chromium (CrR, CrU), and chromium in whole blood and in erythrocytes (CrBl, CrEry) in welders.

Methods Respirable welding fume was collected in 241 welders during a working shift. Blood samples and spot urine samples were collected after the working shift. The content of Cr in the welding fume was determined using inductively coupled plasma mass spectrometry. CrU, CrBl and CrEry were measured by means of graphite furnace atom absorption spectrometry. Linear regression models were applied to model exposure to chromium. A multiple imputation approach was chosen to account for values below the limit of quantitation (LOQ).

Results Median concentrations of CrR were <3.80 \( \mu g/m^3 \), with about 23% below LOQ. Major determinants of the CrR were the chromium content in the electrodes or base material in addition to the type of welding. Airborne exposure was higher when welding was performed under inefficient ventilation. CrR correlated strongly with CrU (Pearson’s correlation \( r = 0.61 \)). Median concentrations of CrU were <1.20 \( \mu g/m^3 \), and 44% of CrU measurements were below LOQ. CrU exposure decreased by a factor of 0.66 when a respiratory mask was used. Most measurements of CrBl and CrEry were below LOQ. All 15 welders with a measurable concentration of CrEry had high chromium contents in the materials (above 5%).

Conclusions CrR was mainly influenced by the chromium content in the materials and the welding process. Welding in confined space increased exposure to CrR. Efficient local exhaust ventilation and the use of respirators decreased exposure. Airborne Cr concentration was a good predictor of urinary Cr exposure.

Conclusion Although much of the monitoring data has been conducted for control evaluation and compliance, they provide a basis for industrial hygienists and exposure assessors to identify work tasks and jobs where exposures are likely, and provide an overview of current exposure levels. This work also shows that for most agents the exposure data is extremely sparse and therefore there is a need to measure chemical exposures in this industry.
aimed to identify determinants of PM$_{10}$ and PM$_{2.5}$ levels in poultry barns and evaluate the effectiveness of electrostatic precipitators (ESP) to reduce environmental air pollution.

**Methods** PM$_{10}$ and PM$_{2.5}$ Harvard impactor samples were collected in “side-by-side” barns (one with an ESP, one without) at five poultry farms in British Columbia, Canada from 2008 to 2012. Measured particulate levels were analysed using multilinear inference and linear mixed-effects models after log-transformation. Random effects were added to account for clustering within farms, barns, and rearing cycles.

**Results** A total of 234 PM$_{2.5}$ and 230 PM$_{10}$ valid samples were modelled. Geometric means of PM$_{2.5}$ and PM$_{10}$ were significantly lower in barns with ESP control in place (151 and 427 µg/m$^3$, respectively) compared to barns with no control (334 and 969 µg/m$^3$), resulting in unadjusted % reductions of 47% and 50% respectively.

In statistical models, the fixed-effects explained 57% and 72% of the total variance in the PM$_{2.5}$ and PM$_{10}$ measurements, respectively. The residual (i.e. within rearing cycle) and between rearing cycle variance were the most affected by adding the fixed effects structure. Strongest determinants in the models for both dust types were ESP use (i.e. approximately halving particulate levels for both PM$_{2.5}$ and PM$_{10}$), bird age (i.e. 10–30 fold increase in particulate levels depending on bird and particulate type), and type of bird (i.e. approximately a 2.5 fold increase for PM$_{2.5}$, and four fold increase in PM$_{10}$ for turkey compared to chicken). Interactions were suggested in PM$_{10}$ models between type of bird, bird age, and ESP use.

**Conclusions** The use of ESP resulted in significant reductions in in-barn particulate even after controlling for other determinants such as bird age, type of bird, ventilation, and date.

**Session: 3. Electro magnetic fields and health**

**239 MEASUREMENTS OF OCCUPATIONAL EXPOSURE TO EMF EMITTED BY HIGH-SPEED MAGLEV TRANSPORTATION SYSTEM AND ITS HEALTH EFFECTS**

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**Objectives** High-speed Maglev transportation system is an advanced technology using magnetic forces to propel, levitate, and guide the train. Our study was to assess the EMF emitted by High-Speed Maglev Transportation System and the possible health effects of occupational exposure to the Maglev EMF.

**Methods** The static magnetic field of Maglev were measured by Narda ETM-1 magnetic field measurement system. The time-varying EMFs of Maglev were evaluated by PMM8053 EMF measurement system. 48 employees exposed to maglev EMF were selected as occupationally exposed group while 54 employees without any Maglev EMF exposure were selected as control. Questionnaires were sent to two groups. Complete blood count was done by haematology analyzer. Blood lipid level was detected by enzymatic method. Thyroid function related hormones was evaluated by chemical immune assay. Serum melatonin level was measured by an ELISA kit.

**Results** EMF strength of all Maglev sites was lower than the safety exposure limits of current international and Chinese national standard.