Manganese and Welder’s Disease

Mixed Bag: Can exposure to manganese fumes really put welders at higher risk for Manganism? Or is this yet another case of people looking for somebody to sue?

Poor air quality in welding stations can cause illnesses ranging from minor irritations to life-threatening diseases. Much attention has been paid in the past to the effects of hexavalent chromium, but more recently a new culprit has come under increased scrutiny: manganese.

Manganese fumes produced during welding operations has become a hot button issue in workplace safety, leading to thousands of product liability lawsuits against manufacturers of arc welding supplies because those fumes are deemed to cause “Manganism”, a serious, incurable, chronic illness with symptoms resembling those of Parkinson’s Disease (PD). Some even refer to Manganism as “the welder’s disease” due to the alleged high incidence in welders. Those exposed to fumes from welding rods have called it the “next asbestos” or the next “hex chrome”.

But are these claims true? The research gives mixed results.

WHAT ARE THE FACTS?

Manganese, stored mainly in the bones, kidneys, and liver, is essential to the human body and can be found in air, water, food, and soil. According to the National Institute for Occupational Safety and Health (NIOSH), the permissible occupational exposure limit for manganese is 5 mg/m³ per day. Prolonged exposure to concentrations greater than 1 mg/m³ may lead to health problems.

At high levels, manganese becomes toxic and is more likely to do so when inhaled because it bypasses the body’s normal defense mechanisms. This can lead to manganese build-up and adverse health effects, including damage to the lungs, liver, kidney and central nervous system, and fertility problems in males. The result of high levels of exposure, or exposure over extended periods, can be the Parkinson-like symptoms known as Manganism: cognitive impairment, headaches, tremors, muscle rigidity, balance problems, slow/clumsy movements, fatigue, muscle soreness, loss of coordination, and mental/emotional disturbances.
Research indicates that workers usually do not develop symptoms of Manganism unless they have been exposed for many months or years. A Mayo Clinic case reported in a June 2005 issue of Neurology magazine examined the medical records from eight former welder patients who were referred to the clinic between 1999 and 2005 for nervous system complaints. All of their MRIs showed an area of increased T1 signal intensity in the basal ganglia region of the brain, which appears as a bright spot on the MRI scan and indicates manganese accumulation. All eight men welded from one to 25 years before developing symptoms.

These T1 findings are uncommon in brain imaging, according to Keith Josephs, MD, Mayo Clinic neurologist. “In the setting of prominent manganese exposure in the environment, as occurred in these otherwise healthy welders, there are no other reasonable explanations than the fume exposure for the damage present in the MRI findings,” he said. “When physicians consider welding and manganese exposure, they often think of a symptom known as ‘cock walk’, which is a staggering, strutting gait. Our analysis shows that symptoms are often more subtle. Damage from manganese exposure is more common than we think.”

One common factor with all eight welders was poor air quality protection. “An important finding from our case series analysis is that these patients were not only all welders,” notes Dr. Josephs, “but all had a lack of ventilation. They didn’t have a mask or were welding in confined spaces.”

That’s not all. Dr. Brad A. Racette, MD, of the Washington University School of Medicine in St. Louis, published two articles in Neurology describing a potential relationship between welding and Parkinson’s. In 2001, Racette and his colleagues studied 15 career welders and two groups of control subjects with idiopathic Parkinson’s. They found that the welders developed symptoms at a younger age (on average, 46 years) than the controls (63 years). They found no difference between groups in terms of symptom type. Racette argues that clinically idiopathic Parkinson’s is nearly identical to manganese-induced Parkinson’s.

But a review article by Dr. Joseph Jankovic, MD, a neurology professor at Baylor College of Medicine, argues that no convincing evidence exists to associate welding with PD, nor is there enough data to associate welding fume exposure with PD. Another approach to exploring the possible relationship between welding and PD was taken by Dr. Samuel Goldman, MD, and his colleagues from the Parkinson’s Institute in Sunnyvale, CA. Their study was specifically designed to explore Racette’s findings, as they had been used to support litigation against welding equipment manufacturers, even though coauthor Joel Perlmutt er, MD, stated it was too early to link welding and Parkinson’s.

Goldman and his colleagues examined the medical records of 885 consecutive patients with PD for whom occupation and age at diagnosis was recorded. The patients reflected the generally white-collar population of the area and included only two welders. The average age at onset for the entire group was 64.3, and 14 percent had
onset at 50 or younger. Age at onset for the two welders was near group average. Caroline Tanner, MD, PhD, Director of Clinical Research at the Parkinson’s Institute and senior co-author of the Goldman study, said that neither the Racette study nor her own can provide any conclusive information about the risks of welding. She states that, despite personal injury claims, “Welding certainly isn’t a common cause of Parkinson’s.”

However, it is broadly accepted that manganese can be dangerous and excessive exposure can lead to disease. Occupational workplace exposure guidelines have been set with this risk in mind. In 1999, the NIEHS funded a study on the health consequences of occupational exposure to manganese. The results showed that miners and steel workers exposed to high levels developed problems with balance, movement, and fine motor coordination and were at much greater risk of developing PD.

On the other hand, a 2004 AWS-commissioned study found no relationship between welding and Parkinson’s. In July 2004, the AWS Safety and Health Committee engaged an outside independent expert, Dr. Woodhall Stopford, MD, MSPH, of the Duke University Division of Occupational and Environmental Medicine, to review the research on manganese fumes. The study found that PD and Manganism are separate and distinct illnesses and its research shows that toxic exposure has occurred primarily in non-welding occupations. Stopford concluded that research has not supported the view that welders have a higher incidence of PD than the general public, or that welders have an earlier onset of PD symptoms.

WHAT DOES THIS MEAN LEGALLY?

In late 2003, a jury awarded $1 million to an Illinois man who said he developed Parkinson’s from years of breathing fumes from welding rods. As of early 2007, this was the only case the welding industry had lost. The plaintiffs have been individuals who were welders suffering from symptoms associated with PD or Manganism. They argued they were given no warning that welding fumes could potentially cause health problems. Many of the pending lawsuits (at one point over 6,000 individual claims) were grouped into multi-district litigation and took place in the U.S. District Court in Cleveland, OH. Plaintiffs alleged that commercial manufacturers and sellers of welding rods were aware of health dangers for many years and failed to provide adequate warnings.

The defendants, mainly welding supply manufacturers and distributors, maintained that welding products are generally safe and there is no causal link between welding and PD or PD-like disorders. Juries have overwhelmingly agreed. The welding industry has a strong track record defending against manganese litigation, and the only trial lost was appealed. An April 2008 Bloomberg story detailed the success defendants have had in this litigation.

Moreover, much of the ongoing research continues to show no strong link between welding and neurological disease. For example, the Geoparkinson Study led by Dr. Finlay D. Dick found no association between high or low exposure to manganese and PD. Also, the February 2006 Air quality standards for welding stations have evolved greatly on the state and federal level. Permissible Exposure Limits (PELs) have changed and the regulations are much more stringent.
issue of Occupational and Environmental Medicine offered the results of a Swedish study led by Dr. C.M. Fored which found welders are not at an increased risk of developing PD or other related disorders.

**WHAT DOES THIS MEAN FOR YOU?**

According to United Air Specialists (Cincinnati, OH), a manufacturer of air filtration systems for welding stations, air quality standards for welding stations have evolved greatly on the state and federal level. Permissible Exposure Limits (PELs) have changed and the regulations are much more stringent. In 2006, OSHA revised its standards regarding levels of hexavalent chromium permissible in welding facilities. By 2010, welding facilities must have an air filtration system in place that removes hexavalent chromium from the air. All of this poses a big impact on welding operations because they must significantly reduce the permissible exposure limit from 52 to 5 micrograms per cubic meter of air.

Like hexavalent chromium, a small amount of manganese can be found in all weld fumes. But it is most prevalent in steel. There are currently more precaution levels out about hexavalent chromium than manganese. Both are by-products of welding, but to date PELs for manganese have not been changed in recent years.

The bottom line is this: welding fumes are not going away, but some are changing. As new welding processes are created for new and different types of materials, it’s more important than ever to use the proper air filtration systems in welding operations.

---