

Fxx - 316 Self-Shielded, Flux Core Arc Welding (FCAW) Welding Process Emission Factors

CALCULATION METHODS

Annual Emissions: $E_a = U_a \times EF \text{ (lbs/lb rod)} \times (1-e)$

Hourly Emissions: $E_h = U_h \times EF \text{ (lbs/lb rod)} \times (1-e)$

E_a = Annual emissions of each listed toxic air contaminant per welding rod, (lbs/year)

E_h = Maximum hourly emissions of each listed toxic air contaminant per welding rod, (lbs/hour)

U_a = Annual usage of each welding rod, (lbs/year)

U_h = Maximum hourly usage of each welding rod, (lbs/hour)

EF = Emission Factor (lbs/lb rod)

Emission Factors:

(1) Complete AP-42 information from Final Section 12.19 (1/95): $EF = \text{Trace Metal EF (Table 12.19-2)}$

(2) Incomplete AP-42 Final Section 12.19 (1/95): $EF = FGR \text{ (Table 12.19-1)} \times FCF \times C_i \text{ (MSDS)}$

(3) No AP-42 information but known welding process: $EF = FGR \text{ (District Default)} \times FCF \times C_i \text{ (MSDS)}$

(4) District Study or AWMA information: $EF = \text{Trace Metal EF}$

(5) Incomplete District Study information: $EF = FGR \text{ (District Study)} \times FCF \times C_i \text{ (MSDS)}$

(*) Incomplete AP-42, District, or AWMA Hexavalent Chromium information: $EF = Cr \text{ (Total Chromium in Fumes)} \times EF \times HCR$

NOTES:

• Emission factors assume "uncontrolled" releases. Emission control methods and efficiencies reported are to be applied within the emission calculations.

• Fume generation rates (FGR) are based on the following:

◦ EPA AP-42 Final Section 12.19 (1/95) Table 12.19-1 (PM10 EF)

◦ ARB, Richard Bode: 0.01 (GMAW, TIG, MIG), 0.02 (SMAW, FCAW), 0.00005 (SAW), 0.05 (unspecified)

• Fume Correction Factors (FCF) per District engineering discussions with Industry:

◦ 0.5464 (GMAW, TIG, MIG), 0.2865 (SMAW, FCAW, SAW), 1.0 (unspecified)

• Trace metal emission factors are based on the following:

◦ AWMA Volume 59, 2009, Issue 5 (Pages 619-626) Table 2 and Table 3

◦ EPA AP-42 Final Section 12.19 (1/95) Table 12.19-2

◦ District engineering estimates using rod compositions (C_i) from MSDS

• Hexavalent chromium conversion rates (HCR) are per District engineering reviews of studies on welding:

◦ 0.05 (GMAW, TIG, MIG), 0.55 (SMAW), 0.0005 (SAW), 0.10 (FCAW, unspecified)

POLLUTANT	DISTRICT EMISSION FACTORS (lbs/lb rod)	REFERENCE DOCUMENT	FACTOR	(UNITS)	COMMENTS
NOX					
CO					
SOX					
TOG					
VOC					
TSP	7.42E-03				Assume PM10 = TSP
PM10	7.42E-03	District FCAW Welding Study	7.42	lbs/lb rod	Assume PM10 = Fume Generation Rate (FGR)
Al					
Al2O3					
Be					
Cd					

Co					
Cr	7.35E-04	District FCAW Welding Study	0.735	lb/1000 lbs rod	District Procedure (4) EF = Cr/Cr+6 EF
Cr(VI)	1.40E-04	District FCAW Welding Study	0.140	lb/1000 lbs rod	District Procedure (4) EF = Cr/Cr+6 EF
Cu					
Mn	4.77E-04	District FCAW Welding Study	0.477	lb/1000 lbs rod	District Procedure (4) EF = Mn EF
Ni	1.73E-04	District FCAW Welding Study	0.173	lb/1000 lbs rod	District Procedure (4) EF = Ni EF
P					
Pb					
Crystalline Silica					
V					
Zn					

REFERENCES:

EPA AP-42 Chapter 12.19: <https://www.epa.gov/sites/production/files/2020-11/documents/c12s19.pdf>

AWMA: <https://www.tandfonline.com/doi/abs/10.3155/1047-3289.59.5.619>

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