



International Truck & Engine Corporation

The Engine Technology Leader

Emissions Improvement Program

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Who is International?

- **Leading North American Manufacturer**
 - **Heavy Duty Truck**
 - **Medium Duty Truck**
 - **School Bus**
 - **Severe Service Trucks**
- **Largest worldwide manufacturer of Mid-Range Diesels**
 - **160 hp to 300 hp**
 - **97% on-highway certified**



Who is International?

- **INTERNATIONAL® brand**
- **Plant Locations**
 - **Midwest**
 - **Canada**
 - **Mexico**
 - **Brazil**
- **100% Diesel Products**
- **International Trucks**
- **International Engines**



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- **RETROFIT DEVICE:**

- Any technology that allows reduction of Particulate Matter and/or NOx in diesel exhaust. This includes aftermarket devices and re-power.

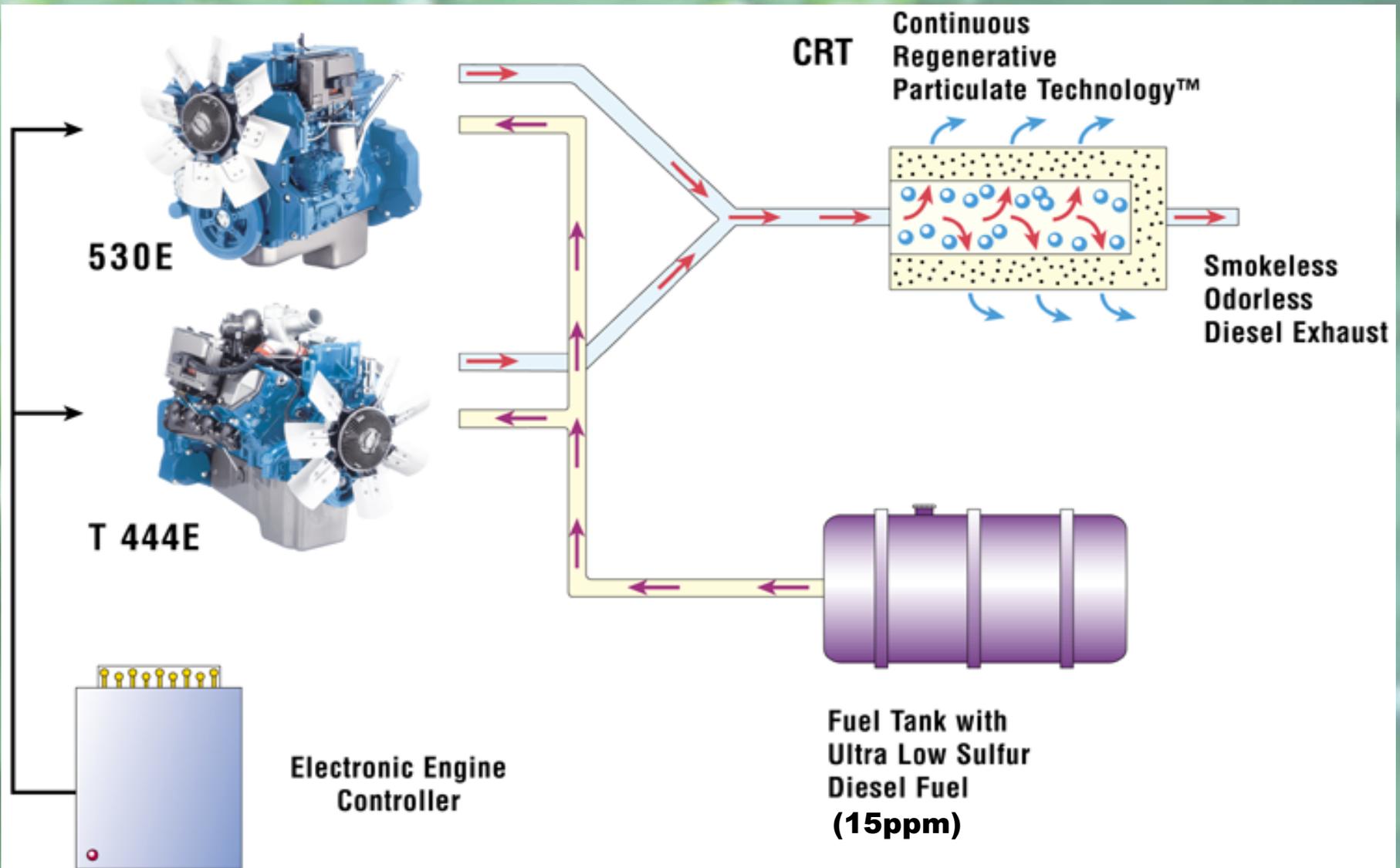


Why Green Diesel ?

- **Demonstrate that alternative-fuel emission levels can be achieved by diesel technology**
- **Demonstrate the emissions reductions that can be achieved with ultra-low sulfur fuel (Ultra-low sulfur fuel is a technology enabler)**
- **Provide an answer to public health concerns associated with particulate matter and toxic hydrocarbons**

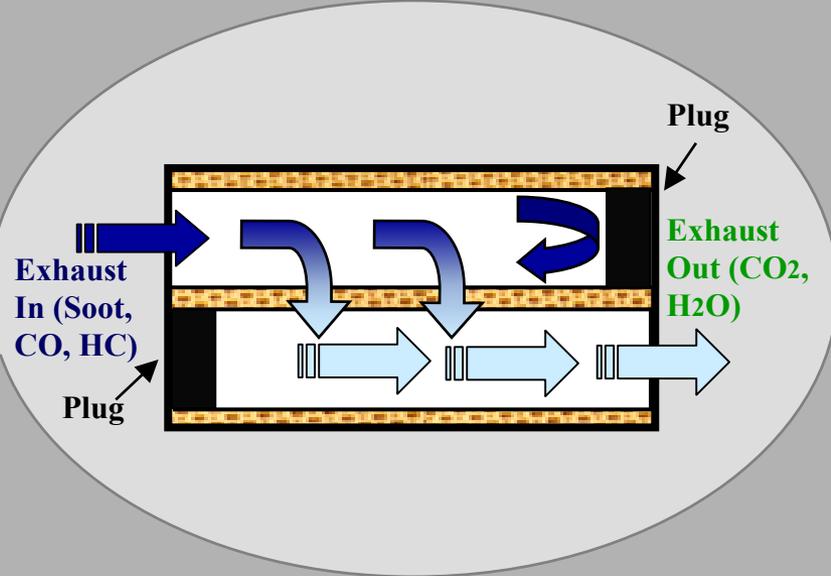


Green Diesel Technology™



Single Brick Passive Diesel Particulate Filter

- Honey Comb Structure
- Alternate Plug



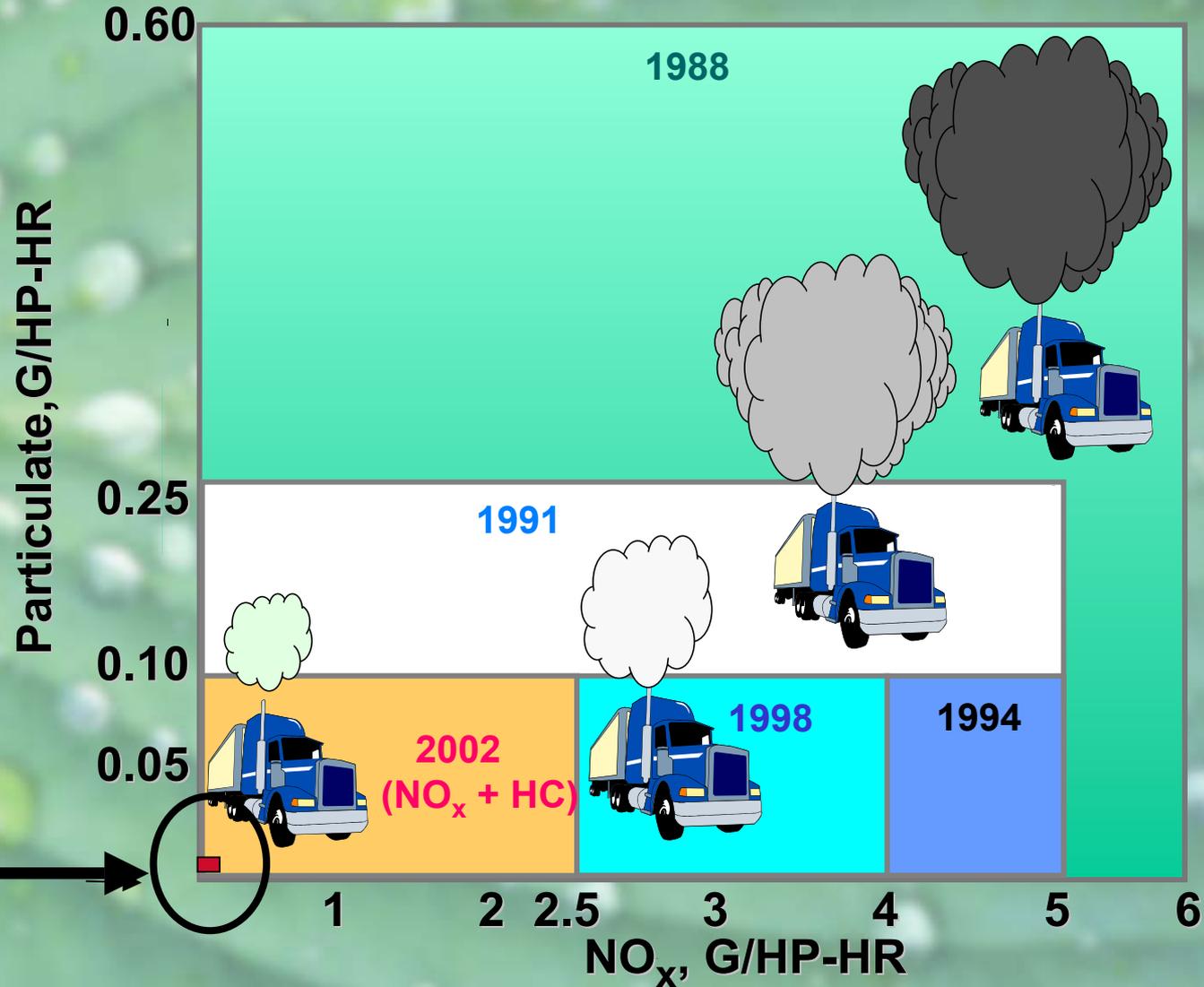
- Exhaust device that traps soot and oxidizes (burns) it at diesel exhaust temperatures.

ENGELHARD
Change the nature of things.



Emissions Standards Overview

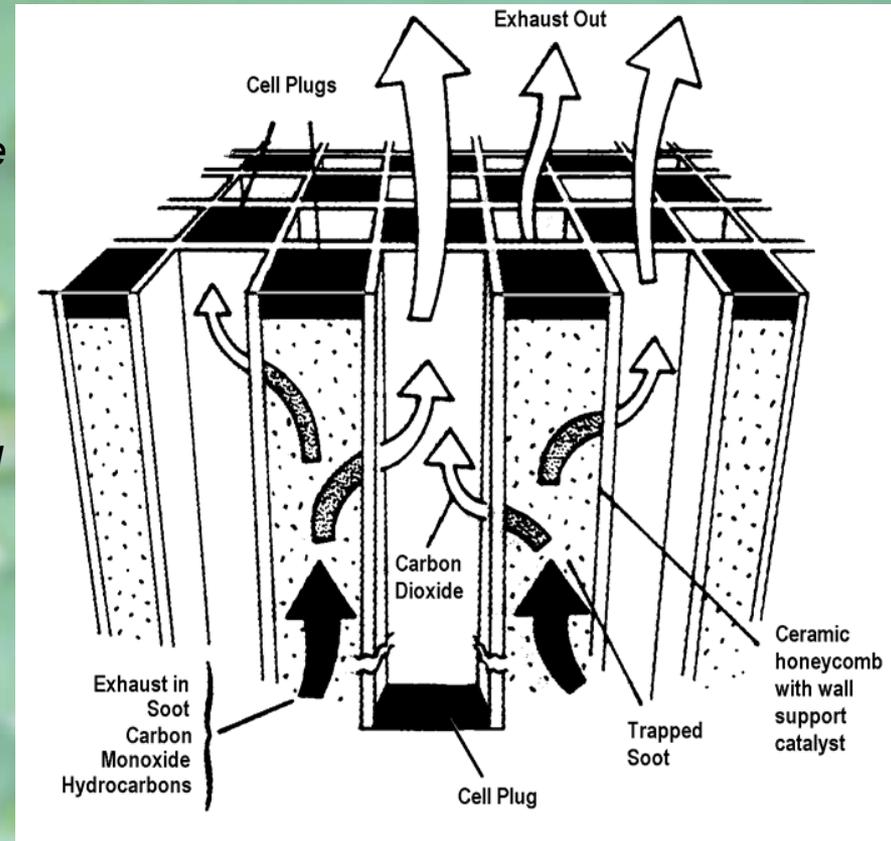
2002 to 2007 shows an unprecedented reduction of both NO_x and PM by 90% to
Nox - 0.2 G/HP-HR
PM - 0.01 G/HP-HR





DPXTM Technology Description

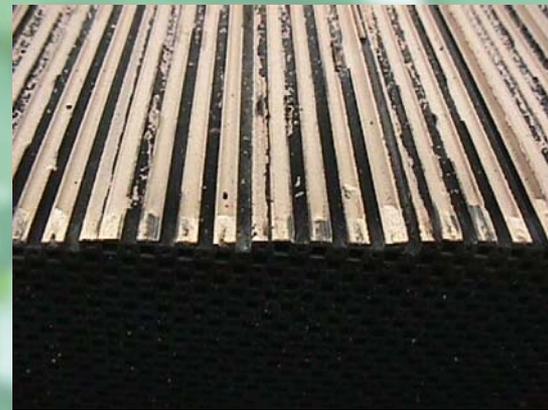
- *It is a Catalyzed cordierite wall flow filter*
- *It uses two distinct catalytic materials – a base metal oxide - CeO₂ and Platinum*
- *DPX is a washcoat technology – This creates a high surface area for better catalyst function.*
- *The WWF substrate captures 99% of the solid particulate*
- *The catalyst lowers the combustion temperature or the particulate below 300C*
- *A DPX eliminates up to 98% TPM, 90% HC and CO*





DPX™ Catalyzed Diesel Soot Filter Functions

- *Removal of Solid Carbon Soot from Exhaust - Physical Filtration. This is a Function of the Porous Filter Substrate.*
 - *Surface Filters (e.g. Wall-Flow, >90% Efficiency). Fine Pore Sizes. 40-60% Void Volume. Efficiency can Increase with Soot Accumulation as a Surface Layer (Soot Cake). Limited Penetration of Soot Particles Into Porous Filter Wall.*
- *Soot Accumulation Shown in Inlet Channels of Cordierite Wall Flow Filter:*





Program Guidelines

- **FUEL**
- **ENGINES**
- **DUTY CYCLE**



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- **Requires Ultra Low Sulfur Fuel**
(<15 ppm)
 - **Reduces Balance Temperature**
 - **Reduces Sulfates**

Ultra-low sulfur fuel is a technology enabler



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ENGINES

- **I-6 (DT 466/530)**
 - **Electronic Only**
 - **1995 & Newer**
- **V-8**
 - **T444E**
 - **1995 & Newer**



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•DUTY CYCLE

–225⁰ C at DPF

–50% of Time

–300⁰ C at DPF

–10% of Time



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RESULTS

- Durability
- Performance (Torque)
- Contributes less to greenhouse gas emissions
- Lower PM emissions
- Lower HC emissions
- Lower CO emissions

Diesels Can Be Clean and Safe !

Good

Diesel Oxidation Catalyst (DOC)

1 step

- DOC only required

Applications:

Mechanical engines built before 1994 (All – makes)

Benefits:

20 to 25% PM reduction

Better

Particulate Filter (Retro-fit Kit)

2 step

- Particulate Filter required
- Ultra low sulfur fuel (15ppm)

Applications:

Electronic engines built after 1994 (All Makes)

Benefits:

90 % or more PM reduction
4 to 5 % NOx reduction

Best

Green Diesel Upgrade (GDT)

3 step

- Particulate Filter required
- Ultra-low sulfur fuel (15ppm)
- Engine Re-calibration

Applications:

Electronic engines built 1999-2003 (International only)

Benefits:

90 % or more PM reduction
25 to 30% NOx reduction



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CONCLUSIONS

- **Alternative-fuel emission levels can be achieved with diesel**
- **Alleged toxic emissions eliminated**
- **No new fueling infrastructure required**
- **No fuel handling issues**
- **No special tanks required**
- **No operating range issues**
- **Lower cost/vehicle enables faster fleet turnover**
- **No additional safety issues**



INTERNATIONAL Green Diesel Technology™



International Green Diesel Heavy Truck



INTERNATIONAL Green Diesel Technology™



International Green Diesel School Buses



INTERNATIONAL Green Diesel Technology™

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