

Emergency Diesel Generator Air Quality Regulations

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CLEAN WATER SoCAL
CREATING SUSTAINABLE SOLUTIONS

Air Quality Regulations

(The 5-Stages of Grief)

Common responses to new air quality requirements:

- Why do we need an air quality permit? (*Denial*)
- AQMD is out of control.... (*Anger*)
- We never had to comply with that before...(*Bargaining*)
- (*Depression*)
- (*Acceptance*)



Why Do We Have Air Quality Regulations?



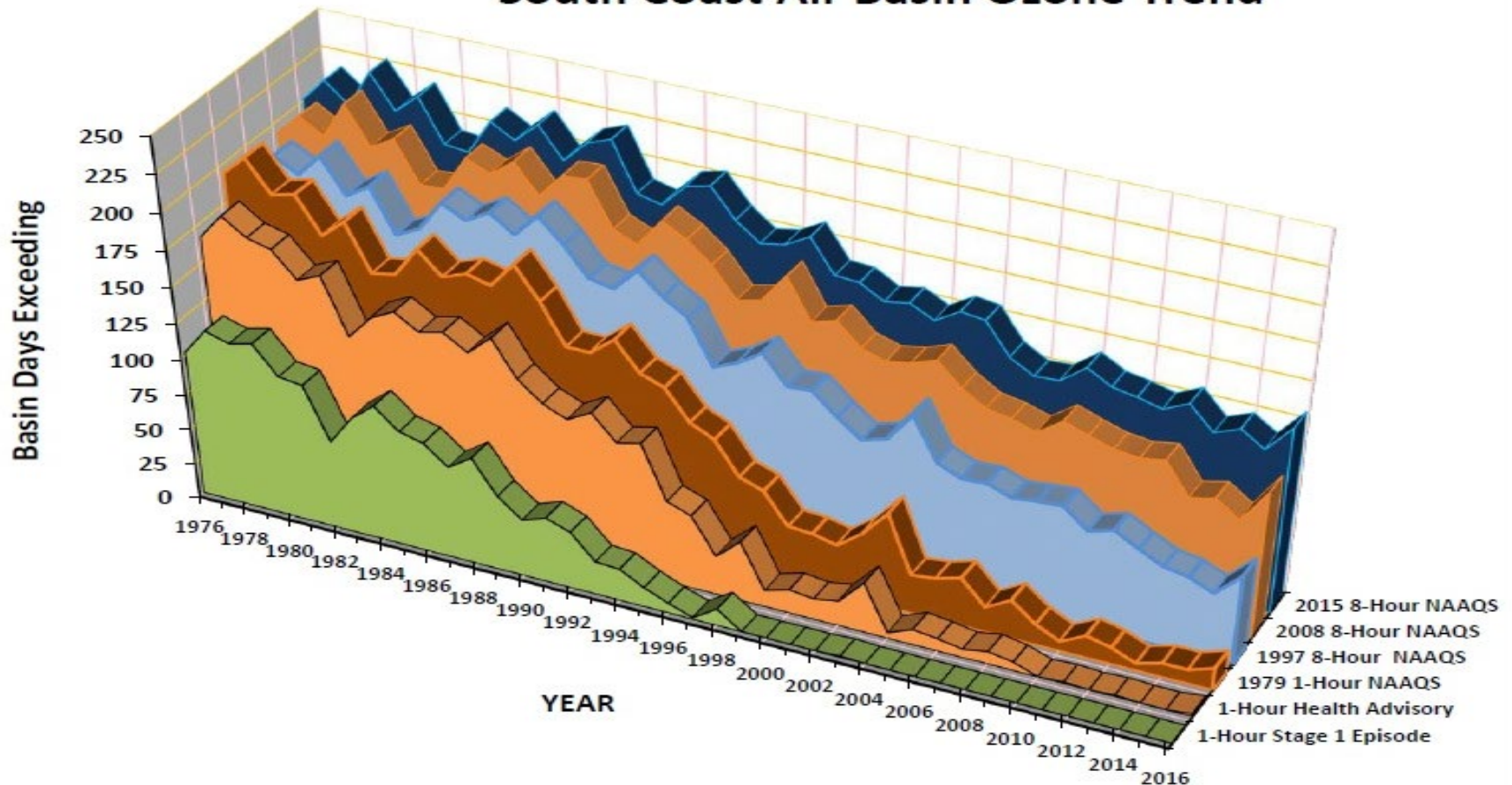
Foundation of Air Quality Requirements

Clean Air Act:

- Established National Ambient Air Quality Standards
- States to achieve standards within specific deadlines or face penalties
- Established requirements to reduce hazardous air pollutants
- Standards to be reviewed every five years by an advisory committee without consideration of cost

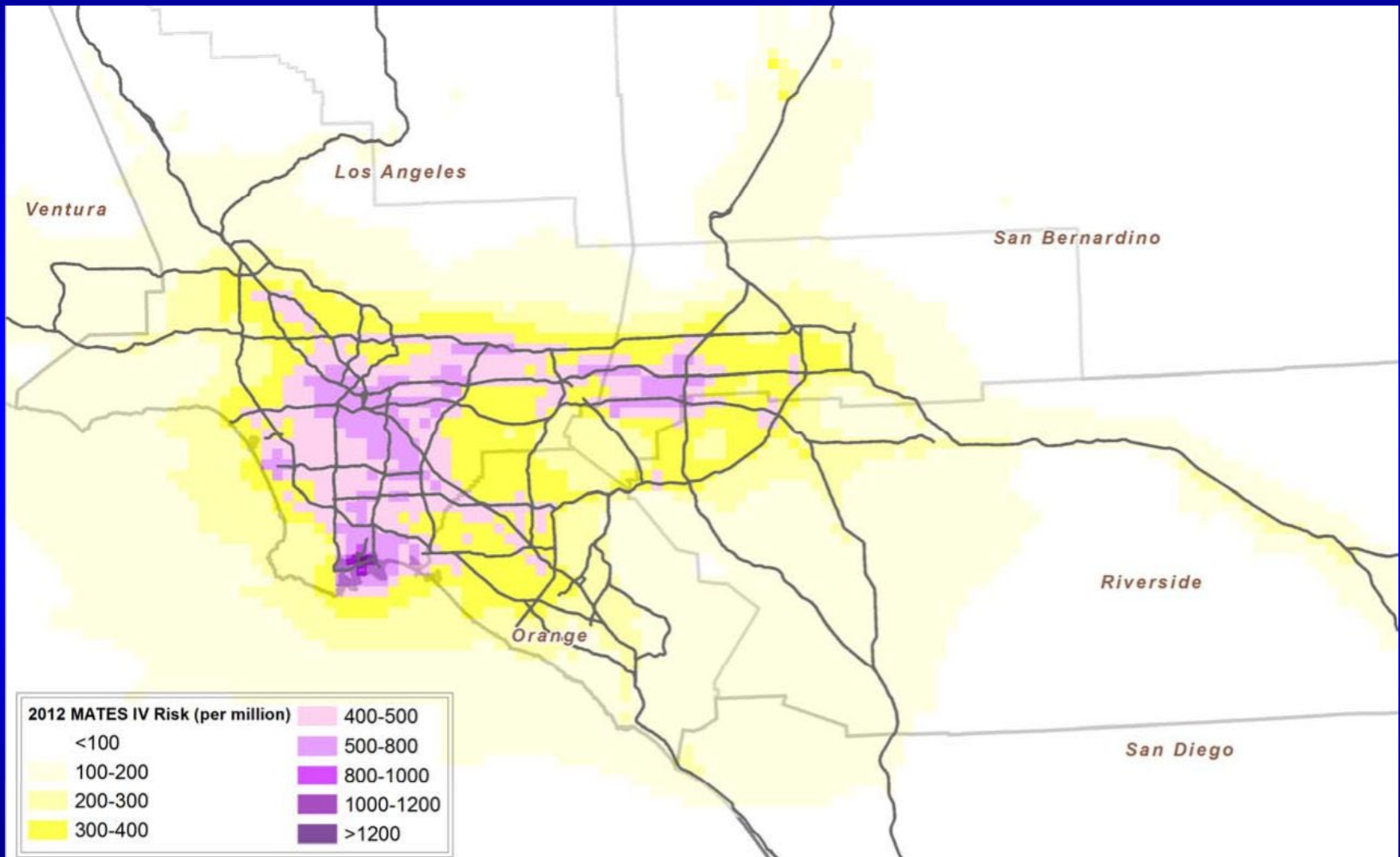
Air Quality Standards Have Become More Stringent Over Time

South Coast Air Basin Ozone Trend



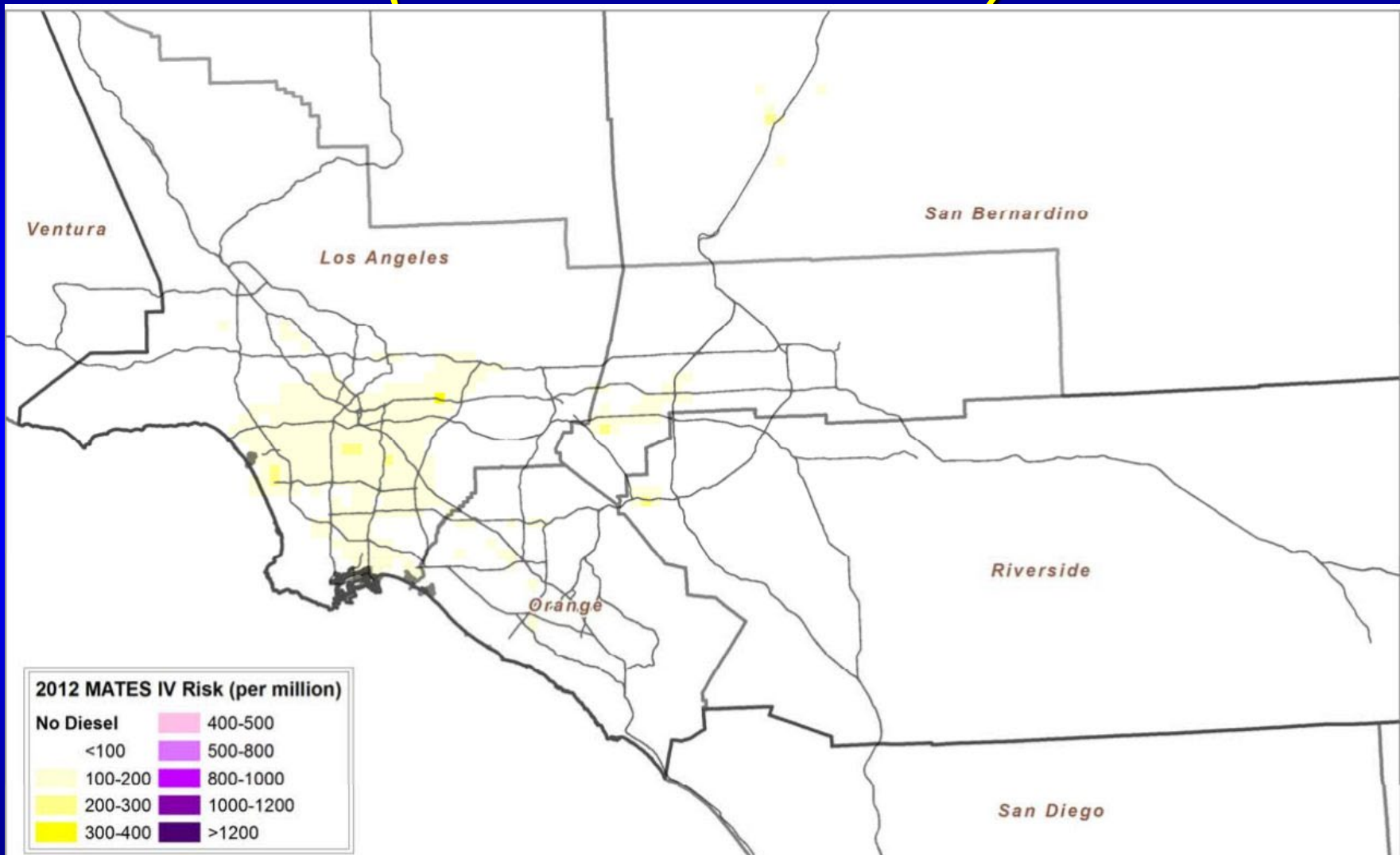
South Coast Air Basin – Days in Exceedance

South Coast Air Basin Cancer Risk



Source: Multiple Air Toxics Exposure Study in the South Coast Air Basin, MATES IV (SCAQMD, 2015)

South Coast Air Basin Cancer Risk (No Diesel Emissions)



***Source: Multiple Air Toxics Exposure Study in the South Coast Air Basin, MATES IV
(SCAQMD, 2015)***

The Desired Air Quality World



What About Emergency Diesel Generators?



Portable



Stationary

Deemed by regulators and environmental groups as having significant emissions (~4 tons per day of NOx in SCAQMD)

Emergency Diesel Generators Stationary vs. Portable Units

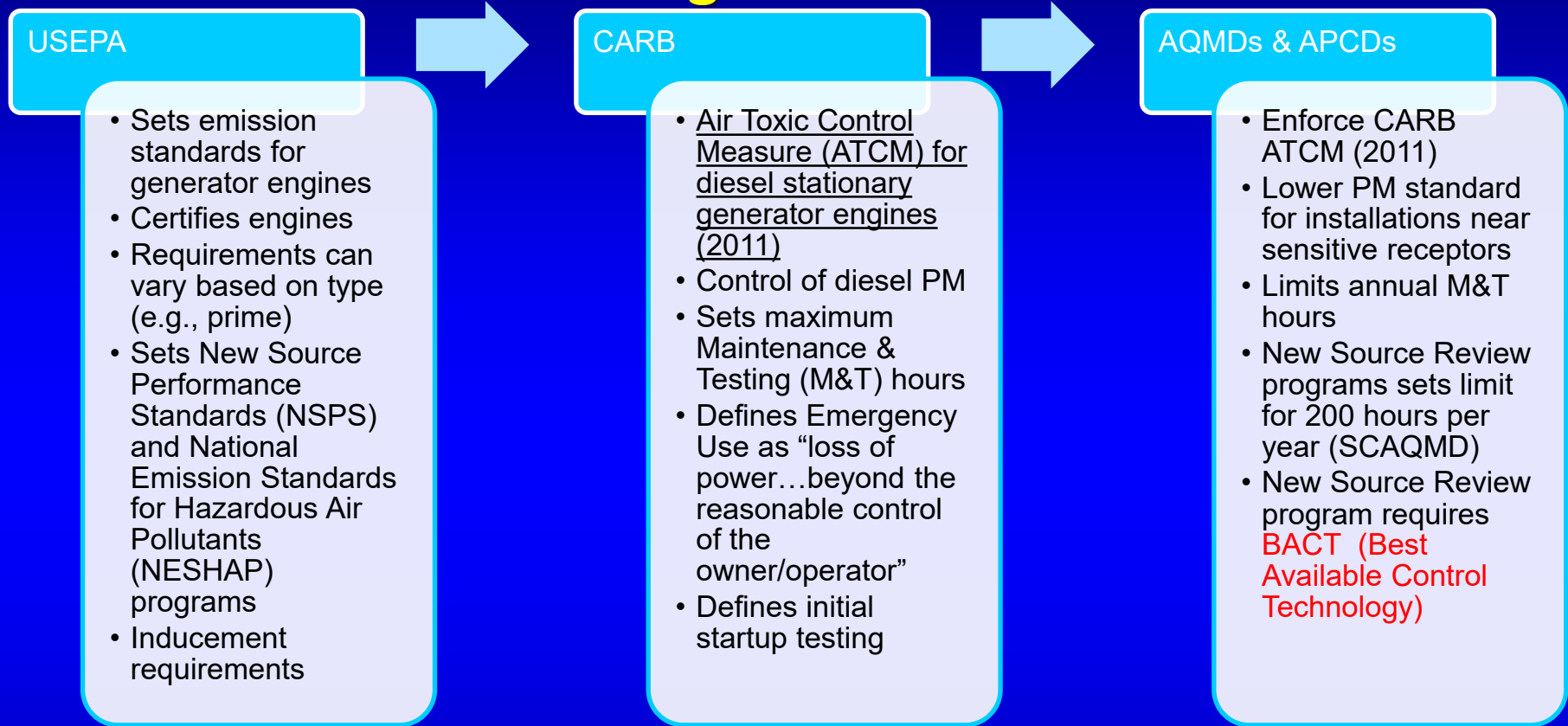
- **Stationary:**

- Fixed location
- 20 to 50-hours per year maintenance and testing limit
- 200-hours per year emergency use limit in South Coast

- **Portable:**

- 12-month limit at any location (**i.e., it's not stationary**)
- Moving from one location to another does not reset the 12-month clock
- Use limited for unforeseen interruptions of electrical power, maintenance and repair, and electrical upgrades

Stationary Emergency Diesel Generator Regulations



The most restrictive requirements are usually required by local air districts/air pollution control districts, which are implemented via BACT, retrofit rules, and during permitting. Tier 4 diesel generators are starting to be required

Portable Emergency Diesel Generator Regulations

Table 1. Off Road Compression - Ignition Diesel Engine Standards (NMHC + Nox/CO/PM in g/bhp hr.)

hp (kw)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015+
≥ 50 (37) < 75 (55.5)				N/A ^(b) 6.9 (9.2) N/A N/A						5.6 (7.5) 3.7 (5.0) 0.30 (0.40)				3.5 (4.7) 3.7 (5.0) 0.22 ^(c)					3.5 3.7 0.02 ^(c)		
≥ 75 (55.5) < 100 (75)				N/A ^(b) 6.9 (9.2) N/A N/A						5.6 (7.5) 3.7 (5.0) 0.30 (0.40)				3.5 (4.7) 3.7 (5.0) 0.3				0.14 2.5 3.7 0.01 ^(b,d)			0.14 0.29 3.7 0.01 ^(b)
≥ 100 (75) < 175 (130) ^(e)			N/A ^(b) 6.9 (9.2) N/A N/A						4.9 (6.6) 3.7 (5.0) 0.22 (0.30)				3.0(4.0) 3.7 (5.0) 0.22					0.14 2.5 3.7 0.01 ^(b,d)			0.14 0.29 3.7 0.01 ^(b)
≥ 175 (130) < 300 (225) ^(e)		1.0 (1.3) ^(b) 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)							4.9 (6.6) 2.6 (3.5) 0.15 (0.20)			3.0 (4.0) 2.6 (3.5) 0.15 ^(e)					0.14 1.5			0.14 0.3 2.6 0.01 ^(b)	
≥ 300 (225) < 600 (450) ^(e)		1.0 (1.3) ^(b) 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)					4.8 (6.4) 2.6 (3.5) 0.15 (0.20)					3.0 (4.0) 2.6 (3.5) 0.15 ^(e)					2.6 0.015 ^(b,d)			0.14 0.3 2.6 0.01 ^(b,d)	
≥ 600 (450) ≤ 750 (560) ^(e)		1.0 (1.3) ^(b) 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)				3.0 (4.0) 2.6 (3.5) 0.15 ^(b)					0.14 1.5 2.6 0.015 ^(b,d)			0.14 0.3 2.6 0.01 ^(b,d)	
> 750 (560) ^(e)						1.0 (1.3) ^(b) 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)					0.3 2.6 2.6 0.07 ^(b)			0.14 2.6 2.6 0.03 ^(b)	
> 750 ≤ 1207	Generators					1.0 (1.3) ^(b) 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)					0.3 2.6 2.6 0.07 ^(b)			0.14 0.5 2.6 0.02 ^(b)	
> 1207	Generators					1.0 (1.3) ^(b) 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)					0.3 0.5 2.6 0.07 ^(b)			0.14 0.5 2.6 0.02 ^(b)	

Tier 4

a. The PM standard for hand-start, air cooled, direct injection engines below 6 bhp may be delayed until 2010 and be set at 0.45 g/bhp-hr.

b. Standards given are NMHC/NOx/CO/PM in g/bhp-hr.

c. Engine families in the power category may alternately meet Tier 3 PM standards (0.3 g/bhp-hr) from 2008-2011 in exchange for introducing final PM standards in 2012.

d. The implementation schedule shown is the three-year alternate Nox approach. Other schedules are available.

e. Certain manufacturers have agreed to comply with these standards by 2005.

Note: This chart was converted into bhp units based on the chart at <http://www.arb.ca.gov/msprog/offroad/offroad.htm> 2/7/06.

	Tier 1		Interim Tier 4
	Tier 2		Final Tier 4
	Tier 3		

Portable Emergency Diesel Generator Regulations

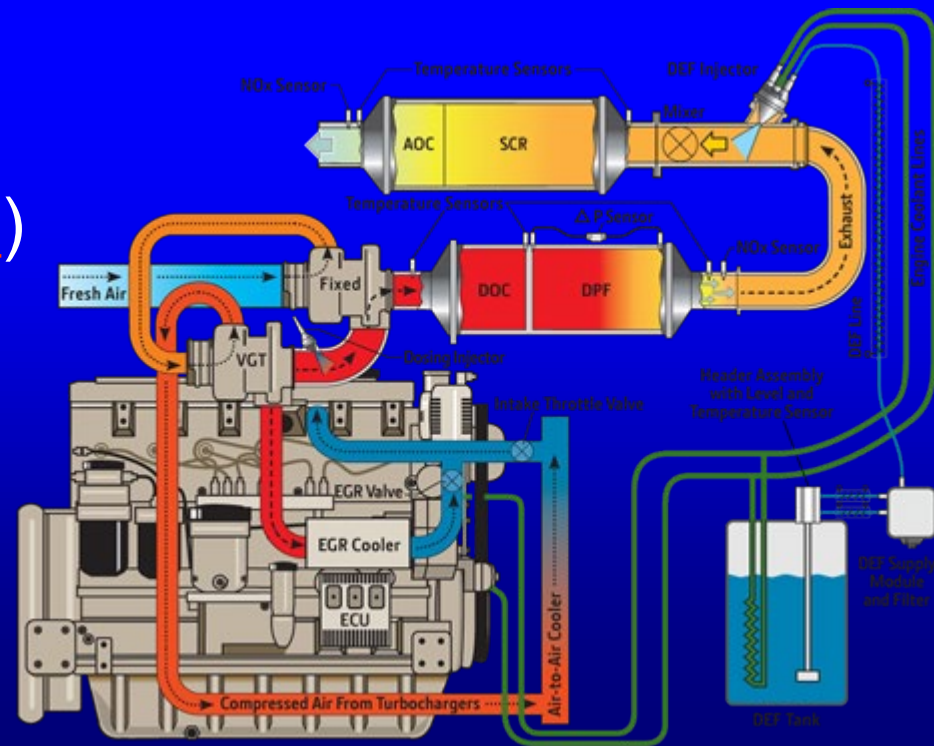
Phase-Out Schedule		
Engine Certification	Engines rated 50 to 750 bhp	Engines rated >750 bhp
Tier 1	1/1/2020	1/1/2022
Tier 2 built prior to 1/1/2009	1/1/2022	1/1/2025
Tier 2 built on or after 1/1/2009	N/A	1/1/2027
Tier 3 built prior 1/1/2009	1/1/2025	N/A
Tier 3 built on or after 1/1/2009	1/1/2027	N/A
Tier 1, 2, and 3 flexibility engines	December 31 of the year 17 years after the date of manufacture. This provision shall not apply to any engine operation before the effective date of this regulation.	

Selling Schedule		
Engine Certification	Engines rated 50 to 750 bhp	Engines rated >750 bhp
Tier 1	1/1/2020	1/1/2022
Tier 2 built prior to 1/1/2009	1/1/2023	1/1/2025
Tier 2 built on or after 1/1/2009	N/A	1/1/2027
Tier 3 built prior 1/1/2009	1/1/2027	N/A
Tier 3 built on or after 1/1/2009	1/1/2029	N/A
Tier 1, 2, and 3 flexibility engines	December 31 of the year 17 years after the date of manufacture. This provision shall not apply to any engine operation before the effective date of this regulation.	

CARB is moving toward Tier 4 requirements for anything larger than 50 hp

What's a Tier 4 Certified Diesel Generator?

- These generators are designed to significantly reduce emissions of particulate matter (PM), nitrogen oxides (NOx), and other pollutants
- Advanced technologies like exhaust gas recirculation, selective catalytic reduction (SCR), and diesel particulate filters (DPF) are needed to achieve low emission levels
- Emissions EPA certified
- Includes inducements
([EPA-HQ-OAR-2014-0866](https://www.epa.gov/epaosr/inducements/inducement-2014-0866))



Certified Tier 4 – Inducements

- Designed to respond to issues with an engine's air emission treatment systems (e.g., SCRs and DPFs)
- Software automatically triggers measures to reduce emissions, including a power derating or shutdown, when the system detects a problem
- In some cases, emergency override mechanisms may be available to allow continued operation. Few manufactures offer such an option at this time
- No source testing required

Certified Tier 4 – Example Inducement Triggers

- Low DEF (diesel exhaust fluid) Level: When the DEF tank reaches a critical low level, the engine may derate or limit speed to prevent complete depletion and ensure proper SCR function
- DEF Quality Issues: If the DEF is contaminated or of poor quality, the SCR system may become less effective, triggering inducements
- SCR System Failures: Faults in SCR components like NOx sensors, DEF injectors, or the SCR catalyst itself can lead to inducements
- DPF Problems: Issues with the DPF can also indirectly trigger SCR inducements if they interfere with the overall exhaust aftertreatment system

Compliant Tier 4 Generators

- Same emission controls as a Tier 4 certified generator
- Excludes any inducement controls
- Source testing required by local air district
 - SCAQMD requires costly testing every 5 years (Title V)
 - Source testing contractors do not normally perform testing on diesel generators
 - Two load average testing includes:
 - PM
 - NO_x
 - CO
 - NMHC/VOCs
 - Ammonia

Clean Water SoCal

Compliant Tier 4 Ongoing Discussions Regulators

- Clean Water SoCal is working with engine manufacturers and other stakeholders to remove inducement requirements for emergency generators
- Will request meetings with EPA to discuss whether the inducement requirement can be eliminated for essential public services
- Working with air districts to minimize source testing requirements for compliant Tier 4 generators

Future Diesel Engine Requirements?

- Regulations are forcing cleaner technology, which attempts to omit fossil fuels
- CARB is drafting more restrictive emission requirements for Tier 5 diesel generators
- SCAQMD is drafting Rule 1110.4, which will consider alternative cleaner technologies:
 - Hydrogen fuel cells
 - Battery backup/solar
 - Clean fuel alternatives

Future Diesel Engine Requirements?

SCAQMD Proposed Rule 1110.4

Tier 4 Diesel Engine, NZE Technology, and ZE Technology NOx Emissions Comparison

Updated Slide

- Tier 1 diesel engines rated between 75 hp and 750 hp emit 23 times more NOx than its Tier 4 equivalent and 345 times more NOx than NZE technologies**

- Potential NZE technologies include fuel cells, gas turbines, and linear generators
- Potential ZE technologies include battery energy storage systems, solar photovoltaic cells, and fuel cells

Comparison of Tier 1, Tier 4 Diesel Engine, and NZE
NOx Emission Limits (g/bhp-hr)

Engine Rating	Tier	Year(s)	NOx	% Diff
50 ≤ hp < 175	1	1997-98	6.9	-
175 ≤ hp < 750		1996		
> 750 hp		2000		
50 ≤ hp < 75	4	2013	3.3*	209%
75 ≤ hp < 750	4	2014	0.3	2300%
> 750 hp	4	2015	0.5	1380%
Near Zero Emission	-	-	0.02**	34500%
Zero Emission	-	-	0	-

* Based on CARB emission factor for NHMC + NOx

** Based on CARB Distributed Generation Certification Regulation standard

The Future of Backup Power?



Questions?



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