
CONCENTRATION OF MERCURY $M_{Chg} = (35.31 * M_{hg}) / V_{mStd}$	MChg	mg/dscm	#DIV/0!
ARSENIC MASS EMISSION RATE $E_{hg} = ((Q_{sd} * M_{hg}) / V_{mStd}) * 1.32e-4$	Ehg	lb/hr	#DIV/0!

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 104 - March, 1986
Substance: Beryllium

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of beryllium emissions from stationary sources. Beryllium emissions are withdrawn isokinetically and the collected sample is digested in acid solution and analyzed by atomic absorption spectrometry.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "a"s. In addition to completing the checklist please answer the following questions:

- 1.) What digestion method was used? _____
- 2.) Enter the digestion date(s). _____
- 3.) Number of Impingers: H2O (2) __ Empty (1) __ Silica Gel (1) __

Blank Procedure

Please be sure that the blank data was applied and considered correctly. For this particular method, the total amount of beryllium detected in the sample is corrected for the total amount of beryllium detected in the acetone and water blanks. There is no criteria for the blank levels, they just need to be performed and corrected for the sample values.

Other Comments

Revised: May 3, 1995

CARB 104



Documents

Document Sharing Hub

Device ID:

SAMPLE LOCATION				
<i>* Swirl Check</i>				
1.) Not conducted?	sc1a	sc1b	M	
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M	
<i>* Stack Size</i>				
1.) Enter stack diameter (inches).			M	
2.) Stack diameter < 12 inch ? or	st2a	st2b	M	
3.) Area <113 inch squared?	st3a	st3b	M	
<i>* Number of Sample Points</i>				
1.) Enter total number of points.			M	
2.) Method 1 not used?	ns2a	ns2b	M	
SAMPLING EQUIPMENT				
<i>* Nozzle Size Check</i>				
1.) Not conducted prior to test?	nz1a	nz1b	M	
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M	
<i>* Field Gas Dry Meter</i>				
1.) Not checked pre- and post-test?	gm1a	gm1b	M	
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M	
<i>* Pitot Tube</i>				
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M	
SAMPLING PROCEDURES				
<i>* Leak Check</i>				
1.) Not conducted?	lc1a	lc1b	M	
2.) Values not reported?	lc2a		M	
3.) Pretest >0.02 cfm or 4% of average?	lc3a	lc3a	lc3a	R
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	lc4a	R
<i>* Isokinetic Variation</i>				
1.) Sample not taken isokinetically?	is1a	is1b	M	
2.) Isokinetic variation not reported?	is2a		M	
3.) Isokinetic <90 or >110%?	is3a	is3a	is3a	R
<i>* Field Reagent Blank</i>				
1.) Not conducted for acetone?	rb1a	rb1b	M	
2.) Not used to correct sample ?	rb2a	rb2b	M	
<i>* Flow Rate</i>				
1.) Flow rate not reported?	fr1a		M	
2.) Flow rate < 0.5 or > 1 cfm?	fr2a	fr2a	fr2a	R
ANALYSIS				
<i>* Method</i>				
1.) Atomic absorption spectrometry (AAS) not used?	mt1a	mt1b	M	

M-Method

a-True

R-Run

b-Not reported

S-Substance

CALCULATION CHECK FOR CARB METHOD 104

Device ID:

DATA ENTRY-SAMPLING	SYMBOL	UNITS	DATA
RUN NUMBER	-	-	
ROUND STACK, DIAMETER	ds	inches	
RECTANGULAR STACK, LENGTH	L	inches	
WIDTH	W	inches	
NOZZLE DIAMETER	dn	inches	
AVERAGE STACK TEMPERATURE	Fs	degrees F	
AVERAGE METER TEMPERATURE	Fm	degrees F	
BAROMETRIC PRESSURE	Pbar	in. Hg	
STACK STATIC PRESSURE	Pg	in. H2O	
AVG. DELTA H	dH	in. H2O	
AVG. RMS VELOCITY HEAD	dP	in. H2O	
PITOT COEFFICIENT	Cp	-	
GAS SAMPLE VOLUME	Vm	cubic ft.	
METER CALIBRATION FACTOR	Y	-	
TOTAL SAMPLING TIME	min	minutes	
STACK GAS OXYGEN CONTENT	Co2,m	%	
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	
CALCULATED DATA-SAMPLING			
RUN NUMBER	-	-	0
NOZZLE AREA, $A_n = 3.14(dn)^2/4$	An	sq. in.	0.000
STACK AREA, $A_s = 3.14*(ds)^2/576$ (ROUND) $= L * W/144$ (RECTANGULAR)	As	sq. feet	0.000
AVG. STACK TEMPERATURE, $T_s = F_s + 460$	Ts	degrees R	460.0
AVG. METER TEMPERATURE, $T_m = F_m + 460$	Tm	degrees R	460.0
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, $V_{mStd} = 17.64*Y*(V_m/T_m)*(P_{bar} + dH/13.6)$	VmStd	cubic ft.	0.0
VOLUME OF WATER VAPOR, $V_{wStd} = 0.04707*W_w$	VwStd	cubic ft.	0.0
MOISTURE FRACTION, $B_{ws} = V_{wStd}/(V_{mStd} + V_{wStd})$	Bws	-	#DIV/0!
DRY STACK GAS MOL. WEIGHT, $M_d = 0.32(Co_{2,m}) + 0.44(Cco_{2,m}) + 0.28[100 - (Co_{2,m}) - (Cco_{2,m})]$	Md	g/g-mole	28.00
WET STACK GAS MOLECULAR WEIGHT, $M_w = M_d(1 - B_{ws}) + 18.0(B_{ws})$	Mw	g/g-mole	#DIV/0!
ABSOLUTE STACK PRESSURE, $P_s = P_{bar} + P_g/13.6$	Ps	in. Hg	0.00
STACK GAS VELOCITY $v_s = 85.49 C_p \{ \sqrt{(dP*T_s)/(P_s*M_w)} \}$	vs	ft/s	#DIV/0!
ACTUAL STACK GAS FLOW RATE, $Q = 60*v_s*A_s$	Q	acf/min	#DIV/0!
DRY GAS STACK FLOW RATE (DRY,STP) $Q_{sd} = 17.64*Q*(1 - B_{ws})*(P_s/T_s)$	Qsd	dscf/min	#DIV/0!
ISOKINETIC RATE, $I = 13.61*T_s*V_{mStd}/[P_s*v_s*A_n*min*(1 - B_{ws})]$	I	%	#DIV/0!
DATA ENTRY-ANALYTICAL			
TOTAL MASS OF BERYLLIUM IN SAMPLE TRAIN	Mass	mg	
TOTAL MASS OF BERYLLIUM IN ACETONE REAGENT BLANK	Mbeac	mg	
TOTAL MASS OF BERYLLIUM IN WATER REAGENT BLANK	Mbeh2o	mg	
CALCULATED DATA-OVERALL			
CORRECTED TOTAL AMOUNT OF BERYLLIUM $M_{be} = Mass - M_{beac} - M_{beh2o}$	Mbe	mg	0.000
CONCENTRATION OF BERYLLIUM $MC_{be} = (35.31*M_{be})/V_{mstd}$	MCbe	mg/dscm	#DIV/0!
ARSENIC MASS EMISSION RATE $E_{be} = ((Q_{sd}*M_{be})/V_{mstd})*1.32e-4$	Ebe	lb/hr	#DIV/0!

Revised: 5/3/95

3-16

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 106 - June, 1983

Substance: Vinyl Chloride

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the measurement of vinyl chloride in stack gases. An integrated bag sample of stack gas is subjected to chromatographic analysis, using a flame ionization detector.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table . If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "b"s.

Other Comments

Revised: November 14, 1994

Device ID:

ANALYSIS		
<i>* Method</i>		
1.) GC/FID not used?	mt1a mt1b	M
<i>* Analysis Date</i>		
1.) Not within 72 hours from collection, all samples?	ad1a ad1b	M
<i>* 3-Point Calibration Curve</i>		
1.) Not conducted daily or before and after test?	pc1a pc1b	M
2.) Percent difference not reported?	pc2a	M
3.) Percent difference > 5%?	pc3a pc3b	M

M-Method

a-True

R-Run

b-Not reported

S-Substance

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 410A/B - March, 1986
Substance: Benzene

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is designed to provide sampling and analysis techniques for measurement of benzene emissions from stationary sources. CARB Method 410A is used for low concentrations (1.0 to 1000 ppb) and CARB Method 410B is used for high concentrations (60 ppb to 1 %). A Tedlar bag is used to collect a sample and the sample is subjected to gas chromatographic with a photo ionization detector for low concentrations and a flame ionization detector for high concentrations.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table . If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "b"s.

Other Comments

Revised: November 14, 1994

Device ID:

SAMPLING EQUIPMENT			
<i>* Tedlar Bag Contamination Checks</i>			
1.) Not conducted for all bags?	tb1a	tb1b	M
SAMPLE COLLECTION			
<i>* Leak Check</i>			
1.) Not conducted before and after each test?	lc1a	lc1b	M
ANALYSIS			
<i>* Method</i>			
1.) FID not used for high concentrations (60ppb to .01) used?	mt1a	mt1b	M
2.) PID not used for low concentratons (1.0 to 1000 ppb)?	mt2a	mt2b	M
<i>* Analysis Date</i>			
1.) Not within 96 hours from collection, each sample?	ad1a	ad1b	M

M-Method a-True
 R-Run b-Not reported
 S-Substance

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 421 - January, 1987
Substance: Hydrochloric Acid

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of hydrochloric acid emissions from stationary sources. Particulate and gaseous chloride emissions are withdrawn isokinetically from the source through a impinger-filter train where the gaseous chloride is absorbed and ionized in a basic buffer solution. Hydrochloric acid is assumed to be the principle compounds detected when testing combustion sources. ARB Method 421 calls for isokinetic sampling, absorption of HCL in impingers filled with ion chromatographic eluent solution, and analysis of samples by ion chromatography using that same eluent solution.

Quality Assurance/Quality Control Checks

Before completing the detailed QA checklist, please answer the following questions:

- 1) Is stack temperature above 250F? Yes No (answer Q #2)
- 2) If No, Is the sampling isokinetic? Yes No
- 3) If No, **STOP** evaluating this method.
- 4) Number of Impingers: NaHCO₃/Na₂CO₃ (2)____ Empty (1)____ Silica Gel (1)____

Please complete the detailed checklist provided in the attached Table . If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "b"s.

Blank Procedure -

Please be sure that the blank data is considered correctly. For this particular method, the peak resulting from the reagent blank **should have been subtracted** off of the sample peaks on the chromatograph.

Revised: November 15, 1994

3-21

Other Comments

Revised: November 15, 1994



Device ID:

SAMPLE LOCATION					
* <i>Swirl Check</i>					
1.) Not conducted?	sc1a	sc1b	M		
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M		
* <i>Stack Size</i>					
1.) Enter stack diameter (inches).			M		
2.) Stack diameter < 12 inch ? or	st2a	st2b	M		
3.) Area <113 inch squared?	st3a	st3b	M		
* <i>Number of Sample Points</i>					
1.) Enter total number of points.			M		
2.) Method 1 not used?	ns2a	ns2b	M		
SAMPLING EQUIPMENT					
* <i>Nozzle Size Check</i>					
1.) Not conducted prior to test?	nz1a	nz1b	M		
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M		
* <i>Field Gas Dry Meter</i>					
1.) Not checked pre- and post-test?	gm1a	gm1b	M		
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M		
* <i>Pitot Tube</i>					
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M		
SAMPLING PROCEDURES					
* <i>Leak Check</i>					
1.) Not conducted?	lc1a	lc1b	M		
2.) Values not reported?	lc2a		M		
3.) Pretest >0.02 cfm or 4% of average?	lc3a	lc3a	lc3a	R	
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	lc4a	R	
* <i>Isokinetic Variation</i>					
1.) Sample not taken isokinetically?	is1a	is1b	M		
2.) Isokinetic variation not reported?	is2a		M		
3.) Isokinetic <90 or >110%?	is3a	is3a	is3a	R	
* <i>Field Reagent Blank</i>					
1.) Not conducted once per test?	fb1a	fb1b	M		
2.) Not used to correct sample peaks on the chromatograph?	fb2a	fb2b	M		
* <i>Impinger Solution</i>					
1.) Biocarbonate (NaHCO ₃) not used ?	im1a	im1b	M		
2.) Sodium carbonate (Na ₂ CO ₃) not used ?	im2a	im2b	M		
3.) Water not used ?	im3a	im3b	M		
ANALYSIS					
* <i>Method</i>					
1.) Ion chromatography not used?	mt1a	mt1b	M		
* <i>Lab Spike</i>					
1.) Not conducted 10% of all samples?	ls1a	ls1b	M		
* <i>Duplicate</i>					
1.) Not conducted for each sample?	du1a	du1b	M		
2.) Percent difference not reported?	du2a		M		
3.) Percent difference > 5%?					
NR	Hydrogen Chloride (HCl)	du3a	du3a	du3a	S

M-Method

R-Run

S-Substance

a-True

b-Not reported

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 421 - December, 1991
Substance: Hydrogen Chloride

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of gaseous chloride emissions from stationary sources. Gaseous chloride is absorbed and ionized in a basic buffer solution and volatile chloride aerosol mist are also detected. Hydrochloric acid is assumed to be the principle compounds detected when testing combustion sources. ARB Method 421 calls for isokinetic sampling, absorption of HCL in impingers filled with ion chromatographic eluent solution, and analysis of samples by ion chromatography using that same eluent solution.

Quality Assurance/Quality Control Checks

Before completing the detailed QA checklist, please answer the following questions:

- 1) Is stack temperature above 250F? Yes No (answer Q #2)
- 2) If No, Is the sampling isokinetic? Yes No
- 3) If No, **STOP** evaluating this method.
- 4) Number of Impingers: NaHCO₃/Na₂CO₃ (2)___ Empty (1)___ Silica Gel (1)___

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "b"s.

Blank Procedure

Please be sure that the blank data is considered correctly. For this particular method, the sample value is not corrected with any of the blank values, although there is a blank level criteria. Make sure the measured blank levels satisfy the method criteria.

Revised: November 15, 1994

Other Comments

Revised: November 15, 1994

Device ID:

SAMPLE LOCATION			
* Swirl Check			
1.) Not conducted?	sc1a	sc1b	M
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M
* Stack Size			
1.) Enter stack diameter (inches).			M
2.) Stack diameter < 12 inch ? or	st2a	st2b	M
3.) Area <113 inch squared?	st3a	st3b	M
* Number of Sample Points			
1.) Enter total number of points.			M
2.) Method 1 not used?	ns2a	ns2b	M
SAMPLING EQUIPMENT			
* Nozzle Size Check			
1.) Not conducted prior to test?	nz1a	nz1b	M
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M
* Field Gas Dry Meter			
1.) Not checked pre- and post-test?	gm1a	gm1b	M
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M
* Pitot Tube			
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M
SAMPLING PROCEDURES			
* Sample Runs			
1.) Runs<3?	sr1a	sr1b	M
* Sample Time			
1.) Not conducted per run?	sd1a	sd1a	M
NR 2.) Runs <60 minutes?	sd2a	sd2a	R
* Leak Check			
1.) Not conducted?	lc1a	lc1b	M
2.) Values not reported?	lc2a	lc2b	M
3.) Pre-test >0.02 cfm or 4% of average?	lc3a	lc3a	R
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	R
* Isokinetic Variation			
1.) Sample not taken isokinetically?	is1a	is1b	M
2.) Isokinetic variation not reported?	is2a		M
3.) Isokinetic <90 or >110%?	is3a	is3a	R
* Field Blank			
1.) Not conducted once per test?	fb1a	fb1b	M
2.) Used to correct sample peaks on the chromatograph?	fb2a	fb2b	M
3.) Contamination >20% of any run ?			
NR HCl	fb3a	fb3a	S
* Impinger Solution			
1.) Biocarbonate (NaHCO3) not used ?	im1a	im1b	M
2.) Sodium carbonate (Na2CO3) not used ?	im2a	im2b	M
3.) Water not used ?	im3a	im3b	M
ANALYSIS			
* Method			
1.) Ion chromatography not used?	mt1a	mt1b	M
* Lab Spike			
1.) Not conducted prior, daily, and after every 40 samples?	ls1a	ls1b	M
2.) Percent recovery not reported?	ls2a		M
3.) Percent recovery <95% or > 105% Hydrogen Chloride (HCl)	ls3a	ls3a	S
* Duplicate			
1.) Not conducted for 10% of all samples?	du1a	du1b	M
2.) Percent difference not reported?	du2a		M
3.) Percent difference > 5% STD? Hydrogen Chloride (HCl)	du3a	du3a	R

M-Method

a-True

R-Run

b-not reported

S-Substance

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 422-January, 1987

Substance: Volatile Halogenated Organic Compounds

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is designed to provide sampling and analysis techniques for measurement of halogenated organics in emissions from stationary sources. A Tedlar bag is used to collect a sample and the sample is subjected to gas chromatographic analysis for quantitation.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a

"s or the corresponding run numbers; and if they are not reported, circle "b"s.

Other Comments

Revised: November 14, 1994

Device ID:

SAMPLING EQUIPMENT		
* Tedlar Bag Contamination Checks		
1.) Not conducted for all bags?	tb1a	tb1b
2.) Levels not reported ?	tb2a	tb2b
SAMPLE Collection		
* Leak Check		
1.) Not conducted before and after each test?	lc1a	lc1b
2.) Leaks > 5% of sample rate ?	lc2a	lc2b
ANALYSIS		
* Method		
1.) GC not used ?	mt1a	mt1b
*Analysis Date		
1.) Not within 24 hours from collection, each sample?	ad1a	ad1b

M-Method

a-True

R-Run

b-Not reported

S-Substance

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 422 - December, 1991
Substance: Volatile Halogenated Organic Compounds

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is designed to provide sampling and analysis techniques for measurement of volatile organic compounds in emissions from stationary sources. This method cannot be used to determine compounds that (1) are polymetric (high molecular weight) (2) can polymerize before analysis, or (3) have very low vapor pressures at stack or instrument conditions. A Tedlar bag is used to collect a sample and the sample is subjected to gas chromatographic analysis for quantitation.

Quality Assurance/Quality Control Checks

Some preliminary determinations and options are available to the source tester based on the stack conditions. The following questions indicate those options.

- 1) Was the sample diluted to avoid condensation? Yes No
- 2) Were impingers used? Yes No
- 3) Was an on-site GC used for 1,3-Butadiene? Yes No

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "a"s.

Other Comments

Revised: November 14, 1994

SAMPLING EQUIPMENT							
* Tedlar Bag Contamination Checks							
1.) Not conducted for all bags?				tb1a	tb1b	M	
2.) Levels not reported ?				tb2a	tb2b	M	
SAMPLE COLLECTION							
* Field Blank							
1.) Not conducted once per test?				fb1a	fb1b	M	
2.) Used to correct sample?				fb2a	fb2b	M	
3.) Blank > 20% of the stack samples?							
	NA	NR	Dichloromethane	fb3a	fb3a	fb3a	S
	NA	NR	Chloroform	fb3a	fb3a	fb3a	S
	NA	NR	1,1,1-trichloroethane	fb3a	fb3a	fb3a	S
	NA	NR	Carbon tetrachloride	fb3a	fb3a	fb3a	S
	NA	NR	1,2-dichloroethane	fb3a	fb3a	fb3a	S
	NA	NR	Trichloroethene	fb3a	fb3a	fb3a	S
	NA	NR	1,2-dibromoethane	fb3a	fb3a	fb3a	S
	NA	NR	Tetrachloroethene	fb3a	fb3a	fb3a	S
	NA	NR	1,3-butadiene	fb3a	fb3a	fb3a	S
* Leak Check							
1.) Not conducted before and after each test?				lc1a	lc1b	M	
2.) Leaks > 5% of sample rate ?				lc2a	lc2b	M	
* Field Spike							
1.) Not collected once per source?				fs1a	fs1b	M	
ANALYSIS							
* Method							
1.) GC not used ?				mt1a	mt1b	M	
* Analysis Date							
1) Not within 72 hours from collection, each sample?				ad1a	ad1b	M	
* Duplicates							
1.) Not conducted once per sample?				du1a	du1b	M	
2.) Values not reported?				du2a		M	
3.) Values > 3 X RSD ?							
	NA		Dichloromethane	du3a	du3b	S	
	NA		Chloroform	du3a	du3b	S	
	NA		1,1,1-trichloroethane	du3a	du3b	S	
	NA		Carbon tetrachloride	du3a	du3b	S	
	NA		1,2-dichloroethane	du3a	du3b	S	
	NA		Trichloroethene	du3a	du3b	S	
	NA		1,2-dibromoethane	du3a	du3b	S	
	NA		Tetrachloroethene	du3a	du3b	S	
	NA		1,3-butadiene	du3a	du3b	S	

M-Method

a-True

R-Run

b-Not reported

S-Substance

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 423 - January, 1987
Substance: Inorganic Arsenic

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of inorganic arsenic emissions from stationary sources. Particulate and gaseous arsenic emissions are withdrawn isokinetically and collected on a filter and in water. The samples are then analyzed by atomic absorption spectrometry.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "a"s. In addition to completing the checklist please answer the following questions:

- 1.) What digestion method was used? _____
- 2.) Enter the digestion date(s). _____
- 3.) Number of Impingers: H2O (2) __ Empty (1) __ Silica Gel (1) __

Blank Procedure

Please be sure that the blank data was applied and considered correctly. For this particular method, the total amount of arsenic detected in the sample is corrected for the total amount of arsenic detected in the filter, NaOH, and water blanks. There is no criteria for the blank levels, they just need to be performed and corrected for the sample values.

Other Comments

Revised: November 14, 1994

Device ID:

SAMPLE LOCATION				
* <i>Swirl Check</i>				
1.) Not conducted?	sc1a	sc1b	M	
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M	
* <i>Stack Size</i>				
1.) Enter stack diameter (inches).			M	
2.) Stack diameter < 12 inch ? or	st2a	st2b	M	
3.) Area <113 inch squared?	st3a	st3b	M	
* <i>Number of Sample Points</i>				
1.) Enter total number of points.			M	
2.) Method 1 not used?	ns2a	ns2b	M	
SAMPLING EQUIPMENT				
* <i>Nozzle Size Check</i>				
1.) Not conducted prior to test?	nz1a	nz1b	M	
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M	
* <i>Field Gas Dry Meter</i>				
1.) Not checked pre- and post-test?	gm1a	gm1b	M	
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M	
* <i>Pitot Tube</i>				
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M	
SAMPLING PROCEDURES				
* <i>Leak Check</i>				
1.) Not conducted?	lc1a	lc1b	M	
2.) Values not reported?	lc2a		M	
3.) Pretest >0.02 cfm or 4% of average?	lc3a	lc3a	lc3a	R
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	lc4a	R
* <i>Isokinetic Variation</i>				
1.) Sample not taken isokinetically?	is1a	is1b	M	
2.) Isokinetic variation not reported?	is2a		M	
3.) Isokinetic <90 or >110%?	is3a	is3a	is3a	R
* <i>Field Reagent Blank</i>				
1.) Not conducted for two filters and 0.1N NaOH?	rb1a	rb1b	M	
2.) Not used to correct sample ?	rb2a	rb2b	M	
* <i>Temperature</i>				
1.) Filter temperature not between 107 and 135 degrees?	tm1a	tm1b	M	
* <i>Flow Rate</i>				
1.) Flow rate not reported?	fr1a		M	
2.) Flow rate > 28 liter per minute (1 cfm)?	fr2a	fr2a	fr2a	R
ANALYSIS				
* <i>Method</i>				
1.) Atomic absorption spectrometry (AAS) not used?	mt1a	mt1b	M	
2.) Combined analysis used ?	mt2a	mt2b	M	

M-Method

a-True

R-Run

b-Not reported

S-Substance

CALCULATION CHECK FOR CARB METHOD 423

Device ID:

DATA ENTRY-SAMPLING	SYMBOL	UNITS	DATA
RUN NUMBER	-	-	
ROUND STACK, DIAMETER	ds	inches	
RECTANGULAR STACK, LENGTH	L	inches	
WIDTH	W	inches	
NOZZLE DIAMETER	dn	inches	
AVERAGE STACK TEMPERATURE	Fs	degrees F	
AVERAGE METER TEMPERATURE	Fm	degrees F	
BAROMETRIC PRESSURE	Pbar	in. Hg	
STACK STATIC PRESSURE	Pg	in. H2O	
AVG. DELTA H	dH	in. H2O	
AVG. RMS VELOCITY HEAD	dP	in. H2O	
PITOT COEFFICIENT	Cp	-	
GAS SAMPLE VOLUME	Vm	cubic ft.	
METER CALIBRATION FACTOR	Y	-	
TOTAL SAMPLING TIME	min	minutes	
STACK GAS OXYGEN CONTENT	Co2,m	%	
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	
CALCULATED DATA-SAMPLING			
RUN NUMBER	-	-	
NOZZLE AREA, $A_n = 3.14(dn)^2/4$	An	sq. in.	0.000
STACK AREA, $A_s = 3.14(ds)^2/576$ (ROUND) $= L * W/144$ (RECTANGULAR)	As	sq. feet	0.000
AVG. STACK TEMPERATURE, $T_s = F_s + 460$	Ts	degrees R	460.0
AVG. METER TEMPERATURE, $T_m = F_m + 460$	Tm	degrees R	460.0
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, $V_{mStd} = 17.64 * Y * (V_m/T_m) * (P_{bar} + dH/13.6)$	VmStd	cubic ft.	0.0
VOLUME OF WATER VAPOR, $V_{wStd} = 0.04707 * W_w$	VwStd	cubic ft.	0.0
MOISTURE FRACTION, $B_{ws} = V_{wStd}/(V_{mStd} + V_{wStd})$	Bws	-	#DIV/0!
DRY STACK GAS MOL. WEIGHT, $M_d = 0.32(Co2,m) + 0.44(Cco2,m) + 0.28(100 - (Co2,m) - (Cco2,m))$	Md	g/g-mole	28.00
WET STACK GAS MOLECULAR WEIGHT, $M_w = M_d(1 - B_{ws}) + 18.0(B_{ws})$	Mw	g/g-mole	#DIV/0!
ABSOLUTE STACK PRESSURE, $P_s = P_{bar} + P_g/13.6$	Ps	in. Hg	0.00
STACK GAS VELOCITY $v_s = 85.49 C_p [\sqrt{(dP * T_s) / (P_s * M_w)}]$	vs	ft/s	#DIV/0!
ACTUAL STACK GAS FLOW RATE, $Q = 60 * v_s * A_s$	Q	act/min	#DIV/0!
DRY GAS STACK FLOW RATE (DRY, STP) $Q_{sd} = 17.64 * Q * (1 - B_{ws}) * (P_s/T_s)$	Qsd	dscf/min	#DIV/0!
ISOKINETIC RATE, $I = 13.61 * T_s * V_{mStd} / (P_s * v_s * A_n * min * (1 - B_{ws}))$	I	%	#DIV/0!
DATA ENTRY-ANALYTICAL			
TOTAL MASS OF ARSENIC IN SAMPLE TRAIN	Mass	mg	
TOTAL MASS OF ARSENIC IN FILTER REAGENT BLANKS	Masf	mg	
TOTAL MASS OF ARSENIC IN 0.1N NaOH REAGENT BLANK	Masoh	mg	
TOTAL MASS OF ARSENIC IN WATER REAGENT BLANK	Mash2o	mg	
CALCULATED DATA-OVERALL			
CORRECTED TOTAL AMOUNT OF ARSENIC $Mas = Mass - Masf - Masoh - Mash2o$	Mas	mg	0.000
CONCENTRATION OF ARSENIC $MCas = (35.31 * Mas) / V_{mstd}$	MCas	mg/dscm	#DIV/0!
ARSENIC MASS EMISSION RATE $Eas = ((Q_{sd} * Mas) / V_{mstd}) * 1.32e-4$	Eas	lb/hr	#DIV/0!

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 424 - January, 1987
Substance: Inorganic Cadmium

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of inorganic cadmium emissions from stationary sources. Particulate and gaseous cadmium emissions are withdrawn isokinetically and collected on a filter and in a solution of nitric acid. The samples are then analyzed by atomic absorption spectrometry (direct aspiration method).

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "a"s. In addition to completing the checklist please answer the following questions:

- 1.) What digestion method was used? _____
- 2.) Enter the digestion date(s). _____
- 3.) Number of Impingers: 0.1N HNO₃ (2) __ Empty (1) __ Silica Gel (1) __

Blank Procedure

Please be sure that the blank data was applied and considered correctly. For this particular method, the absorbance reading from the sample needs to be corrected for the absorbance readings of the filter and nitric blanks. There is no criteria for the blank levels, they just need to be performed and corrected for the sample values.

Other Comments

Revised: May 3, 1995

CARB 424



Documents

Document Sharing Hub

Device ID:

SAMPLE LOCATION				
<i>* Swirl Check</i>				
1.) Not conducted?	sc1a	sc1b	M	
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M	
<i>* Stack Size</i>				
1.) Enter stack diameter (inches).			M	
2.) Stack diameter < 12 inch ? or	st2a	st2b	M	
3.) Area <113 inch squared?	st3a	st3b	M	
<i>* Number of Sample Points</i>				
1.) Enter total number of points.			M	
2.) Method 1 not used?	ns2a	ns2b	M	
SAMPLING EQUIPMENT				
<i>* Nozzle Size Check</i>				
1.) Not conducted prior to test?	nz1a	nz1b	M	
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M	
<i>* Field Gas Dry Meter</i>				
1.) Not checked pre- and post-test?	gm1a	gm1b	M	
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M	
<i>* Pitot Tube</i>				
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M	
SAMPLING PROCEDURES				
<i>* Leak Check</i>				
1.) Not conducted?	lc1a	lc1b	M	
2.) Values not reported?	lc2a		M	
3.) Pretest >0.02 cfm or 4% of average?	lc3a	lc3a	lc3a	R
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	lc4a	R
<i>* Isokinetic Variation</i>				
1.) Sample not taken isokinetically?	is1a	is1b	M	
2.) Isokinetic variation not reported?	is2a		M	
3.) Isokinetic <90 or >110%?	is3a	is3a	is3a	R
<i>* Field Reagent Blank</i>				
1.) Not conducted for two filters and 0.1N HNO ₃ ?	rb1a	rb1b	M	
2.) Not used to correct sample ?	rb2a	rb2b	M	
ANALYSIS				
<i>* Method</i>				
1.) Atomic absorption spectrometry (AAS) not used?	mt1a	mt1b	M	
2.) Not conducted in triplicate ?	mt2a	mt2b	M	

M-Method

a-True

R-Run

b-Not reported

S-Substance

CALCULATION CHECK FOR CARB METHOD 424

Device ID:

DATA ENTRY-SAMPLING	SYMBOL	UNITS	DATA
RUN NUMBER	-	-	
ROUND STACK, DIAMETER	ds	inches	
RECTANGULAR STACK, LENGTH	L	inches	
WIDTH	W	inches	
NOZZLE DIAMETER	dn	inches	
AVERAGE STACK TEMPERATURE	Fs	degrees F	
AVERAGE METER TEMPERATURE	Fm	degrees F	
BAROMETRIC PRESSURE	Pbar	in. Hg	
STACK STATIC PRESSURE	Pg	in. H2O	
AVG. DELTA H	dH	in. H2O	
AVG. RMS VELOCITY HEAD	dP	in. H2O	
PITOT COEFFICIENT	Cp	-	
GAS SAMPLE VOLUME	Vm	cubic ft.	
METER CALIBRATION FACTOR	Y	-	
TOTAL SAMPLING TIME	min	minutes	
STACK GAS OXYGEN CONTENT	Co2,m	%	
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	
CALCULATED DATA-SAMPLING			
RUN NUMBER	-	-	0
NOZZLE AREA, $A_n = 3.14(dn)^2/4$	An	sq. in.	0.000
STACK AREA, $A_s = 3.14(ds)^2/576$ (ROUND) $= L * W/144$ (RECTANGULAR)	As	sq. feet	0.000
AVG. STACK TEMPERATURE, $T_s = F_s + 460$	Ts	degrees R	460.0
AVG. METER TEMPERATURE, $T_m = F_m + 460$	Tm	degrees R	460.0
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, $V_{mStd} = 17.64 * Y * (V_m / T_m) * (P_{bar} + dH / 13.6)$	VmStd	cubic ft.	0.0
VOLUME OF WATER VAPOR, $V_{wStd} = 0.04707 * W_w$	VwStd	cubic ft.	0.0
MOISTURE FRACTION, $B_{ws} = V_{wStd} / (V_{mStd} + V_{wStd})$	Bws	-	#DIV/0!
DRY STACK GAS MOL. WEIGHT, $M_d = 0.32(Co_{2,m}) + 0.44(Cco_{2,m}) + 0.28(100 - (Co_{2,m}) - (Cco_{2,m}))$	Md	g/g-mole	28.00
WET STACK GAS MOLECULAR WEIGHT, $M_w = M_d(1 - B_{ws}) + 18.0(B_{ws})$	Mw	g/g-mole	#DIV/0!
ABSOLUTE STACK PRESSURE, $P_s = P_{bar} + P_g / 13.6$	Ps	in. Hg	0.00
STACK GAS VELOCITY $v_s = 85.49 C_p \{ \sqrt{(dP * T_s) / (P_s * M_w)} \}$	vs	ft/s	#DIV/0!
ACTUAL STACK GAS FLOW RATE, $Q = 60 * v_s * A_s$	Q	acf/min	#DIV/0!
DRY GAS STACK FLOW RATE (DRY,STP) $Q_{sd} = 17.64 * Q * (1 - B_{ws}) * (P_s / T_s)$	Qsd	dscf/min	#DIV/0!
ISOKINETIC RATE, $I = 13.61 * T_s * V_{mStd} / [P_s * v_s * A_n * \min * (1 - B_{ws})]$	I	%	#DIV/0!
DATA ENTRY-ANALYTICAL			
TOTAL MASS OF CADMIUM IN SAMPLE TRAIN	Mcd	mg	
CALCULATED DATA-OVERALL			
CONCENTRATION OF CADMIUM $MC_{cd} = (35.31 * M_{cd}) / V_{mstd}$	MCcd	mg/dscm	#DIV/0!
CADMIUM MASS EMISSION RATE $E_{cd} = ((Q_{sd} * M_{cd}) / V_{mstd}) * 1.32e-4$	Ecd	lb/hr	#DIV/0!

SOURCE TEST METHOD DETAILED VALIDATION CHECKLIST

Test Method: CARB 425 - January, 1987
Substance: Total and Hexavalent Chromium

Report ID Number: _____

Reviewer: _____

Review Date: _____

Method Description and Applicability

This method is applicable to the determination of total chromium and hexavalent chromium emissions from stationary sources. Particulate emissions are withdrawn isokinetically and collected on a filter and in DI water. The components of the collected sample are then split and analyzed. Analysis for hexavalent chromium is performed by a diphenylcarbazide colorimetric method after alkaline extraction. Total chromium is analyzed by a graphite furnace technique after acid digestion and dissolution.

Quality Assurance/Quality Control Checks

Please complete the detailed checklist provided in the attached Table. If the statements are true, please circle "a"s or the corresponding run numbers; and if they are not reported, circle "a"s.

Other Comments

Revised: November 14, 1994

Device ID:

SAMPLE LOCATION			
* <i>Swirl Check</i>			
1.) Not conducted?	sc1a	sc1b	M
2.) Average absolute value of angles > 10%?	sc2a	sc2b	M
* <i>Stack Size</i>			
1.) Enter stack diameter (inches).			
2.) Stack diameter < 12 inch ? or	st2a	st2b	M
3.) Area <113 inch squared?	st3a	st3b	M
* <i>Number of Sample Points</i>			
1.) Enter total number of points.			
2.) Method 1 not used?	ns2a	ns2b	M
SAMPLING EQUIPMENT			
* <i>Nozzle Size Check</i>			
1.) Not conducted prior to test?	nz1a	nz1b	M
2.) Variation in diameter > 0.004 inch?	nz2a	nz2b	M
* <i>Field Gas Dry Meter</i>			
1.) Not checked pre- and post-test?	gm1a	gm1b	M
2.) Pre- and post-test Y not within (+/-) 5%?	gm2a	gm2b	M
* <i>Pitot Tube</i>			
1.) Semi-annual calibration sheet not included?	pt1a	pt1b	M
SAMPLING PROCEDURES			
* <i>Leak Check</i>			
1.) Not conducted?	lc1a	lc1b	M
2.) Values not reported?	lc2a		M
3.) Pretest >0.02 cfm or 4% of average?	lc3a	lc3a	R
4.) Post-test >0.02 cfm or 4% of average?	lc4a	lc4a	R
* <i>Isokinetic Variation</i>			
1.) Sample not taken isokinetically?	is1a	is1b	M
2.) Isokinetic variation not reported?	is2a		M
3.) Isokinetic <90 or >110%?	is3a	is3a	R
* <i>Reagent Blank</i>			
1.) Not conducted once per sample batch?	rb1a	rb1b	M
2.) Used to correct sample?	rb2a	rb2b	M
ANALYSIS (Hexavalent Chromium)			
* <i>Matrix Spike</i>			
1.) Not conducted per test?	ms1a	ms1b	M
2.) Percent recovery not reported?	ms2a		M
3.) Was percent recovery > 10%?			
Hexavalent Chromium	ms3a	ms3a	S
ANALYSIS (Total Chromium)			
* <i>Duplicates</i>			
1.) Not conducted for every 10 samples?	du1a	du1b	M
* <i>Matrix Spike</i>			
1.) Not conducted daily?	ms4a	ms4b	M

M-Method

a-True

R-Run

b-Not reported

S-Substance