MEMORANDUM

DATE: April 14, 2003

SUBJECT: Additional Information on Nonroad Retrofit Engine ABT Credit Concepts

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TO: Docket A-2001-28

The attached document provides additional information and detail on the nonroad diesel engine retrofit ABT credit program discussed in Section VII.A.of the Preamble, but not proposing, as part of the Notice of Proposed Rulemaking (NPRM) for nonroad diesel engine Tier 4 standards. The attached provides further discussion of issues raised in the NPRM preamble and provides a framework for how a nonroad retrofit ABT program could be structured.

Attachment

Nonroad retrofit engine credits within the ABT program

As discussed in section VII.A. of the preamble, we are considering expanding the averaging, banking, and trading (ABT) program to allow NOx and PM credits to be generated through retrofitting in-use nonroad diesel engines so that the engines meet more stringent emissions levels than required. Such credits would then be available for use by Tier 4 nonroad engines through the usual ABT mechanisms. The following memorandum further discusses possible ways to structure a nonroad retrofit program. Below, we have outlined potential procedures for credit generation and credit use, and provisions for ensuring in-use compliance.

A. What would be the environmental impact of allowing ABT nonroad retrofit credits?

As noted in the preamble, one objective of this potential program would be to achieve greater emission reductions from nonroad diesel engines than would otherwise occur without expansion of the ABT program. We are considering applying a discount of 20 percent to ABT retrofit credits that are used to meet nonroad standards to ensure that the program achieves these additional overall emissions reductions. The result of applying a discount would be that each ABT retrofit credit generated would translate to less than one nonroad engine credit available for consumption in the nonroad program. For example, the discount of 20 percent which we are considering would reduce the consumable credits by 20 percent. The discount would provide greater overall net reductions from the use of the ABT retrofit program than would otherwise occur, and the amount of this environmental benefit would increase with increased use of the program. A discount would also serve to mitigate the potential for net environmental detriments due to uncertainties in credit calculation and use.

In addition, a discount would also help to mitigate the negative impact that the expanded ABT program could have on the inventory in later calendar years. Because most credits would be generated several years before they would be consumed, the environment would experience the benefits of retrofits several years in advance of the detriments associated with higher-emitting (i.e. higher emitting than would otherwise occur under the proposed rule), credit-consuming nonroad engines. This would occur regardless of the presence or absence of a discount. As a result, 5 - 10 years after the program begins, there would be some calendar years in which the detriments due to credit consumption would be larger than the benefits due to credit generation. Since the application of a discount means that fewer credits are consumed than were generated, the net environmental detriment in later years would be reduced. Among other things, this would help assure that the expanded ABT program would not jeopardize maintenance or attainment planning with the PM or ozone NAAQS in these later years, and also would provide needed certainty to State and local officials in ascertaining steps necessary for their planning.

We believe that a discount of 20 percent would be appropriate for the nonroad retrofit program and applying a discount would be consistent with past Agency actions. Among other credit trading programs that have made use of this type of credit discounting, most have used values at or slightly below this range. For instance, prior to the enactment of the Clean Air Act Amendments of 1990, 20 percent discount rates were standard. The Tier 2 standards for light-

duty vehicles and trucks indicate that credits generated on pre-2004 vehicles for 100k mile useful life certification must multiply those credits by 5/6 before they can be used, resulting in an effective discount of approximately 17 percent [65 FR 6745/1, February 10, 2000]. Other programs have implemented slightly smaller discounts. Under the National Low Emission Vehicle Program, for example, early credits must be discounted 10 percent [63 FR 31191, June 6, 1997]. The guidance for the Open Market Trading Rule also indicates that sources consuming discrete emission reductions (DERs) must retire 10 percent of the DERs they use [60 FR 39673/2, August 3, 1995].

B. How would manufacturers generate and use nonroad ABT retrofit credits?

This section provides details on approaches that we could consider for the generation and use of credits. Credit use would be governed by the provisions of the ABT program. We are considering an approach for credit generation that is based on the use of advanced exhaust emission control technology/engine system combinations that would provide significant emissions reductions. Credits could be earned for NOx and PM reductions and the credits could then be used to show compliance with both the NOx and PM Tier 4 standards for new nonroad engines. As discussed below, retrofit engines would be considered and treated as new engines ensuring that credits are surplus (i.e., not counted in another program), verifiable, quantifiable, and enforceable.

Manufacturers (see section B.2. as to which entities could be considered “manufacturers”) who voluntarily certify their engines to the retrofit standards would generate ABT credits, and the retrofit standards would then be mandatory and enforceable on the manufacturer for the specified useful life of the retrofit-engine system. This would be similar in nature to the voluntary Blue Sky standards, to which manufacturers voluntarily certify but then are bound to meet as a mandatory standard.

Although this approach would not explicitly limit eligibility to retrofits where post-combustion emissions controls (also known as "exhaust aftertreatment”, e.g., DOCs or diesel particulate traps) are installed, we would condition credit-generating eligibility to engines which certify to designated emission standards (which we are referring to here as standards from a particular "bin") and the standards to which engines would certify are based upon the performance achievable through application of post-combustion exhaust emission controls to an engine certified and produced initially without such emission controls. We are contemplating this restriction to ensure that the emission reductions on which the credits are predicated will occur in use. The bins thus are predicated on retrofits involving more than engine recalibration. Rebuilding an existing engine to a newer specification that includes the use of exhaust emission controls (e.g., rebuilding a nonroad Tier 1 to a nonroad Tier 4 specification), or re-powering a chassis with a newer engine meeting emission standards for later years than that of the original engine (e.g. repowering a wheel loader with a 2011 model year Tier 4 engine including all exhaust emission control systems) would be possibilities for generating ABT retrofit credits under this program. EPA sees no technical impediments that would preclude such retrofits, as long as the appropriate diesel fuel is also used, as discussed below. Engine manufacturers are well equipped to change electronic strategies to trigger trap regeneration and to ensure that the

engine is functioning properly to prevent failure of emission control systems. Retrofit systems supported and warranted by an original engine manufacturer may be well received by users of diesel engines.

Retrofits under a nonroad retrofit credit program would include options to modify in-use engines and emission control systems and would permit the credits generated to be used within the nonroad ABT program. In keeping with the goal that credits under this program be verifiable, quantifiable, and enforceable, we contemplate that nonroad retrofit credit program would include a number of requirements to verify that the emissions credits generated reflect real in-use emission reductions from the participating nonroad retrofit engine systems.

Emission reductions would need to be significant in order to meet the emission standards set out in the bins below and thus to and generate emission credits under this program. Because of this, the degree of hardware changes necessary for engine retrofits sufficient to generate credit would be significant. In order to comply with the emissions standards nonroad retrofit credit program, it is most likely that retrofit manufacturers would take an entire engine system approach and that the retrofit-engine systems would incorporate:

- Modifications to engine hardware
- Modifications to the electronic control strategy of the engine to ensure proper functioning of the exhaust emission control system
- The addition of integrated exhaust emission control systems
- Ensuring the use of diesel fuel with less than 15 ppm sulfur fuel as necessary to enable the use of advanced exhaust emission control systems (if the retrofit involves such systems)

We anticipate that such a program, if adopted, would be implemented using certification procedures similar to those applicable to certification of new nonroad engines. The related compliance and enforcement provisions would also be applicable, as discussed in section C, below. Because only NOx and PM credits are used for averaging, banking, and trading within the nonroad ABT program, only NOx and PM credit could be generated within the nonroad retrofit credit program. While this program would be voluntary, the rules applicable to engines retrofitted and certified under this program would become mandatory once the voluntary decision to participate in the program is made.

1. How would a nonroad engine retrofitted under this program be defined from a regulatory standpoint?

For purposes of the nonroad retrofit credit program, a nonroad retrofit-engine system that is voluntarily certified to this program's new emissions standards would be considered a "new" nonroad engine.[1] It would be reasonable to take this approach, given the substantial amount of

[1]EPA is not asserting authority to compel such retrofits. We are only stating that should an entity voluntarily choose to retrofit a nonroad engine and voluntarily seek certification under the nonroad retrofit ABT credit program, the retrofitted engine would be deemed a new nonroad

modification such an engine would need to undergo in order to meet the emission standards of the nonroad retrofit credit program as explained above. The consequences of this are that a retrofit-engine system generating credit under this program would be subject to the full range of requirements applicable to new nonroad engines. Specifically, the engine would be certified to the emission level specified in the applicable bin as defined in the following sections, and the enforcement remedies of warranty and recall (as well as testing and information-gathering authorities) would be required.

2. Who is the retrofit engine manufacturer?

Section 216 (a) (1) of the Clean Air Act defines ``manufacturer'' as ``any person engaged in the manufacturing or assembling'' of the new motor vehicles or new motor vehicle engines. The term is significant because the "manufacturer" is the entity responsible for compliance with emission standards and attendant implementation provisions. In the case of retrofits that voluntarily certify under a possible nonroad retrofit program and generate ABT credit, the manufacturer could be either the builder of the retrofit engine system, the installer, or the entity creating specifications for the installation of a retrofitted engine, such as the owner/operator. We would expect, however, that only one of these entities would seek certification, and, once this election is made, this entity would be considered to be the sole retrofit engine manufacturer for purposes of enforcement and for purposes of credit generation and use within the nonroad ABT program. This approach is similar in many ways to that used previously for remanufactured locomotive engines.[2]

3. What about the original engine manufacturer?

Nonroad engine retrofit would not automatically relieve the pre-retrofit, original engine manufacturer of all responsibility. Although “new” for purposes of the nonroad retrofit credit program, the engine could still have useful life under its original certification, and the original engine manufacturer would remain subject to enforcement under the terms of that certification. Thus, if there is a violation of the original certification levels (not the bin standards to which the retrofitted engine would be certified), and that violation can be shown to be attributable to the pre-retrofit engine and not attributable to the retrofit, then the original engine manufacturer would be liable. Conversely, if the problem is attributable to the retrofitted design, the original engine manufacturer would not be liable, even if the original certification level is violated.

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engine, and at that point subject to mandatory emissions standards.

[2] See the locomotive Final Rule, 63 FR 18991, April, 16, 1998, and, specifically, the definition of remanufacturer in 40 CFR §92.2 and the provisions of 40 CFR §92.209 (b). Unlike the locomotive rule, under the potential nonroad retrofit credit program only the person who applies for and receives the certificate is subject to any legal obligations as a manufacture.

4. What are the specific responsibilities of a retrofit engine manufacturer under this program?

Under this program, the manufacturer would be responsible for:

- Certification of the emissions of the retrofitted engines to a new emission standard for the specified useful life, as well as compliance with related emissions warranty, recall, and other provisions normally applicable to a manufacturer of a new nonroad engine
- Maintenance of records
- Ensuring proper installation of the retrofit-engine system[3]

The retrofit engine manufacturer would be liable for the performance of the retrofit-engine system over a specified warranty and useful life as described the following sections. EPA would issue a certificate of conformity for each retrofit engine system for which emission credit is generated. Information such as what is currently submitted for new engine certification would be required as a condition of certification of retrofitted engine families participating in this program. Manufacturers would have the option to group engines and retrofit designs. Engine families or models within families which are carried over from year to year may, at the manufacturers option, be grouped with the same retrofit technology if the manufacturer has confidence all applicable requirements will be met.

5. What emissions standards would a nonroad retrofit-engine system need to be certified to in order to generate PM and NOx nonroad ABT credits under the potential nonroad retrofit credit program?

To receive credits, nonroad retrofit-engine systems would need to be certified to one of the emissions standards contained in Table 1, below, using the test procedures described in section 6. Specific bins were chosen over other approaches, such as use of FELs, in order to simplify determination of in-use compliance with emissions standards and achieve the objective of robust controls which will achieve substantial emission reductions in use. The standards are arranged into a series of "emission standard bins". The NMHC+NOx emission standards represented within the nonroad emission standard bins N4 and N3 correspond with the Tier 2 nonroad CI emission standards. The NMHC+NOx emission standard of bin N2 corresponds with the Tier 3 nonroad CI emission standard. PM emission standards represented within nonroad emission standard bins N2-N4 under the nonroad retrofit credit program are based upon the application of post-combustion exhaust emission control systems (e.g., DOCs, base-metal PM traps and precious metal-based PM traps) to Tier 2 and Tier 3 engines. Certification to bin N1 would be identical to certification to the nonroad Tier 4 NOx and PM emission standards. Only retrofit engine systems certified to bin N1 would be eligible to generate NOx credit, as one goal of this program is to achieve significant emissions reductions from the introduction of exhaust emission control technology. Only incidental NOx reductions will occur in the case of

[3] Where the builder of the retrofit-engine system is the manufacturer, the installer or owner/operator would be required to properly install the system according to the manufacturer's's instructions, to avoid liability for tampering.

retrofit-engine systems meeting lower NOx or NMHC+NOx standards than bin N1, so that allowing NOx credits for these bins would be inappropriate. PM credit could be generated in the nonroad retrofit credit program by certification to any of the emission standard bins in Table 1.

Table 1: Retrofit Emission Standards for Nonroad CI Engines Participating in the Nonroad Retrofit Credit Program

Rated Power (kW)	Emission Standard Bins	NOx (g/kW-hr)	NMHC (g/kW-hr)	NMHC + NOx (g/kW-hr)	PM (g/kW-hr)	Notes
Pre-Tier 1 Baseline Emission Levels		10	N/A	N/A	0.54	a
37 ≤ kW < 75	N4			7.5	0.05	b, c, d
75 ≤ kW < 225	N4			6.6	0.05	b, c, d
kW ≥225	N4			6.4	0.05	b, c, d
37 ≤ kW < 75	N3			7.5	(Tier 4)	b, c, d
75 ≤ kW < 225	N3			6.6	(Tier 4)	b, c, d
kW ≥225	N3			6.4	(Tier 4)	b, c, d
37 ≤ kW < 75	N2			4.7	(Tier 4)	b, c
75 ≤ kW < 225	N2			4.0	(Tier 4)	b, c
kW ≥225	N2			4.0	(Tier 4)	b, c
37 ≤ kW < 75	N1	(Tier 4)	(Tier 4)		(Tier 4)	b, c
75 ≤ kW < 225	N1	(Tier 4)	(Tier 4)		(Tier 4)	b, c
kW ≥225	N1	(Tier 4)	(Tier 4)		(Tier 4)	b, c

Notes:

a. Base emissions for calculation of emission credit generated by retrofitting pre-Tier 1 uncontrolled engines nonroad engines. Emission credit for engines certified to Tier 1 and later engines is based on the engine family's FEL.

b. Only NOx and PM credits are generated by this program. Engines originally certified to an NMHC+NOx standard that certify to bin N1 under the noroad retrofit credit program would generate NOx credit based on the difference between 80% of the pre-retrofit NMHC+NOx FEL and the bin N1 NOx standard (based on an 80% contribution of NOx to the NMHC+NOx total). Only certification to bin N1 generates NOx credit for nonroad ABT.

c. System useful life:
3,000 hours of operation or five years of use - or -
6,000 hours of operation or 7 years of use

d. Retrofitted Tier 1 and 2 engines only

* NMHC+NOx / NOx Limits for Bins N2-N4 serve as caps at current standards for the power categories listed for their specific model years to prevent backsliding.

The specific structure of bins N2-N4 was chosen to facilitate certification of nonroad Tier 2 and Tier 3 engines to more stringent PM emission levels via the application of exhaust emission control systems such as DOCs and diesel particulate traps. The engine would be required to meet all standards contained in the bin and retrofit engines would be required to be certified to standards at least as stringent as those for the original engine, including applicable CO standards. If an engine was originally certified to an FEL, the retrofit engine would not be allowed to exceed that FEL. Since bin N1 was chosen to be identical to nonroad Tier 4 emission standards, in addition to exhaust emission controls for PM it would add high-efficiency exhaust emission controls for NOx such as the use of NOx adsorption catalysts. Specific examples of generation of credit via certification to these bins for nonroad retrofit engine systems would include:

- Retrofit of a piece of nonroad equipment originally equipped with pre-Tier1 engine with a Tier 2 engine equipped with a platinum-based particulate filter, operating the equipment using a diesel fuel of less than 15 ppm sulfur, and with certification of the retrofit-engine system to bin N3 in Table 1 (generation of PM credit only)
- Retrofit of an existing nonroad Tier 2 engine with a base-metal particulate filter and operating on pre-2006 specification highway diesel fuel (500 ppm sulfur maximum), and with certification of the retrofit-system to bin N4 in Table 1 (generation of PM credit only)
- Retrofit of a Tier 2 engine via rebuilding the Tier 2 engine to match a Tier 3 engine specification, and by further retrofit of the engine with a platinum-based particulate filter and operating using a diesel fuel of less than 15 ppm, with certification of the retrofit-engine system to bin N2 in Table 1 (generation of PM credit only)
- Retrofit of nonroad equipment originally equipped with a Tier 3 engine with a Tier 4 engine certified to bin N1 in Table 1 (generation of both NOx and PM credit)

In all of these cases, PM credit is generated. In use, the amount of PM reduction obtained by these retrofits in comparison to the pre-retrofit condition could be larger than the actual amount of PM credit generated. The credit calculation would only give credit between the new nonroad retrofit PM standard and either to the previous, pre-retrofit PM FEL or (if higher than the Tier 1 standards) to the nonroad Tier 1 PM standard. PM emissions from older, pre-control engines can be much higher than the Tier 1 PM standard, and in these cases, the actual reduction in PM due to the retrofit will be greater than the credit generated.

Retrofit-engine systems that replace engines originally certified to an NMHC+NOx standard, and that certify to bin N1 would generate NOx credit based on the difference between 80% of the pre-retrofit NMHC+NOx FEL and the NOx standard for bin N1 (based on a contribution of 80% NOx to the NMHC+NOx total). Retrofit to bin N1 would likely result in a PM credit calculated using somewhat different test procedures for measurement of PM emissions. As explained in more detail in the next section of this memorandum, nonroad engines certified to bin N1 would use a transient test procedure, while most pre-retrofit engines that would be retrofitted to bin N1 use a steady-state test procedure. PM emissions are generally much higher for transient test procedures than for steady-state procedures, thus the credit generated should be conservative relative to the actual reduction in PM emissions in-use due to the retrofit. (This is consistent with our treatment of this issue in ABT.)

We believe these retrofits can be performed in an environmentally beneficial way for each pollutant. We would not allow engines to be retrofitted in a manner that increases any regulated emissions above the original FEL for NOx or PM to which the engine family was originally certified prior to retrofit. For example, a nonroad engine family at a rated power of 100 kW that was originally certified to the nonroad Tier 3 emission standards with an original FEL of 3.6 g/bhp-hr NMHC+NOx could not be retrofitted and certified to the N2 emission standard bin and certified with NOx emissions at 4.0 g/bhp-hr for the purpose of generating PM credit.

6. What test procedures would be used for emissions certification of a nonroad retrofit system participating in this program?

Compliance with the applicable emission standard bin would be based upon the emission measurement procedures proposed for the measurement of Tier 4 nonroad emissions and specified in proposed 40 CFR § 1065. This would include steady-state test procedures for bins N2, N3, and N4; and both transient and steady-state test procedures for bin N1. These test procedure requirements are based on the original certification requirements for the base engines. Engine families certified to bins N2, N3 and N4 would not be subject to NTE provisions. NTE was not a requirement for the original base engine certification. These test requirements are designed to ensure that emissions reductions can be compared to the base engine on an equal basis. Engine families certified to bin N1 meet the same standards as new nonroad Tier 4 engines, and would be subject to all of the NTE provisions for certification of new nonroad Tier 4 engines as specified in this proposed rule.

7. How would useful life be defined for nonroad retrofit-engine systems?

For nonroad engines participating in a nonroad retrofit credit program, useful life would be defined from the point that the retrofit-engine system is reintroduced into use, and would be defined the same as in § 89.104 for engines of 37 kW or greater. To summarize, useful life for these engine families would be:

- 6,000 hours of operation or 7 years of use, whichever first occurs

Manufacturers would have an option to certify to a reduced useful life for retrofit of specific engines that have already either:

- Surpassed 3000 hours of operation prior to retrofit - or -
- Are uncontrolled or have already surpassed the useful life (years, or hours as applicable) of the original pre-retrofit engine certification

The optional reduced useful life for nonroad CI engines would be:

- 3,000 hours of operation or 4 years of use, whichever first occurs

8. Calculating Nonroad Retrofit Credits

The above section describes how credits from retrofit engine systems would be generated, including test procedures, certification requirements, and compliance provisions. As described in preamble ABT section VII.A., the change in test procedure for nonroad (transient vs. steady-

state) would not impact the calculation of credits. The following describes how credits from retrofit engine systems would be calculated. Credits from retrofits would be calculated in a manner similar to ABT credits calculations, using the following equations and methodology.[4]

Nonroad Retrofit Emissions Credits in megagrams = (Original Standard/FEL in g/bhp-hr – Retrofit Bin Standard, in g/bhp-hr) x (average power rating in HP) x (useful life or remaining equipment life, whichever is shorter in hours) x (number of retrofits) x (10^{-6})

The first portion of the equation would be determined by the difference in the baseline FEL and the standards in the bin structure, as described in detail above. The (10^{-6}) factor converts all credits from grams to megagrams, which is the credits unit used in the nonroad ABT program. The "number of retrofits" term in the equation would apply in cases where a manufacturer performs multiple retrofits earning the same amount of credits. Remaining equipment life is discussed below.

For nonroad, the useful life interval is in hours. In use emissions are estimated based on emissions levels (g/bhp-hr), engine rated horsepower and the useful life in hours. Grams are estimated by multiplying these factors together, as shown in the equation above. The load factor is not part of this calculation. The load factor is an estimate of the percentage of rated horsepower that is used on average by engines in typical use and typically are in the range of 0.40-0.60 for nonroad diesel engines. For the existing nonroad ABT program, the load factor is not part of the calculation because it would essentially cancel itself out in the credit generation and use credits calculations in the overall program. Applying the load factor for credits generated under the nonroad retrofit program without applying it to the credit use calculations in the ABT program would in effect decrease the value of retrofit credits within the ABT program. Applying the load factor for both credit generation and use would result in the load factors essentially offsetting. Load factor is therefore not part of the credit generation or credit use calculations.

As noted in the credit generation equations above, we believe that it may not always be appropriate to provide credits for the entire useful life period. We are concerned that retrofits could be placed in nonroad equipment that are close to being retired. In such cases, the equipment would likely be retired prior to the end of the useful life period. This disconnect could result in a significant overestimation of emissions reductions that result from the retrofit.

To address this potential situation, we are considering having manufacturers use an adjusted interval, the "remaining equipment life", for credit calculation purposes (see equation). The adjusted interval would correspond with the likely hours left in the life of the equipment at time of retrofit. Manufacturers would use this adjusted interval only in cases where the interval is shorter than the useful life interval. Our NONROAD models contain average usage rates in hours by equipment age and also contain equipment scrappage rates. We used these model inputs to estimate average activity (in hours) remaining in the life of equipment by age. The estimates are provided in the table below. For purposes of credit calculation, manufacturers

[4] see 40 CFR §89.207 for nonroad ABT credit calculation.

would use the hours interval from the table, based on equipment age at time of retrofit, in cases where the interval is shorter than the useful life intervals noted above. For example, if the useful life interval for a nonroad retrofit is 6,000 hours, manufacturers retrofitting an 8 year old 150 hp engine would earn credits over 5,498 hours rather than 6,000 hours.

Table 2: NONROAD Model Average Hours Remaining in Life of Equipment by Age

Age	<=50hp	50<100hp	100<175hp	175<300hp	300<600hp	600<750hp	>750hp
1	6,525	13,365	10,603	9,762	14,300	13,223	13,359
2	5,890	12,493	9,835	9,053	13,573	12,123	12,187
3	5,265	11,622	9,067	8,350	12,845	11,026	11,024
4	4,660	10,755	8,306	7,650	12,118	9,946	9,881
5	4,107	9,926	7,564	6,967	11,390	8,883	8,765
6	3,583	9,108	6,832	6,296	10,663	7,854	7,693
7	3,084	8,311	6,137	5,671	9,938	6,883	6,706
8	2,619	7,561	5,498	5,104	9,226	6,056	5,934
9	2,221	6,885	4,919	4,602	8,517	5,261	5,202
10	1,858	6,236	4,373	4,131	7,826	4,511	4,508
11	1,537	5,632	3,887	3,710	7,156	3,807	3,861
12	1,261	5,062	3,433	3,308	6,514	3,169	3,283
13	1,049	4,522	3,008	2,924	5,920	2,735	2,870
14	862	4,019	2,603	2,555	5,361	2,399	2,540
15	714	3,545	2,224	2,208	4,828	2,102	2,255
16	581	3,100	1,881	1,898	4,347	1,862	2,035
17	465	2,741	1,641	1,698	3,895	1,648	1,834
18	387	2,409	1,429	1,524	3,461	1,456	1,651
19	329	2,094	1,234	1,359	3,035	1,280	1,480
20	279	1,828	1,080	1,209	2,626	1,124	1,317
21	235	1,577	939	1,066	2,231	982	1,164
22	194	1,340	806	928	1,859	850	1,019
23	159	1,121	682	795	1,498	725	878
24	129	916	569	670	1,164	607	742
25	101	720	462	551	901	496	613
26	75	537	361	436	700	393	488
27	52	370	262	321	513	293	366
28	32	238	171	211	330	194	243
29	14	117	85	105	162	96	120
30	0	0	0	0	0	0	0

Alternatively, manufacturers could determine an age cut point for their retrofits based on the above tables and the useful life period. Manufacturers could designate that equipment older than this age cut point are not eligible for retrofit. For example, a manufacturer certifying a

retrofit engine system for a 300 hp nonroad engine with a useful life of 6,000 hours could designate that the retrofit may only be applied to engines that are 6 years old or newer. The above table has been truncated at age 30 years, which means that no credits could be earned by retrofitting equipment more than 29 years old. We believe that it is unlikely retrofits would be made available for equipment of this age due to the lack of credits that would be available.

9. How would nonroad retrofit credits be used?

We are considering allowing nonroad retrofit credits to be used within the ABT program. Credits generated as described above, would be used by a manufacturer of a new nonroad diesel engine to meet the Tier 4 engine emissions standards for NOx or PM beginning in 2011 for engines above 19kW (25 hp). We are not contemplating the use of retrofit credits for compliance with Tier 3 standards, including during the phase-in period for Tier 4 standards, because we are not proposing changes to the Tier 3 standards. We would consider these ABT credits and credits use would be governed by the provisions of the ABT program. Manufacturers would apply the discount discussed in section A, above, to credits prior to their use.

C. How would EPA ensure compliance with retrofit emissions standards?

1. Proper maintenance and proper fueling of retrofit-engine systems

A significant part of ensuring the intended benefits related to implementing the retrofit engine ABT provisions are achieved in use is to ensure that engines are properly maintained and fueled. In the context of advanced emission control technology being applied for purposes of meeting any retrofit engine standards, EPA would continue its regulatory practice at 40 CFR 89.109 of monitoring a manufacturer's maintenance intervals during certification testing and by ensuring that the maintenance instructions furnished to ultimate purchasers are appropriate. It is likely that much of the new emission control technology applied to retrofit-engine systems certified would rely upon the use of diesel fuels with very low sulfur levels and that there may be a limited availability of such fuel during the time period when credits may be generated or manufacturers will first apply such technology to meet the new standards. Therefore, it will be important for both the manufacturer to understand its responsibilities during the certification process and the ultimate purchaser and/or operator to understand how to operate and maintain the new engines and technology in order to ensure that the emissions benefits are achieved from such a program.

Therefore, if this program were adopted, we would expect that it would be necessary to require the retrofit manufacturer to list the type of fuel used to certify its retrofit-engine system and whether a particular fuel sulfur level is necessary to meet the standard and to maintain emissions compliance of the retrofit-engine system in-use. If such a fuel is necessary to maintain emissions compliance in-use, EPA would consider the fuel to be "critical emission related scheduled maintenance" under a retrofit engine program. As a result of such classification, the manufacturer would be required to demonstrate that proper fueling will be performed in-use. Depending upon the nature of the manufacturers' engines and fleet, it may be able to make this demonstration by showing that the engine would not otherwise operate with the wrong fuel

and/or that this type of fueling already typically takes place. Such a demonstration may require the installation of a visible label instructing the operator of proper fueling requirements and instructions in the owner's manual regarding such fueling and that there be an affirmative demonstration that the ultimate consumer or fleet operator has the appropriate low sulfur fuel available and will be proper fueling retrofit engines.

In order to truly capture the emission benefits envisioned by a retrofit credit program, EPA also believes it essential that the ultimate purchaser not only understand the necessity of proper fueling of their engine, but that such purchaser or operator also understand the potential legal consequence if purposeful misfueling occurs. Under section 203(a)(3) of the CAA, EPA considers it "tampering" to render a certified emission related part inoperative by misfueling a vehicle or engine. As noted in EPA's guidance on the applicability of EPA's Memo1A to EPA's Voluntary Diesel Retrofit Program (Program), parties that participate in verifying their control technology through the Program would not violate the tampering provisions of the CAA because the Program's verification process would provide a reasonable basis for knowing that emissions are not adversely affected[5]. However, this assurance against tampering is conditioned upon the adherence to all installation instructions and meeting all operating conditions (including fueling) listed (in today's case during the certification process) with the retrofit technology. Therefore, we are considering requiring that engines equipped with technology requiring the use of specific low sulfur fuels that do not use this specified fuel be considered in violation of the tampering prohibitions. If it is an entity other than the manufacturer or dealer that misfuels they would be subject to a civil penalty under 205(a) of $3,100 per day.

2 Labeling, record keeping, reporting, and notification

As with any new engine certification, manufacturers participating in a nonroad ABT retrofit program would be required to label each retrofitted engine. At a minimum, the label would have to include the original engine manufacturer, the retrofit manufacturer, if different, the date of retrofit, engine serial number , power rating, original and retrofit engine family, FEL or applicable certified Tier of the retrofit and a clear statement regarding any special fuel requirements, if any. This labeling would be in addition to any other certification labeling requirements that apply to certified engines.

Manufacturers participating in a nonroad ABT retrofit program would be required to establish and maintain the following types of records for each retrofit system and engine:

- Certification support records similar to those currently required for new engine certification demonstrating compliance with the new emission standard

- Records regarding each individual vehicle installation including the owner/operator, type of equipment, persons(s) completing the installation, date of installation, and the age of engine and equipment at the time of installation

[5]See Docket A-2001-28.

- Demonstrations regarding the proper maintenance and fueling of the new retrofit system as required for emissions performance including appropriate assurances from the owners and/or operators that the required lower sulfur is available

Such records would have to be submitted periodically to EPA as specified or upon request.

EPA may require the retrofit manufacturer to submit a plan for implementing retrofits for EPA review and approval prior to implementing any retrofit installation and prior to generating credits under this program. This plan may have to include audits if a third party is to complete the retrofit/installation, if special maintenance is required and/or if low sulfur fuel is not universally available but is required to achieve the emissions benefits of the retrofit system.

Additionally, the retrofit manufacturer would have to ensure that complete emissions system warrant coverage is available to the ultimate consumer throughout the useful life of the retrofit engine and how such warranty coverage would be shared by the original engine manufacturer, the retrofit manufacturer and any other parties involved in the retrofit system.

3. In-use performance of retrofit-engine systems

Retrofit-engine systems participating in a ABT retrofit program must have satisfactory in-use performance in order for credits to be real. We are considering requiring that on a system where, as with current requirements for new engines, manufacturers would report to EPA all emission related defects and voluntary recalls for retrofit systems. Retrofit-engine systems would be required to comply with the standard bins throughout the declared useful life from the time of retrofit installation and introduction of the retrofit-engine system into commerce. We believe it would be necessary for retrofit-engine systems to have an emission warranty for a minimum of the declared useful life. The Clean Air Act's mandatory recall provisions would also apply for the retrofit manufacturer.

As with any new engine certification, manufacturers participating in a nonroad ABT retrofit program would be required to demonstrate emissions performance and durability as a condition of certification of retrofit-engine systems. Although in-chassis emission testing is not currently being widely conducted, we expect in-chassis testing will become common and an acceptable method to demonstrate emission compliance and system durability. Manufacturers may perform in-chassis testing to demonstrate in-use emission performance. Because the accuracy of in-chassis emission test systems and the operating conditions do not match laboratory testing, in-chassis compliance would necessarily be demonstrated in the NTE zone or demonstrate to correlate with the required certification tests and standards. Alternatively, a manufacturer may elect to remove the retrofit-engine system from equipment chassis and conduct the in-use testing in a laboratory test cell using the emissions test procedure originally used for certification of the retrofit-engine system.

We have learned for our on-road compliance oversight that it may be very easy to

recalibrate the electronic control module (ECM) on electronically controlled engines in such a manner that defeats the emissions control system. Therefore, for any retrofits that also require recalibration of the ECM, the retrofit manufacturer would have to demonstrate that the appropriate calibration information is available through the OEM's normal network of dealers and other maintenance support to ensure that the proper calibrations are retained in-use and that each retrofit that requires recalibration is done properly as required under this program. Auditing of retrofits and calibrations would be part of the process for verifying credits generated under a retrofit program. A recalibration alone will not constitute a retrofit under this program.

As mentioned previously, the retrofit manufacturer will be required to perform in-use emissions testing to verify that the certified emissions reductions are being achieved. We are considering the type and extent of in-use performance testing that should be required to demonstrate that the retrofits continue to meet standards throughout their useful life as originally certified. Since FTP's (out of chassis tests) are very costly, we are considering whether other types of in-use tests should be permitted for this purpose and how those results should be correlated to FTP test results.