Evolution Of Tier 4 Regulations & Project Specific Diesel Engine Emissions Requirements

Association of Equipment Managers (AEM)

CONEXPO / CON-AGG 2014
Las Vegas, NV
March 5, 2014
Topics To Be Covered Today

• Alpha & Omega (Tier 0 to Tier 4 Final).
• Evolution of Tier 4 Regulations.
  – Engine & Equipment Manufacturers.
  – Equipment Owners/Operators.
• Project Specifications and Local Initiatives are Often More Stringent than Federal or State Regulations.
Alpha & Omega
(Tier 0 To Tier 4 Final)
Table 1. ARB and USEPA Off-Road Compression-Ignition (Diesel) Engine Standards (NMHC+NOx/CO/PM in g/bhp-hr). When ARB and USEPA standards differ, the standards shown here represent the more stringent of the two.

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</table>

a) The PM standard for hand-start, air cooled, direct injection engines below 11 hp may be delayed until 2010 and be set at 0.45 g/bhp-hr.
b) Standards given are NMHC/NOx/CO/PM in g/bhp-hr.
c) Engine families in this power category may alternately meet Tier 3 PM standards (0.30 g/bhp-hr) from 2008-2011 in exchange for introducing final PM standards in 2012.
d) The implementation schedule shown is the three-year alternate NOx approach. Other schedules are available.
e) Certain manufacturers have agreed to comply with these standards by 2005.
EPA Non-Road Emission Regulations

Tier 1 / Stage I (1996-1999)
- PM (g/kWh) for USA, Europe

Tier 2 / Stage II (2001-2004)
- PM (g/kWh) for USA, Europe

Tier 3 / Stage III A (2006-2008)
- PM (g/kWh) for USA, Europe

Interim Tier 4 / Stage III B (2008-2013)
- Exhaust After Treatment Required

Final Tier 4 / Stage IV (2012-2015)
- PM (g/kWh) for USA, Europe

<table>
<thead>
<tr>
<th>NOx (g/kWh)</th>
<th>NOx + HC (g/kWh)</th>
<th>NOx + HC (g/kWh)</th>
<th>NOx (g/kWh)</th>
<th>NOx (g/kWh)</th>
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<tbody>
<tr>
<td>37 – 75 kW (50 – 100 hp)</td>
<td>75 – 130 kW (100 – 175 hp)</td>
<td>130 – 560 kW (175 – 750 hp)</td>
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www.conexpoconagg.com
Evolution Of EPA Off-Highway Emission Standards

- 2000 Tier 1
- 2006 Tier 2
- 2011 Tier 4 Interim (≥1207 HP)
- 2011 Tier 4I (751-1207 HP)

Excludes Emergency Standby

- NOx [g/kW-hr]
- PM [g/kW-hr]
Evolution of Tier 4 Regulations
Evolution Of Tier 4 Regulations

• Engine & Equipment Manufacturers Were the Initial Focus.
  – United States Environmental Protection Agency (USEPA).
  – California Air Resources Board (CARB).

• A Nearly 20-Year Process to Get From Tier 0 to Tier 4 Final.
  – First Tier 1 engines introduced in 1996.
  – All horsepower ranges required to be Tier 4 Final beginning in 2015.
# Evolution Of Tier 4 Regulations

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Evolution Of Tier 4 Regulations

- Dramatic Emission Reduction Requirements.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Tier 1 (g/bhp-hr)</th>
<th>Tier 4 Final (g/bhp-hr)</th>
<th>Percent Reduction (%)</th>
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<td>Hydrocarbons</td>
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<tr>
<td>Nitrogen Oxides (NOx)</td>
<td>6.9</td>
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<tr>
<td>Carbon Monoxide (CO)</td>
<td>8.5</td>
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<tr>
<td>Particulate Matter (PM)</td>
<td>0.4</td>
<td>0.015</td>
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Evolution Of Tier 4 Regulations

• Historically, state and local air quality agencies have waited for mobile equipment meeting new manufacturer’s emissions limits to cycle into the field “naturally” as older equipment was replaced and retired.

• California has changed that approach with two regulations that require Contractors to accelerate the introduction of newer equipment:
  – In-Use Off-Road Vehicle Regulation (Off-Road Regulation).
  – On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation (Truck & Bus Regulation).
A Look At The Future For Older Off-Road Equipment
CARB Off-Road Regulation
Reliance On Tier 4

- Long-term Compliance with CARB Off-Road Regulation Depends Largely on Tier 4: NOX Requirements.

<table>
<thead>
<tr>
<th>Compliance Date: January 1 of Year</th>
<th>25-49 hp</th>
<th>50-74 hp</th>
<th>75-99 hp</th>
<th>100-174 hp</th>
<th>175-299 hp</th>
<th>300-599 hp</th>
<th>600-750 hp</th>
<th>&gt;750 hp</th>
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<td>2014 (Large Only)</td>
<td>5.8</td>
<td>6.5</td>
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</table>

: Tier 1

: Tier 2

: Tier 3

: Tier 4 Interim

: Tier 4 Final
Evolution Of Tier 4 Regulations

Why You Should Care What California Does
Why You Should Care What California Does

• Section 209(e)(2) of the Clean Air Act, 42 U.S.C. 7543(e)(2) specifies that EPA must authorize California to adopt and enforce covered non-road emission standards if California determines that its standards are, in the aggregate, at least as protective of public health and welfare as applicable Federal standards.
  – Unless EPA makes one of three findings specified under the Clean Air Act:
    1. California’s protectiveness finding is arbitrary and capricious;
Why You Should Care What California Does

2. That California does not need such standards to meet compelling and extraordinary conditions; or
3. That California’s standards and accompanying enforcement procedures are not consistent with the Clean Air Act.

• When California asks EPA for a waiver…
  – EPA says yes…
    ▪ Virtually all of the time.

• EPA Granted California Authorization to Enforce the Off-Road Regulation on:
  – September 13, 2013
    ▪ And yes, this was Friday the 13th!
Why You Should Care What California Does

• 49-State Adoption of California Standards.
  – The Clean Air Act allows other states to adopt California’s emission standards under Section 177.
  – Section 177 requires that when another state adopts California’s standards, the standards must be identical to California’s.
  – Other states are not required to seek EPA authorization to adopt a California standard.
  – The state’s rule must provide for a minimum two year lead time after adoption.
States With Ozone Nonattainment Areas (2008 Standard)

8-Hour Ozone Nonattainment Areas (2008 Standard)

Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.
Project Specifications and Local Initiatives are Often More Stringent than Federal or State Regulations
Project Specifications Beyond The Regulations

• This is for a Container Terminal Construction Project in California.

MM AQ-3: Fleet Modernization for Equipment
Contractor:
Project: Berth 136-147 TraPac Container Terminal Project
Application for Development Project Log Number: 080127-020
State Clearinghouse Number: 2003104005

SECTION I: MITIGATION MEASURE

Construction Equipment (Excluding Vessels, Harbor Craft, and On-Road Trucks)

1. Construction equipment shall incorporate, where feasible, emissions-savings technology such as hybrid drives and specific fuel economy standards.

2. Idling shall be restricted to a maximum of 5 minutes when not in use.

3. Equipment Engine Specifications:

   a. From January 1, 2012, to December 31, 2014: All off-road diesel powered construction equipment greater than 50 horsepower (hp), except marine vessels and harbor craft, shall meet Tier-2 off-road emission standards at a minimum. In addition, all construction equipment greater than 50 hp shall be retrofitted with a CARB-verified Level 3 DECS.

   b. From January 1, 2015 on: All off-road diesel powered construction equipment greater than 50 hp, except marine vessels and harbor craft, shall meet Tier-4 off-road emission standards at a minimum.

The above “Equipment Engine Specifications” measures shall be met, unless one of the following circumstances exists, and the Contractor is able to provide proof that any of these circumstances exist:

• A piece of specialized equipment is unavailable as specified in 3(a), 3(b) or 3(c) within 200 miles of the Port of Los Angeles, including through a leasing agreement. If this circumstance exists, the equipment must comply with one of the options contained in the Step Down Schedule as shown in Table A below. At no time shall equipment meet less than a Tier 1 engine standard with a CARB-verified Level 2 DECS.

• The availability of construction equipment shall be reassessed in conjunction with the years listed in the above Tier Specifications (January 1, 2012 and January 15, 2015) on an annual basis. For example, if a piece of equipment is not available prior to December 31, 2014, the Contractor shall reassess this availability on January 1, 2015.
# Project Specifications Beyond The Regulations

## Table A: Compliance Stepdown Schedule

<table>
<thead>
<tr>
<th>Compliance Alternative</th>
<th>Engine Standard</th>
<th>CARB-verified DECS</th>
<th>PM Emissions* g/bhp-hr</th>
<th>NOx Emissions g/bhp-hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tier 4</td>
<td>N/A</td>
<td>0.01</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>Tier 3</td>
<td>Level 3</td>
<td>0.02</td>
<td>2.9</td>
</tr>
<tr>
<td>3</td>
<td>Tier 2</td>
<td>Level 3</td>
<td>0.02</td>
<td>4.7</td>
</tr>
<tr>
<td>4</td>
<td>Tier 1</td>
<td>Level 3</td>
<td>0.06</td>
<td>6.9</td>
</tr>
<tr>
<td>5</td>
<td>Tier 2</td>
<td>Level 2</td>
<td>0.08</td>
<td>4.7</td>
</tr>
<tr>
<td>6</td>
<td>Tier 2</td>
<td>Level 1</td>
<td>0.11</td>
<td>4.7</td>
</tr>
<tr>
<td>7</td>
<td>Tier 2</td>
<td>Uncontrolled</td>
<td>0.15</td>
<td>4.7</td>
</tr>
<tr>
<td>8</td>
<td>Tier 1</td>
<td>Level 2</td>
<td>0.2</td>
<td>6.9</td>
</tr>
</tbody>
</table>

*Equipment less than Tier 1, Level 2 shall not be permitted.*

*Stated emissions levels are for engine horsepower ratings of 176 bhp and above. Emissions levels for engine bhp ratings below 176 hp are marginally higher.*

(0.02-0.08 g/bhp-hr depending on hp, Tier & VDEC level)
Project Specifications Beyond The Regulations

- These are Excerpts from Permit Conditions Related to a Wind Turbine Construction Project off the Coast of Rhode Island and Massachusetts.

### III. Emission Standards - Phase 1 and Phase 2

The emissions standards of Section III apply to each OCS Stationary Engine, during each OCS Source Period.

**A.** The owner/operator shall ensure that any OCS Stationary Engine with a maximum power output at or below 560 kilowatts (kW) on any OCS Source has been certified by the manufacturer(s) to meet or surpass the following emission standards required for 40 C.F.R. Part 89, Tier 3 engines:

<table>
<thead>
<tr>
<th>Emission Category</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen oxides (NOx) +</td>
<td>4.0 grams/kW-hr</td>
</tr>
<tr>
<td>non-methane hydrocarbons (NMHC)</td>
<td></td>
</tr>
<tr>
<td>Particulate Matter (PM)</td>
<td>0.2 g/kW-hr</td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>3.5 g/kW-hr</td>
</tr>
</tbody>
</table>

**B.** The owner/operator shall ensure that any OCS Stationary Engine with a maximum power output greater than 560 kW on any OCS Source has been certified by the manufacturer(s) to meet or surpass the following emission standards required for 40 C.F.R. Part 89, Tier 2 engines:

<table>
<thead>
<tr>
<th>Emission Category</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx + NMHC</td>
<td>6.4 g/KW-hr</td>
</tr>
<tr>
<td>PM</td>
<td>0.2 g/KW-hr</td>
</tr>
<tr>
<td>CO</td>
<td>3.5 g/KW-hr</td>
</tr>
</tbody>
</table>
Project Specifications Beyond The Regulations

IV. Operational Conditions

A. For each OCS Stationary Engine, the owner/operator shall use only ultra-low sulfur fuel oil with a sulfur content that does not exceed 0.0015% by weight.

B. From the Phase 1 Start Date to the Phase 1 End Date, the Total OCS Emissions of NOx shall not exceed 226 tons.

C. From the Phase 2 Start Date and continuing thereafter, Total OCS Emissions of NOx shall not exceed 49 tons per year in any rolling 12-month period.
Project Specifications Beyond The Regulations

• This is from a Bridge Project in New York.

New York State Thruway Authority
Tappan Zee Hudson River Crossing Project

PART 3, PROJECT REQUIREMENT 3 – ENVIRONMENTAL COMPLIANCE EXHIBIT B
Environmental Performance Commitments

Exhibit B Item 1. AIR QUALITY CONTROL

A. Use of clean fuel such that all diesel fuel used for the Project shall contain 15 parts per million (ppm) or less sulfur by weight. This includes fuel for on-road, non-road and vessels operating on-site.

B. The use of best available technologies for reducing particulate matter (PM) emissions from nonroad, non-marine diesel engines with a power rating of 50 horsepower (hp) or greater and controlled truck fleets (i.e., truck fleets under long-term contract) including concrete mixing and pumping trucks. Diesel particulate filters (DPFs) have been identified as being the tailpipe technology currently proven to have the highest PM reduction capability. All diesel non-road engines rated at 50 hp or greater shall utilize DPFs, either installed on the engine by the original equipment manufacturer (OEM) or retrofitted with a DPF verified by the United States Environmental Protection Agency (USEPA) or the California Air Resources Board, and may include active DPFs, if necessary; or other technology proven to reduce PM emissions by at least 90 percent relative to the same operation of the same engine with no BAT installed.

C. All nonroad construction equipment in the Project greater than 50 hp, excluding tug boats and other marine vessels, shall meet at least the Tier 3 emissions standard. All nonroad construction equipment less than 50 hp shall meet at least the Tier 2 emissions standard.
City Of Chicago Clean Contracting Ordinance

• Ordinance Applies to Contractors and Subcontractors Performing Work Under Contract to the City of Chicago.

• Section 1, Chapter 2-92-595 of the Municipal Code of Chicago.

• Requirements:

  2014
  – Tier 1 or newer to avoid particulate filters.
  – 2.1 or higher “Clean Fleet Score”

  2017
  – Clean Fleet Score of 3.0 or higher.
City Of Chicago Clean Contracting Ordinance

2020

– Clean Fleet Score of 4.0 or higher.

• Scoring Summary

– 0 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 1 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;

– 2 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 2 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;
• Scoring Summary (continued)
  – 2.25 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 3 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;
  – 4 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 4 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;
Massachusetts DOT

• Revised Specifications for Non-road Diesel Equipment on Massachusetts DOT Job Sites as of September 2, 2009.

• Most Current Tier Applies to Equipment Greater than 50 hp.

• If not Tier 4, the Equipment Must Retrofit with an EPA or CARB Verified Device.
Massachusetts DOT

• No “grandfathering”.
  – If the emissions from diesel equipment comply with the most current EPA emission standards for particulate matter in effect at the time, but are superseded by newer Tier emission standards (i.e. Tier 3 emission standards replaced by Tier 4 emission standards), then the superseded diesel equipment will have to be retrofitted prior to the end of the contract with emission control technology.
    ▪ This will not be an issue much longer.
Virginia - Army Relocation Of National Capitol Region Facilities To Fort Belvoir, VA

• The Following Requirements Were Included in the Bid Specification:
  
  – All Contractor and Sub-contractor diesel powered non-road construction equipment with engine horsepower (hp) ratings of 50 hp and above…shall be retrofitted with Emission Control Devices in order to reduce diesel emissions. The Retrofit Emission Control Devices shall consist of oxidation catalysts, or similar retrofit equipment control technology that (1) is included on the Environmental Protection Agency (EPA) Verified Retrofit Technology List and (2) is verified by EPA or certified by the manufacturer to provide a minimum emissions reduction of 20% PM$_{10}$, 40% CO, and 50% HC.
Virginia - Army Relocation Of National Capitol Region Facilities To Fort Belvoir, VA

- Tier 2, Tier 3 and Tier 4 engines exempt from this requirement.
- No Contractor will allow any diesel-fueled commercial motor vehicles or diesel non-road construction equipment to idle for a period greater than 5 minutes.
Northeast Diesel Collaborative Model Contract Specification

• Released in April, 2008.
• Guidance for Hospitals, Universities, Municipalities and Transportation Agencies.
• Until December 31, 2012, all diesel non-road construction equipment with engines 75 hp and greater on site more than 10 total days must have either (1) engines that meet EPA Tier 4 non-road emissions standards, or (2) emission control technology verified by EPA or CARB for use with non-road engines to reduce PM emissions by a minimum of 20%.
Northeast Diesel Collaborative
Model Contract Specification

• Beginning January 1, 2013, all diesel non-road construction equipment on site for more than 10 total days must have either (1) engines meeting EPA Tier 4 non-road emission standards or (2) emission control technology verified by EPA or CARB for use with non-road engines to reduce PM emissions by a minimum of 85% for engines 75 hp and greater and by a minimum of 20% for engines between 25 and 75 hp.
New York City Local Law 77

- Requires Best Available Technology (BAT) for Construction Equipment 50 hp or Greater Operated by Agencies and Contractors Working Within the City.
- BAT is Technically Feasible EPA or CARB Verified Devices, or Tier 4 Engines.
- Ultra Low Sulfur Diesel fuel (ULSD) is Also Required.
- BAT Needs to be Continuously Updated to Reflect Introduction of New Technology.
  - Greater Tier 4 requirements as BAT over time.
Pennsylvania DOT


• Released August 26, 2009.

• Implements Philadelphia Executive Order 1-07, Which Requires the Inclusion of Clean Diesel Specifications in Contracts for Public Works Projects.
  – Applies to projects estimated to be $1,000,000 or more.
Pennsylvania DOT

- Applies to vehicles greater than 50 hp on the project in excess of 7 working days (consecutive or non-consecutive).

- Requires Use of Retrofits or Vehicles Meeting Tier 4 Emissions Requirements.
Philadelphia Specification Requiring Diesel Engine Controls

• Applies to $1 Million or Greater Projects from July 1, 2013 to June 30, 2014.
• Applies to All Projects Beginning July 1, 2014.
• At least two business days before any covered vehicle is brought onto the city’s contract site, the successful bidder must submit to the city’s project manager information about the vehicle including confirmation that the appropriate emissions control technology has been installed on the vehicle or that the vehicle is Tier 4 or Tier 4 Interim.
New Jersey Executive Order

• Initially a Pilot Plan for Reducing Diesel Emissions in Publicly Funded Projects.
• After a Two Year Pilot, Expanded to all Projects Valued at Greater than $5,000,000.
• Requires Engines Meeting Tier 4 Non-road Emission Standards or Retrofit Technology Verified by EPA or CARB.
## List Of Projects Impacted By New Jersey Executive Order - 2013

<table>
<thead>
<tr>
<th>Projects as of N 2-12:</th>
<th>County</th>
<th>Municipality</th>
<th>Construction Type</th>
<th>Program Completion Date</th>
<th>Current Month of Award</th>
<th>Fiscal Year</th>
<th>Decider</th>
<th>Awarded To</th>
</tr>
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<tr>
<td>FY2013</td>
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# List Of Projects Impacted By New Jersey Executive Order - 2014

**FY 2014**

<table>
<thead>
<tr>
<th>Project Description</th>
<th>County</th>
<th>Municipality</th>
<th>Construction Type</th>
<th>Program Funding</th>
<th>Anticipated Month of Award</th>
<th>Fiscal Year</th>
<th>Quarter</th>
<th>Award Status</th>
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<tbody>
<tr>
<td>Rt 200 Bypass Contract C</td>
<td>Somerset</td>
<td>Hillsborough Twp.</td>
<td>Oper. &amp; Safety Improvements</td>
<td>State-FY14</td>
<td>July</td>
<td>2014</td>
<td>1</td>
<td>Awarded to Koskis Corp. on 8/1/2013</td>
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<tr>
<td>Rt 9 Green Street Interchange</td>
<td>Middlesex</td>
<td>Woodbridge Twp.</td>
<td>Oper. &amp; Safety Improvements</td>
<td>Federal-FY13</td>
<td>September</td>
<td>2014</td>
<td>1</td>
<td>Awarded to IEW on 9/5/2013</td>
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<tr>
<td>Rt 46 Little Ferry Circle Exit &amp; Bridge over Hackensack River</td>
<td>Bergen</td>
<td>Ridgefield Pk Village</td>
<td>Circle Elimination/ Bridge Replacement</td>
<td>Fed/Other-FY13</td>
<td>September</td>
<td>2014</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rt 36 &amp; Evergreen Road Interchange Improvements</td>
<td>Middlesex</td>
<td>Magnolia Boro</td>
<td>Oper. &amp; Safety Improvements</td>
<td>Federal-FY13</td>
<td>September</td>
<td>2014</td>
<td>1</td>
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<tr>
<td>Rt 27 Sec 3E Six Mile Run Bridge</td>
<td>Middlesex</td>
<td>Holmdel Twp.</td>
<td>Bridge Replacement</td>
<td>Federal-FY13</td>
<td>October</td>
<td>2014</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7 Hackensack River Wetlands Bridge Contract #3</td>
<td>Hudson</td>
<td>Jersey City</td>
<td>Bridge Replacement</td>
<td>PA-NY/NJ-FY14</td>
<td>October</td>
<td>2014</td>
<td>2</td>
<td></td>
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<tr>
<td>259/420-75, Direct Connect, Contract 2</td>
<td>Camden</td>
<td>Bellmomy Boro</td>
<td>Oper. &amp; Safety Improvements</td>
<td>Federal-FY13</td>
<td>November</td>
<td>2014</td>
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<tr>
<td>Rt 36 North of Beebe Road to Rt 35, Pavement Improvements</td>
<td>Monmouth</td>
<td>Hazlet Twp.</td>
<td>Roadway Improvements</td>
<td>Prop-State-FY14</td>
<td>January</td>
<td>2014</td>
<td>3</td>
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<tr>
<td>Rt 22, EB Auxiliary Lane between D-Turns H &amp; G</td>
<td>Union</td>
<td>Springfield Twp.</td>
<td>Oper. &amp; Safety Improvements</td>
<td>Prop-Fed-FY14</td>
<td>January</td>
<td>2014</td>
<td>3</td>
<td></td>
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<tr>
<td>Rt 208, New York Street to Amaron Rd, Pavement Improvements</td>
<td>Mercer</td>
<td>Princeton Boro</td>
<td>Roadway Improvements</td>
<td>State-FY13</td>
<td>January</td>
<td>2014</td>
<td>3</td>
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<tr>
<td>Pulaski Contract #4</td>
<td>Hudson</td>
<td>Essex</td>
<td>Bridge Improvements</td>
<td>PA-NY/NJ-FY14</td>
<td>February</td>
<td>2014</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Rt 46 Main St to vicinity of Frederick Place</td>
<td>Bergen</td>
<td>Little Ferry Boro, Hackensack Twp.</td>
<td>Oper. &amp; Safety Improvements</td>
<td>Prop-Fed-FY15</td>
<td>March</td>
<td>2014</td>
<td>3</td>
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<tr>
<td>Rt 31 NB &amp; SB from South of Rt 78 to North of CR 83</td>
<td>Hunterdon</td>
<td>Washington Twp.</td>
<td>Roadway Improvements</td>
<td>Prop-Fed-FY14</td>
<td>April</td>
<td>2014</td>
<td>4</td>
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<tr>
<td>Little Falls Hump, Contract A</td>
<td>Passaic</td>
<td>Boro of Woodland Park</td>
<td>Oper. &amp; Safety Improvements</td>
<td>Prop-Fed-FY14</td>
<td>May</td>
<td>2014</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Rt 38, MP 0.9-6.1, Pavement Improvements</td>
<td>Burlington</td>
<td>Maple Shade Twp., Pennsauken Twp.</td>
<td>Roadway Improvements</td>
<td>Prop-Fed-FY14</td>
<td>May</td>
<td>2014</td>
<td>4</td>
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</tr>
<tr>
<td>Rt 27 Riveride Dr to Wilt Rd Pavement, Franklin Twp.</td>
<td>Middlesex</td>
<td>Sayreville Boro</td>
<td>Roadway Improvements</td>
<td>Prop-State-FY14</td>
<td>May</td>
<td>2014</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Rt 22 EB &amp; WB from Middlebrook to Westfield Rd</td>
<td>Somerset</td>
<td>Bridgewater Twp., Bound Brook Boro, Grover Town</td>
<td>Roadway Improvements</td>
<td>Federal-FY13</td>
<td>June</td>
<td>2014</td>
<td>4</td>
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<tr>
<td>Rt 7, Bridge over COXRAIL</td>
<td>Hudson</td>
<td>Kezar Twp.</td>
<td>Bridge Replacement</td>
<td>Prop-Fed-FY14</td>
<td>June</td>
<td>2014</td>
<td>4</td>
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<tr>
<td>Rt 18 Bridge over Rt 1</td>
<td>Middlesex</td>
<td>New Brunswick City</td>
<td>Bridge Improvements</td>
<td>Prop-Fed-FY14</td>
<td>June</td>
<td>2014</td>
<td>4</td>
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<tr>
<td>Rt 130 Main Street to Rt 1 Pavement Improvements</td>
<td>Middlesex</td>
<td>New Brunswick Twp.</td>
<td>Roadway Improvements</td>
<td>Prop-Fed-FY15</td>
<td>May</td>
<td>2014</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
Making A List, Checking It Twice

• Naughty or Nice, Send Me Your Project Requirements or Bid Specifications Promoting the Use of Newer Off-Road Equipment or Retrofit Control Technology.

• Mike Buckantz
  – mbuck@associatesenvironmental.com
Tier 4 Promotion at CONEXPO

THE TRANSITION TO TIER 4

Reduced emissions benefit everyone.

Doosan is doing its part in making the world a cleaner place with its emissions strategy.

Health & Environment Benefits:
- Lower respiratory problems and less respiratory disease
- Reduced air and noise pollution
- According to the EPA, by 2030, cleaner air will prevent:
  - 12,000 deaths per year
  - 700,000 hospitalizations per year
  - One million food weeks per year

The equipment industry has been in transition for decades. Heavy equipment has been working to meet federal emission standards since 1996. Tier 4 (Tier 4) is the latest step in this process.

After-Treatment Technology Implementation in Doosan Equipment.

<table>
<thead>
<tr>
<th>Tier 4</th>
<th>Tier 4 (Tier 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. torque (ft-lb)</td>
<td>650</td>
</tr>
<tr>
<td>Max. torque (ft-lb)</td>
<td>1350</td>
</tr>
<tr>
<td>Gross Power (hp)</td>
<td>200</td>
</tr>
<tr>
<td>Net Power (hp)</td>
<td>150</td>
</tr>
</tbody>
</table>

Doosan is committed to giving you the best emission-compliant solution.

To meet between Tier 4 (Tier 4) and Tier 4 (Tier 4) emission standards in heavy equipment, a system-based clean diesel approach is needed, which includes:
- Internal engine modifications
- After-treatment technologies
- Achievement of diesel fuel

The Doosan Tier 4 strategy includes combinations of different technologies, designed to provide the optimum balance between engine performance and fuel-efficient emissions while complying with emission standards.

MOROOKA
MST 2200VD
Tier 4 Interim

- 22,046 lbs payload
- Caterpillar C7.1
  - 250 hp
- Ground Pressure 4.7 psi
  - Dimensions
    - Length: 20’ 6”
    - Width: 9’ 7”
    - Height: 10’ 2”
- Weight: 30,755 lbs

www.conexpoconagg.com
Tier 4 Promotion at CONEXPO

**CASE**

**CASE 721F WHEEL LOADER**

**ADVANTAGES:**

Tier 4 Final SCR ONLY technology provides greater fuel savings without sacrificing strength and a simple, pour-and-go setup.

Four selectable power modes (Eco, Standard, Max and Auto) match engine output to the task at hand.

Available five-speed transmission with lock-up clutch improves acceleration and hill climbing while reducing fuel consumption.

Mid-mount cooling module maximizes cooling efficiency and includes an auto-reversing fan option that purges debris for you.

Award-winning joystick steering option greatly helps to improve cycle times.

Excellent all-around visibility thanks to floor-to-ceiling windows and a low-profile hood design.

**SPECIFICATIONS:**

- Engine Make: FPT
- Engine Model: F4HFE613Y
- Tier 4 Final Certified: 178 (133)
- Peak Torque - bhp (nm): 674 (914)
- Peak Torque - rpm (bhp): 411 (6.7) / 6
- Operating Weight - lb (kg): 31,500 (14 288)
- Transmission Gears: 4 or 5F/3R
- Full Turn Tipping Load - lb (kg): 31,500 (14 288)
- Cab Height - feet inches (mm): 11' 1" (3 385)
- Pipe Grapple Clearance @ Full Height, Ground to Top - feet inches (mm): 12' 6" (3 827)
- Pipe Grapple Clearance @ Max Reach, Ground to Top - inches (mm): 71.1 (1 806)
- Wheelbase - inches (mm): 128.1 (3 253)
- Spec / Show Configuration: XT Tool Carrier Pipe Grapple

---

**180G LC EXCAVATOR**

- Interim Tier 4 emission-certified engine
- “Load-and-go” versatility
- Powerwise III hydraulic management system
- Cool-on-demand variable-speed fan
- Three bulkheads in boom

**KEY SPECS**

- Power: 90 kW (121 net hp) @ 2,200 rpm
- Operating weight: 20,120 kg (44,317 lb)
- Digging depth: 7.07 m (23 ft. 2 in.)
- Maximum reach: 9.94 m (32 ft. 7 in.)
- Bucket digging force: 126 kN (28,244 lb)
- Arm length: 2.71 m (8 ft. 10 in.) / 3.21 m (10 ft. 6 in.)
- Arm digging force: 84 kN (18,825 lb)
- Drawbar pull: 17,250 kg (38,030 lb)
Except for this Classic: NOT Tier 4
Thank You For Attending

If you have any questions, please contact me:

Mike Buckantz
Associates Environmental
16882 Bolsa Chica Street, Suite 202
Huntington Beach, CA 92649
(714) 625-7020 / (714) 362-9085 Fax
mbuck@associatesenvironmental.com