Oxy/acetylene, arc, MIG, TIG, plasma cutting, and brazing are often done on location. These processes create toxic fumes. However, it is manganese from mild steel that will now dictate policy regarding ventilation.

MANGANESE. The American Conference of Governmental Industrial Hygienists (ACGIH) adopted a workplace air quality limits for manganese (Mn).

<table>
<thead>
<tr>
<th>AGENCY - LIMIT</th>
<th>milligrams/cubic meter (mg/m³)</th>
</tr>
</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>
</tr>
</tbody>
</table>

* 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 <10 microns.

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 black pigment. The old TLV air quality standards were set to prevent this crippling disease.

Mild steel welding was not considered a problem because it contains manganese at a maximum of 1.65 percent—a percentage thought to be too low to be a significant. But Parkinson’s disease was found to be more prevalent in welders. Some researchers did not believe these cases were caused by manganese and some did. 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 neurological 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.*


The next step was to monitor workers to find out just how much each type of welding will expose workers to. This data arranged from the highest exposure job to the lowest is as follows:

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, and
7) gas tungsten welding (TIG)

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 manganese standard. Power grinding of surfaces should be done in local exhaust or with respiratory protection.

Since TIG exposed workers to manganese only a bit below the new TLV, it makes sense provide local exhaust ventilation for all welding processes. On location, renting HEPA filtered flexible duct systems is an option. And welders should be aware that the ozone, nitrogen oxides and other gases or vapors produced are NOT captured by the HEPA filter. But the manganese particulates will be captured.

If respiratory protection is used instead, the 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.

SUMMARY:

1. Rent HEPA-filtered, portable flexible duct welding exhausts on location
2. When these systems are not available, use respiratory protection with P100 filters.