

factors, would be more appropriate for characterizing TRU emissions.

## 2. Cold Start Testing

EPA is proposing to include a requirement for a cold start transient test to be run in conjunction with the Agency's proposed nonroad diesel engine transient test. While EPA does not have available a database of emission information to characterize cold start emissions from all power categories of nonroad diesel engines, EPA has been able to analyze the second-by-second in-use operation of some forty pieces of Tier 1 and older nonroad equipment. Using a subset of equipment from this study, the Agency characterized the "average" workday of each piece of equipment in the data set<sup>311</sup> and attempted to define the role "cold start" operation, generally characterized by lower exhaust temperatures and higher-than-idle engine speeds, played in engine emissions. Generally, the Agency found that times when the engine was operating at cold start, higher engine emission rates were seen than during normal, temperature-stabilized operation of the engine. These cold start, or "warming-up", periods were seen to last on average ten minutes after equipment key-on for the units in our study.

The Agency found, that over an eight to ten hour workday, a piece of nonroad equipment would spend between 25 and 35 percent of its in-use day running in idle operation at a relatively low rate of emission output. With downtime on the equipment for operator lunch times and equipment transport, there could be a further period of an hour or more of low to no emissions from the equipment in-use. At first key-on of the workday, and with each additional "key-on" cold start event during the day, the equipment experiences a period of higher emissions until it reaches a stabilized operating temperature. Start-up of the equipment after a period of downtime which lasted an hour or more was generally seen to experience rates of engine emissions similar to those seen at first key-on, or cold start, and were considered periods of cold start emissions, as well. The total time the equipment in the study spent at these higher rates of "cold start" engine emissions could be estimated to generate approximately one-tenth of the engine emissions that the equipment would be expected to produce over the

whole workday. Therefore, EPA proposes to weight the emission test results from its additional cold start transient test requirement as one tenth of the composite transient emission test results for a particular engine. The Agency requests comments as to the robustness of this weighting factor and as to its applicability across the spectrum of nonroad diesel equipment.

In addition, EPA requests comment on the potential to apply an approach adopted for commercial spark-ignition engines, in which engines operate over a single "warm-start" cycle (67 FR 68298, November 8, 2002; see 40 CFR 1048.510), to nonroad diesel engines. The regulations for these spark-ignition engines address cold-start emissions indirectly through a combination of provisions. First, the warm-up period before emission measurement can start is limited to three minutes of operation. As a result, any engine operation after this three-minute period is fully accounted for by emission measurements. Second, the regulations direct manufacturers to design their emission-control systems to start working as soon as possible after engine starting and to describe in their application for certification how their engines meet this objective. For engines that take advantage of the period of unmeasured emissions with a design that has unnecessarily high emissions, we can consider this a defeat device and deny certification. Manufacturers therefore need to take steps to design their engines and any emission-control equipment to control emissions during the warm-up period without the additional effort of supplemental cold-start testing. EPA requests comment on whether this approach would be appropriate for nonroad diesel engines. In particular, we request comment on how long the warm-up period prior to start of emissions measurement should be for diesel engines. The three-minute warm-up period specified for these spark-ignition engines reflects the time needed for their catalysts to start working. The emission-control technologies anticipated for diesel engines under this proposal would need additional time, perhaps 10 minutes, before they achieved nearly full effectiveness in controlling diesel emissions. Any comments regarding this approach should address how the changed procedure would affect measured emission levels and how the emission standard should be adjusted to reflect these changes.

## 3. Control of Smoke

Manufacturers are currently responsible for testing and reporting

results for nonroad "peak acceleration" and "lugging" smoke emissions. These regulations are detailed in 40 CFR 89.113<sup>312</sup> and refer the reader back to 40 CFR 86, subpart I, which was developed for highway engines. This rulemaking however proposes to replace the present Federal Smoke Procedure for nonroad engines with the ISO 8178 Part 9 nonroad smoke procedure as the method and standards by which engine manufacturers will certify their nonroad engines. This new smoke testing procedure with its related smoke standards will become effective for a particular engine when that engine is certified to EPA's proposed Tier 4 or transition PM and NO<sub>x</sub>-NMHC standards. Proposed regulations may be found at 40 CFR part 1039.

The ISO-TC70/SC8/WG1 committee developed a nonroad smoke test procedure, ISO 8178-9 and finalized it on October 15, 2000. Recognizing the value of harmonized test procedures and limit standards, EPA is proposing through this rulemaking to use ISO 8178-9 for smoke testing of nonroad diesel engines. EPA has analyzed ISO 8178-9 and concluded that it is appropriate for adoption within the Agency's nonroad test procedures. It is important to note that the ISO 8178-9 smoke emissions test procedure is very different from the procedure specified in Subpart I of Part 86. As a consequence, in adopting the ISO 8178-9 procedure, EPA proposes to revise the numerical limit value associated with this ISO procedure. EPA proposes that the appropriate (maximum) numerical standard for ISO 8178-9 peak (acceleration) smoke value measurement will be 20 percent opacity, peak smoke values at 3x, 6x, and 9x will be 18 percent opacity, 16 percent opacity and 14 percent opacity, respectively, and the lug smoke value will be 10 percent opacity. The Agency has determined this value on review of data from smoke tests on various engines<sup>313</sup> across differing programs and requests comment as to the appropriateness of these particular limit values.

Some state governments have expressed a desire for a federal smoke regulatory program that would enable

<sup>312</sup> Smoke testing guidelines are detailed under ISO 8178-9, First Ed. 10-15-2000, "Reciprocating internal combustion engines-Exhaust emission measurement-Part 9: Test cycles and test procedures for test bed measurement of exhaust gas smoke emissions from compression ignition engines operating under transient conditions". A copy of the testing procedure may be found for reference only in Docket A-2001-28.

<sup>313</sup> "Nonroad Diesel Engine Smoke Testing and Limited Filter Analysis" May, 2001. Final Report to Engine Manufacturers Association from Southwest Research Institute. Docket A-2001-28

<sup>311</sup> Memorandum to Docket, "Analysis of Second-by-Second Emission and Activity Data for a Private Rental Fleet of Construction Equipment" Docket A-2001-28.