SCIENTIFIC CONTROL LABORATORIES INC
Admiral Environmental

Eric Dangoy
Engineering Services
3158 S. Kolin Ave
Chicago, IL 60623-4889
Phone: (773) 254-2406 x26
Fax: (773) 254-6661
edangoy@sclweb.com

Karen Baweja
Lacks Enterprises, Inc.
4260 Airlane Dr SE,
Kentwood, MI 49512
SRN 0895
MT-ROP-N0895-2018

Project Number: 2018080494-1
Project Type: Method 306a Stack Testing
Testing Date: August 23, 2018
Report Date: 10/10/18
Page Number: 1

RECEIVED
OCT 29 2018
AIR QUALITY DIVISION

IDENTIFICATION OF MATERIAL:
Four (4) sample bottles, from 306A air testing, identified as SVN-2:

PROCEDURE:
Lacks Enterprises, Inc. is an electroplating facility specializing in nickel and chromium plating for the automotive industry. A Method 306A Stack Test was performed in order to demonstrate compliance with both the National Emission Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks and the Renewable Operating Permit. The tested system consists of one stack which exhausts emissions from three decorative chromium electroplating tanks controlled by a 3-stage composite mesh pad system.

The system tested, SVN-2, has a duct diameter of 48 inches. The sampling points were located more than 2.0 duct diameters downstream from a bend in the stack, and more than 0.5 duct diameters upstream from a bend before the top of the stack. Therefore, the sampling points for the stack met the criteria for an acceptable sampling point as specified in Section 11 of USEPA Method 1 (40 CFR Part 60, Appendix A). There are twelve (12) sampling points on two traverses for a total of twenty-four (24) sampling points as per Section 11 of USEPA Method 1. Specific pressure drop readings and other operating data was recorded by Mr. Eric Dangoy, Mr. Anthony Rodriguez, and Mr. Jeffrey Zak of Scientific Control Laboratories, Inc. and Lacks Enterprises, Inc. personnel. This data is included at the end of this report. A stack test plan was submitted to the Michigan Department of Environmental Quality for their review on June 21, 2018.

The USEPA Method 306A sampling procedure was performed on August 23, 2018 by Mr. Eric Dangoy, Mr. Anthony Rodriguez, and Mr. Jeffrey Zak of Scientific Control Laboratories, Inc. All analyses were performed in accordance with the EPA approved test procedures as specified in 40 CFR, Part 63, Method 306A.

RESULTS:
Leak tests were conducted before and after each run and were found to be less than 0.02 ft^3/min. The presence of cyclonic flow was checked at each sampling location and the average angle of misalignment was 3.54°. Since the average angle of misalignment for the stack was less than 20°, the amount of cyclonic flow is acceptable. Samples were analyzed by ICP-MS for the detection of total chromium.

CONCENTRATION BASED RESULTS

Sample I.D.	Test Conc. [1]	Total Cr Emissions[2]	Current Emission Limit[3]
Test Run #1	5.88 µg	0.0028 mg/dscm	0.007 mg/dscm
Test Run #2	5.33 µg	0.0026 mg/dscm	0.007 mg/dscm
Test Run #3	3.70 µg	0.0018 mg/dscm	0.007 mg/dscm
Blank	0.309 µg	NA	N/A

[1] Analyzed by ElementOne, [2] Calculated by SCL (see attached) [3] existing source decorative

AVERAGE (Total Chromium) = 0.0024 mg/dscm

MASS BASED RESULTS

Sample I.D.	Test Conc. [1]	Total Cr Emissions[2]	Current Emission Limit
Test Run #1	5.88 µg	0.00028 lbs/hr	0.00043 lbs/hr
Test Run #2	5.33 µg	0.00026 lbs/hr	0.00043 lbs/hr
Test Run #3	3.70 µg	0.00017 lbs/hr	0.00043 lbs/hr
Blank	0.309 µg	NA	N/A

[1] Analyzed by ElementOne, [2] Calculated by SCL (see attached)

AVERAGE (Total Chromium) = 0.00024 lb/hr

Section 1A Concentration Based Results:

SUPPLEMENTAL CALCULATIONS FOR LACKS ENTERPRISES, INC.

Equation from Method 306A, FR 1/25/95, Pg. 4992:

$$C_{cr} = \frac{(M_{cr})(T_m + 460)}{(499.8)(Y_m)(V_m)(P_{bar})}$$

Where:

C_{cr} =Concentration in stack gas in mg/dscm
M_{cr} =Amount of Cr in sample from stack sampling in micrograms
T_m =Dry gas meter temperature, ° F
Y_m =Dry gas meter correction factor
V_m =Dry gas meter volume in ft^3
P_{bar} =Barometric pressure in inches of Hg

Stack Test Results Test Run #1

(453 ml in test trial #1 sample)

M_{cr} = 5.88 micrograms
T_m = 90.2° F
Y_m = 0.977 (see section 2)
V_m = (2.199 m^3)(35.315 ft^3/m^3) = 77.65 ft^3
P_{bar} = 30.1 in Hg

$$C_{cr} = \frac{(5.88)(90.2+460)}{(499.8)(0.977)(77.65)(30.1)} = \mathbf{0.0028\ mg/dscm}$$

Stack Test Results Test Run #2

(500 ml in test trial #2 sample)

M_{cr} = 5.33 micrograms
T_m = 95.7° F
Y_m = 0.977 (see section 2)
V_m = (2.230 m³)(35.315 ft³/m³) = 78.75 ft³
P_{bar} = 30.1 in Hg

$$C_{cr} = \frac{(5.33)(95.7+460)}{(499.8)(0.977)(78.75)(30.1)} = \mathbf{0.0026\ mg/dscm}$$

Stack Test Results Test Run #3

(441 ml in test trial #3 sample)

M_{cr} = 3.70 micrograms
T_m = 92.2°F
Y_m = 0.977 (see section 2)
V_m = (2.135 m³)(35.315 ft³/m³) = 75.40 ft³
P_{bar} = 30.1 in Hg

$$C_{cr} = \frac{(3.70)(92.2+460)}{(499.8)(0.977)(75.40)(30.1)} = \mathbf{0.0018\ mg/dscm}$$

Section 1B Volumetric Flowrate Results:

Volumetric Flow Rate is calculated as follows:

$$Q_{std} = 62{,}234 v_s A \left(\frac{P_s}{T_{s(avg)}}\right)$$

Eq.306A-12

Where:

V_s = stack gas average velocity as calculated by Equation 306A-9, in (ft/sec)
A = Cross-sectional area of stack, in ft²
P_s = Absolute stack gas pressure, in inHg
$T_{s(avg)}$ = Absolute average stack gas temperature, in R

$$v_s = 85.49 \times C_P\left(\sqrt{\Delta p}\right)_{avg}\sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

Eq. 306A-9

Where:

C_p =Pitot tube coefficient
$P_{avg}^{1/2}$ = Average velocity head measured by pitot tube, inH_2O
$T_{s(avg)}$= Absolute average stack gas temperature, in R
P_s = Absolute stack gas pressure, in inHg
M_s = Molecular weight of wet stack gas in (lb/lb-mol)

Volumetric flowrate calculation Test Run #1

C_p = 0.84
$(P_{avg})^{1/2}$ = 0.64 inH_2O
$T_{s(avg)}$ = 541.7 R
P_s = 30.1 in Hg
M_s = 28.62 lb/lb-mol

$$v_s = (85.49)(0.84)(0.64)[(541.7)/(30.1)(28.62)]^{1/2} = \mathbf{36.4\ ft/sec}$$

V_s = 36.4 ft/sec
A = 12.56 ft^2
P_s = 30.1 in Hg
$T_{s(avg)}$ = 541.7 R

$$Q_{std} = (62{,}234)(36.4)(12.56)[(30.1)/(541.7)] = \begin{array}{c}\mathbf{1,580,980\ ft^3/hr}\\ \mathbf{44,803\ dscm/hr}\\ \mathbf{26,350\ ft^3/min}\end{array}$$

Volumetric flowrate calculation Test Run #2

C_p = 0.84
$P_{avg}^{1/2}$ = 0.64 inH_2O
$T_{s(avg)}$ = 544.0 R
P_s = 30.1 in Hg
M_s = 28.62 lb/lb-mol

$$v_s = (85.49)(0.84)(0.64)[(544.0)/(30.1)(28.62)]^{1/2} = \mathbf{36.5\ ft/sec}$$

V_s = 36.5 ft/sec
A = 12.56 ft^2
P_s = 30.1 in Hg
$T_{s(avg)}$ = 544.0 R

$$Q_{std} = (62{,}234)(36.5)(12.56)[(30.1)/(544.0)] = \begin{array}{c}\mathbf{1,578,621\ ft^3/hr}\\ \mathbf{44,736\ dscm/hr}\\ \mathbf{26,310\ ft^3/min}\end{array}$$

Volumetric flowrate calculation Test Run #3

$C_p = 0.84$
$P_{avg}{}^{1/2} = 0.63$ inH_2O
$T_{s(avg)} = 544.0$ R
$P_s = 30.1$ in Hg
$M_s = 28.62$ lb/lb-mol

$$v_s = (85.49)(0.84)(0.63)[(544.0)/(30.1)(28.62)]^{1/2} = \mathbf{36.0\ ft/sec}$$

$V_s = 36.0$ ft/sec
$A = 12.56\ ft^2$
$P_s = 30.1$ in Hg
$T_{s(avg)} = 544.0$ R

$$Q_{std} = (62{,}234)(36.0)(12.56)[(30.1)/(544.0)] = \begin{matrix}\mathbf{1{,}556{,}996\ ft^3/hr} \\ \mathbf{44{,}123\ dscm/hr} \\ \mathbf{25{,}950\ ft^3/min}\end{matrix}$$

Section 1C Mass Emission Rate

The mass emission rate is calculated as follows:

$$ER = C_{cr} \times Q_{std} \times 10^{-3} (mg/hr)$$

Eq.306A-13dd

Where:

C_{cr} = Concentration of Cr in stack gas, dry basis, in µg/dscm
Q_{std} = Average stack gas volumetric flow in dscm/hr

Mass Emission Rate Test Run #1

$C_{cr} = 2.8$ ug/dscm
$Q_{std} = 44{,}803$ dscm/hr

$$ER = (2.8)(44{,}803)(10^{-3}) = 125.4\ mg/hr = \mathbf{0.00028\ lbs/hr}$$

Mass Emission Rate Test Run #2

$C_{cr} = 2.6$ ug/dscm
$Q_{std} = 44{,}736$ dscm/hr

$$ER = (2.6)(44{,}736)(10^{-3}) = 116.3\ mg/hr = \mathbf{0.00026\ lbs/hr}$$

Mass Emission Rate   Test Run #3

C_{cr} = 1.8 ug/dscm
Q_{std} = 44,123 dscm/hr

$$ER = (1.8)(44{,}123)(10^{-3}) = 79.4\ mg/hr = \mathbf{0.00017\ lbs/hr}$$

Section 2:

Calculation for Pre and Post Test Gas Meter Calibration:

Pre-Test Calibration (08/21/2018):
The meter was run for 6 minutes with a critical orifice that allows 0.75 cfm. The meter recorded a volume of 4.662 ft^3. The average temperature was 75.5° F and the barometric pressure was 29.80 in. of mercury.

Post-Test Calibration (09/21/2018):
The meter was run for 6 minutes with a critical orifice that allows 0.75 cfm. The meter recorded a volume of 4.556 ft^3. The average temperature was 77.5° F and the barometric pressure was 29.90 in. of mercury.

$$Y_m = \frac{V_{m(std),mfg} \times T_m}{17.64 \times V_m \times P_{bar}}$$

K_1 = 17.64
V_m = volume of gas recorded from posttest in ft^3
P_{bar} = barometric pressure in inches of mercury
T_m = temperature in degrees R
$V_{m(std),mfg}$ = Volume of gas sample measured by manufacture's calibrated orifice and dry gas meter, corrected to standard conditions (dscf)

$$V_{m(std),mfg} = V_{cr(std)} = K' \frac{P_{bar}\theta}{\sqrt{T_{amb}}}$$

where (see attached calibration sheet for values):
K' = factor from orifice calibration sheet provided with critical orifice by manufacturer
P_{bar} = barometric pressure in inches of mercury
Θ = time in minutes
T_{amb} = ambient temperature in degrees R

$$V_{(std),mfg} = \frac{0.5876(29.65)(6)}{\sqrt{539}}$$

$$V_{(std),mfg} = 4.50\ ft^3$$

Therefore,

$$Y_{m(pretest)} = \frac{(4.50)\times(75.5+460)}{17.64\times4.662\times29.80}$$

$$Y_{m(pretest)} = 0.983$$

$$Y_{m(posttest)} = \frac{(4.50)\times(77.5+460)}{17.64\times4.556\times29.90}$$

$$Y_{m(posttest)} = 1.007$$

Post Y_m value as compared to pretest Y_m value

$$\frac{Y_{m(pretest)}}{Y_{m(posttest)}} = \frac{0.983}{1.007} = 0.977$$

Since the Y value is between 0.95 and 1.05, the gas meter is acceptable.

CONCLUSION:

The tests were conducted to demonstrate compliance with the National Emission Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks and the Renewable Operating Permit. The results indicate that SVN-2 at Lacks Enterprises, Inc. meets the chromium emission limit of 0.007 mg/dscm and the 0.00043 lbs/hr limit for their decorative chromium plating system. The 3-stage composite mesh pad system, as it is currently implemented, is sufficient as a pollution control device, in order to meet the chromium electroplating NESHAP. To maintain compliance, Lacks Enterprises, Inc. must keep the total pressure drop reading across the composite mesh pad system within +/- 2.0" of the pressure drop that was recorded on the day of the test. The total pressure drop readings as recorded on the day of the test is as follows:

- SVN-2 CMP: 3.37 inches W.C. (+/-) 2 inches W.C.

I certify that the preceding results are true and accurate.

Respectfully submitted,

SCIENTIFIC CONTROL LABORATORIES, INC.

By_______________

Eric Dangoy, Engineering Services

ED:ed

Appendix

Stack Testing Plan

Sampling Point Locations

Sampling Train Diagram

Sampling Log Sheets

Pre and Post Meter Calibration Sheets

Pollution Control Device/Tank Data Summary

Analytical Data – Total Chromium

Chain of Custody

Critical Orifice Mfg. Calibration

Dry Gas Meter Calibration

Pitot Tube Calibration