

# **Low levels of manganese in welding fumes cause neurological problems**

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Welders exposed to airborne manganese at estimated levels below

federal occupational safety standards exhibit neurological problems similar to Parkinson's disease, according to new research at Washington University School of Medicine in St. Louis. Further, the more they are exposed to manganese-containing welding fumes, the faster the workers' signs and symptoms worsen.

The findings, published Dec. 28 in *Neurology*, suggest that current safety standards may not adequately protect [welders](#) from the dangers of the job.

"We found that chronic exposure to [manganese](#)-containing welding fumes is associated with progressive neurological symptoms such as slow movement and difficulty speaking," said Brad A. Racette, MD, a professor of neurology and the study's senior author. "The more exposure you have to welding fumes, the more quickly those symptoms progress over time."

At high levels, manganese - a key component of important industrial processes such as welding and steelmaking - can cause manganism, a severe neurologic disorder with symptoms similar to Parkinson's disease, including slowness, clumsiness, tremors, mood changes, and difficulty walking and speaking. The risk of manganism drove the Occupational Safety and Health Administration (OSHA) decades ago to set standards limiting the amount of manganese in the air at workplaces. While these [safety standards](#) are widely believed to have eliminated manganism as an occupational hazard, researchers who study the effects of manganese exposure have long suspected that there may still be some [health effects](#) at levels much lower than what is allowable per OSHA standards.

"Many researchers view what's allowable as too high a level of manganese, but until now there really weren't data to prove it," said Racette, who also is executive vice chairman in the Department of Neurology. "This is the first study that shows clinically relevant health

effects that are occurring at estimated exposures that are an order of magnitude lower than the OSHA limit."

Racette and colleagues studied 886 welders at three worksites in the Midwest - two shipyards and one heavy-machinery fabrication shop. Each welder filled out a detailed job history questionnaire, which the researchers used to calculate each participant's exposure by combining the estimated manganese exposure for specific job titles with the amount of time spent in each job.

Each participant also underwent at least two standardized clinical evaluations of motor function spaced a year or more apart and using the Unified Parkinson's Disease Rating Scale. The evaluations were performed by trained neurologists looking for signs of neurological damage such as muscle stiffness, gait instability, reduced facial expressions and slow movement.

A score of 6 or lower was considered normal on the evaluation scale, and those with scores of 15 or higher were placed in the parkinsonism category. Parkinsonism is a set of neurological signs and symptoms similar to what is seen in Parkinson's disease. At their first evaluation, the welders had an average score of 8.8, and 15 percent of the welders fell into the parkinsonism category.

Moreover, participants' scores increased over time, and the welders exposed to the highest levels of manganese showed the biggest changes in their scores, an indication that their [neurological problems](#) were worsening faster than those of workers exposed to less manganese.

The scores for workers at the same sites who were not exposed to welding fumes did not change over time, suggesting that welding fumes, not aging, were responsible for the increasing scores.

Racette's team did not directly measure the participants' quality of life, but previous studies by his team have shown that higher parkinsonism scores in welders are associated with more difficulty with activities of daily life such as eating, mobility and writing.

"This is not something we can ignore," Racette said. "I think a qualified neurologist would look at these clinical signs and say, 'There's something wrong here.' This would be having an effect on people's lives."

The most worrisome aspect of the study, Racette said, is that the neurological signs showed up in people with an estimated exposure of only 0.14 milligrams of manganese per cubic meter of air, far below the safety standard set by OSHA at 5 milligrams per cubic meter.

In 2013, the American Conference of Governmental Industrial Hygienists recommended a limit of 0.02 milligrams of manganese per cubic meter. Some companies already are attempting to keep their workers' exposures below that level by improving ventilation, mandating personal protective equipment and using low-manganese welding wire. However, only OSHA's standards are enforceable by law.

"We can make the workplace safer for welders," Racette said. "Reducing OSHA's allowable levels of manganese would probably make a big difference in terms of safety and help workers avoid such risks."

Provided by Washington University School of Medicine

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