US EPA ARCHIVE DOCUMENT
Caterpillar Emissions Solutions (CES)

Emissions Repower and Upgrade Group Overview

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Objective

- Fleet Emissions Profile
- Retrofit Options
- Emissions Repower
- Emissions Upgrade Groups

Goals:
- Compliance
- Green Image
- Competitive

Making Sustainable Progress Possible

Caterpillar Confidential: Yellow
Fleet Emissions Profile
Understand the emissions status of your fleet

Emissions Certificates

Handout

Regulations Table

Cat Fleet Tool

Emissions Family Code

Fleet Baseline

Fleet Plan

See your Cat Dealer

CARB Certificates

www.arb.ca.gov/msprog/offroad/cert/cert.php

Making Sustainable Progress Possible
Product Overviews

Repower

- Replace existing engine with a newer engine SYSTEM
- NOx, PM, HC, CO, Reduction option
- Tier 1 is often the most cost effective
- 90+ Emissions repower options
- Potential enabler for passive DPFs
Emissions Repowers – Tier 1

EPA Nonroad Engine Phase-In

1990 Model Year 285 HP Dozer Repowered to Tier 1

Annual Emissions Results

<table>
<thead>
<tr>
<th></th>
<th>NOx</th>
<th>PM</th>
<th>HC</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Reduced</td>
<td>33%</td>
<td>38%</td>
<td>55%</td>
<td>74%</td>
</tr>
<tr>
<td>Amount (ton/year)</td>
<td>0.51</td>
<td>0.05</td>
<td>0.08</td>
<td>0.69</td>
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</tbody>
</table>

Tier 1 includes straightforward engine changes (fuel rates, timing, ...etc.)

From EPA Quantifier: [www.epa.gov/quantifier](http://www.epa.gov/quantifier)
Emissions Repowers – Tier 3

EPA Nonroad Engine Phase-In

1990 Model Year 285 HP Dozer Repowered to Tier 3

Annual Emissions Results

<table>
<thead>
<tr>
<th></th>
<th>NOx</th>
<th>PM</th>
<th>HC</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Reduced</td>
<td>67%</td>
<td>66%</td>
<td>74%</td>
<td>76%</td>
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<tr>
<td>Amount (ton/year)</td>
<td>0.84</td>
<td>0.07</td>
<td>0.08</td>
<td>0.57</td>
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From EPA Quantifier: www.epa.gov/quantifier

Tier 3 reduces emissions for off-highway engines by integrating support systems into engines (ACERT® technology) and machines.
Product Overviews

Repower – Fleet Example

The DEQ emissions reductions were used along with the estimated project costs to determine the Capital Cost Effectiveness and Total Cost Effectiveness using a generally accepted discount rate of 4 percent and capital recovery factors based on a 5 year life for aftertreatment and 7 year for repowers and engine upgrades. The cost effectiveness calculations using the DEQ emissions reductions are consistent with funding programs like the Carl Moyer program in California. The cost effectiveness calculations are conservative because the actual engine life, and corresponding emissions reductions, typically far exceeds the engine life used in the calculations.
Product Overviews

Emissions Upgrade Groups (EUG)

- Overhaul option
- NOx, PM, HC, CO, Reduction
- Dealer installed
- Proven technology
- Emissions label
- Achieves Tier 1 Level emissions
- EPA Verified for 3306

EPA Verification List

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Technology</th>
<th>Applicability</th>
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<tbody>
<tr>
<td>Caterpillar, Inc.</td>
<td>Emissions Upgrade Group</td>
<td>Caterpillar model 3306 diesel engines for nonroad applications with model years from 1998 to 1995 with mechanical direct fuel injection.</td>
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</tbody>
</table>

http://www.epa.gov/otaq/retrofit/verif-list.htm

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