LOCATION WELDERS NEED EXHAUST SYSTEMS: MANGANESE FUME IS TOXIC

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Things need to change in the shop if we don’t want to see welders retiring early due to health problems. Recent studies confirm that the levels of airborne manganese fume from mild steel welding is high enough to cause symptoms similar to those of Parkinson’s disease.

HISTORY. Years ago it was established that a disabling disease, called manganese Parkinsonism, could be caused by exposure to airborne manganese. The disease was well-documented in manganese ore miners and other people exposed to large amounts of manganese dust. This included 1960s studies of Australian aboriginal artist-painters who used ground manganese dioxide ore as a pigment. Workplace air quality standards were set to prevent the heavy exposures that could cause this crippling form of manganism.

No one was worried about the small amount of manganese in steel. Common carbon mild steel contains a maximum of 1.65 percent manganese. However, some researchers noticed that Parkinson’s disease seemed more prevalent in welders. Labor wanted action. And the welding industry demanded more proof before making changes.

Studies to either prove or disprove the Parkinson’s-manganese connection were devised. Some of these involved medical testing of healthy welders for early signs of the disease. The results of these tests made it clear that a significant number of welders had neurological deficits consistent with early Parkinson’s. Further, the degree of impairment was proportional in severity to the worker’s estimated levels of exposure to manganese.

The physical deficits seen in welders include slower visual reaction time, poorer hand-eye coordination, less control of fine hand and forearm movements, tremor and changes in short term memory. Ironically, these are exactly those physical attributes that welders need to do their work well. Clearly, manganese was affecting welders and lower air quality limits were needed.

A NEW WORKPLACE LIMIT. The standards that are most often followed in the workplace are the threshold limit values (TLV) of the American Conference of Governmental Industrial Hygienists. Their old TLV for the tiny manganese particles found in welding fume was 0.2 milligrams per cubic meter of air (mg/m$^3$). To accommodate the new data, the TLV has now been lowered by ten times to 0.02 mg/m$^3$.*

The next important study was one which evaluated various types of welding processes to see which will expose workers above the new limits. This study, discussed in detail in the Welding Journal, August 2012,** found that only one type of shielded TIG (tungsten inert gas) welding would expose workers to less than the limit. All of the other common types of welding and handheld grinding of steel exposed workers above the limits. The table below lists various processes in order of the highest to lowest exposures.
WELDING TYPES IN ORDER OF Mn GENERATION

1) flux cored arc welding (extremely high!)
2) pulsed gas metal arc welding
3) shielded metal arc welding (MIG)
4) carbon arc gouging gas tungsten arc welding
5) handheld power tool surface grinding
6) hybrid laser arc welding
7) gas tungsten welding (TIG) (under the limit)

WHAT TO DO. Since TIG still exposed workers to manganese at levels only a bit below the standard, it makes sense to do all types of welding in local exhaust ventilation. If flexible duct exhaust hoods are used, there are many brands of portable filter systems that roll easily and whose flexible ducts can be positioned closest to the point of weld. Even welding outdoors will not insure adequate reduction of exposure to manganese without a vent system.

If respiratory protection is used instead, we need to follow the OSHA regulations which requires employers to place each welder under their respiratory protection program. This program must provide a medical certification by a health professional to ensure that the worker has no physical problem that would be made worse by the breathing stress caused by wearing a respirator. Next, the workers must be professionally fit tested and trained. Only when all these requirements are met can welders rely on their respirators to be protective. It is cheaper and safer to use the portable ventilation systems.

Without protection, it is now known that the health of welders is being slowly and permanently damaged. Its time to rent flexible duct ventilation systems along with the welding equipment whenever welders plan to occupy a location or shop.

Footnotes
* TLVs and BEIs, ACGIH, 2013.
HERE IS THE ORIGINAL ARTICLE FROM OUR ACTS FACTS NEWSLETTER. SINCE MOST OF OUR CONSTITUENTS ARE COLLEGES, SCHOOLS AND PROFESSIONALS, IT IS AT A HIGHER TECHNICAL LEVEL.

**MANGANESE LIMITS DROP: WELDERS NEED VENTILATION**


Exactly a year ago, ACTS FACTS covered a study showing that if the American Conference of Governmental Industrial Hygienists (ACGIH) adopted their new proposed workplace air quality limits for manganese (Mn), workers doing almost any form of welding would exceed them. Well, the proposed standard was adopted. Here’s the old and new limits we must consider:

<table>
<thead>
<tr>
<th>MANGANESE LIMITS</th>
<th>milligrams/cubic meter (mg/m³)</th>
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</thead>
<tbody>
<tr>
<td>OSHA permissible exposure limit - ceiling limit (PEL-C)*</td>
<td>total Mn 5.0</td>
</tr>
<tr>
<td>Old ACGIH threshold limit value - 8 hour limit (TLV-TWA)**</td>
<td>total fume 0.2</td>
</tr>
<tr>
<td>The two new ACGIH TLV-TWAs</td>
<td>inhalable*** 0.1</td>
</tr>
<tr>
<td></td>
<td>respirable*** 0.02</td>
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</tbody>
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* PEL-C = permissible exposure limit, instantaneous ceiling limit not to be exceeded.
** TLV-TWA = threshold limit value, 8-hr time-weighted average.
*** Inhalable particles have diameters in the range of 10-100 microns. Respirable particles are <10 microns.

**HISTORY.** The reason for the changes can be traced to studies of manganese exposure over time. Years ago it was established that a disabling disease call manganese Parkinsonism could be caused by exposure to airborne manganese. The disease was well-documented in manganese ore miners and other people exposed to large amounts of manganese dust. This included 1960s studies of Australian aboriginal artist-painters who used ground manganese dioxide ore as a pigment. The old workplace air quality standards were set to prevent this crippling form of manganism.

Mild steel is a type of carbon steel that contains manganese at a maximum of 1.65 percent. It was thought this percentage was too low to be a significant health issue for welders. But Parkinson’s disease was found to be more prevalent in welders. Some researchers did not believe these cases were directly caused by manganese. The disease was given different names by various researchers. Lawsuits were filed on behalf of sick welders. Labor wanted action. And the welding industry demanded proof.

Studies to either prove or disprove the Parkinsons/manganese connection were devised. Some of these involved medical testing of healthy welders for early signs of the disease. These tests made it clear that many welders had significant neuorological deficits. Further, the degree of impairment was proportional in severity to their estimated levels of exposure to manganese.

The deficits include slower visual reaction time, poorer hand-eye coordination, less control of fine hand and forearm movements, tremor and changes in short term memory. Ironically, these are physical attributes that welders need to do their work. Clearly, manganese was affecting welders and lower air quality limits were needed.
TYPES OF WELDING JOBS ASSESSED. To review the manganese exposure data reported last year, airborne manganese produced by different processes listed from the highest to the lowest are:

1) flux cored arc welding (extremely high!), Of these, only welders doing shielded TIG were exposed to levels below the new ACGIH respirable standard. The shocker in the study was that even plain handheld power grinding of mild steel exceeded the respirable standard.

4) carbon arc gouging gas tungsten arc welding,

5) handheld power tool surface grinding,

6) hybrid laser arc welding, and

7) gas tungsten welding (TIG)

WHAT TO DO. Since TIG still exposed workers to manganese at levels only a bit below the standard, it makes sense to do all types of welding in local exhaust ventilation. If flexible duct exhaust hoods are used, only the types that move easily from one position to another should be used. Schools must require students to take the time to move the flexible hoods close to the point of weld since they only collect well within a foot from the face of the hood. Welding outdoors also will not insure adequate reduction of exposure to manganese.

If respiratory protection is used, the school or shop should institute a full respiratory protection program, medical certification, fit testing and training. The type of respirator should be selected based on a risk assessment involving personal monitoring of the welders. There are special types of respiratory protection that will work under welding face shields.