

AIR QUALITY ENGINEERING
M66V HEXAVALENT CHROMIUM TESTING
M66V: 2HP with B.I. Blower: with 95% DOP
Installed with UPGRADED SEAL
JUNE 25, 2011

INTRODUCTION

Hamlin & Harris, Incorporated (H&H) conducted Industrial Hygiene monitoring for Air Quality Engineering (AQE) on June 25, 2011 to evaluate the effectiveness of an AQE Model M66V portable air cleaner in controlling Hexavalent Chromium exposures during Shielded Metal Arc Welding (SMAW).

AQE wished to evaluate their equipment in terms of compliance with the requirements of the Occupational Safety and Health Administration (OSHA) Hexavalent Chromium Standard (29 CFR 1910.1026). This federal standard requires use of engineering controls for almost all circumstances where employee exposure to hexavalent chromium may exceed the Permissible Exposure Limit (PEL) of 5 micrograms per cubic meter ($5\mu\text{g}/\text{m}^3$). Welding with stainless steel electrodes is among the tasks affected by this federal standard.

The work described here is a follow up to H&H's evaluation of June 26, 2009 which addressed a similar M66V Air Cleaner with and without HEPA filtration.

Questions to be addressed during this assignment were:

1. How close does the air cleaner intake hood need to be to maintain welder exposures to less than $5\mu\text{g}/\text{m}^3$ hexavalent chromium?
2. One of the presumed advantages of using an air cleaner for controlling hexavalent chromium exposures is reduction or elimination of the "Regulated Area."¹ Does the use of an UPGRADED SEL for the 95% DOP Primary Filter maintain hexavalent chromium exposures to less than $5\mu\text{g}/\text{m}^3$, thereby eliminating the need for a Regulated Area?
3. What is the airflow at the arc for various distances from the hood to the arc?
4. Can welder exposure be maintained at less than $5\mu\text{g}/\text{m}^3$ while keeping airflow less than 100 feet per minute at the arc per the recommendations of the American Welding Society?

TEST CONDITIONS

Welding Parameters:

The welding consisted of running stringer beads under the following conditions:

- 1/8" diameter 308L stainless steel electrodes.
- 125 amps current
- Flat position
- 20 to 26 electrodes consumed during a 30 minute exposure period.

Work Area

¹ A "Regulated Area as defined by the OSHA Standard is an area where workers may expect to be exposed to $5\mu\text{g}/\text{m}^3$ hexavalent chromium, or more, while working in the area.

This work was conducted at the AQE welding area at the Minneapolis, Mn facility. The work area exhibited the following characteristics

- Welding area dimensions:
 - 38' X 30' = 1140 ft²
 - 24' height
 - Work area volume = 27,360 ft³
- Walls to ceiling on two sides.
- Screens to ceiling on two sides
- One 6.5' X 7' walk-through opening on West side of welding area.
- No ventilation (e.g., shop fans, over head fans or open doors) other than the AQE equipment being evaluated)

AQE Equipment Specifications

The air cleaner evaluated was an AQE Model M66V portable air cleaner. Relevant specifications include:

- 2HP 220/240 volt motor
- Backwards Inclined (B.I.) Blower
- 35% ASHRAE prefilter – 4" in thickness
- 95% ASHRAE Primary Filter WITH UPGRADED SEAL
- 8 inch diameter, 10' long flexible intake equipped with a 13" diameter conical hood.

Air Cleaner Application Parameters

Welder exposures, area concentrations and air flow at the arc were measured under the following conditions:

- No air cleaner. This was the baseline or “control” condition. (Figure 1)
- Air cleaner with Hood 1 diameter from the arc (Figure 2)
- Air cleaner with Hood 1½ diameters from the arc (Figure 3)
- Air cleaner with Hood 2 diameters from the arc (Figure 4)
- Air cleaner with Hood 2 diameters from the arc ON THE WELDING TABLE (Figure 5)



Figure 1: No Air Cleaner:
Welder: 658.24 µg/m³



Figure 2: Hood 1 diameter from the arc:
Welder: 2.075 µg/m³



Figure 3: Hood 1½ diameters from the arc:
Welder: 2.222 $\mu\text{g}/\text{m}^3$



Figure 4: Hood 2 diameters from the arc:
Welder: 13.722 $\mu\text{g}/\text{m}^3$



Figure 5: Hood 2 diameters from arc with hood ON THE TABLE
Welder: 2.195 $\mu\text{g}/\text{m}^3$

MONITORING RESULTS

Copies of the laboratory analytical reports detailing the results of sample media analysis are included in the report appendices. These analytical results are combined with task descriptions and comments in the tables in the appendix. These results are summarized as follows:

1. How close does the air cleaner intake hood need to be to maintain welder exposures to less than $5\mu\text{g}/\text{m}^3$ hexavalent chromium?

1 to 1½ diameters was effective at keeping welder exposures to less than $5\mu\text{g}/\text{m}^3$.

2 diameters was NOT shown to be effective when hood was ELEVATED from table.

2 diameters WAS shown to be EFFECTIVE when hood was ON THE TABLE.

One of the presumed advantages of using an air cleaner for controlling hexavalent chromium exposures is reduction or elimination of the "Regulated Area."²

Does this evaluation indicate that the "M66V: 2HP with B.I. Blower: with 95% DOP Installed with UPGRADED SEAL" is capable of performing to that criterion?

Yes.

All area samples were less than $5\mu\text{g}/\text{m}^3$.

2. What is the airflow at the arc for various distances from the hood to the arc? Did these values exceed the AWS recommended value of 100 fpm?

At one hood diameter (13") airflow at the arc was 97 fpm.

At 1½ diameter (17") airflow at the arc was 64 fpm.

At two hood diameters ELEVATED ABOVE THE TABLE (26") airflow at the arc was 37 fpm.

At two hood diameters LYING ON THE TABLE (26") airflow at the arc was 95 fpm.

AWS recommended value of 100 fpm was not exceeded.

3. Can welder exposure be maintained at less than $5\mu\text{g}/\text{m}^3$ while keeping airflow less than 100 feet per minute at the arc per the recommendations of the American Welding Society?

Yes, if the hood is within 1 to 1½ diameters from the arc when elevated

Yes, if the hood is within 2 diameters from the arc when on the table or on the part being welded.

COMMENTS

- These data should be interpreted with caution. They are believed to be accurate but they do not represent all possible applications of the equipment.
- Variations in shop air movement can affect the effectiveness of source capture equipment. Those variations in shop conditions were NOT duplicated during this effort.

² A "Regulated Area as defined by the OSHA Standard is an area where workers may expect to be exposed to $5\mu\text{g}/\text{m}^3$ hexavalent chromium, or more, while working in the area.

- Additional replications are recommended to provide a more robust data set.
- These data are not to be construed as a substitute for the Employee Monitoring required by the Occupational Safety and Health Administration (OSHA) Hexavalent Chromium Standard (29 CFR 1910.1026). Employers remain responsible for performing that monitoring.

Thank you for this opportunity to offer industrial hygiene services to Air Quality Engineering. If you have any questions or comments regarding this report, please feel free to contact me at (225) 387-2847. I may also be reached at cell phone (225) 229-2847.

Sincerely,

Hamlin & Harris Incorporated

A handwritten signature in black ink that reads "Mike Harris". The signature is written in a cursive style with a large initial "M" and "H".

Mike Harris, Ph.D. CIH