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Sixth Plenary meeting of the Working Group On Off-Cycle Emissions
22 March 2004, London, England

Meeting Minutes

Agenda Item 1

A. Maureen Delaney, the Chairperson of the Off-Cycle Emissions Working Group, opened the meeting by welcoming all of the participants and thanking the UK Department for Transport for hosting the Sixth Plenary Meeting.
B. The Agenda for the Sixth Plenary Meeting was reviewed and approved by the membership.

Agenda Item 2

A. The minutes of the Fifth Plenary Meeting ("Fifth") were reviewed.

Mr. Stefan Rodt suggested three amendments be made to the minutes:

at page 7 in the first paragraph:
"... Electronic injection systems in heavy-duty commercial vehicles, introduced as part of the EURO II *technology*, …"

at page 7 in the paragraph prior to Agenda Item 5:
"…The UK stated that the Artemis group put some data together, which included engines that were not subject to the amendment to the Directive for EURO III, so could the data in these materials be artificial especially if not taken from the EURO III engines subject to the revisions to the Directive Mr. Rodt stated that it is possible that the data are *preliminary*…."

at page 9 in the paragraph prior to Agenda Item 6:
"German UBA suggested that if the goal is to establish a global NTE, *the principles shall also be transferable to passenger cars and motorcycles*, starting from the whole engine map and then deciding where the carve outs should be, adding that once we have the NTE, definitions become less important."

The working group adopted the Minutes of the Fifth Plenary meeting incorporating the amendments suggested by Mr. Rodt. The final version of the minutes will be submitted to GRPE at the June 2004 meeting.

Agenda Item 3

A. The Chairperson reiterated the commitment made by the US EPA ("EPA") at the Fifth, which was to take the EMA proposed definitions, review them and distribute EPA's comments to other regulatory authorities for review and further comment.

The Chairperson indicated that the topic of Definitions will be given further consideration at the next plenary meeting.

B. Dr. Paul Greening provided an update to the group on the latest draft of the EURO Directive for on-highway vehicles. In September 2003, a proposal was made to add OBD, Durability and In-use compliance provisions to the EURO IV requirements. The proposed changes came in two parts:
   - the first part involved the introduction of OBD, OBD thresholds, and durability distances for vehicle categories;
   - the second part, which is now in the process of being completed, is the means by which these elements are to be implemented.

At a meeting in Brussels in early March, a discussion took place regarding technical issues and defeat strategies. When the last Directive was written, the European Commission devoted a considerable amount of time and discussion in looking to see how to ban defeat devices, while giving consideration to the market conditions in the EU. It was felt that this was an appropriate time to introduce revised definitions on the subject of AECDs and Defeat Strategies. Thus, the latest version of the Directive contains broad versions of the proposed EMA definitions, as well as requirements for operation and conditions of use.

Currently, within the Commission, the discussion of the first part as detailed above is complete and will be published in a legislative text by June or July. With respect to the second part, it too will be published in a legislative text, soon after the first. This being said, and though the Commission is pressed for time, it is still open to hearing comments on what the Off-Cycle Working Group will do in terms of definitions, because it wants to move to a common text and have a harmonized approach, recognizing that there is still some time before a GTR is finalized. The Commission will have some time to make modifications to the text, though the goal is to adopt the text it has written. EPA committed to looking at the draft Directive and to move as quickly as possible to discuss the proposed EMA definitions from the Fifth, with a goal of coming to an agreement at the June meeting.

Agenda Item 4

A. The Chairperson stated that she received a number of questions on the Charter from Mr. Christoph Albus of Germany (Deputy Head of Division, Federal Ministry of Transport, Building and Housing), who was trying to understand the focus and goals of the Charter. Mr. Albus' questions were timely, in that the Chairperson herself was also trying to come to an understanding of the goals of the Charter. The Charter was proposed to the GRPE in January 2002 as a working document and no comments were made on its content at that time. The following questions were discussed:

If a GTR is going to be the output of this working group, what is the goal of the regulation?

A review of the terms of reference reveals that goal is to come up with a GTR, which will be a global view for off-cycle emissions. The group wants to ensure that emissions continue to be met with the advent of more sophisticated electronic controls and also want to ensure that the standards are being met in-use. The Chairperson asked if other regulators share this view. Environment Canada suggested that there is a need to set parameters which ensure that there is no opportunity to systematically defeat so that emissions are increased outside the test procedure under conditions that are expected to be encountered in use. EPA indicated that this is consistent with the US approach.

Will this GTR also apply to nonroad engines and vehicles?

The Chairperson indicated that this GTR will be specific to Heavy Duty vehicles, but will be drafted with a view to having common definitions where possible. The work of this group will be separate output from WHDC, though it initially was conceived as part of WHDC.

Will this GTR apply only to type approval or will it also apply to in-use testing?

The EPA view is that any structure the group comes up with, in terms of this GTR, should also apply to in-use, to be demonstrated throughout the entire life of the vehicle. Manufacturers, at the time of certification, should have to provide a compliance statement, but it will not be until in-use testing is in effect when true emission profiles will be determined.

Mr. Stephan Rodt of German UBA supports the inclusion of in-use compliance, in that it will be important for the future.

Mr. Paul Greening of the EU agreed that this was an important policy objective. Certification testing is only a part of the picture; the true information comes from in-use. There is also a need

to be able to monitor any aftertreatment system that may be used. The work in the United States will be a good baseline to work from.

B. EMA presented an amendment to language in the Charter, for consideration by the Working Group:

> *"…With the advent of electronic controls, the possibility grows that many parameters of a particular test cycle may be recognized and engines adjusted* ***outside of the test cycle, which may result in higher emissions****."*

The Chairperson stated that the language currently contained in the Charter is not wrong.
The Chairperson indicated that she understand the EMA position and the desire for clarity in the certification process. The Chairperson stated that the amendment itself might not be necessary because this issue is much clearer now, than when the Charter was written. The group has moved forward and has minutes of meetings which reflect how the group has progressed on this issue, therefore, amending the Charter language is not going to make a difference to the work of the group.

EPA stated that it does not see a deficiency in the language, but did agree that the working group has gone beyond this point in its work so far.

EMA reiterated that the Charter language seems to focus on strategies that increase emissions, but the proposed modification to the test text covers the actual circumstances under which the strategies are used.

The Chairperson indicated that the group will look at this further at the next meeting.

Agenda Item 5

A. A presentation was made by Mr. Stefan Rodt of the German Federal Environmental Agency (German UBA), on the merits of adopting an NTE-like program as part of the GTR.

Mr. Rodt's presentation provided an overview of what has occurred in the past in the United States and what is currently happening in Europe in terms of cycle-bypass, and how a not to exceed concept (NTE) may be an efficient tool to address this issue.

Detailed data was presented comparing engine technologies, emission factors and drive cycles to illustrate the need for an NTE program. A good overview on off–cycle emission control in the EU and in the United States was also presented.

Mr. Rodt asked EPA if there are plans to extend the NTE control area downward. EPA stated that currently, there is no plan to extend the control area, because the method to calculate brake specific emissions significantly increases as engine torque drops below the 30 percent maximum torque NTE boundary. EPA has no immediate plans to extend the 30 percent torque boundary, but cannot completely rule out extending the area. For example, EPA could extend the boundary if a fuel-specific standard were ever established or if the minimum NTE sampling time were revised. Furthermore, the FTP does capture some operation in this area and any auxiliary emissions control strategies that activate in this region of operation. The Chairperson stated that if the working group has some measure of engine activity in this area, the group could determine from engine manufacturers what their expectations are in this area. OICA stated that the control area should cover most of the normal load operation of the engine. EPA stated that with the number of carve out provisions, the general purpose is to recognize the limitations of engine technology and to not hold engine manufacturers responsible for emissions performance in areas where the engine is incapable of operating. Nor does EPA want to overemphasize emissions performance where the engine operates infrequently. In any event, EPA wants to avoid overemphasizing operating conditions which have a nominal effect on overall emissions performance or the environment. The goal of the NTE as an off-cycle tool is to ensure level of control outside of the traditional test cycles is similar to the control outside of those test cycles.

Mr. Rodt presented a series of questions at the end of his presentation, which were discussed by the working group.

•Is the NTE/MAEL 2007 concept of the US the best to start with?

The Chairperson stated that in the US, the NTE protocols cannot be looked at individually, but as a suite of protocols. The NTE needs to be considered in a larger context. By expanding coverage over the test procedures you reduce off-cycle emissions, thus there is a lesser need to rely on the traditional defeat device provisions. In US there exists the FTP, SET (EURO III), MAEL and the NTE is overlaid on top of these test cycles.

Japan indicated that the objective of the off-cycle working groups protocol should be to revise the emission factors.

Canada stated that the NTE may not be the complete concept for this GTR and asked that consideration be given to the specific areas that need to be addressed by the GTR.

•What was the rational of EPA to design the NTE/MAEL concept this way?

The Chairperson stated that the goal of the MAEL, as a steady state type test , is to ensure that emissions control and performance off cycle is somewhat linear in between the EURO points.

OICA stated that in the US, the MAEL is only an interpolation, which can be interpolated higher or lower than it is interpolated in the EU. Therefore the overlay of US and EU interpolation may be slightly, but not significantly, different.

EPA stated that difference in interpolation is really between the 5% and 10% allowance. The 5% allowance was part of the Consent Decree negotiation, but in the 2007 regulation, the allowance is back to 10% and the control over speed and load is identical.

•What is the experience of EPA with the voluntary application (type approval/ in use) in advance of the 2007 requirements?

EPA stated that the current voluntary submission has been limited, but as more manufacturers had to comply with the 2004 standards, more voluntary statements have been made. This has reduced the workload at the Agency in terms of reviewing Auxiliary Emissions Control Device Descriptions, but they still look at strategies for operation outside the suite of tests.

•Is it necessary to have a NTE requirement as well as a MAEL requirement in parallel?

The MAEL in the Consent Decrees is stricter than what is accepted in practice and what has been implemented in the 2007 regulation in that EPA is considering the MAEL only for steady-state operation. The concept of MAEL is difficult to implement for in-use transient operation. NTE is flat, but the MAEL varies as a function of load and speed therefore the emissions standard or limit changes as load and speed changes. EPA has therefore used the MAEL only as a check for the EURO III test. For MY2010 this requirement is being eliminated from EPA regulations because once emissions reach the level required in 2010 there will be less opportunity for a manufacturer to significantly vary emissions performance one test point to the next or eliminate emission control between test points.

•Are there reasons to limit a NTE and/or MAEL control area to certain speed and torque values? If yes, is this dependant on certain technologies or engine layout ?

The MAEL control area is defined by the Euro control zone. For the NTE, the answer is yes because the zone is driven by break specific nature of the standards for operation below 30 percent of maximum torque. If you consider the NTE as a complimentary test, EPA believes that the NTE control area is appropriate. In the past, EPA has considered ways to expand coverage of the NTE, and would be interested in considering this further in the future. For example, if EPA were to consider moving to a

fuel consumption based standard as mentioned previously. EPA has spent a lot of time looking at alternative NTE approaches in the proposed Tier 4 nonroad regulation.

Left of the carve out of ESC speed, there is no one specific reason to explain why the carve out stopped there, other than this operating area presents t challenges for compliance and drivability, and you could end up with a higher standard for that operating area. Also, in this area you have significant more transient operation and FTP covers some of this area.

With the advent of PM filters in future, the lower carve out can be eliminated. OICA supported this stating the most operation in this lower area is transient and the FTP covers it.

To the extent where a carve out is technologically based, it will be reviewed as technology advances.

•In use data of HDV indicates that a relevant proportion of driving events occurs outside the US NTE 2007 control area. What does it mean in terms of emissions (NOx and PM) of future engines? Are emission maps of modern/future engines available or predictable? Are driving frequency maps of modern/future engines available or predictable?

The Chairperson asked the manufacturers present if emission maps and/or driving frequency maps for future technologies are available and/or predictable and if so, would they consider sharing this information with the working group. EPA stated that their experience to date has shown that the NTE is an excellent method for capturing worst case NOx during highway operation, but potentially not as effective at capturing transient PM and that the FTP does a good job capturing the transient emissions. However, with the advent of new technologies we are interested in any evidence that may suggest otherwise

•If a NTE control area is defined, is there a need for technology specific or emission specific carve outs?

Yes today and possibly in the future. What EPA tried to do with the NTE carve outs was to ensure that manufacturers are not held responsible for micro events which will not have a significant overall impact on emissions or the environment.

EPA acknowledged that there could possibly be other carve outs that could be considered as technology evolves. If a manufacturer speaks to EPA about a specific future technology , and how the current carve outs may need to adapt accordingly EPA will give consideration to this. The reason for having the same general carve outs apply to all manufacturers is to make it a consistent test. NTE Deficiencies are similar to carve-outs, but allow the NTE standard to be temporarily exceeded under limited circumstances due to the limitations of technology. Manufacturer's can apply for an NTE deficiency for a given engine and year. Deficiencies are typically eliminated after the third year a new standard has been in place.

•Have the 30s(econd) windows proven to be appropiate ?

Yes, but EPA does consider emissions performance over periods greater than 30 seconds, and the agency has addressed this issue in a negotiated settlement to the NTE. The answers to some of the questions being asked about the NTE are contained within the settlement elements. One element of the settlement EPA NTE guidance document in a Q&A form, and another is a document which outlines the establishment of a manufacturer run in-use program. In this document, the EPA looks at the NTE slightly differently than in the regulation. The settlement has defined an NTE sampling event, which includes when a vehicle transverses into the NTE zone and stays for longer than 30 seconds. EPA does not want to hold companies responsible for emissions in an area where the engine would not be designed to operate, and does not want to over emphasize operation where. (US EPA will make the Q&A document available to the working group)

•In the US 2007 regulations several specific exceptions of operating modes are possible on petition of the manufacturer. What is the rational, are they really necessary ?

EPA stated that the NTE zone (engine speed and torque) was defined by a desire to have a homogeneous emissions limit. Carve-outs within that zone exclude certain areas of operation from NTE consideration or limit how much emissions from that operation can contribute to an NTE result, Deficiencies allow temporary exceedences of the NTE standards due to technical limitations under limited operating conditions. The idea is not to hold the manufacturer responsible for NTE compliance during modes where the engine is not capable of operating or where it is not technically feasible to meet the NTE standards.

The Chairperson stated that EPA will provide a more detailed written response to the questions posed by Mr. Rodt.

B. EPA stated that the trends shown in the data presented by Mr. Rodt show that NTE is an effective tool for steady-state operation, but not as an effective tool for transient operation. Though transient operation is in and out of the NTE zone frequently, the FTP does a good job of capturing transient emissions.

OICA, stressed that manufacturers want to have some type of confirmation that the EPA program works, before it is in full force in 2007.

EPA acknowledged that this is an important concern, but stressed that if there are going to be modifications to the program, they will be made through in-use testing and not to the NTE regulations themselves. The in-use program may provide information on which helps to refine the NTE.

C. Mr. Kenji Kamita of the Ministry of the Environment, Japan, made a presentation on Japan's current regulatory situation on addressing off-cycle emissions.

Mr. Kamita stated that the Ministry of the Environment has acknowledged that it is necessary to examine specific measures against off-cycle emission as soon as possible and that it is also necessary to assess the effectiveness of such measures.

Mr. Kamita indicated that Japan is just now starting to address the issue of off-cycle emissions and is currently in the data-gathering phase, having started a 3-year project to gather real world emission data, using on-board exhaust gas measurement instruments.
Japan is prepared to present data collected at a later date to the group.

Mr. Kamita stated that Japan has not yet determined what the appropriate means of controlling off-cycle emissions are, but is very interested in the work of this group and hopes to be an active participant in the discussions. The Chairperson thanked Mr. Kamita and stated that she is hopeful that the working group will have interim reports of testing taking place in Japan.

D. The Chairperson stated, that this is a process where we are continuing to learn about the applicability of the NTE and in-use procedures. A lot of information is coming to the group, and it has to focus on off-cycle issues in a global context.

The Chairperson stated that one of the working group' future activities will be to determine how a global NTE will be applied in multiple jurisdictions.

The UK stated that the problem in the EU is that member states will apply in-use testing requirements on their own if none are established as part of the off-cycle GTR. The Chairperson stated that such an in-service compliance mechanism as a part of the GTR may help make this easier, so it does not matter who the type approval authority is, if there is an in-service compliance mechanism.

Agenda Item 6

A. The chairperson stated that WP.29 will be asking all of the working groups about the progress and timelines for their respective GTRs.

The Chairperson identified NTE protocol areas which have been discussed in the past and which require further clarification such as: operating regions, ambient conditions, setting the limit of in-use testing (is this part of GTR or should it be a separate entity) and asked if there are other topics/issues to be added to the list as the group moves forward.

Some suggestions from the floor included: measurement of emissions, communication interface between portable units, confirmation that the portable systems are operating properly as described by the manufacturer to the regulatory authorities.

OICA stated that before limits are set, the group needs a statistical evaluation of the measurement equipment (for accuracy and repeatability) because the limits should be connected to the method of measurement.

EPA, in response to the statement on the accuracy of measurement, stated that if we talk about standards, need to look at in-use accuracy of equipment and this is an important aspect. EPA also stated that for the 2007 standards the in-use standard is less stringent than the certification standard for first few years the program. As a part of the EPA NTE in-use testing program, the NTE threshold for compliance will account for both measurement accuracy and any specific in-use margin that may apply.

Canada stated that the first few years of a new standard generally have this discrepancy, but as we move forward, the two become aligned.

UK stated that communication interface is an area of concern, and would like to see draft provisions which do not intrude with the electronics of the engine. The concern is if engine can be designed to know it is being tested and would thus revert to operate in a compliant configuration during testing. In response the EPA stated that with the NTE there is a need to extract some info to see if operating within the NTE and to know if passing, therefore, at a minimum we need to know torque and speed.

Mr. Rodt stated that we need a better understanding of operating regions and emission maps, and for future technologies if possible.

Chairperson stated that in this regard, the OICA concept of blocks, depending on the location of the vehicle, may be an option, but more information is needed and factual basis for determining separate regional applications of operating condition ranges.

OICA made a brief summary of this concept for the group. OICA stated that the concept needs to be refined because, worldwide, have all extremes of operating conditions, but we also need to have an engine which complies with the GTR. How do we find a worldwide test that is acceptable?

Chairperson stated that even within the United States there are extreme operating conditions, and when EPA developed the NTE, they did look at cost and the capability of technology available.

OICA stated that they do have access to some data, both meteorological and miles driven in some areas, including Western Europe and Japan. If we can gather data from different parts of the world can try to refine the concept and come-up with something that is acceptable worldwide.

Chairperson stated that we do not want a situation where each region has its own engine requirements and understands that manufacturers have concern with how many engines to design and build.

The Chairperson stated that the NTE, for the purpose of the GTR, will focus on certification, but should it focus on in-use as well? In the US, both exist, or perhaps the GTR only needs to look at the procedures that need to be followed for in-use testing

Canada stated that not all countries may have the same authority as the United States to conduct in-use testing. In Canada, regulators may not have the authority to enforce compliance with the standards after certification.

EPA stated that today, industry questions this authority in the United States to require manufacturers to do in-use testing. The United States and EMA agreed on a manufacturer-run in-use testing program in the terms of a settlement over an NTE dispute, which works for all parties. The goal is to be able to satisfy the needs of the parties at the same time.

OICA stated that if the GTR is going to include an in-use protocol, it has to be a common protocol. This is not something which is currently in place in the EU.

Chairperson is concerned about the delay the development of an in-use program would have to completing the GTR.

The Chairperson asked if it is reasonable to focus on a program for certification purposes rather than focus on in-use as well because certification has merit in and of itself.

Japan stated that this is difficult to answer right now.

Mr. Greening stated that within the EU, there is a political obligation to introduce in-use compliance, but still need to lay down a menu of items to show that the engine is compliant. What they do not know is what will happen if the in-use data is not good, do you pull the engine to conduct the laboratory-based certification test? The EU has a preliminary plan to use a portable device, which may satisfy its long-term goals. The use portable equipment, which tests engines in vehicles and which can be correlated with the certification procedures may be a more elegant solution

Chairperson stated that regulators want to avoid pulling engines.

Mr. Rodt stated that in the future, in-use and OBD will be important. If the group creates a GTR that is appropriate for certification, but not appropriate for in-use, it may not be good solution.

EPA stated that the negotiated settlement made the NTE provisions written in the regulation more clear. Perhaps the group can gather information on how portable systems can be used and how to check the accuracy of those systems.

Sweden questioned if we want to draft a GTR as a general description of how to conduct in-use by the manufacturer or by authorities, but we do need to start with a certification protocol which can be conducted by regional authorities.

Chairperson stated that we should start with a GTR that addresses certification, so that an engine is designed to comply over various test cycles and which will contain the type approval requirements that manufacturers will have to comply with. At a minimum we have to advise through the GTR, the importance of the NTE as an in-use tool, but to we want to take the next step to write an in-use protocol?

Canada suggested that a common approach to an in-use protocol that ties to a certification, i.e. a specific route, should be something we consider when writing the GTR.

EPA stated that it wants to avoid the NTE being an on-road verification of the test cycle, because then you lose the off-cycle aspect of it. The idea is that at the time of certification the manufacturer will have done all that is necessary to be able to sign a statement that engine meets the NTE standards over the broad range operating conditions required by the NTE.

Mr. Rodt suggested that at the certification level, the manufacturer can make a compliance statement, and with in-use testing will later confirm the statement with real world emissions data.

Chairperson stated that the NTE will be a good starting point. The group will use the current US EPA model, for initial discussion purposes.

Agenda Item 7

The Chairperson outlined the next critical steps for the working group:

- To provide to WP 29 a proposal for the GTR and will try to make this available prior to the June meeting.
- For the June meeting, EPA will develop a common understanding of EMA definitions and the EU definitions, will distribute this document to other regulators, and will make it available for discussion at the June meeting. It is an important part of work to have definitions in place, and to see how generic they can be with the view that they can be applied to other vehicles.
- In June will organize an editorial group which will work on the draft, and an annotated time-line.
- By January 2005 the group will plan to have a one day meeting at GRPE to allow the full group to see an expanded version of the language in the GTR.
- By June 2005, to have a fairly complete draft of the GTR and need to see if we will include an in-use element
- By January 2006, to have a final draft of the GTR for comment

The group will plan to have a one day editorial committee meeting in September 2004 in the United States.

The group will plan to have a two day plenary meeting in November 2004 in Japan.

Agenda Item 8

The next plenary meeting of the Off-Cycle Working Group will be held on June 1, 2004 from 14:30 to 17:30 at the Palais Des Nations, Geneva, Switzerland. A draft agenda and any working and informal documents will be circulated to the membership prior to the meeting.

Dated this 6th day of May 2004

Joanna Vardas, Secretariat