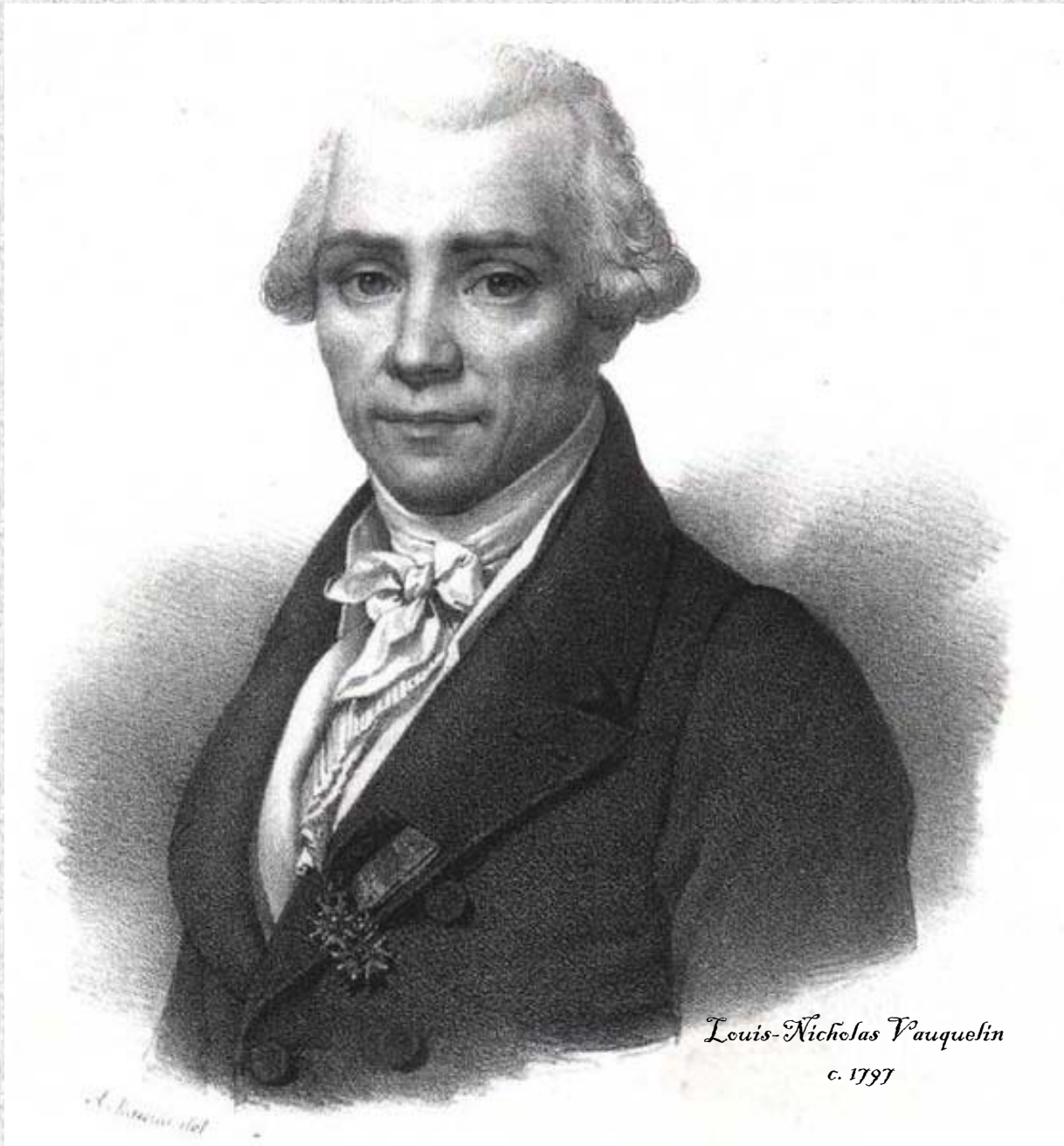


Exposures to Hexavalent Chromium in the Utility Industry

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c. 1797

Sources of Exposure within the Utility Industry

- Grinding of stainless steels and other chromium containing or coated metals
- Flyash
- CCA-treated wood (poles & cooling towers)
- Welding & thermal cutting of stainless steels and other chromium containing or coated metals

Exposure Monitoring

- Pre-2006 – modified NIOSH 7300 Method (ICPMS) or NIOSH Method 7600/7604/7605
- Current – OSHA ID 215 (ICP)
 - Samples collected on PVC filters
 - To lab within 8 days of sampling
- Wipe sampling (W4001)
 - Target concentration = $0.050 \mu/100 \text{ cm}^2$

Air Monitoring Data Form – Hexavalent Chromium

Air Monitoring Data Form – Hexavalent Chromium

Location: _____ Date: _____ Sampler: _____ Pump # _____

Sample Type: Personal Sample Media: PVC

Employee Information: (Name, employee id#, Job title, respirator & filter type, personal protective equipment used)

Task Description: (use back of this form if more space is needed)

Tools (grinder, type of welder – stick, TIG, MIG, etc.): _____

Base Metal: Consumables (type of welding rod/wire, carrier gases): _____

Number of Employees involved with task: _____

Description of Space (size, shape, etc.): _____

Work orientation (vertical/horizontal surface? overhead/waist height/below waist, etc): _____

Is the work performed in a confined space? _____ If yes, what is the permit number/identifier? _____

Controls Used (air horns, capture hoods, other?): _____

Direction of Airflow (from behind welder, in welder's face, etc.): _____

Sample #	Analyte	Time On	Time Off	Minutes	Flow Rate	Volume	Comments

Pre-calibration Flow rate: _____ Post-calibration Flow Rate: _____

The sample cassette must be positioned so that it is under the welding hood when the hood is lowered. This can be achieved by taping or clipping the cassette to the inside of the hood near the cheek. If the hood is removed, tape or clip the cassette to the employee's lapel or outer clothing shoulder area. Care should be taken to avoid crimping the hose or blocking the inlet to the cassette.

Objective data

Objective data means information such as air monitoring data from industry-wide surveys or calculations based on the composition or chemical and physical properties of a substance demonstrating the employee exposure to chromium (VI) associated with a particular product or material or a specific process, operation, or activity. The data must reflect workplace conditions closely resembling the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

OSHA's Letter of Interpretation
to Mr. Douglas Greenhaus, National
Automobile Dealers Association, et al. –
11/14/2006

Main emphasis:

- Accuracy of data collected
- Level of detail of data collected
- Reproducibility of the results (proven by each user)



Grinding

“The U.S. Department of Labor’s Occupational Safety and Health Administration (OSHA) is publishing a minor amendment in today’s ***Federal Register*** to the compliance date provision of its hexavalent chromium standard for general industry. The amendment is part of a settlement agreement with the Surface Finishing Industry Council (SFIC), Public Citizen Health Research Group, and the United Steel, Paper and Forestry, Rubber, Manufacturing, Energy, Allied Industrial and Service Workers International Union. The agreement resolves a legal challenge by the SFIC to OSHA’s [hexavalent chromium standard](#).”

National News Release 06-1906-NAT
October 30, 2006

Grinding

“6. Dust Control

Better housekeeping. Chrome dust that comes off products that are polished or grinded is actually elemental chromium, not hexavalent chromium, so polishing and grinding contribute little to airborne hexavalent chromium levels. However, Companies should use good housekeeping practices, including wet mopping, and wet wipe downs, to reduce the amount of dust present.”

Grinding

- Number of Samples = 3*
- Highest Exposure = 0.323 $\mu\text{g}/\text{M}^3$
- Number of samples below detection limit = 2
(both were short duration samples – 1 hour or less)

*Note: work involving both grinding and welding are not included in this data set.

Flyash Exposures

- Number of Samples = 36
- Highest Exposure = 0.44 $\mu\text{g}/\text{M}^3$
- 15 samples below detection limit

Comments: total of 4 samples above
0.2 $\mu\text{g}/\text{M}^3$, all in “very dusty” environment

Cutting &/or Drilling Holes into Utility Poles

- Number of Samples = 6
- Highest Exposure = 0.062 $\mu\text{g}/\text{M}^3$

Comments: Wooden Cooling Towers?

Coal Handling

- Number of Samples = 13
- Highest Exposure = 0.12 $\mu\text{g}/\text{M}^3$

Comments: Range of other 12 samples was
< 0.01 to 0.05 $\mu\text{g}/\text{M}^3$

Work Activities Not Involving Anticipated Exposures

'Normal' Operations

- Operators, Auxiliary Operators
 - Number of Samples = 39
 - Highest Exposure = $0.12 \mu\text{g}/\text{M}^3$
 - 23 samples below detection limit

- Maintenance Personnel (no welding, etc.)
 - Number of Samples = 50
 - Highest Exposure = $0.38 \mu\text{g}/\text{M}^3$
 - 17 samples below detection limit
 - Only 2 samples above $0.1 \mu\text{g}/\text{M}^3$, both in precipitators

Welding & Thermal Cutting

Types of Steel

- Mild steel
- Chromalloy
- Nickel-Chromium steels
- Chromium steels
- Stainless steels

Sampling Welders



Welding & Thermal Cutting

- Total Samples Collected = 227
- SMAW = 55
- GMAW = 5
- GMAW-P = 4
- GTAW = 136
- Carbon Arc Cutting/PAC = 16
- Hardfacing = 10
- Welding (not defined & mixed) = 21

Information gathered from several sources within the Utility Industry

Range of Exposure Levels

- SMAW = ND* to 47 $\mu\text{g}/\text{M}^3$
- GMAW** = 0.05 to 0.64 $\mu\text{g}/\text{M}^3$
- GMAW-P = ND to 13 $\mu\text{g}/\text{M}^3$
- GTAW = ND to 6.4 $\mu\text{g}/\text{M}^3$
- ACAC/PAC = ND to 48.2
- Hard facing = 9 to 220 $\mu\text{g}/\text{M}^3$
- Welding not defined = < 0.018 to 0.64 $\mu\text{g}/\text{M}^3$

* ND = none detected

** All were carbon steels

Factors Influencing Exposure

- Configuration of Workspace
- Use of Ventilation Controls
- Type of Welding
- Base & Consumable Metals Used
- Number of Welders Working in Same Area
- Work/Worker Orientation
- Duration of Work
- Where the Work is Performed

Controlling Exposures

- Hood
- Fume extraction gun
- Down draft or back draft table
- Dilution ventilation
- Housekeeping & Hygiene
- Respiratory Protection









Welding & Cutting Fume Job Aid

Welding and Cutting Fume Decision Job Aid

This job aid has been designed to assist employees in the proper selection of fume controls (ventilation and/or respiratory protection) for welding and cutting operations.

For steps 1 through 4, select the Safety Rating that matches the work to be performed. Add these Safety Rating numbers together, then divide the sum by the Duration of Work Adjustment from Step 5. The resulting number is the Composite Safety Rating for the task. Compare this number to the Fume Control Requirements Chart to determine the appropriate controls for the task.

If the tasks to be performed are not included in this job aid, contact the Site Health and Safety Specialist for fume control guidance.

Step 1: Process	Safety Rating
GTAW, Oxy-fuel Welding, or GMAW short-circuit transfer	1
SMAW (3/32" & 1/8" diameter electrodes), Oxy-fuel Cutting, Oxy-fuel Brazing, or GMAW spray or pulse transfer	2
SMAW (5/32" diameter and larger electrodes), FCAW	3
Air Arc Cutting or Gouging with round electrodes 1/4" diameter and smaller, or Plasma Arc Cutting or Gouging	4
Air Arc Cutting or Gouging with flat or round electrodes larger than 1/4" diameter	5
GTAW = Gas-Tungsten Arc Welding (TIG) GMAW = Gas-Metal Arc Welding (MIG) SMAW = Shielded Metal Arc Welding (Stick or Manual Arc Welding) FCAW = Flux Core Arc Welding	

Step 2: Filler Metal/Base Metal		
Welding	Safety Rating	Thermal Cutting
GTAW using steel, stainless steel, nickel, copper, or cobalt filler rods	0	n/a
GTAW and GMAW on aluminum, ER4043, ER5554, or ER5556	1	n/a
E7018, E6010, E6013, E71T-1	0	P#1 carbon steel (A36, SA-106 Gr. B)
E7018-A1, E8018-B2, E6013, E81T1-B2	1	P#3 and P#4 alloy steel (T1a, T11, F11)
E9018-B3, E91T1-B3	2	P#5A alloy steel (T22, P22, F22)
E9018-B7, E9018-B9 (old E502 and E505)	3	P#5B alloy steel (T5, T7, T9, T91)
E3xx-15, E3xx-16, E3xxT-1	4	P#8 stainless steel (304, 316, 347)
Nickel electrodes, ENiCrFe-2, ENiCrFe-3, ENiCrMo-10, ENi-CI, ENiFe-CI	5	P#43 and similar nickel alloy (iconel alloys 622, 625, nickel Hastelloys)
EcU, ECuNi, EcuSi, ECuSn, ECuAl	5	Copper, Bronze, Brass
ECoCr-A, ECoCr-B	5	Cobalt (Stellite 6, Stellite21)
Carbide and alloy steel hardfacing rods (see manufacturers' literature for details)	5	Chrome carbide hardfacing alloys, mill rolls, mill bowls, breaker bars, breaker hammers
Austenitic manganese electrodes (see manufacturers' literature for details)	4	Manganese 'Hadfield' steel, non-magnetic railroad rails, frogs, wear pads
n/a	0	Aluminum (1100, 3003, 5054, 6061, 7075)

Step 3: Paint, Plating, or Other Coatings on Work piece	Safety Rating
None or coating removed prior to thermal cutting or welding	0
Ash deposits containing sulfur (rotten egg odor when heated)	2
Known or Suspect Zinc or Chromate - based paints	3
	(4 if paint layer is 1/16" or thicker)
Electroplated coatings (electro-galvanized, chromated, etc.) including EMT conduit and electro-galvanized Unistrut	4
Hot-dip galvanized	5
Cadmium plated (dull silver bolts, nuts, washers, all-thread)	6

Step 4: Position and Local Ventilation Use	Safety Rating
Outdoors where worker can keep head out of fume plume most of the time	0
Inside buildings where all of the following are true: <ol style="list-style-type: none"> 1. Building/room volume is over 10,000 cubic feet per fume source (such as turbine and boiler buildings and large fuel handling garages) 2. Worker can keep head out of fume plume most of the time 3. Nearby workers are not exposed to concentrated fume plume 	
Inside buildings where all of the following are true: <ol style="list-style-type: none"> 1. Building/room volume is less than 10,000 cubic feet per fume source 2. Fume capture and removal system is used (exhaust trunk or hood) 3. Worker can keep head out of fume plume most of the time 	
Large confined spaces (boiler firebox, backpass, windbox, hydro spiral case, tanks over 10,000 cubic in volume (condensers, long tunnels) where all of the following are true: <ol style="list-style-type: none"> 1. Natural draft or mechanical ventilation creates perceptible air flow that is not swirling in the space 2. Worker can keep head out of fume plume most of the time 3. Nearby workers are not exposed to concentrated fume plume 	
Small confined spaces that are difficult to ventilate (feed water heater hemispherical heads, mud and steam drums, tanks less than 10,000 cubic feet in volume, underground vaults)	
Any location (including outdoors) where the worker cannot keep head out of fume plume most of the time	3

Step 5: Duration of Work Adjustment	Divide By
Less than one (1) hour of fume-generating activity per eight (8) hours of work, and no individual Safety Rating equals 4 or higher	8
Less than four (4) hours of fume-generating activity per eight (8) hours of work, and no individual Safety Rating equals 4 or higher	2
More than four (4) hours of fume-generating activity per eight (8) hours of work	1 (no reduction)
Any duration if an individual Safety Rating equals 4 or higher	1 (no reduction)

Safety Ratings from Steps 1 - 4				Subtotal	Divide by Duration of Work Adjustment (Step 5)	Composite Rating
0	0	0	0	0	0	0
Fume Control Requirements*						
Composite Rating		Required Ventilation or Minimum Required Respiratory Protection				
Less than 3		Natural ventilation is sufficient.				
3 to 5		Use capture hood or airhorn positioned to draw/blow fume plume away from worker, if feasible. If mechanical ventilation is not feasible, use half-face, N100 or P100 filtered respirators.				
over 5 to 7		Use capture hood or airhorn positioned to draw/blow fume plume away from worker, if feasible, <u>and</u> use half-face, N100 or P100 filtered respirators. If mechanical ventilation is not feasible, use powered-air purifying respirator with N100 or P100 filters.				
over 7 to 14		Use capture hood or airhorn positioned to draw/blow fume plume away from worker and powered-air purifying respirator with N100 or P100 filters.				
over 14		Consider alternate work methods to reduce or eliminate fume creation. Supplied air respirators required.				

***Note:** Per 1910.252 (c) (2), mechanical ventilation (supply or exhaust) is required regardless of the "Composite Rating" calculated for the

- (1) In a space less than 10,000 cubic feet per welder;
- (2) In a room having a ceiling height of less than 15 feet; or
- (3) in confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross ventilation.

Example 1:

A welder is assigned to place a safety valve body (F11 - alloy steel) on a steam line (P22 - alloy steel) using E9018-B9 and TIG welding in a large open space of the plant, with little perceptible air movement. The job is expected to take no more than four hours.

Step 1	Step 2	Step 3	Step 4	Subtotal	Divide by Duration of Work	Composite
					Adjustment (Step 5)	Rating
1	3	0	0	4	2	2

Using the Fume Control Requirements Chart, the composite Rating of 2 specifies that natural ventilation is sufficient for this task.

Example 2:

Three welders are assigned to torch cut boiler tubes (T11 & T22) in the superheat section of the boiler using oxy-fuel torches. The FD fans have been locked out, but there is perceptible air movement in the space. The job is expected to take eight hours.

					Divide by Duration of Work	Composite
Step 1	Step 2	Step 3	Step 4	Subtotal	Adjustment (Step 5)	Rating
2	2	2	3	9	1	9

Using the Fume Control Requirements Chart, the composite Rating of 9 specifies that for this task, a capture hood or airhorn positioned to draw/blow fume plume away from workers and powered-air purifying

respirator with N100 or P100 filters is required. Note - also that since the work is in a confined place, mechanical ventilation would be required, regardless of the Composite Rating.

Future Activities

- EEI Members' Collective Data & EPRI study to gather and evaluate data from various utilities
 - Need to standardize level of detail for data collected
 - Resolve issue of identifying locations of testing
 - Data Quality Control
 - Trend Analysis
- NIOSH Studies on Welding Fumes
 - Continued Epidemiological Studies
 - Toxicology Studies
 - Robotic welder studies