Emergency Vehicle SCR and DEF Inducement Guidelines
2010 EPA Engine Emissions Control Requirements
Roger Lackore
Mike Power
July 15, 2010

Background
After extensive consultations, the Fire Apparatus Manufacturers Association (FAMA), the Ambulance Manufacturers Division of the National Truck Equipment Manufacturers Association (AMD), and the International Association of Fire Chiefs (IAFC), have reached an understanding with the US EPA regarding an approach to Diesel Emission Fluid (DEF) inducement strategies for emergency vehicles. Beginning in 2010, routine DEF replenishment is considered a critical emission-related engine maintenance requirement under EPA regulations; however, engine safety concerns that are particular to emergency vehicles permit manufacturers of emergency vehicles to employ less severe vehicle inducement measures than those applicable to typical commercial vehicles.

Inducements perform two functions. One is to ensure that vehicle operators are disciplined enough to plan for adequate DEF supply just as they must plan for adequate fuel supply. The second function is to ensure any mechanical faults in the emission control system are remedied quickly, assuring that any vehicle in service complies with EPA emissions standards. This approach will ensure that an emergency vehicle that runs low on DEF or experiences a mechanical fault is subjected to an inducement sufficient to ensure proper SCR system maintenance without undue risk of damage to emergency vehicles and without jeopardizing the ability of the vehicle to complete its emergency response mission.

Inducements for Emergency Vehicles
The EPA has stated that the following inducement strategies for emergency vehicles that are aligned to the function these vehicles perform and the critical nature of their use for public safety will meet requirements for ensuring that scheduled maintenance is performed in use. The inducement strategy should adhere to the following criteria:

1. Emergency vehicles will employ graduated driver warning signals previously established by engine manufacturers with respect to SCR systems.
2. Emergency vehicles will employ an “initial” driver inducement that limits the vehicle speed to 55 mph.
3. Emergency vehicles will employ a “last resort” driver inducement that limits vehicle speed to 25 mph. This speed limitation will be sufficiently onerous to induce emergency vehicle operators to perform the required maintenance quickly, but still allow them to transport a patient or reach the scene of an emergency, albeit at a significantly reduced speed.
4. Inducements for emergency vehicles will not be required to limit engine torque. This will avoid the situation where an emergency vehicle would be unable to climb a grade that it can normally ascend.

5. Fire apparatus inducements may be postponed while the apparatus is operating in PTO mode. If the apparatus drops out of PTO mode to reposition, the 25 mph limit may be employed, but may be discontinued temporarily prior to the engine being shut off. This will assure that essential functions such as pumping operation or aerial operation can continue uninterrupted while fighting a fire or conducting other operations at the scene of an emergency.

6. At the conclusion of the emergency event, the “last resort” inducement (25 mph speed limit) as well as cessation of PTO operation will be employed and will continue until DEF has been added.

EPA Agrees That These Inducement Strategies Will Meet the EPA Emissions Regulations

Strategies 1 and 2 fit with the general industry inducement strategies employed by on-highway vehicles to meet 2010 emissions standards using selective catalytic reduction technologies. Although the 25 mph “last resort” vehicle speed limitation is higher than the typical level of 5 mph employed for commercial vehicles, this limit in conjunction with a limit on PTO operation is sufficiently onerous to induce emergency vehicle operators and fleet managers to take immediate action to maintain an effective SCR system. Any emergency vehicle limited to a top speed of 25 mph will represent a significant liability to the fire fighting or care provider organization. Any organization that does not either remedy the situation or remove the vehicle from service at the earliest safe opportunity would be vulnerable to serious legal liability claims.

Inducement strategies 4 and 5 are provisions that are meant to mitigate risk of damage to the vehicle engaged in emergency operations. In addition these provisions mitigate the risk of harm to the vehicle operator and the public. These strategies are allowed under EPA regulations since protection from vehicle damage is one of the allowed uses of Auxiliary Emissions Control Devices as prescribed by the definition of a defeat device in 40CFR 86.004-2.

The nature of fire fighting often requires the apparatus be placed close to structure fires, or in the path of wild fires. Shifts in wind or other changes in the situation will require the apparatus to be moved quickly to protect the vehicle against damage. This damage can result from heat or open flame, or may be caused by the ingestion of excessive amounts of soot or burning embers into the engine.

Inducement strategy 4 ensures that an apparatus operator attempting to move the vehicle away from rapidly approaching flames will be able to do so. Engine torque derates could prevent the apparatus from ascending a grade at any speed and approaching flames, heat, or soot could envelope and damage a vehicle without sufficient engine torque to escape.

Inducement strategy 5 ensures a fire fighting vehicle may continue to perform fire suppression operations in close proximity to an approaching fire, or eminent structure collapse. Rapid repositioning and subsequent re-engagement of the pumping function...
during an emergency event is necessary to move the vehicle out of harms way, while permitting the vehicle operator to continue suppression operations to protect the vehicle from damage consistent with EPA regulations.

**Emergency Vehicle Definition**

These inducement strategies may only apply to emergency vehicles. EPA will require engine OEM’s to demonstrate to EPA that these strategies will only be available to vehicles that meet the limited definition of emergency vehicle – to include automotive fire apparatus, wildland fire apparatus, or ambulances meeting one of the following criteria:

1. Fire apparatus shall meet the scope and application of National Fire Protection 1901 Standard for Automotive Fire Apparatus – 2009 Edition and shall conform to one of the following definitions as found in that standard: Pumper Apparatus; Initial Attack Apparatus; Mobile Water Supply Apparatus; Aerial Fire Apparatus; Quint Fire Apparatus; Special Service Fire Apparatus; or Mobile Foam Fire Apparatus.

2. Wildland fire apparatus shall meet the scope and application of NFPA 1906 Standard for Wildland Fire Apparatus – 2006 Edition and shall conform to wildland fire apparatus definition found in that standard.

3. Ambulances shall meet the scope and definition of General Services Administration KKK-A-1822F “Federal Specification for the Star of Life Ambulance” and shall conform to one of the following definitions: Type I Ambulance; Type I - AD (Additional Duty) Ambulance; Type II Ambulance; Type III Ambulance; or Type III - AD (Additional Duty) Ambulance.

**General Inducement Strategies**

The following tables describe general strategies appropriate for emergency vehicles, reflecting the revised emergency vehicle inducements. Fluid levels are provided only as general guidelines. The specific progression of lamp colors and flash patterns is determined by the engine OEM and described to the EPA.

### DEF Keep-Fill Inducement Strategy

<table>
<thead>
<tr>
<th>Condition</th>
<th>Warning Lamps</th>
<th>Inducement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid Level Above 10%</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Fluid Level 5% to 10%</td>
<td>First Warning Lamp</td>
<td>None</td>
</tr>
<tr>
<td>Fluid Level below 5%</td>
<td>Additional Lamp Actions</td>
<td>55 mph Speed Limit</td>
</tr>
<tr>
<td>DEF Tank Empty</td>
<td>Additional Lamp Actions</td>
<td>55 mph Speed Limit</td>
</tr>
</tbody>
</table>

Inducement mode is exited by adding DEF to the tank.

* Tank empty and ignored after one of the following events: refueling, parking or restart.*
DEF Quality Inducement Strategy

<table>
<thead>
<tr>
<th>Condition</th>
<th>Warning Lamps</th>
<th>Inducement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect DEF Fluid Detected</td>
<td>First Warning Lamp</td>
<td>None</td>
</tr>
<tr>
<td>Engine has run for several hours after detection</td>
<td>Additional Lamp Actions</td>
<td>55 mph Speed Limit</td>
</tr>
<tr>
<td>Engine has run for many hours after detection and after one of the following events: refueling, parking or restart.*</td>
<td>Additional Lamp Actions</td>
<td>25 mph Speed Limit and no PTO operation after emergency event</td>
</tr>
</tbody>
</table>

Inducement mode is exited by replacing fluid with proper DEF

SCR Fault Inducement Strategy

<table>
<thead>
<tr>
<th>Condition</th>
<th>Warning Lamps</th>
<th>Inducement</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR Fault Detected</td>
<td>First Warning Lamp</td>
<td>None</td>
</tr>
<tr>
<td>Engine has run for several hours after detection</td>
<td>Additional Lamp Actions</td>
<td>55 mph Speed Limit</td>
</tr>
<tr>
<td>Engine has run for many hours after detection and after one of the following events: refueling, parking or restart.*</td>
<td>Additional Lamp Actions</td>
<td>25 mph Speed Limit and no PTO operation after emergency event</td>
</tr>
</tbody>
</table>

Inducement mode is exited by repairing the cause of the fault
*The inducement strategy should use one of these trigger events (refueling, parking, or restart).

Engine OEM Reporting
Details of the exact inducement strategy must be presented by each engine OEM and approved by the EPA. The EPA will expect to be provided with answers to the following questions:

- What is the exact inducement strategy for emergency vehicles?
  - How is each inducement entered?
  - How is each inducement exited?
- What control does the OEM have in place to ensure that engines with emergency vehicle inducement strategies are sold only for use in emergency vehicles?

For questions regarding this document contact:
Roger Lackore
FAMA Chassis Technical Committee Chair
920 832 3249
rlackore@piercemfg.com