# F120 - INCO 62, Flux Core Arc Welding (FCAW) Welding Process Emission Factors

**CALCULATION METHODS**

Annual Emissions: Ea = Ua x EF (lbs/lb rod) x (1-e)
Hourly Emissions: Eh = Uh x EF (lbs/lb rod) x (1-e)

Ea = Annual emissions of each listed toxic air contaminant per welding rod, (lbs/year)
Eh = Maximum hourly emissions of each listed toxic air contaminant per welding rod, (lbs/hour)
Ua = Annual usage of each welding rod, (lbs/year)
Uh = 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 = Trace Metal EF (Table 12.19-2)
(2) Incomplete AP-42 Final Section 12.19 (1/95): EF = FGR (Table 12.19-1) x FCF x Ci (MSDS)
(3) No AP-42 information but known welding process: EF = FGR (District Default) x FCF x Ci (MSDS)
(4) District Study or AWMA information: EF = Trace Metal EF
(5) Incomplete District Study information: EF = FGR (District Study) x FCF x Ci (MSDS)
(*) Incomplete AP-42, District, or AWMA Hexavalent Chromium information: EF = Cr (Total Chromium in Fumes) EF x HCR

**NOTES:**

- Emission factors assume "uncontrolled" releases. Emission control methods and efficiencies reported are 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 (Ci) 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** | 2.00E-02 | | | | Assume PM10 = TSP |
| **PM10** | 2.00E-02 | CARB Welding Recommendations (1993) | 0.02 | lbs/lb rod | Assume PM10 = Fume Generation Rate (FGR) |
| **Al** | | | | | |
| **Al2O3** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Be** | | | | | |
| **Cd** | | | | | |
| **Co** | | | | | |
| **Cr** | 9.74E-04 | District Welding Study SDS - WA Alloy Ni-62 (NIiCrFe-5) | 17 | wt% | District Procedure (3) EF = FGR x FCF x Ci |
| **Cr(VI)** | 9.74E-05 | AWMA Page 623 | 10 | % | District Procedure (*) EF = Cr EF x HCR |
| **Cu** | 2.87E-05 | District Welding Study SDS - WA Alloy Ni-62 (NIiCrFe-5) | 0.5 | wt% | District Procedure (3) EF = FGR x FCF x Ci |
| **Mn** | 5.73E-05 | District Welding Study SDS - WA Alloy Ni-62 (NIiCrFe-5) | 1 | wt% | District Procedure (3) EF = FGR x FCF x Ci |
| **Ni** | 4.01E-03 | District Welding Study SDS - WA Alloy Ni-62 (NIiCrFe-5) | 70 | wt% | District Procedure (3) EF = FGR x FCF x Ci |
| **P** | 1.64E-06 | District Welding Study SDS - WA Alloy Ni-62 (NIiCrFe-5) | 0.03 | wt% | District Procedure (3) EF = FGR x FCF x Ci |
| **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

Last Updated on 07/07/2022 by A.Weller