American Foundry Society
Foundry Environmental 101-13

II. Air Quality

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Air Quality Laws and Regulations
A Brief History of the Clean Air Act…

• Clean Air Act of 1955
  – First air quality legislation and provided funding for research on sources of air pollution

• Clean Air Act of 1963
  – Authorized development of a national program

• Federal Air Quality Act of 1967
  – First enforcement procedures for air quality problems
  – First required states to establish SIPs and adopt standards

• Clean Air Act of 1970
  – NAAQS set for non-hazardous pollutants
  – NESHAPS set for hazardous pollutants
  – NSPS established for new/modified sources in certain industry categories
  – Motor vehicle inspection & maintenance programs established
Clean Air Act Amendments of 1977 and 1990...

- **CAA Amendments of 1977**
  - authorized provisions of Prevention of Significant Deterioration (PSD)
  - enhanced the NAAQS program with respect to non-attainment area designations and requirements

- **CAA Amendments of 1990**
  - New Planning Provisions for Ozone Non-attainment areas.
  - Acid Rain Control Program
MAJOR CAAA SECTIONS

- TITLE I  Non-attainment Areas
- TITLE II  Mobile Source Emissions
- TITLE III  Hazardous Air Pollutants
- TITLE IV  Acid Deposition Control
- TITLE V  Permits
- TITLE VI  Stratospheric Ozone Protection
- TITLE VII  Enforcement
- TITLE VIII  Miscellaneous Provisions
- TITLE IX  Clean Air Research
- TITLE X  Disadvantaged Business Concerns
# Federal Clean Air Regulations

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<th>Title</th>
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Strategies for Clean Air

- Attainment Strategy
- Limited Deterioration Strategy
- Elimination Strategy

Air Quality

Time
Ambient Monitoring

Health Effects

Setting Ambient Air Quality Standards

Ambient Monitoring

Attainment Designations

Emissions Inventories

Modeling

Permit Modifications

Adoption of Control Regulations

Control Strategies

Compliance Monitoring

Control Strategies

Adoption of Control Regulations

Permit Modifications

Compliance Monitoring
## Health Based versus Technology Based

<table>
<thead>
<tr>
<th>Health Based</th>
<th>Technology Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>• NAAQS</td>
<td>• New Source Performance Standards (NSPS)</td>
</tr>
<tr>
<td>– State Implementation Plans</td>
<td>• Part 63 NESHAPs - MACT</td>
</tr>
<tr>
<td>• Part 61 NESHAPs</td>
<td>• Reasonably Available Control Technology (RACT)</td>
</tr>
<tr>
<td>• Residual Risk Under Air Toxic Regulations</td>
<td>• Best Available Control Technology (BACT)</td>
</tr>
<tr>
<td></td>
<td>• Lowest Achievable Emission Rate (LAER)</td>
</tr>
</tbody>
</table>
Major Control Technology Programs of CAA

• New Source Performance Review (NSPS) – 40 CFR 60
  - approximately 60 industry specific standards established to control criteria pollutant emissions (No Specific Standards for Iron or Steel Foundries)

• National Emission Standards for Hazardous Air Pollutants (NESHAP) – 40 CFR 61
  - Pre-1990 amendments established standards to reduce emissions for asbestos, benzene, beryllium, arsenic, mercury, radionuclides, and vinyl chloride.

• Maximum Achievable Control Technology (MACT) – 40 CFR 63
  - 1990 amendments require Maximum Achievable Control Technology (MACT) standards for major sources of 188 hazardous air pollutants. Currently, there are over 120 source categories that are covered.
Pollutants Regulated Under CAA

- Criteria Pollutants – PM$_{10}$, PM$_{2.5}$ (SO$_2$ and Possibly NO$_x$, VOCs and Ammonia as precursors), CO, NO$_2$, SO$_2$, Ozone (VOCs and NO$_x$ as precursors), and Lead.
- Other NSPS and PSD Regulated Pollutants (TRS, H$_2$S, Sulfuric Acid Mist, Fluorides)
- Hazardous Air Pollutants (188)
- Ozone Depleting Substances (ODS)
- Extremely Hazardous Substances (regulated under accidental release provisions – Risk Management Plans)
- Greenhouse Gases: CO$_2$, Methane, N$_2$O, PFCs, HFCs, SF$_6$
National Ambient Air Quality Standards (NAAQS)

• Based on threshold levels of pollution such that there will be no adverse health effects
• Maximum permissible concentrations of pollutants in “ambient” air
• Covers six (6) criteria pollutants
  – Sulfur Dioxide (SO$_2$)
  – Nitrogen Dioxide (NO$_2$)
  – Ozone (precursor to VOCs and NO$_x$)
  – PM$_{10}$; PM$_{2.5}$
  – Carbon Monoxide (CO)
  – Lead
## Changes to the NAAQS

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Old Standard</th>
<th>Current/Proposed Standard</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>1.5 μg/m³ Quarterly Average</td>
<td>0.15 μg/m³ 3-month average</td>
<td>Monitoring for States and Industry Potential new Non-attainment areas.</td>
</tr>
<tr>
<td>NO₂</td>
<td>53 ppb, Annual Avg.</td>
<td>100 ppb, 1-hour average</td>
<td>New Monitors (Roadside) Potential New Nonattainment areas.</td>
</tr>
<tr>
<td>Ozone</td>
<td>0.08 ppm 8-hour avg.</td>
<td>Current Standard 0.075 ppm 8-hr avg.</td>
<td></td>
</tr>
<tr>
<td>PM10</td>
<td></td>
<td>150 μg/m³ 24-hr avg.</td>
<td></td>
</tr>
<tr>
<td>PM₂.₅</td>
<td></td>
<td>Current Standard 35 μg/m³ 24-hr avg. 12 μg/m³ annual avg.</td>
<td>Revised Annual Standard will result in re-designations in late 2014, early 2015 for areas that don’t meet the standard based on 2011-2013 air quality data.</td>
</tr>
<tr>
<td>SO₂</td>
<td>140 ppb, 24-hr avg. 30 ppb, annual avg.</td>
<td>75ppb 1-hour</td>
<td>Designations to be based on data from 2009-20011.</td>
</tr>
<tr>
<td>CO</td>
<td>9 ppm 8-hr 35 ppm 1-hr</td>
<td>9 ppm 8-hr 35 ppm 1-hr</td>
<td></td>
</tr>
</tbody>
</table>
Air Quality Designations

- Classification of Areas for the National Ambient Air Quality Standards (NAAQS) or “Criteria Pollutants”.
- Attainment, Non-attainment, Unclassified.
- Designations Generally by County.
- Area Can Be Non-attainment for One Pollutant and Attainment for Others.
- Ozone Non-attainment Areas Sub-categorized as Marginal, Moderate, Serious, Severe and Extreme.
- Applicability of Major Source Permitting Rules Based on Classifications.
Particulate Matter: What is It?
A complex mixture of extremely small particles and liquid droplets
What are PM$_{10}$ and PM$_{2.5}$

- Solid or liquid “particulate” with a mean aerometric diameter equal to or less than 10 or 2.5 microns.

- At a source PM$_{10}$ and PM$_{2.5}$ include:
  - Solid and Liquid particles
  - Condensable Emissions (Form outside stack)
  - Precursor emissions (NO$_x$ and SO$_2$)
PM$_{2.5}$ Issues

- Emission Estimating
- SIP development and RACT Standard implementation
- NSR impacts: 24-hour and annual NAAQS
- Test method inconsistency and data availability
PM$_{2.5}$ Test Method Issues

- EPA Method 202 is formal standard for condensable Particulate Matter.
- Historic Method 202 did not always result in reproducible results and is biased high.
- Revised Method 202 (dry impingers method) effective in 2010.
- Inclusion of Condensable Emissions is now required everywhere.
- Little or no emissions data using revised Method 202.
PM10 and PM2.5 Emission Estimates

- AP-42 Emission Factors for Foundries are generally of low quality. Some data is provided for PM10 and PM2.5 filterable estimates.

- AP-42 Emission Factors for Foundry Processes are not based on tests which include condensible emissions.

- There are no reliable published sources of emission factors for PM10 or PM2.5 that do include condensible emissions.


- Emission factors which include condensables can be significantly higher which may result in permitting and compliance issues.
PM10 & PM2.5 Annual Standard

- PM10: Annual Standard = 50 ug/M³
- PM2.5: Annual Standard = 17 ug/M³

Typical Background Levels:
- PM10: 15 ug/M³
- PM2.5: 12 ug/M³

Annual Standard Lowered:
- December 2012

Court Ruling on Use of SILS:
- January 2013
PM$_{2.5}$ Recent Developments

- January 2013 DC Circuit Ruling vacating/remanding PM$_{2.5}$ Significant Impact Levels and Significant Monitoring Concentrations

- March 23, 2013 EPA Draft PM$_{2.5}$ Implementation Guidance.

- Look for additional litigation.
Air Quality Modeling
Relationship Between Stack Emissions and Air Quality
Air Quality Modeling

- Used to Develop Attainment Plans
  - Define cause and effect between stack emissions and ambient air quality levels.
  - Quantify levels used for setting emission standards.
  - Tool used to partition emission limits between different sources in an area.

- Used to Quantify Impacts from New and Modified major Sources.
  - Ensures maintenance of compliance with NAAQS.
  - Ensures PSD air Quality Increments are met.
Source Data
- Pollutant Emission Rates
- Stack heights, Diameters, Exhaust flow rates, locations
- Source Boundaries
- Building Dimensions

Met Data
- Wind Speed & Direction.
- Temperature
- Stability Class
- 5 years of data by hour.

Topographic Inputs
- Ground Elevations in Impact Area.
- Receptor Grid

Dispersion Model
- AERMOD

Calculated Air Quality Values
- For Defined Averaging Period
- For worst Case location on the receptor Grid
- For Defined Statistical maximum
- Culpability Assessment
- Comparison to air quality increments and NAAQS

Baseline Monitored Air Quality
- worst case for most recent two years

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EMISSION INVENTORIES
# Foundry Process Air Emissions

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Emission Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cupola Melt</td>
<td>PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; VOCs Lead VOCs HAPs</td>
</tr>
<tr>
<td>Electric Induction Melt</td>
<td>PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; VOCs HAPs</td>
</tr>
<tr>
<td>Innoculation</td>
<td>PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; VOCs HAPs</td>
</tr>
<tr>
<td>Core Making</td>
<td>PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; VOCs HAPs</td>
</tr>
<tr>
<td>Sand System</td>
<td>PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; VOCs HAPs</td>
</tr>
<tr>
<td>Pouring, Cooling &amp; Shakeout</td>
<td>PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; VOCs CO HAPs GHGs</td>
</tr>
<tr>
<td>Grinding &amp; Finishing</td>
<td>PM/PM&lt;sub&gt;10&lt;/sub&gt; PM/PM&lt;sub&gt;10&lt;/sub&gt; VOCs CO HAPs GHGs</td>
</tr>
</tbody>
</table>

**Other Potential Emission Sources:** Boilers, Heaters, Painting, Solvent Metal Cleaning, Welding
Quantifying Emission Rates

Part I Measurement Methods

• Continuous emission monitoring systems (CEMS)
• Source testing
CEMS Measurement Methods

- Pollutant-specific (i.e., $\text{SO}_2$, $\text{NO}_x$, CO)
- Relatively costly
- Real-time actual emissions
- Averaging Period
- Calibration
Source Testing Methods

- Pollutant-specific (see list)
- Less costly than CEMSs, but still moderately costly
- Snapshot in time
- Averaging period
- Errors
# Source Testing Methods

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulates</td>
<td>EPA Method 5</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>EPA Method 6</td>
</tr>
<tr>
<td>NO$_x$</td>
<td>EPA Method 7</td>
</tr>
<tr>
<td>Sulfuric acid mist and SO$_2$</td>
<td>EPA Method 8</td>
</tr>
<tr>
<td>Visible Emissions (Opacity)</td>
<td>EPA Method 9</td>
</tr>
<tr>
<td>CO</td>
<td>EPA Method 10</td>
</tr>
<tr>
<td>Lead (Inorganic)</td>
<td>EPA Method 12</td>
</tr>
</tbody>
</table>
# Source Testing Methods

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOCs in coatings/inks</td>
<td>EPA Method 24-24A</td>
</tr>
<tr>
<td>Gaseous organics (gas chromatography)</td>
<td>EPA Method 18</td>
</tr>
<tr>
<td>VOCs as TGNMOs</td>
<td>EPA Method 25</td>
</tr>
<tr>
<td>Gaseous Organics (FID)</td>
<td>EPA Method 25A</td>
</tr>
<tr>
<td>Gaseous Organics (NDIR)</td>
<td>EPA Method 25B</td>
</tr>
<tr>
<td>Hydrogen Halides/Halogens</td>
<td>EPA Methods 26-26A</td>
</tr>
<tr>
<td>Multiple Metals</td>
<td>EPA Metals Train</td>
</tr>
<tr>
<td>Other HAPs</td>
<td>NIOSH/OSHA/EPA TO and SW-846 Methods</td>
</tr>
<tr>
<td>PCDDs/PCDFs</td>
<td>EPA Method 23</td>
</tr>
</tbody>
</table>
Quantifying Emission Rates (cont’d)

Part II Estimation Methods

• Emission factors
• Mass balances
• Engineering estimation
What is an Emission Factor?

- Emissions/Unit Parameter (e.g. #/ton, gr/dscf, #/MMBTU)
- Based on reliable (?) test data
- Known production/process conditions
- Normalized
- Recognized by regulatory agency(s)
Ideal Emission Factor

- Specific (e.g. benzene, NOx)
- Accurate (Correct Test Methodology)
- Representative (Apply to your operation)
- Correctable (Can modify to fit your operation better)
- Conservative (err on side of safety)
Overestimating Emissions

- **Pro’s**
  - Unlikely to be challenged by USEPA and State
  - Easily defendable
  - Sleep well at night
Overestimating Emissions

• Con’s
  – Incur unnecessary emission control costs ($$$$$$$)
  – Incur unnecessary operational and administrative costs ($$)
Overestimating Emissions
A BIG NEGATIVE

- Lose your job if/when discovered
Underestimating Emissions

• **Pro’s**
  – Avoid emission control costs ($$$$$$)
  – Avoid Operational and Administrative Costs ($$)
  – Be a Hero in Management’s Eyes
Underestimating Emissions

• Con’s
  – Unable to demonstrate compliance via stack test
  – Be subject to Enforcement Action and Penalties
Underestimating Emissions
A BIG NEGATIVE

– Be fired if/when discovered
Emission Factors

- Speciated emission factors (derived from emission factors and speciation profiles)
- Specified as uncontrolled or controlled
- Control device efficiency information:
  - Manufacturer specifications or guarantees
  - Source testing data
Emission Factor Sources

- Compilation of Air Pollutant Emission Factors (AP-42)
- Factor Information Retrieval Estimation (FIRE)
- TANKS 3 Program
- Air Pollution Engineering Manual (AP-40)
- AIRS Facility Subsystem Sources Classification Codes (SCCs) and Emission Factor Listing for Criteria Pollutants
- Other published USEPA references and software (see list)
Emission Factor Sources (con’t)

- Published Research Reports (e.g. CERP)
- Professional journals (e.g., Modern Casting, AWMA Journal)
- Industrial/trade organization guidance (e.g. AFS, CISA, OCMA, WCMA)
Other USEPA References/Software

• BACT/LAER Clearinghouse
• USEPA Form R Toxic Release Estimation Guidance
• USEPA Air Pollution Control Training Seminar Coursebooks/Manuals
• Control Technologies for Hazardous Air Pollutants Handbook
• Evaluation of Control Technologies for Hazardous Air Pollutants (Volume I)
• OAQPS Control Cost Manual
USEPA Web Sites

- www.epa.gov
  USEPA
- www.epa.gov/oar
  USEPA Office of Air and Radiation (OAR)
- www.epa.gov/ttn
  USEPA Technology Transfer
- www.epa.gov/ttn.atw
  USEPA Air Toxics
- www.epa.gov/ttn/oarpg
  OAR Policy and Guidance Information
Limited List of Emission References for Iron Foundries

- USEPA Documents:
  - Environmental Assessment of Iron Casting (EPA 600/2-80-021)
  - Summary of Factors Affecting Compliance by Ferrous Foundries (EPA 340/1-80-020)
  - AP-42 (Compilation of Air Pollutant Emission factors)
  - Air Emissions Species Manuals (EPA 450/2-90-001a and 450/90-001b)
  - AIRS SCCs and Criteria Pollutant Emission Factor Listing (EPA 450/4-90-003)
  - Emission Factors for Iron Foundries – Criteria and Toxic Pollutants (EPA 600/2-90-044)
  - Toxic Air Pollutant Emission Factors (EPA 450/2-90-011)
Limited List of Emission References for Iron Foundries (cont’d)

- AFS Publications
  - Iron Foundry Hazardous Air Pollutants - “What We Know and What We Don’t” (AFS Transactions 2003)
  - Environmental Assessment of Melting, Inoculation, and Pouring (AFS Transactions 82-153)
  - Form R Reporting of Binder Chemicals Used in Foundries (AFS and CISA)
  - Chemical Emissions from Foundry Molds (AFS Transactions 77-98)
Problem: Estimate annual manganese emissions from cupola

Given: Annual Production = 100,000 Tons
# Cupola Emission Factors

<table>
<thead>
<tr>
<th>SCC</th>
<th>Process Name</th>
<th>Part lbs/unit</th>
<th>PM10 lbs/unit</th>
<th>Sox lbs/unit</th>
<th>NOx lbs/unit</th>
<th>VOC lbs/unit</th>
<th>CO lbs/unit</th>
<th>LEAD lbs/unit</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-04-003-01</td>
<td>Cupola</td>
<td>13.8</td>
<td>12.40</td>
<td>0.90</td>
<td>0.10</td>
<td>0.18</td>
<td>145.0</td>
<td>0.51</td>
<td>Tons of Metal Changed</td>
</tr>
<tr>
<td>3-04-003-02</td>
<td>Reverb Furnace</td>
<td>2.10</td>
<td>1.70</td>
<td>180.00</td>
<td>5.80</td>
<td>0.15</td>
<td>0.00</td>
<td>0.06</td>
<td>Tons of Metal Changed</td>
</tr>
<tr>
<td>3-04-003-03</td>
<td>Electric Induction</td>
<td>0.90</td>
<td>0.86</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.0425</td>
<td>Tons of Metal Changed</td>
</tr>
<tr>
<td>3-04-003-20</td>
<td>Pouring/Casting</td>
<td>2.8</td>
<td>2.8</td>
<td>0.02</td>
<td>0.01</td>
<td>0.14</td>
<td></td>
<td></td>
<td>Tons of Metal Changed</td>
</tr>
</tbody>
</table>

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Profile Name: Cast Iron Cupola

Data Quality: C/D

Control Device: Unspecified

Reference(s): 47

Data Source: Mean of 5 tests. XRF and IWWA analysis. Scrap, pig iron, coke and limestone raw materials.

SCC Assignments: 30400301

Mass Fraction Data-
Size Interval (um): (0-2.5) (0-6) (0-10)
Mass Fraction: 0.850 0.920 0.930

Total Particulate Matter-

<table>
<thead>
<tr>
<th>CAS Number</th>
<th>Num</th>
<th>Sym</th>
<th>0-2.5 um</th>
<th>2.5-10 um</th>
<th>0-10 um</th>
<th>Total Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>7439-96-5</td>
<td>25</td>
<td>Mn</td>
<td>4.500</td>
<td>0.000</td>
<td>4.500</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>82</td>
<td>Pb</td>
<td>0.230</td>
<td>0.000</td>
<td>0.230</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>Ni</td>
<td>0.035</td>
<td>0.000</td>
<td>0.035</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>Co</td>
<td>0.004</td>
<td>0.000</td>
<td>0.004</td>
<td>0.000</td>
</tr>
</tbody>
</table>

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Calculating Mn Emissions

• From SCC factors and speciation data, estimate manganese emissions from cupola

\[
\frac{13.8 \text{ lbs. part.}}{\text{Ton metal charged}} \times \frac{4.5 \text{ lbs. Mn}}{100 \text{ lbs. part}} = \frac{0.62 \text{ lbs. Mn}}{\text{Ton metal charged}}
\]
Calculating Mn Emissions

• Estimate annual manganese emissions based on annual production
  – Assume 100,000 tons metal charged per year

\[
\frac{0.62 \text{ lbs. Mn}}{\text{Ton metal charged}} \times \frac{100,000 \text{ tons metal}}{\text{Year}} = \frac{62,000 \text{ lbs. Mn}}{\text{Year}}
\]

\[
\frac{62,000 \text{ lbs. Mn}}{\text{Year}} \times \frac{1 \text{ ton}}{2,000 \text{ lbs.}} = \frac{31 \text{ tons Mn}}{\text{Year}}
\]

• Note: This resulting emission estimate is uncontrolled, since the cupola particulate emission factor is uncontrolled.
Foundry Air Emission Calculations – Example 2

Problem: Estimate annual benzene emissions from pouring and cooling

Given: Annual Production = 100,000 Tons
Calculating Benzene Emissions

VOC Profile Speciation Report

**Profile Name:** Secondary Metal Production – Gray Iron Foundries – Pouring/Casting

**Profile Number:** 1089

**Data Quality:** B

**Control Device:** Not Reported

**Reference(s):** 49

**Data Source:** Exhaust gasses from twelve binder systems and sand formulations were sampled by enclosed hood during the pouring of gray iron. Air grab samples were analyzed by GC; reagent bubblers were analyzed by ion specific electrodes, titration, GC or spectrophotometric methods; sorbent tube samples were analyzed by GC

<table>
<thead>
<tr>
<th>Saroad</th>
<th>CAS Number</th>
<th>Name</th>
<th>Spec-MW</th>
<th>Spec-WIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>43502</td>
<td>50-00-0</td>
<td>Formaldehyde</td>
<td>30.03</td>
<td>0.70</td>
</tr>
<tr>
<td>43505</td>
<td>107-02-8</td>
<td>Acrolein</td>
<td>59.07</td>
<td>0.33</td>
</tr>
<tr>
<td>43520</td>
<td></td>
<td>Total C2-C5 Aldehydes</td>
<td>72.12</td>
<td>24.20</td>
</tr>
<tr>
<td>45201</td>
<td>71-43-2</td>
<td>Benzene</td>
<td>78.11</td>
<td>34.70</td>
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<td>45202</td>
<td>108-88-3</td>
<td>Toluene</td>
<td>92.13</td>
<td>14.10</td>
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<td>45204</td>
<td>95-47-6</td>
<td>o-Xylene</td>
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<td>108-95-2</td>
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<td>Total Aromatic Amines</td>
<td>93.13</td>
<td>7.42</td>
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<td>46701</td>
<td>91-20-3</td>
<td>Naphthalene</td>
<td>128.17</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Calculating Benzene Emissions

Estimate annual emissions based on annual production
Assume 100,000 tons metal charged per year

\[
\frac{0.14 \text{ lbs. VOC}}{\text{Ton metal charged}} \times \frac{34.70 \text{ lbs. benzene}}{100 \text{ lbs. VOC}} = \frac{0.0486 \text{ lbs. benzene}}{\text{Ton metal charged}}
\]

\[
\frac{0.0486 \text{ lbs. benzene}}{\text{Ton metal charged}} \times \frac{100,000 \text{ tons metal}}{\text{Year}} = \frac{4860 \text{ lbs. benzene}}{\text{Year}}
\]

\[
\frac{4860 \text{ lbs. benzene}}{\text{Year}} \times \frac{1 \text{ ton}}{2,000 \text{ lbs.}} = \frac{2.43 \text{ tons benzene}}{\text{Year}}
\]
Example Foundry Air Emission Calculations Blast Cleaning

- SCC particulate emission factor (uncontrolled) for blast cleaning is 17.0 pounds particulate per ton of metal (SCC 3-04-003-40)
  - Toxic emissions from blast cleaning can be approximated by assuming that particulate emissions will be speciated in the same fractions as the metal castings being cleaned
  - Assume a maximum casting manganese percentage of 1.20%

\[
\begin{align*}
\frac{17.0 \text{ lbs. part.}}{\text{Ton metal}} \times \frac{1.20 \text{ lbs. Mn}}{100 \text{ lbs. part.}} &= \frac{0.204 \text{ lbs. Mn}}{\text{Ton metal}}
\end{align*}
\]
Example Foundry Air Emission Calculations Blast Cleaning cont’d

- Estimate annual manganese emissions based on annual production (assume 100,000 tons per year)

\[
\frac{0.204 \text{ lbs. Mn}}{\text{Ton metal charged}} \times \frac{100,000 \text{ tons metal}}{\text{Year}} = \frac{20,400 \text{ lbs. Mn}}{\text{Year}}
\]

\[
\frac{20,400 \text{ lbs. Mn}}{\text{Year}} \times \frac{1 \text{ ton}}{2,000 \text{ lbs.}} = \frac{10.2 \text{ tons Mn}}{\text{Year}}
\]

- Note: This resulting emission estimate is uncontrolled, since the blast cleaning emission factor is uncontrolled.
Mass Balances

• Relate process input rates to consumption, accumulation, and loss rates for all routes of inflow and outflow

• Inappropriate when relatively small emission rates are expected
Engineering Estimation

- Useful when emission not easily measurable or quantifiable by other techniques
  - Ideal gas law (PV=nRT) to estimate the amount of gas contained in a process unit for gases that approximate ideal gases (i.e., low pressures and high temperatures)
AIR PERMITTING
<table>
<thead>
<tr>
<th>Source Classification</th>
<th>Construction Permit Program</th>
<th>Operating permit Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Sources</td>
<td>PSD/NSR</td>
<td>Title V</td>
</tr>
<tr>
<td>True Minor Sources</td>
<td>State Construction</td>
<td>State Minor Source</td>
</tr>
<tr>
<td></td>
<td>Permits or Registrations</td>
<td>Operating Permits</td>
</tr>
<tr>
<td>Synthetic Minor Sources</td>
<td>State Construction</td>
<td>FESOP, SSOA, Permit by</td>
</tr>
<tr>
<td></td>
<td>Permits or Registrations</td>
<td>Rule</td>
</tr>
</tbody>
</table>

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MAJOR SOURCE DEFINITION

• POTENTIAL TO EMIT: (based on 8760 hours/year operation)
  • Maximum annual emission rate considering “Federally Enforceable” limits. [Fugitive emissions may or may not be included.]

• MAJOR SOURCE THRESHOLDS FOR TITLE V:
  • 100 Tons/Year for PM/PM-10, SO₂, CO, NOₓ, and VOC.
  • 25 Tons/Year for the sum of all air toxics.
  • 10 Tons/Year for any one air toxic.
FEDERALLY ENFORCEABLE

- Federally enforceable rules must be in the State Implementation Plan (SIP).

- Federally enforceable permit limits may be in permits approved under rules in the SIP, and which have had a 30-day comment period.

- Construction permits

- Federal rules (NSPS and NESHAPs)
TITLE V PERMITS

• OBJECTIVE:
  – Establish a national operating permit program.

• PURPOSES:
  – Ensure compliance with all applicable CAAA requirements.
  – Enhance EPA’s ability to enforce CAA.
TITLE V - GENERAL

- Permits codify, but do not modify or create, applicable CAA requirements.

- States must develop permit programs to review, issue, administer, and enforce operating permits.

- If states fail to develop acceptable program, EPA will implement federal program.

- EPA has veto authority over all state operating permits.
LIMITATIONS IN TITLE V PERMITS

- State Implementation Plan (SIP) Regulations
- Prevention of Significant Deterioration (PSD) or New Source Review (NSR) Permits
- State Construction and/or Operating Permits
- New Source Performance Standards (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAPs)
- Federal Regulations or Permits issued under Title IV or Title VI or the CAAA
Title V Permit
Compliance Requirements

- Periodic Source Testing for larger Emissions Units
- Preventive Maintenance
- Parametric Monitoring
- Record keeping and Reporting requirements
- Quarterly or Semi-Annual Compliance Reports
- Annual Compliance Certification
- Identification of Terms and conditions which are federally enforceable and those which are not.
What Are the PSD and NSR Programs?

• At the most basic level:
  – are preconstruction permitting programs required under the CAA
  – impose control technology requirements (i.e. BACT or LAER)
  – Require Air Quality Modeling or Emission Offsets
Relationship Between NAAQS and PSD/NSR

- PSD applies to attainment & unclassifiable areas
  - to preserve, or prevent, significant deterioration of air quality
- Nonattainment New Source Review (NNSR) applies to nonattainment areas
  - to enable areas to achieve the NAAQS or restore air quality
- Together, PSD + NNSR = New Source Review (NSR)
Delegated vs. SIP Approved

• Delegated States:
  – EPA oversight is more rigorous
  – Rules Change when the Federal Rules Change (e.g. PM2.5 changes)
  – Appeals go to the Federal Environmental Appeals Board and permits are automatically stayed until resolution.

• SIP Approved States
  – Have More Decision Making Autonomy.
  – Rule Changes have to be made at State Level which can take 2 years or more.
  – Appeals are handled through State Appeal Procedures.
  – State Rules can be more Stringent Than Federal Rules.
PSD Permit Program Status

SIP Approved Areas

EPA or Delegated Areas

Combination of SIP and EPA or Delegated Areas

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## PSD/ NNSR Overview

<table>
<thead>
<tr>
<th>PSD</th>
<th>NNSR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applies to</strong></td>
<td>“Attainment Pollutants”</td>
</tr>
<tr>
<td><strong>Major Source Threshold</strong></td>
<td>100 or 250 tpy of PSD regulated Pollutants</td>
</tr>
<tr>
<td><strong>Major Modification Threshold</strong></td>
<td>(Varies: See Next Slide)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technology Requirement</strong></td>
<td>Best Available Control Technology (BACT)</td>
</tr>
<tr>
<td><strong>Air Quality Requirements</strong></td>
<td>PSD Increment and NAAQS Criteria</td>
</tr>
<tr>
<td><strong>Other Requirements</strong></td>
<td>Visibility, Soils and Vegetation Assessments</td>
</tr>
</tbody>
</table>
### PSD “Significant Increase” Thresholds

<table>
<thead>
<tr>
<th>Criteria Pollutants</th>
<th>Other PSD Pollutants</th>
<th>Old PSD HAPs</th>
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</thead>
<tbody>
<tr>
<td>VOCs</td>
<td>Fluorides</td>
<td>Be</td>
</tr>
<tr>
<td>40 tpy</td>
<td>3 tpy</td>
<td>0.0004 tpy</td>
</tr>
<tr>
<td>NOx</td>
<td>Sulfuric Acid Mist</td>
<td>Hg</td>
</tr>
<tr>
<td>40 tpy</td>
<td>7 tpy</td>
<td>0.1 tpy</td>
</tr>
<tr>
<td>SO2</td>
<td>Total Reduced Sulfur</td>
<td>Asbestos</td>
</tr>
<tr>
<td>40 tpy</td>
<td>10 tpy</td>
<td>0.007 tpy</td>
</tr>
<tr>
<td>PM</td>
<td>Reduced Sulfur Compounds</td>
<td>Vinyl Chloride</td>
</tr>
<tr>
<td>25 tpy</td>
<td>10 tpy</td>
<td>1 tpy</td>
</tr>
<tr>
<td>PM10</td>
<td>H2S</td>
<td></td>
</tr>
<tr>
<td>15 tpy</td>
<td>10 tpy</td>
<td></td>
</tr>
<tr>
<td>PM2.5</td>
<td>Ozone Depleting Substances</td>
<td></td>
</tr>
<tr>
<td>10 tpy</td>
<td>100 tpy</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>CO2e</td>
<td></td>
</tr>
<tr>
<td>0.6 tpy</td>
<td>75,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Regulated Pollutants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 tpy</td>
<td></td>
</tr>
</tbody>
</table>

Pollutants Shown in Red are those most likely to require PSD review for Foundry emission sources

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PSD Applicability for Foundries

- Secondary Metal Production is One of the 28 Listed categories
- Iron and Steel Foundries are considered Secondary Metal Production.
- Aluminum Foundries May not be Secondary Metal if melting “clean charge”.
- Source is major if PTE is > 100 tpy for any one PSD Regulated Pollutant.
- Once Major for One Pollutant, Applicability for Other Pollutants is based on “significance thresholds”
PSD/NNSR Applicability Overview

- Emissions data
- Source test data
- Past production data
- Future production
- Process impacts

PSD/ NNSR Applicability Assessment

- PSD and /or NNSR Applies for One or More Pollutants
- “Synthetic Minor “ Required to Avoid PSD or NNSR
- Modification is “minor” for PSD or NNSR

PSD and /or NNSR Permit Process
- PSD and /or NNSR Permit Process
- Title V Major Source and Permit Modification
- Title V Source and Permit Modification

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**Applicability Determinations**

1. **Is the Source (or the modification) a Major Source for any Regulated Pollutants?**
   - No: PSD/NSR Does Not Apply
   - Yes: PSD/NSR Applies

2. **Is the project a new Major Source or a Major Modification?**
   - No: PSD/NSR Does Not Apply
   - Yes: PSD/NSR Applies

3. **Is the project “Routine Maintenance Repair or Replacement”?**
   - Yes: PSD/NSR Does Not Apply
   - No: PSD/NSR Applies

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Top 10 PSD Headaches

1. Time frame for issuing permit
2. Cost of the permit
3. Potential for pre or post construction monitoring
4. Uncertainty of BACT determinations
5. Uncertainty of Emission Estimates
Top 10 PSD Headaches

6. Inability to Construct
7. PM2.5, PM2.5, PM2.5
8. Debottlenecking and increased utilization.
9. EPA Oversight
10. Look backs (7th Circuit Decision may be the remedy)
Applicability

Four possible “off-ramps” open for avoiding major modification status.

- RMRR Exemption
- Non-significant emissions increase (proposed project is a change, but project emissions increase is not significant)
- Significant emissions increase for project, but source can “net out” of being major modification
- Plantwide Applicability Limits
Current Routine Maintenance Repair and Replacement Exemption:
WEPCO Memoranda: Five Factor Test

- No one factor is deciding
- Weight of factors not specified
- Factors Include:
  - **Nature**: Involves replacement of several major components
  - **Extent**: Significantly enhances the present efficiency and capacity of the plant
  - **Purpose**: Substantially extends the plant’s useful economic life
  - **Frequency**: Rarely performed on that unit (although challengers contend this should be source category frequency), or
  - **Cost**: Is costly in both relative and absolute terms

---

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“Significant Increase”
Actual to Projected Actual Basis

Net Increase = Future Actual – Baseline Actual

Baseline Actual = average annual emissions based on highest 24 month period in past 10 years.

Future Actual = Projected future annual emissions for next 5 or 10 years.
<table>
<thead>
<tr>
<th></th>
<th>Baseline Actual Production</th>
<th>Future Projected Annual Production</th>
<th>Production that could have been accommodated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons of Iron melted</td>
<td>150,000</td>
<td>200,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Tons of Metal Finished (Blast and Grinding)</td>
<td>90,000</td>
<td>120,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Tons of Mold Sand Used</td>
<td>750,000</td>
<td>1,000,000</td>
<td>250,000</td>
</tr>
<tr>
<td>PUCB Core Production</td>
<td>0</td>
<td>25,404</td>
<td>0</td>
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<tr>
<td>PUCB Resin usage (lbs)</td>
<td>0</td>
<td>624,938</td>
<td>0</td>
</tr>
<tr>
<td>DMIPA Catalyst Usage, lbs</td>
<td>0</td>
<td>15,750</td>
<td>0</td>
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</table>

**Actual Baseline Emissions, tons/year**

<table>
<thead>
<tr>
<th>Emission Unit</th>
<th>PM (Filt)</th>
<th>PM10 (Filt + Cond)</th>
<th>PM2.5 (filt + Cond)</th>
<th>Lead</th>
<th>CO</th>
<th>VOC</th>
<th>NOx</th>
<th>SO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction melt + pouring</td>
<td>4.50</td>
<td>4.50</td>
<td>4.50</td>
<td>0.23</td>
<td>450.0</td>
<td>127.5</td>
<td>0.75</td>
<td>1.50</td>
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<tr>
<td>Mold Cooling</td>
<td>3.38</td>
<td>3.38</td>
<td>3.38</td>
<td>0.05</td>
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<td></td>
<td></td>
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<tr>
<td>Shakeout</td>
<td>4.50</td>
<td>4.50</td>
<td>4.50</td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blast Units</td>
<td>1.58</td>
<td>1.58</td>
<td>1.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Grinding</td>
<td>7.65</td>
<td>3.83</td>
<td>3.83</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sand Handling</td>
<td>1.09</td>
<td>1.09</td>
<td>1.09</td>
<td></td>
<td></td>
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<tr>
<td><strong>Plantwide Totals</strong></td>
<td><strong>35.49</strong></td>
<td><strong>29.41</strong></td>
<td><strong>29.41</strong></td>
<td><strong>0.41</strong></td>
<td><strong>450.0</strong></td>
<td><strong>127.5</strong></td>
<td><strong>0.75</strong></td>
<td><strong>1.50</strong></td>
</tr>
</tbody>
</table>

**Projected Actual Emissions, tons/year**

<table>
<thead>
<tr>
<th>Emission Unit</th>
<th>PM (Filt)</th>
<th>PM10 (Filt + Cond)</th>
<th>PM2.5 (filt + Cond)</th>
<th>Lead</th>
<th>CO</th>
<th>VOC</th>
<th>NOx</th>
<th>SO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction melt</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>0.20</td>
<td>600</td>
<td>170</td>
<td>1.00</td>
<td>2.00</td>
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<tr>
<td>Pouring</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>0.10</td>
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<td></td>
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<tr>
<td>Cooling</td>
<td>4.50</td>
<td>4.50</td>
<td>4.50</td>
<td>0.06</td>
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<td></td>
<td></td>
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<tr>
<td>Shakeout</td>
<td>6.00</td>
<td>6.00</td>
<td>6.00</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Blast Units</td>
<td>2.10</td>
<td>2.10</td>
<td>2.10</td>
<td></td>
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<tr>
<td>Grinding</td>
<td>10.20</td>
<td>5.10</td>
<td>5.10</td>
<td></td>
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<tr>
<td>Sand Handling</td>
<td>1.45</td>
<td>1.45</td>
<td>1.45</td>
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<tr>
<td>Cold Box Core Production (Sand handling )</td>
<td>0.64</td>
<td>0.64</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cold Box Core Resins</td>
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<td>Cold Box Catalyst Usage</td>
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<td></td>
<td></td>
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<tr>
<td><strong>Plantwide Totals</strong></td>
<td><strong>51.82</strong></td>
<td><strong>42.50</strong></td>
<td><strong>42.50</strong></td>
<td><strong>0.54</strong></td>
<td><strong>600.76</strong></td>
<td><strong>185.75</strong></td>
<td><strong>1.90</strong></td>
<td><strong>2.01</strong></td>
</tr>
</tbody>
</table>

**Emissions that could have been accomodated, tons/year**

<table>
<thead>
<tr>
<th>Emission Unit</th>
<th>PM (Filt)</th>
<th>PM10 (Filt + Cond)</th>
<th>PM2.5 (filt + Cond)</th>
<th>Lead</th>
<th>CO</th>
<th>VOC</th>
<th>NOx</th>
<th>SO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction melt + pouring</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>0.075</td>
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<td>1.13</td>
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<td></td>
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<tr>
<td>Shakeout</td>
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<td>1.50</td>
<td>1.50</td>
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<tr>
<td>Blast Units</td>
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<td>0.53</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grinding</td>
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<td>1.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Handling</td>
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<td>0.36</td>
<td>0.36</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plantwide Totals</strong></td>
<td><strong>15.05</strong></td>
<td><strong>11.75</strong></td>
<td><strong>11.75</strong></td>
<td><strong>0.14</strong></td>
<td><strong>150.00</strong></td>
<td><strong>42.50</strong></td>
<td><strong>0.25</strong></td>
<td><strong>0.50</strong></td>
</tr>
</tbody>
</table>

**Plantwide ATPA (Projected Actual - Baseline - Could Have Accomodated Emissions)**

|                                | 1.29 | 1.34 | 1.34 | 0.00 | 0.76 | 15.75 | 0.90 | 0.01 |

**PSD Major Modification Thresholds, tons/year**

|                                | 25   | 15   | 10   | 0.6  | 100  | 40   | 40   | 40   |
Net Emissions Increase

• Increase in emissions from a particular physical change or change in the method of operation.
• Includes increases and decreases in actual emissions from contemporaneous projects.
• Contemporaneous window is 5 years prior to commencement of construction and date increase from project begins.
Plant wide Applicability Limit - PAL

- A PAL is an annual plant wide cap on emissions of a particular pollutant.
- Compliance with a PAL is Based on Actual Emissions.
- Allows a Source to Make Changes without Triggering New Source Review.
- PAL may be Established for a New or an Existing Source.
- PAL can be Renewed
PSD and NNSR Lookbacks

- EPA and/or State Review of previous “Projects” to determine if PSD or NNSR may have applied.
- Projects may go back as far as 1977.
- If a project is determined to be subject to PSD or NNSR the remedy may include:
  - Capping Emissions at Applicability Thresholds if the Thresholds have never been exceeded, or
  - Application of BACT or LAER as determined today.
  - Penalties can be assessed.
  - Claims for past “excess emissions” or natural resources damages can be sought.
- Recent Decision in the 7th circuit indicated failure to get PSD permit is not a continuing violation and 5-year statute of limitations applies.
Control of Hazardous Air Pollutants
Title III OF THE CLEAN AIR ACT

- 188 Hazardous Air Pollutants
- Risk Based Standards 40 CFR Part 61
- Technology Based Maximum Achievable Control Technology (MACT): 40 CFR Part 63
- Major Source = 10 tons/year Single HAP, 25 Tons/year Total HAP Potential to Emit
- MACT Standards – Apply to New and Existing Sources
NESHAPs UNDER 40 CFR PART 63

- Source Category specific
- Standards for Major Sources and Area Sources
- Technology Standards based on
  - average of best performing 12% for existing
  - best performing for new
- Residual Risk Standards
- May regulate traditional pollutants as a surrogate
MACT Applicability

“What parts of my facility are covered?”

Rule applies to:

- each *existing affected source*
- each *new affected source*
What is “affected source”?

Rule will specify what constitutes an “Affected Source”

- It may be the entire facility.
- It may be a single process unit or line.
Existing vs. New Affected Source

• **Existing Affected Source:** Constructed or reconstructed before Proposal Date

• **New Affected Source:** Constructed or reconstructed after the proposal Date
Affected Sources

Prime Coat Booth → Oven → Top Coat Booth

Mold & Core Assembly

Green Sand System

Material Handling System

Induction Furnace

Cupola

Scrap Preheater

Mold Pouring

Mold Cooling

Shakeout

Shot Blast Grinding Finishing

Waste Sand System
What is Reconstruction?

- Reconstructed Sources are subject to standards for New Affected Sources
- Reconstruction means replacement of components of an affected source such that:

  1. fixed capital cost exceeds 50% of that which would be required to construct a comparable new source, and

  2. it is technologically and economically feasible for the reconstructed source to meet the relevant standard.
What is a Synthetic Minor?

- Sources that are major for HAPs can propose restrictions to be “Minor”.
- Restrictions can be production limits, control system limits or both.
- Restrictions are embodied in enforceable permits.
- Permits must contain suitable compliance monitoring and reporting requirements.
- Must have limits in place before 1\textsuperscript{st} substantive compliance date.
Compliance Demonstrations

• Compliance Testing for units with specific emission limits.
• Stack testing to Verify Emission Factors for Synthetic Minor Sources.
• Testing Required Within 180 days of compliance date.
• Repeat testing every five years.
Notifications and Plans

• Initial Notice - 120 days after effective date
• Performance Test Notification - 60 days prior to test.
• Notification of Compliance Status.
• Compliance Notifications Under Title V.
• Startup Shutdown and Malfunction Plan.
• Operation, Maintenance and Monitoring Plan.
## Completed Standards

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Subpart</th>
<th>Date</th>
</tr>
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<tbody>
<tr>
<td>Iron and Steel Foundries</td>
<td>EEEEEE</td>
<td>April 22, 2004</td>
</tr>
<tr>
<td>Iron and Steel Foundry Area Source Rule</td>
<td>ZZZZZZ</td>
<td>January 2, 2008</td>
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<tr>
<td>Aluminum, Copper &amp; ONF Foundry Area Source Rule</td>
<td>ZZZZZZZ</td>
<td>June 25, 2009</td>
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<td>Miscellaneous Metal Parts &amp; Products Surface Coating</td>
<td>MMMMM</td>
<td>January 2, 2004</td>
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<td>Area Source Surface Coating</td>
<td>HHHHHHHH</td>
<td>January 9, 2008</td>
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<tr>
<td>Area Source Metal Fabrication and Finishing Processes</td>
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<td>July 23, 2008</td>
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# Completed Standards

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<th>CATEGORY</th>
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<th>Date</th>
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<tr>
<td>Reciprocating Internal Combustion Engines</td>
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<td>June 15, 2004</td>
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<tr>
<td>Organic Liquid Distribution</td>
<td>EEEEEE</td>
<td>February 3, 2004</td>
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<tr>
<td>Industrial Commercial and Institutional Boilers and Process Heaters</td>
<td>JJJJJJ</td>
<td>March 2011</td>
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<tr>
<td>for Area Sources</td>
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<tr>
<td>Industrial Commercial and Institutional Boilers and Process Heaters</td>
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<td>March 2012</td>
</tr>
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<td>for Major Sources</td>
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</table>
Iron and Steel Foundry MACT Standard
(40 CFR Part 63 Subpart EEEEEE)

- Major source of HAPs (>= 10/25 tpy)
- Rule Adopted in 2004 and in Effect Since April 2007
- Major Sections Regulate:
  - Melting
  - Pouring, Cooling and Shakeout (PCS)
  - Chemically Bonded Core and Mold Making
  - Work Practices
Capture and Collection System

- PM/PM HAPs requirements apply when “discharging emissions through a conveyance to the atmosphere that exceeds either the limit for PM – or alternative limit for total metal HAPs. “

- VOHAPs – “must install, operate, and maintain a capture and collection system for all emissions sources subject to an emissions limit or standard for VOHAP or TEA --- Must meet accepted engineering practices such as” ACGIH.
Emission Limitations – Melting, Cupolas

Existing Cupolas

- PM Limit of 0.006 gr/dscf, or Metal HAPs Limit of 0.0005 gr/dscf, or 0.1 lbs PM /ton metal, or 0.08 lbs Metal HAP/ton metal
- VOHAP or VOC Limit of 20 ppmv. Afterburner minimum of 1300 °F (15 minute averaging with 15 minute start up allowance)

New Cupolas

- PM Limit of 0.002 gr/dscf or Metal HAPs Limit of 0.0002 gr/dscf.
- VOHAP or VOC limit same as for Existing Sources.
PM/ Metallic HAP Emission Limitations Melting: Pre-heaters, Electric Induction Furnaces and Electric Arc Furnaces

Existing Pre-heaters, Induction Furnaces and EAFs
PM Limit of 0.005 gr/dscf or Metal HAPs Limit of 0.0004 gr/dscf

New Induction Furnaces and Scrap Preheater
PM Limit of 0.001 gr/dscf or Metal HAPs Limit of 0.00008 gr/dscf

New EAF PM
PM Limit of 0.002 gr/dscf or Metal HAPs Limit of 0.0002 gr/dscf
Organic Emission Limitations – Scrap Preheaters

Existing Scrap Preheaters
VOHAP or VOC limit of 20 ppmv or
Direct contact gas-fired pre-heater or
Scrap Certification

New Organic, Melting Scrap Preheaters
VOHAP or VOC limit of 20 ppmv or
Scrap Certification
Scrap Certification

“Written Supplier Certification: Only certified-metal ingots, pig iron, slitter, or other materials that do not include post-consumer automotive body scrap, post-consumer engine blocks, oil filters, oily turnings, lead components, mercury switches, plastics, or organic liquids”

or
Scrap Selection and Inspection Program

Operate by a written plan “approved by the Administrator”

- “To minimize, to the extent practicable, the amount of organics and HAP metals”
- For scrap pre-heater, EAF, EIF, “depleted (to the extent practicable) of the presence of used oil filters, plastic parts, organic liquids, and a program to ensure the scrap materials are drained of free liquids.” For scrap charged to a cupola “depleted (to the extent practicable) of the presence of plastic, and a program to ensure the scrap materials are drained of free liquids.”
- A program --- “specifying that scrap supplier remove accessible mercury switches from the trunks and hoods of any automotive bodies -- accessible lead components
- “Procedure for visual inspection of representative portion, but not less than 10% of all incoming scrap shipments.”
- And lots of paperwork!
Emission Limitations – PCS

Existing Pouring Station*

- PM Limit of 0.010 gr/dscf or Metal HAPs
  Limit of 0.0008 gr/dscf

New Pouring Station or Pouring Area*

- PM Limit of 0.002 gr/dscf or Metal HAPs
  Limit of 0.0002 gr/dscf

* If emissions discharged to the atmosphere through a “conveyance”
Emission Limitations – Cooling and Shakeout

Automated conveyor and pallet cooling lines or Automated shakeout lines that use a sand mold system at a new iron and steel foundry

VOHAP or VOC limit of 20 ppmv flow-weighted average
Mold Vents Light-off

Requires a procedure for providing an ignition source for mold vent light off. – unless you determine the mold vent gases are not ignitable, ignite automatically, or cannot be ignited due to accessibility or safety issues.

Within 5 minutes of pouring
Flame present for 15 seconds
Auto if ignites more than 75%
Not ignitable if less than 25%
Fugitive Emissions

For each building or structure housing an emission source at an iron or steel foundry

20% opacity, except for one 6-minute period per hour that does not exceed 27% opacity

Initial Fugitives Test during Stack Testing

Repeat Fugitive Evaluation Every Six Months
Emission Limitations
Cold Box Core and Mold Making (New and Existing)

• Control triethylamine (TEA) emissions to 1 ppmv TEA or demonstrate a 99% control efficiency (with fresh solution)

• Furan Warm Box Mod or Core Making – No methanol as listed in the MSDS for catalyst portion only
Iron and Steel Foundries Area Source Rule

• Published on January 2, 2008
• Production Level Applicability Threshold of 20,000 tons per year for existing sources (based on 2008 production data).
• Production Level Applicability Threshold of 10,000 tons/year for new sources (based on metal melt capacity).
Iron and Steel Foundries Area Source Rule

- Existing Large Foundries must comply with all requirements by January 1, 2011.

- New Large Foundries must comply upon startup.
Iron and Steel Foundries Area Source Rule

Small area source Foundries must:
• Have a written Scrap Management Plan.
• Purchase scrap from Vendors participating in approved mercury switch removal program.
• Furfuryl Alcohol Warm Box: no Methanol.
• Initial Notification w/l 120 days.
• Monthly Metal production Records, Binder Records.
Iron and Steel Foundries Area Source Rule

Large area source Foundries must:

- Meet the same requirements as small area source foundries.
- Meet a PM limit of 0.8 lbs PM/ ton of metal charged or 0.06 lbs HAP/ ton metal charged for existing foundries.
- Meet a PM limit of 0.1 lbs PM/ ton of metal charged or 0.008 lbs HAP/ ton metal charged for new foundries.
- 20% opacity limit for Fugitive Emissions. (Evaluated every six months).
- Initial and monthly baghouse inspections, compliance monitoring for new sources, initial and periodic compliance testing.

Environmental 101 – 25th EH&S Conference Pittsburg, PA
Nonferrous Foundry Area Source Rule

- Aluminum, Copper and Other Nonferrous Foundry Rule (40 CFR Part 63, Subpart ZZZZZZ)
- Applicability
  - Area Source
  - Existing (act 600 tpy); New (cap 600 tpy)
  - Material containing Al HAPs, Cu HAPs, ONF HAPs
- Existing Source (on or before Feb 9, 2009)
- Affected Source – “all metal melting operations”
- Major Compliance Date - June 27, 2011
Nonferrous Foundry Area Source Rule (con’t)

- Cover or enclose melting furnaces that are equipped with covers or enclosures during the melting process, to the extent practicable.
- Scrap material that has been depleted (to the extent practicable) of HAPs id’ed by foundry type.
- Written management plan.
- Large (>6,000 tpy), copper/ONF (exc AL) melting
  - Existing – 95% control or 0.015 gr/dscf
  - New – 99% control or 0.01 gr/dscf
Greenhouse Gases and the Metalcasting Industry
Atmospheric Concentrations of GHGs

Water vapor accounts for 97% of GHGs in the atmosphere.

CO₂ accounts for about half of the other 3% of GHGs in the atmosphere.

Water vapor accounts for 97% of GHGs in the atmosphere.

- Carbon dioxide: 50%
- Methane: 20%
- Nitrous Oxide: 15%
- Halocarbons: 10%
- Ozone: 5%

IPCC, Climate Change 2001: The Scientific Basis
IPCC, Climate Change 2001: The Scientific Basis
PPC Updated 2/03
Global Emissions in 1990s

- Natural-Land: 90
- Natural-Oceans: 120
- Manmade: 8.0

Manmade sources account for about 4% of annual global carbon dioxide emissions.

IPCC, Climate Change 2001: The Scientific Basis
PPC Updated 2/03

Manmade U.S. Emissions in 2000

- Industry: 0.28
- Residential: 0.33
- Commercial: 0.20
- Agriculture: 0.29
- Light-duty Vehicles: 0.47
- Other Transportation: Total U.S. = 1.6

Light-duty vehicles contributed 18% of U.S. CO₂ emissions in year 2000.

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Contribution of US Foundries to Annual US CO$_2$ Emissions

Other US CO$_2$ Emissions
1.59 gigatonnes C

US Metalcasting CO$_2$ Emissions
0.01 gigatonnes C
(0.03 gigatonnes CO$_2$)

US Metalcasting CO$_2$ Emissions = 0.50% to 0.63% of US CO$_2$
Typical Foundry Tacit Energy Profile

Typical Metalcasting Tacit Energy Profile by Process*

- Melting/Holding: 72%
- Mold/Core Make: 7%
- Heat Treat: 3%
- Finishing: 6%
- Other, Utilities, Air, Water, Heat: 12%

Melting/Holding = 72%

Theoretical/Best Practice Energy Use in Metalcasting Operations (DOE 2004)
Metalcasting GHG Profiles

- Electricity and Natural Gas are the predominant emission sources.
- Process emissions are very small although they may need to be accounted for in future inventories.
- Indirect emissions (electricity) will vary significantly depending on the location of the facility.
- GHG profiles to date do not include other gases such as Methane, N₂O and CFC/HCFCs. These are not as significant as energy related emissions.
CO₂ Emissions -- Iron Foundries vs. Aluminum Die Casting

**Environmental 101 – 25th EH&S Conference Pittsburg, PA**
Mandatory GHG Reporting Rule
Mandatory GHG Reporting Rule

- Rule published on 10/30/09

- Applies if direct GHG emissions > 25,000 metric tons CO2e

- Requires reporting of GHG emissions annually starting with CY2010
## Global Warming Potentials

### Effect compared to CO2*

<table>
<thead>
<tr>
<th>Compound</th>
<th>Effect</th>
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<tbody>
<tr>
<td>CO₂</td>
<td>1</td>
</tr>
<tr>
<td>CH₄</td>
<td>21</td>
</tr>
<tr>
<td>N₂O</td>
<td>310</td>
</tr>
<tr>
<td>HFCs</td>
<td>Varies, most 1,000s</td>
</tr>
<tr>
<td>PFCs</td>
<td>Varies, most 1,000</td>
</tr>
<tr>
<td>SF₆</td>
<td>23,900</td>
</tr>
</tbody>
</table>

*40 CFR Part 98 Table A-1

- Magnesium Assn. has committed to a goal of eliminating SF₆ by 2010 but few metal casters are aware of this voluntary commitment.
Specifically What Must I Do?

- Identify all stationary fuel combustion sources at the foundry.

Examples include:

- Cupolas
- Scrap Preheaters
- Ladle Heaters
- Annealing Ovens
- Boilers
How Do I Know if the Rule Applies to Me?

• Estimate your GHG emissions for CY2009 using the AFS GHG Calculation Tool or emission factors provided in the rule

• If you expect CY2010 CO2e to be > 25,000 metric tons, you need to begin monitoring on 1/1/10
Direct Greenhouse Gas Calculation Tool

This tool is intended to provide a preliminary ballpark estimate of direct greenhouse gas emissions for a foundry. It must not be used to meet the reporting or other requirements of any current or future law or regulation.**

<table>
<thead>
<tr>
<th>Facility/Year:</th>
<th></th>
</tr>
</thead>
</table>

**Greenhouse Gas Emissions Tool**

Enter the foundry's annual usage of the following to determine carbon dioxide emissions:

- (Standard Cubic Feet) of Natural Gas Used \( \times 0.054 \) / 1000 kg = Tones
- (Short Tons) of Metallurgical Coke Used \( \times 2.531 \) / 1000 kg = Tones
- (Short Tons) of Anthracite Coal Used \( \times 2.585 \) / 1000 kg = Tones
- (Gallons) of Fuel Oil Used \( \times 10.2 \) / 1000 kg = Tones

Total Metric Tons / Year of Direct Carbon Dioxide Emissions =

**Important Notes:**

** The primary purpose of this tool is to allow the user to obtain a preliminary ballpark estimate of Greenhouse Gases (GHGs) from a foundry. It is not intended to be a substitute for a detailed GHG inventory or to meet the reporting and other requirements of any current or future local, state, or federal laws or regulations. Please note the following features and limitations of this tool:

1. This tool is designed to provide either actual or potential GHG emissions depending on the data inputs.
2. Since GHG emissions from foundry processes (e.g., pouring) are small compared to the emissions from fuel combustion, foundry process emissions are excluded from calculations in this tool.
3. This tool calculates CO₂ emissions only. Emissions of GHGs other than CO₂ from foundry operations are relatively small and are not calculated by this tool. Please note that the Mandatory GHG Reporting Rule requires quantification of all GHGs.
4. The Mandatory GHG Reporting Rule was finalized on September 22, 2009. The rule requires foundries to quantify GHGs from stationary fuel combustion sources and all other listed source categories present on the site. This tool is designed only to estimate that rule’s applicability but cannot be used to meet the rule’s reporting requirements.
5. This tool partially estimates CO₂ emissions according to the Tier 1 methodology described in the Mandatory GHG Reporting Rule. This tool would not appropriately estimate CO₂ emissions if the methodology of a different tier (II, III, or IV) applies to the foundry.

**Emission Factor (EF) Table**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>EF</th>
<th>Reference</th>
</tr>
</thead>
</table>
Specifically What Must I Do?

- Most foundries will qualify for *stationary fuel combustion sources only*
  - *monitoring and reporting is required for these sources only.*

- Prepare a GHG Monitoring Plan (Example Template available at afsinc.org) Begin monitoring fuel usage for all fuel types, including: Coke, Natural Gas, LPG, Fuel Oil

- Can utilize *fuel billing meters* to monitor usage (e.g. gas company NG meter)
PSD AND TITLE V GHG TAILORING RULE
PSD and Title V Tailoring Rule

• Final Rule published on June 3, 2010
• Establishes major source and major modification thresholds for GHG emissions under PSD and Title V rules.
• What GHGs are covered:
  – CO$_2$, CH$_4$, N$_2$O, HFCs, PFCs, and SF$_6$
Background

• Reasons for the rulemaking:
  – EPA believes that these rulemaking makes GHG emissions a pollutant ‘regulated under the CAA’
  – Title V rules require regulatory agencies to issue Federally enforceable operating permits to sources with potential emissions of more than \textbf{100 tpy} of any regulated air pollutant.
Background

• Reasons for the rulemaking:
  – PSD rules apply to sources which have the potential to emit 100 tons per year or 250 tons per year (depending on the category) of pollutants regulated under the Clean Air Act.
  
  – PSD rules would have required review for any increase in emissions of a pollutant regulated under the CAA unless a separate threshold has been established.
Issues With GHG Becoming Regulated Under CAA

• EPA estimates that at the 100 tpy threshold it would result in the need for over six million sources to file Title V permit applications.

• EPA estimates that 41,000 sources per year would require PSD permits based on an applicability threshold of 250 tons per year of CO$_{2e}$ for a new or modified source.
Rule Provisions

• Phase I (January 2, 2010):
  – PSD applies for new or modified sources for projects that would have otherwise been subject to PSD review, and increase in GHGs is > 75,000 tpy.
  – Title V applies to new sources with GHGs > 75,000 tpy.
  – Would not apply for projects that have obtained a permit prior to January 2, 2011.

• Phase II (July 1, 2011)
  – In addition to Phase I.
  – Projects that would increase GHGs by > 100,000 tpy that don’t have permits and haven’t commenced construction.
Final Rule Provisions

• EPA will evaluate lowering the thresholds as part of future rulemaking and following an impact assessment.

• EPA issued guidance on BACT determinations for GHGs in November 2010.

• Strategies for avoiding PSD applicability will be the same as under the current rules (APTA, Synthetic Minor, Netting, PALs).
Air Pollution Controls for Foundries
Dust Collector Types

- **Dry**
  - Cyclones
  - Fabric Filters
  - ESP

- **Wet**
  - Spray Tower
  - Packed – Bed
  - Orifice
  - Venturi Scrubber
SINGLE CYCLONE

DESIGN PARAMETERS
- CONFIGURATION
- PARTICLE SIZE & DENSITY
- AIR FLOW RATE
  - OPTIMUM INLET VELOCITY
  - 30-60 fps

APPLICATIONS
- PRE-CLEANER
  - HIGH LOADING
- FINISHING OPERATIONS
  - ABRASIVE DUSTS
  - LARGE PARTICLE SIZE
Dry fabric tube filter (mechanical cleaning)
TWO TECHNIQUES OF COLLECTED DUST REMOVAL FROM FILTER BAGS IN BAGHOUSES

Air Manifold w/ Nozzle

Clean Air Plenum

Compressed Air Cleaning

Bag Plate

Bag Cake

Bag

Dirty Airflow

Clean Airflow

Pulse Cleaning

Clean Airflow

Dirty Airflow

Bag Cake

Bag

Clean Airflow

Dirty Airflow

Shaker Cleaning

Shaker Motion

Clean Airflow

Bag Cake

Bag

Dirty Airflow

Dirty Airflow

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DESIGN PARAMETERS

* AIR-TO-CLOTH RATIO
  2-15 acfm per sqft.
* CLEANING MECHANISM
  - SHAKER
  - REVERSE AIR
  - PULSE JET
* FABRIC
* GAS CHARACTERISTICS
  - TEMPERATURE
  - MOISTURE
  - ACID CONTENT
* UPWARD "CAN" VELOCITY
* PARTICLE CHARACTERISTICS

REVERSE AIR BAGHOUSE
Clean air out

Dusty air in

Intense spray zone

Drag link conveyor-sludge removal

ORIFICE TYPE COLLECTOR
VENTURI SCRUBBER

DESIGN PARAMETERS
- THROAT LENGTH
- ENTRY ANGLE
- DIVERTING ANGLE
- PRESSURE DROP
Relationship Between Collection Efficiency and Particle Size in Venturi Scrubbers at Various Pressure Drops
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Percentage efficiency at</th>
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<tbody>
<tr>
<td></td>
<td>50-μm</td>
</tr>
<tr>
<td>Inertial collector</td>
<td>95</td>
</tr>
<tr>
<td>Medium-efficiency cyclone</td>
<td>96</td>
</tr>
<tr>
<td>Low resistance cellular cyclone</td>
<td>98</td>
</tr>
<tr>
<td>High-efficiency cyclone</td>
<td>94</td>
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<tr>
<td>Impingement scrubber (Doyle type)</td>
<td>98</td>
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<tr>
<td>Self-induced spray deduster</td>
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<tr>
<td>Void spray tower</td>
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<tr>
<td>Fluidized-bed scrubber</td>
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<tr>
<td>Irrigated-target scrubber (Peabody type)</td>
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<tr>
<td>Electrostatic precipitator</td>
<td>99</td>
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<tr>
<td>Irrigated electrostatic precipitator</td>
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<tr>
<td>Flooded-disc scrubber – low energy</td>
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</tr>
<tr>
<td>Flooded-disc scrubber – medium energy</td>
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<tr>
<td>Venturi-scrubber – medium energy</td>
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<td>High-efficiency electrostatic precipitator</td>
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<td>Venturi-scrubber – high energy</td>
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<tr>
<td>Shaker-type fabric filter</td>
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<tr>
<td>Reverse-jet fabric filter</td>
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<tr>
<td></td>
<td>Cyclones</td>
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<tr>
<td>----------------------</td>
<td>----------</td>
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<tr>
<td>Typical Efficiency</td>
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<td>Capital Cost/scfm</td>
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<td>Effective Particle Size Limitations (microns)</td>
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<tr>
<td>Pressure Drop (inches H$_2$O)</td>
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</tbody>
</table>
Vapor & Gas Collection

- Absorbers
- Adsorbers
- Thermal Incinerators
- Catalytic Incinerators
CATALYTIC INCINERATION FLOW SCHEMATIC

DESIGN PARAMETERS

- CATALYST
  - NOBLE METAL (PL-Pd)
  - BASE METAL (Ni/Co)
- CATALYST VOLUME
- GAS FLOW RATE
- CONTAMINANT CONCENTRATION
Collector Selection Parameters

- Concentration & Particle Size
- Contaminants
- Collection Efficiency
- Temp. & Humidity
- Energy
- Waste Disposal
Compliance and Enforcement
CAAA COMPLIANCE

- Comprehensive Permits
- Complete Inventory
- Compliance Certification
- Continuous Compliance
- Citizen Suit Provisions
Compliance Monitoring

- Compliance Monitoring Plans
- Preventive Maintenance Plans
- Periodic Performance Testing
- Continuous Emissions Monitoring
- Parametric Monitoring
- Record keeping and Reporting
- NSPS and NESHAPs Monitoring Requirements
EPA CAM Rule

Applies to Emission Units Meeting All of the Following Criteria:

- Part 70 or 71 Sources (Not FESOP Sources)
- Emission Units Subject to an Applicable Requirement
- Emission Units Which Use a Control Device
- Emission Units with Pre Control Device Potential to Emit Greater Than or Equal to 100 % of a Title V Major Source Threshold.
CAA Enforcement Provisions

- Civil Penalties.
- Criminal Penalties
- Contract Restrictions
- Injunctive Relief
- Majority of Enforcement is for Recordkeeping and Reporting Requirements.
Road to Success – Air Professionals Top 10

1. Gather all construction and operating permits and file in reverse chronological order by emissions unit.

2. Complete Source and Permit Inventory
   – Include date installed, last modification, construction permit number and date issued

3. Identify your state’s permitting exemptions
   – Listed (i.e. grinding)
   – Exemptions by Emissions
Road to Success (con’t)

4. Complete Emissions Inventory
   – Use AP-42 and Ohio EPA Engr Guide 24 to help identify/define sources
   – Use this presentation to help define pollutants and quantify emissions

5. Determine units that need permits and permit changes
   – Units that need permits (e.g. Charge Handling)
   – Can’t comply with limit; missing pollutants
6. Identify and determine compliance with existing Monitoring, Recordkeeping and Reporting requirements

7. Complete facility process flow diagram include EPA Id by emissions and APC devices, consider including pollutants

8. Review avoidance status
9. Learn rules that apply to your facility
   - Look in permits for rule citations
   - Print out those sections and highlight

10. Go electronic when possible to save time
    - Reminders for Reporting Dates
    - Spreadsheets that use alerts for out of range values.