Nonconformance Penalties for Heavy-Duty Diesel Engines Subject to the 2010 NOx Emission Standard

Response to Comments

United States Environmental Protection Agency

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Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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EPA United States Environmental Protection Agency

EPA-420-R-12-015
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List of Commenters

Commenter	Abbreviation/Acronym	Docket number of comment(s) *EPA-HQ-OAR-2011-1000- . . .*
Anonymous public comment	Anonymous public comment	0013
Clean Air Task Force, et al.	CATF	0021-0022
Cummins, Inc	Cummins	0015, 0025 & 0048
Daimler Trucks North America LLC and Detroit Diesel Corp.	Daimler	0028, 0043-0045 & 0049
Environmental Defense Fund	EDF	0026
Ford Motor Company	Ford	0029
International Council on Clean Transportation	ICCT	0030
Jennifer V. Sinisi	J. V. Sinisi	0020
Jennifer Whittaker	J. Whittaker	0023
Mack Trucks, Inc. and Volvo Group North America, LLC	Mack	0024, 0046, 0047 & 0051
Manufacturers Of Emission Controls Association	MECA	0017 & 0040
Navistar, Inc.	Navistar	0027, 0031-0039, 0042 & 0050
Northeast States for Coordinated Air Use Management	NESCAUM	0018-0019
New Jersey Department of Environmental Protection	NJDEP	0016
PACCAR, Inc	PACCAR	0041

Table of Contents

Introduction

On January 31, 2012 EPA proposed to establish nonconformance penalties (NCPs) for heavy-duty diesel engines. On that same day, we also promulgated an Interim Final Rule to establish interim NCPs for heavy heavy-duty diesel engines. We held a public hearing on March 5, 2012, at which oral comments on the NPRM were received and recorded. Additionally, a written comment period remained open until April 4, 2012. A complete list of organizations, their abbreviations, and individuals that provided comments on the NPRM is contained in this document.

This Response to Comments contains a summary of all comments we received on the NPRM as well as our responses to these comments. Note that quotation marks are not used in all cases in which comments are repeated verbatim; rather quotation marks are used only where we believe it to be worth noting that the commenter's exact words are repeated. In some cases where several commenters raised the same point, we did not separately summarize the comments. Also, to the extent that commenters' written comments repeated comments made during the public hearing, our response focuses on the written comments, which were generally more detailed. The comments and responses are organized by topic (see Table of Contents) to help the reader find comments and responses of interest.

1. Legal Issues

1.1. Statutory Basis for NCPs

Section 206(g) of the Clean Air Act (the Act), 42 U.S.C. 7525(g), requires EPA to promulgate regulations permitting manufacturers of heavy-duty engines (HDEs) or heavy-duty vehicles (HDVs) to receive a certificate of conformity for HDEs or HDVs that exceed a federal emissions standard, but do not exceed an upper limit associated with that standard, if the manufacturer pays a nonconformance penalty (NCP) established by rulemaking. Congress adopted section 206(g) in the Clean Air Act Amendments of 1977 as a response to a concern with requiring technology-forcing emissions standards for heavy-duty engines. The concern was if strict technology-forcing standards were promulgated, then some manufacturers might be unable to comply initially and would be forced out of the marketplace. NCPs were intended to remedy this concern. With this provision, the nonconforming manufacturers would have a temporary alternative that would permit them to sell their engines or vehicles by payment of a penalty. At the same time, conforming manufacturers would not suffer a competitive disadvantage compared to nonconforming manufacturers, because the amount of the NCPs would be determined, in part, based on the money saved by the nonconforming manufacturer.

Under section 206(g)(1), NCPs may be offered for HDVs or HDEs. The penalty may vary by pollutant and by class or category of vehicle or engine. Section 206(g)(3) requires that NCPs:

- Account for the degree of emission nonconformity;
- Increase periodically to provide incentive for nonconforming manufacturers to achieve the emission standards; and
- Remove the competitive disadvantage to conforming manufacturers.

Section 206(g) authorizes EPA to require testing of production vehicles or engines in order to determine the emission level upon which the penalty is based. If the emission level of a vehicle or engine exceeds an upper limit of nonconformity established by EPA through regulation, the vehicle or engine would not qualify for an NCP under section 206(g) and no certificate of conformity could be issued to the manufacturer. If the emission level is below the upper limit but above the standard, that emission level becomes the "compliance level," which is also the benchmark for warranty and recall liability. The manufacturer who elects to pay the NCP is liable for vehicles or engines that exceed the compliance level in use. The manufacturer does not have in-use warranty or recall liability for emissions levels above the standard but below the compliance level.

1.1.1. **Removing All Competitive Disadvantages for Complying Manufacturers**

This section addresses general comments related to competitive advantages. More specific comments are addressed later in this document.

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
EDF	EPA-HQ-OAR-2011-1000-0026
Ford	EPA-HQ-OAR-2011-1000-0029
ICCT	EPA-HQ-OAR-2011-1000-0030
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
MECA	EPA-HQ-OAR-2011-1000-0017 & 0040
NESCAUM	EPA-HQ-OAR-2011-1000-0018 - 0019
PACCAR	EPA-HQ-OAR-2011-1000-0041

Several manufacturers of SCR engines commented that the proposed NCPs do not meet the statutory requirement to remove the competitive disadvantage to complying manufacturers. These commenters believe that EPA proposed penalties that are too low to remove the competitive disadvantage. Some of these comments focused on the competitive advantage of engines that do not use SCR. Others addressed potential competitive advantages for SCR engines that could be reoptimized to have NOx emissions near 0.50 g/hp-hr. These commenters further stated that failing to fully remove all competitive advantages for noncomplying engines would create an incentive for noncompliance.

Cummins emphasized that neither manufacturers of compliant engines, nor operators who purchase them should be penalized relative to noncompliant engines.

Mack also commented that low NCP levels will encourage compliant manufacturers to develop engines that could take advantage of a 0.50 g/hp-hr upper limit and gain a market advantage. Mack cited the testimony from Cummins and its own market decisions to indicate this is not hypothetical. Mack also noted that the availability of NCPs affects the analysis of market share impacts.

Mack commented that EPA's analysis of market advantages is fundamentally flawed because it "fails to consider what the market share would have been if all manufacturers had to meet the same standard." It also stated that "EPA apparently assumes that if this happened each manufacturer's share of the market would not have changed, which is not true." Mack considered two scenarios. Under the first, Navistar would have been forced to comply with the 0.20 g/bhp-hr standard, which Mack argued would have reduced Navistar's share of the heavy-HDDE market to zero. Under the second scenario, all other manufacturers would have been given the opportunity to comply with a 0.50 g/bhp-hr standard and reaped a "dramatic shift in market share."

Mack also commented that EPA "must both demonstrate a true technological need for NCPs (which it has not) and, if able to do that, must ensure the NCP is high enough to discourage production of engines beyond those absolutely necessary (which it again has not)."

EDF commented that NCPs must be large enough to discourage complying manufacturers from backsliding to the upper limit. Ford made similar comments.

NESCAUM stated that quantifying the competitive advantage of an engine manufacturer is a potentially significant problem with respect to engines are not equipped with selective catalytic reduction (SCR) systems for controlling NOx emissions. It commented that consumers may disproportionately choose to purchase vehicles powered by this manufacturer's engines (the nonconformance penalty notwithstanding) on the basis of a perceived convenience of not having to maintain appropriate levels of diesel exhaust fluid for proper functioning of the SCR system.

There were also comments involving competitive impacts that are more directly related to the actual level of the penalty, but these are addressed in Chapter 2.

Response

The purpose of adopting NCPs is to allow a noncompliant manufacturer to continue selling its engines. However, the Clean Air Act directs EPA to set the NCPs at a level that will "remove any competitive disadvantage" to complying manufacturers. Thus, the statute effectively requires us to set the penalties at a level that we reasonably expect to protect the complying manufacturers, but not so high that it cripples any noncomplying manufacturers. The purpose of the NCP is not to punish noncomplying manufacturers, but to remove competitive advantages and to incentivize compliance. To the extent there is uncertainty about compliance costs and/or competitive impacts, we believe that the explicit statutory requirement to remove the competitive disadvantage for complying manufacturers means that complying manufacturers should generally be given the benefit of these uncertainties. Thus, we are somewhat conservative (i.e. high) in our estimate of costs, including looking at our estimate of the highest cost for complying manufacturers in developing the COC_{90} calculation.

For the proposal and interim rule, EPA *estimated* compliance costs relative to an SCR baseline engine similar to today's compliant engines, but also *evaluated* the NCPs in the context of competition between SCR engines with NOx emissions at or below 0.20 g/hp-hr and non-SCR engines with NOx emissions at or just below 0.50 g/hp-hr. This was appropriate because these two categories represented all heavy heavy-duty engines being sold currently. However, EPA agrees with commenters that the final NCPs should be high enough to also protect complying manufacturers from a competitive disadvantage relative to SCR engines that are more fully optimized for 0.50 g/hp-hr than were considered for the proposal and interim rule. The final rule should be, and is, more forward looking to also address potential competitive advantages that could arise in the future. The Clean Air Act's requirements to "remove any competitive disadvantage" to complying manufacturers effectively requires EPA to consider not only existing engines with NOx emissions over the standard, but also engines that could reasonably be developed during the period in which NCPs are available. In this case, this requires EPA to also consider SCR engines that would be reoptimized for 0.50 g/hp-hr. With respect to Mack's, Cummins's, and EDF's comments, we believe that the level of the *final* penalty, which was

developed using a baseline engine emitting at 0.50 g/hp-hr that has been fully optimized, is high enough to discourage optional use of NCPs by compliant manufacturers.

Mack is incorrect when it stated that *we assumed* that each manufacturer's share of the market would not have changed if all manufacturers had to meet the same emission level. What would have happened if all manufacturers had to meet the same emission level because NCPs or credits were not available is not relevant. We believe that Congress intended us to consider competitive impacts based on the market conditions that existed before the new standard took effect, which is what we have done.

It is unclear to us what Mack meant when it commented that EPA must ensure the NCP is high enough to "discourage production of engines beyond those absolutely necessary". If it meant that we should calculate some number of engines that would be necessary for Navistar to stay in business and set the NCP at a level that made it unlikely that Navistar would sell more than that number, then we disagree with the comment. It is clear that Congress intended us to allow Navistar (or any other noncompliant manufacturer) to continue to sell its engines but also intended us to set the NCP at a level that ensures that Navistar (or any other noncompliant manufacturer) does not gain any competitive advantage over compliant manufacturers. We believe the final rule meets this intent.

With respect to the NESCAUM comment, the commenter provides no evidence, nor have we seen any evidence, that there is a competitive disadvantage for SCR manufacturers beyond the difference in compliance costs.

1.1.2. **Consideration of Environmental Impacts**

Summary of Comments

EDF	EPA-HQ-OAR-2011-1000-0026
Ford	EPA-HQ-OAR-2011-1000-0029
ICCT	EPA-HQ-OAR-2011-1000-0030
J. V. Sinisi	EPA-HQ-OAR-2011-1000-0020
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
MECA	EPA-HQ-OAR-2011-1000-0017 & 0040
NESCAUM	EPA-HQ-OAR-2011-1000-0018 - 0019
NJDEP	EPA-HQ-OAR-2011-1000-0016

Some commenters argued that EPA should consider environmental impacts when deciding whether to establish NCPs and/or when setting the penalty level. In particular, Mack commented that allowing Navistar to continue production of current engines using NCPs would result in more than 55,440 excess tons of NOx emissions for model year 2012 and more than 110,000 tons for model year 2013. Its argues that "this is not in keeping with EPA's central mission of protecting the environment and the air we breathe."

ICCT commented that it believe that the Agency should also consider taking into account the societal costs of increased air pollution resulting from noncompliance. Given the goals of the original rule and the Agency's mission, ICCT believes that any accounting of costs is incomplete without estimating the damages to human health and the environment that would result from increased NOx emissions. ICCT suggested using the methodology developed in the regulatory impact assessment as the basis for evaluating damages from noncompliance.

MECA stated that NCPs should not be based simply on costs of emission reduction technologies because such an approach doesn't take into effect the societal costs of higher emissions.

Response

The Clean Air Act does not direct EPA to consider environmental impacts in setting NCPs. Congress was clear in its mandate in section 206(g) that EPA shall permit manufacturers to certify using NCPs. While Congress did require EPA to take certain factors into account when setting NCPs, evaluation of environmental impacts or "societal costs" is not set out as a criterion. The language and history of this provision indicate that Congress effectively determined that requiring EPA to issue standards for heavy-duty vehicles and engines that are technology forcing in nature, with NCPs acting in part as a safety valve preventing a manufacturer from being forced from the market, serves the public interest in the long term and outweighs any short-term harm to the environment caused by allowing NCPs. We note that we do escalate the amount of the NCP annually "in order to create incentives for the development of production vehicles which achieve the required degree of emission reduction."

1.2. Regulatory Criteria for NCPs

Since the promulgation of the first NCP rule in 1985, subsequent NCP rules generally have been described as continuing "phases" of the initial NCP rule. The first NCP rule (Phase I), sometimes referred to as the "generic" NCP rule, established three basic criteria for determining the eligibility of emission standards for nonconformance penalties in any given model year (50 FR 35374, August 30, 1985). (For regulatory language, see 40 CFR 86.1103-87.) The first criterion is that the emission standard in question must become more difficult to meet. This can occur in two ways, either by the emission standard itself becoming more stringent, or due to its interaction with another emission standard that has become more stringent. Second, substantial work must be required in order to meet the emission standard. EPA considers "substantial work" to mean the application of technology not previously used in that vehicle or engine class/subclass, or a significant modification of existing technology, in order to bring that vehicle/engine into compliance. EPA does not consider minor modifications or calibration changes to be classified as substantial work. Third, EPA must find that a manufacturer is *likely to be* noncomplying for technological reasons (referred to in earlier rules as a "technological laggard"). Prior NCP rules have considered such a technological laggard to be a manufacturer who cannot meet a particular emission standard due to technological (not economic) difficulties and who, in the absence of NCPs, might be forced from the marketplace.

1.2.1. **EPA Required to Follow Regulatory Criteria**

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
MECA	EPA-HQ-OAR-2011-1000-0017 & 0040
PACCAR	EPA-HQ-OAR-2011-1000-0041

Several commenters argued (implicitly or explicitly) that EPA *cannot* establish NCPs unless all of the *regulatory* criteria for NCPs (in 40 CFR 86.1103-87) are met. Mack also stated that EPA "must demonstrate" that the criteria are met.

Response

When adopted in 1985, EPA intended to use the criteria of 40 CFR 86.1103-87 in determining whether to establish NCPs. However, we note that actual regulatory text does not state that EPA may establish NCPs *only if* all criteria are met, but rather that EPA shall establish NCPs "provided that EPA finds" the criteria are met. These criteria were included in the regulations to clarify that manufacturers should not expect EPA to initiate a rulemaking to establish NCPs where these criteria were not met. Moreover, EPA may revise the criteria at any time through notice and comment rulemaking as long as the statutory criteria of section 206(g) are met. Nevertheless, as noted elsewhere, EPA has found that the criteria have been met.

Regarding Mack's comment that EPA must *demonstrate* that the criteria are met, the regulations clearly defer to EPA's judgment for *finding* that the criteria are met. While we must *explain* the basis of our finding, the regulatory language does not require us to *prove* or *demonstrate* that the criteria are met.

1.2.2. **New or Revised Standard More Stringent than Previous Standard and for Which Substantial Work is Required**

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
EDF	EPA-HQ-OAR-2011-1000-0026
J. Whittaker	EPA-HQ-OAR-2011-1000-0023
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050
PACCAR	EPA-HQ-OAR-2011-1000-0041

Several commenters opposed EPA's determinations that the 2010 NOx standard qualifies as a new or revised standard that is more stringent than the previous standard and that substantial work is required to meet the standard. The commenters made arguments similar to one another.

First, they argued that the 2010 NOx standard does not qualify as a new standard because it was promulgated in 2001. Second, they argued that nothing happen in 2012 to make the standard "more difficult to achieve". Third, with regard to the "substantial work" criterion, these commenters stated that substantial work is no longer required to meet the standard.[1] Most repeated EPA's statement in the preamble to the proposal that:

> EPA considers "substantial work" to mean the application of technology not previously used in that vehicle or engine class/subclass, or a significant modification of existing technology, in order to bring that vehicle/engine into compliance. EPA does not consider minor modifications or calibration changes to be classified as substantial work.

These commenters argued that viewed from 2012, this "substantial work" criterion has not been met because SCR is now an existing technology that has been used within the engine class. Finally, more than one commenter noted that Navistar cannot claim that it would need to do substantial work to use SCR because one of its subsidiaries uses SCR on trucks in Brazil. Other comments that we received are summarized below.

Mack stated that "EPA's 'substantial work' finding is at odds with its own use of a 'hypothetical' 0.5 g/bhp-hr engine, and its assumption in setting the NCP level that all manufacturers save Navistar would have adopted SCR to meet a 0.5 g/bhp-hr standard" and that "EPA cannot, on one hand, declare that SCR did not previously exist for purposes of justifying its substantial work finding in the NCP rule, and, on the other, decide that it always existed and would only require minor modification for purposes of developing an NCP calculation." Mack also commented that it is incorrect to presume that Navistar will need to innovate further and use "technology not previously used in an engine or vehicle class or subclass" to meet the 0.20 g/bhp-hr standard. Cummins made a similar argument that it is inconsistent to find that substantial work is required to meet the 2010 NOx standard while proposing as its "baseline" engine an engine capable of emitting 0.20 g/hp-hr NOx that is de-tuned to meet the upper limit.

Mack also stated that "Navistar's public statements also confirm that it also does not believe substantial work is required for its current EGR engines to meet the 0.20 g/bhp-hr NOx standard." It quoted Navistar's Senior Vice President of North American Sales Operations as saying:

> "[d]rivers and owners 'won't see the difference' in the point-2 engine's performance … because there are no equipment changes… The lower NOx emissions can be achieved with modified fuel pressures, altered introduction of inlet air, and recalibration of electronic controls."[2]

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[1] In particular, Cummins noted that verb tense is significant and determinative of the regulation's meaning, stating that "the Supreme Court has recognized as much in the analogous task of interpreting statutes. Ingalls Shipbuilding v. Director, OWCP, 519 U.S. 248, 255 (1997) (tense of verb is an element of plain meaning); United States v. Wilson, 503 U.S. 329, 333 (1992) ("Congress's use of a verb tense is significant"); see also Carr v. United States, 130 S. Ct. 2229, 2236-37 (2010) (collecting cases)."

[2] Mack cited: TruckingInfo.com, "Customers Wouldn't Pay Extra for Any Non-Compliance Penalties Imposed on Navistar, Hebe Says,"(Feb. 1, 2012)

Daimler stated that "the regulatory provisions cannot reasonably be read to allow for such a belated NCP determination" and that EPA's conclusion in the standard-setting rule that the standard is a technology forcing standard "has no bearing on whether there now exists a new or revised and more stringent emission standard applicable to the current model year for which EPA seeks to set NCPs." It also stated that for EPA to find that substantial work is still required "would justify NCPs any time new technology is used to meet an emission standard - a result Congress surely did not intend under the Clean Air Act and a result EPA does not permit under its regulations."

Navistar agreed with EPA's determination that the first two criteria for establishing NCPs were met, stating that "under the plain language set forth in EPA's regulations as well as the agency's longstanding application and interpretation of both CAA § 206(g) and the agency's own regulations, this is clearly a case where Navistar is applying new and/or significantly modified technology—that it spent hundreds of millions of dollars developing—in order to comply with the new stringent NOx standard set at near-zero levels." Finally, Navistar noted that "the 0.20 g NOx Standard did not become fully effective across all engine families in model year 2007, or even in 2010" due to the availability of banked NOx emission credits. It argues that SCR engine manufacturers' disregard of these regulatory flexibilities is "illogical" and "jettisons EPA's well-established interpretation of the NCP statute and rules."

Response

When EPA initially proposed the NCP criteria, we noted that the first two criteria addressed whether there was a *possibility* for a technological laggard to develop.[3] We stated that when the first criterion is met, it "creates the possibility for a technological laggard to exist." We also stated that "When manufacturers must perform substantial work, it is possible that at least one will be unsuccessful and will become a laggard. Thus, when evaluating these criteria, the purpose is to determine whether the standard created the possibility for a laggard to exist."

The first regulatory NCP criterion is met when "any new or revised emission standard is more stringent than the previous standard for the pollutant, or when an existing standard for that pollutant becomes more difficult to achieve because of a new or revised standard." This is the case with the 2010 NOx standard. The previous emission standard for this category is a combined NMHC + NOx standard of 2.4 g/hp-hr, or optionally a 2.5 g/hp-hr NMHC + NOx with a limit of 0.5 g/hp-hr NMHC.[4] (EPA has viewed this standard as being equivalent to a 2.3 g/hp-hr NOx-only standard.[5]) The 2010 (i.e., current) standards are 0.20 g/hp-hr for NOx and 0.14 g/hp-hr for NMHC. When promulgated, the Agency concluded that the 0.20 g/hp-hr NOx standard was a technology forcing standard.

[3] 50 FR 9206, March 6, 1985.
[4] NMHC stands for non-methane hydrocarbons, which is a measure of total hydrocarbons with the methane emissions subtracted out. For typical on-highway diesel fueled heavy-duty engines, methane emissions are on the order of 10 percent of the total hydrocarbon emissions.
[5] "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines," page 109, EPA420-R-00-010, July 2000.

The second criterion requires that substantial work be need to meet the new standard. Since all heavy heavy-duty diesel engines currently certified to the 0.20 g/hp-hr standard (without using credits) are using new aftertreatment systems to meet this standard, it is appropriate to conclude that the standard qualifies as more difficult to meet and that substantial work was required to meet the emission standard. Thus, when we adopted the 2010 NOx standard, it created the possibility for a technological laggard to develop.

We note that the commenters generally do not dispute that the first two criteria were met before 2010, and that we could have set NCPs at that time had we determined that a technological laggard was likely to develop. In fact, none of the manufacturers questioned EPA's determination when we notified them in 2010 that we had found that the new NOx standard required substantial work.[6] When making that determination, EPA noted that the reason that we were not establishing NCPs at that time was because we had not determined that a technological laggard was likely to develop. Had we known before 2010 that Navistar would run out of credits in 2012 and that it would have not yet brought its NOx levels down to 0.20 g/hp-hr, we would have established NCPs. We do not believe that these commenters would have opposed establishing NCPs at that time.

Regarding the first criterion, some commenters now claim that EPA no longer has the authority to establish NCPs for the 2010 NOx standard because they claim it is no longer a new or revised standard. One commenter noted that the standard was promulgated in 2001. Yet it is often not apparent, and was not apparent in this case, that there would be a need for NCPs until close to, or in this case after, the implementation of a standard. In this case, EPA did not promulgate NCPs earlier than 2012 because no manufacturer needed them, as they all met the standard either directly or through credits. The 0.20 g/hp-hr NOx standard clearly is a revised standard, and a more stringent one, since the previous standard was approximately ten times higher than the 0.20 g/hp-hr standard. The fact that EPA did not promulgate NCPs prior to the standard being implemented does not forever preclude EPA from promulgating them when they are needed.

Although we reject the commenters' argument that we may not establish NCPs once a standard has been implemented, it is worthwhile to consider the logical result of this argument. Many of these commenters seem to believe that the NOx standard was new in 2010. However, strictly speaking this standard was not new in 2010. It was actually first applicable to model year 2007 engines. The commenters provide no basis for treating the phase-in provisions that applied in model year 2007 through 2009 differently than the flexibility of the emission credit program that Navistar has used since then to certify engines near 0.50 g/hp-hr NOx. Thus, the logic of the commenters opposing our finding that the first criteria was met would lead to a result in which we could not have set NCPs after 2007. If we accepted this logic, it would severely hinder our ability to set NCPs for standards for which there is extensive phase-in flexibility. We do not believe that such a result would be consistent with the intent of the statute.

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[6] "Nonconformance Penalties for Heavy-Duty Diesel Engines in 2010 Model Year", Letter from Karl J. Simon, Director, EPA Compliance and Innovative Strategies Division, February 22, 2010.

Regarding the substantial work criterion, there can be no argument that substantial work was necessary to meet the 2010 NOx standard. Every manufacturer other than Navistar has for the first time included NOx aftertreatment (selective catalytic reduction), on their engines to meet the standard, and Navistar has also greatly modified in exhaust gas recirculation (EGR) system to reduce its NOx emissions and has now stated that it will also use NOx aftertreatment to meet the standard. These are substantial changes to the emission control systems of these engines. While manufacturers may currently be using SCR systems, they were not doing so until they were required to meet the 2010 NOx standard. Therefore, it is clear that substantial work was needed to meet the standard.

Commenters do not dispute that substantial work *was* required to meet the 2010 standard, and in fact, complying engine manufacturers generally emphasized in their comments how much work they had done to meet the standards. Nevertheless, some commenters claim that this criterion has not been met because they claim it is no longer true that substantial work is required because some manufacturers have met the standard. We disagree for two reasons. First, this is not how EPA interprets this criterion. This criterion is to be evaluated based on actual work needed to go from meeting the previous standard to meeting the current standard, regardless of the timing of such changes. EPA looks at whether "substantial work" is or was required to meet the revised standard at any time after the standard was issued – the important question is whether manufacturers who were using technology that met the previous standard would need to build upon that technology to meet the revised standard. Indeed, the commenters' argument would seem to be directly contrary to the purpose of the statute, which is designed to allow technological laggards to be able to certify engines even if other manufacturers have met the standard. Commenters' approach would prevent this by apparently preventing lagging manufacturers from certifying in exactly those circumstances. To avoid this confusion for future NCPs, we are clarifying in the regulatory text that this criterion is to be evaluated based on the need for new or modified technology or design to meet the new or revised standard regardless of the timing for such changes.

Second, even under the current circumstances, we find that Navistar will need to do substantial work to meet the standard, whether it meets the standards through advanced EGR or through SCR. Mack cited public statements by a vice president of Navistar responsible for sales, but we do not believe these statements reflect the full extent of the challenge facing Navistar in its attempt to meet the standard through advanced EGR. Navistar has been working to bring all its engines into compliance with the 0.20 g/hp-hr NOx standard without credits, and is devoting a substantial fraction of its engineering resources to the task, but it has not yet been able to do so.

Moreover, Navistar has subsequently withdrawn its application for a 0.20 g/hp-hr certificate for its non-SCR engines and announced that it has begun work to redesign its engines and vehicles to use SCR. While our analysis of this technological challenge is discussed in more

detail in Section 1.2.3, we note here that Navistar must complete the work that other manufacturers have already done, including:

- Selecting an SCR system design
- Making arrangements with component suppliers
- Validating components
- Recalibrating its engine to work with the SCR system
- Redesigning it trucks to fit the SCR hardware
- Completing its emission testing and durability testing for certification
- Obtaining EPA approval for the new engine-SCR system

Thus, we also disagree with the views of the commenters who claim that Navistar could now add SCR to its engines without substantial work, simply because its competitors have already done so. Even if it Navistar could take full advantage of the research of its competitors, this would not eliminate the substantial work needed for such things as redesigning its vehicles and retooling its factories. Regarding the use of SCR by one of Navistar's subsidiaries in Brazil, this does not mean that Navistar can apply SCR to its trucks for the U.S. market in the near future. Neither the trucks being built in Brazil nor the market served by those trucks, are the same as those being sold in the United States. Even though Navistar has announced that it will incorporate SCR technology in its U.S. engines and trucks, it will take substantial time and resources to accomplish this. More importantly, while these comments have some relevance in the context of determining whether Navistar is a technological laggard, they are not relevant to whether substantial work was required to meet the 2010 standard. Whether manufacturers have used SCR or advanced EGR to reduce emissions, it is clear that the changes to their engines have required considerable work.

With respect to Mack's assertion that "EPA cannot" declare that SCR required substantial work and "decide that it always existed", we note that we never declared it always existed. Cummins made a similar comment, but both Cummins and Mack are mixing two separate provisions. First, our evaluation of the regulatory criteria for NCPs must necessarily be based on the factual differences between the *prior standard* and the *new standard* (as well as the technology required to meet them). This is clearly separate from issues related to the baseline engine that EPA used to estimate compliance costs relative to the upper limit because the upper limit is well below the prior standard. The engines being considered when evaluating whether a new standard requires substantial work are engines meeting the previous standard (i.e. model year 2006 or earlier engines), while the baseline engine represents engines that are currently practicable (i.e. current model year engines).

We also disagree with Daimler's comment that EPA's logic "would justify NCPs any time new technology is used to meet an emission standard- a result Congress surely did not intend." It is important to emphasize that this comment was made in the context of the first two criteria, which merely address the *possibility* for a laggard to develop. It ignores the third criterion that requires a *likelihood* of a technological laggard. We do not believe that using a new technology would justify NCPs if the manufacturer had already met the standard and was simply choosing to change its emission controls because we would not consider such a manufacturer to be a technological laggard. Additionally, it is clear that Congress indeed intended that manufacturers be permitted to use NCPs when new technology is used to meet an

emission standard. Nothing in section 206(g) requires that a manufacturer whose technology is lagging be denied the ability to use NCPs because its technology is different than the technology of compliant manufacturers.

Finally, the regulatory text states that we will establish NCPs when "EPA finds" that substantial work was needed. Thus, the regulations clearly leave the determination up to the Agency's discretion, provided we have a reasonable basis for making such a finding. See Section 1.2.1 for additional discussion of the extent to which EPA the regulatory criteria constrain EPA.

1.2.3. **Technological Laggard**

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
EDF	EPA-HQ-OAR-2011-1000-0026
J. V. Sinisi	EPA-HQ-OAR-2011-1000-0020
J. Whittaker	EPA-HQ-OAR-2011-1000-0023
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050
PACCAR	EPA-HQ-OAR-2011-1000-0041

Several commenters opposed our finding that there is a likely to be a technological laggard, arguing that the technology exists for all manufacturers to comply with the 2010 NOx standard.

Mack

Mack commented that EPA must demonstrate that a "true" technological laggard exists, arguing that EPA has identified nothing to date to suggest that Navistar is a technological laggard. It noted further Navistar has "never publicly expressed any inability to meet the standard" and has actually submitted two applications for certificates of conformity for engine families that purport to comply with the 0.20 g/bhp-hr 2010 NOX standard. Mack argued that EPA has failed to examine the relevant data and articulate a satisfactory explanation for its action, including a rational connection between the facts found and the choice made and that EPA must provide technical analysis to demonstrate that Navistar:

1. Selected technology that cannot meet the 0.20 g/bhp-hr standard for purely technological reasons.
2. Was incapable of using a proven, demonstrated, and available technology, such as SCR, to meet the standard.
3. Actually submitted a formal request for NCPs or claimed that it was unable to meet the standard.

On the other hand, Mack did acknowledge that "it was readily apparent as far back as (and indeed, even earlier than) 2009, when Navistar sued EPA seeking to overturn the 2010 standard based on allegations that it was not feasible, that Navistar would need NCPs."

Cummins

Cummins stated that Navistar has chosen not to utilize SCR technology to comply with the 0.20 g/hp-hr NOx standard and instead pursued a different path, not based on a lack of technological ability to employ SCR, but because of a conscious business calculation. It quoted a Navistar official as saying: "There's no question that SCR works. It's just not the choice our management wanted to take. It's just too easy."[7] It also noted that Navistar is currently using SCR technology in some of its engines in South America, and has submitted an application for a certificate of conformity that does not rely on the use of emissions credits to comply. Finally, Cummins noted that because "the factual predicate for the agency's proposed action has completely changed" (i.e. after the proposal, Navistar submitted a request for certification of a 0.20 g/hp-hr NOx engine family) EPA must reconsider its finding that NCPs are appropriate. Nevertheless, in its hearing testimony, Cummins did not seem to object to EPA finalizing the rule stating, "We urge the Agency to follow due process expeditiously and finalize a sound rule that ensures all manufacturers are treated fairly . . ."

Daimler

Daimler emphasized the distinction between "true technological laggards and economic laggards-particularly intentional economic laggards", stating that "one federal court has held, "NCPs were intended to give a manufacturer that has made every effort to comply, but has been unable to achieve compliance, a chance to continue to participate in the market." (United States v. Caterpillar, Inc., 227 F. Supp. 2d 73,88 (D.D.C. 2002)). Daimler argued that "Navistar has failed to demonstrate that it cannot use SCR" and noted that Navistar's wholly owned subsidiary is already using SCR in Brazil. It argues that this means "that Navistar purposefully chose not to use SCR in the United States, thinking it could gain some economic or competitive advantage." Daimler further noted that Navistar stated in its annual reports that it "chose [ ] EGR, combined with other technologies, as our solution to meet the 2010 emissions standards [because] [w]e believe that our customer-friendly solution provides our products with a significant competitive advantage in North America" over all of its competitors, which "have chosen liquid-based urea SCR as the solution to meet 2010 emission standards." Daimler also stated that "a critical factual predicate of the Agency's rulemakings has been proven incorrect" because a Navistar official stated that the company could meet the standard but did not want to produce the engine until it further improves fuel economy and noted that Navistar has submitted an application for a 0.20 g/hp-hr engine.

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[7] E. Ballam, 2010 Emission Standards Limit Apparatus Engine Choices, Fire Apparatus & Emergency Equipment, Mar. 2009, available at http://www.fireapparatusmagazine.com/ index/display/article-display/4258450219/articles/fire-apparatus/Volume-14/issue-03/features/2010-emissions-standards-limit-apparatus-engine-choices.html.

Ms. Whittaker

Ms.Whittaker identified several emission control technologies that she believes could be used by Navistar to meet the emission standard and stated that a technological laggard does not exist because Navistar could have used other technologies to meet the standard.

Ms. Sinisi

Ms. Sinisi commented that EPA should not establish NCPs "every time a single engine manufacturer is in danger of becoming noncompliant."

EDF

EDF stated that NCPs provide a narrow exception to other requirements for truly exigent circumstances where compliance is impossible for technological reasons

Navistar

Navistar acknowledged during the public hearing that it "needs" NCPs and agrees with EPA's determination that there is a reasonable possibility that Navistar will be unable to comply for technological reasons because it will run out of credits in model year 2012. Navistar stated that without the interim NCPs, it would have already run out of HHDDE credits.

It acknowledged that it submitted an application for a certificate at 0.20 g NOx, but stated that even were EPA to approve that application tomorrow, it would still take Navistar until June or July 2012 to produce road-ready engines covered by the application. It also noted that the submitted 0.20 g NOx application only covers one family of Navistar's 13 liter MaxxForce heavy HDDEs. Navistar also has two other 13 liter families, one 11 liter family, and two 15 liter families in its heavy HDDE line. Navistar indicated that it expected there would be more than a year of lag time to prepare and have approved its certificates, including all other requirements needed for introduction into commerce, for its other HHDDEs. Navistar also provided evidence that it needs NCPs to ensure continued operations.

Navistar agrees with EPA's finding that its issues arise from technological as opposed to economic reasons (noting that it had invested $700 million to develop its emission controls). Navistar noted that long term economic interest influences all decisions of for-profit companies, but that the delay in compliance came because of the technological decision to use a technologically innovative path, rather than using "the more primitive SCR option." Navistar stated that it needs NCPs as a temporary bridge to keep certain engine families in the marketplace.

Navistar stated that NCPs are precisely intended to provide relief for manufacturers who have chosen a different technology path for compliance. Navistar noted that if it were required that a noncomplying manufacturer must adopt the technology of those who do comply, there could never be a finding of a likelihood of a technological laggard. Navistar stated that it did not "choose" not to comply, but chose a different technology.

Navistar also stated that the fact that one of its international facilities manufacturers engines using SCRs is not relevant as those engines are designed to meet Europeans standards and requirements that are substantially different from EPA requirements and would require an entirely new development program, taking approximately 22 months.

Finally, although Navistar does not expect a need for NCPs for its medium HDDE families during the 2012 model year, it stated that it may need NCPs for at least some of these families in the time period covered by the proposed rule.

Navistar also submitted a late comment in which it responded to the claims of SCR engine manufacturers that Navistar does not need NCPs because it has submitted an application for certification for one of its engines. Navistar responded by stating:

> SCR engine makers arc blatantly wrong both legally and factually. As discussed in detail below, should EPA accept Navistar's current certificate application for one rating of one of its 13 liter engines - and it should - that in no way changes Navistar's need for, or the appropriateness of issuing, NCPs for either the accepted 13 liter application (as a temporary bridge between certification and actual production and sale for that one configuration), or for Navistar's many other HDDE families and ratings none of which have 0.20 g applications submitted. Moreover, the claims of SCR engine makers reflect either a complete disregard, or a complete misunderstanding, of not only the law and intent behind NCPs, but also EPA's application and interpretation of those rules. To contend, as they do, that Navistar does not qualify for NCPs because it consciously "chose" what unknowingly resulted in a late-complying technology path (when they say they made it on time with a separate inferior path and that Navistar could have too) is simply nonsensical. Their claims have no legal basis and, thus, should be summarily rejected.

Navistar noted that its decision to embark alone on development of advanced EGR, rather than using "off-the-shelf technology" has slowed development and increased the costs of the necessary advancements. It argued this reinforces the appropriateness of NCPs in this instance.

Response

The Clean Air Act places no explicit restrictions on when EPA can set NCPs. In fact, it seems to create a presumption that NCPs will be available. The Act requires EPA to allow certification of engines that do not meet the standard (unless EPA determines the practicable upper limit to be equal to the new emission standard). The commenters arguing that either EPA or Navistar must prove the existence of a technological laggard are misreading both the statute and the regulations. In 40 CFR 86.1103-87(a)(2), EPA specifies that we will issue NCPs, provided we find "that there is likely to be a technological laggard." The regulations do not require any explicit proof that a technological laggard currently exists, only a finding that one is likely.

Nor do the regulations require any sort of formal request by a manufacturer that it needs NCPs. EPA's decision is based on its own evaluation of the facts. In any case, commenters cannot now dispute the fact that Navistar has effectively requested in its comments on this rule

that NCPs be available. Moreover, commenters can also not dispute the fact that Navistar certified heavy heavy-duty engines to use the interim NCPs, and therefore, can be considered to have formally requested NCPs.

While the regulations do not define "technological laggard", the commenters correctly noted that EPA has previously interpreted this as meaning a manufacturer who cannot meet the emission standard due to technological difficulties, not merely economic difficulties (67 Fed. Reg. 51,464-5, Aug. 8, 2002). The regulations do not require EPA to be *certain* that one or more manufacturers will actually be unable to meet the standard for technological reasons. Rather, the regulations specify that it is sufficient for EPA to find this will *likely* be the case. Moreover, the regulatory text states that we will establish NCPs when "EPA finds" that there is likely to be a technological laggard. Thus, just as with the finding that substantial work is needed, the determination of the likelihood of a technological laggard developing is one that is made at EPA's discretion, provided we have a reasonable basis for making such a finding.

EPA proposed NCPs for heavy-duty diesel engines because we found that there was a significant likelihood that they would be needed by Navistar and that Navistar had not met the requirements for technological reasons. Navistar was then using NOx credits to certify all of its heavy heavy-duty diesel engines at nearly the FEL cap level of 0.50 g/hp-hr and did not have sufficient credits to cover its entire model year 2012 production. The comments opposing this determination can be summarized as the following three reasons:

1. Navistar should have used SCR to meet the standard.
2. Navistar could still use SCR (or other advanced emission controls) to meet the standard.
3. Navistar could meet the standard without SCR, but is choosing to not meet the standard for economic reasons.

With respect to the first reason, we agree that Navistar could have decided over two years ago to apply SCR to its engines (as the rest of the industry did) and that it would likely be able to meet the standard if it had. However, it made a decision to attempt to meet the emission standard without SCR. The emission standard adopted by EPA is a performance standard, and does not require that all manufacturers use the same technology to meet the standards. Congress, understanding that manufacturers may not all be in the same place regarding compliance with technology-forcing standards, specifically permitted manufacturers to emit higher levels of pollutants using NCPs. EPA believes commenters are incorrect in interpreting the NCP provisions to effectively discourage technological innovation by requiring all manufacturers to use the same technology once one manufacturer has met the standard using that technology. As Navistar noted, such an interpretation would seem to negate the entire purpose of NCPs, which presume that at least one manufacturer has met the standard. Having made its decision to use a different technology to meet the standards, Navistar has not yet developed and produced engines that have been certified to meet the 0.020 standard. This is similar to the circumstances in 2002

when Caterpillar developed its "ACERT" technology rather than use cooled exhaust gas recirculation (EGR) technology and needed to use NCPs while developing ACERT.[8, 9]

As Navistar noted, all for-profit companies look at economics in making long-term decisions. However, this does not refute the clear evidence that Navistar made a decision to use a different technological solution to meet the 0.20 g/hp-hr standard than other manufacturers, and that this technological solution has delayed Navistar's ability to meet the standard. It is for this technological reason that Navistar cannot meet the standard, not because it has made an economic decision not to try.

With respect to Daimler's comment that a federal court has held that "NCPs were intended to give a manufacturer that has made every effort to comply, but has been unable to achieve compliance, a chance to continue to participate in the market", we believe that this was quoted out of context. The broader context for the court's statement is: [10]

> EPA also refutes Caterpillar's suggestion that the purpose of the NCPs was to allow a manufacturer to weigh the costs of compliance against the costs of paying NCPs. If that were the case, EPA points out, engine manufacturers would be able to calibrate the intensity of their compliance efforts to the NCP for each new standard, allowing them to opt for noncompliance when compliance becomes more expensive than the NCP. This kind of second-guessing, however, was clearly not Congress' intent in providing for NCPs:
>
> > The principal purpose of the Clean Air Act is to protect public health. The mere payment of an economic penalty required by the delayed compliance penalty provision should not be insulation against achieving requirements related to protection of public health.... [T]he delayed compliance penalty ... is not intended to provide an opportunity for continued non-compliance.
>
> Instead, *NCPs were intended to give a manufacturer that has made every effort to comply, but has been unable to achieve compliance, a chance to continue to participate in the market* (emphasis added). Thus, NCPs serve their purpose even if promulgated after a company has made its engine design decisions, since those decisions should be based on whether compliance can be achieved, not on whether compliance is less expensive than paying NCPs.

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[8] *See* "Caterpillar Announces Plans to Phase Out Bridge Engines," Transport Topics, Sept. 9, 2003.

[9] Final Technical Support Document: Nonconformance Penalties for 2004 Highway Heavy Duty Diesel Engines, EPA420-R-02-021 August 2002, at 11-12 ("Engine manufacturers generally agree with us that cooled EGR is one of the principal technologies capable of achieving the 2004 emission standards. In the past several months, a number of engine manufacturers have announced they are pursuing cooled EGR technology as their principle means of complying with the 2004 standards. In addition, at least one engine manufacturer [identified as Caterpillar] has announced they are pursuing an alternative technology for complying with the 2004 HDDE standards which does not include the use of cooled EGR.")

[10] United States v. Caterpillar, Inc., 227 F. Supp. 2d 73, 88 (D.D.C. 2002).

When considered in its broader context, it becomes clear that this statement had nothing to do with evaluating in retrospect whether a manufacturer had made every effort to comply, but rather addresses the possibility of a manufacturer choosing which technology to pursue based on the availability of NCPs. This is not the case for Navistar. Clearly, Navistar chose to pursue a non-SCR solution long before NCPs were available. Navistar has made considerable efforts to meet the standard, and has not simply weighed the costs of compliance with the cost of NCPs. Navistar's choice of innovative in-cylinder control has led to a delay in its full compliance should not be confused with a manufacturer that has failed to meet standards based on a weighing of costs.

With respect to the second reason, we agree it is reasonable to conclude that Navistar can meet the 0.20 g/hp-hr NOx standard by adding SCR to its engines. In fact, Navistar has recently announced that it will do just that. However, this does not mean that it is not currently a technological laggard. Even before Navistar's announcement, our technological laggard determination considered Navistar's ability to add SCR to its engines, but found this to be an unrealistic near-term strategy (i.e., for 2012) due to the amount of time it would take to redesign engines and vehicles for an alternate compliance path that would use SCR. The same would be true for other advanced technologies. These limitations are technological rather than economic in nature, and no amount of money could be spent by Navistar to bring its engines into compliance during the current model year. We continue to believe that there is no viable technological path available to Navistar that would allow it to produce engines that fully comply with 0.20 g/hp-hr NOx emission standard for model year 2012, or to use compliant engines made by another engine manufacturer in its vehicles.

With respect to the third reason, commenters are correct that prior to the end of the comment period, Navistar submitted an application for certification of engines to the 0.20 g/hp-hr standard without using credits. However, after EPA's review of the initial application, there were substantial issues regarding the extent to which Navistar's engines truly meet the standards and other regulations, and that request was withdrawn. Subsequently, Navistar submitted a new application for certification for one of its 13 liter engines. This application would have covered a single engine configuration and would not cover Navistar's other 13 liter engines or any of its 11 liter or 15 liter engines. Navistar noted that even if its application were approved, it would take more than a year to incorporate appropriate revisions for all of its engines. Our initial review of this revised application did not convince us that Navistar's newer engine design met the standards and other regulations. Navistar has since withdrawn this application.

When considered in totality, we continue to believe that there is a significant *likelihood* that Navistar is a technological laggard with respect to a significant number of engines. We also note that if we are incorrect and Navistar is able to comply with the standard for all its engines in the very near future, the final NCP is high enough that it would discourage Navistar from using NCPs in those circumstances.

With respect to the comment from Ms. Sinisi, we note that the Clean Air Act does not require more than one manufacturer to be at risk of noncompliance in order for EPA to set NCPs.

1.2.4. **Other Criteria**

Summary of Comments

Daimler EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049

Daimler commented that NCPs are only appropriate where EPA finds that the regulatory lead time it has provided is insufficient to enable manufacturers to develop the technology necessary to meet the standards.

Response

We disagree with this comment. EPA would not set standards such that the regulatory lead time is not sufficient to meet the standard – see section 202(a)(3). In any case, while it is true that allowing certification through NCPs might be appropriate where the regulatory lead time has proved insufficient for manufacturers to meet the standards, NCPs are generally intended for circumstances like the current circumstances, where only a portion of the industry has met the standards. Navistar needs NCPs not because we did not provide sufficient lead time, but rather because it chose to pursue an emission control technology path that has not yet achieved 0.20 g/hp-hr NOx.

1.3. Interim Final Rule

On January 31, 2012 EPA simultaneously published an Interim Final Rule establishing interim NCPs for heavy heavy-duty engines and a parallel Notice of Proposed Rulemaking (NPRM). Several engine manufacturers petitioned EPA to rescind that Interim Final Rule. These petitions and EPA's responses to them have been placed into the Docket for this rule.

Summary of Comments

Cummins EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051

Mack, Daimler and Cummins reiterated in their comments objections that they made to the Interim Final Rule in their petitions. Navistar commented in support of the Interim Final Rule.

Response

EPA has placed into the docket for this rule responses to the issues raised by the commenters in their petitions. The procedural issues raised in the petitions with regard to the interim final rule are not relevant to this final rule that was issued after notice and comments. The substantive comments regarding the provisions of the Interim Final Rule are moot as the final rule has superseded that rule, and are generally answered in responses to comments regarding the notice of proposed rulemaking.

2. Penalty Level and Cost Analysis

This chapter responds to comments addressing our cost analysis. Note that additional discussion of the basis of our cost analysis can be found in the Final Technical Support Document for this rulemaking.

2.1. Appropriateness of Penalty Level

Section 206(g)(3)(B) of the CAA instructs EPA to set NCPs at a level that "remove[s] any competitive disadvantage to manufacturers whose engines or vehicles achieve the required degree of emission reduction." This section discusses general comments about the level of the penalty. Later sections in this chapter discuss more specific comments related to the penalty level, such as those related to the methodology or data used to support our analysis.

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Ford	EPA-HQ-OAR-2011-1000-0029
ICCT	EPA-HQ-OAR-2011-1000-0030
J. V. Sinisi	EPA-HQ-OAR-2011-1000-0020
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
MECA	EPA-HQ-OAR-2011-1000-0017 & 0040
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050
NESCAUM	EPA-HQ-OAR-2011-1000-0018-0019
NJDEP	EPA-HQ-OAR-2011-1000-0016
PACCAR	EPA-HQ-OAR-2011-1000-0041

Navistar

Navistar commented that EPA set the NCP penalties too high in the proposal and Interim Final Rule. Navistar believes that EPA overestimated DEF costs and underestimated investment. It commissioned Compass Lexecon ("Lexecon") to analyze the economics of EPA's Proposed NCP Rule and Interim Final NCP Rule. Navistar reports that Lexecon concludes that:

- EPA's method is an "economically appropriate approach" in balancing the CAA's twin goals of not forcing a manufacturer out of the market and of not placing a complying manufacturer at a competitive disadvantage.
- If Navistar were eliminated from or significantly restricted in the market, there would likely be a substantial competitive effect and consumer harm.

Navistar noted that the purpose of a NCP "is not to penalize nonconforming manufacturers" but to ensure that there is no competitive advantage received from the failure to comply.

Ford

Ford commented that if it is cheaper and easier simply to pay the NCPs rather than install the aftertreatment equipment necessary to meet the standards, many if not all manufacturers will elect to pay the NCPs. Such an outcome would be contrary to the CAA goals of improving air quality. Ford also commented that the proposed NCP levels for *medium* heavy duty diesel engines (MHDDEs) are substantially lower than necessary to achieve the goal of removing the competitive advantages of certifying to a less stringent Oxides of Nitrogen (NOx) standard. Ford stated that the COC 50 value of $462 and COC 90 value of $682 are as much as an order of magnitude less than would be suggested by comparisons of retail or wholesale prices of fully compliant engines to engines that will require NCPs.

NJDEP and CATF

NJDEP and CATF commented that the proposed NCP values were too low to meet the applicable NCP statutory and regulatory provisions. NJDEP stated that "the NCP does not appear to be large enough to incentivize the one non-conforming manufacturer to spend the required money and resources to develop a compliant emission control system quickly." It also stated that "the amount of the NCP should act as a deterrent to prevent manufacturers from failing to invest the necessary resources to develop a compliant system" and should be greater than the costs of a compliant system. CATF submitted a memorandum that evaluates potential NCP values that would potentially derive from a "high engine-out" nonconformance path, using best available recent projections of the future relationship between DEF and diesel fuel prices. That analysis indicates that a year 1 NCP value in the range of $4,000-$5,000 might be warranted to preclude backsliding by current conforming engine manufacturers.

J. Sinisi

Ms. Sinisi commented that noncompliance penalties really only offer engine manufacturers an incentive to remain noncompliant with applicable emissions standards. She stated that though noncompliance penalties are designed to increase over time in order to encourage more efficient compliance; in reality it may actually be cheaper for some engine manufacturers to produce noncompliant engines for a very long time. She further stated that certain manufacturers may only bring their engines up to code on the very day that it becomes too expensive to pay the increased noncompliance penalty. She stated that engine manufacturers will continue to pump dangerous nitrogen oxides into the environment because they have an incentive to do so in the form of a noncompliance penalty. Ms. Sinisi commented that the penalty may only buy them time to increase their profits until they are either finally forced to comply or until the next noncompliance penalty is instituted.

MECA

MECA stated that a powertrain manufacturer may decide to take short term profits rather than investing millions of dollars and years of resources into R&D, manufacturing upgrades and other new product commercialization costs and in the end fall back on NCPs to buy their way into compliance. Incentivizing such an approach is a significant concern to MECA members and threatens the establishment of a fair market, based on a level playing field. MECA urges the

agency to manage the NCP compliance option so as to not threaten the future development of advanced technologies that actually deliver the emission reductions used to justify the original rule.

Cummins

Cummins commented that EPA's proposed NCPs would create a situation where paying NCPs to produce noncompliant engines is a lower cost option compared to compliance, stating:

> When Congress authorized NCPs, it foresaw this possibility and spoke directly to it: "The Committee does not intend to encourage noncompliance with the revised standards. For example, if a manufacturer opts to pay the penalty and to design or tune the vehicle or engine to higher emission levels, the nonconformance penalty would probably be inadequate and should be revised." House Rep. No. 95-294 at 276 (95th Cong. 2d Sess. 1977), 2 U.S.C.C.A.N. 1355 (1977). But that is just what EPA has done here.

Cummins also commented that the too-low NCPs create a much greater issue with regard to compliance among SCR manufacturers than between EGR and SCR manufacturers. Cummins continued to say that since NCPs are available to all manufacturers once enacted, and since the cost of the proposed NCPs are much lower than the economic value that can be created by paying them and optimizing engines at higher, noncompliant NOx levels, SCR manufacturers that are otherwise capable of producing compliant engines will be driven by competitive market forces to pay NCPs as a license to produce higher emitting engines. Cummins also commented that a correct analysis would recognize the first cost and operating cost benefits of operating at higher NOx levels up to 0.50 g/hp-hr and would incorporate a more appropriate DEF/diesel price ratio which would result in a much higher NCP level of $8,100 for a heavy heavy-duty diesel engine and $2,600 for a medium heavy-duty diesel engine.

Daimler

Daimler stated that the penalty levels set forth in the Interim Final Rule and NPRM do not meet the paramount statutory obligation to remove any competitive disadvantage to manufacturers whose engines or vehicles achieve the required degree of emissions reduction." Daimler also commented that EPA focuses in on an emissions reduction that is 1/8 the amount that has been achieved by manufacturers to meet the current standard, thereby ensuring that any calculation under this new method will always be grossly inadequate. Daimler stated that EPA explained in response to comments on its most recent prior NCP rulemaking: "The statute requires we remove any disadvantage which the complying manufacturer may encounter. . . . [T]he statute does *not* require that we establish an NCP which removes any disadvantage to the non-complying manufacturer."

PACCAR

PACCAR stated that the proposed NCP level is so low that it creates an additional competitive disadvantage for manufacturers that have invested considerable time and resources in developing emission control technology that complies with the 2010 NOx standard. PACCAR commented that in order to eliminate the competitive advantage Navistar gains under

the current NCP, EPA should add the value of Navistar's fuel economy advantage to the SCR hardware, R&D and warranty component costs, and increase the NCP for 2012 to a minimum of $14,378.

Mack

Mack stated that EPA's NCP for the 2010 standard is a fraction of its previous NCPs. Mack commented that the maximum penalty, or penalty associated with meeting the upper limit of 6.0 g/bhp-hr established by the 1991 NCP, was $2,250. Adjusted for inflation to 2012 dollars, the penalty is $3,744. In addition, it commented that this penalty was established for an upper limit that was only 17 percent higher than the applicable 5.0 g/bhp-hr standard. Mack stated that the maximum penalty associated with meeting the upper limit of 5.0 g/bhp-hr established by the 1998 NCP was $2,540. Adjusted for inflation to 2012 dollars, the penalty is $3,532. Mack further stated that the upper limit for this rulemaking, meanwhile, was set at about 20 percent higher than the applicable 4.0 g/bhp-hr standard. It said for 2004, the maximum penalty associated with meeting the upper limit of 6.0 g/bhp-hr was $12,210, or $14,651 in 2012 dollars. The upper limit for that rulemaking was 2.4 times the standard. Further, by comparison, the maximum penalty established for meeting the upper limit of 0.50 g/bhp-hr in the NCP under the Proposed NCP Rule is $1,919, which is lower than all previously established NCPs for NOX emissions from heavy heavy-duty diesel engines, even if not adjusted for inflation. Mack concluded that this is despite the fact that the rule was the most expensive emissions mandate the industry had ever faced.

Mack concluded that by setting an extraordinarily low NCP for MY 2010, EPA not only would remove any incentive by Navistar to develop a compliant engine, it also would create new incentives for conforming manufacturers to develop engines that can take advantage of a 0.50 g/bhp-hr upper limit through payment of a nominal penalty.

Response

NCPs must conform to the statute and the regulations. With respect to the statutory requirements, we note that while the purpose of adopting NCPs is to allow a noncompliant manufacturer to continue selling its engines, the Clean Air Act directs EPA to set the NCPs at a level that will "remove any competitive disadvantage" to complying manufacturers. We believe that the statute effectively requires us to set the penalties at a level that we reasonably expect to protect the complying manufacturers, but not so high that it effectively forces any noncomplying manufacturers from the market, (unless that is the only way to protect the complying manufacturers). In this context we agree with commenters that state EPA must consider competitive disadvantages for complying manufacturers relative to both noncomplying SCR and noncomplying non-SCR engines. We agree with commenters that setting NCPs too low could cause manufacturers who can now comply with the standard to instead make a decision to comply using NCPs, which would lead to more NOx emissions. We believe that the NCPs promulgated in this final rule, which are substantially larger than those proposed, are sufficient to protect complying manufacturers from competitive disadvantage, but not so high as to *create* a substantial competitive *advantage* for complying manufacturers.

While commenters provided arguments why Navistar *could* have a competitive advantage over compliant engines, none provided any evidence of an *actual* competitive advantage. Commenters did not dispute EPA's statement in the Interim and Proposed Technical Support Document that Navistar has not gained any market share since the 2010 standard has gone into effect, during a period when Navistar was not paying any penalties at all. Some commenters claim that Navistar has saved money by not developing SCR, but Navistar claims that it has actually spent more on R&D than its competitors. Thus, while we agree that producing engines with NOx emissions at 0.50 g/hp-hr provides Navistar some competitive advantage, we do not believe it is as high as some commenters claim. Moreover, we agree with Cummins that an optimized SCR engine with NOx emissions at 0.50 g/hp-hr would have an even greater competitive advantage than Navistar's engine.

It is also worth noting that Navistar has revealed in its quarterly reports that it has had higher than expected warranty claims for its 2010 and 2011 engines, which led to the company posting a net loss so far for 2012.[11] We believe those commenters focused on costs of SCR hardware overestimate Navistar's competitive advantage because they did not consider the high warranty costs for Navistar's high-EGR engines.

EPA has also set regulatory requirements for penalty levels. Most significantly, the regulations state that we must set penalties based on total incremental costs of compliance relative to engines at the upper limit. These requirements apply in addition to the statutory requirements. Unlike the statutory requirements, the regulatory requirements may be revised at any time through rulemaking. Thus, while EPA follows the regulatory requirements, this does not allow us to ignore the statutory requirements. In fact, should we find that conforming to the regulatory requirements would not conform to the statutory requirements, we would revise the regulatory requirements. Having said this, as noted elsewhere, we believe that the final NCPs being established conform to the regulatory requirements.

As is described in the Final Technical Support Document, the final NCP levels meet both the statutory and regulatory criteria. They are also consistent with the legislative history cited by Cummins, which stated "if a manufacturer opts to pay the penalty and to design or tune the vehicle or engine to higher emission levels, the nonconformance penalty would probably be inadequate." In summary, we have found that the final NCP parameters are set at a level that will:

1. Remove any competitive advantage Navistar may have otherwise had by selling non-SCR engines.
2. Allow Navistar to remain in the market.
3. Eliminate the incentive for SCR engine manufacturers to reoptimize their engines for 0.50 g/hp-hr NOx.

While many commenters addressed this first conclusion, none provided any evidence that the actual competitive advantage for Navistar is so large that it is not eliminated by our penalty, and

[11] "Navistar Announces Management Reorganization, Reports Second Quarter Results", Navistar Press Release, June 7, 2012.

none of the comments even suggest that the penalty level would not allow Navistar to remain in the market. However, several commenters provided information to support their belief that the proposed penalty was not large enough to eliminate the incentive for SCR engine manufacturers to reoptimize their engines for 0.50 g/hp-hr NOx. As is described in later sections, we have made changes to our analysis in response to these comments so that our final penalty now does eliminate this incentive.

Neither the statute nor regulations state (or even imply) that NCPs should be evaluated based on prior NCPs. Thus, comments comparing the proposed NCPs to prior NCPs are not relevant without specific reference to differences in methodology and costs. Nevertheless, we have compared them to prior NCPs to show that, while the commenters are correct that the proposed maximum penalty was lower than those for recent NCPs, the reason for this is that the difference between the standard and upper limit is so much lower than for these recent NCP rules. As shown in the following table, when considered on a dollar per g/hp-hr basis, the proposed NCPs are actually higher than those of these recent NCP rules.

2-1 Comparison of Proposed NCPs to Prior NCPs for Heavy Heavy-Duty Engines.

Comparison of Proposed NCPs to Most Recent NCPs for Heavy Heavy-Duty Engines			
Standard	Upper Limit	COC_{90} (in 2011 Dollars)	Dollars per g/hp-hr
4.0 g/hp-hr 1998 NOx Standard	5.0 g/hp-hr	$3,855	$3,855
2.4 g/hp-hr 2004 NOx+NMHC Standard	6.0 g/hp-hr	$15,508	$4,308
0.20 g/hp-hr 2010 NOx Standard	0.50 g/hp-hr	$1,919	$6,397

Daimler's comment about our focus on the costs of going from 0.50 g/hp-hr to 0.20 g/hp-hr, rather than the previous standard (about 2.0-2.3 g/hp-hr) to 0.20 g/hp-hr, disregards the fact that, pursuant to section 206(g)(2), the upper limit should be set to the level we find to be practicable, which in this case is 0.50 g/hp-hr, which every manufacturer has met. Moreover, it is not true that looking at the smaller emissions difference will "ensure" lower NCPs. Whether or not we based our analysis on the smaller or larger difference, NCPs would still only be permitted to the upper limit (0.50 g/hp-hr). There is no reason to believe that an NCP for an engine emitted at 0.50 g/hp-hr will necessarily be higher under the existing regulatory structure because it is based on the calculation of going from the previous standard to 0.20 g/hp-hr, rather than going from 0.50 g/hp-hr to 0.20 g/hp. Indeed, in our analysis of alternatives in the Final

Technical Support Document, we reviewed a possible NCP based on going from a baseline engine emitting NOx at 1.2 g/hp-hr (the effective interim standard from model year 2007 to 2009) to 0.20 g/hp-hr, and we found that the NCPs at 0.50 g/hp-hr were actually lower in that scenario than in the scenario we used in the final rule. See Sections 2.4 and 2.5 for additional discussion of this comment.

With respect to Ford's comments regarding the appropriateness of the medium heavy-duty NCP values, we have decided to seek additional comment before finalizing medium heavy-duty engine NCPs. The Final Technical Support Document includes an analysis of three alternative methods that could be used to calculate medium heavy-duty NCP values.

We did receive other relevant and more specific comments on the level of the penalty. These comments are addressed in separate sections of this document, as specified in the following table:

2-2 Sections Addressing Details of NCP Level Derivation

Comments related to . . .	Are addressed in Section . . .
Consideration of cost information from engine manufacturers	2.3
Basing compliance costs on engines at the upper limit	2.5
Baseline engines	2.6
Hardware costs	2.7
Operating costs	2.8
Warranty and repair costs	2.9.1
Research and development costs	2.9.2
Other costs	2.9.3

While we are responding separately to comments on specific aspects of our cost analysis, it is important to note that the costs must ultimately be evaluated as a whole. This is true in the context of the regulatory definition of COC_{90} as well as in the context of whether the resulting penalties meet the statutory requirements. The COC_{90} cost is defined as the 90th percentile cost of compliance, although it is often thought of as a worst case cost of compliance. This leads some commenters to argue that each individual cost should be set at the highest possible value. However, there is uncertainty associated with each cost component and we have attempted to address this uncertainty so that the resulting *total* COC_{90} cost represents the 90th percentile cost of compliance and removes the competitive disadvantage for complying manufacturers.

Finally, we note that several commenters recommended specific values for COC_{90} (in some cases stated as the recommended penalty). These recommendations, which each differ from our final COC_{90} value, are summarized in Section 2.10. In those cases where it is possible to do so, we identify the primary reasons why the recommended value differs from our estimate.

2.2. Differences from Cost Methodologies Used in Prior NCP Rulemakings

This section addresses comments on the general topic of the extent to which EPA must follow the same cost methodologies used in prior NCP rules. Similar comments addressing specific differences between this rule and prior NCP rules are addressed elsewhere in this document.

Summary of Comments

Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050

Daimler and Mack argued against EPA's cost methodology because it differs from methodologies used in prior NCP rules.

Daimler stated that EPA acknowledged that its methodology "differs from that used in all past NCP rules", but added that "EPA never offers a rational explanation for the change and has failed to recognize the fact that this methodology inevitably leads to a gross underestimation of the true cost of compliance." (Daimler's other comments related to specific aspects of prior methodologies, as well as Mack's, are discussed in later sections.)

Navistar stated that EPA's overall analysis and methodology is a rational and reasonable path for calculating the cost parameters and NCP penalty levels in the circumstances presented. It said that EPA applies the exact same methodology and NCP formula that the agency has applied for decades. Navistar continued to state that although the exact cost inputs for each NCP are dependent upon the specific circumstances that apply at the time, as with every other previous NCP, the Agency has based the NCP on incremental compliance costs, including engine and vehicle manufacturing costs (such as variable costs including hardware and assembly and fixed costs including tooling, research and development, and warranty costs) in addition to operating costs (such as fuel and DEF costs). Navistar also stated that the baseline engine selected by EPA is reasonable for calculating NCPs.

Response

This section addresses the general issue of whether EPA is obligated to follow past practices used in other NCP rules. See Sections 2.4, 2.6, and 2.8.1, for additional discussion of ways in which this current rule differs from prior NCP rules.

As noted earlier, the Clean Air Act directs EPA to set the NCPs at the level necessary to "remove any competitive disadvantage" to complying manufacturers. However, since it is generally not possible to precisely quantify the competitive disadvantage to complying manufacturers, EPA's original "generic rule" provides for the NCPs to be calculated from total

incremental costs of compliance. In that rule, EPA noted that to evaluate the total incremental costs of compliance, it would "assess both manufacturers' and users' cost impacts."[12] The logic of this approach was that penalties based on total incremental costs of compliance would generally be the best surrogate for penalties based directly on competitive disadvantages. Nevertheless, this has never meant that we would knowingly ignore other factors related to competitive advantages.

The commenters' suggestion that EPA not deviate from prior precedents for calculating costs implies that EPA has always used the same methodology. However this is not true. EPA explained this in the Technical Support Document for the NPRM when we said:

> In each of our six previous NCP rulemakings, we estimated costs using a methodology appropriate for the specific circumstances that applied at the time. None were approached in exactly the same way. In each case we considered key factors such as differences in calibration, hardware, and operating costs, but there have been some NCP calculations where other potential individual cost or cost saving elements have been included or excluded for various reasons.

Even if it were true that EPA had used the same methodology for all prior NCP rules, this would not obligate us to continue using the same methodology in perpetuity. By arguing that EPA may never change from approaches taken in prior NCP rules, the commenters are essentially saying that we should consider only certain compliance costs, and may never consider new costs or other competitive impacts that we have not considered previously. However, this would clearly not be consistent with the plain meaning of the statutory language.

With respect to Daimler's comment, we believe it was referring to following statement of page 7740 of the proposal:

> This approach differs slightly from that used in previous NCP rules, where EPA based the NCPs directly on an average of actual compliance costs for all manufacturers.

If so, then Daimler's statement that this represents an acknowledgement "that the methodology it adopted in the NPRM differs from that used in all past NCP rules" suggests that it is missing the intent of this sentence. This statement was intended to address the narrow issue of how to calculate costs when the upper limit is set at a level different than the previous standard. As we discussed in the proposal, the upper limit in this rule is lower than the previous standard, and therefore we had to determine the best way to approximate the cost of going from this upper limit to the new standard, even though no manufacturer had actually done this in reality. See Section 2.5 for additional discussion.

[12] 50 FR 35382, August 30, 1985.

2.3. Consideration of Manufacturer Costs

Summary of Comments

Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051

Mack stated that "the statutory mandate to remove competitive harm effectively requires EPA to consult with and obtain actual cost data from complying manufacturers." It also stated that "every manufacturer, save one, has information that can demonstrate, accurately and unequivocally, what it cost them to comply with a 0.20 g/bhp-hr NOX standard." It stated that EPA solicited no input on actual compliance costs and "asked manufacturers to speculate what technology and approaches they would undertake to achieve compliance with a 0.2 g/bhp-hr engine when starting with a 0.5 g/bhp-hr engine." It stated further that EPA dismissed this input citing our concern that manufacturers were aware that their estimated costs could be used to determine the amount of the NCP paid by a competitor, but that "there would have been no opportunity for such alleged strategic estimates" if EPA had it used actual compliance cost information. Mack cited the following EPA statements from the 2002 Response to Comments for the Phase VI NCP rulemaking:

> Our request for data from manufacturers was not for them to speculate on costs for a development program which they did not undertake. Rather, our request from manufacturers was for them to provide us with data that reflected the actual development programs they were performing (i.e., making a model year 2001 engine comply with the 2004 emission standards).
>
> Again, EPA's request prior to the proposal was for the cost estimate for the development programs that the manufacturer was actually undertaking keyed to costs for the 2004 model year, not for a theoretical development program, or a prior model year.

Daimler commented that EPA must gather cost data from manufacturers in order to determine the costs of compliance with the emission standard and use these data to derive various factors and inputs necessary to calculate the appropriate penalty amount, so that any competitive disadvantage to complying manufacturers is removed. Daimler continued to note that in the past, EPA has requested information in writing from engine manufacturers, proposed the values for a new NCP for a given emission standard with proper public notice, accepted comments from the manufacturers and other members of the public, revised its proposal accordingly, and then issued its final rule. Daimler also said that "EPA contacted various engine manufacturers by telephone in late 2011 requesting preliminary information for a proposed NCP rulemaking but did not take written submissions and refused requests for additional meetings with individual manufacturers."

Navistar commented that it previously provided cost data to EPA for meeting 0.20 g NOx using only Advanced EGR, but noted that the data is protected as confidential business information. Navistar's estimates that the projected costs provided by Navistar (using an alternative "baseline") would result in a significantly lower NCP level than EPA proposed.

Response

Neither the Clean Air Act nor our regulations require us to give any special consideration to manufacturers' estimates of compliance costs. In fact, for some prior NCP rules EPA did not explicitly solicit any cost information from manufacturers other than the general solicitation of public comments on a proposal. In the end, the compliance costs must be those that *EPA determines* to most appropriately conform to the intent of the Clean Air Act. As EPA noted in the generic Phase I NCP rule, NCP costs are to be based on "the best cost and emission performance data available to EPA during the specific NCP rulemaking." The basis for our final cost estimates is described in detail in the Final Technical Support Document.

Moreover, we did seek input from heavy heavy-duty engine manufacturers before the proposal and did consider that input. However, as we noted in the Interim Technical Support Document, each manufacturer was aware that its estimated costs could be used to determine the amount of the NCP paid by a competitor, or by itself. We stated that we were "concerned about this because we cannot independently verify the validity of the manufacturers' costs." We relied on our own experience in determining compliance costs from all information available to us, including information provided by manufacturers. We believe that, especially in this context, this is appropriate because we do not have the same incentive to skew our results as competing manufacturers do. For example, as we note in the Final Technical Support Document, information about operating costs provided by both SCR and non-SCR manufacturers is not necessarily consistent with information provided to customers in marketing materials and press statements.

Our cost estimates are neither arbitrary nor speculative, but are based on our unbiased view of the collection of data provided by manufacturers (both publicly and confidentially) as well as other data collected by EPA. In particular, we note that our methodology for aftertreatment costs is an approach that we have used in several previous notice-and-comment rulemakings. This and other examples of independent sources of cost informations are summarized in Table 2-3. (See the Final Technical Support Document for additional discussion of the basis of our cost estimates.)

2-3 Examples of Independent Data Sources.

Cost Components	Data Sources
Aftertreatment Hardware Cost	Independent EPA methodology used in prior rulemakings, which has been made available for public comment several times.
Vehicle Miles Travelled	EPA Motor Vehicle Emissions Simulator
Fuel Price	DOE Energy Information Administration's Annual Energy Outlook 2012
DEF Price	Integer Research
DEF Consumption Rates	EPA test data

With respect to Mack's concern that EPA had requested speculative data, we note that *we did* specifically request cost data relative to engine emitting at the upper limit of 0.50 g/hp-hr, consistent with the regulatory provision specifying that compliance costs are to be estimated relative to the upper limit (see Section 2.5 for additional discussion). Since Mack has not manufactured engines at this upper limit, this necessarily required some speculation on its part. While it is true that Mack would not have needed to speculate about costs relative to its 2009 engines, these costs do not supply the critical information needed to determine COC_{90} because the 2009 engines had NOx emissions well above the upper limit (Mack did not object to setting the upper limit at 0.50 g/hp-hr.) The prior EPA statements cited by Mack are taken out of context. Mack suggests that these statements are evidence that EPA has previously argued that manufacturers *should not* speculate on costs for NCPs. However, these statements were made in response to comments about what EPA *actually did* when requesting preproposal information for that Phase VI rule, rather than what we *should do.* Thus, these statements are not relevant to this rule.

With respect to Daimler's comments related to the process of soliciting cost information, we note that this seems to be a misunderstanding caused by the very short timeline of the proposal and Interim Final Rule. We did not solicit written comments because we wanted to gather the information quickly. While we did inform manufacturers that we needed to end the discussions so that we could get the rulemaking out as soon as possible, we did not actually refuse requests for meetings.

It is import to note that we also received cost information from manufacturers during the public comment period and met with those manufacturers who wanted to discuss their cost information further. We considered this new information along with the preproposal information

in our final analysis of compliance costs. In particular, we found the cost information provided by Cummins to be especially helpful because it provided detailed information about how an SCR engine could be optimized for 0.50 g/hp-hr NOx. While we did not agree with Cummins' fuel and DEF prices (see Section 2.8.3), the rest of our cost analysis is similar to the analysis it provided. We should also note that information provided by manufacturers other than Cummins (those manufacturers who addressed costs relative to other baseline engines) was considered in our analysis of alternative scenarios as described in Appendix B of the Final Technical Support Document.

Finally, there are two primary reasons why we are not basing our NCPs on the costs estimates provided by Navistar. First, just as with its competitors' costs, we are concerned because we cannot verify Navistar's costs. Second, even if we could verify these costs, they would clearly not represent the COC_{90} costs, which are supposed to represent the costs for the 90th percentile manufacturer. While we cannot divulge Navistar's exact estimate, we can say that it much lower than our final estimate of COC_{90}. Because they are lower than our estimated COC_{90}, we believe they would not be large enough to remove the competitive advantage of an optimized 0.50 g/hp-hr SCR engine.

2.4. Upper Limit

The upper limit used in the NCP derivation is the emission level established by regulation above which NCPs are not available, and a heavy-duty engine cannot be certified or introduced into commerce if its emissions are above the upper limit. CAA section 206(g)(2) refers to the upper limit as a level above the emission standard, set by regulation, that corresponds to an emission level EPA determines to be "practicable." The upper limit is an important aspect of the NCP regulations not only because it establishes an emission level above which no engine can be certified, but it is also a critical component of the cost analysis used to develop the NCP factors. The regulations specify that the relevant NCP costs for determining the COC_{50} and the COC_{90} factors are the cost difference between an engine emitting at the upper limit and one that meets the new standards (see 40 CFR 86.1113-87). In the proposal, we set the upper limit at 0.50 g/hp-hr based on the existing family emissions limit (FEL) cap and the fact that all manufacturers are producing products today at NOx levels at or below 0.50 g/hp-hr.

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
EDF	EPA-HQ-OAR-2011-1000-0026
ICCT	EPA-HQ-OAR-2011-1000-0030

Several commenters noted their support for setting the upper limit at 0.50 g/hp-hr. No commenters opposed setting the upper limit at 0.50 g/hp-hr.

The ICCT believes that the upper certification limit of 0.50 g/hp-hr outlined in the NPRM is justified and necessary to ensure a minimum level of emissions performance from engines.

EDF supports EPA's proposal to "revise the regulations in 40 C.F.R. § 86.1104–91 to clarify that EPA may set (during rulemaking) the upper limit at a level below the previous standard if we determine that the lower level is achievable by all engines." EDF also agrees that the upper limit should be set at the tightest standard achievable by all manufacturers. EDF supports EPA's proposal to set a limit of 0.50 g/hp-hr for this NCP rule, as all manufacturers are already meeting this standard.

CATF supports EPA's proposal to set the limit at 0.50 g/hp-hr NOx.

Daimler supports setting the upper limit at the maximum technologically feasible by the laggard rather than the prior emissions standard, but stated that doing so "is no reason to understate the compliant manufacturers' full cost of compliance." Daimler also stated that "if EPA changes the definition of upper limit, the Agency needs to implement a corresponding change to 40 C.F.R. § 86.1113-87(a)(4) to define COC50 and COC_{90} in relevant part as the total incremental cost to comply with the standard relative to complying with *the previous emission standard."* Daimler commented that failure to do this would render the NCP regulation and formula incapable of measuring compliant manufacturers' full cost of moving from one generation of emissions standards to the next.

Response

The Clean Air Act directs EPA to establish an upper limit for emissions that is equal to the level EPA determines "to be practicable." The regulatory approach adopted under the prior NCP rules sets the default upper limit at the prior emission standard when a prior emission standard exists and that standard is changed and becomes more stringent. EPA concluded that the upper limit should be set at a level reasonably achievable by all manufacturers with vehicles in the relevant class. It should be within reach of all manufacturers of HDEs or HDVs that are currently allowed so that they can continue to sell their engines and vehicles while finishing their development of complying engines. A manufacturer of a previously certified engine or vehicle should not be forced to immediately remove an HDE or HDV from the market when an emission standard becomes more stringent. The prior emissions standard generally meets these goals, because manufactures have already certified their vehicles to that standard. However, in the prior NCP rule, we did set the upper limit for heavy heavy-duty engines at a level different than the prior standard. We set the upper limit above the prior standard because of a Consent Decree that allowed manufacturers to exceed the otherwise applicable standard.

In the past, EPA has rejected suggestions that the upper limit should be more stringent than the prior emission standard because it would be very difficult to identify a limit that could be met by all manufacturers. For this rule, however, all manufacturers are currently certifying all of their engines at or below the 0.50 g/hp-hr FEL cap. Thus, since NCPs were not intended to allow manufacturers to increase emissions, we are setting the upper limit at 0.50 g/hp-hr. This will conform to the purpose of NCPs, which is to allow manufacturers to continue selling engines they are producing, but not to allow backsliding. No commenter opposed using 0.50 g/hp-hr as the upper limit.

Daimler supports setting the upper limit at 0.50 g/hp-hr, but stated that EPA must also redefine COC50 and COC_{90} as the compliance costs relative to the previous emission standard. We do not agree that this is an appropriate condition for setting the upper limit below the prior standard. Daimler's comment is discussed in more detail in Section 2.5.

Although no commenters support setting an upper limit above 0.50 g/hp-hr, it is worth considering a scenario in which the upper limit was set at 1.2 g/hp-hr (the level widely considered to be the effective standard during the 2007-2009 phase-in period). As shown in Figure 2-1, if we had set the upper limit at 1.2 g/hp-hr, the COC_{90} would have had to be set at $12,583 to result in the same penalty at 0.50 g/hp-hr as the penalty we are finalizing - $3,775. In fact, however, as described in Appendix B of the Final Technical Support Document, we estimated the actual net 90th percentile costs of reducing emissions from 1.2 g/hp-hr to 0.20 g/hp-hr to be only $6,990. Thus, if we had set the upper limit at 1.2 g/hp-hr, we would have likely set COC_{90} equal to $6,990 which would have resulted in a $2,097 penalty for engines at 0.50 g/hp-hr.

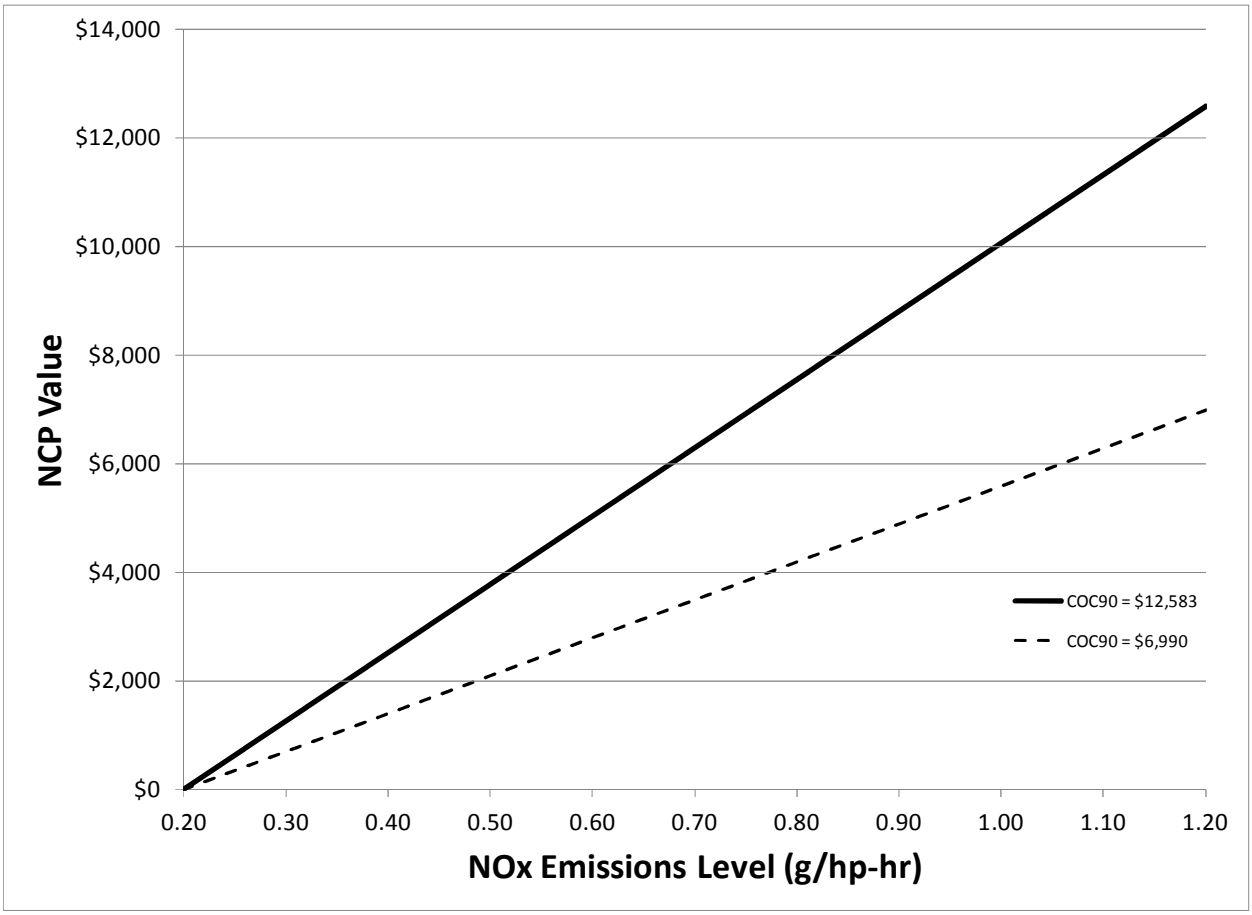

Figure 2-1 - Example of NCPs with Upper Limit at 1.2 g/hp-hr

2.5. Basing Compliance Costs on the Upper Limit Engine

We estimated compliance costs relative to a baseline engine with NOx emissions at the upper limit, as specified in §86.1113-87(a)(4) of the existing regulations, which states that:

> COC_{50} = Estimate of the average total incremental cost to comply with the standard *relative to complying with the upper limit* (emphasis added).
>
> COC_{90} = Estimate of the 90th percentile total incremental cost to comply with the standard *relative to complying with the upper limit* (emphasis added).

Summary of Comments

Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051

Mack stated that the fact that the "starting point of compliance – the phase-in standard that manufacturers met between 2007 and 2009 – was different from EPA's upper limit" is not a sufficient reason to not include the full cost of SCR hardware. It argued that the "NCP formula is designed to reflect actual compliance costs, which are then adjusted based on the degree a given compliance level exceeds the standard" and that "there is no reason to arbitrarily link the engine used to develop an NCP to the upper limit set by EPA." Mack also commented that EPA needs to consider the full engineering and development costs related to meeting the 0.20 g/hp-hr engine.

Daimler supports setting the upper limit at 0.50 g/hp-hr and acknowledged that §86.1113-87(a)(4) defines COC50 and COC_{90} in relevant part as the "total incremental cost to comply with the standard relative to complying with the upper limit." However, it nevertheless argues that compliance costs should be measured based on the emissions delta between the prior and current standards because EPA has historically set the upper limit at the previous pollutant emission standard.

Daimler also commented that the "cost for a manufacturer that has already developed emissions control technology to meet the standard will always be significantly less than the cost for a manufacturer who has not yet developed the necessary enabling technology." It further said that "establishing a penalty amount based on a small fraction of the compliant manufacturer's marginal cost of compliance does nothing to eliminate the competitive advantage that accrues to a noncompliant manufacturer when that manufacturer is allowed to sell engines that do not meet the emissions standards" and that "anything less would incentivize laggards to simply wait and let others make the investment necessary to develop required emissions control technology, and then piggy-back on that development by paying only the incremental cost of using the other manufacturers' technology."

Response

The regulations specify that costs of compliance are to be determined relative to the upper limit. Thus, our linkage of the costs of compliance to the upper limit in our cost analysis is not arbitrary, but rather it is consistent with our long-standing regulations and all prior NCP rulemakings. For example, in the Phase VI rule, when we adopted an upper limit above the prior standard, we estimated compliance costs relative to the upper limit rather than the prior standard. Given the extent to which Mack argues in other areas that EPA must follow the regulations and be consistent with prior NCP rulemakings, it is unclear how it finds this to be an insufficient reason.

We fundamentally disagree with Daimler that compliance costs used for the penalty can be disconnected from the upper limit. The regulations are based on analysis of costs related to emission differences between the current standard and the upper limit (i.e., the only emission levels allowed for NCP engines). We do not see how costs outside this range can determine the appropriate NCP within that range. The determining factors are the costs that reflect the competitive advantage for engines within this range. The flaw in Daimler's argument can be readily seen by considering the counterfactual scenario in which the 2004 standard never existed and the prior NOx standard would have been 4.0 g/hp-hr. Clearly the compliance costs for going from 4.0 g/hp-hr to the current standard would have been greater than the cost to reach the standard from 2.3 g/hp-hr (the effective NOx level of the 2004 NOx standard) or 1.2 g/hp-hr (the effective intermediate standard during the 2007-2009 phase-in period). However, this would have had no impact on the *actual* competitive advantage of *current* engines with NOx emissions between 0.20 and 0.50 g/hp-hr. Since the competitive advantage of engines at the upper limit is independent of the level of the prior standard, basing the penalty on the prior standard would be arbitrary.

The NCP formula is intended to result in a penalty at any given compliance level equal to the cost for the worst case manufacturer (i.e., the manufacturer with the highest compliance costs) to reduce its emissions from that compliance level and meet the standard. For example, the penalty for compliance levels near the standard is set based on the worst case marginal compliance costs (MC_{90}) so that the NCP associated with being 0.10 g/hp-hr above the standard is equal to the highest cost paid by any compliant manufacturer (more precisely, the 90th percentile costs) to achieve that last 0.10 g/hp-hr. Since the regulations set the penalty equal to COC_{90} for engines at the upper limit, and the Clean Air Act requires us to set the penalty at a level that removes the competitive disadvantage for complying manufacturers, Daimler's argument that COC_{90} should be based on engines at the prior standard could only be valid if it were true that engines with emissions at the prior standard and engines with emissions at the upper limit have equivalent competitive advantages over compliant engines. This is clearly not true. No manufacturer has claimed that the cost of reducing emissions from 1.2 g/hp-hr to 0.50 g/hp-hr is zero, and the comments all indicate, either directly or through implication, that there are considerable costs to do so. Daimler provides no basis to believe that the additional costs it wants to be included have any relation to competitive advantage for manufacturers producing engines *at the upper limit.*

Daimler's comment that we need to take into account the costs of going from the old standard to the new standard in developing NCPs, even though the NCPs would not allow any

manufacturer to actually emit at the old standard, is not inherently more rational than EPA determining NCPs based on our view of what a 0.20 g/hp-hr engine would cost compared to an optimized 0.50 g/hp-hr engine. We did not *ignore* the costs that manufacturers had to pay to move from the previous standard to 0.50 g/hp-hr, whether they did so using SCR or advanced EGR. (Mack and other manufacturers who use SCR seem never to acknowledge that Navistar also experienced costs in moving from the old standard to 0.50 g/hp-hr, and that such costs would also be relevant if we were to use such an approach.) Our analysis simply begins with the understanding that whatever costs manufacturers incurred to reduce emissions, those emissions will never be permitted to be above 0.50 g/hp-hr and it is not necessary to determine NCPs for values above 0.50 g/hp-hr. Moreover, as noted above, we actually did analyze the costs for manufacturers of reducing emissions from the previous effective standard (1.2 g/hp-hr), and determined the NCPs for a 0.50 g/hp-hr engine based on that analysis, and the resulting NCPs were actually lower than when EPA used the optimized 0.50 g/hp-hr engine as the baseline.

It is unclear how Daimler reconciles its comment that the "cost for a manufacturer that has already developed emissions control technology to meet the standard will always be significantly less than the cost for a manufacturer who has not yet developed the necessary enabling technology" with its comment that a competitor could save money if it would "let others make the investment necessary to develop required emissions control technology, and then piggy-back on that development by paying only the incremental cost of using the other manufacturers' technology." It seems that they cannot both be correct.

Mack's comment that EPA must consider full compliance costs relative to 2009 engines appear to ignore the fact that, like all manufacturers, Navistar has expended capital to reduce emissions from their engines from the previous standard to 0.50 g/hp-hr, or lower. It also appears to ignore the fact that all new engine designs have some effect on operating costs. Whatever those capital and operating costs may have been, all manufacturers have had to face such costs to reduce their emissions. What is more relevant is the cost associated with reducing engine emissions from the upper limit to the standard. With the upper limit set at 0.50 g/hp-hr, the only purpose for evaluating the costs to get to 0.50 g/hp-hr would be to allow an indirect calculation of the costs to get from 0.50 to 0.20.[13] Moreover, as noted above, EPA did review an alternative approach that included a baseline engine of 1.2 g/hp-hr, not using SCR, and found that the NCP calculated for an engine emitting at 0.50 g/hp-hr using that baseline engine was actually lower than the final NCP.

Finally, we note that while both Mack and Daimler provided information to support their beliefs that the total costs associated with SCR are higher than the proposed COC_{90}, as well as arguments why the penalty should be based on these costs, neither one provided any evidence that Navistar has a competitive advantage over their engines that is equivalent to these costs. One of the reasons Navistar's advantage is less than the total SCR costs is that it invested considerable money to achieve its 0.50 emissions level, which effectively offsets much of the

[13] For example, if we knew the cost associated with reducing NOx emissions from 1.2 g/hp-hr to 0.50 g/hp-hr was $7,000, and the cost associated with reducing NOx emissions from 1.2 g/hp-hr to 0.20 g/hp-hr was $10,000, we could indirectly calculate the cost associated with reducing NOx emissions from 0.50 g/hp-hr to 0.20 g/hp-hr as the difference between the two ($3,000).

savings associated with not using SCR. Navistar has also recently acknowledged that its warranty costs for its EGR engines are higher than expected. Neither Mack nor Daimler considered these costs. Basing the NCP on the total costs of SCR without accounting for Navistar's costs would actually *give* a substantial competitive *advantage* to complying manufacturers – a result clearly not consistent with the intent of the statute.

2.6. Baseline Engine for Cost Analysis

To calculate the 90th percentile costs of compliance relative to the upper limit, we have to define a baseline engine with NOx emissions at the upper limit. For the proposal, we assumed a baseline engine with *engine-out* NOx emissions equivalent to the compliant engines (and thus having no impact on fuel consumption), but that included less expensive hardware and a lower DEF consumption rate. We calculated compliance costs relative to such an engine.

Note that comments related to the numerical value of the upper limit are discussed in Section 2.4 and comments related to whether compliance costs should be calculated based on the upper limit are discussed in Section 2.5. Also, many comments about the baseline engine that relate to specific cost categories (such as specific hardware elements or fuel consumption rates) are addressed in other sections of this document.

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
ICCT	EPA-HQ-OAR-2011-1000-0030
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050

Mack commented that the only way to avoid what it calls the arbitrary, speculative and unreliable results associated with EPA's 0.50 g/bhp-hr hypothetical engine would be to engage in extensive engineering work to determine what engine configuration would be appropriate to meet a 0.50 g/bhp-hr NOx level and then determine the full set of hardware, operating, maintenance, and research and development costs associated with such an engine. It stated that it is unreasonable for EPA to expect manufacturers to engage in such a burdensome, resource-intensive and time-consuming exercise for purposes of developing an NCP. Mack commented that absent such an undertaking, however, EPA's proposed approach does not yield reliable results. It continued to say that given that EPA is not an engine manufacturer itself, its hypothetical engine cost analysis cannot substitute for actual cost data from manufacturers. Mack concluded that in light of the ample amount of *actual* cost information available to EPA, there simply is no need to invent entirely new, hypothetical engines.

Mack also commented that though every other manufacturer opted to use SCR technology, it did so for purposes of complying with a 0.20 g/bhp-hr standard, *not* a 0.50 g/bhp-hr standard. It commented that it is inappropriate for EPA to "conclude that SCR manufacturers

would have relied on SCR technology to comply with a 0.50 g/bhp-hr limit without considering and analyzing a host of additional costs potentially associated with the use of this technology." Mack stated that these "include additional warranty costs associated with SCR systems; costs associated with designing and adapting vehicles to accommodate SCR technology; and operating and maintenance costs associated with SCR systems" and that "these costs must be considered in developing an NCP, and cannot be conveniently ignored based on unsubstantiated speculation that all manufacturers would have incurred them equally under a 0.5 g/bhp-hr standard as under a 0.2 g/bhp-hr standard." Mack stated that EPA needs to consider the full engineering and development costs related to meeting the 0.20 g/hp-hr engine.

Mack also argues that EPA speculated that "manufacturers would have pursued SCR technology to meet the fuel-economy demands of their customers and the Agency's own greenhouse gas standards for heavy-duty diesel engines" but that "there is no reason why manufacturers could not have achieved substantially improved fuel economy using technologies other than SCR, if given the opportunity to design to a less stringent standard." It also stated "EPA's conclusion that new fuel economy mandates under the GHG rule would have driven manufacturers to use SCR makes no sense, given that the GHG rule was not even proposed until November 30, 2010, after the MY 2010 standards took effect, and years after manufacturers had made their decisions regarding the technologies they would use to meet the 2010 standard."

CATF agreed with the proposed baseline engine approach, but recommended changes in other areas, particularly regarding its view that manufacturers would attempt to optimize fuel economy. Responses to these comments are included in Section 2.8.2.

ICCT stated that the definition of the baseline is a significant flaw that led to undervalued non-compliance penalties because it does not consider reoptimization of an SCR engine for fuel efficiency and because it "does not account fully" for different levels of investment in technology. It supports using two different baseline engines to produce two different penalty curves. (See Section 3.4 for our response to this last comment.)

Daimler commented that SCR engine manufacturers have invested hundreds of millions of dollars to develop SCR and that "any NCP cost methodology which assumes, contrary to reality, that the noncompliant manufacturer has already spent money to develop and install SCR on each truck, radically understates actual costs." It also stated during the hearing that "EPA should not predicate its rule on a nonexistent hypothetical baseline engine with SCR simply to address an operating cost disparity that does not exist, according to the company seeking NCPs."

Navistar commented that EPA's baseline selection is reasonable for calculating NCPs and it supports the agency's determination, but that costs estimated using Navistar's alternative baseline would result in a significantly lower NCP level than EPA selected.

Navistar also responded to comments made about fuel consumption by SCR engine manufacturers at the public hearing. Those manufacturers objected to EPA's assumption that there would be no difference in fuel consumption between the baseline and compliant engines. Navistar stated that their objections miss the point. It said that while there are other paths to reduce NOx emissions from 0.50 g to 0.20 g, EPA should not (and legally cannot) select a particular path because it is the most expensive. Rather, in Navistar's view, EPA reasonably

selected the path that was available and would have been selected by the manufacturers (who are the "competitors" that should not be disadvantaged).

Cummins supports our proposal to base compliance costs on an optimized SCR engine. However, it emphasized that an SCR engine truly optimized for 0.50 g/hp-hr NOx would have lower hardware and operating costs than EPA's baseline engine, and recommended specific changes to our estimates of such an engine's hardware and performance characteristics (see Sections 2.7 and 2.8). Cummins noted that it is currently producing heavy-duty SCR-equipped engines with NOx emissions up to 0.50 g/hp-hr.

Response

We have determined that the appropriate upper limit is 0.50 g/hp-hr, and no manufacturer supported setting the upper limit above that level. As noted in Section 2.5, the regulations have always required compliance costs to be calculated relative to engines at the upper limit, and we are not revising this requirement. Since manufacturers cannot introduce engines that emit above the upper limit, it is appropriate to determine the competitive disadvantage to the complying manufacturer from this upper limit.

Prior to the proposal, we considered other technology paths suggested by manufacturers in additional to our proposed baseline engine. Some manufacturers suggested baseline engines with EGR but not SCR, or baseline engines with SCR but not EGR. However, we believed (and continue to believe) it is likely that these baseline engines would have had high operating costs. In general, relying on EGR to reduce NOx emissions significantly increases fuel consumption. Although Daimler is correct that Navistar has stated in marketing material that SCR engines do not have an operating cost advantage over its engines, this does not change our assessment that increasing EGR increases fuel consumption. Similarly, relying on SCR to reduce NOx emissions without EGR requires a larger amount of DEF. In either case, over the life of a truck, the increased operating costs could be greater than the original hardware cost. We stated that we did not have the information required to calculate these operating costs with the accuracy needed to use these scenarios as the basis of our NCPs. However, the only comments we received on the technology of the baseline engine during the comment period supported using an optimized SCR baseline engine that included EGR, or a non-SCR engine.

We agree with commenters that our proposed baseline SCR engine does not represent how an engine manufacturer would optimize an SCR engine to meet 0.50 g/hp-hr based on the latest price projections for fuel and DEF. We have revised our baseline engine significantly so that it now is very similar to the baseline engine recommended by Cummins. Mack objected to our use of any hypothetical baseline engine for compliance costs. However, since the baseline engine must reflect the upper limit (see Section 2.5) and Navistar is the only manufacturer

producing heavy heavy-duty engines at the 0.50 g/hp-hr upper limit[14], there are essentially only three options:

1. Setting the upper limit at 1.2 g/hp-hr (or higher) and using a pre 2010 engine as the baseline engine.
2. Using the Navistar engine (or a similar engine) as the baseline engine.
3. Using a hypothetical optimized SCR engine as the baseline engine.

Setting the upper limit at 0.50 g/hp-hr means that, at least for heavy heavy-duty engines, the only alternative to using a hypothetical engine would have been to use Navistar's engine. To address this comment, we evaluated using a baseline engine equivalent to Navistar's engine. However, contrary to the view of many commenters, we found that basing our NCPs on costs of compliance relative to a reoptimized SCR engine was the best approach to removing the competitive advantage for both SCR and non-SCR manufacturers that could potentially use NCPs. This is because we calculated the full lifetime cost savings of using an optimized SCR engine that emitted 0.50 g/hp-hr NOx, compared to an engine meeting the standard, to be greater than the cost savings of using an advanced EGR engine to that emitted 0.50 g/hp-hr NOx. See Appendix B of the Final Technical Support Document for additional details about this comparison.

Contrary to Mack's comment, our cost estimates are neither arbitrary nor speculative. They are based on our unbiased view of the collection of data provided by manufacturers (both publicly and confidentially) as well as other data collected by EPA. In particular, we note that our costs are based on many unbiased and publicly available sources of data, such as those discussed in Section 2.3. (See the Final Technical Support Document for additional discussion of the basis of our cost estimates.) While there is still some uncertainty associated our estimates, they are more reliable than relying solely on the word of specific manufacturers who have an interest in either maximizing (for complying manufacturers) or minimizing (for manufacturers using NCPs) the NCP level. Moreover, because much of the information manufacturers have provided was provided under protection as confidential business information, EPA must in part provide information other than information from specific manufacturers to justify its cost estimates in this final rule.

With respect to Mack's comment that it is inappropriate for EPA to "conclude that SCR manufacturers would have relied on SCR technology to comply with a 0.50 g/bhp-hr limit without considering and analyzing a host of additional costs potentially associated with the use of this technology", we note that we are not concluding what manufacturers *would have done*. We also did not speculate or conclude that "manufacturers would have pursued SCR technology to meet the fuel-economy demands of their customers and the Agency's own greenhouse gas standards for heavy-duty diesel engines." This confusion seems to be caused by Mack's misreading of the following text from the Interim Technical Support Document:

[14] Cummins is producing *medium* heavy-duty engines with NOx emission near 0.50 g/hp-hr and *heavy* heavy-duty engines with NOx emission near 0.35 g/hp-hr, but not *heavy* heavy-duty engines with NOx emission near 0.50 g/hp-hr

> The greenhouse gas requirements are potentially relevant to this NCP rulemaking because they affect the types of emission controls manufactures would pursue. As noted later, we believe that it is appropriate to assume that even if the NOx standard was higher, manufacturers would not have chosen emission controls that would have increased fuel consumption rates because they must also meet the greenhouse gas emission standards.

Note that this text does not mention SCR. We drew no *conclusions* about what manufacturers would have specifically done. Rather, we are basing our compliance costs on what we believe to be the greatest cost savings that a manufacturer could achieve by meeting a 0.50 g/hp-hr upper limit compared to the 0.20 g/hp-hr standard, considering what could be achieved currently or in the near future. Our calculation is that the greatest cost savings a manufacturer could obtain would be by reoptimizing SCR engines for 0.50 g/hp-hr in the near future.

Similarly, we disagree with Daimler's comment that implies that our baseline engine selection results in a "cost methodology which assumes, contrary to reality, that the noncompliant manufacturer has already spent money to develop and install SCR on each truck." We made no such assumption. We estimated compliance costs for different noncompliant baseline engines (most notably, a hypothetical SCR engine and an engine equivalent to Navistar's non-SCR engine), and selected the COC_{90} value that will result in penalties that protect compliant manufacturers from being at a competitive disadvantage with respect to any of them. The extent to which Daimler comments address which technologies should be included on the baseline engine representing engines *at 0.50 g/hp-hr* is unclear because Daimler conflates the issue of whether compliance costs should be estimated relative to the upper limit with the issue of which technologies should be included with the baseline engine. We included SCR-equipped engines in some of our baseline alternatives, and indeed used an SCR-equipped engine as our final baseline engine, because it is a completely reasonable choice for an engine manufacturer to use SCR technology to meet a 0.50 g/hp-hr emission level. Cummins already has done for some of its medium heavy duty engines. See Section 2.5 for our response to Daimler's objections to calculating compliance costs relative to the upper limit and Appendix B of the Final Technical Support Document for our consideration of alternate baseline engine scenarios.

While we are not basing our costs on the baseline engine recommended by Navistar, we did evaluate such a scenario (as described in Appendix B of the Final Technical Support Document). Consistent with Navistar's comment, we found that such a scenario would probably have resulted in lower penalties. However, we also found this scenario to be inappropriate. First and foremost, the COC_{90} value we estimated was about one-quarter of the COC_{90} for optimized SCR engines. Thus, NCPs based on this scenario would not large enough to ensure that SCR engine manufacturers could not gain a competitive advantage by reoptimizing their engines for 0.50 g/hp-hr and paying the lower NCP. In addition, the reason the COC_{90} for the non-SCR baseline scenario is so much lower than the SCR baseline scenario is that we estimate that compliant SCR engines actually have significantly *lower operating costs* than engines like Navistar's 0.50 g/hp-hr engines, which largely offsets the higher hardware costs. However, Navistar does not agree that its engines have higher operating costs. Thus, we cannot be sure that NCPs based on the lower COC_{90} value would completely remove the competitive advantage for Navistar, let alone optimized SCR engines.

Finally, while we appreciate Navistar's support for our proposed baseline engine analysis, it is important to address Navistar's statement that "EPA should not (and legally cannot) select a particular path because it is the most expensive." The Clean Air Act directs EPA to set the NCPs at a level that will "remove any competitive disadvantage" to complying manufacturers. To do this, EPA determines the baseline engine using the most cost-effective way for a non-complying manufacture to, in this case, manufacture an engine meeting a 0.50 g/hp-hr level, compared to a 0.20 g/hp-hr. Were we to determine the baseline engine using an engine that did not maximize cost-effectiveness, complying manufacturers would be potentially subject to a competitive disadvantage if a noncomplying manufacturer chooses a more cost-effective 0.50 g/hp-hr than the one EPA used for its analysis. EPA would not characterize this as the most expensive path, but it is the path that maximizes the potential benefits that a manufacturer may achieve through noncompliance, and thus is appropriate for evaluating the proper NCP.

2.7. Hardware Costs

For the NPRM, we projected that the *hardware costs* to reduce NOx emissions from 0.50 to 0.20 g/hp-hr would fall into two categories –an additional sensor to improve the dosing control, and improved SCR catalyst to increase the NOx conversion efficiency. We assumed the lower tailpipe NOx emissions levels would require the addition of a sensor for better control over the urea injection. This cost would apply for both the typical and worst case engines. In addition, for the worst case manufacturer, we projected a larger SCR catalyst would be required to increase the NOx conversion efficiency. We estimate that the size and loading of the catalyst would need to increase by about 20 percent.

We did not estimate total costs for SCR for the NPRM. See Sections 2.3, 2.5, and 2.10 for comments related to total SCR costs.

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack	Undocketed Confidential Business Information

Cummins was the only manufacturer that provided hardware cost information related to our proposed cost methodology. (As noted below, other manufacturers provided hardware cost information that was not directly related to our proposed cost methodology.) Cummins stated the following in comments:

> EPA did allow for precious metal reduction in the SCR catalyst; however, there are other hardware changes between compliant and noncompliant engines that were not taken into account. Precious metals used for the diesel oxidation catalyst (DOC) and ammonia oxidation catalyst could be reduced and reformulated with a greater substitution of cheaper precious metals for the optimized NCP baseline. The cost reduced DOC is possible

because the optimized NCP baseline engine would experience more passive DPF regeneration due to the higher engine out NOx and would not need as much nitrogen dioxide (NO2) production from the DOC. This results in lower precious metal content required to produce the needed levels of NO2 used for the DPF regeneration process. The SCR catalyst performance over the lifetime of the vehicle is not diminished using the cost reduced DOC because the SCR catalyst will experience less high temperature exhaust due to lower temperature DPF regeneration (i.e., less thermal aging of the SCR catalyst). The NCP baseline engine will have a reduced need for aftertreatment and vehicle insulation to prevent excessive heat loss. Thermal management of the aftertreatment system and providing acceptable driving performance to the end user will be easier to achieve on the NCP baseline engine so cost reduced turbomachinery can be utilized. Additionally, improved emissions measurement devices for NOx-related, on-board diagnostics would be removed, because the NCP baseline engine will not have to measure the smaller amounts of NOx and a sensor with a higher level of accuracy will not be needed. These hardware differences are important to account for when going between a nonconforming and compliant engine. A customer purchasing a 0.50 g/hp-hr NOx engine would not be willing to pay the additional upfront costs of extra precious metal, insulation, turbomachinery, and OBD equipment that the engine does not require for regulatory or performance reasons.

Daimler commented that even if there were some rational basis for using a hypothetical 0.50 g/bhp-hr engine as the baseline engine for NCP cost calculations, the engine hypothesized by EPA bears no resemblance to the engine that DTNA would have developed for 0.50 g/bhp-hr NOx performance. Specifically, DTNA's 0.50 g/bhp-hr SCR engine would have had much better fuel economy and lower material costs than the 0.50 g/bhp-hr engine that EPA hypothesizes.

Daimler also provided confidential information on total SCR costs, including hardware costs. The costs reflected the difference between a baseline 2008 engine and a compliant 2010 engine. The baseline engine included turbocharging, aftercooling, electronically controlled common rail fuel injection, cooled EGR, oxidations catalyst, a catalyzed diesel particulate filter, and an open crankcase breather with separator. Daimler's compliant 2010 engine had similar technology as their baseline engine, with the addition of a SCR system with urea injection, post-SCR oxidation catalyst, and OBD diagnostics associated with the aftertreatment system.

Mack also provided confidential information on total SCR costs, including hardware costs.

Response

For the final rulemaking, we determined that an SCR aftertreatment system originally designed for 0.50 g/hp-hr NOx would require hardware modifications to achieve tailpipe emissions levels of 0.20 g/hp-hr. Based on conversations with manufacturers, we believe that the lower NOx emissions levels would require:

- The addition of SCR catalyst volume to gain NOx efficiency,
- Improvements to the diesel oxidation catalyst (DOC) due to the lower engine-out NOx emissions and higher soot conditions,
- An optimized turbocharger to cover a broader range of EGR flow, and
- A sensor for better control over the urea injection.

We note that these hardware elements are largely consistent with the information provided by Cummins in its comments.

As noted in the previous response and included in detail in the Appendix B of the Final Technical Support Document, we considered and analyzed alternative baseline engines, including baseline engines with only EGR, in the final rulemaking. The comments from Daimler and Mack were helpful to EPA in developing our costs for those alternative baseline engines and in evaluating these alternative baseline engines. However, as discussed above, those alternative baseline engines were determined not to be appropriate in developing our final NCPs and they were not relevant to our estimates of compliance costs in our final methodology.

2.8. Operating Costs

We received comments on several aspects of our proposed analysis of operating costs. While the comments on these costs are addressed separately in the following subsections, we also considered the costs collectively to ensure that our final estimate of the COC_{90} operating costs accurately reflected the 90th percentile value for the potential market impact of lower operating costs for the baseline engine.

2.8.1. Cost Savings and Performance Improvements

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
PACCAR	EPA-HQ-OAR-2011-1000-0041

Cummins supports EPA's use of total life cycle cost and the inclusion of operating costs for all future years in the NCP calculation because engines that use NCPs will have a cost advantage for the entire life of the engine. This cost advantage will include lower fuel consumption and better resale value based on this lower fuel consumption. It further stated

engines that use NCPs will emit a higher level of NOx for the entire life of that engine, not just the first five years. Cummins also noted that if the entire life cycle cost is not included, this could result in a lower NCP which would be more enticing for manufacturers to use, resulting in a greater NOx impact on the environment.

PACCAR stated that "EPA should include in the NCP calculation the fuel consumption advantages for engines that do not meet the 0.20 gram standard" because the "fuel economy advantage is extraordinarily important in today's engine market."

Daimler commented that customers' operating costs are arguably relevant to manufacturers' compliance costs only to the extent they impact the purchase price that customers are willing to pay for compliant manufacturers' trucks. Based on industry sales and marketing experience, DTNA's Product Planning Department generally estimates that truck customers are willing to pay for of net fluid superiority when making new truck purchase decisions. Daimler noted that SCR engines have a net fluid superiority but that it is less than the fixed and variable costs of SCR. Therefore it concluded the net fluid superiority of SCR is no reason not to use manufacturers' actual costs of compliance, even if EPA erroneously includes the fuel benefit in the calculation.

Daimler also commented that EPA has never counted the fuel efficiency *benefit* of increased emissions controls against compliant manufacturers, and there is no reason to start now. Daimler stated that in the past, EPA included the fuel economy *penalty* associated with emissions compliance in the NCP because failing to do so would have effectively created a financial incentive to use the NCP rather than meet emissions standards. Daimler said that the "entire focus on fuel costs has always related to the need to disgorge any potential benefit of noncompliance from the laggard, thus ensuring no harm to compliant manufacturers." The purpose was not to fully equalize the operating cost and net present value of compliant and noncompliant products. Daimler also stated that attempting to deduct all commercial benefits of environmental compliance would be contrary to the congressional intent behind NCPs and EPA's mission more generally. It stated that Congress provided NCPs as actual "penalties," and that attempting to extract all of the indirect benefits of environmental compliance would also eliminate the deterrence element that is critically important to the NCP program.

Daimler and Mack's comments stated that in the 1990 NCP rule, EPA explained that it did not account for any side benefits of the emissions reduction technologies that compliant manufacturers adopted and that it would be inappropriate to do so. Mack stated that "by factoring in the value of the side benefits of SCR emissions technology, the Agency is creating incentive for companies such as Navistar to claim an artificially high fuel economy penalty associated with the use of its technology (relative to the complying technologies) for purposes of setting an NCP." Daimler and Mack both noted that EPA excluded side benefits from NCP calculations in 1990 for the following three reasons:

1. That it was difficult to place a dollar value on the side benefits, especially intangible benefits like increased power or improved driveability.
2. That not all potential buyers will place the same value on these side benefits such as less intensive users placing a lower value on improved fuel consumption.

3. That if a conforming manufacturer is forced for emissions control reasons to add a technology to an engine line whose users do not value the side benefits as much as EPA's estimate assumes they do, that manufacturer will be at a disadvantage in comparison to a non-conforming manufacturer.

Daimler cited our prior statement that *"EPA has an overriding obligation to protect the conforming manufacturer."* Daimler and Mack commented that if customers do not value the side benefit as much as EPA has assumed they will, the compliant manufacturer who uses that emissions reduction technology will be at a disadvantage compared to noncompliant manufacturers.

Mack also commented that it believes that "EPA has stated in its generic NCP rulemaking that user costs, such as fuel economy penalties, should be taken into account only to the extent they result in placing compliant engines at a disadvantage." Mack's comments stated that EPA noted:

> Users' costs may include the present value of any fuel economy penalty, requirements for unleaded fuel, and changes in maintenance costs associated with operating a conforming engine or vehicle over its lifetime. To the extent that these cost impacts are known by potential buyers, a purchaser should be willing to pay more for an engine or vehicle with lower total user costs. Therefore, in order to remove a manufacturer's economic incentive for nonconformance and to prevent manufacturers of conforming engines or vehicles from being placed at a competitive advantage, the NCP must also reflect user cost increase.[15]

Mack also stated:

> This is in keeping with Congress' intent that the calculation "would include such items as the actual cost of compliance for complying vehicles, the capital costs foregone as a result of non-compliance, the market value of any fuel economy gains made by noncomplying vehicles compared to complying vehicles and the competitive advantage that may arise because of the lesser warranty and recall obligations for noncomplying vehicles compared to complying vehicles." H. Conf. Report No. 95-564, p. 163, reprinted at 77 U.S.C.A.A.N. 1544. It is clear from both the legislative history of the Clean Air Act and EPA's generic NCP rule that fuel economy penalties are only to be considered to the extent they give a non complying manufacturer a competitive advantage over a complying manufacturer.

[15] 50 FR 35383, August 30, 1985.

Response

We agree with Cummins that our cost analysis should consider full life cycle costs, which our analysis does. As discussed earlier, suggestions that EPA not deviate from prior precedents for calculating costs incorrectly imply that EPA has always used the same methodology. Even if it were true that EPA had used the same methodology for all prior NCP rules, this would not obligate us to continue using the same methodology in perpetuity. The methodology EPA uses to account for cost savings is dependent on the factual circumstances for each NCP rule. The methodology we used to develop operating costs is fully in compliance with the regulations and the statute, and is a completely reasonable method for accounting for operating costs in this rule.

We do not agree with Mack's assertion that EPA stated in the generic rule that "user costs, such as fuel economy penalties, should be taken into account *only* (emphasis added) to the extent they result in placing compliant engines at a disadvantage." Mack inappropriately inserts the word "only" where it was not used. The text Mack cites to support its claim includes the recognition by EPA that "to the extent that these cost impacts are known by potential buyers, a purchaser should be willing to pay more for an engine or vehicle with lower total user costs." Mack does not dispute that its fuel savings are known by potential buyers, or that buyers would be willing to pay more for an engine with lower total user costs.

We do not believe the reasons previously given in the 1990 NCP rule for not considering side benefits apply for fuel consumption savings in this NCP rule – at least not to point of justifying ignoring the fuel savings associated with SCR. First and foremost, as PACCAR and Cummins noted in their comments, current purchasers of heavy heavy-duty diesel engines care very much about changes in fuel consumption. Thus, it is not possible to accurately reflect the competitive market if we ignore fuel savings. As noted in Section 1.1.1, while the statute requires us protect the competitive interests of complying manufacturers, we cannot knowingly set the first year NCP at a level that is much higher than the actual dollar value of the competitive disadvantage of the complying manufacturers. We believe that simply ignoring fuel savings could easily result in penalties that are several thousand dollars higher than needed or appropriate to remove the competitive disadvantage for complying manufacturers. Moreover, it is contrary to the clear evidence that fuel consumption of these vehicles is a key element in the purchasing decisions of customers, and thus the value of the engines. As noted in the excerpt from the legislative history included in Mack's comment, Congress intended EPA to address the "market value" of differences in the engines. Nothing in the legislative history indicates that our evaluation of competitive disadvantage requires us to ignore any real tangible benefits that exist for complying engines and that would affect the competitive balance of manufacturers.

It is also relevant that EPA noted in 1990 that its concerns about assigning dollar values for side benefits were more significant for "intangible benefits like increased power or improved driveability." There was somewhat less concern in that rule about fuel economy benefits. As Daimler noted, historically compliance with NOx standards hurt fuel economy. This is in substantial contrast to the very tangible (if somewhat difficult to project) benefits of higher fuel efficiency, particularly for these vehicles. In fact, for this current rulemaking, we received comments from manufacturers insisting that we can and must include costs associated with changing fuel consumption. Indeed, Mack, in criticizing our decision in the proposal not to include potential fuel economy benefits associated with complying with a 0.50 g/hp-hr upper

limit, rather than a 0.20 g/hp-hr standard, noted the importance of accounting for increased fuel efficiency. While we acknowledge that precisely quantifying the value that purchasers will place on fuel savings can be difficult, we believe that this issue is more appropriately addressed by choosing a cost methodology that takes this difficulty into account in estimating fuel savings. See the following sections for our discussions of how to best estimate the values of fuel savings.

Even if we were to exclude operating cost savings from our COC_{90} calculations, we believe that it would be appropriate to determine whether such operating cost savings exist by analyzing the combined consumption of *fuel and DEF*, which is commonly described as *"fluid consumption."* In other words, if we were to agree with Daimler and Mack that our cost analysis should ignore operating cost *benefits*, we should only ignore them to extent that a noncompliant engine's cost savings with regard to reduced DEF use exceeds the increased fuel cost of such an engine. Our understanding of the market is that operators evaluating SCR equipped engines consider *fluid* consumption costs rather than the traditional consideration of *fuel* consumption. Our conversations with manufacturers, as well as Daimler's comments, further support this concept. When considered this way, our methodology is consistent with the prior approaches because it counts the additional fluid consumption *costs* for compliant engines, relative to the upper limit engine. Neither Daimler nor Mack provides any basis for separating DEF consumption from fuel consumption when both manufacturers and operators consider them together as fluid consumption. Moreover, Daimler acknowledges that purchasers are willing to pay for net fluid savings.

As described in the Final Technical Support Document, with the revised baseline engine used in the final analysis, we estimate that reducing emissions to 0.20 g/hp-hr would require recalibrating the engine to decrease engine-out NOx which would increase fuel consumption. These costs would be partially offset by lower DEF costs. Thus, while we are including the *benefit* of reduced DEF usage, it is only in the context of a *net increase in fluid costs*. We are doing this because it reflects how the market actually values these changes.

Mack's comment that "the Agency is creating incentive for companies such as Navistar to claim an artificially high fuel economy penalty associated with the use of its technology", would be true only to the extent that EPA relies on Navistar's claims. However, this issue is not relevant because EPA is independently estimating costs. Moreover, applying this logic would preclude EPA from considering any costs or savings. For example, according to this logic, EPA could not consider DEF costs because doing so would create an incentive for SCR manufacturers to claim artificially high DEF costs. Clearly this would be unworkable.

It is also important to note that manufacturers could possibly have used compliance strategies that would have had lower upfront hardware costs. When first adopting the 0.20 g/hp-hr NOx standard, EPA projected that manufacturers would have used lean NOx traps (LNTs – also known as NOx adsorbers) to meet the standard. We still believe that manufacturers could have used LNTs and that they may have had less expensive hardware. Instead, manufacturers chose to add SCR hardware in part because it would result in lower fuel consumption for operators. Clearly, this implies that fuel savings would make engines more desirable for purchasers and have an impact on the competitive balance in the marketplace.

2.8.2. **DEF Usage and Fuel Consumption Rates**

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Ford	EPA-HQ-OAR-2011-1000-0029
ICCT	EPA-HQ-OAR-2011-1000-0030
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050
PACCAR	EPA-HQ-OAR-2011-1000-0041

Ford estimates that, for a medium heavy-duty engine manufacturer who would otherwise fully comply with the NOx standard via a SCR aftertreatment system, relaxing the NOx standard from 0.20 g/hp-hr to 0.50 g/hp-hr would allow for a 2.7% improvement in fuel economy at constant DEF dosing. It stated that from a marketing perspective, the ability to provide such a fuel efficiency benefit to the customer offers a significant competitive advantage. Ford noted that from the perspective of compliance with the 2014+ MY EPA and NHTSA Heavy Duty Greenhouse Gas and Fuel Consumption Standards, it provides an additional competitive advantage by displacing the need to deploy other, more costly technologies that would potentially be required to achieve a 2.7% improvement in fuel economy.

ICCT stated that the assumptions about fuel efficiency are significant flaws that lead to undervalued non-compliance penalties. ICCT commented that the assumption that an engine fully optimized at 0.50 g/hp-hr would have the same engine-out NOx as an engine design to meet 0.20 g/hp-hr is likely unrealistic. It further stated that it would be reasonable to assume that manufacturers would likely look to maximize fuel efficiency in order to deliver savings to their customers and enhance their competitiveness (and that this would affect NOx emissions given the relationship between engine-out NOx and fuel consumption). The ICCT recommends that if non-compliance provides a fuel efficiency benefits and a competitive advantage, these benefits should be included in the assessment of NCPs.

Cummins commented that its SCR system is delivering up to 6% better fuel economy than the engines it produced in 2009 and that fuel consumption is a major consideration when customers are purchasing a new heavy-duty vehicle. Cummins stated that an NCP engine at the upper limit would have a 2% fuel consumption advantage over a compliant engine when fuel and DEF consumption are optimized. It stated that rather than holding engine-out NOx as constant, a manufacturer could hold constant the percent reduction of NOx across the SCR catalyst, which is a more realistic optimized baseline. This leads to a fuel consumption advantage due to higher engine-out NOx, reduced exhaust backpressure, and reduced particulate filter regenerations for the NCP engine. Cummins provided fuel economy data based on a proprietary drive cycle which demonstrated a 2% fuel economy benefit.

CATF commented that given the obvious advantages of reduced fuel consumption, it would be entirely reasonable for an engine manufacturer to meet a 0.50 g standard by allowing engine-out emissions to increase substantially above 2.0 g/hp-hr in order to take advantage of the

high removal efficiencies of SCR. Thus, assuming a 90% SCR efficiency, engine-out emissions could approach or slightly exceed 4.0 g/hp-hr and still meet the 0.50 g upper limit at the tailpipe. CATF also submitted a memo from M.J. Bradley and Associates with their comments. M.J. Bradley conducted an analysis of the NCP values in response to comments made by engine manufacturers in the public hearing. It noted that Volvo indicated a 2 percent reduction in fuel use was possible for an engine meeting 0.50 g/hp-hr NOx tailpipe levels relative to an engine with 0.20 g/hp-hr NOx. M.J. Bradley agreed with this assessment and estimated that it could be achieved with a baseline engine emitting 4.0 g/hp-hr NOx engine-out, while the engine meeting the 2010 NOx standards would emit 2.0 g/hp-hr. M.J. Bradley also noted that Cummins has publicly stated that the brake thermal efficiency of their 1998 engines with 4.0 g/hp-hr engine-out emissions was 3 percent higher than their 2002 engines with 2.5 g/hp-hr engine-out NOx emissions.

Daimler commented that even if there were some rational basis for using a hypothetical 0.50 g/bhp-hr engine as the baseline engine for NCP cost calculations, the engine hypothesized by EPA bears no resemblance to the engine that Daimler would have developed for 0.50 g/bhp-hr NOx performance. Specifically, Daimler's 0.50 g/bhp-hr SCR engine would have had much better fuel economy and lower material costs than the 0.50 g/bhp-hr engine that EPA hypothesizes.

PACCAR commented that it "estimates that the fuel consumption advantage for the 0.50 gram design is approximately 4% over a 0.20 gram design, which, allowing for a 2% increase in DEF usage, would result in a net cost reduction of $13,833." (PACCAR cited its experience designing engines meeting emissions standards of EPA 2007, EPA 2010 with both EGR and EGR/SCR technologies, Euro V, and Euro IV). PACCAR commented that "this fuel economy advantage is extraordinarily important in today's engine market." PACCAR noted that Cummins produces only one rating of its ISX15 engine that is certified at 0.20 g/bhp-hr NOx which is sold primarily to customers who must meet municipal bid requirements. PACCAR stated that the overwhelming majority of Cummins' large block engines are sold at higher certification levels using credits because of the advantage for customers in engine performance and for Cummins in the market compared to other engine manufacturers. PACCAR concluded that this example highlights PACCAR's position that EPA should include in the NCP calculation the fuel consumption advantages for engines that do not meet the 0.20 gram standard.

Navistar commented that EPA inappropriately overestimates the lifetime costs of DEF, which must be corrected in the final rule. EPA also assumes that DEF will always be used in the SCR-equipped truck during those 30 years. Navistar commented that later assumption has no basis in fact, as the SCR system is authorized to operate many thousands of miles (and, indeed, operates indefinitely) without using any DEF. It also stated that there is thus no record basis for such significant DEF costs, and EPA must recalculate its NCP using appropriate assumptions regarding DEF use. It based its concern in part on the Federal Motor Carrier Safety Administration roadside inspection statistics between 2008 and 2012, which it claimed show that "trucks" are in some type of violation over 60% of the time, including violations that result in an "out-of-service" order nearly 20% of the time. It stated that if 20% of the vehicles inspected contain violations serious enough to require them to be taken out of service, it seems completely reasonable to assume that at least 20% of the time DEF will not be used. Navistar concluded that for purposes of calculating the current NOx NCP, EPA cannot estimate the

lifetime cost of DEF on the basis that DEF is always used—when it is not— because it grossly miscalculates the true SCR operating costs for end users and, as a result, goes well past removing any purported competitive disadvantage to complying manufacturers. Thus, Navistar is effectively arguing that we should assume a smaller change in the DEF consumption.

Mack also stated that EPA's position in the NCP NPRM is inconsistent with the Agency's position in its Final Rule establishing GHG emissions standards for heavy-duty engines and vehicles. Mack commented that in the GHG regulation, EPA provides an exception for increased fuel consumption where NOx emissions are decreased from 0.50 g/bhp-hr to 0.20 g/bhp-hr, thus verifying that the Agency recognizes a fuel efficiency benefit associated with complying with the 0.5 g/bhp-hr standard over the more stringent standard. 76 ***Fed. Reg.*** 57,205 (Sept. 15, 2011). Mack also noted in the public hearing held on March 5, 2012, that it is possible to achieve a 2 percent fuel savings with a 0.50 g/hp-hr engine versus a 0.20 g/hp-hr engine.

Response

Based on new information and comments we received, we are revising our baseline engine for the heavy heavy-duty service class. Specifically, we are revising the COC_{90} baseline engine to be more optimized for lower fuel consumption at 0.50 g/hp-hr NOx than was assumed for the proposal. This change is consistent with the majority of the comments we received on the fuel consumption rate of the baseline engine. For the proposal, we estimated that reducing NOx emissions from 0.50 g/hp-hr to 0.20 g/hp-hr would require an increase in DEF consumption but would not change fuel consumption because we projected that there would be little price difference between DEF and fuel. For most engines, without a difference in fuel and DEF prices, there is little to be gained by reoptimizing for lower fuel consumption because much or all of the savings would be offset by higher DEF costs. However, as is described in Chapter 3 of the Final Technical Support Document, we now have new information (some of which came from comments) indicating that fuel prices will likely be significantly higher than DEF prices for the foreseeable future. We agree with commenters that *heavy heavy-duty* engine manufacturers designing engines for 0.50 g/hp-hr NOx would have responded (and could still respond) to this *price difference* by optimizing the engines to have higher engine-out NOx, which would reduce fuel consumption, and reduce the excess NOx by increasing DEF consumption. We now estimate that the difference in fuel consumption between the baseline engine and compliant engines would be 1.9 percent.

Estimating the relationship between NOx emissions and fuel consumption is difficult for several reasons. In particular, we note the following:

- The relationship between tailpipe NOx emissions and fuel consumption is a function of both aftertreatment efficiency and the relationship between engine-out NOx emissions and fuel consumption.
- Manufacturers generally consider both aftertreatment efficiency and the relationship between engine-out NOx emissions and fuel consumption to be confidential business information.
- Manufacturers providing test data for this rulemaking have an incentive to provide data selectively to support either a higher or lower penalty value.
- Some manufacturers providing fuel consumption data did not provide the corresponding engine-out NOx emission data.
- The relationship between engine-out NOx emissions and fuel consumption varies by engine model and is highly dependent on how the vehicle is operated and factors such as injection pressure, aftertreatment heating control strategies, and EGR rates.

Facing these challenges, we chose to estimate fuel consumption impacts by developing a curve to represent the relationship between *engine-out* NOx emissions and fuel consumption and using the curve in conjunction with our estimates of catalyst efficiencies. The fuel curve, which is shown in Figure 2-2, largely reflects the majority of the fuel consumption data provided by engine manufacturers. This relationship is based on the CBI data provided by manufacturers.[16] While most of the data on fuel consumption versus engine-out NOx that we received are CBI, CATF did include in its comments public data for increasing engine-out NOx emissions from a compliant engine that was provided by M.J. Bradley. These data are also shown in Figure 2-2. To the extent possible, manufacturer data was weighted based on the amount of detail provided by the manufacturer and each manufacturer's approximate share of the heavy heavy-duty engine market, and data provided in the 3.0 to 4.8 g/hp-hr range was given a greater weight (because this is the range that represents the expected change in engine-out emissions and resulting fuel consumption from the baseline engine to a compliant engine). The goal was to derive a curve that is somewhat conservative to protect complying manufacturers, but not unreasonably conservative.

[16] "Consideration of Confidential Business Information on the Relationship between Engine-Out NOx Emissions and Fuel Consumption", EPA Memorandum from Charles Moulis to Matt Spears, August 3, 2012.

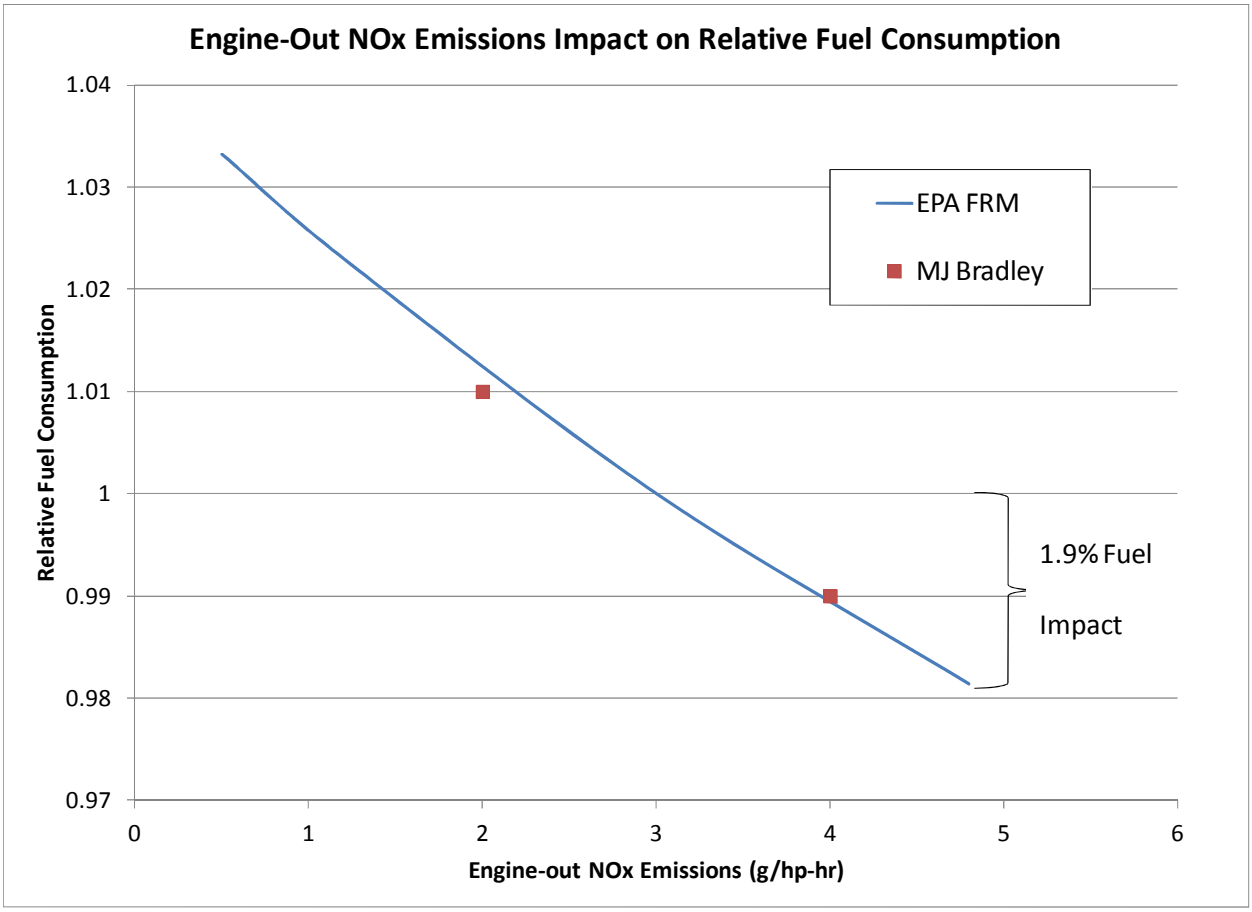

Figure 2-2: Engine-Out NOx and Fuel Consumption Relationship

With respect to whether 1.9 percent is the correct value for COC_{90}, it is important to emphasize that we do not believe that a 1.9 percent increase in fuel consumption is necessarily the worst case possible. There is a significant amount of uncertainty related to fuel consumption impacts and some commenters claimed that the impact could be higher than 1.9 percent – either in public comments or in confidential business information. However, we cannot verify these claims. For example, PACCAR stated in its comments that an SCR engine reoptimized for 0.50 g/hp-hr could achieve four percent lower fuel consumption than its current compliant engines. While we cannot verify this number and do not know if it broadly represents in-use operation, it does suggest that the actual fuel consumption impact for *some* vehicles *could be* somewhat higher than our 1.9 percent. It would be more conservative (in terms of protecting complying manufacturers) to assume the fuel impact is equal to the highest value within possible range of impacts (perhaps as high as the value suggested by PACCAR). Nevertheless, we note that our value is equivalent (when rounded to one significant figure) to the values recommended by CATF, Cummins, and Mack (as Summarized in Table 2-4). Thus, we believe that using PACCAR's four percent would be unreasonably conservative, especially since this value is not supported by any other information available in the record for this rulemaking.

2-4 Summary of Commenters Recommendations for the Fuel Consumption Difference between the baseline and compliant engines

Commenter	Percent Difference Between Baseline SCR engine and Compliant Engine	Notes
Cummins	2 percent	Also provided CBI
Mack	2 percent	Public Hearing
CATF	2 percent	From MJ Bradley
PACCAR	4 percent	Also provided CBI
Ford	2.7 percent	Medium Heavy-Duty

We also believe that a higher value may very well overstate the *market value* of reduced fuel consumption. As is described in the Final Technical Support Document, and as several commenters have noted, there is reason to believe that many truck purchasers may undervalue future fuel savings (relative to our estimate of the net present value). Therefore, by using the full lifetime impacts of our estimated increase in fuel economy, we are already using a conservative value for the market value of fuel savings benefit. We did not believe it was appropriate to make an even further conservative assumption by using a fuel consumption rate that was higher than the value we are using. For example, if customers typically discount fuel consumption impacts so much that they value them at one-quarter of the lifetime cost, then the actual competitive impact of a four percent increase in fuel consumption (the highest value recommended by commenters) would be equivalent to the full lifetime cost of a one percent increase. Compared to this value, 1.9 percent calculated for the full lifetime would be conservative (i.e. it would lead to higher presumed fuel impacts for complying engines, which would lead to higher NCPs). See Section 2.8.4 for additional discussion of comments on how to address discounting of future costs by operators. See the Final Technical Support Document for additional discussion of how we addressed uncertainty related to fuel consumption impacts.

We disagree with Navistar's assertion that we should not assume that DEF is always used in the NCP calculations. EPA has provided detailed guidance to manufacturers of engines using SCR technology regarding possible methods for safeguarding their engines against operation without proper DEF. EPA noted that a series of warnings that alert operators to potential operation without proper DEF, followed by engine operational controls that reduce the effectiveness of engine performance (e.g. derates of engine power, reductions in possible speed), would be particularly beneficial in reducing the likelihood that the vehicle will be used outside of manufacturer's settings in use. EPA has certified many engine families that have incorporated such warnings and engines controls into their systems. EPA has received evidence that these engines, when in actual use, have operated almost exclusively with proper DEF.[17,18] Navistar has produced no evidence that actual operators of these engines have been operating for any

[17] Greuel, Justin. Cummins Memo to Docket. Docket EPA-HQ-OAR-2010-0162.
[18] California Air Resources Board. Heavy-Duty Vehicle Selective Catalytic Reduction Technology Field Evaluation. May 2011. Docket EPA-HQ-OAR-2010-0162. Last viewed on July 29, 2011 at http://www.arb.ca.gov/msprog/cihd/resources/reports/scrreport.pdf

significant amount of time with no SCR controls. Thus, the evidence leads us to believe that the warnings and engine controls put in place by manufacturers are having the intended effect of reducing the likelihood that engines equipped with SCR are operated without proper DEF. Finally, we also note that using the new baseline engine means that lowering DEF costs would actually increase penalties, which Navistar does not support.

2.8.3. **DEF and Fuel Prices**

For the NPRM, we used a DEF price of $2.99 per gallon for calendar years 2012 and beyond. That DEF price represented the national average retail pump price of on-highway DEF.[19]

EPA did not include additional fuel operating costs as part of the NCP calculation for the proposal. However, we noted that if we did project an impact on fuel consumption, we would have used the Annual Energy Outlook (AEO) 2011 fuel price projections adjusted to 2011 dollars.

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
PACCAR	EPA-HQ-OAR-2011-1000-0041

CATF recommended that EPA conduct an assessment of projected fuel and DEF prices. It recommends using Integer Research as a source for DEF prices and that the fuel prices be updated to reflect the latest Annual Energy Outlook prices.

Cummins stated the following in its comments:

> Since those initial conservative estimates, the view of the DEF market has changed significantly in that there has been a shift towards more bulk distribution thereby driving down the average price of DEF. This trend is expected to continue for several more years. Cummins has combined data from large fleets, truck stops, and Integer Research to show the relative use of each distribution method and price information. An extensive set of data has been gathered by Cummins Filtration which sells packaged and bulk DEF. These data have been compiled and are shown in the Cummins comments. The fact that more customers are continuing to convert their DEF purchases to bulk distribution is supported by the front page article in Transport Topics titled *Truck Stops, Fleets Respond to DEF Demand By Installing More Bulk Filling Dispensers* published April 2, 2012. As stated in the article, "All the major truck-stop chains have bulk DEF available, and many small and midsize operators are following suit." An

[19] DieselExhuastFluid.com. Last accessed on November 14, 2011 at http://www.dieselexhaustfluid.com/.

increasing number of customers are installing bulk DEF sites even if the customers do not distribute their own fuel. This trend toward bulk distribution of DEF is further supported by Integer Research's DEF Tracker monthly price reporting service. According to Figure 2, over forty percent of the total volume of DEF distributed in North America will be by bulk distribution channels by 2017. Customers site the ability to transition to on-site bulk dispensing due to the safe and economical solutions provided by an increasing number of companies that offer equipment assistance programs. With the growing number of vehicles utilizing SCR engines, customers are increasingly moving to bulk dispensing. This market dynamic is driving the cost of bulk and retail pump prices lower as shown in Attachment A. The retail pump operators (truck stops) are challenging other DEF supply formats on cost (bulk and totes) as a necessity to preserving diesel fuel sales.

Combining the information on DEF distribution method with diesel price information from http://www.eia.gov/petroleum/gasdiesel and with the DEF price data provided by Integer Research, which can be found in the Cummins comments. This shows that a 0.4 DEF/diesel price ratio is a good forward looking representative value. It incorporates the DEF price variation associated with the distribution methods along with the downward price pressure due to market competition. This type of price projection is typical of a new market where the volume of DEF consumed is increasing rapidly while the distribution channels mature.

Additionally, we expect that going forward the price of DEF will more closely track the price of natural gas. Urea, the active component in DEF, is manufactured from natural gas, and the price of natural gas has been and is projected to remain lower relative to the price of diesel. This likely results in the cost ratio of DEF to diesel decreasing even further.

[Cummins comments at 11-13, figures and attachments not reprinted.]

PACCAR commented that based on the European experience with AdBlue, the DEF equivalent for Europe, it is expected that the DEF price will continue to drop until an equilibrium price is reached. PACCAR further stated that the Integer presentation dated July 12, 2010, previously provided to EPA, outlines the downward pricing trend of AdBlue.

Response

For the final rule, we updated the fuel price projections and used the Energy Information Administration's (EIA) Annual Energy Outlook 2012 (AEO2012) to project fuel prices through 2035 and applied the annual projected price increase found in AEO2012 to project the fuel prices through 2042.

We also revised the source for current and future DEF prices in the Final Technical Support Document based on the comments we received. Instead of using a constant DEF price

through 2042, we are projecting that the long term DEF prices will trend with the prices of industrial natural gas, which is used in the production of the ammonia used in urea, at an annual increase of 1.3 percent based on AEO 2012. For the near term, we used the Integer Research retail DEF pricing projections for 2012 through 2014, which range between $2.60 and $2.50 per gallon. Note that our analysis uses an annual average DEF price, which does not consider seasonal variations in DEF prices, or other short term fluctuations.

We are not using bulk DEF prices, as recommended by some commenters, because this would be inconsistent with our fuel price, which reflects the *retail* pump price. Bulk prices of both fuel and DEF are typically substantially lower than retail prices, although sometimes reported price differences can be overstated because the specified bulk price excludes any delivery charges.[20] We believe that the majority of operators paying retail price for fuel are paying retail price for DEF, and the majority of operators paying bulk price for DEF are paying bulk price for fuel. Thus, using a DEF price based even in part on bulk DEF prices while using a retail price for fuel would significantly overestimate actual costs.

2.8.4. **Discounting Operating Costs**

In the NPRM, we evaluated the full lifetime operating costs based on a typical vehicle's annual mileage over a 30 year period. The annual mileage took into consideration the impact of vehicle scrappage. We also discounted the operating costs by 7 percent, consistent with past NCP rulemakings.

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Ford	EPA-HQ-OAR-2011-1000-0029
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050

Daimler stated that fuel efficiency is relevant only to the extent it impacts the purchase price that the manufacturer receives and that operating cost savings for the customer after the sale is irrelevant if there is no related impact on purchase price. It generally estimates that truck customers are willing to pay for [confidential business information redacted] months of reduced operating costs when making new truck purchase decisions. Ford stated that purchasers do not fully value the lifetime operating costs, and suggested that the direct market value of reduce operating costs is less than one-half of the total.

Cummins supports using full lifetime costs to reflect both reduce operating costs for the first purchaser as well as better resale value. Cummins stated that engines that use NCPs will

[20] For example, if the delivery charge for 200 gallons of DEF was $200, then a bulk price without delivery charge would understate the actual price of DEF by $1.00 per gallon.

have a cost advantage for the entire life of the engine and that not including the entire life cycle cost could be incentive to manufacturers to use NCPs.

Navistar believes that EPA's proposed 7% discount rate is too low and, thus, improperly overestimates the NCP cost parameters. Navistar uses a 15% standard rate for discounting future cash flows for any new product program. The reason is that making investments in differentiated engineered products is far from a risk-free proposition. Navistar continued to state that there are huge variables in product programs, including the investment required, the timing of the program launch, the length of life of the product, market acceptance (volumes and pricing), and product cost. Each of these factors has a high degree of variability and thus risk.

Navistar also commented that EPA's use of a 30-year truck life and the lifetime mileage over that 30 years for estimating owner operating costs is inappropriate because EPA's emission standards are only applicable for the prescribed "useful life" of the engine, and that EPA has no basis for including DEF-maintenance costs that fall outside the prescribed regulatory life of the vehicle when the NOx emissions standards no longer apply.

Navistar commented that truck purchasers only consider operating costs that occur in the first 5 years (or less) of the truck's life. Navistar stated that the purpose of including owner costs in the NCP formula is to eliminate the impact on purchase decisions "not to penalize nonconforming manufacturers." It stated that to the extent that operating costs do not impact a buyer's purchasing decision—*i.e.*, the costs are not considered by the buyer to be relevant and, thus, do not factor into creating a market disadvantage—those costs then do not serve any NCP purpose and cannot be included without unlawfully penalizing the nonconforming manufacturer. Navistar stated that operating costs beyond those five years should be excluded because they have no impact on a buyer's purchasing decision and cannot create a competitive disadvantage for a complying manufacturer.

Response

We disagree with commenters arguing that the NCP analysis should not include the operating costs over the full lifetime of the vehicle. The difference in operating costs due to fuel consumption and DEF consumption exist throughout the life of a vehicle and are not limited to the vehicle's regulatory useful life or any other arbitrary time period. Thus, we are considering the full lifetime operating costs in the final rule because it is essential to take into account the operating cost difference over the full life of the engine to properly incorporate this market factor into the NCP calculation. It is also worth noting in response to Navistar's comment that, while manufacturers are liable for the emission performance throughout the engine's regulatory useful life, we generally expect the emission controls to continue functioning beyond this period. We also continue to prohibit operators from tampering with emission controls including urea inducements.

We agree with commenters that the full amount of future operating costs is discounted by consumers in purchasing new and used vehicles. Commenters provided a range of suggestions for discounting operating costs. We believe that a seven percent discount rate appropriately

reflects the uncertainty of the lifetime vehicle mileage, fuel price, and DEF price. This value is consistent with OMB guidance on discounting future costs.[21] Of note, the use of a seven percent discount rate is essentially the same as considering 57 percent of the total fuel cost, similar in magnitude to the discount rate comments provided by Ford.[22] This is shown in 2-5 below, which compares different methods of discounting future fuel costs.

2-5 Comparison of Discounting Methods

Method	Percent of Total Undiscounted Lifetime Fuel Costs
Include the first two years of fuel costs without calculating net present value	25%
Net present value (7%) of costs occurring within the first 5 years	30%
Net present value (15%) of lifetime fuel cost	36%
Include the one-half of the undiscounted lifetime fuel cost	50%
Include the first five years of fuel costs without calculating net present value	53%
Net present value (7%) of lifetime fuel cost *(EPA Method)*	57%
Include total undiscounted lifetime fuel cost	100%

We also recognize that not all purchasers will value lifetime operating costs to the same extent that we estimate. We considered this uncertainty in evaluating how to include operating costs in our analysis. For example, as noted in Section 2.8.2, we did not use the worst case fuel consumption rates that some commenters suggested should be incorporated into our cost analysis. One reason we did not use those suggested rates is because it would have substantially overestimated the competitive impact for customers who discount lifetime operating costs more than we do in our analysis. While we do not have sufficient information to precisely analyze the distribution of how much customers will value changes in fuel consumption, we believe that the inclusion of full lifetime costs for a 1.9 percent increase discounted by seven percent appropriately reflects the 90th percentile compliance costs. We note that this is about the same net result as would have been calculated if we had assumed a fuel consumption impact of four percent (as PACCAR recommended), but only considered the first two years of operating costs.

Finally, while we disagree with Navistar's comment that we should not include operating costs that occur after the first five years of an engine's life, we note that using a seven percent discount rate means that about sixty percent of the NPV of the lifetime operating costs are due to the costs that occur in the first five years. In other words, excluding operating costs that occur

[21] OMB Circular A-4, September 17, 2003.

[22] The 57 percent value reflects the increases in fuel prices and decreases in annual mileage accumulation for future years, as well as the discounting for future costs. For example, this value would mean that an actual 30-year fuel cost of $10,000 would have a net present value of $5,700.

after this time would reduce the calculated NPV of operating costs by about 40 percent. As noted above, when estimating operating costs, we did consider the possibility that *some* operators may consider costs this way.

2.9. Other Costs

2.9.1. Warranty and Post-Warranty Repairs

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Ford	EPA-HQ-OAR-2011-1000-0029
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051

Several commenters stated that EPA needs to consider costs for warranty in calculating the NCP value, though the only details on warranty costs were included in the confidential information submitted to the Agency. Much of this was related to total warranty costs for SCR systems rather than incremental warranty costs relative to the upper limit. Several commenters also commented that we needed to add costs for repairs that happen after the warranty period and demurrage costs for time that the trucks will be out of service.

Cummins commented that an optimized NCP baseline engine will have higher warranty and down time cost *advantages* compared to a compliant engine. First, the addition of the more expensive hardware discussed by Cummins will be associated with warranty costs. Second, as the level of NOx is reduced, the NOx OBD requirements become more stringent, which will likely lead to more OBD-triggered warranty claims. Cummins further stated that it is important to consider the cost to the customer for the additional down time associated with this additional warranty, as well as the cost to the consumer for the additional down time associated with this additional warranty.

Ford comments included the following:

> The final NCP amount should also account for onboard diagnostic implications of certifying to the higher standards. 2013 MY+ California Heavy Duty OBD requirements (to which most manufacturers certify nationwide) included additive NOx thresholds of 0.2 g/bhphr for both NOx catalyst monitoring and NOx sensor monitoring. Manufacturers certifying to a 0.2 g/bhphr standard are required to detect malfunctions before emissions reach 0.4 g/bhphr. Manufacturers certifying to a 0.5 g/bhphr NOx FEL would only be required to detect malfunctions before emissions reach 0.7 g/bhphr. This is effectively the difference between a 2 x standard threshold and a 3.5 x standard threshold. The implications of this would vary depending upon the emissions control and monitoring strategies for the engine, with the most extreme case being the difference between a

compliant engine with SCR aftertreatment and one or more NOx sensors, and an engine certifying via NCPs with no NOx aftertreatment and no NOx sensors.

Response

We proposed to include additional warranty costs related to incremental hardware costs and are not changing this analysis for the Final Rule. Commenters focused on the total warranty costs associated with SCR ignore the substantial warranty costs Navistar is incurring for its non-SCR engines. To be consistent with our baseline engine, we need to include only those warranty costs associated with the changes to the baseline engine necessary to reach 0.20 g/hp-hr NOx. However, based on the comments, we are adding costs for similar repairs that operators will incur after the warranty period and demurrage costs for time that the trucks will be out of service. These costs are discussed in more detail in the Final Technical Support Document.

We also agreed with commenters who stated that because OBD systems must detect emission problems relative to thresholds specified as an addition to the family emission limit (or compliance level for NCP engines) and notify the operator of concerns, using NCPs to certify above the standard could result in fewer emission-related repairs. We estimated warranty and post warranty repair costs of the OBD-related costs for the final rulemaking. It is important to emphasize that such costs are appropriate for NCP rulemakings that address competitive effects; however, such costs were not included in our OBD rule because the OBD system is only catching failure modes for which manufacturers were already responsible.

2.9.2. **Research and Development**

Summary of Comments

Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
ICCT	EPA-HQ-OAR-2011-1000-0030
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050

ICCT commented that compliant manufacturers have made significant investments over the last decade, and as a result, are in a position to comply with the emission standards. ICCT further stated that the current definition of the baseline technology package does not account fully for these differences in investment in technology, which is critical if NCPs are to serve deterrents to noncompliance for both this regulation and future rulemakings.

Cummins stated that it invested over $200 million dollars to comply, and that heavy-duty truck prices increased by $10,000 and medium-duty truck prices increased by $6,000 as the emissions surcharge for 2010-compliant equipment.

Mack commented that through EPA's invention of a hypothetical 0.5 g/bhp-hr baseline engine, EPA conveniently kept out of the NCP calculation the hundreds of millions of dollars spent by SCR manufacturers in researching, engineering, developing and implementing their SCR technology.

Navistar provided a lengthy discussion of its technology path in developing advanced EGR. Navistar commented that their choice of Advanced EGR was not a gamble but a significant, capital intensive commitment in response to EPA's 2001 Rule. Navistar stated that it has devoted tens of thousands of employee hours and has invested approximately $700 million in the development of its clean-burning, in-cylinder solution. Navistar stated that these costs include:

> $543 million – *Engineering/Research & Development.* These are costs to design, develop, test and validate the product and include both engine and vehicle costs.
>
> $32 million – *Capital Expenditures.* These are costs primarily for property, plant and equipment used in Navistar facilities required to test and manufacturer the new product.
>
> $81 million – *Supplier Tooling.* These costs include unique fixtures in suppliers' facilities that physically touch Navistar parts in the supplier production process.
>
> $36 million – *Other Costs.* These include remaining costs associated with the project, including such costs as manufacturing start-up costs in Navistar's plants as well as field testing of the product.

Ford commented that investment costs for vehicle manufacturers associated with packaging SCR aftertreatment systems and the necessary sensors that go with them have been underestimated in the proposed analysis.

Response

Several commenters provided information about the total research expenditures associated with meeting the 0.20 g/hp-hr, but did not provide such information relative to engines at the upper limit. As explained in the Final Technical Support Document, we estimated R&D costs as a fraction of the total incremental hardware costs (relative to the upper limit) using the near term, low complexity indirect cost multiplier (ICM) value of 1.15 which includes a portion (0.02) for research and development costs.

It is important to emphasize that we are not developing costs to reflect a specific manufacturer, but rather the general difference between compliant engines and those at the upper limit. We see no evidence that research and development costs for the noncomplying manufacturer are substantially lower than for complying manufacturers. For example, Navistar commented that it spent $700 million in the development of their current engines, while Cummins stated that it had spent $200 million to comply with the 2010 standards. Thus, while commenters may feel that we have underestimated compliance costs associated with R&D, there is no evidence that we have underestimated the competitive advantage or disadvantage associated with R&D costs.

Finally, we note that §1113-87(h) of the NCP regulations contain provisions that allow a manufacturer that pays NCPs to recover up to 90 percent of the portion of the penalty which EPA determines to be related to research and development costs. Therefore, R&D costs only

have a short term impact on a manufacturer using NCPs because the majority of these costs would be refunded. While this would not justify knowingly using the wrong R&D costs, it does provide context for how important this cost component is compared to other costs.

2.9.3. **Costs not included**

Summary of Comments

Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Ford	EPA-HQ-OAR-2011-1000-0029
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051

Ford commented that the final NCP amount should also account for the additional marketing advantages that a manufacturer of non-SCR engines or vehicles has over manufacturers of comparable SCR equipped engines or vehicles. Ford further stated that these include the ability to market vehicles that do not entail the cost and inconvenience associated with having to regularly replace DEF over the life of the vehicle (likely offset in part by an increase in fuel consumption). Daimler had similar comments and noted that "so-called "convenience factors" have been the focus of Navistar marketing and publicity campaigns for years. It argued that EPA ignored this factor because we had not identified any substantial shift in market share in favor Navistar. It stated that this lack of market shift could be because customers may "choose to purchase [SCR engines] because of their superior environmental performance, and because they prefer the certainty afforded by manufacturers who do have the technology to meet emission standards over a company that has not developed technology to meet the standards. Finally, it argued that "if Navistar's non-SCR engines were no longer on the market, then all trucks would have essentially equal NOx maintenance requirements, and this would no longer be negative cost factor for DTNA." Neither Ford nor Daimler provided a dollar value estimate of this advantage.

Daimler also stated that "Navistar's future costs are irrelevant", and that EPA should not have taken these costs "into account". It argued that "the only costs that are relevant to protecting the competitive position of compliant manufacturers are the compliant manufacturers' total costs of compliance."

Mack argued that the compliance costs need to reflect differences in deterioration rates. It said, a non-SCR engine certified at 0.5 g/bhp-hr, such as those Navistar would produce under the NCP as proposed, does not require as significant a compliance margin as evidenced by Navistar's certification levels, which range from 0.423 – 0.473 g/bhp-hr to achieve a 0.5 g/bhp-hr FEL (i.e., a compliance margin of 5 – 15 percent). In addition Mack stated, Navistar applies a deterioration factor multiplier of 1.0 for its 0.5-gram engines (i.e., no deterioration at all), while Mack must use a multiplier of 1.25. Based on Mack's calculations, when the additional compliance margin necessary to meet a 0.20 g/bhp-hr standard (versus a 0.50 g/bhp-hr standard) is accounted for, the cost differential between achieving a 0.50 g/bhp-hr standard and a 0.20 g/bhp-hr standard is increased by approximately 53 percent.

Response

Our final COC_{90} costs do not include any amount to address "convenience factors" like those identified by Ford and Daimler. The *regulations* require that the NCP be based on estimated compliance *costs* rather than perceived value. This is intended to capture marketing advantage by setting the maximum penalty based on the worst case cost that a complying manufacturer has to pay to reduce emissions from the upper limit to the standard and the additional costs its customers pay to operate the compliant engine. Nevertheless, we acknowledged the commenters' concern in our proposal, stating:

> In establishing prior NCP rules, we have frequently made it clear that satisfying the statutory objective of protecting the complying manufacturer was paramount. The generic NCP rule established an approach which attempts to remove any competitive disadvantage to complying manufacturers by assessing a cost to the manufacturer of a non-complying engine in the form of an NCP, with the expectation that this cost is at least equivalent to or exceeds the value of the competitive benefit gained by building a noncomplying engine. Imposing such a cost is a way to level the playing field without interfering in the actual marketing or pricing of the engines. However, since the issue of competitive advantage involves many subjective factors, the regulatory structure cannot by itself ensure that no competitive advantage remains.

In both the Interim and Final Technical Support Documents, we evaluated the market impacts of the NCP to determine if our estimated costs, which do not include additional factors for subjective market impacts, were sufficiently large to cover the competitive impacts including the marketing differences. We concluded that they are. None of the commenters provided any evidence that they are not. More specifically, we determined that Navistar has not gained market share as a result of selling engines without SCR, even though it is selling its engines for a lower price. Thus, if these "convenience factors" are impacting operators purchase decisions at all, the impact must be small.

With respect to Daimler's assertion that we "ignored" this issue, we note that we addressed this issue in Section 4.2 of the Interim Technical Support Document, and even addresses one of Daimler's specific points when we stated that "a trucking company that promotes itself as being an environmentally responsible company may be willing to pay a premium to ensure that its trucks have low-emitting engines." On the broader issue, we stated:

> EPA recognizes that insufficient information is available to conclusively prove that the NCP removes all competitive disadvantages to all complying manufacturers. However, it is still helpful to consider market data to put the amount of the NCPs into context. To do this, EPA considered the available information about market prices and market share. As described below, both market prices and market shares *support* (emphasis added) our conclusion that the NCPs are large enough to remove the competitive disadvantage to complying manufacturers. The analyses are presented here for the comparison of engines equipped with SCR to those that are not equipped with SCR.

Also, while we do not fully agree with other Daimler comment that Navistar's future costs are irrelevant, we did not use Navistar's future costs to calculate either the proposed or final NCPs.

We disagree with Mack that costs need to be adjusted to reflect differences in deterioration factors. Neither the regulations nor past precedent support any additional adjustment for deterioration factors , beyond what is already taken into account in our cost analysis and we do not believe that Mack's argument support such adjustments now. Mack stated that it recommends increasing costs to reflect differences in deterioration factors (DFs) because Navistar uses a lower deterioration factor near 0.50 g/hp-hr than Mack does at 0.20 g/hp-hr. However, it is unclear why Mack believes this is relevant. Therefore, we are addressing this comment in the following three contexts:

1. Impact on compliance costs relative to our baseline SCR engine.
2. Impact on our analysis of alternative methodologies.
3. Impact on Navistar's compliance level and the penalty it would pay.

In the first context, we note that since our final COC_{90} is not based on Navistar's engine, the Navistar DF is not directly relevant. Mack could be arguing that Navistar's lower deterioration factor is intrinsic to its higher emission level. However, the difference in DFs between Navistar and Mack is more likely to result from the fact that Navistar has not been using catalytic aftertreatment to control NOx emissions than anything intrinsic to the emission level. Even if it is not, our analysis bases costs on the end-of useful-life catalyst efficiencies of the baseline and compliant engines, and thus fully addresses deterioration. In other words, EPA's cost analysis presumes that the expected technology will meet emission levels at the end of the useful life of the engine. Thus, cost analysis already includes assumptions regarding catalyst deterioration that would affect the cost of the compliant technology. Inclusion of an additional cost for deterioration would effectively double-count these costs. It is also worth noting that Cummins was the only manufacturer to comment specifically on the hardware costs associated with our cost scenario (i.e., optimizing engines for 0.50 versus 0.20 g/hp-hr NOx) and it did not support including any additional costs for deterioration.

A second context to consider is how deterioration is addressed in our analysis of alternatives. For the first alternative, we looked at the costs associated with an upper limit of 1.2 g/hp-hr NOx and our cost estimates were consistent with compliance costs provided by engine manufacturers of going from a 1.2 g/hp-hr engine that does not use SCR to a compliant engine that uses SCR. These manufacturers provided SCR hardware costs for the systems they are actually producing, which necessarily include any costs associated with deterioration.

The only alternative scenario in which Mack's comment could apply would be the second alternative, in which we estimated costs relative to an EGR engine similar to Navistar's current engines. While, as discussed above, we believe we fully accounted for deterioration in this alternative, even if we did underestimate the costs associated with deterioration of engines like Navistar's engines, it would not have changed our conclusion. We estimated that the COC_{90} costs for this alternative would have been $994, which is $2,781 less than our final COC_{90} ($3,775). Thus, even if omitted a deterioration-cost of $2,000 per engine (which would be much more than any such error could reasonably be expected to be), we still would have concluded that the optimized SCR engine is the more appropriate baseline for our cost analysis.

With respect to the third context, we note that the actual amount of the NCP paid by noncomplying manufacturers is calculated from the compliance level, which includes a

deterioration factor (see §86.1102-87). NCP cost parameters are based on the levels of emission standards (or effective standards such as the 1.2 g/hp-hr phase-in NOx level or the 0.50 g/hp-hr FEL cap), which is consistent with the regulatory provisions that treat the compliance level as the in-use standard for NCP engines. Thus, Navistar would have to include an appropriate deterioration factor in its application for certification to insure that its engines meet its NCP compliance level at the end of their useful lives. Any question regarding the appropriateness of Navistar's DF would be a certification issue that is not within the scope of this NCP rulemaking.

2.10. Comparison of Commenters' and EPA's Estimates of Total Compliance Costs and Penalties

Several commenters recommended specific values for COC_{90} (in some cases stated as the recommended penalty). These recommendations, which each differ from our final COC_{90} value, are summarized in this section. Note that in many cases we cannot respond to these comments in full detail because the underlying cost analyses shared with EPA are considered by the commenters to be confidential business information.

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050 PACCAR EPA-HQ-OAR-2011-1000-0041

CATF submitted a memorandum that evaluates potential NCP values that would potentially derive from a "high engine-out" nonconformance path, using best available recent projections of the future relationship between DEF and diesel fuel prices. CATF believes this analysis indicates that a year 1 NCP value in the range of $4,000-$5,000 might be warranted to preclude backsliding by current conforming engine manufacturers.

Cummins also commented that NCPs that are too low create a much greater issue with regard to compliance *among SCR manufacturers* than *between EGR and SCR manufacturers*. Cummins continued to say that since NCPs are available to all manufacturers once enacted, and since the cost of the proposed NCPs are much lower than the economic value that can be created by paying them and optimizing engines at higher, noncompliant NOx levels, SCR manufacturers that are otherwise capable of producing compliant engines will be driven by competitive market forces to pay NCPs as a license to produce higher emitting engines. Cummins also commented that a correct analysis would recognize the first cost and operating cost benefits of operating at higher NOx levels up to 0.50 g/hp-hr and would incorporate a more appropriate DEF/diesel price ratio which would result in a much higher NCP level of $8,100 for a heavy heavy-duty diesel engine.

PACCAR also stated that the proposed NCP level is so low that it creates an additional competitive disadvantage for manufacturers that have invested considerable time and resources in developing emission control technology that complies with the 2010 NOx standard. PACCAR commented that in order to eliminate the competitive advantage Navistar gains under the current NCP, EPA should add the value of "Navistar's fuel economy advantage" to the SCR hardware, R&D and warranty component costs, and increase the NCP for 2012 to a minimum of $14,378.

Mack provided confidential business information summarizing its costs associated with developing, producing, operating and maintaining an engine that complies with a 0.20 g/bhp-hr standard compared with an engine that complies with a 1.2 g/bhp-hr NOx limit (the effective standard during the 2007-2009 phase-in period). It stated the costs ranges from $14,520 to $21,390, depending on the DEF dosing level adopted. Mack's cost estimates did not include any fuel savings associated with going from 1.2 to 0.20 g/hp-hr, because it believes EPA's past practice was to neglect any side benefits associated with compliance. Mack stated that if the total cost represented 1.2 g/hp-hr NOx and was adjusted to represent the cost difference between meeting a 0.5 g/bhp-hr standard and a 0.20 g/bhp-hr standard, it would result in COC_{90} of $4,356 to $6,417 per engine (which is 30 percent of the total SCR cost). However, it argued that a higher value is needed to reflect differences in deterioration rates. It said, a non-SCR engine certified at 0.5 g/bhp-hr, such as those Navistar would produce under the NCP as proposed, does not require as significant a compliance margin as evidenced by Navistar's certification levels, which range from 0.423 – 0.473 g/bhp-hr to achieve a 0.5 g/bhp-hr FEL (i.e., a compliance margin of 5 – 15 percent). In addition Mack stated, Navistar applies a deterioration factor multiplier of 1.0 for its 0.5-gram engines (i.e., no deterioration at all), while Mack must use a multiplier of 1.25. Based on Mack's calculations, when the additional compliance margin necessary to meet a 0.20 g/bhp-hr standard (versus a 0.5 g/bhp-hr standard) is accounted for, the cost differential between achieving a 0.5 g/bhp-hr standard and a 0.20 g/bhp-hr standard is increased by approximately 53 percent. Mack commented that the base range of costs of $4,356 to $6,417 per engine, therefore, must be adjusted to account for these factors. Once so adjusted, Mack's estimated costs of compliance range from $6,655 to $9,804 per engine. Note: Mack also submitted comments more than three months after the close of the comment period that argued for a penalty of approximately $19,000 per engine based on fundamentally redesigned SCR engines.

Daimler provided a similar analysis of the costs it incurred to meet the 2010 NOx standard. However, it entire analysis was identified as confidential business information.

Response

We considered each of the specific values for COC_{90} (or recommended penalty) presented by commenters. Where it is possible, we identify the primary reasons why the recommended value differs from our estimate. Note that this summary of reasons is not intended to be exhaustive, but rather is intended to identify the most significant difference between the commenters' analyses and ours. We also identify other sections in this chapter where these differences are discussed in more detail.

CATF recommended a COC_{90} of $4,000-$5,000 based on using an optimized 0.50 g/hp-hr SCR engine as the baseline (similar to EPA's final baseline engine). This value is slightly higher than our final COC_{90} value. While it did not provide full details of its calculations, the difference appears to be due primarily to its use of a slightly lower DEF price (about 10 percent less than our DEF price) and a slightly larger fuel consumption impact. See Section 2.8.3 for a discussion of why our projected DEF price is more appropriate than the value assumed by CATF.

The baseline engine for Cummins' recommended COC_{90} value of $8,100 is very similar to our final baseline engine. While the details of Cummins calculations are considered to be confidential business information, we can say that the difference between our COC_{90} and Cummins' COC_{90} is due primarily to Cummins' assumption that the price of DEF ($/gal) will be only 40 percent of the cost of fuel, while we project that the DEF price will be 65 to 70 percent of the price of fuel. Its confidential estimates for other costs (such as hardware, warranty, and fuel consumption) also differ from our estimates, but these differences are less significant than the different DEF price. See Section 2.8.3 for a discussion of why our projected DEF price is more appropriate than the value assumed by Cummins.

PACCAR's baseline engine is also very similar to our baseline engine. However, PACCAR believes the fuel consumption cost should be $20,108. It calculated essentially the same DEF consumption as our final estimate, and assumed all other costs are the same as our proposed COC_{90}. See Section 2.8.2 for a discussion of why we believe PACCAR overestimates the COC_{90} fuel consumption impact. PACCAR argued that the penalty should also include the value of "Navistar's fuel economy advantage", but we see no evidence that Navistar has any fuel economy advantage over compliant engines.

Mack did not use the same type of baseline engine for its analysis as we did. Its baseline engine is a 2009 non-SCR engine that has NOx emissions at 1.2 g/hp-hr, which is above the upper limit. It attempted to address this difference by scaling its costs to be proportional to the difference in emissions. As described in Appendix B of the Final Technical Support Document, we evaluated this methodology using our own independent cost inputs. Our analysis using this methodology results in a COC_{90} that is slightly less than our final COC_{90} based on our SCR-baseline methodology, which is much less than Mack's estimate. The primary reasons for the difference are that: (1) we account for the fuel benefit associated with adding SCR, while Mack does not; and (2) we do not agree with Mack's adjustment for deterioration factors. We estimate the NPV of the lifetime fuel benefit of adding SCR to about $10,000. When scaled by 30 percent to represent the upper limit, this benefit reduces Mack's COC_{90} values by about $3,000. So our final COC_{90} value is consistent with the range recommended by Mack, as long as Mack's

estimates are corrected for the fuel benefit. Moreover, our final COC_{90} value is actually higher than the range recommended by Mack without its deterioration factor adjustment when those estimates are corrected for the fuel benefit. See Section 2.8.1 for our discussion of why it is not appropriate to neglect fuel savings in this NCP rule, and Section 2.9.3 for a discussion of why Mack's deterioration adjustment is not appropriate. Regarding, Mack's very late comments pertaining to fundamentally redesigned SCR engines, these comments came in too late for EPA to include in our cost analysis or for EPA to provide detailed analysis. However, see Section B.3 of the Final Technical Support Document for a discussion of why we are not basing our costs on fundamentally redesigned SCR engines, such as those discussed in Mack's late comments.

While we cannot respond in detail to Daimler's analysis because Daimler considers it to be confidential business information, we can note that Daimler's costs were relative to a model year 2009 baseline engine with NOx emissions near 1.2 g/hp-hr rather than the a baseline engine at the upper limit. Daimler does not scale its estimate of costs or resulting COC_{90} to take into account the upper limit of 0.50 g/hp-hr. Its costs also excluded fuel savings associated with adding SCR to model year 2009 engine. See Sections 2.5 and 2.8.1 for our discussions of why these assumptions are not appropriate.

2-6 Summary of Why EPA's Final COC_{90} Differs from Commenter Recommendations

Commenter	Recommended COC_{90}/Penalty	Primary Difference from EPA Analysis	Related Sections
CATF	$4,000 to $5,000	Uses lower DEF price and larger increase in fuel consumption.	2.8.2 2.8.3
Cummins	$8,100	Uses lower DEF price.	2.8.3
Daimler	At least $19,000	Costs not calculated relative to the upper limit and fuel savings are neglected.	2.5 2.8.1
Mack	$6,655 to $9,804	Fuel savings are neglected, and costs are calculated using an alternative methodology.	2.8.1 2.9.3
PACCAR	At least $14,378	Assumes larger increase in fuel consumption.	2.8.2

3. Regulatory Issues

3.1. Base Year for Calculating NCPs

As required by the Clean Air Act, the existing regulations include a formula that increases the penalty rates with each new model year. We proposed to apply this formula to the NCPs beginning with the 2013 model year by setting the 2012 model year as year number one. This would be consistent with the pre-existing regulatory text in §1113-87(a)(4) which states that "n=1 for the first year that the NCP is *available*" (emphasis added).

Summary of Comments

CATF	EPA-HQ-OAR-2011-1000-0021-0022
Cummins	EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Daimler	EPA-HQ-OAR-2011-1000-0028, 0043-0045 & 0049
EDF	EPA-HQ-OAR-2011-1000-0026
Mack	EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051
Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050
PACCAR	EPA-HQ-OAR-2011-1000-0041

Cummins, Daimler, Mack, and PACCAR each commented that EPA incorrectly selected 2012 as the proposed "first year" for purposes of the NCP annual escalator adjustment factor. Cummins commented that EPA provided "scant justification for this proposal." It argued that "setting the 'first year' for purposes of penalty escalation based on the time that one particular manufacturer runs out of credits is wholly at odds with the purpose of the statutory provision requiring NCPs to escalate over time: to increase the incentive to come into compliance quickly. See 42 U.S.C. § 7525(g)(3)(D)." It also stated that "the availability of credits should not exempt any manufacturer from the escalation of NCPs required by Congress."

Mack commented that EPA's "perception of when NCPs might be needed is wholly irrelevant to the separate question of when an escalation factor should be initiated." It also stated that "since NCPs are designed to protect both the environment and the competitive interests of compliant manufacturers, the relevant point at which escalation factors must apply is the point at which the industry must comply (i.e., the year the standard takes effect). "

Daimler commented that the only reason that EPA finds itself setting NCPs in 2012 is because Navistar has used credits to sell its engines for the past two years, and that compliant manufacturers have been meeting the NOx standard since 2010, and it is the competitive disadvantage to compliant manufacturers that EPA must remove. It stated that where NCPs are made available beginning one or more model years after the effective date of the pertinent emission standard, either the "n" value or the initial cost level must be adjusted upward to reflect that fact and that failure to make such an adjustment would breach EPA's statutory obligation to ensure that penalties incentivize compliance and remove "any competitive disadvantage" to compliant manufacturers.

EDF believes EPA was "misguided in choosing model year 2012 as the first year for NCPs," noting that "every year the NCP does not escalate, there is less incentive for nonconforming manufacturers to conform." EDF opposes rewarding the nonconforming manufacturer by allowing them two model years without an increase in penalties. It stated that "EPA should have established the NCP by 2010 so that the manufacturer would have had to choose then between using credits or paying the NCP," but that using model year 2010 as the first year for the escalator would "prevent conforming manufacturers from suffering a competitive advantage (*sic*), to give the nonconforming manufacturer greater incentive to conform, and to disincentivize conforming manufacturers from backsliding."

CATF stated that EPA's selection of 2012 as the first year of the NCP escalation clause is unreasonable and unlawful, rewards noncompliance, and is inconsistent with the Clean Air Act and EPA precedent. CATF noted that CAA section 206(g)(3)(D) provides that penalties "shall be increased periodically" and that EPA has traditionally structured NCPs as escalating beginning with the effective date of the new emission standard. CATF noted that the purpose of the escalator clause is to minimize the production of noncompliant engines.

Navistar commented that choosing model year 2012 as the base year was correct. It argued that "selecting an earlier model year would run counter to EPA's longstanding interpretation of when NCPs (and the corresponding annual adjustment) are appropriate." To support this, it cited EPA's statement in the proposal for the Phase I rule (50 Fed. Reg. at 9212) that "annual adjustment factors would be used to increase the amount of the nonconformance penalty from year to year, beginning with the second year that the NCP is available for a particular standard." Navistar also stated that the SCR engine manufacturers' argument is flawed because the 0.20 g NOx standard actually was in effect in model year 2007 and there was no standard change in 2010 but a lowering of a cap under the phase-in process. It also argued that selecting an earlier model year would run counter to Congressional intent and there could be no other purpose for moving "year one" earlier other than to unlawfully and unfairly penalize Navistar. Finally, Navistar commented that we "must make NCPs available retroactively" if we set 2010 as year one.

Response

Many of the commenters addressing the appropriate base year for NCP inferred what Congress' intent was with respect to this issue. However, we believe that this is not appropriate. Congress did not specifically address circumstances in which the NCPs are established after a standard has already gone into effect. Nevertheless, Congress did establish two very clear requirements that are relevant here. First, Congress requires the NCP to always be high enough to protect the complying manufacturers. As is described elsewhere, the final NCPs (that are based on 2012 compliance costs) are high enough to meet this requirement without setting 2010 as the base year. Second, Congress requires the NCP to increase periodically. The existing regulations fulfill this requirement without regard to which base year is used. However, since the purpose of this escalator is to provide an incentive for manufacturers who use NCPs for more than one model year to achieve compliance quickly rather than continuing to use NCPs for multiple model years, using 2012 as the base year is consistent with the requirements in the Clean Air Act.

We also note that the existing regulatory text states that year one is the first year that NCPs are available, which in this case is 2012. Thus, using 2012 as the base year is also consistent with the existing regulations.

Setting 2012 as the base year is consistent with both the Clean Air Act and the existing regulations, and we believe that there would need to be a significant policy reason to finalizing 2010 as the base year. The commenters have not provided such a reason. On the contrary, using the first year of NCP availability as the first year for the escalator calculation, the NCPs for the first year of availability are sufficient to protect the complying manufacturers while allowing Navistar to continue making engines, as Congress intended. Adding an extra penalty equivalent to two years of escalation seems contrary to the intent for this escalation, which is to encourage manufacturers who are using NCPs to come into compliance. As no manufacturer has had access to NCPs prior to 2012, requiring an escalator for the two previous years is not consistent with the purpose of the escalator. Moreover, EPA disagrees with commenters who apparently believe that Navistar's use of emission credits in model years 2010 and 2011 amounted to noncompliance. This is false. Emission credits are a completely valid and environmentally neutral (if not beneficial) method for manufacturers to reduce emissions early and use credits to have higher emissions later. Commenters who wish to penalize Navistar for using a credit program that has been part of the regulations since the NOx standard was promulgated, and that can be credited with achieving NOx reductions earlier than otherwise required, are mistaken.

3.2. Retaining Emission Credit While Using NCPs

Summary of Comments

Mack EPA-HQ-OAR-2011-1000-0024, 0046, 0047 & 0051

Mack commented that since we justified our adoption of NCPs based on concerns that Navistar will exhaust emissions credits, we should require that Navistar exhaust all available emissions credits before it is allowed to utilize NCPs, noting that we have previously stated that "NCPs have always been intended for manufacturers that cannot meet an emission standard for technological reasons rather than manufacturers choosing not to comply." Mack argues that this logic means that "EPA should not make NCPs available to any manufacturer until such time as the Agency has confirmed the manufacturer has exhausted all credits available for use in the United States."

Response

We neither proposed nor requested comment on any requirement to exhaust emission credits before using NCPs. We are not adding such a restriction to the regulations in this Final Rule because we do not believe it is necessary as long as the penalty is high enough to remove all competitive disadvantages for complying manufacturers and as long as there is a technological laggard. We note that Navistar would have already exhausted its emission credits had interim NCPs not been available, and that Navistar has been using its remaining credits to certify its engines for use in California. There does not appear to be any environmental benefit to including the requirement to exhaust credits, since in either case the engines would be emitting above the level of the standard.

3.3. Prohibition against generating emission credits from NCP engines

Summary of Comments

Cummins EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
Navistar EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050

Cummins commented that disallowing the ability to generate greenhouse gas credits for engines that use NCPs is not a sufficient deterrent to prevent otherwise compliant engine manufacturers from using NCPs to economic advantage.

Navistar stated that it "EPA overstates the issue and thus proposes a limit that is too broad." However Navistar "agrees that SCR engine makers should not be able to "game" the system to generate CO2 credits in the manner described by EPA." It suggested that we "should clarify that engine manufacturers that implement approved methods for generating CO2

credits—i.e., actions other than simply dialing up NOx and paying an NCP—are not precluded from generating CO2 credits for future use."

Response

We are not relying on this prohibition to prevent compliant engine manufacturers from using NCPs to gain an economic advantage. We believe our final regulations set the penalties high enough to prevent this.

With respect to Navistar's comment, we note that the new 86.1105-87(j)(2) states only that:

> (j)(2) Manufacturers may not generate emission credits for any pollutant from engines for which the manufacturer pays an NCP for the NOx standard identified in paragraph (j)(1) of this section.

Thus a manufacturer is precluded from generating credits only from those engines for which it pays the NCP. This rule does not preclude manufacturers from generating credits from any engines for which they do not pay the NCP. Nor does this rule preclude manufacturers from generating vehicle credits (i.e., non-engine credits) from any vehicles, even if the vehicles include engines for which NCPs are paid.

3.4. NCP Formula

Summary of Comments

ICCT EPA-HQ-OAR-2011-1000-0030

The ICCT believes that the proposed methodology rewards noncompliant manufacturers who have not made sufficient investments in technology. ICCT proposes an alternative methodology wherein two sets of NCPs are developed based on the particular technology pathway the manufacturer has chosen. Using this approach, the Agency would develop one set of NCPs for noncompliant manufacturers using only EGR and another set of NCPs for potential noncompliant manufacturers using SCR+EGR. Then, the appropriate penalties can be applied based on the manufacturer's specific technology platform. This system avoids having to set penalty levels that do not reflect the technology choices of a given manufacturer. Under the current cost estimation methodology, choosing a baseline SCR+EGR engine to determine the NCPs for a manufacturer using EGR discounts the years of substantial research and development costs that the compliant manufacturers have devoted to achieving the current standard.

Response

The generic Phase I NCP rule established that a single NCP curve should apply for all engines, and that the curve should be based on the full distribution of compliance costs for all engines. We did not propose to revise this approach. While we understand the ICCT's concern, we do not believe it would be appropriate to adopt such a significant change without full notice and opportunity for public comment. Moreover, we believe that this recommendation was made to address the ICCT's broader goal of ensuring that there is no incentive for SCR engine manufacturers to reoptimize their engines for higher NOx emissions. We are confident that our final NCPs will achieve this broader goal. We believe the best approach is to have a single NCP level that reasonably represents the 90th percentile costs for manufacturers.

3.5. Significant figures of the upper limit.

Summary of Comments

Cummins EPA-HQ-OAR-2011-1000-0015, 0025 & 0048

Cummins noted that the preamble and proposed regulatory language for the upper limit vary by one significant digit, and that the regulatory upper limit should contain the extra significant digit.

Response

We agree and the final regulatory text has been corrected.

3.6. Dollar values

Summary of Comments

Anonymous public commentEPA-HQ-OAR-2011-1000-0013

We received an anonymous comment asking the reason some of the regulatory values are expressed in monetary amounts from another decade (e.g., "December 1991 dollars" or "December 1984 dollars").

Response

These references in the regulations identify the basis of costs listed in the regulations for purposes of adjusting for inflation in later years. For example, the statement in the regulations that the new NCP parameters for the 2010 NOx standard are "expressed in December 2011 dollars" means that these values are consistent with the Consumer Price Index (CPI) for the month of December in 2011.

4. Other Issues

4.1. Sunsetting NCPs

Summary of Comments

NJDEP EPA-HQ-OAR-2011-1000-0016

The State of New Jersey commented that there should be a definitive deadline to the length of time nonconformance penalties will be allowed as a substitute for a complying engine.

Response

Section 206(g)(1) of the Clean Air Act states "a certificate of conformity shall be issued ... if such manufacturer pays a nonconformance penalty as provided under regulations ..." The statute does not refer to EPA setting end dates for NCPs and EPA's has not included end dates in its previous generic or specific NCP regulations. However, we believe that the yearly increase in the penalty rates, which is authorized by the Act, will effectively accomplish the same goal by making the penalty much higher than the cost of compliance. Nevertheless, it is possible that we could determine in the future that NCPs are no longer needed and are being used inappropriately, in which case we could effectively end the NCPs by revising the upper limit to be equal to 0.20 g/hp-hr through a new rulemaking.

4.2. Alternative Penalties

EPA requested comment on whether we could or should also include a non-monetary value as an option in the definition of the noncompliance penalty. Specifically, we asked if there should be an option where the penalty could be defined as the amount of NOx emission reductions that would not be achieved by the engine compared to the applicable standard.

Summary of Comments

Cummins EPA-HQ-OAR-2011-1000-0015, 0025 & 0048
NESCAUM EPA-HQ-OAR-2011-1000-0018-0019
NJDEP EPA-HQ-OAR-2011-1000-0016

NESCAUM and NJDEP support the alternative penalty approach discussed in the NPRM. NESCAUM stated that this "would provide a means to recover the environmental loss, calculated as the total excess NOx emissions expected from the non-conformance engines over their lifetimes, through a specific offset plan developed by the engine manufacturer and at a cost equivalent to or greater than what the nonconformance penalty would be under the conventional approach outlined in the proposed rule." NJDEP stated that due to "the uncertainty in determining actual tons of NOx that should be offset, the level of NOx to be mitigated should be

set above the excess tons of expected NOx emissions that will occur from the engines certified using NCPs."

Navistar stated that EPA's past practice shows that a non-monetary NCP is a desirable, equitable option and that an alternative penalty would ensure that excess NOx emitted by nonconforming engines are off-set. It also noted that because EPA would require that the cost of achieving these reductions would be at least as great as the dollar amount of the NCP, any purported competitive disadvantage to complying manufacturers would be eliminated to the same extent as simply paying a dollar amount. Navistar stated that "under EPA's proposal, it makes most sense to continue to use the existing penalty formula, but then to offer an option that the penalty be paid in terms of money spent on a "green project" rather than money spent by writing a check" and that this approach "is well suited for ensuring that the CAA § 206(g)(3) requirement is met and that the penalty will remove any competitive disadvantage. " Navistar recommends that NCPs continue to be defined in monetary terms, but that manufacturers choosing to pay penalties have the added option of instead spending the "penalty money" on green projects. Finally, Navistar stated that "EPA does not need to fully establish the alternative penalty/green project regulatory structure in the current rulemaking" but could promulgate regulations now that allow for/create the alternative penalty payment option later.

Cummins stated that it would be inappropriate to allow for nonmonetary NCPs because "Section 206(g) calls for manufactures to "pay" a nonconformance "penalty" in "amounts" set by EPA." It cited the legislative history of the NCP provision to support its belief that Congress intended the penalties to be monetary:

> "The provision requires that the nonconforming technology penalty to be set at a level which will eliminate the competitive advantage, if any, for the manufacturer of a nonconforming vehicle or engine. Thus, its calculation would include such items as the actual cost of compliance for complying vehicles, the capital costs foregone as a result of noncompliance, the market value of any fuel economy gains made by non-complying vehicles compared to complying vehicles…." House Conf. Rept. No. 95-564 at 163 (95th Cong., 2d Sess. 1977), 2 U.S.C.C.A.N. 1544 (1977) (emphasis added).

Response

While we recognize the potential environmental benefits of allowing manufacturers to offset the emission impacts of NCP engines instead of paying a cash penalty, we are not finalizing such an approach at this time. We have concerns regarding the complexity of such a program and the enforceability (in terms of monitoring compliance) of this approach. Such an approach would be a substantial shift from the current NCP program and would need considerable review regarding its parameters and compliance mechanisms. EPA also notes the comments of Cummins, regarding the intent of Congress regarding NCPs and possible inconsistencies of such a program with Congressional intent, though we do not conclude that such a program would be necessarily inappropriate.

4.3. Regional Impacts of NCPs

Summary of Comments

NESCAUM	EPA-HQ-OAR-2011-1000-0018-0019
NJDEP	EPA-HQ-OAR-2011-1000-0016

NESCAUM estimates as a result of the sale and use of these higher emitting engines that NOx emissions within our eight-state region will increase by as much as 2590 tons in 2012, and by 45,500 tons over the useful life of these model year 2012 engines as compared with the use of fully compliant engines. The NESCAUM states are concerned about the effect that this unanticipated increase in NOx emissions will have on attainment and maintenance of the ozone standard.

NJDEP stated that operation of nonconforming engines could increase in NOx emissions throughout the northeast region because states upwind of New Jersey have a significant impact on New Jersey's ozone levels. It argued that the non-compliant engine manufacturer should also offset NOx emission increases in those upwind states.

Response

There is little question that the promulgation of NCPs could have a negative impact in terms of the emissions of new heavy heavy-duty diesel engines in the near future. However, Congress clearly intended that NCPs be made available. The language and history of this provision indicate that Congress effectively determined that requiring EPA to issue standards for heavy-duty vehicles and engines that are technology forcing in nature, with NCPs acting in part as a safety valve preventing a manufacturer from being forced from the market, serves the public interest in the long term and outweighs any short-term harm to the environment caused by allowing NCPs.

4.4. Comments about SCR unrelated to costs

Summary of Comments

Navistar	EPA-HQ-OAR-2011-1000-0027, 0031-0039, 0042 & 0050

Navistar also included comments arguing against the use of SCR by its competitors. In particular, it stated that "EPA unlawfully eliminated the inconvenience and cost of DEF-maintenance, by authorizing SCR-equipped vehicles to run for thousands of miles (and, in practice, indefinitely) with the SCR system turned off."

Response

These comments are not relevant to the current proceeding. We based our NCP rule on the statutory and regulatory provisions for developing NCPs and the reasonable cost estimates

we developed for the rule. Other tangential issues regarding the heavy duty diesel engine manufacturing industry were not relevant to our actions during the proceeding.

4.5. Timing of NCP Rulemaking

Summary of Comments

Daimler	EPA-HQ-OAR-2011-1000-0043 & 0045
EDF	EPA-HQ-OAR-2011-1000-0026
Mack	EPA-HQ-OAR-2011-1000-0046 & 0047

EDF commented that EPA's failure to timely set NCPs before 2010 contradicts the agency's regulatory mandate to set such penalties "when any new or revised emission standard is more stringent than the previous standard" and frustrates the Act's directive mandating that NCPs "shall remove any competitive disadvantage to manufacturers whose engines or vehicles achieve the required degree of emission reduction." 42 U.S.C. § 7525(g)(3)(E).

Mack stated in it hearing testimony that if Navistar was in danger of running out of emission credits before achieving the standard, it should have requested NCPs soon enough to allow for a proper process. It added that the fact that Navistar did not "should not work to its advantage.

Daimler commented that all previous NCP rules were "conducted before or at the same time that the emission standards were taking effect."

Response

We notified manufacturers in 2010 that we had found that the new NOx standard required substantial work.[23] When making that determination, EPA noted that the reason that we were not establishing NCPs at that time was because we had not determined that a technological laggard was likely to develop. Had we known before 2010 that Navistar would run out of credits in 2012 and that it would have not yet brought its NOx levels down to 0.20 g/hp-hr, we would have established NCPs. It was not apparent that there would be a need for NCPs until after, the implementation of a standard. Daimler is correct that the timing of this rule is different than for other NCP rules. However, the appropriateness of the NCP rule is determined by its compliance with the statute, not its timing. The fact that Navistar did not need NCPs until after the initial implementation of the standard does not change our obligation under the Clean Air Act.

[23] "Nonconformance Penalties for Heavy-Duty Diesel Engines in 2010 Model Year", Letter from Karl J. Simon, Director, EPA Compliance and Innovative Strategies Division, February 22, 2010.

It is also important to note that although many commenters seem to believe that the NOx standard was new in 2010, it was actually first applicable to model year 2007 engines. There is no basis for treating the phase-in provisions that applied in model year 2007 through 2009 differently than the flexibility of the emission credit program that Navistar has used since then to certify engines near 0.50 g/hp-hr NOx.

With respect to Mack's comment, while it may have been better had Navistar notified us earlier of its need for NCPs, we do not agree that its failure to notify us sooner has worked to its benefit, particularly not in with regard to this final rule completed after notice and comment. Mack's comment may have been addressing the Interim Final Rule, rather than the proposal. Indeed, given the events that have occurred since the publication of the proposal and interim final rule, it is likely that an earlier proposal and final rule promulgating NCPs would have been more advantageous to Navistar. It is also likely that, had we finalized an NCP rule last year, the final rule may have been based on the fuel and DEF prices similar to those used for the proposal, which were appropriate at that time, and would likely have resulted in lower penalties.

4.6. Late Comments

Daimler	EPA-HQ-OAR-2011-1000-0043 & 0045
Mack	EPA-HQ-OAR-2011-1000-0046 & 0047
Navistar	EPA-HQ-OAR-2011-1000-0042
PACCAR	EPA-HQ-OAR-2011-1000-0041

Daimler, Mack, Navistar, and PACCAR submitted these comments after the close of the comment period. In most cases, these were supplemental comments. We considered these late comments to the extent practicable and many details of these late comments are addressed in the respective other sections of this document. For example, PACCAR's comments were received shortly after the close of the comment period and have been addressed in this document. Navistar submitted comments in May to rebut arguments raised by other commenters, and these comments are also addressed to some extent. On the other hand, comments from Daimler and Mack that were received in July (more than three months after the close of the comment period and after we had completed our analysis of costs) are generally not explicitly addressed in this document. Nevertheless, we did summarily review these very late comments and determined that they did not contain any new information that would have changed our conclusions or our final NCP level.

APPENDIX: Section 206(g) of the Clean Air Act

(g) *Nonconformance penalty*

(1) In the case of any class or category of heavy-duty vehicles or engines to which a standard promulgated under section 7521(a) of this title applies, except as provided in paragraph (2), a certificate of conformity shall be issued under subsection (a) of this section and shall not be suspended or revoked under subsection (b) of this section for such vehicles or engines manufactured by a manufacturer notwithstanding the failure of such vehicles or engines to meet such standard if such manufacturer pays a nonconformance penalty as provided under regulations promulgated by the Administrator after notice and opportunity for public hearing. In the case of motorcycles to which such a standard applies, such a certificate may be issued notwithstanding such failure if the manufacturer pays such a penalty.

(2) No certificate of conformity may be issued under paragraph (1) with respect to any class or category of vehicle or engine if the degree by which the manufacturer fails to meet any standard promulgated under section 7521(a) of this title with respect to such class or category exceeds the percentage determined under regulations promulgated by the Administrator to be practicable. Such regulations shall require such testing of vehicles or engines being produced as may be necessary to determine the percentage of the classes or categories of vehicles or engines which are not in compliance with the regulations with respect to which a certificate of conformity was issued and shall be promulgated not later than one year after August 7, 1977.

(3) The regulations promulgated under paragraph (1) shall, not later than one year after August 7, 1977, provide for nonconformance penalties in amounts determined under a formula established by the Administrator. Such penalties under such formula—

(A) may vary from pollutant-to-pollutant;

(B) may vary by class or category or vehicle or engine;

(C) shall take into account the extent to which actual emissions of any air pollutant exceed allowable emissions under the standards promulgated under section 7521 of this title;

(D) shall be increased periodically in order to create incentives for the development of production vehicles or engines which achieve the required degree of emission reduction; and

(E) shall remove any competitive disadvantage to manufacturers whose engines or vehicles achieve the required degree of emission reduction (including any such disadvantage arising from the application of paragraph (4)).

(4) In any case in which a certificate of conformity has been issued under this subsection, any warranty required under section 7541(b)(2) of this title and any action under section 7541(c) of this title shall be required to be effective only for the emission levels which the Administrator determines that such certificate was issued and not for the emission levels required under the applicable standard.

(5) The authorities of section 7542(a) of this title shall apply, subject to the conditions of section 7542(b) 2 of this title, for purposes of this subsection.