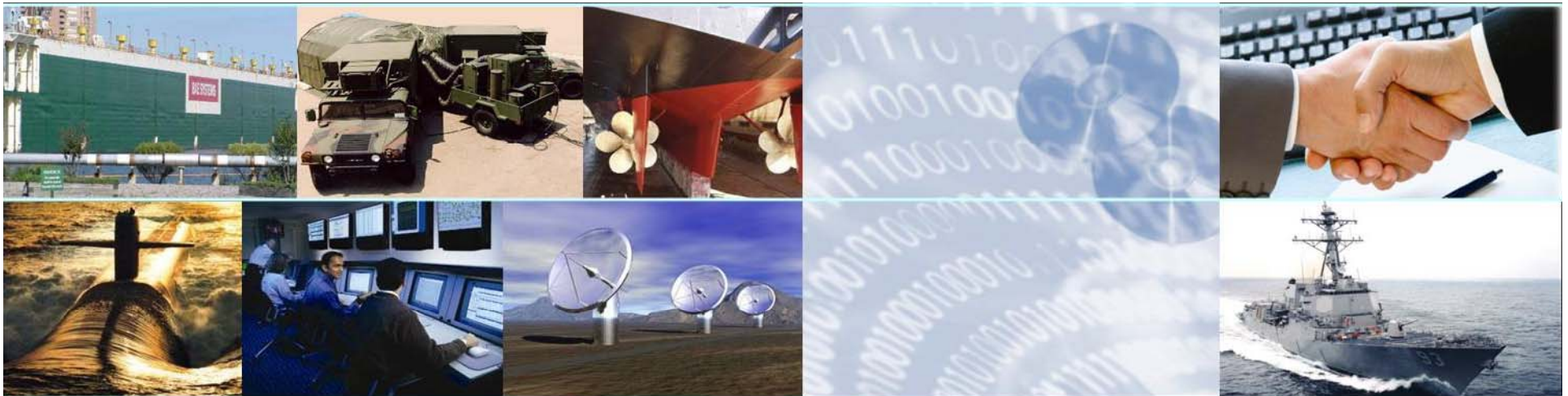


# National Shipbuilding Research Programs (NSRP) Environmental Technologies Panel (ETP)

## *Regulation of Internal Combustion Engines*

February 10, 2010



## Regulatory History and Rationale

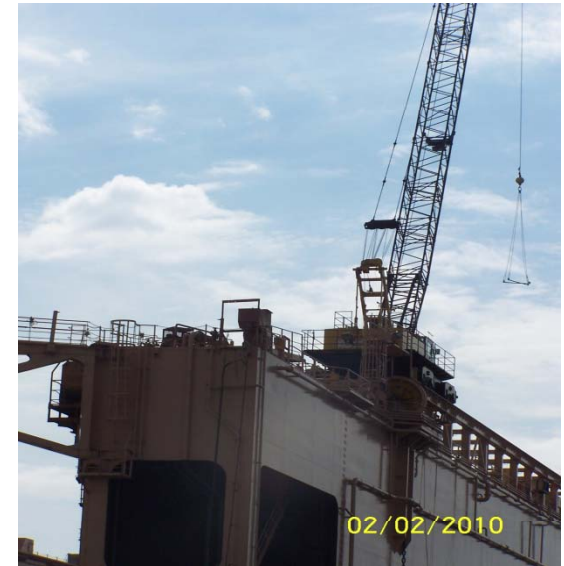
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- Diesel engines emit a complex mix of pollutants, the most visible of which are very small carbon particles or "soot", known as diesel PM
  - Cancer, premature death, and other health problems
  - Diesel engine emissions are responsible for the majority of California's known cancer risk from outdoor air pollutants
- 1990, OEHHA (Cal EPA) listed *diesel engine exhaust* on Prop 65 as known to cause cancer
- 1998, California identified *diesel PM* as a toxic air contaminant (TAC)
- 2000, California Air Resources Board (CARB) developed Diesel Risk Reduction Plan
  - Goal = reduce diesel PM by 85% by 2020
  - Regulate all diesel engines in CA

## ARB Engine Regulations

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- Off-Road Large Spark-Ignition Engines
  - 13 CCR 2775 (13 pages)
- Portable Diesel-Fueled Engines
  - 17 CCR 93116 (20 pages)
- Diesel Engines on Commercial Harbor Craft
  - 17 CCR 93118.5 (46 pages)
- Off-Road Diesel Vehicles
  - 13 CCR 2449 thru 2449.3 (53 pages)
- On-Road Heavy-Duty Diesel Vehicles
  - 13 CCR 2025 (50 pages)
- Stationary Compression-Ignition (Diesel-Fueled) Engines
  - 17 CCR 93115 (52 pages)



## Tier Standards

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- Tier standards for new off-road (nonroad) engines adopted by EPA after agreements made with engine manufacturers
- Phase-in
  - Tier 1: 1996-2000
  - Tier 2 & 3: 2000-2008
  - Tier 4: 2008-2015 (don't expect to see for most engine until 2011-2014)
- Tier 1-3 standards are met through advanced engine design, with no or only limited use of exhaust gas after treatment (oxidation catalysts)
- Tier 4 standards require that emissions of PM and NOx be further reduced by about 90% from Tier 2 & 3 standards.
  - achieved through the use of control technologies—including advanced exhaust gas after treatment.

## Off-Road Large Spark-Ignition (LSI) Engines

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- Applicability
  - 25 bhp and greater
  - Fueled by gasoline, CNG, or LPG
  - Forklifts, industrial tow tractors, sweepers/scrubbers
- Baseline Fleet Average by November 12, 2007
- Tightening fleet averages in 2009, 2011, and 2013
  - Nox Emissions only
  - Records and compliance determinations/status maintained onsite only
  - Fleet average includes lease and rental equipment
  - Only if operate equipment over 250 hours per year, through 2010
  - Cannot “double” count in both LSI and Off-Road fleet calculations
  - May include electric Class 1 and 2 forklifts
  - Large, medium, and small fleet based on pieces of equipment
    - Medium = 4 to 25 pieces of equipment



## Portable Diesel-Fueled Engines

- Applicability
  - 50 bhp and greater
  - Examples: Cranes, portable generators, air compressors
  - Moves from one location to another to perform function
    - Equipment not in same location for > 12 months
    - Location means any single point at a facility
- Tier 0 engines removed from service by December 31, 2009
  - ARB recently added a small exemption if own less than 25 engines, then up to 5 Tier 0 engines may be used for another year.
- Requires ARB or APCD registration or permit



## Portable Diesel-Fueled Engines

- Fleet Average calculations tightening in 2013, 2017, and 2020
  - by 2020 all engines Tier 4 equivalent
- Rental engines not included in facility fleet



## Portable Engine – State Territorial Waters

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- ARB registered engines require 14-day notification prior to operation in State Territorial Waters (STW)
  - STW includes water within shipyard
  - Engines on ships, primarily when docking or undocking from dry dock
- Notification to local air agency (APCD)
  - Information required in notification:
    - engine make, model, and year
    - usage hours and time estimate
    - emissions created during the duration of the project
  - APCD conducts an air quality analysis prior to giving approval for operation
- Typically operate in STW for only a few hours and use an emergency fire pump, but 14-day notification still required

## Diesel Engines on Commercial Harbor Craft

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- Applicability
  - Diesel fueled harbor craft engines
  - Auxiliary engines on harbor craft vessels
  - Examples: engines on dry docks and floating barges
- Exemption
  - Registered in State of California before 1/1/09
  - Registered in State of California after 1/1/09 and not permanently affixed to the vessel (portable engine)
- Initial report due by Feb 28, 2009 (one month grace period)
  - Electronic reporting available
- Engine replacement requirements for ferries, excursion vessels, tugboats, towboat, push boats, and multipurpose harbor craft only



## Off-Road Diesel Vehicles

- Applicability
  - Off-Road compression-ignition vehicle engines 25 bhp and greater used to provide motive power to any off-road motor vehicle
  - Examples: Cranes, forklifts, and aerial lifts
- Fleet Average Calculations
  - Small (<2500 hp), medium, large fleets (>5000 hp)
  - Fleet size includes all vehicles owned by corporation and operated in CA
  - NOx and PM requirements
  - Emission requirements begin 2010-2020
  - NOx BACT & PM retrofit turnover allowed if can't meet fleet targets



## Off-Road Diesel Vehicles

- No idling for more than 5 minutes
  - Large and medium fleets must have written idling policy by March 1, 2009
- Reporting
  - Initial reporting in 2009 (April, June, August) with online reporting (DOORS)
  - Update when changes occur to fleet
- Labels
  - All equipment in fleet must have a label with equipment identification number
  - Right side of vehicle and 5 feet above ground
  - Characters 3" tall and 1.5" wide
  - White numbers on red background



# Off-Road Diesel Vehicle Fleet Calculation Example

EQUIPMENT TYPE	Certified/Verified Level	Engine HP	NOx (g/bhp-hr)	PM (g/bhp-hr)	Index NOx	Index PM	Target 2010 NOx	Target 2010 PM	Target Calc Nox	Target Calc PM
Crane	Tier 2	46	4.9	0.45	225.4	20.7	5.8	0.46	266.8	21.16
Crane	Tier 1	300	6.9	0.4	2070	120	5.9	0.18	1770	54
Crane	Tier 2	275	4.3	0.15	1182.5	41.25	6.2	0.23	1705	63.25
Forklift	Tier 0	210	13.6	0.78	2856	163.8	6.2	0.23	1302	48.3
Forklift	Tier 0	112	9.3	0.54	1041.6	60.48	6.4	0.33	716.8	36.96
Forklift	Tier 0	125	9.3	0.54	1162.5	67.5	6.4	0.33	800	41.25
Forklift (P)	Tier 2	84	4.9	0.3	411.6	25.2	7.1	0.62	596.4	52.08
Forklift (P)	Tier 2	94	0.97	0	91.18	0	7.1	0.62	667.4	58.28
Forklift (P)	Tier 2	94	0.97	0	91.18	0	7.1	0.62	667.4	58.28
Forklift (P)	Tier 2	94	0.97	0	91.18	0	7.1	0.62	667.4	58.28
Forklift (P)	Propane	98	2	0	196	0	7.1	0.62	695.8	60.76
Forklift (P)	Propane	98	2	0	196	0	7.1	0.62	695.8	60.76
					9811.14	498.93			11246.6	674.12
				<b>Index 2010</b>	<b>5.68</b>	<b>0.29</b>	<b>Target 2010</b>		<b>6.51</b>	<b>0.39</b>

## On-Road Heavy Duty Diesel Vehicles

- Applicability
  - On-Road diesel-fueled vehicles registered to be driven on public highways and have a gross vehicular weight rating greater than 14,000 pounds
  - Examples: flat-bed trucks, large tool vans, and tractor trailers
- Exemptions
  - Small (3 or few vehicles) exempt, and
  - Less than 1000 miles per year & 100 hours per year



## On-Road Heavy Duty Diesel Vehicles – cont.

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- Fleet Average Calculations
  - Fleet size includes all vehicles owned by corporation
  - Fleet requirements for medium-heavy duty and heavy heavy-duty
  - NOx and PM requirements
  - Emission requirements begin 2011-2023
  - NOx BACT & PM retrofit turnover allowed if can't meet fleet targets
- Reporting
  - Annual compliance reports due beginning 2011.



## Stationary Compression Ignition (Diesel-Fueled) Engines

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- Applicability
  - 50 bhp and greater
  - Examples: generators, emergency generators, air compressors, pumps
  - Remains at the same location for more than 12 months
    - Location means any single point at a facility
- In-use prime engines required to have diesel particulate filter
- Emergency engines limited hours per year for maintenance and testing depending on engine's current emissions
- New prime use engines must meet an emission limit of 0.01 g/bhp-hr, equivalent to a Tier 3 engines with a diesel particulate filter

## Enhanced Vapor Recovery (Gasoline Station)

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- California State Regulation for Vapor Recovery at Gasoline Stations
  - Requires Enhanced Vapor Recovery (EVR)
  - Low-use exemption if less than 2,000 gallons pumped per month (20 company vehicles exceeds this threshold)
  - Cost of EVR for one gasoline pump \$100,000
- Exemption
  - 95% of vehicles have onboard refueling vapor recovery (ORVR)
  - ORVR phased-in beginning for cars in 1998 and light-duty trucks in 2001
  - Some of BAE Systems fleet without ORVR fueled off-site with gas cards (2004 model year trucks)
  - Removed Phase II vapor recovery
  - Only required to have Phase I vapor recovery because of ORVR



# Heavy-Duty Diesel Vehicles Green House Gas Regulation

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- Applicability
  - Heavy-duty tractors that pull 53-foot or longer box-type trailers
  - 53-foot or longer box-type trailers pulled by heavy-duty tractors
  - Trucks driving on a highway within California
- Compliance
  - Use U.S. EPA SmartWay certified tractors or trailers
  - Retrofit existing fleet with SmartWay verified technologies

