

# Detailed characterization of welding fumes in personal exposure samples

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## Objectives

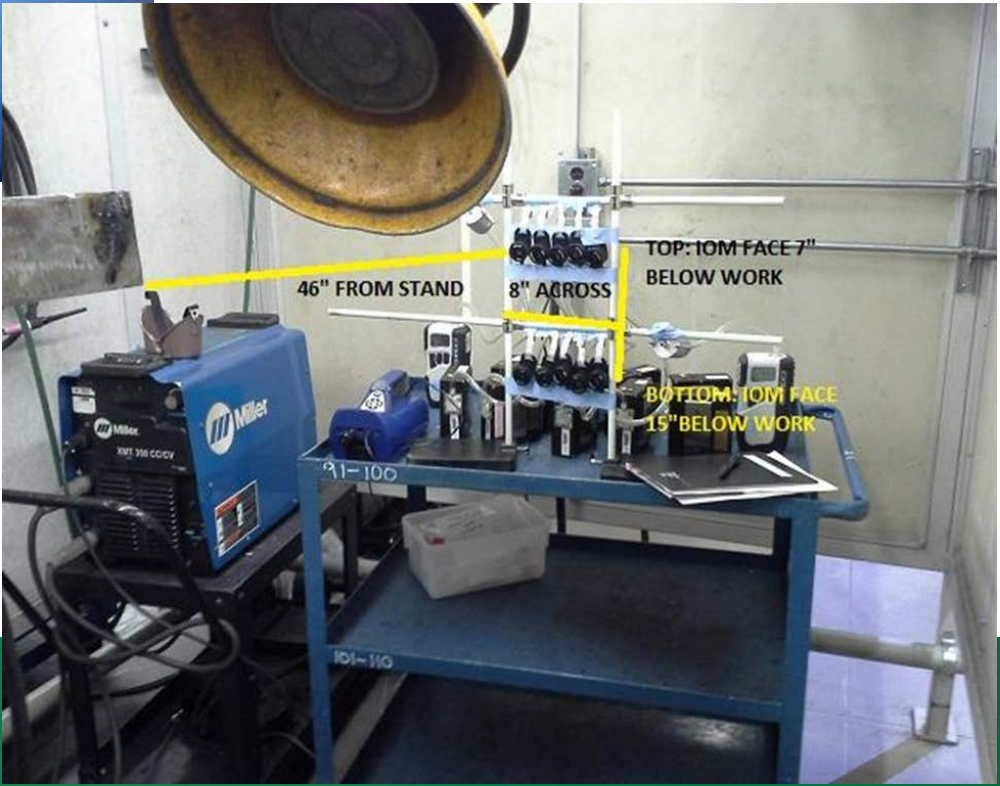
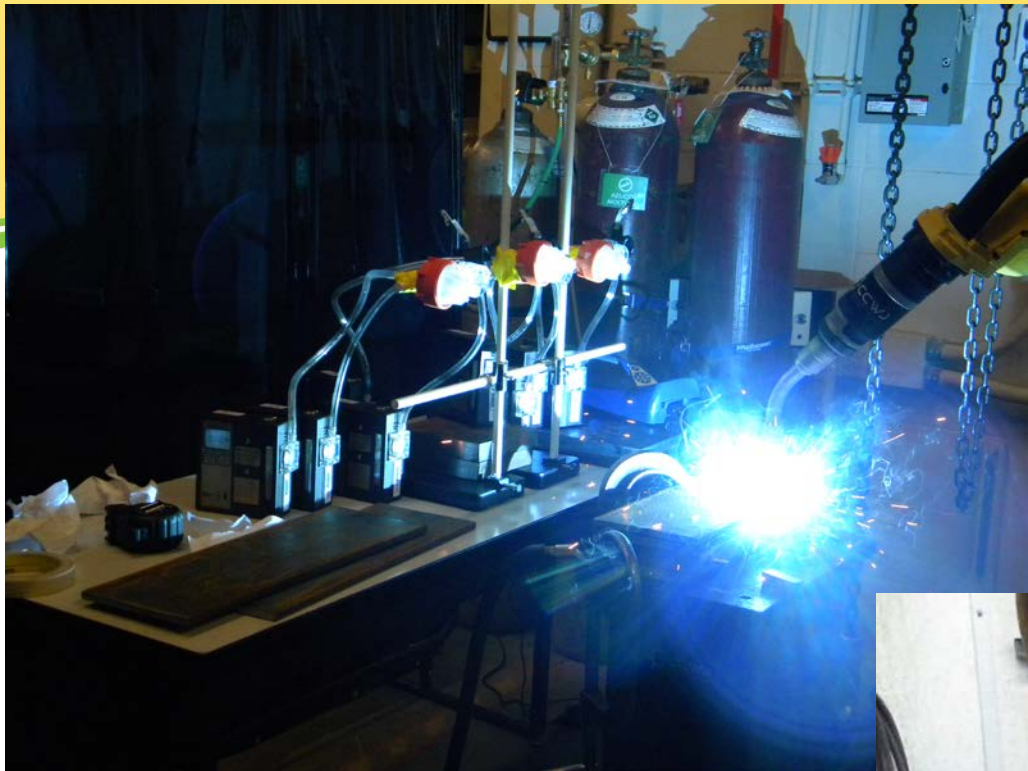
- **Develop a method allowing for detailed characterization of nanoparticles in personal exposure samples using regular samplers (i.e. cassette and personal sampling pump).**
- **Characterization:**
  - **Mass concentration**
  - **Chemical concentration**
  - **Surface chemistry**
  - **Size distribution**
  - **Surface area**

## Methods

- **Sampling at the Canadian Centre for Welding and Joining (CCWJ) and at NAIT**
- **Mass concentration: microbalance in a temperature- and humidity-controlled room**
- **Metal concentration: microwave digestion; analysis by ICP/AES and ICP/MS**

## Methods

- **SEM/STEM: size distribution and surface area**
- **XPS: allows for the determination of surface chemistry**
- **XRD: determination of crystalline structure of the sample**
- **Tested various samplers and filters**



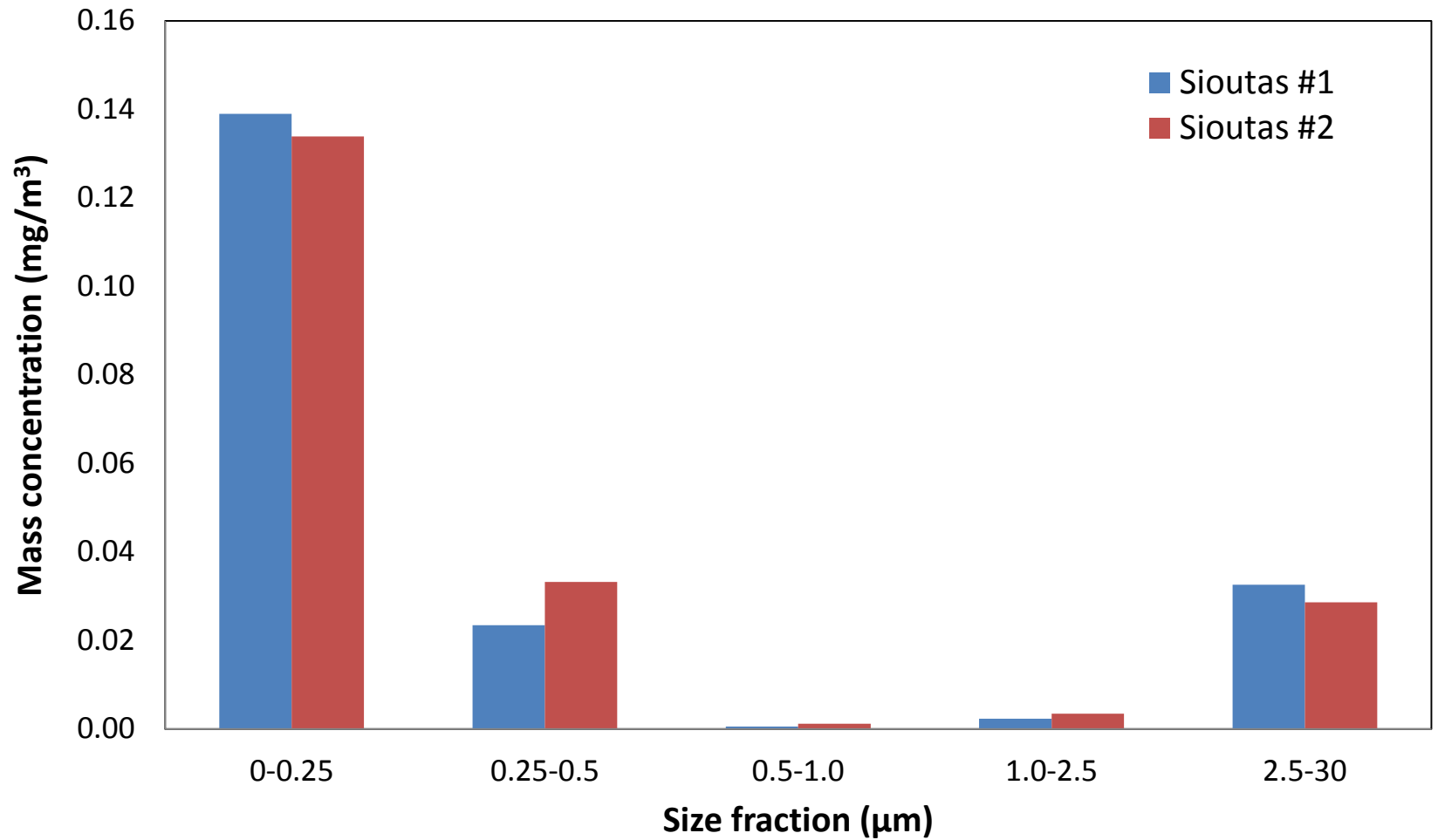
## Mass concentration - NAIT

	PVC 25 mm	PVC 37 mm
Average (mg/m <sup>3</sup> )	0.673	0.598
St Dev (mg/m <sup>3</sup> )	0.010	0.059
CV (%)	1.5	9.9

	PVC	Omnipore
Average (mg/m <sup>3</sup> )	0.415	0.474
St Dev (mg/m <sup>3</sup> )		0.016
CV (%)		3.3

	PVC	LCR
Average (mg/m <sup>3</sup> )	0.45	0.33
St Dev (mg/m <sup>3</sup> )	0.03	0.05
CV (%)	6.6	13.83

## Comparison of size distribution for two Sioutas impactors

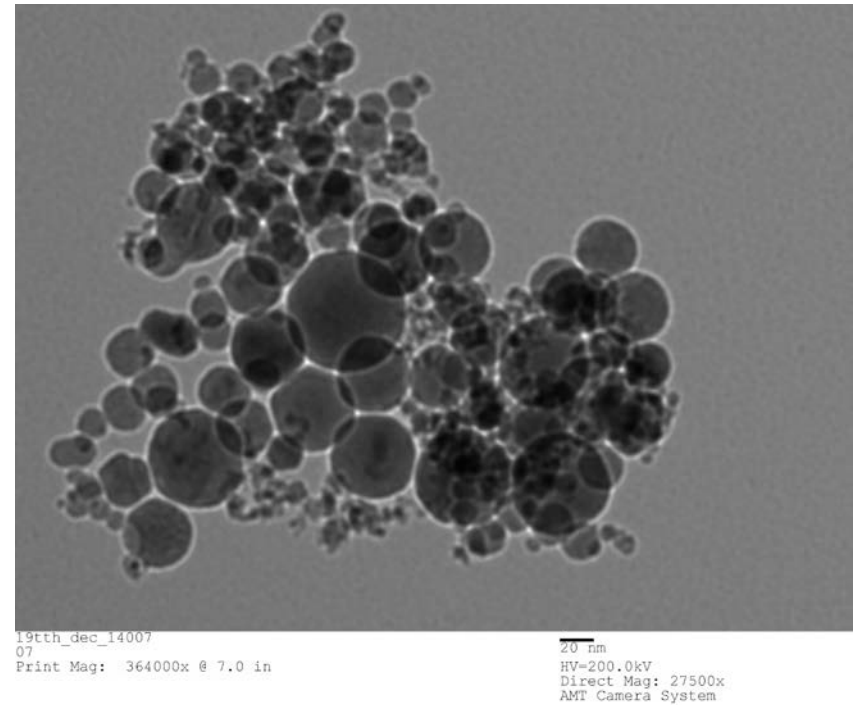
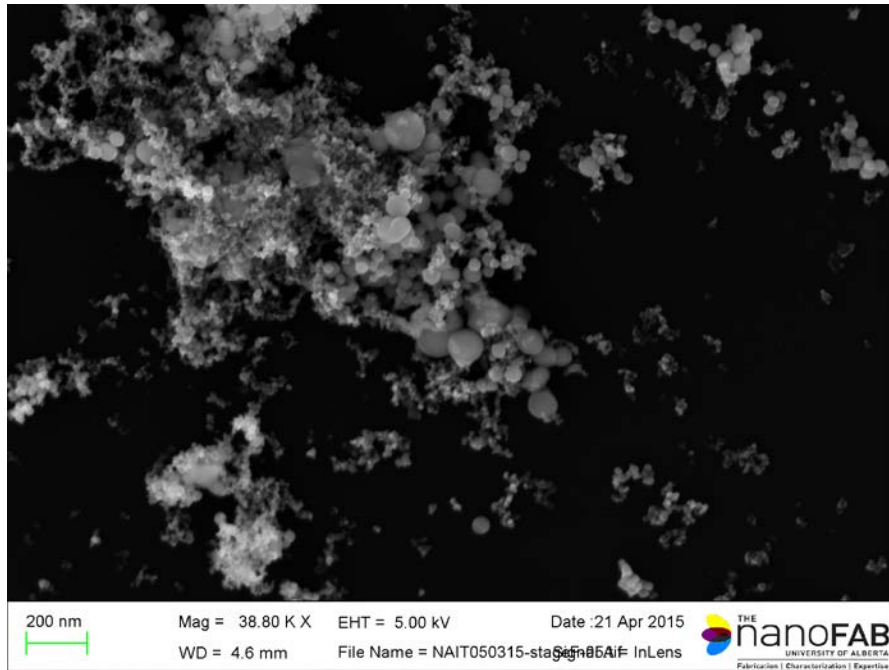


## **Metal concentration**

- **Filter blanks: good in both laboratories**
- **Welding fume bulk sample: good agreement between laboratories except for Al**



# SEM and STEM

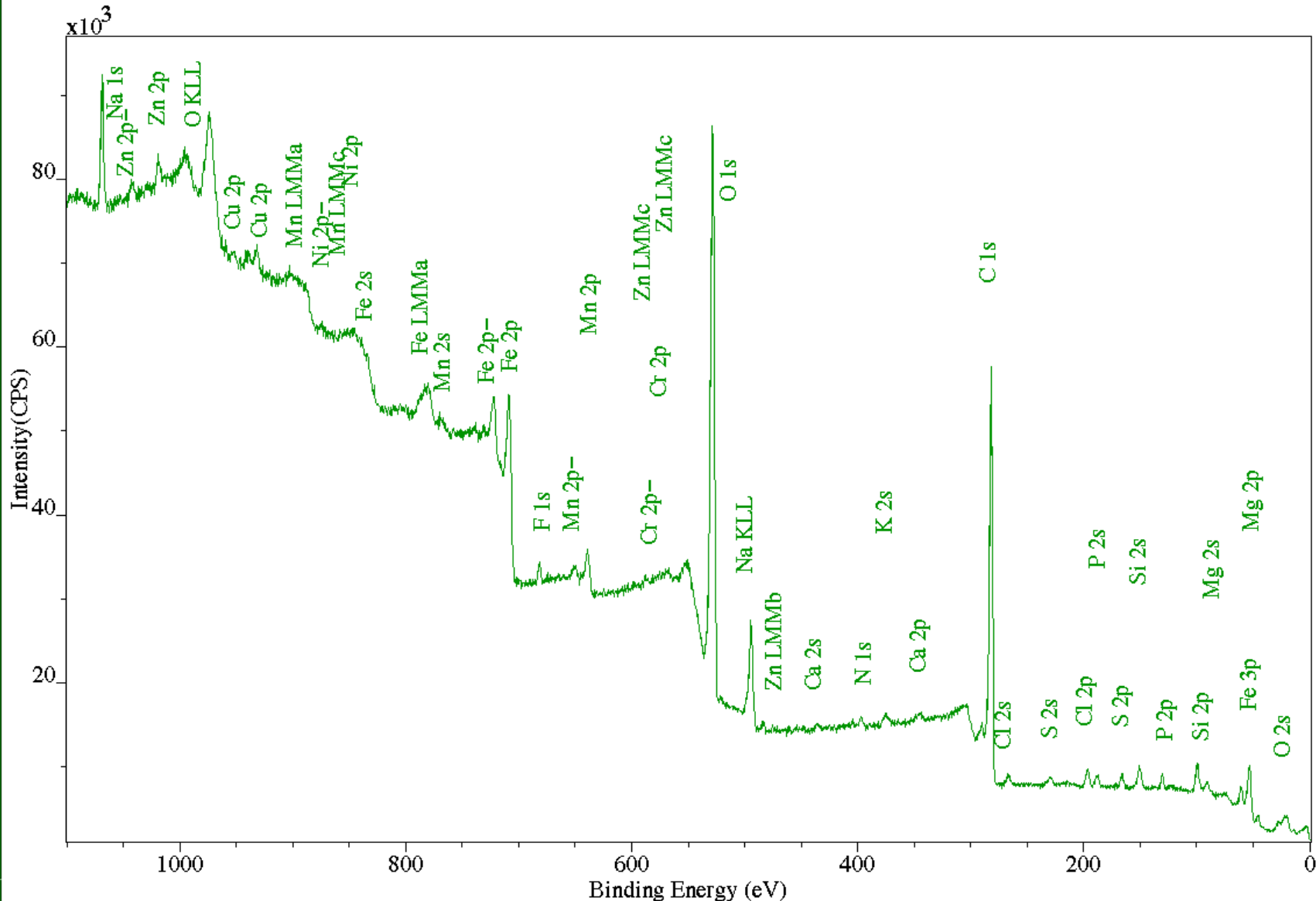


Survey:2(Aug25\_2014-Bernadelte)

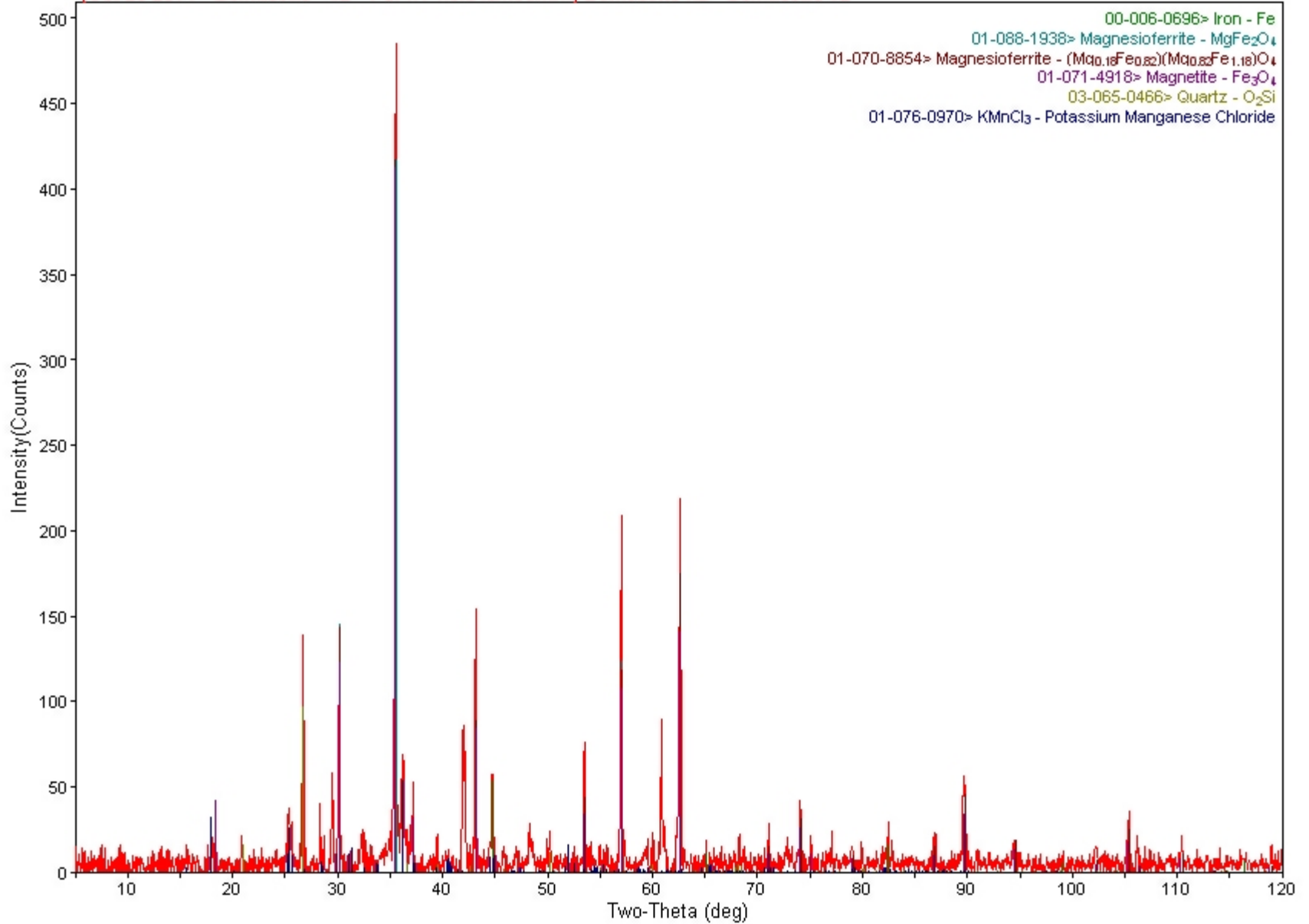
Lens Mode:Hybrid Resolution:Pass energy 160 Iris(Aperture):slot(Slot)

Anode:Mono(Al (Mono))(168 W) Step(meV): 400.0 Dwell(ms): 100 Sweeps: 3 Acqn. Time(s): 825

Acquired On :14/08/25 09:57:09 C/N :On



[Oct 26 2014 - Bernadette - #2 - FCAW weld fumes.raw] Bernadette #2 - Bernadette #2



## Conclusions

- **One filter will not do it**
- **Size distribution/surface area: cascade impactor, TEM sampler**
- **XPS works well on filters**
- **XRD did not work on filter (not sensitive enough); we need to find another more sensitive machine**
- **Test mini sampler**

## **Funding:**

**Government of Alberta: Occupational Disease Prevention Unit  
(Ministry of Jobs, Skills, Training, and Labour)**