

of the most promising mineral development opportunities in Ontario, has a potential of generating \$120 billion.

**Resolution:** Safety and health initiatives due to fatalities and critical injuries statistics are being focused in underground mines; mining plants; open pit mines and quarries; sand and gravel pits; and diamond drilling. Ontario Ministry of Labour inspectors have made over 1,500 proactive visits to mining workplaces in 2012–13. The Ministry is conducting a comprehensive 1-year mining health, safety and prevention review in 2014 to focus on mines with large fleets of diesel equipment operating in the underground environment; recently reopened or new mines operating diesel equipment; mines with previous ventilation concerns and those with a poor compliance history.

**Results:** Specifically, ventilation in underground mines: carbon monoxide in diesel exhaust; new Mining Regulation diesel provisions in 2012; routine testing and control of diesel emissions; ensure testing measures and procedures for each piece of diesel equipment and that the equipment used for underground transportation of workers and materials are being regularly tested. Regular air testing in underground mines to ensure exposure to toxic airborne substances does not exceed legislative requirements. Ensuring appropriate ground stability and water management practices methods are being used; measures to control, monitor and prevent falls of ground and rockbursts. All explosives storage areas are constructed in compliance with legislated requirements. Also, examining the need for better education and training of employers, supervisors and workers on injury prevention.

**Lessons Learned:** The high fatality rates in Ontario mines have prompted the need for new initiatives to keep miners safe at work.

#### SR-118-08

### Assessing the Health Effects of Rotating Shift Work among Refinery Workers

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**Objective:** Refinery workers in operator and maintenance positions typically work extended, rotating shifts. This study aimed to characterize work schedules and prevalence of chronic diseases in the study population, and explore associations between work hours, fatigue, and health & quality of life outcomes.

**Methods:** We assessed the health impacts of extended shifts, shift rotation, and overtime among refinery workers using a self-reported health questionnaire administered to members of the United Steelworkers (N=17,333). Reported work schedules, annual estimates of overtime worked, typical sleep schedules and an evaluation of sleep quality were used to estimate fatigue exposure. Self-reported diagnoses of heart disease, hypertension, diabetes, and gastro-intestinal illness were used to calculate disease prevalence within the workforce. Calculated disease prevalence rates were compared to day shift workers from the surveyed population, rotating shift workers in other industries, and the general public. Job stress and quality of life indicators were measured, and a depression assessment was performed.

**Results:** A shift work exposure index will be calculated based on the exposure to alternate and rotating shift assignments (self-reported work schedules, annual overtime estimates, and

work histories). Then an overall fatigue index will be calculated based on associations between hours worked, hours slept and sleep quality scores. These two exposure indices will be tested against individual health outcomes. Disease prevalence will be calculated based on self-reported assessment of current health symptoms and biometrics, and known medical diagnoses. Responses will be coded according to NHANES codebooks for CVD, diabetes, and blood pressure. Likert scales will be used to assess severity of job stress, depression, and quality of life factors, then scored to yield a positive or negative overall result.

**Conclusions:** The mechanisms of chronic diseases associated with fatigue are poorly understood. The direct effect of shift work on blood pressure, BMI, CVD and metabolic disease is debated. Recent research indicates that metabolic disease could be the primary causal mechanism for hypertension, CVD, and diabetes among shift workers. Our study has accessed a large workforce with a significant exposure to work related fatigue. Our detailed assessment of their past and current exposure, recovery periods, and health and mental status will generate valuable insights.

#### SR-118-09

### New Results from the Comprehensive Lead Education and Reduction by Window Replacement (CLEAR-WIN) Program in Illinois

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**Objective:** Childhood lead poisoning remains a widespread problem, with over half a million children having blood lead levels above the CDC reference value of 5 µg/dL. Windows are known to have the highest levels of both lead paint and lead dust compared to other building components, but large-scale window replacement programs have not been forthcoming and financed. This study was conducted to measure lead and other health outcomes associated with large scale replacement of old windows contaminated with lead.

**Methods:** Dust lead on floors, interior window sills and exterior window troughs, as well as resident health interviews was conducted in 50 housing units in Chicago (urban) and another 50 units in Peoria (rural). Dust lead was collected using the standard HUD wipe method and analyzed in an accredited laboratory. Health interviews were conducted using questions drawn from the CDC National Health Interview Survey.

**Results:** Preliminary results show geometric mean (GM) interior window sill dust lead loadings declined from 287 µg/ft<sup>2</sup> to 32 µg/ft<sup>2</sup> (89% reduction); exterior window troughs declined from 5,022 µg/ft<sup>2</sup> to 120 µg/ft<sup>2</sup> (98% reduction); and interior floors declined from 11.4 µg/ft<sup>2</sup> to 9.7 µg/ft<sup>2</sup> (15% reduction). Health interviews suggest there are also important health improvements associated with asthma and mental health. The data also show significant improvements in energy use and property value.

**Conclusions:** The findings suggest that replacement of lead painted windows can substantially reduce children's exposure and illustrate the importance of establishing large-scale window replacement with state, federal and local financing mechanisms.



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