

Welding and Manganese Exposure

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Background

- In 2013, the American Conference of Governmental Industrial Hygienist (ACGIH) has lowered occupational exposure limit (i.e. threshold limit value or TLV) for manganese.
- In Manitoba, TLVs have been adopted by Workplace Safety & Health Regulation

What is Mn?

- Manganese (Mn) is a grey-white metal resembling iron.
- Used extensively to produce a variety of important alloys and to desulfurize and deoxidize steel.
- Found in many welding rods and filler metals to promote hardness.
- Mn oxide fume is formed when Mn metal is heated and reacts with oxygen in air, such as occurs during welding.

What is the new level?

- Prior to this recent reduction, the TLV-TWA for Mn was 0.2 mg/m³.
- As of 2013, ACGIH has adopted a TLV-TWA of 0.02 mg/m³, based on the respirable fraction.

Health Effects

- High Mn exposure has been associated with central nervous system effects, referred as *manganism*.
- Symptoms similar to Parkinson's disease
 - Tremors
 - Slowness of movement
 - Muscle rigidity
 - Poor balance

Why was the TLV reduced?

- The reduction of any TLV is based on current research studies that reveal a link between the current occupational exposure limit and potential negative impact on the human body.
- For Mn, 5 key studies were given consideration that derived lowest-observed-adverse-effect levels (LOAEL) among workers.

- LOAEL concentrations ranged from 0.03 to 0.04 mg/m³, measured as respirable fraction.
- A 6th study demonstrated increased neurobehavioral changes among workers exposed to 0.01 – 0.04 mg/m³ (respirable fraction)

TLV is less than the level where effects are seen

- Lowest Observed Adverse Effect Level
- 0.03 - 0.04 mg/m³ is start of effects
- TLV was lowered to 0.02 mg/m³

Centre for Disease Control (CDC)

- Recent studies indicate neurological and neurobehavioral deficits may occur when workers are exposed to low levels of manganese (<0.2 mg/m³) in welding fumes. These effects include changes in mood and short-term memory, altered reaction time, and reduced hand-eye coordination.
- NIOSH is currently reviewing its Recommended Exposure Limit (REL) for manganese as a result of these studies.

Consensus but not unanimous agreement

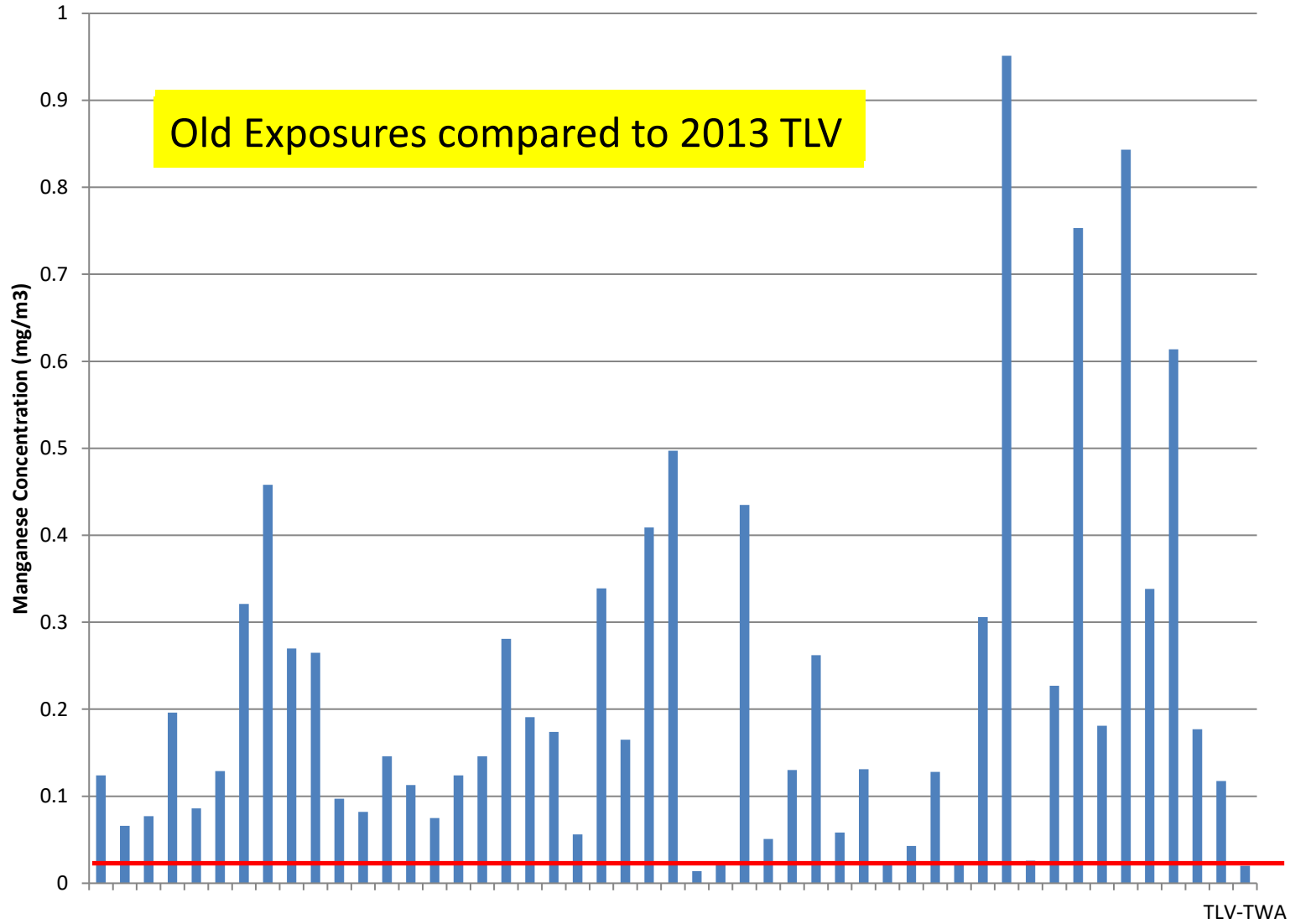
- Growing body of long-term detailed studies
- One study had 1,300 samples taken over a 8 year period and rigorous medical tests for workers.

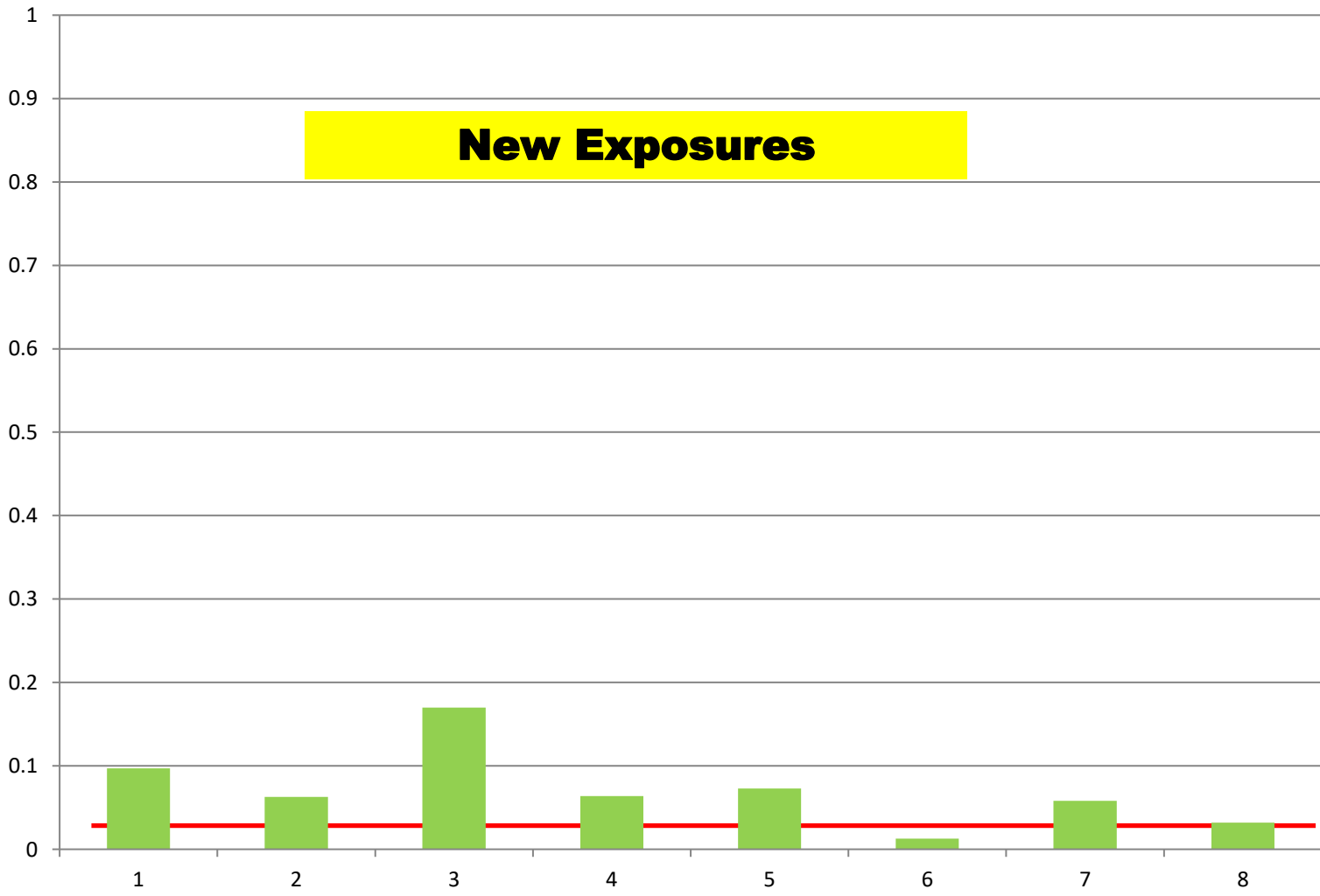
Where do we stand compared to the new TLV?

- Looking at trends in exposure, manganese levels are coming down.
- Large part to this is due to less Mn in welding wire.

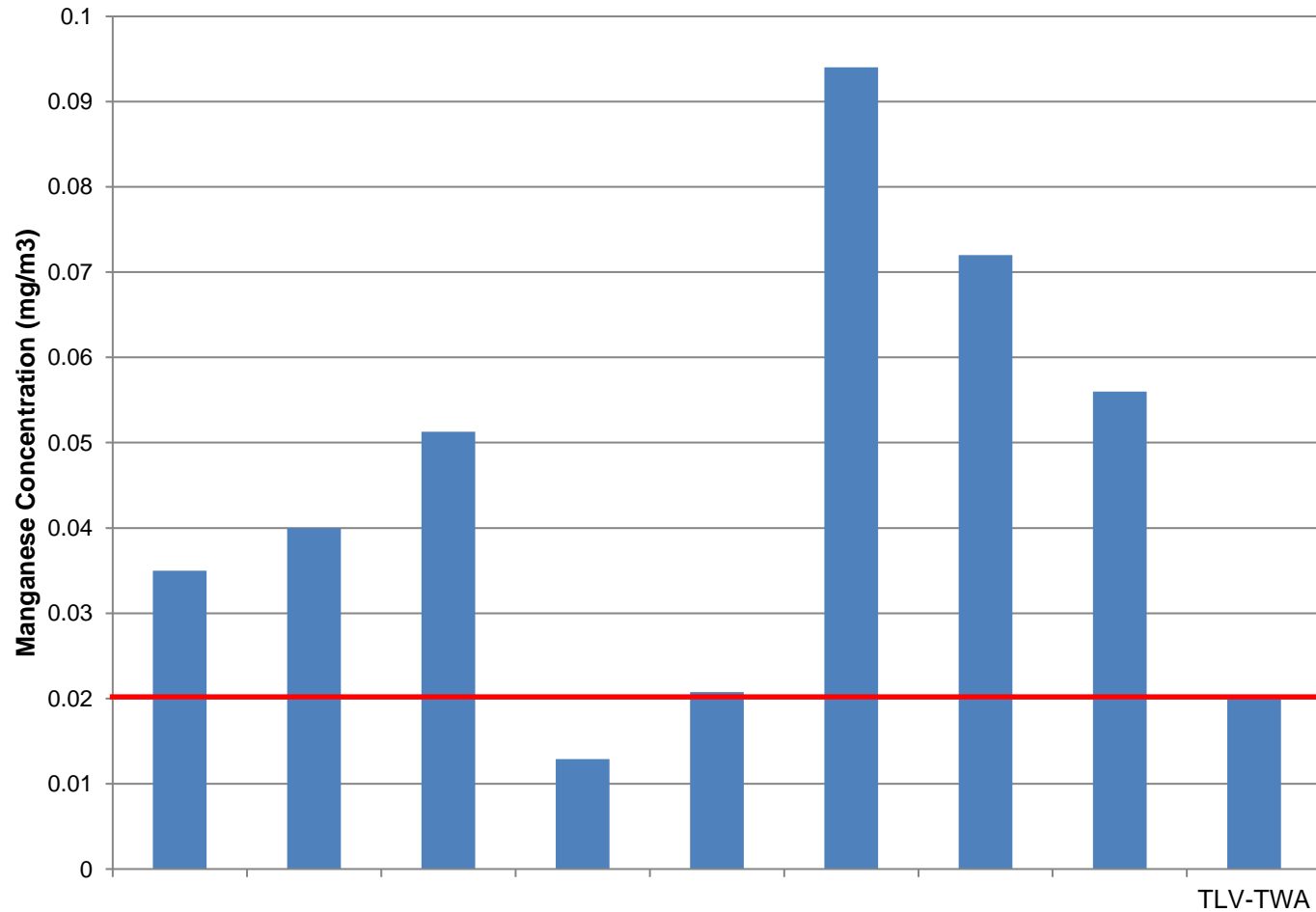
Impact on Welding Industry

- Very few companies performing significant amounts of MIG welding on mild steel have Mn concentrations less than this new TLV.
- It was common to find exposures significantly above the old TLV of 0.2 mg/m³.





In large welding areas, non-welders can be exposed above TLV



Summary

- Most welding operations that are not well controlled will result in exposures above the 2013 TLV for manganese.
- In large welding operations, background levels may result in significant exposures to non-welders.
- Air sampling can measure worker exposure and provide direction for better controlling welding exposures.