AEP Corporate Industrial Hygiene Welding Fume Study

Welding Fume Study

- From early 2007 until April 2009, a study to identify exposures to the metals (other than hexavalent chromium) in welding fumes was conducted by Corporate IH.
- The study uses 555 personal air samples taken throughout AEP on many different types of jobs.
- The study included both AEP employees and contractor employees.

Welding Fume Study

- The study was undertaken to determine the level of exposure from the various metal fumes and make recommendations based on the information.

- Each of the metals that could be present in the welding process has potential health effects.

Welding Fume Study

- The primary type of welding performed was Shielded Metal Arc Welding (SMAW), commonly referred to as “stick welding”

- Other common welding procedures performed were:
  -- MIG (Gas Metal Arc Welding)
  -- TIG (Gas Tungsten Arc Welding)
  -- Arc Gouging (Air Carbon Arc Cutting)

Welding Fume Study

- The metals that were measured in the welding fume profile are:

- Aluminum
- Cadmium
- Cobalt
- Iron
- Manganese
- Nickel
- Zinc
- Beryllium
- Chromium (total)
- Copper
- Lead
- Molybdenum
- Titanium
- Vanadium

Welding Fume Study

- Although the health effects differ by the metal, amount of fume exposure, etc., some health concerns from welding fumes include:

- Carcinogenic Effects
- Acute and Chronic Pulmonary Changes
- Asthma
- Nervous System Effects
- Metal Fume Fever

Welding Fume Study

- Welding can also expose the worker to many other hazardous substances, including:

-- Fluorine compounds
-- Carbon monoxide
-- Nitrogen oxides
-- Shielding gases
-- Fluxes
-- Ozone
-- Silica
-- Ionizing, IR and UV radiation

Welding Fume Study

- Compounds from cleaners and coatings decomposed by heat, including Phosgene and Acrolein, can also create exposure potentials.
- The non-metal hazards were not monitored during the study.
- Exposures to all welding hazards must be covered under the OSHA HAZCOM requirements.

Welding Fume Study

- There are many variables that can affect the amount of metal fume exposure, including:

-- type of welding process being performed, i.e., stick welding generates a large amount of fume.

-- position of welder

-- ventilation used

Welding Fume Study

-- base metal

-- diameter of rod or wire

-- time that worker is exposed to the fumes

-- work area

-- paints and coatings present

Due to the many variables that can affect the level of exposure, it is difficult to predict what exposures might be from job to job.

Welding Fume Study

- The highlights of the study include:

-- 100% of a PEL or TLV was exceeded 29 times in the study.

-- 50% up to 100% of a PEL or TLV was exceeded 52 times. This was noted due to the fact that under slightly longer actual work exposure times or other factors, these could approach the PEL or TLV.

Welding Fume Study

-- Aluminum, Chromium, Copper, Iron, Manganese, Nickel, Titanium and Zinc were found above detectable levels in greater than 75% of the samples.

-- Beryllium was found above detectable levels in only 6 (or 1.1%) of samples.

-- Cadmium was found above detectable levels in only 12 (or 2.2%) of samples.

Welding Fume Study

- The metal of most concern from the study is Manganese (Mn):

-- Found above detectable levels in 97.1% of all samples, from all types of welding.

-- The TLV (0.2 mg/M3) was exceeded 19 times. The PEL is a ceiling limit (5.0 mg/M3), was not measured.

-- The 50% to 100% of TLV was exceeded 32 times.

Welding Fume Study

- Manganese exposure is a hot issue in the legal community.
- Numerous cases involving Manganese exposure have been tried, with varying results. These lawsuits have been directed at manufacturers. The next step could be large users of Mn containing welding materials.
- The primary health concern is Manganism, a Parkinson’s-like disease which affects the nervous system.

Welding Fume Study

"The evidence so far is sufficiently reliable to support the assertion that exposure to low-manganese welding fumes can cause, contribute to, or accelerate a movement disorder, including a parkinsonian syndrome that some doctors will diagnose as PD (Parkinson's Disease)."

- Written order from Federal District Judge Kathleen O'Malley, presiding judge over Cleveland District welding product trials

Welding Fume Study

- Currently, there are more than 10,000 cases outstanding against welding product manufacturers.
- One statement in nearly every case was that the welder did not know of the health hazards associated with welding.
- HAZCOM issues must be addressed at all levels.

Welding Fume Study

- The recommended practices include:

  - Respiratory protection will be required unless a Negative Exposure Assessment (NEA) has been established or the practice has been exempted.

  - The NEA will be job-specific unless Corporate IH has issued a system-wide NEA for a specific practice.

Welding Fume Study

- The local S&H professional or the competent person can make this determination, based on the NEA guidelines.

- For traveling work groups, the competent person can use data from jobs that are essentially same between plants.

Welding Fume Study

- There will be specific guidelines for making these determinations.

- The competent persons that make these decisions will be approved by Corporate IH.

- Time will be given to allow for data collection for establishing NEAs.

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- Respirator requirements (when NEAs have not been established):

a) Air-Arcing (Arc Gouging) operations require protection greater than a half-face respirator (APF of 25X or greater) with P-100 filters.

-- Process generates both metal fumes and particulate matter.

-- PAPR or greater protection must be used.

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b) A half-face respirator with P-100 filters, at a minimum, will be required for most welding processes, including:

-- Stick welding (SMAW)
-- MIG welding (GMAW)
-- Torch cutting (OFC)
-- Plasma cutting (PAC)
-- Plasma welding (PAW)

Welding Fume Study

- If a process is not listed or specifically exempted, it will require, at a minimum, a half-face respirator with P-100 filters.
- The respiratory protection (RP) requirements will apply to both welder and any others in the immediate vicinity of the welding operation.
- The respiratory protection will be required until NEA shows that it is not necessary.

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c) Practices that will NOT require a respirator include:

-- Work in welding shop that has sufficient ventilation to keep fumes out of worker's breathing zone.

-- TIG welding (GTAW). Ventilation should be used to protect worker from ozone and shielding gas hazards. TIG welding has a system-wide NEA.

Welding Fume Study

- Grinding of bare metals. If coatings are present, they must be treated in accordance with applicable OSHA and corporate policies.

- Brazing and soldering. For short duration jobs, Respiratory Protection is not required, but ventilation should be used.

Welding Fume Study

d) Require the use of local exhaust ventilation (LEV) when practical and general dilution ventilation whenever feasible.

-- engineering controls are required to be used whenever it is possible. Use of respiratory protection does not eliminate the need to use engineering controls.

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- Numerous OSHA regulations require ventilation, depending upon the type of work, materials involved, location of work, etc.

-- 29CFR 1910.252 and 29CFR 1926.353 address specific ventilation requirements for welding in both General Industry and Construction.

Welding Fume Study

- The OSHA Respiratory Protection Standard (29CFR 1910.134) requires engineering controls be used as the primary worker protection.

- The OSHA Air Contaminants Standard (29CFR 1910.1000) also requires engineering controls as the primary means to reduce exposures.

Welding Fume Study

- Any recommendations that are implemented will apply to both employees and contractors working for AEP.

- The respiratory protection and ventilation requirements are in effect while welding fumes are being generated, when the fume has dispersed, they are no longer required.

Welding Fume Study

- The implemented recommendations DO NOT supersede any regulated metals requirements, such as:

  -- Hexavalent Chromium
  -- Arsenic
  -- Lead
  -- Cadmium

  However, even after these areas are deregulated, respiratory protection and ventilation may required, depending upon monitoring results of other metals.

Hexavalent Chromium

- When the Hexavalent Chromium standard was issued, a study was done to determine both our levels of exposure and the work procedures that are of the most concern.

- The welding fume study was an extension of the Hexavalent Chromium study.

Hexavalent Chromium

TASK	#	# >AL	%>AL	# > PEL	%>PEL	High (mg/M3)
Air arcing / Arc gouging - Stainless Steel	56	48	86	41	73	173
Air arcing / Arc gouging - < 15% Chromium Alloys	21	13	62	8	38	34.1
Stick Welding - Stainless Steel - With Local Exhaust Ventilation	57	34	60	30	53	148
Stick Welding - Stainless Steel - Without Local Exhaust Ventilation	177	83	47	59	33	261.6
Stick Welding - < 15% Chromium Alloys - With Local Exhaust Ventilation	90	17	19	6	7	45

Hexavalent Chromium

TASK	#	# >AL	%>AL	# > PEL	%>PEL	High (mg/M3)
Stick Welding - < 15% Chromium Alloys - Without Local Exhaust Ventilation	182	40	22	20	11	65.8
MIG Welding - Stainless Steel	25	13	52	8	32	30.46
MIG Welding - < 15% Chromium Alloys	12	2	17	0	0	4.37
TIG Welding - Stainless Steel	94	0	0	0	0	1.51
TIG Welding - < 15% Chromium Alloys	14	0	0	0	0	1.1

Hexavalent Chromium

TASK	#	# >AL	%>AL	# > PEL	%>PEL	High (mg/M3)
Grinding / Mechanical Cutting - Stainless Steel	26	1	4	1	4	5.21
Grinding / Mechanical Cutting - < 15% Chromium Alloys	44	4	9	1	2	5.34
Torch Cutting - Stainless Steel	5	0	0	0	0	2.02
Torch Cutting - < 15% Chromium Alloys	24	3	13	2	8	11.4
Plasma Cutting / Welding - Stainless Steel	9	4	44	3	33	27.6

Hexavalent Chromium

- Assumptions for hexavalent chromium data:

-- Multiple samples added together for one time-weighted average are counted as one sample.

-- If there was not a clear description of the work being conducted, it was not included in this summary.

-- Mixed work (i.e., both stick and TIG welding conducted) was not included in this summary with the exception of small amounts of grinding conducted while welding.

-- In most cases, single samples < 480 minutes are treated as full-shift shift samples to represent the worst-case scenarios.

Industrial Hygiene - Supplemental Form for Hexavalent Chromium / Welding Fume Air Samples
- May be used in addition to the AEP Air Sampling Worksheet

Sample Number: _____

Welding Process (stick, MIG, TIG, etc.):
_____

Base Metal:
_____

Filler Metal / Rod Type:
_____

Filler Metal Size:
_____

Welding Position (Horizontal / Vertical):
_____

Equipment Manufacturer:
_____

Welding Technique (Stringer / Weave):
_____

Pickup (More than one person used to make a continuous weld):
_____ Yes _____ No

Area Description (confined, open, etc.):
_____

Ventilation (Natural, fans, fume extraction, etc.):
_____

Approximate time of actual welding / No. of rods used
_____

Conclusions

- Exposures to welding fumes are highly variable and dependent on many factors.
- The most serious health effects from welding fumes are chronic in nature.
- Many PELs are outdated, based on 1960's guidelines. Newer research indicates that these levels should be more protective.

Conclusions

- Basing the worker's protection on strictly whether or not a PEL has been exceeded may not be enough to protect the worker over time.

- The combination of respiratory protection and ventilation (regardless of the metal) gives the worker the best possible protection, protecting the worker is what Safety & Health is all about.

Welding Fume Study

ANY

QUESTIONS??