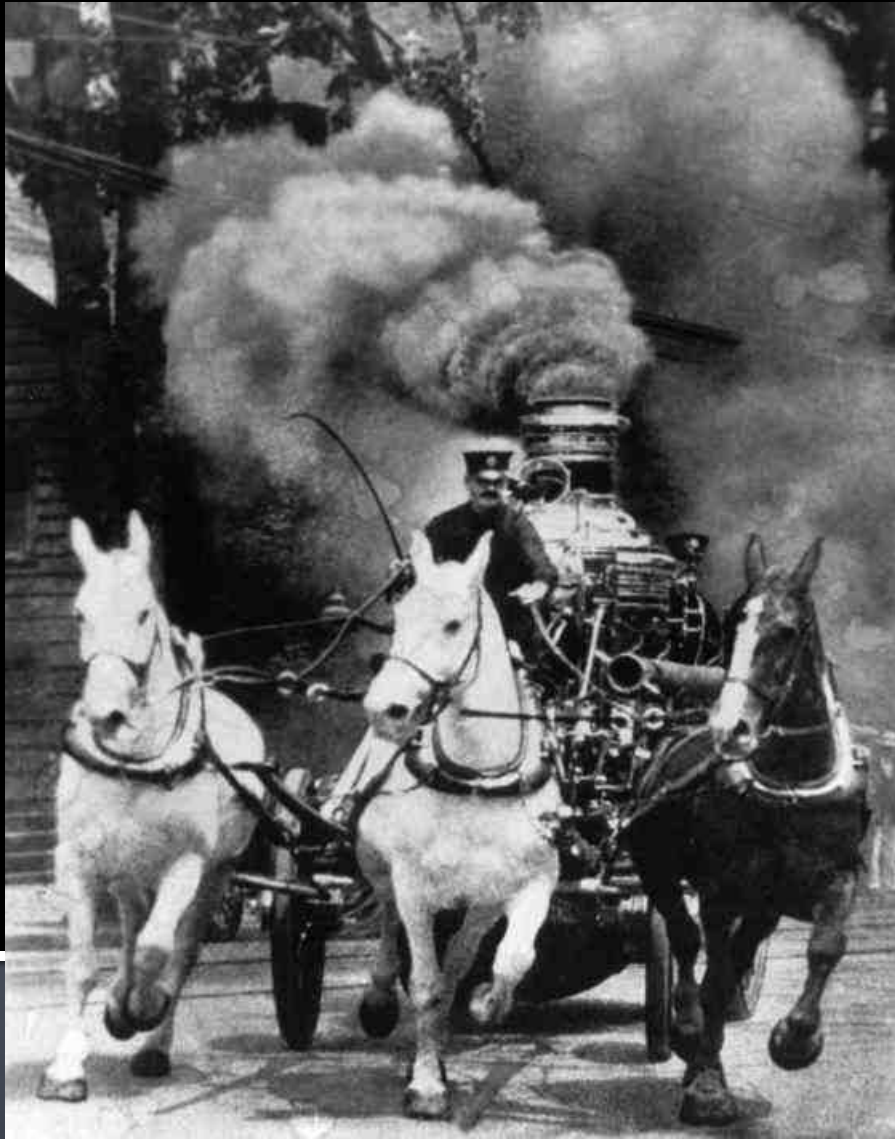


# DIESEL ENGINE REGENERATION ISSUES



Latest Federal Emissions Standards and  
the San Diego Fire-Rescue Department

# BACKGROUND

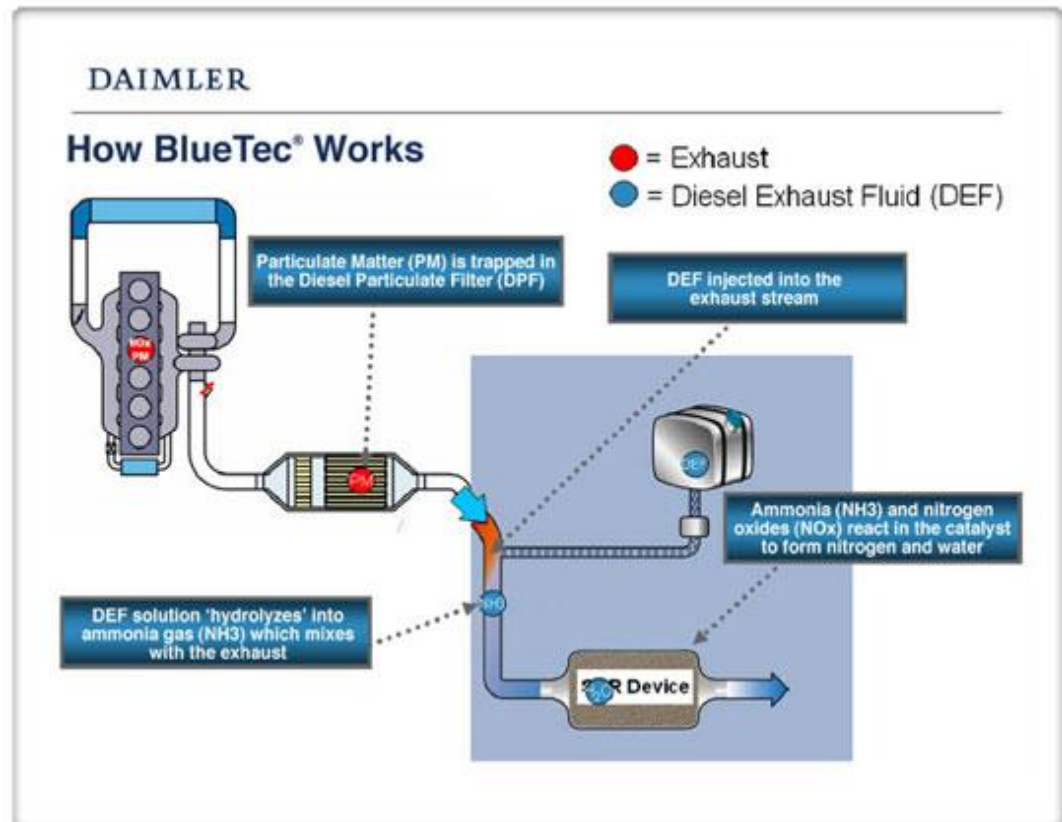
- As of 2007, all on-road diesel engines in the U.S. are required to comply with new federal regulations on soot emissions, regardless of vocation.
  - *This added about \$8K to vehicle price in 2007*
- This is done by capturing the soot in a special muffler (diesel particulate filter, or DPF) and burning it off periodically (the act of regeneration, or 'regen').

# BACKGROUND

- Early emissions systems were modifications to then-current engines, not 'new from the ground up' designs.
- For 2010, standards were increased requiring the addition of Selective Catalyst Reduction systems utilizing diesel exhaust fluid (DEF), or an enhanced EGR system.
  - *This added about \$30K to vehicle price in 2010*

# HOW DOES THIS WORK?

- Exhaust leaves the engine, and enters the filter;
- When full, a small amount of fuel enters the exhaust stream and is ignited, burning most of the soot;
- For 2010, DEF is added to eliminate nitrogen oxide, leaving only nitrogen and water.



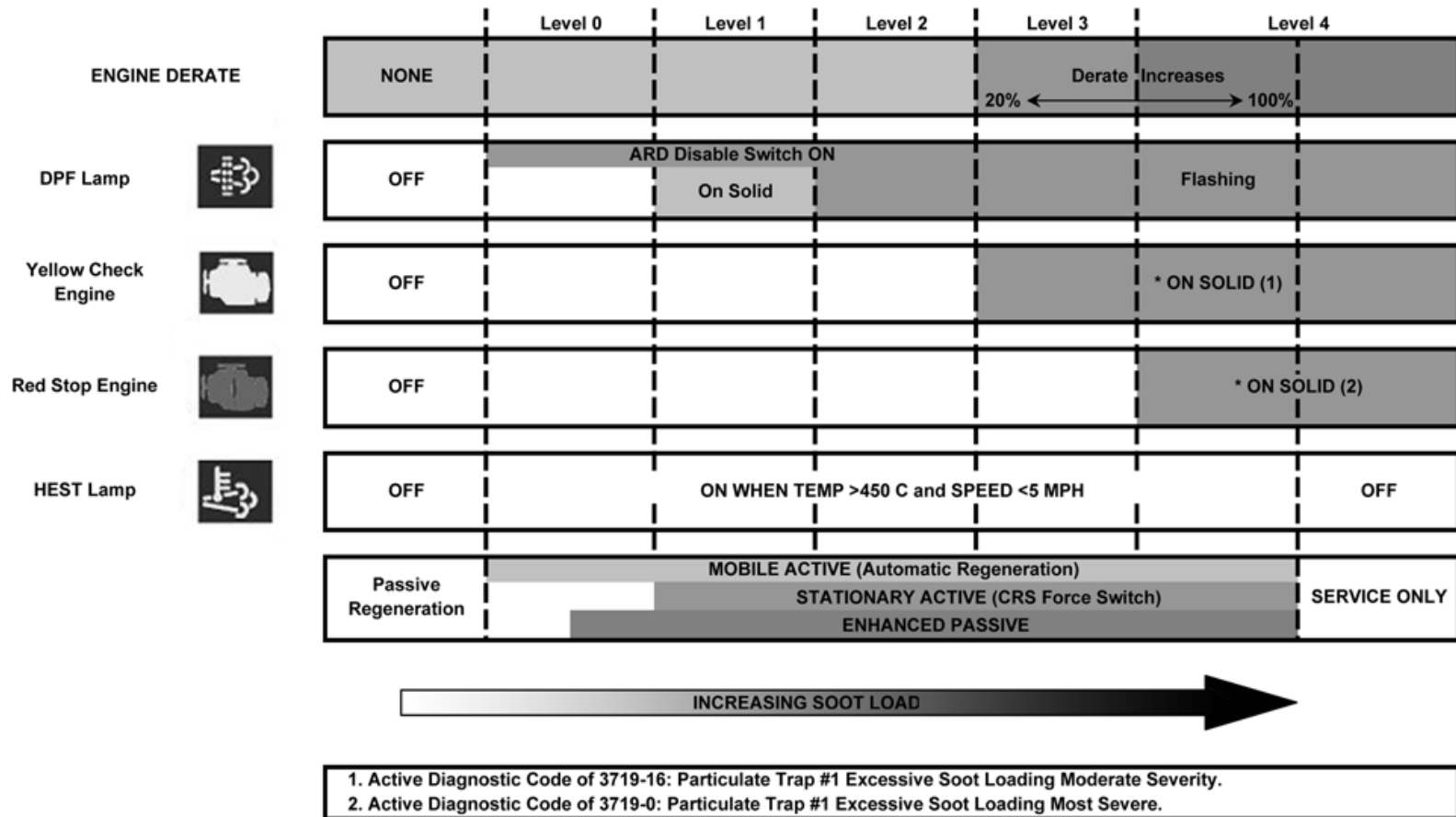
# WHEN DO WE HAVE TO REGEN?

- Indicator lights will tell the operator when regen is needed, and the severity of the request.
- All of our 2007 or newer diesel apparatus are affected (currently about 40 out of 150 diesel-powered vehicles).
- These 40 apparatus are spread throughout the city, 30+ on Type I (engine company) apparatus.

# HOW MANY WAYS TO REGEN?

- **Passive** – Simple act of driving can accomplish. No burn off is performed to clean DPF.
- **Mobile Active** – Burn off of soot occurs while driving. Must be sustained driving (like freeway). 45-60 minutes.
- **Stationary Active** – Park and use an on-board switch to active the regen process. 45-60 min.
- **Laptop Forced** – Performed by Fleet. 45-60 min. + drive time and wait for mechanic (routinely 2 hours total time).
- **Dealer Service Required** – Costly.

# “LEVELS” OF REGEN



# “THE PROBLEMS”

Several issues have plagued SDFD with regen

- Changed engine manufacturers in 2006, anticipating withdrawals from the market;
- Unfortunately, CAT pulled out of the OTR market in 2009 and did not further develop its technology we now own;
- CAT software and hardware issues (multiple component failures, ‘under’ engineering);
- Back with Detroit Diesel, but are seeing some issues with their 2009 engines;
- Pierce system software integration issues;
- Apparatus routinely failed to complete the regen cycle due to emissions-related failures, requiring change outs and extended out of service time;
- Issues are more prevalent in San Diego due to size of fleet, number of responses, new age of fleet.

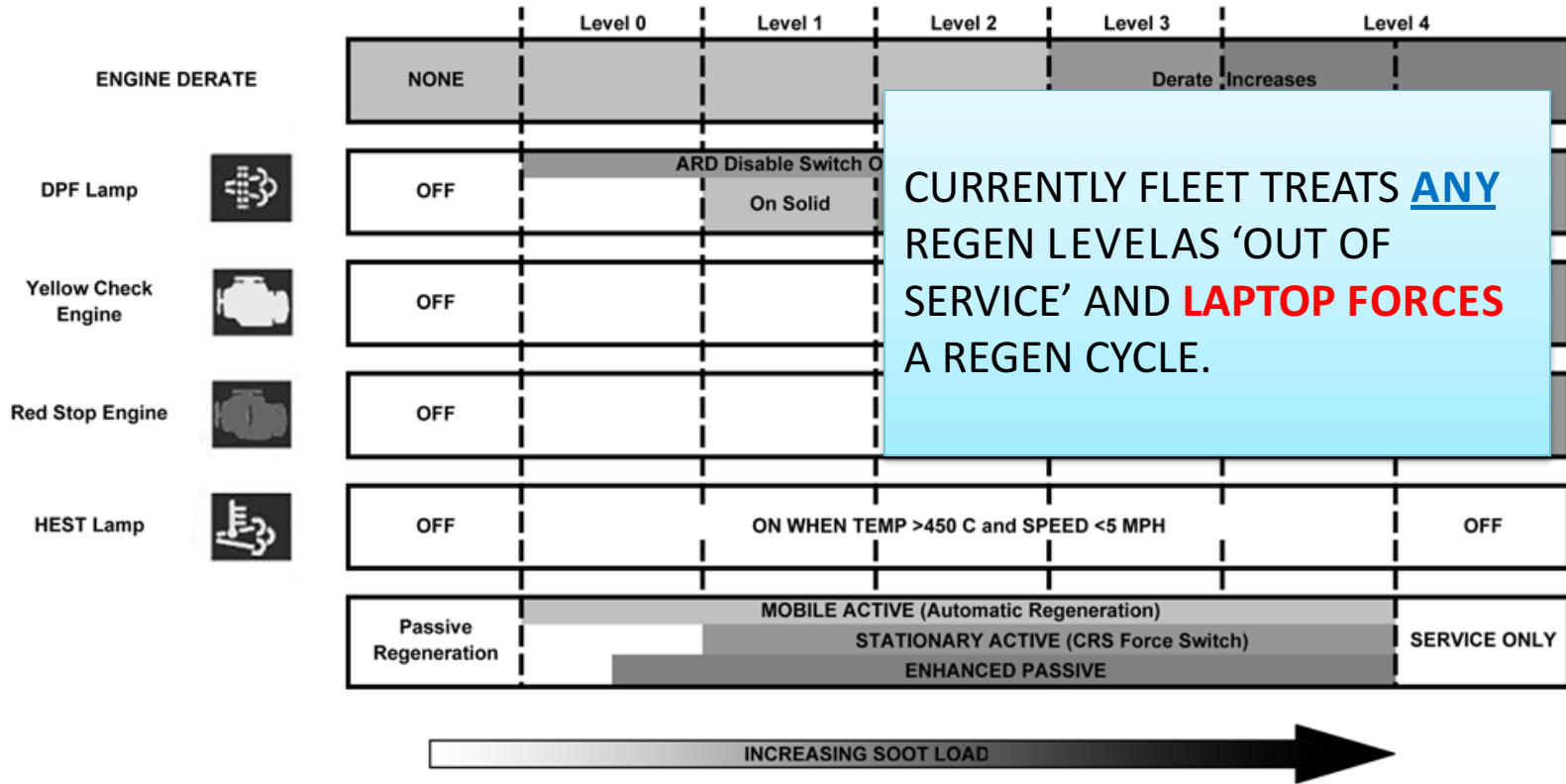
These issues drove Fleet Services current regen practice of a mechanic performing every regen



# IMPACT ON FIRE FLEET

- For the last 10 months of 2010, 195 'regen out-of-service' events occurred citywide;
- For the first 10 months of 2011, 355 'regen out-of-service' events occurred. Several new apparatus were added during this time, influencing this total;
- These are not necessarily failures, but regens that had to be performed. Many did result in extended out-of-service time or 'change outs'.





# CURRENT PRACTICE



CURRENTLY FLEET TREATS **ANY** REGEN LEVEL AS 'OUT OF SERVICE' AND **LAPTOP FORCES** A REGEN CYCLE.

1. Active Diagnostic Code of 3719-16: Particulate Trap #1 Excessive Soot Loading Moderate Severity.
2. Active Diagnostic Code of 3719-0: Particulate Trap #1 Excessive Soot Loading Most Severe.

# PROPOSED PRACTICE

		Level 0	Level 1
ENGINE DERATE	NONE		
DPF Lamp 	OFF	ARD Disable Switch O	On Solid
Yellow Check Engine 	OFF		
Red Stop Engine 	OFF		
HEST Lamp 	OFF		ON WHEN TEM
Passive Regeneration			MOBILE ACT ST
			INCREASING S

1. Active Diagnostic Code of 3719-16: Particulate Trap #  
2. Active Diagnostic Code of 3719-0: Particulate Trap #



A "LEVEL1" REQUEST WILL NOT REQUIRE OUT OF SERVICE STATUS.

MUST BE THE #2 PRIORITY BEHIND EMERGENCY RESPONSE.

CREWS WILL DOCUMENT ACTION IN ENGINEERS MANUAL. NO SHOP NOTIFICATION REQUIRED.

CAN BE PERFORMED IN DISTRICT.

CREW CAN INTERRUPT REGEN FOR AN EMERGENCY RESPONSE.

# PROPOSED PRACTICE

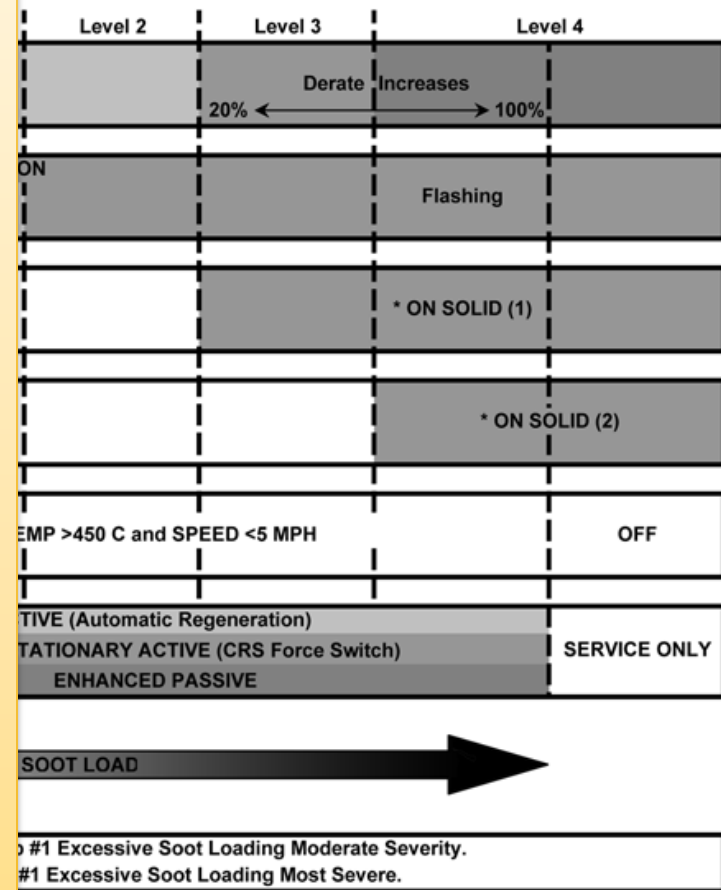
A "LEVEL2" REQUEST **WILL** REQUIRE OUT OF SERVICE STATUS.

IT MUST BE PERFORMED BEFORE ANY EMERGENCY RESPONSE.

CREWS WILL DOCUMENT ACTION IN ENGINEERS MANUAL. NO SHOP NOTIFICATION REQUIRED.

CAN BE PERFORMED IN DISTRICT.

WILL RESULT IN 45-60 MINUTE OOS TIME, vs. CURRENT 2 HOUR WINDOW WITH TRAVEL AND OTHER DELAYS.



# PROPOSED PRACTICE

## ENGINE DERATE

DPF Lamp



Yellow Check Engine



Red Stop Engine



HEST Lamp

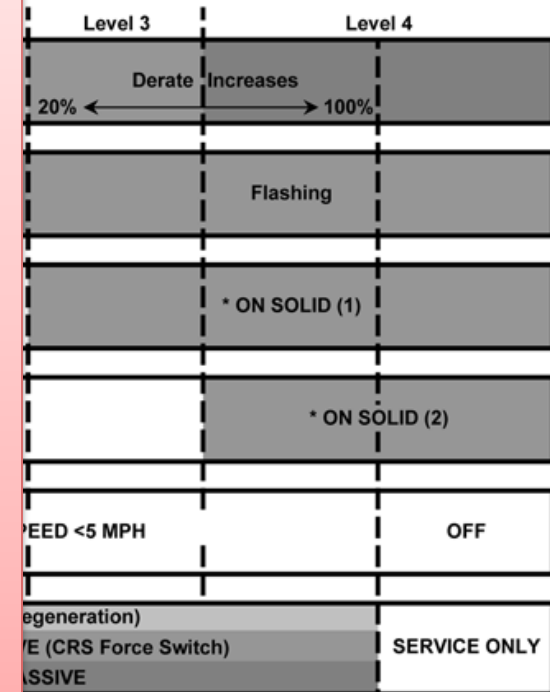


A "LEVEL3 or 4" REQUEST **WILL STILL REQUIRE OUT OF SERVICE STATUS TO PREVENT ENGINE DAMAGE.**

HORSEPOWER WILL BE DECREASED FROM 20-100%.

MUST CONTACT FLEET SERVICES FOR DIRECTION.

CAN ESCALATE QUICKLY TO A TERMINAL STATUS.



at Loading Moderate Severity.  
Loading Most Severe.

# MOVING FORWARD...

- Manufacturers are now working closely with Fleet Services to overcome problems with the existing fleet. Problems still exist, but have become less frequent. Continue to press for improvement;
- Have discussed these issues with the IAFF, manufacturers and other peer groups to capture problems;
- The beginning of field regens within 30 days will reduce total out-of-service time across the fleet, by eliminating travel time to Repair Facility or wait for mechanic;
- For 2010, specify a new engine specifically designed to incorporate these systems, for better reliability;
- Continue to seek out improved technology that will increase in-service time for future fleet purchases.

# QUESTIONS?

