



Manganese PEL Proposal: Feasibility Issues to be Addressed

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Proposed Welding Mn PEL (0.02 mg/m³) raises significant feasibility issues

- **Major feasibility issues:**

1. Available exposure data show most welders will require respiratory protection even for outdoor welding on carbon (mild) steel:
 - » Existing airborne levels may require tight-fitting PAPR with Assigned Protection Factor (APF) = 1,000.
2. AWS D1.8, FEMA and California Seismic Welding Codes (implemented post-1994 Northridge Earthquake) govern certain structural welds:
 - » Since Mn is critical to weld ductility, substitution of low-Mn consumables or changes to low fume welding processes will cause non-compliance.
 - » Fabrication of compliant joints requires more welding per joint than pre-Northridge.
3. AWS D1.8 (Structural Welding Code – Seismic Supplement) and related codes limit wind (air velocity) through weld zone for GMAW and FCAW-S welding to 3 mph (264 ft/min) to protect weld quality:
 - » Ventilation options are limited if maximum velocity is to be maintained throughout weld zone.

- **A more science-based protective PEL will resolve many of these feasibility issues.**

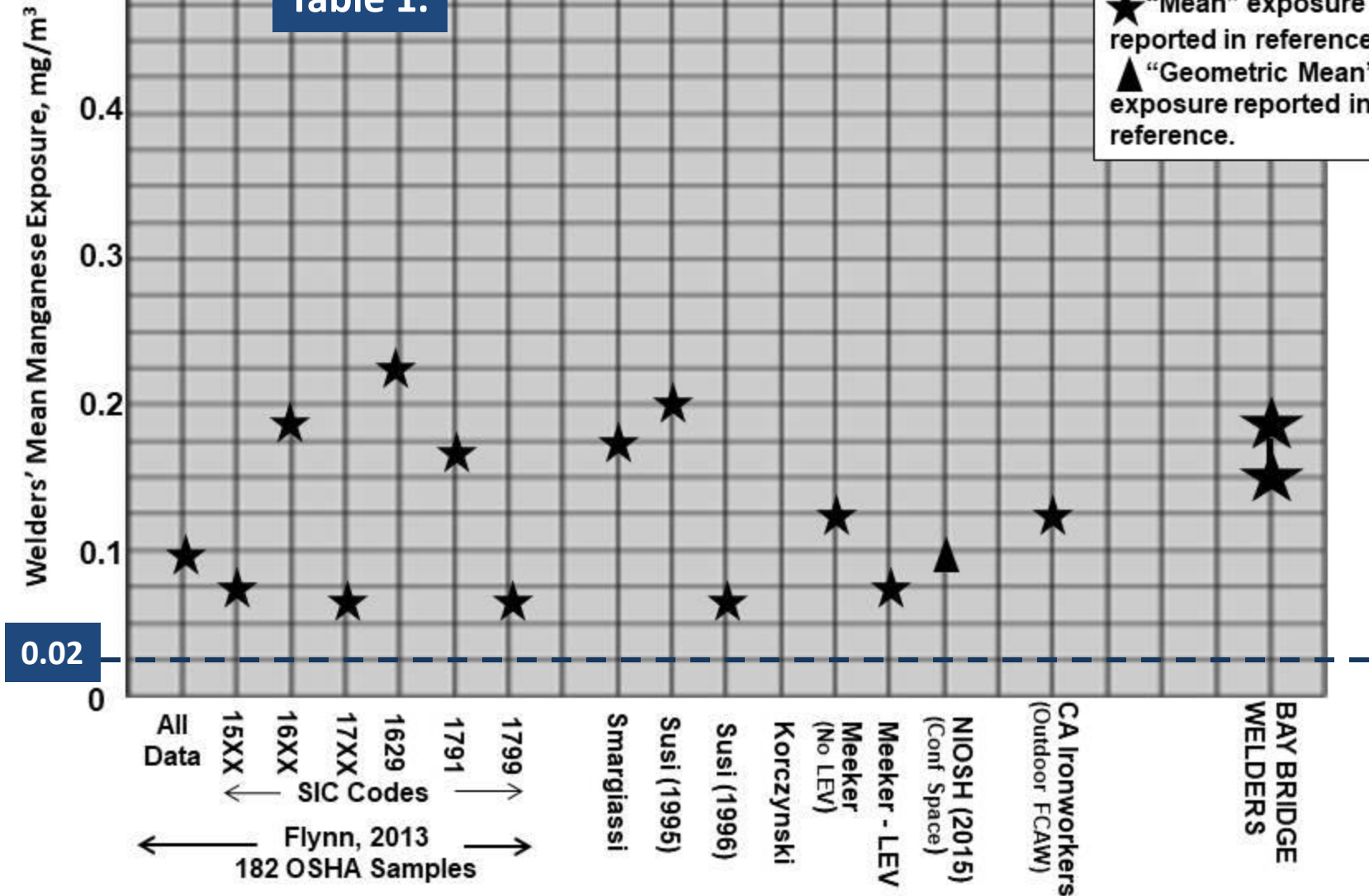
Literature Reports of Welders' Mean and Maximum Manganese Exposures, mg/m³

Maximum Exposure reported in Study →

NR .34 1.66 .58 1.66 .58 .35 .37 1.31 .47 .93 NR NR .47 .66 .67

Table 1.

★ "Mean" exposure reported in reference.
▲ "Geometric Mean" exposure reported in reference.



0.02

← Flynn, 2013 182 OSHA Samples →

References Cited in Graph

References for Table 1.

Flynn (2013): Flynn, M.R., *Welding Exposures in Construction – 30 Years of OSHA Data* (AIHCe2013) (<http://elcosh.org/record/document/3679/d001220.pdf>).

For his analysis of 182 Manganese samples, Flynn categorized the data by SIC:

- 15XX: Building General Contractors
- 16XX: Heavy Construction
- 17XX: Special Trade Contractors
- 1629: Heavy Construction, NOC (Petrochemical plants, Power plants, Pile driving, Boilermakers)
- 1791: Structural Steel Erection (Iron work, Structural contractors, Storage tanks)
- 1799: Special Trade Contractors, NOC (Welding contractors, Lead burning contractors)

Smargiassi: A. Smargiassi, et. al., *Assessment of exposure to manganese in welding operations during the assembly of heavy excavation machinery accessories*, Appl. Occ. Env. Hyg., 15:646-750 (2000).

Susi(1995 and 1996): P. Susi, et al., *The use of a task-based exposure assessment model (T-BEAM) for assessment of metal fume exposures during welding and thermal cutting*, Appl. Occ. Env. Hyg., 15:26-38 (2000).

Korczynski: R.E. Korczynski, *Occupational health concerns in the welding industry*, Appl. Occ. Env. Hyg., 15:935-945 (2000).

Meeker: J.D. Meeker, et. al., *Manganese and welding fume exposures and controls in construction*, J. Occ. Envir. Hyg. 4:943-951 (2007).

NIOSH 2015: Kevin W. Hanley, , et. al., *“Manganese Fractionation Using a Sequential Extraction Method to Evaluate Welders’ Shielded Metal Arc Welding Exposures During Construction Projects in Oil Refineries,”* J. Occ. Envir. Hyg., 12:11, 774-784 (2015).

Ironworkers: Sampling for California Ironworkers - see next sheet for data and source citation. The data used to calculate the “Mean” represent 14 outdoor samples collected under the welding helmet during Flux Cored Arc Welding (FCAW) on carbon steel as identified from data table either from Welding Process” or “Consumable” information. These are “Cases” 1-7, 19-24, and 25.

Bay Bridge Welders: R.M.Park, et. al., *Issues in neurological risk assessment for occupational exposures: The Bay Bridge Welders*, NeuroToxicology, October, 2005.

CALIFORNIA IRONWORKERS OUTDOOR WELDING SAMPLES FOR MANGANESE

Source: *California Guide to Welding Fume Hazards for the Ironworkers Industry*

<http://www.impact-net.org/news/2016/05/24/download-the-new-california-guide-to-welding-fume-hazards>

Sample Type	Sampling Time, min.	Mn, mg/m3	Comments
BZ	483	0.037	Hospital construction - steel erection
BZ	450	0.13	Carbon and galvanized roof supports, office structure
BZ	420	0.098	Carbon and galvanized steel, office structure
BZ	237	0.016	Carbon and galvanized steel, office structure
BZ	490	0.0029	Carbon and galvanized steel, Hospital construction
BZ	477	0.1	Carbon steel
BZ	61	0.0025	Rebar - flat, 5 sticks
BZ	119	0.0014	Rebar, 90+ cuts
BZ-NUH	466	0.066	Carbon steel
BZ-NUH	468	0.069	Carbon steel
BZ-NUH	484	0.18	Carbon steel
BZ-NUH	440	0.072	Carbon steel
BZ-NUH	489	0.045	Carbon steel
BZ-NUH	485	0.038	Carbon steel - column splicing
BZ	464	0.205	Mild steel - Outdoor Parking Structure steel erection
BZ	464	0.129	Mild steel - Outdoor Parking Structure steel erection
BZ	482	0.15	Mild steel - Outdoor Parking Structure steel erection
BZ	481	0.66	Mild steel - Outdoor Parking Structure steel erection
BZ	478	0.037	Carbon steel, Hospital construction - steel erection
BZ	483	0.077	Carbon steel, Hospital construction - steel erection
BZ	479	0.037	Carbon steel, Hospital construction - steel erection
BZ-NUH	489	0.045	Carbon steel
BZ-NUH	477	0.038	Carbon steel - column splicing

Table 2.

NUH: Not under helmet – other BZ samples collected under Welder’s helmet.

California Oil and Gas Contractors' Data

Table 3.

Task	Weld Type	Atmosphere	8 Hr TWA (mg/m ³)	When was sample collected?	Sampling Time, minutes	Job Length, minutes	Personal or Area Sample?	If Personal Sample, Sampled under Hood or on Lapel?	Local or General Ventilation?	Type of Work Space
Repair SS brackets and patch tank wall pits	SMAW	Confined Space w/ Ventilation	0.0070	05/2018	193	600	P	Lapel (Welding Supplied Air Worn)	General	Vessel
Patch tank wall pits	SMAW	Confined Space w/ Ventilation	0.0566	05/2018	324	600	P	Lapel (Welding Supplied Air Worn)	General	Vessel
Install Structural Plates	SMAW & FCAW	Confined Space w/ Ventilation	0.0571	02/2017	196	600	P	Under hood	General	Vessel
Install Structural Plates	SMAW & FCAW	Confined Space w/ Ventilation	0.01816	02/2017	218	600	P	Under hood	General	Vessel
Install Structural Plates	SMAW & FCAW	Confined Space w/ Ventilation	1.682	02/2017	323	600	P	Under hood	General	Vessel
Install Structural Plates	SMAW & FCAW	Confined Space w/ Ventilation	0.0692	02/2017	302	600	P	Under hood	General	Vessel
Install Structural Plates	SMAW & FCAW	Confined Space w/ Ventilation	0.3061	02/2017	237	600	P	Under hood	General	Vessel
Welding Pipe	FCAW	Indoor w/o Ventilation	0.031625	04/2015	276	480	P	Under hood	N/A	Shop
Welding Pipe	FCAW	Indoor w/o Ventilation	0.014592	04/2015	412	480	P	Under hood	N/A	Shop
Welding	FCAW	Indoor w/o Ventilation	0.096	02/2014	260	480	P	Under hood	N/A	Shop
Welding	FCAW	Indoor w/o Ventilation	0.034	02/2014	262	480	P	Under hood	N/A	Shop
Welding	FCAW	Indoor w/o Ventilation	0.032	02/2014	264	480	P	Under hood	N/A	Shop

Wrap-up

- Current DOSH proposal for Welding Fume Mn PEL of 0.02 mg/m^3 causes significant feasibility problems that need to be further understood.
- A protective PEL based on latest science will resolve some feasibility issues.

Questions???