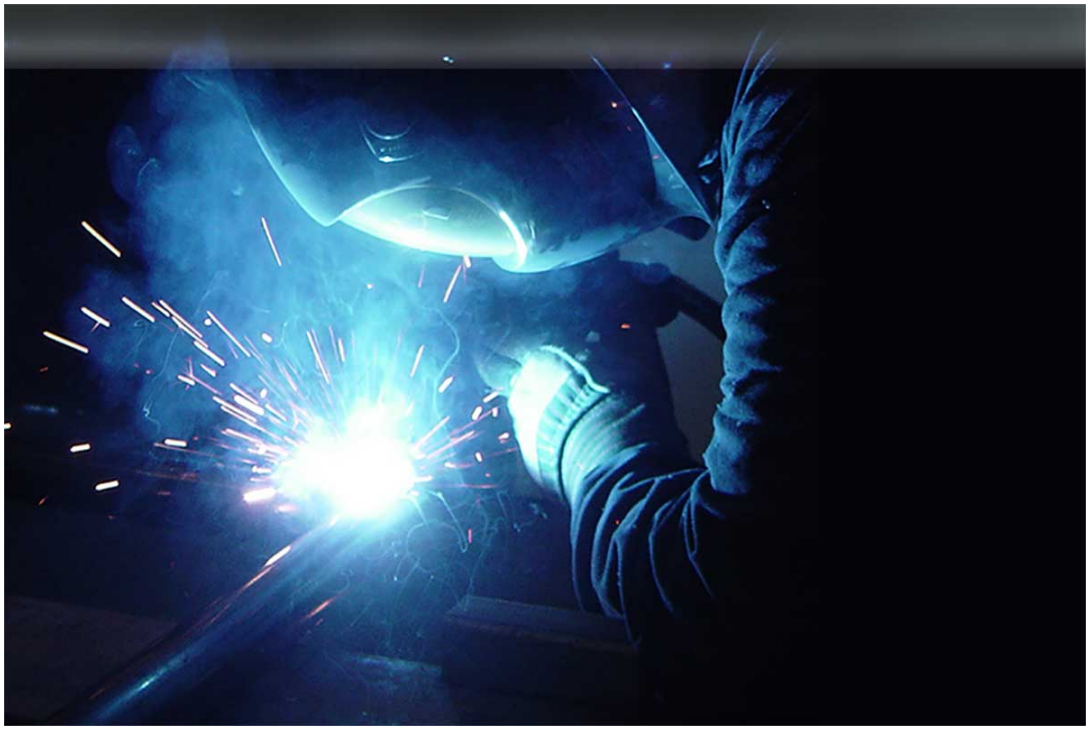


Particle and metal exposure in welder apprentices

Bernadette Quémerais, James Mino, Robbin Law, Mark Balser, Christopher Manning, Meghan Dueck, Sindhu Nair, Marc Cassiède, Paige Lacy

Objectives of the project

- Evaluate exposure to welding fumes for apprentice welders
- Evaluate metabolic changes in apprentice welders
- Evaluate urinary metabolites as biomarkers of exposure

Sampling design

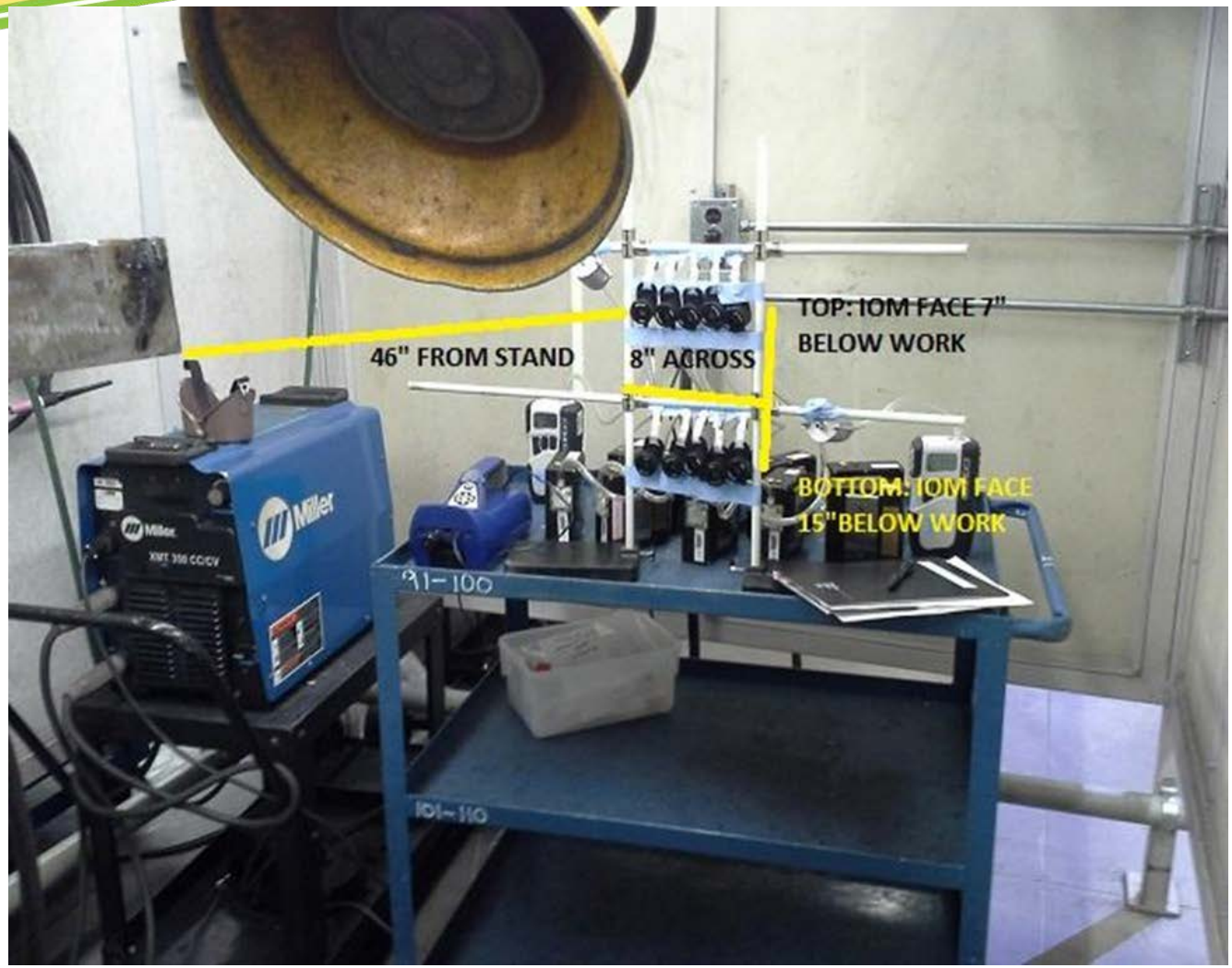
- What did we need for the project?
  - Air samples
  - Urine samples
- Subjects:
  - Apprentice welders (1st year students at NAIT)
  - Controls (not exposed to welding fumes, students at NAIT)
  - 1st study: non-smoking males

Sampling design

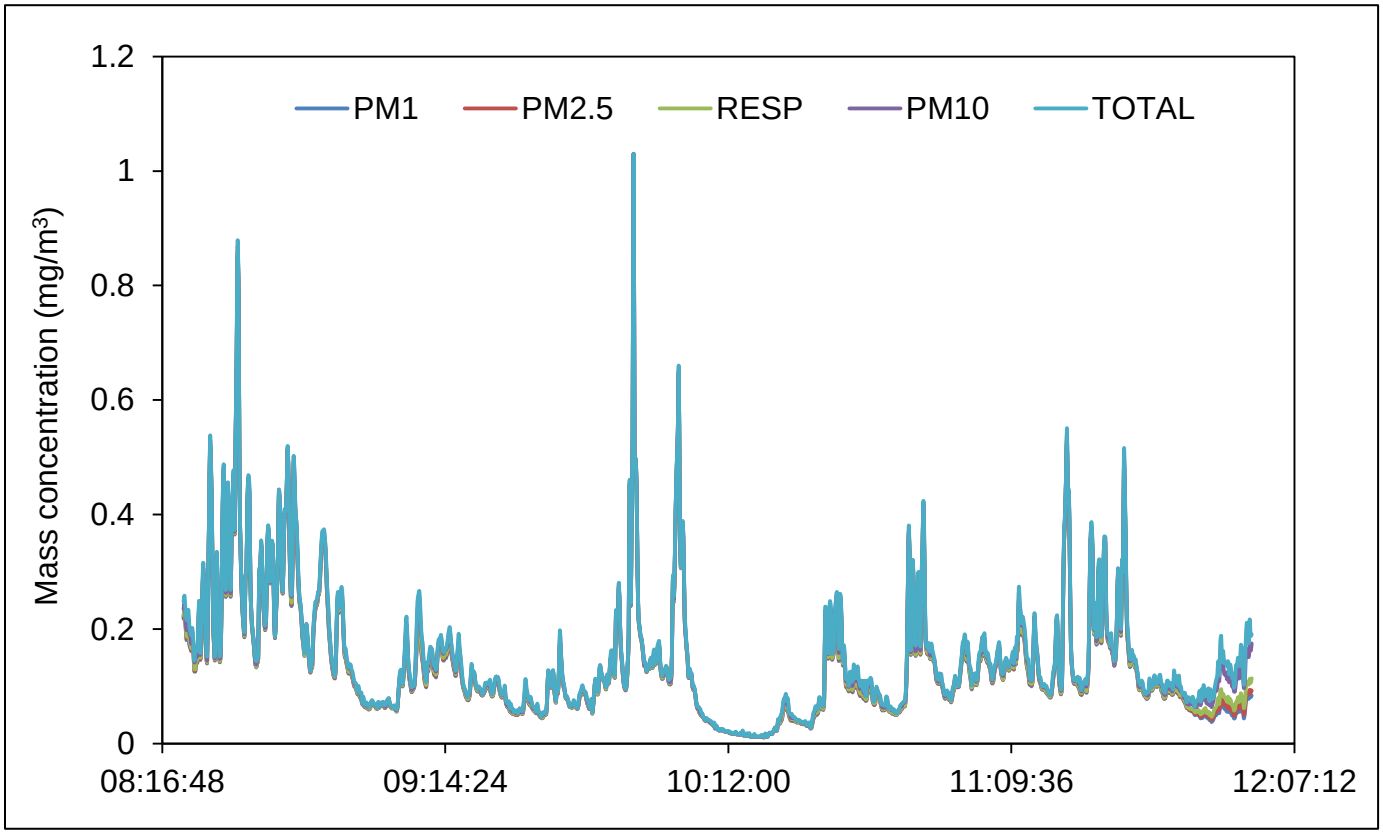
- Longitudinal study:
  - Day 0, day 1, day 7, and day 50
  - Air samples collected the day prior to the collection of urine samples
- Air samples:
  - Controls: area air samples
  - Welders: personal air samples

Method

- Filters: 37 mm PVC membranes 5 µm
- Mass concentration: Mettler Toledo XP6 microbalance
- Acid digestion: HNO_3 + H_3OBF_4
- Metal concentration: iCAP Q ICP-MS
- P-Trak, Dust-Trak, particle sizers

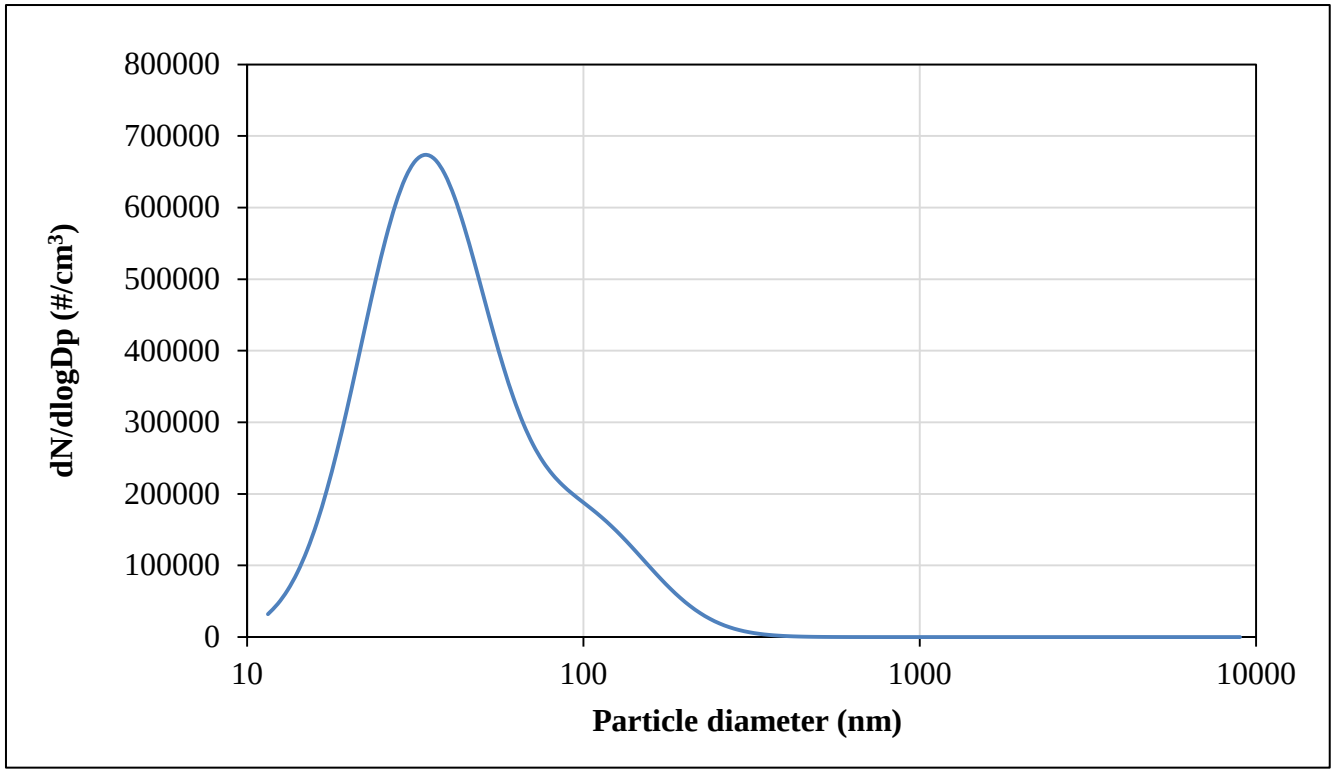

46" FROM STAND
8" ACROSS
TOP: 10M FACE 7"
BELOW WORK
BOTTOM: 10M FACE
15"BELOW WORK
91-100
101-110
Miller
XMT 350 CC/CV

Dust-Trak



Process: GMAW, 100% CO2, DCEP - Electrode: Praxair Prostar S-6 - Position: Flat

Particle sizers



Process: GMAW, 100% CO2, DCEP - Electrode: Praxair Prostar S-6 - Position: Flat

mg/m^3

Gravimetry – 8-hour TWA

Mass concentration (mg/m^3)

	Day 0	Day 1	Day 7	Day 50
Average	0.01 (ND-0.03)	0.33 (ND-1.7)	0.48 (0.11-1.3)	0.96 (0.17-3.0)

mg/m^3

$\mu g/m^3$

$\mu g/m^3$

$Fe\ (mg/m^3)$

Mn ($\mu g/m^3$)

Metal analysis – 8-hour TWA

Concentrations in µg/m^3 (Fe in mg/m^3)

Welders	Day 0	Day 1	Day 7	Day 50
Al		1.5	1.1	4.8
As		0.03	0.12	0.66
Cd		0.01	0.01	0.02
Co		0.01	0.03	0.14
Cr	0.46	0.52	0.77	1.7
Cu	0.02	1.5	3.4	12
Fe	0.00	0.13	0.22	1.2
Mn		13	20	107
Mo	0.00	0.03	0.10	0.55
Ni	0.01	0.17	0.48	5.5
Pb		0.05	0.22	0.77
V	0.00	0.01	0.01	0.05
Zn	0.03	1.2	1.8	7.7

Geometric mean of 9 samples

Conclusion

- Particles are mostly respirable
- Particle and metal concentrations increase as students become more proficient in welding techniques
- Particles: one student was at the Alberta 8-hour OEL and TLV-TWA for respirable particles
- Metals: 1 student had a value over the TLV-TWA for respirable Mn on day 1, 4 students were over on day 7, and 7 students were over on day 50
- Ventilation system is not used properly by students

Funding

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