BASELINE
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<11(8)					*5.6 .60*								
≥11 (8) <25 (19)					*5.6 .60*								
≥25 (19) <50 (37)				*5.6 .44*									
≥50 (37) <100 (75)				*5.6 .30*				**3.5** *.30*					
≥100 (75) <175 (130)			*4.9 .22*				**3.0** *.22*						
≥175 (130) <300 (225)			*4.9 .15*			**3.0** *.15*							
≥300 (225) <600 (450)	*4.8 .15*				**3.0 *** *.15*								
≥600 (450) <750 (560)		*4.8 .15*			**3.0 *** *.15*								
≥750 (560)						**4.8** *.15*							

Tier 2 standards are shaded and italicized and Tier 3 standards are shaded and bold

PREMISE: No change in existing engine standards. Future aftertreatment technology forcing standards will be considered in a subsequent rulemaking. Tier 3 standards require the use of 500ppm (or less) sulfur fuel. See discussion text above for additional explanation.

* Consent decree pull ahead to 2005 has been assumed for this modeling.
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.

Scenario 1
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<11(8)					*5.6 .60*				5.6 .30				
≥11 (8) <25 (19)					*5.6 .60*				5.6 .30				
≥25 (19) <50 (37)				*5.6 .44*				5.6 .22					
≥50 (37) <100 (75)				*5.6 .30*				3.5 .02			***.48 .02***		
≥100 (75) <175 (130)			*4.9 .22*				**3.0 .15**	3.0 .02		***.41 .02***			
≥175 (130) <300 (225)			*4.9 .15*			**3.0 .15**	3.0 .02		***.41 .02***				
≥300 (225) <600 (450)	*4.8 .15*				**3.0 * .15**		3.0 .02		***.41 .02***				
≥600 (450) <750 (560)		*4.8 .15*			**3.0 * .15**		3.0 .02		***.41 .02***				
≥750 (560)						*4.8 .15*	4.8 .02						

Tier 2 standards are shaded (green) and italicized
Tier 3 NOx+NMHC standards with Tier 2 PM standards are shaded (red) and bold
Tier 3 NOx+NMHC standards with aftertreatment based PM standards are shaded (yellow) only
Tier 4 aftertreatment based HC+NMHC and PM standards are shaded (blue), bold, and italicized

PREMISE: Retain schedule for Tier 3 implementation with pull-ahead agreement, introduce PM aftertreatment standards with Tier 3 NOx+NMHC standards, then implement Tier 4 aftertreatment based NOx+NMHC standards.

* Consent decree pull ahead to 2005 has been assumed for this modeling.
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.

Scenario 2
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<11(8)					*5.6 .60*							40% eff. NOx A/T 90% eff. PM A/T	
≥11 (8) <25 (19)					*5.6 .60*							40% eff. NOx A/T 90% eff. PM A/T	
≥25 (19) <50 (37)				*5.6 .44*							40% eff. NOx A/T 90% eff. PM A/T		
≥50 (37) <100 (75)				*5.6 .30*							40% eff. NOx A/T 90% eff. PM A/T		
≥100 (75) <175 (130)			*4.9 .22*							40% eff. NOx A/T 90% eff. PM A/T			
≥175 (130) <300 (225)			*4.9 .15*						40% eff. NOx A/T 90% eff. PM A/T				
≥300 (225) <600 (450)	*4.8 .15*							40% eff. * NOx A/T 90% eff. PM A/T					
≥600 (450) <750 (560)		*4.8 .15*						40% eff. * NOx A/T 90% eff. PM A/T					
≥750 (560)						*4.8 .15*							40% eff. NOx A/T 90% eff. PM A/T

Tier 2 standards are shaded and italicized

PREMISE: Delay and revise Tier 3 to aftertreatment technology forcing standards. Provide minimum 5 year period of stability and staggered implementation between significant engine and equipment redesigns. 15ppm (max.) sulfur fuel required for revised Tier 3. See discussion text above for additional explanation.

* Consent decree pull ahead to 2008 is assumed (requires modification to the consent decrees).
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.

Scenario 3
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<11(8)					*5.6 .60*							40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T	
≥11 (8) <25 (19)					*5.6 .60*							40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T	
≥25 (19) <50 (37)				*5.6 .44*							40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T		
≥50 (37) <100 (75)				*5.6 .30*							40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T		
≥100 (75) <175 (130)			*4.9 .22*							40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T			
≥175 (130) <300 (225)			*4.9 .15*						40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T				
≥300 (225) <600 (450)	*4.8 .15*							40% eff. * NOx A/T 90% eff. PM A/T				90% eff. Nox A/T 90% eff. PM A/T				
≥600 (450) <750 (560)		*4.8 .15*						40% eff. * NOx A/T 90% eff. PM A/T				90% eff. Nox A/T 90% eff. PM A/T				
≥750 (560)						*4.8 .15*							40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T

Tier 2 standards are shaded and italicized

PREMISE: Delay and revise Tier 3 to aftertreatment technology forcing standards. Provide minimum 5 year period of stability and staggered implementation between significant engine and equipment redesigns. 15ppm (max.) sulfur fuel required for revised Tier 3. Show upgrade to 90% eff. NOx A/T using on-highway 3 year phase-in as per request of NRWG on 7/10/2001.

* Consent decree pull ahead to 2008 is assumed (requires modification to the consent decrees).
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.

Scenario 4
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<11(8)					*5.6 .60*							40% eff. NOx A/T 90% eff. PM A/T		90% eff. Nox A/T 90% eff. PM A/T
≥11 (8) <25 (19)					*5.6 .60*							40% eff. NOx A/T 90% eff. PM A/T		90% eff. Nox A/T 90% eff. PM A/T
≥25 (19) <50 (37)				*5.6 .44*							40% eff. NOx A/T 90% eff. PM A/T		90% eff. Nox A/T 90% eff. PM A/T	
≥50 (37) <100 (75)				*5.6 .30*							40% eff. NOx A/T 90% eff. PM A/T		90% eff. Nox A/T 90% eff. PM A/T	
≥100 (75) <175 (130)			*4.9 .22*							40% eff. NOx A/T 90% eff. PM A/T		90% eff. Nox A/T 90% eff. PM A/T		
≥175 (130) <300 (225)			*4.9 .15*						40% eff. NOx A/T 90% eff. PM A/T			90% eff. Nox A/T 90% eff. PM A/T		
≥300 (225) <600 (450)	*4.8 .15*							40% eff. * NOx A/T 90% eff. PM A/T				90% eff. Nox A/T 90% eff. PM A/T		
≥600 (450) <750 (560)		*4.8 .15*						40% eff. * NOx A/T 90% eff. PM A/T				90% eff. Nox A/T 90% eff. PM A/T		
≥750 (560)						*4.8 .15*							40% eff. NOx A/T 90% eff. PM A/T	90% eff. Nox A/T 90% eff. PM A/T

Tier 2 standards are shaded and italicized

PREMISE: Delay and revise Tier 3 to aftertreatment technology forcing standards. Provide minimum 5 year period of stability and staggered implementation between significant engine and equipment redesigns. Artificially forces accelerated phase-in of 90% eff. NOx A/T to be completed by 2014 (as per Glenn Passavant's 7/10/2001 comments). 15ppm (max.) sulfur fuel required for revised Tier 3.

* Consent decree pull ahead to 2008 is assumed (requires modification to the consent decrees).
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.

Scenario 5
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<11(8)					*5.6 .60*									90% eff. Nox A/T 90% eff. PM A/T
≥11 (8) <25 (19)					*5.6 .60*									90% eff. Nox A/T 90% eff. PM A/T
≥25 (19) <50 (37)				*5.6 .44*									90% eff. Nox A/T 90% eff. PM A/T	
≥50 (37) <100 (75)				*5.6 .30*				**3.5** *.30*					90% eff. Nox A/T 90% eff. PM A/T	
≥100 (75) <175 (130)			*4.9 .22*				**3.0** *.22*					90% eff. Nox A/T 90% eff. PM A/T		
≥175 (130) <300 (225)			*4.9 .15*			**3.0** *.15*						90% eff. Nox A/T 90% eff. PM A/T		
≥300 (225) <600 (450)	*4.8 .15*				3.0 * .15							90% eff. Nox A/T 90% eff. PM A/T		
≥600 (450) <750 (560)		*4.8 .15*			3.0 * .15							90% eff. Nox A/T 90% eff. PM A/T		
≥750 (560)						**4.8** *.15*								90% eff. Nox A/T 90% eff. PM A/T

Tier 2 standards are shaded and italicized and Tier 3 standards are shaded and bold

PREMISE: No change in existing engine standards. Immediate jump to 90% eff. A/T for both NOx and PM (i.e. no phase-in). Tier 4 implementation dates compress the existing staggering. 15ppm sulfur (max.) fuel required for Tier 4. Tier 3 standards require the use of 500ppm (or less) sulfur fuel.

* Consent decree pull ahead to 2005 has been assumed for this modeling.
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.

Scenario 6
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<11(8)					*5.6* *0.60*							**5.6** **0.30**		
≥11 (8) <25 (19)					*5.6* *0.60*							**5.6** **0.30**		
≥25 (19) <50 (37)				*5.6* *0.44*							**5.6** **0.22**			
≥50 (37) <100 (75)				*5.6* *0.30*					0.35 0.03					
≥100 (75) <175 (130)			*4.9* *0.22*							0.30 0.02				
≥175 (130) <300 (225)			*4.9* *0.15*						0.30 0.02					
≥300 (225) <600 (450)	*4.8* *0.15*							0.30 0.02						
≥600 (450) <750 (560)		*4.8* *0.15*						0.30 0.02						
≥750 (560)						*4.8* *0.15*							***0.48*** ***0.15***	

Tier 2 standards are shaded and italicized (green)
Tier 2 HC+NOx + ½ Tier 2 PM standards are shaded and bold (yellow)
Tier 4 HC+NOx and PM aftertreatment standards are shaded only (blue)
Tier 4 HC+NOx aftertreatment and Tier 2 PM are shaded, bold, and italicized (red)

PREMISE: Skip Tier 3. Reduce PM levels for < 50hp, but not to aftertreatment forcing levels. Keep HC+NOx levels for < 50hp at Tier 2 levels. Reduce HC+NOx levels for > 750hp through aftertreatment. Keep PM levels for > 750hp at Tier 2 levels. Assume 90% efficiency from Tier 3 for all HC+NOx and PM aftertreatment technologies. 15ppm (max.) sulfur fuel required for all aftertreatment technologies.

Consent decree pull ahead to 2008 is assumed (requires modification to the consent decrees).
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.

Scenario 7
NOx + NMHC
PM
(g/bhp-hr)

Hp(kW)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<11(8)					*5.6* *0.60*		5.6 0.06							
≥11 (8) <25 (19)					*5.6* *0.60*		5.6 0.06							
≥25 (19) <50 (37)				*5.6* *0.44*			5.6 0.04							
≥50 (37) <100 (75)				*5.6* *0.30*			5.6 0.03	**3.5** **0.03**		**0.35** **0.03**				
≥100 (75) <175 (130)			*4.9* *0.22*				**3.0** **0.02**		**0.30** **0.02**					
≥175 (130) <300 (225)			*4.9* *0.15*			3.0 0.15	**3.0** **0.02**	**0.30** **0.02**						
≥300 (225) <600 (450)	*4.8* *0.15*				3.0 * 0.15		**0.30** **0.02**							
≥600 (450) <750 (560)		*4.8* *0.15*			3.0 * 0.15		**0.30** **0.02**							
≥750 (560)						*4.8* *0.15*	4.8 0.02							

Tier 2 standards are shaded and italicized (green)
Tier 3 standards are shaded only (red)
Tier 3 NMHC & Tier 4 PM standards are shaded and bold (red)
Tier 2 NMHC & Tier 4 PM standards are shaded and underlined (yellow)
Tier 4 HC+NOx and Tier 4 PM aftertreatment standards are shaded, bold and underlined (blue)

PREMISE: Reduce PM to Tier 4 levels across the board in 2007. Phase in HC+NOx Tier 4 levels beginning in 2007 through 2010. Assume 90% efficiency from Tier 3 for all HC+NOx and PM aftertreatment technologies. 15ppm (max.) sulfur fuel required for all aftertreatment technologies.

* Consent decree pull ahead to 2005 has been assumed for this modeling.
Tier2/Tier1 flexibility provision incorporated.
Inventory calculated on combined preempt and non-preempt engines.