Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 87

Title: Naval Undersea Warefare Center
Plating Plant, Building 72, Scrubber #3

Am Test Air Quality, Inc.

March 1993

AP-42 Section 13.2.0
Reference
Report Sect. 4
Reference 87

AMTEST AIR QUALITY, INC.

AmTest-Air
30545 S.E. 84
Preston, WA 98050
Office: (206) 222-7746
FAX: (206) 222-7849

SOURCE

EMISSION

EVALUATION

March 3, 1993

Prepared For:

NAVAL UNDERSEA WARFARE CENTER
PLATING PLANT
BUILDING 72, SCRUBBER #3
KEYPORT, WASHINGTON
FEBRUARY 4, 1993

Submitted by:

Kris A. Hansen
Project Manager

James A. Guenthoer
Sr. Project Engineer

E. Ray Lawrence
Air Quality Specialist

Angela F. Blaisdell
Sr. Technical Writer

Am Test - Air Quality, Inc.
Preston, Washington

We certify that the information contained herein is accurate and complete to the best of our knowledge.

AP-42 Section 12.20
Reference
Report Sect. 4
Reference 87

AMTEST AIR QUALITY, INC.

AmTest-Air
30545 S.E. 84
Preston, WA 98050
Office: (206) 222-7746
FAX: (206) 222-7849

SOURCE

EMISSION

EVALUATION

March 3, 1993

Prepared For:

NAVAL UNDERSEA WARFARE CENTER
PLATING PLANT
BUILDING 72, SCRUBBER #3
KEYPORT, WASHINGTON
FEBRUARY 4, 1993

Submitted by:

Kris A. Hansen
Project Manager

James A. Guenthoer
Sr. Project Engineer

E. Ray Lawrence
Air Quality Specialist

Angela F. Blaisdell
Sr. Technical Writer

Am Test - Air Quality, Inc.
Preston, Washington

We certify that the information contained herein is accurate and complete to the best of our knowledge.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

1.0
INTRODUCTION

The purpose of this sampling and analysis program was to quantify emissions of hexavalent chromium at the inlet and outlet of the #3 scrubber system which controls emissions from nine (9) tanks in Building 72 at the Naval Undersea Warfare Center's (NUWC) plating plant in Keyport, Washington. Emissions from the tanks are controlled by the Mapco Enforcer III scrubber system. Only one of the tanks is used for hard chrome plating (Type 1 anodizing). NUWC contracted Am Test-Air Quality, Inc., based in Preston, Washington, to perform these emissions tests to demonstrate compliance with the Puget Sound Air Pollution Control Agency (PSAPCA) Notice of Construction permit #3700, under Regulation III, Section 3.01 for sources with chromium emissions under 1 kilogram per year (kg/yr).

Chromium testing and analysis methods presented in a paper titled "Method Development and Testing for Measurement of Source Levels of Hexavalent and Total Chromium" by Daniel G. Bivens and W. G. DeWees were utilized for this project. Analysis was performed using diphenylcarbazide photometric procedures detailed in a method titled "Determination of Hexavalent Chromium Emissions from Decorative and Hard Chrome Electroplating" dated July 26, 1988. The chromium sample train used is similar to EPA Method 5, except the sample train was modified to exclude the front-half filter, and utilized 0.1 N sodium hydroxide (NaOH) in the impingers. The probe liner was rinsed with NaOH instead of acetone, and the rinse was combined with the NaOH solution from the impingers for hexavalent chromium analysis.

Supporting information was collected during each chromium test using methodology presented in the July 1, 1992 edition of the Environmental Protection Agency (EPA) document Title 40, Code of Federal Regulations, Parts 53-60 (40 CFR 60), Appendix A, Methods 1, 2, 3A and 4. EPA Methods 1 and 2 were performed to measure the gas velocity and temperature for calculating the volumetric flow rate. Method 3A was used to calculate the molecular weight of the stack gas, based on ambient levels of oxygen (O_2) and carbon dioxide (CO_2). Method 4 was performed to measure the moisture content of the stack gas. Am Test performed one (1) 360-minute (6-hour) test simultaneously at the scrubber inlet and outlet on February 4, 1993.

Mr. James A. Guenthoer and Mr. E. Ray Lawrence of Am Test-Air Quality, Inc., performed the field testing. Ms. Cassie B. Heaton and Mr. Stanley B. Moye performed the sample recovery. Ms. Heaton and Ms. Kristi L. Bischofberger of Am Test-Air Quality, Inc. analyzed the samples for hexavalent chromium. Data reduction, quality assurance review, and final report preparation were performed by Mr. Kris A. Hansen, Ms. Angela F. Blaisdell, Ms. Heaton, Ms. Jan W. Alden and Ms. Amy M. Brotherton of Am Test-Air Quality, Inc. Mr. David Gisi and Mr. Richard Waite of NUWC coordinated this project.

2.0
SUMMARY OF RESULTS

A total of two (2) hexavalent chromium (Cr^{+6}) samples were collected on February 4, 1993 simultaneously at the inlet and outlet of the #3 scrubber system which controls emissions from nine (9) tanks in Building 72 at NUWC's Keyport, Washington facility. Each sample was collected over a 360-minute (6-hour) time period. The samples were recovered and analyzed using EPA Method 7196, a diphenylcarbizide colorimetric method for quantifying Cr^{+6}. The results of the analyses, included in Appendix B of this report, were reported in concentration units of micrograms of hexavalent chromium per milliliter of sample (ug/mL), and were reduced to units of micrograms (ug) per sample. The laboratory results were converted to emission concentration units of milligrams per dry standard cubic meter (mg/dscm) and parts per million (ppm). The results were also converted to emission rate units of milligrams per hour (mg/hr) and kilograms per year (kg/yr). The annual emission rate, in kg/yr, was based on a "worst case" operating schedule of 24 hours a day, 365 days a year. The chromium emission factor was calculated in units of milligrams per ampere-hour (mg/amp-hr), based on amp-hr data obtained from NUWC personnel. The results are summarized in Table 2.0 below, and on page 5 in a computer printout titled "Summary of Results - Methods 1, 2, 3A, 4 and Hexavalent Chromium".

Table 2.0. Hexavalent chromium (Cr^{+6}) emission test results from samples collected on February 4, 1993 at the inlet and outlet of the #3 Mapco scrubber system in Building 72 at NUWC's plating plant in Keyport, Washington.

Site	Hexavalent Chromium Emission Conc. (ppm)	Hexavalent Chromium Emission Rate (mg/hr)	Hexavalent Chromium Emission Rate (kg/yr)	Hexavalent Chromium Emission Factor (mg/amp-hr)
Inlet	0.0001	8.51	0.075	1.89
Outlet	< 0.00005	< 4.57	< 0.040	< 1.02

Computer printouts of the results for each run are included in Appendix A of this report. Example calculations of the derivation of the Method 1, 2, 3A, 4 and hexavalent chromium results are included in Appendix C of this report along with copies of the field data sheets.

AMTEST
AIR QUALITY, INC.

SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4 AND HEXAVALENT CHROMIUM
AM TEST - AIR QUALITY, INC.

FILE NAME: 1898\NUWCCRSM
CLIENT: NAVAL UNDERSEA WARFARE CENTER
LOCATION: KEYPORT, WASHINGTON

	BLDG 72 SCRUBBER #3		
	INLET		OUTLET
LAB #:	3662		3663
DATE:	2/4/93		2/4/93
START TIME:	09:54		09:53
STOP TIME:	15:54		15:53
SAMPLE LENGTH (minutes):	360.0		360.0
CONDITION (amp-hr/hr):	4.5		4.5
VOLUME SAMPLED (cubic feet):	248.519		269.574
VOLUME SAMPLED (dry std. cubic feet):	254.528		276.960
VOLUME SAMPLED (dry std. cubic meters):	7.208		7.844
STACK GAS MOISTURE (percent):	0.77		0.81
BAROMETRIC PRESSURE (inches of Hg):	29.94		29.94
STATIC PRESSURE (inches of H2O):	-4.5		-9.0
STACK PRESSURE (inches of Hg):	29.61		29.28
STACK GAS TEMPERATURE (degrees F.):	73.8		68.0
STACK GAS TEMPERATURE (degrees R.):	533.8		528.0
CARBON DIOXIDE (percent):	0.1		0.1
OXYGEN (percent):	20.9		20.9
MOLECULAR WEIGHT (dry, lb/lb-mole):	28.85		28.85
MOLECULAR WEIGHT (wet, lb/lb-mole):	28.77		28.76
AVERAGE VELOCITY HEAD (inches of H2O):	0.260		0.481
PITOT TUBE Cp:	0.84		0.84
STACK GAS VELOCITY (feet per second):	29.0		39.4
STACK DIAMETER (inches):	43.0		43.75
STACK AREA (square feet):	10.1		10.4
STACK GAS AIRFLOW (dry std. cubic feet per min.):	17034.2		23974.8
STACK GAS AIRFLOW (actual cubic feet per min.):	17535.9		24699.7
NOZZLE DIAMETER (inches):	0.276		0.265
ISOKINETICS (percent):	101		88
HEXAVALENT CHROMIUM EMISSION CONCENTRATION (mg/dscm):	0.0003	<	0.0001
HEXAVALENT CHROMIUM EMISSION CONCENTRATION (ppm):	0.0001	<	0.00005
HEXAVALENT CHROMIUM EMISSION RATE (mg/hr):	8.51	<	4.57
HEXAVALENT CHROMIUM EMISSION RATE (kg/yr):	0.075	<	0.040
HEXAVALENT CHROMIUM EMISSION FACTOR (mg/amp-hr):	1.89	<	1.02

3.0
SOURCE OPERATION

The #3 scrubber system which controls emissions from nine (9) tanks, one of which is a hard chrome plating tank, located in Building 72 at NUWC's Keyport, Washington facility was evaluated on February 4, 1993. The plating tank is normally in use for 40-minute cycles at a set amperage as part of the plating process. Steel parts are plated to increase their durability. Emissions from the tanks vent to a Mapco Enforcer III scrubber system prior to exiting via an exhaust stack. "Dummy" parts were processed in the plating tank during the testing. A total of nine (9) parts were plated for 40 minutes each during the 6-hour test period. When a part was plated the current ramped to 130 amps then dropped to 2-3 amps after 40 seconds and was maintained at that level until a new part was plated. The amp-hour data provided by NUWC are included in Appendix D of this report.

The scrubber services nine (9) tanks, but only the Type I Anodize tank has a cathode and can be considered a source of hexavalent chromium emissions. The total system designed exhaust flow is 18,400 cubic feet per minute (cfm). The design parameters for the Type I Anodize tank are 3,750 cfm with a maximum temperature of 120°F and maximum amperage of 150 amps. The tank dimensions are 5 feet by 2.5 feet.

4.0
SAMPLING AND ANALYSIS PROCEDURES

The following sections discuss the Environmental Protection Agency (EPA) methodology which was used to collect the samples for this project. The objective of the testing was to determine the emission factor for hexavalent chromium. Airflow data which were collected concurrent with each test were used to calculate the emission rate of hexavalent chromium. A description of each sample procedure used follows.

4.1 EPA Methods 1 and 2 - Velocity, Temperature and Airflow

EPA Method 1 procedures were used to assure that representative measurements of volumetric flow rate were obtained by dividing the cross-section of the scrubber inlet duct and exhaust stack into a number of equal areas, and then locating a traverse point within each of the equal areas. Method 2 was performed to measure the stack gas velocity using a pitot tube, and the gas temperature using a thermocouple. S-type pitot tubes were connected with tubing to magnehelic gauges or an oil-filled inclined manometer to obtain velocity measurements. The pitot tube lines were leak-checked, and the magnehelic gauges or manometer were leveled and zeroed prior to use. Temperatures were measured using calibrated thermocouple probes connected to a digital thermocouple indicator.

The scrubber inlet is a horizontal, circular duct 43.0 inches in diameter and is fitted with one (1) sample port. Throughout the chromium test period, a single velocity and temperature traverse was performed at twelve (12) points across the duct. The sample probe was marked with felt pen and heat resistant tape to indicate the proper point location at the edge of the stack opening.