10 Questions for Metalcasters on Fine Particulates

The regulation of particulate matter may have a significant impact on newly built or updated metalcasting facilities.

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MODERN CASTING last discussed the regulation of fine particulate matter (PM) and the implications for metalcasting facilities in July 2012. In the past three years, a number of developments have occurred, including the lowering of the annual standard. This article provides updated information and perspectives on this topic, which may have significant consequences for metalcasters wanting to expand and modernize their facilities.

1 What is $PM_{2.5}$?

$PM_{2.5}$ consists of solid and liquid particles that are equal to or smaller than 2.5 microns, which is approximately 30 times thinner than the diameter of a human hair. These fine particles can be emitted directly from a metalcasting facility or can form as a result of gaseous emissions that condense to form particles downstream. As such, when $PM_{2.5}$ is evaluated, both filterable (solid) particulate is measured as well as condensable particulate matter (CPM).

2 How are $PM_{2.5}$ emissions from metalcasting sources estimated?

Accurately estimating $PM_{2.5}$ emissions from metalcasting sources is important because these estimates are used:

1. To determine whether certain rules may apply.
2. As the basis for enforceable emission limits.
3. As the basis of air quality assessments.
4. To predict the ability to comply with enforceable limits.

Estimates can be based on general emission factors or preferably on stack test data. A limited amount of data is available for use in estimating $PM_{2.5}$ emissions from most metalcasting sources. In addition, emission levels have considerable variability, especially for CPM. The U.S. Environmental Protection Agency (EPA)'s "Compilation of Air Pollutant Emission Factors" (or AP-42) is of limited help since most of the emission factors are for total particulate matter. Limited data exists on the size distribution of PM to allow for accurately estimating the $PM_{2.5}$ portion. Lastly, none of the factors for foundry processes include the condensable portion of the emissions. As a practical matter, estimating emission levels can be a fairly complex process of selecting the best data available and also assessing the potential variability of emissions and its impact on the specific regulatory use of the emissions estimates.

3 How do you measure $PM_{2.5}$ emissions from your facility?

EPA has specific test methods for measuring both filterable $PM_{2.5}$ emissions (EPA Method 201A) and CPM (EPA Method 202). Method 201A measures the weight of the solid or liquid particles that are captured on a filter (after the particles larger than 2.5 microns are segregated out). Method 202, the specified method for measuring CPM, is applied downstream of the filter and measures condensed materials that may have passed through the filter. The combined result of these two methods is reported as the total $PM_{2.5}$ value.

4 What are the principal $PM_{2.5}$ emission sources at metalcasting facilities?

The emission sources with the largest $PM_{2.5}$ emissions at typical metalcasting facilities include melting, sand handling, pouring and shakeout. Filterable emissions from these processes can be significantly reduced using fabric filters or high efficiency wet scrubbers. CPM emissions are not effectively controlled by baghouses and can be significant, especially from the pouring, cooling and shakeout processes where they can be much more prevalent than the controlled filterable emissions. Other smaller emission sources also contribute to total $PM_{2.5}$ emissions including material handling processes, natural gas combustion, diesel engines, scrap pre-heaters and emissions from roadways.

5 What national ambient air quality standards apply to $PM_{2.5}$?

Table 1 summarizes the current PM_{10} and $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS), which are expressed as a concentration in micrograms per cubic meter ($\mu g/M^3$).

The $PM_{2.5}$ annual standard was lowered from 15 µg/M3 to 12 $\mu g/M^3$ in March 2013. In December 2014, EPA designated 38 counties in

Table 1. Daily and Yearly National Ambient Air Quality Standards

	24-Hour Average ($\mu g/M^3$)	Annual Average, ($\mu g/M^3$)
PM_{10}	150	NA
$PM_{2.5}$	35	12

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six states as nonattainment. States will be required to submit plans for these non-attainment areas in 2018 that must provide for attainment by 2020. EPA projects that most areas will be able to meet the new standards based on implementation of federal rules on power plants and diesel engines and that only a few areas will be required to adopt rules for specific sources such as metalcasting facilities.

6 Which metalcasting facilities will be subject to $PM_{2.5}$ limits?

Most metalcasting sources do not have $PM_{2.5}$ limits now, nor will such limits likely be established unless the facility is modified or replaced. Limits may be established through rules promulgated by states to meet air quality standards, but these will be rare for metalcasting sources. Generally $PM_{2.5}$ limits are established through permitting requirements to either

- Limit annual emissions below thresholds that would subject a project to the review under either the Prevention of Significant Deterioration (PSD) or Non-Attainment New Source Review (NNSR) rules.
- Establish limits as either Best Available Control Technology (BACT) under the PSD rules or Lowest Achievable Emission Rate (LAER) under the NNSR rules.

The most common technology for meeting these requirements is the use of a highly efficient fabric filter baghouse and the limits would include both filterable and condensable particulate matter.

7 Will new $PM_{2.5}$ emission sources trigger PSD or NNSR permit requirements?

The PSD and NNSR permitting rules apply to projects where the increase in emissions from the project is expected to exceed certain thresholds. If a location is already a major source under either of these rules, an emissions increase of only 10 tons/year of $PM_{2.5}$ would be required to meet the technology and air quality impact requirements of these rules. Sources can limit emissions from new and modified sources to less than 10 tons/year to avoid being subject to these rules through enforceable permit limits. If subject to the PSD rules, the project would be subject to the BACT technology requirement as well as the requirement to demonstrate that the project would not result in exceedances of the air quality standards or PSD increments. The air quality assessment requirement may pose the biggest challenge for projects subject to the PSD rules. For new and modified sources in non-attainment areas, the NNSR rules require the use of LAER level controls and for sources to obtain offsets from third parties for any emission increases associated with a proposed project. If a project is subject to either the PSD or NNSR requirements, the time frame for obtaining a permit can extend from three months to a year or more.

8 Why is air modeling for $PM_{2.5}$ under the PSD rules a problem?

Under the PSD rules an air quality model is used to predict the ground level concentrations of $PM_{2.5}$ associated with the project. The model required under the PSD rule is the AERMOD model that has undergone several modifications since late 2013. The two basic analyses required are an evaluation to demonstrate that the project will not result in an exceedance of the PSD increment and the project plus background air quality levels plus impacts from other nearby sources in the area do not exceed the NAAQS. The PSD increments for $PM_{2.5}$ are 9 $\mu g/M^3$ for the 24-hour standard and 4 $\mu g/M^3$ for the annual standard. Lower increment values are used for sources that may construct near Class I areas, which include a number of National Parks. The "increment assessment" may be the limiting analysis, especially for greenfield metalcasting facilities

For modified sources, the limiting assessment is more often the NAAQS assessment where the modeled value for the source is added to the background air quality value (from a representative monitor) as well as impacts from other significant sources near the project site. Typical background values for the 24-hour standard may range from 23 to 31 $\mu g/M^3$, leaving very little room for new sources of $PM_{2.5}$ since the standard is 35 $\mu g/M^3$. The recently lowered annual standard of 12 $\mu g/M^3$ may pose an even greater challenge with background levels at or above 11 $\mu g/M^3$ in some areas. Attainment has not been possible to achieve for a number of projects, which either have been shelved or the facilities are continuing to try to find ways to accommodate the specific modeling challenges.

The air quality assessments carried out under the PSD permit rules are governed by EPA modeling guidance, which was most recently updated in May 2014. One change in this guidance is that the eighth high (98th percentile) modeled value for the 24-hour standard is used rather than the first high value, which will make it somewhat easier to show the standard will be protected. Also influencing how the modeling assessments are carried out

are recent court rulings, with the most notable from the Washington, D.C. Circuit Court of Appeals in January 2013 that determined the full air quality assessment could not be avoided merely by showing the impact of the project was below a minimal "Significant Impact Level."

9 Is it possible to get a PSD permit for $PM_{2.5}$ for a new or modified foundry source?

The short answer is yes. In many instances it is possible to avoid review under the PSD and NNSR rules by demonstrating that a project is not a "major modification" using various tools in the rules including: comparisons of "actual to projected actual emissions"; netting, wherein the benefits of recent or concurrent emission reductions offset increases; or by applying more effective emission controls. For larger projects that cannot avoid review under these rules, a variety of strategies can be used, including making adjustments to background data to remove the impacts of sources that do not impact the area where the source is located, and/or adjusting the locations of emission sources and the height or exit velocity of stacks.

10 What should metalcasters do to prepare $PM_{2.5}$ issues?

It is important for metalcasting facilities to understand how the regulatory and permitting requirements may impact the facility. Key questions to answer include:

- Is the facility (existing or new) a major source under the PSD or NNSR rule?
- Is the facility located in a nonattainment area or an attainment area that could be reclassified as nonattainment in the future?
- What are the physical changes the facility may want to undertake in the future and how will those changes impact the overall facility, such as increasing the capacity or throughput of other processes?
- Obtaining accurate $PM_{2.5}$ emission estimates is crucial to making strategic decisions and ensuring the source can comply with possible future limitations. Sources should consider conducting $PM_{2.5}$ emission testing to fill in gaps in available information especially for CPM.
- More than ever before facilities need to budget sufficient time and resources for advanced planning for capital projects. Determining the applicability of the regulations, finding ways of avoiding unnecessary complex requirements and allowing sufficient time to prepare permit applications are key to successful projects. MC