ILLINOIS POLLUTION CONTROL BOARD
May 20, 1993

IN THE MATTER OF:	)	
	)	
JOINT PETITION OF DETROIT	)	
DIESEL CORPORATION AND THE	)	AS 92-4
ENGINE MANUFACTURERS	)	(Adjusted Standard)
ASSOCIATION FOR ADJUSTED	)	
STANDARD FROM 35 ILL. ADM.	)	
CODE 240.141	)	

OPINION AND ORDER OF THE BOARD (by J. Anderson):

This matter is before the Board on the November 10, 1993 filing of a second amended petition for adjusted standard by Detroit Diesel Corporation and the Engine Manufacturers Association (Detroit Diesel). Detroit Diesel seeks an adjusted standard from the heavy-duty diesel smoke opacity standards and test procedures found at 35 Ill. Adm. Code 240.141. More specifically, Detroit Diesel is seeking an adjusted standard from the 55% peak opacity standard found at 35 Ill. Adm. Code 240.141(a)(2). Detroit Diesel proposes an adjusted standard of eighty-five (85%) peak smoke opacity for its 1987-1990 Series 60 engines.

On February 1, 1993, the Illinois Environmental Protection Agency (Agency) filed an amended response to Detroit Diesel's second amended petition recommending that the Board grant the requested relief. On February 16, 1993, Detroit Diesel waived hearing and none has been held.

The Board hereby grants Detroit Diesel's request for adjusted standard from 35 Ill. Adm. Code 240.141.

PROCEDURAL HISTORY

On April 27, 1992, Detroit Diesel, Navistar International Transportation Corporation (Navistar), Cummins Engine Company (Cummins), and the Engine Manufacturers Association filed a petition for adjusted standard from the heavy-duty diesel smoke opacity standards and test procedures found at 35 Ill. Adm. Code 240.141. On May 12, 1992, the petitioners filed their proof of publication as required by 35 Ill. Adm. Code 106.712. On May 4, 1992, the petitioners filed an amended adjusted standard petition.

On May 21, 1992, the Board issued an order accepting the petition and directing the petitioners to address certain issues at hearing. On July 9, 1992, the Agency filed its response recommending that the requested relief be granted.

On September 29, 1992, the Agency filed a motion requesting the Board to separate docket AS 92-4 into three dockets for Detroit Diesel and the Engine Manufacturer's Association, Navistar and the Engine Manufacturers Association, and Cummins and the Engine Manufacturers Association. In support of its motion, the Agency asserted that separate dockets were necessary because each petitioner requested a different opacity standard and took a different technical approach to support its petition and because a hearing might not be necessary for each petitioner. The Agency also asserted that petitioners concurred with the motion.

On October 1, 1992, the Board granted the Agency's motion and assigned separate docket numbers (i.e., AS 92-4, AS 92-11, and AS 92-12) to the petitioners, as recommended by the Agency. In addition, the Board directed all of the petitioners to file amended petitions no later than November 13, 1992. In response to the Board's October 1, 1992 order, Detroit Diesel, Navistar, and Cummins each filed amended petitions on November 10, 1992. On April 2,1993, Navistar and Cummins filed motions to withdraw their petitions. On April 8, 1993, the Board granted both motions and closed dockets AS 92-11 and AS 92-12.

BACKGROUND

Detroit Diesel is a manufacturer of heavy-duty diesel engines headquartered in Detroit, Michigan. Although Detroit Diesel's engines are manufactured outside of Illinois, the activity at issue (i.e., smoke emissions of engines in use) occurs within the State. As a result, Detroit Diesel's engines are subject to the Board's diesel opacity regulations. There are two Series 60 engines subject to the Board's diesel opacity standard: those equipped with an electronic control system known as DDEC I and those that are equipped with an electronic control system known as DDEC II.

APPLICABLE REGULATION

On July 25, 1991, the Board proposed diesel vehicle exhaust opacity limits, which included exhaust opacity limits for heavy-duty diesel vehicles operating in Illinois. (see In the Matter of: Diesel Vehicle Exhaust Opacity Limits (July 25, 1992), R90-20, 124 PCB 317.) The regulations, which became effective on April 7, 1992, set forth opacity standards for heavy-duty diesel vehicles aimed at detecting excessive smoke emissions and emission control system tampering. As stated above, the opacity standard from which Detroit Diesel is seeking an adjusted standard is found at 35 Ill. Adm. Code 240.141(a)(2). That section states as follows:

> a) The standard for heavy-duty diesel vehicle smoke opacity is as follows:

* * * *

2) ...no heavy-duty diesel-powered vehicle operating on the roadway within...Illinois shall exceed fifty-five percent (55%) peak smoke opacity when tested in accordance with subsections (b) and (c).

35 Ill. Adm. Code 240.141(b), in part, provides:

[t]he smoke opacity measurement shall be carried out using a light-extinction type opacimeter capable of measuring and recording opacity continuously during the snap idle testing cycle....

35 Ill. Adm. Code 240.141(c), in part, provides:

The test procedure using the snap idle cycle shall occur when the engine is at normal operating temperature. The test shall consist of preparation, preconditioning, and testing phases.

1) In the preparation phase, the vehicle shall be placed at rest, the transmission shall be placed in neutral, and the vehicle wheels shall be properly restrained....

2) In the preconditioning phase, the vehicle shall be put through a snap idle cycle three or more times until successive measured smoke opacity reading are within ten percent (10%) of each other....

3) In the testing phase, the vehicle shall be put through the snap idle cycle three times.

Section 28.1 of the Environmental Protection Act (Act) provides that the Board may specify a level of justification that is required for a petitioner to qualify for an adjusted standard. 35 Ill. Adm. Code 240.141(d) sets forth the justification needed by Detroit Diesel to support an adjusted standard from the 55% peak opacity standard for DDC 1987-1990 Series 60 engines. The justification is as follows:

the specific characteristics common only to all the 1987-1990 Series 60 engines that result in noncompliance with the 55% opacity standard;

all USEPA certification and snap idle test data;

economic and technical data related to the logistical or other perceived difficulties encountered or that may be encountered if the existing 1987-1990 Series 60 engine software were to be reprogrammed so as to come

into compliance;

the alternative opacity standard proposed and supporting data; and

supporting data showing that the requested standard will not result in environmental or health effects substantially and significantly more adverse than the effects considered by the Board in adopting the rule of general applicability.

JUSTIFICATION

Characteristics Resulting in Non-Compliance

Although Series 60 engines are available in two different displacement sizes, 11.1 liters (L) and 12.7L, and several different power and speed ratings, they have similar design characteristics and share many similar components. The Series 60 engines have six in-line cylinders and operate on a four stroke cycle. The engines also are turbocharged, chargecooled, direct injected, and electronically controlled.

The 11.1L and 12.7L engines, however, have different piston strokes. Different ratings are achieved by loading different software calibrations into an electronic control module (ECM). All Series 60 engines control smoke resulting from acceleration by sensing intake manifold pressure and limiting fuel input when the combustion air supply is inadequate to permit complete combustion of the fuel. These conditions are most frequently encountered during acceleration when the air supply is limited because the turbocharger cannot instantaneously respond to the increased airflow requirement. A table of maximum allowable fuel input versus engine speed and boost pressure is programmed into computer controls. The computer controls perform a key function for the engines' smoke control software. For each individual Series 60 rating, the computer controls ensure that federal smoke limits are met and that acceptable levels of smoke are maintained under all driving conditions.

Because the turbocharger produces some "boost" throughout the federal smoke test procedure and most driving conditions, the smoke control tables originally developed to the 1987-1990 Series 60 engines did not include fueling limits for absolute manifold pressure less than 105 kiloPascals (KPa). Detroit Diesel asserts that, while the limits in the smoke control tables provide satisfactory smoke control under actual driving conditions, a problem occurs when the engines are subjected to the high rates of acceleration experienced in the snap idle test adopted by the Board. At the high rate of acceleration achieved during the snap idle test, the engines pass through their speed range before the turbo chargers can respond and before there is any build up of

intake manifold pressure. As a result, the fuel limiting portion of the table is never entered and the engines emit higher levels of smoke during the test than under the federal testing procedure and under normal operating conditions.[1]

USEPA Certification and Snap Idle Test Data

Detroit Diesel, in its petition, includes USEPA's smoke certification data for the 1987-1990 Series 60 engines. (Pet. Ex. E.) Although Detroit Diesel does not have any snap idle test data on new pre-1991 engines because the snap idle test was not used until California began using it in 1991, it provides snap idle test results from a number of in-service vehicles using 1989 and 1990 engines. (Pet. Ex. F.)

Economic and Technical Data

When the Series 60 engines were first introduced in 1987, they were equipped with a first generation electronic control system known as DDEC I. Engine calibration programming in the DDEC I system resides in a programmable read-only memory (PROM) within the ECM. The only way to reprogram the DDEC I engine is to open the ECM and physically remove and replace the PROM. In order to prevent the usage of non-approved and certified engine calibrations, Detroit Diesel discourages PROM replacement in the field. Notwithstanding any PROM replacement, Detroit Diesel states that the DDEC I might not be capable of reacting quickly enough to provide control of fuel input and smoke under the rapid acceleration conditions experienced in the Board's snap idle test.

Detroit Diesel built only 969 DDEC I engines during the 1987 model year. Detroit Diesel has not developed PROM calibrations to reduce the snap idle smoke of DDEC I engines because of the low sales volumes of the engines, the slow response time of the DDEC I system, and the problems associated with in-field disassembly and PROM replacement.

Late in the 1987 model year, Detroit Diesel introduced its second generation electronic control system, DDEC II. DDEC II engines possess a much faster computer and an erasable PROM that can be reprogrammed in the field. Detroit Diesel distributors can reprogram the PROM by connecting the vehicle to a computer

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[1]Detroit Diesel has revised the smoke control table to include fueling limits for absolute intake manifold pressures of less than 105KPa for all new Series 60 engines beginning in the 1991 model year. As a result, all 1991 and later model year Series 60 engines meet federal smoke standards, control smoke under normal driving conditions, and meet the 40% snap idle peak smoke opacity limit found at 35 Ill. Adm. Code 240.141(a)(1).

terminal linked to the factory mainframe computer that contains all calibration files. The standard charge for recalibration is $200.00. The DDEC II Series 60 engines represent ninety-seven percent (97%) of all of the Series 60 engines for which the adjusted standard has been requested.

Detroit Diesel is currently recalibrating affected DDEC II Series 60 engines which are voluntarily brought in by vehicle owners to comply with California's diesel opacity rule. As of October 1992, Detroit Diesel reported that 29% of all DDEC II Series 60 engines had been recalibrated and that over 27,000 DDEC II engines are operating with unmodified calibration.

Alterative Opacity Proposed and Supporting Data

As previously stated, Detroit Diesel proposes an adjusted peak smoke opacity standard of 85% for all 1987-1990 Series 60 engines. Detroit Diesel did not evaluate the snap idle smoke performance of its 1987-1990 Series 60 engines at the time of manufacture because it was unaware of the requirement at that time. Detroit Diesel, however, has determined the appropriate snap idle standard for its engines based on data from two studies, one conducted by the California Air Resources Board (CARB) and one conducted by Detroit Diesel, that examined in-use vehicles.

The CARB study examined 1990 model year engines in order to focus on data from relatively low mileage engines (i.e., engines representative of the design capability of new pre-1991 Series 60 engines). The data indicates that the distribution of the opacity results is trimodal (i.e., Mode I, II, and III) and that it is appropriate to base the snap idle standard on engines in the intermediate mode, Mode II. (Pet. Ex. F-Figure 1.) Although the engines in Mode II appear to be properly performing, they have not been reprogrammed to upgrade the snap acceleration smoke control. Mode II runs from 35% to 80% opacity. (Pet. Ex. F-Figure 1.)

Engines in Mode II show a mean snap acceleration smoke opacity of 58.2% and a standard deviation of 10.7%. (Pet. Ex. F-Figure 2.) With this distribution and a 55% peak smoke opacity cutoff, 62% of the vehicles would be improperly identified as requiring maintenance (i.e., the percentage of false positives or the error of commission rate). (Pet. Ex. F-Figure 2.)

Detroit Diesel, in its study, obtained snap idle data on seven vehicles powered by pre-1991 Series 60 engines which supplements the CARB data. (Pet. Ex. F-Figures 3 and 4.) After being tested with their original calibrations, the engines were recalibrated with the 1991 snap idle smoke control strategy and retested. The average snap idle smoke opacity for the vehicles with their original calibrations was 75.7%. (Pet. Ex. F-Figure

3.) With this figure and a 55% peak smoke opacity limit, Detroit Diesel determined that approximately 100% of the vehicles would be improperly identified as requiring maintenance. (Pet. Ex. F-Figure 4.)

Detroit Diesel believes that no more than 2% of the Series 60 engines will be identified as requiring maintenance. Accordingly, Detroit Diesel recommends the 85% peak smoke opacity standard for its 1987-1990 Series 60 engines because the cutpoint associated with a 2% error of commission rate for the above two studies are 80% and 90%, respectively.

Environmental or Health Effects

Detroit Diesel, in its petition, compares smoke and emission data obtained on its Series 60 engines with and without the 1991 snap idle smoke controls. (Pet. Ex. G.) The snap idle controls dramatically reduced peak smoke opacity observed during the snap idle test. However, the calibration change had virtually no effect on smoke and emissions measured in Agency transient tests, which represent actual in-use driving conditions. Because in-use smoke or emissions profiles of the Series 60 engines operating with and without the snap idle smoke control programming changes are similar, Detroit Diesel contends that the adjusted standard will have no adverse impact on the environment. Detroit Diesel also adds that its Series 60 engines meet the applicable federal smoke standards.

HARDSHIP

Detroit Diesel claims that it will face significant hardship if its engines are forced to comply with the peak smoke opacity standards. Specifically, Detroit Diesel claims either 1) the engines cannot be altered to comply with the standards without involving an expensive and complicated process, or 2) there is a high cost associated with having its customers take their engines out of service to have authorized distributors perform engine adjustments for the purpose of passing the Board's snap idle test procedure. Detroit Diesel adds that, notwithstanding any reprogramming costs, it is not feasible to reprogram 21,000 DDEC II engines in the near future. Detroit Diesel finally notes that, inasmuch as there is no measurable environmental benefit associated with making adjustments solely for the purpose of passing the snap idle test procedure, it is appropriate for the Board to adopt the proposed adjusted standard to avoid unnecessary costs and false failures.

CONSISTENCY WITH FEDERAL LAW

Detroit Diesel asserts that the Board may grant the proposed adjusted standard consistent with federal law. First, Detroit Diesel states that the Board's diesel smoke opacity program will

likely contribute to Illinois' efforts to control PM-10 and localized nuisance conditions because particulate emissions from diesel engines were included in the background concentrations in the Agency's PM-10 proposals (In the Matter of: PM-10 Emission Limits for the McCook and Lake Calumet Areas of Cook county, Illinois, and the Granite City Area of Madison County, Illinois: Amendments to 35 Ill. Adm. Code 211 and 212 (April 9, 1992), R91-22, 133 PCB 1). Detroit Diesel also notes that neither the Clean Air Act nor the State Implementation Plan mandate a diesel smoke opacity program. Section 209 of the Clean air Act, 42 U.S.C. 7543, states that:

> no state or any political subdivision thereof shall adopt or attempt to enforce any standard relating to the control of emissions from new motor vehicles or new motor vehicle engines subject to this part. No states shall require certification, inspection, or any other approval relating to the control of emissions from any new motor vehicle or new motor vehicle engines as a condition precedent to the initial retail sale, titling, or registration....

Detroit Diesel concludes that, based on the above, the Board's adoption of the diesel opacity program constitutes an independent effort to further improve ambient air quality in Illinois. Detroit Diesel adds that the Board's current standards propose a level of opacity measured under different conditions than the federal opacity regulations. In fact, Detroit Diesel asserts that the proposed adjusted standard will more closely resemble the federal requirements because its engines meet federal standards where testing is performed under more tightly controlled conditions that the Board's procedures provide.

AGENCY RESPONSE

As previously stated, the Agency recommends that the Board grant Detroit Diesel's request for relief. The Agency's recommendation is based on its review of all of the data presented by Detroit Diesel, including information that CARB has granted Detroit Diesel an exemption from its own diesel opacity regulation based on data that is similar to the data presented in this matter.

The Agency also believes that in-use engines which are properly certified by the federal program and well maintained should pass a state vehicle emission program. The Agency notes that many of the participants at the hearings held on the diesel opacity regulations stated that the primary cause of excessive diesel emissions are due to tampering or improper maintenance. Accordingly, the Agency believes that the regulation was not

intended to require retrofitting of engines that meet the federal guidelines, but was intended to deter improper maintenance and tampering. The Agency therefore states that exemptions should be granted for engines that cannot meet the standard because of inherent engine design characteristics if the engines meet the federal certification process.

Finally, the Agency states that Detroit Diesel has demonstrated in Exhibit G of its petition that the granting of the eighty-five percent (85%) adjusted standard for its MY 1987-1990 Series 60 engines will have minimal environmental impact.

DISCUSSION

Detroit Diesel has demonstrated that compliance with the standard of general applicability is economically unreasonable. The Board also concludes that Detroit Diesel has presented sufficient data in Exhibit G of its petition showing that granting the adjusted standard will have a minimal environmental impact. The Board accordingly finds that Detroit Diesel has provided sufficient justification to support its request for adjusted standard from the 55% peak smoke opacity limit found at 35 Ill. Adm. Code 240.141(a)(2). After considering Detroit Diesel's justification as well as the Agency's recommendation that the requested relief be granted, the Board hereby grants Detroit Diesel an adjusted standard of 85% peak smoke opacity for all 1987-1990 model year DDC Series 60 engines.

This opinion constitutes the Board's findings of fact and conclusions of law in this matter.

ORDER

Pursuant to Section 28.1(b) of the Environmental Protection Act, 415 ILCS 5/28.1 (1992), the Board hereby grants an adjusted standard from 35 Ill. Adm. Code 240.141(a)(2) to Detroit Diesel Corporation and the Engine Manufacturers Association. The following standard shall become effective on the date of this order:

> Detroit Diesel Corporation is granted an eighty-five percent (85%) peak smoke opacity standard for all DDC 1987-1990 model year Series 60 engines in lieu of the fifty-five percent (55%) peak opacity standard of 35 Ill. Adm. Code 214.141(a)(2).

IT IS SO ORDERED.

Section 41 of the Environmental Protection Act, (415 ILCS 5/41 (1992)), provides for appeal of final orders of the Board within 35 days. The Rules of the Supreme Court of Illinois

establish filing requirements. (See also 35 Ill. Adm. Code 101.246, Motion for Reconsideration.)

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above opinion and order was adopted on the 20th day of May, 1993, by a vote of 6-0.

Dorothy M. Gunn

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board