**Based on the decisions of the last OCE meeting, OICA proposes the following changes to working document n° 12:**

- **section 4: new introductory sentence**
- **section 5.1: streamlining with definitions**
- **section 5.2: new WNTE factors**
- **section 6: reference to atmospheric pressure (as proposed by EMA) and modified temperature equation**
- **section 7.1: new WNTE area**
- **sections 7.2, 7.3, 7.4, 7.5: proposal for WNTE in-use and laboratory testing**

**All changes are marked in red.**

## A. Statement of Technical Rationale and Justification

### 1. Introduction

The objective of this Global Technical Regulation ("gtr") is to establish a harmonized regulation which ensures off-cycle emissions from heavy-duty engines and vehicles are appropriately controlled over a broad range of engine and ambient operating conditions encountered during normal in-use vehicle operation. The gtr is designed to be applicable to engines certified or type approved under the test procedures of the World-Harmonized Heavy-duty Certification (WHDC) gtr.

To that purpose, this Off-cycle Emissions (OCE) gtr includes provisions that prohibit the use of defeat strategies. This OCE gtr also adopts new harmonized emissions factors which cover a broad range of engine and ambient operating conditions, the World-Harmonized Not-to-Exceed requirements ("WNTE"). The gtr requires the control of emissions during engine and ambient operating conditions that are broader than those covered in emissions testing during the two components of the WHDC, the World-Harmonized Transient Cycle and the World-Harmonized Steady-state Cycle.

It is important to note that the WHDC gtr is being implemented as a global test procedure without emission limits as a first step towards the world harmonization of cycle-based emission certification requirements for heavy-duty engines. During this first stage, regional authorities are expected to introduce the WHDC test procedures into their individual regulatory programs. However, it is anticipated there will continue to be a range of WHDC-based emission limits in effect in the various regions until such time that world-wide emission limits are adopted as part of the WHDC gtr. This being the case, the WNTE-based emission limits defined in this gtr relate directly to the emission limits to which a specific engine has been certified based on the WHDC test procedures. This structure enables regional authorities to implement a common approach to establishing WNTE-based emission limits, even in the period where global WHDC emission limits are not set out in the WHDC gtr. The eventual adoption of global WHDC-based emission limits will effectively result in world harmonized WNTE emission limits.

**Editorial Comment: Group needs to capture the following idea, subject to further discussion:**

***WNTE does not cover all operating conditions, therefore contracting parties may decide to introduce additional procedures for the control of off-cycle emissions. These could be subject to a future gtr, possibly an amendment to this gtr.***

### 2. Background on Off-cycle Emissions

The basic regulatory approach historically utilized by a number of countries to reduce exhaust emissions from heavy-duty engines was to use a combination of an emissions certification test cycle with an emissions limit (or standard) and a prohibition against the use of defeat strategies.

The test cycle for heavy-duty engines, while different among various countries, had a number of common characteristics. The test cycle was based on an engine test, performed in a laboratory, under a limited range of ambient conditions, and the test cycle contained a pre-defined set of speed and load point always run in the same order. The prohibition against the use of defeat strategies generally required that the engine could not operate differently in-use in a manner which reduced the effectiveness of the engine's emission control system. Emissions which occur under conditions not well represented by the laboratory-based test cycle are typically called off-cycle emissions.

Heavy-duty vehicles are driven over a wide variety of operating conditions, including starts, stops, accelerations, decelerations, steady cruises, and under varying ambient conditions (e.g., temperature, humidity and barometric pressure). The establishment of the WHDC gtr will result in a laboratory based test cycle which reflects world-wide on-road heavy-duty engine operation, but as with any standardized test cycle, the wide variety of real world driving conditions are not fully incorporated.

Heavy-duty engines have progressed over the past decade to become very sophisticated electronic and mechanical systems. These systems are capable of controlling the performance of heavy-duty engines over a wide variety of driving conditions. A central aspect of this sophisticated engineering is the capability to continuously monitor a wide range of operating parameters, including engine rotational speed, vehicle ground speed, and intake manifold pressure and temperature, and to modify the performance of the engine and its emission control systems in real-time in response to the monitored data.

The defeat strategy provisions do not provide a quantified numerical emissions limit and associated test procedure for conditions not encountered on the regulatory test cycles. This has often resulted in the need for case-by-case decision making during the certification and type-approval process regarding whether a particular element of design constitutes a defeat strategy. These design-based reviews have become increasingly difficult as the engines and the emission control technologies have grown more complex.

The approach contained in this OCE gtr may reduce the reliance on case-by-case design reviews by additionally requiring compliance with the WNTE provisions. The WNTE supplements the prohibition against defeat strategies and can allow for a more efficient and objective performance-based means for evaluating off-cycle emissions behavior. The WNTE provisions accomplish this by substantially increasing the range of engine and ambient operating conditions which are subject to an emission limit, thereby reducing the scope of emissions considered to be off-cycle.

When considered as a whole, the WHDC gtr and this OCE gtr promote global harmonization of regulations that reduce air pollution from heavy-duty vehicles and engines.

**3. Procedural Background and Development of GTR**

This gtr was developed by the GRPE informal working group on Off-cycle Emissions (the OCE Informal group). A full report of the work of the OCE Informal group, its deliberations and conclusions is provided in the group's Technical Report, TRANS/WP.29/GRPE/xxxxx.

The work to develop this gtr began with the establishment of the OCE Informal group. The OCE Informal group had its first meeting in December 2001.

As required by the 1998 Global Agreement, a formal proposal for the establishment of a gtr was proposed to the Executive Committee for the 1998 Agreement (AC3) by the United States. At its session on 13th March 2005, the proposal from the United States was approved as a gtr project by AC.3 (TRANS/WP.29/AC.3/13).

The following is a summary of the key issues that were discussed and resolved during the development of this gtr by the OCE working group. Additional discussion of these issues can be found in the Technical Report.

WNTE Control Area
Engine Operating Conditions (e.g. Temperature, Humidity, Altitude)
Definition of Defeat Strategy and related items

One of the key issues discussed during the development of the OCE gtr was the scope of the gtr with respect to in-use, on-vehicle emissions testing. After considerable debate by the OCE working group, it was decided the OCE gtr would not include specifications for in-use, on-vehicle

emission measurement equipment. However, the OCE gtr was developed with the specific intent to enable the testing of compliance with the WNTE during in-use, on the road operation of the engine. Therefore, it may be appropriate in the future to consider the development of a gtr which would include harmonized test procedures for in-use on vehicle emissions measurement.

**Editorial comment: need to revisit this paragraph after decision on Options is made.**

## 4. Technical and Economic Feasibility

The OCE gtr has been developed with the input and expertise from a large number of stakeholders, including regulatory authorities, type approval authorities, engine and vehicle manufacturers, and independent technical consultants. The gtr has built upon the experience of many organizations and individuals with expertise in addressing off-cycle emissions.

The gtr has been designed to improve the control of off-cycle emissions, and the WNTE requirements specified in the gtr are based, in-part, on the approaches which exist in some Contracting Parties' existing legislation.

The WNTE requirements in this gtr are a function of the laboratory-based test cycle limits, specifically emission limits associated with the WHDC gtr's transient test cycle (the WHTC). However, the WHDC gtr does not currently contain any limit values. As such, no formal analysis of the technical and economic feasibility of the WNTE limits in this OCE gtr has been undertaken. It is recommended that Contracting Parties consider the technical and economic feasibility of the OCE gtr when they adopt this regulation into their national requirements.

## 5. Anticipated Benefits

This gtr is expected to result in a number of benefits, including: improved emissions control; more efficient certification or type approval methods, and reduced costs for engine and vehicle manufacturers.

The addition of harmonized defeat strategy provisions and WNTE requirements to the certification testing regime (e.g. the WHDC test cycles) will more adequately ensure that an appropriate control of emissions is achieved in-use, under a wide range of operating conditions. As a result, it can be expected that the adoption of this gtr by Contracting Parties will result in an improved level of emissions control.

The gtr may reduce the need for time consuming case-by-case design reviews and provide a more efficient and objective performance-based means for evaluating off-cycle emissions.

Finally, heavy-duty engines and vehicles are often produced for the world market. It is economically more efficient for manufacturers to design and produce models which meet emissions objectives specified in a common Global Technical Regulation rather than developing products to meet a wide array of different and potentially conflicting regulatory requirements in individual countries and regions. This in turn may allow manufacturers to develop new models more effectively at a lower cost.

## 6. Potential Cost Effectiveness

A formal cost-effectiveness analysis of the OCE gtr has not been performed for the reasons discussed in Section A 4.

However, it is fully expected that this information will be developed, generally, in response to the adoption of this regulation in national requirements and also at the time the WHDC gtr develops harmonized limit values, and the future corresponding amendments to this gtr. For example,

each Contracting Party adopting this gtr into its national law will be expected to determine the appropriate level of stringency associated with using these new test procedures, with these new values being at least as stringent as comparable existing requirements. Also, experience will be gained by the heavy-duty engine industry as to any costs and cost savings associated with using this test procedure. The cost and emissions performance data could be analyzed as part of a possible future amendment to this gtr to determine the cost effectiveness of the test procedures along with the application of any future harmonized WHDC limit values. While no formal cost-effectiveness has been done, the belief of the GRPE experts is that there are clear benefits associated with this gtr, as discussed in Section A 5.

## B. Text of Regulations

### 1. Scope and Purpose

This regulation establishes performance-based off-cycle emission requirements and a prohibition on defeat strategies for heavy-duty engines and vehicles so as to require effective control of emissions under a broad range of operating conditions.[1]

### 2. Application

This regulation applies to the emission of gaseous and particulate pollutants from compression-ignition engines, and positive-ignition engines fuelled with natural gas (NG) or liquefied petroleum gas (LPG), used for propelling motor vehicles of categories 1-2 and 2, having a design speed exceeding 25 km/h and having a maximum mass exceeding 3.5 tonnes.

### 3. Definitions

**Auxiliary Emission Control Strategy ("AECS")**

means an emission control strategy that becomes active and replaces or modifies the base emission control strategy for a specific purpose or purposes and in response to a specific set of ambient and/or operating conditions.

**Editorial comment: take examples (e.g. vehicle speed, engine speed, gear used, intake temperature, or intake pressure) from US EPA definition and include them in either A.3 or in the Technical Report**

**Base Emission Control Strategy ("BECS")**

means an emission control strategy that is active throughout the speed and load operating range of the engine unless an AECS is activated.

**Editorial comment: take examples from EC directive definition and include them in either A.3 or in the Technical Report**

"Category 1 vehicle" means a power driven vehicle with four or more wheels designed and constructed primarily for the carriage of (a) person(s).

"Category 1-2 vehicle" means a category 1 vehicle designed for the carriage of more than eight passengers, whether seated or standing, in addition to the driver.

[1] While the Application section of this GTR (Section B.2.) refers specifically to engines, the GTR also often discusses vehicles. The reason for including vehicles in the GTR is that many Contracting Parties allow the certification or type-approval of a heavy-duty vehicle, not just an engine. This GTR at a minimum applies to engines, but at the discretion of the Contracting Party it could apply to vehicles as well, when adopted into their country or regional regulations.

"Category 2 vehicle" means a power driven vehicle with four or more wheels designed and constructed primarily for the carriage of goods. This category shall also include:

i) tractive units
ii) chassis designed specifically to be equipped with special equipment.

**Editorial comment: List category definitions, but add footnote referencing Special Resolution 1. (look at OBD gtr language)**

**Defeat Strategy**

Means either

(a) an AECS that reduces the effectiveness of the emission control relative to the BECS under conditions that may reasonably be expected to be encountered in normal vehicle operation and use, unless:

- the operation of the AECS is substantially included in the applicable type approval or certification tests, including the WNTE requirements; or
- the AECS is activated for the purposes of protecting the engine and/or vehicle from damage or accident; or
- the AECS is only activated during engine starting or warm up; or
- the AECS is used to trade-off the control of one type of regulated emissions in order to maintain control of another type of regulated emissions under specific ambient or operating conditions not substantially included in the type approval or certification tests. The overall affect of such an AECS is to compensate for the effects of extreme ambient conditions in a manner that provides acceptable control of all regulated emissions

or

(b) a BECS that discriminates between operation on an applicable type approval or certification test and other operations and provides a lesser level of emission control under conditions not substantially included in the applicable type approval or certification tests.

**Element of Design**

Means

(a) any control system, including: computer software; electronic control systems; and computer logic;
(b) any control system calibration;
(c) the results of the interaction of systems; or
(d) any hardware.

**Editorial comment: group should consider combining the element of design definition into the emission control strategy definition and eliminating element of design.**
**Group to consider including the defeat strategy definition diagram in the gtr as an Annex.**

**Emission Control Strategy (ECS)**

means an element or set of elements of design that is incorporated into the overall design of an engine system or vehicle and used in controlling emissions. ECS consists of base emission control strategies (BECS) and auxiliary emission control strategies (AECS).

**Emission Control System**

Means hardware and software on a vehicle which has been developed or calibrated for the purpose of controlling emissions (e.g. particulate filter, charge air cooler, EGR cooler)

**Engine Family**
means a manufacturer's grouping of engines which, through their design as defined in paragraph 5.2 of gtr No. 4 (the WHDC gtr) have similar emission characteristics; all members of the family must comply with the applicable emission limit values

**Engine Starting**
**Editorial Comment: refer to California OBD regulation for potential language**

**Engine System**
means the engine, the emission control strategies and any other powertrain or vehicle control unit;

**Editorial comment: OICA is going to consider changes to the Engine System definition to make it consistent with the WHDC and OBD gtrs and any related changes to other definitions**

**Engine Warm-up**
**Editorial Comment: refer to California OBD/EU Directive/OBD gtr for potential language.**

**Periodic Regeneration**
means the regeneration process of an exhaust aftertreatment system that occurs periodically in typically less than 100 hours of normal engine operation.

**Steady State Engine Operation**
**Editorial comment: definition needed (referring to smoke requirements)**

**Transient Engine Operation** [referring to smoke requirements]
means a period of operation during which engine speed and/or load are changing relatively quickly.

**4. General Requirements**

Any engine system and any element of design liable to affect the emission of gaseous and particulate pollutants from diesel engines and the emission of gaseous pollutants from gas engines shall be so designed, constructed, assembled and installed as to enable the engine, in normal use, to comply with the provisions of this gtr including when installed in the vehicle. Normal use is not restricted to the conditions of use as specified in section 6.

**4.1 Prohibition of Defeat Strategies**

Engine systems and vehicles shall not be equipped with a defeat strategy.

**4.2 WNTE Requirement.**

Engine systems and vehicles shall comply with the WNTE emission limit values described in Section 5.2 when measured in accordance with the requirements of this gtr.

**5. Performance Requirements**

**5.1. Emission control strategy**

### 5.1.1. Requirements for base emission control strategy

The base emission control strategy (BECS) shall be so designed as to enable the engine, in normal use, to comply with the provisions of this gtr. Normal use is not restricted to the conditions of use as specified in section 6.

### 5.1.2. Requirements for auxiliary emission control strategy

An auxiliary emission control strategy (AECS) may be installed to an engine or on a vehicle provided that the AECS:

- operates only outside the conditions of use specified in section 6 or,
- is activated only temporarily within the conditions of use specified in section 6

**5.1.2.2**. An auxiliary emission control strategy (AECS) that operates within the conditions of use specified in section 6 and which results in the use of a different or modified emission control strategy (ECS) to that normally employed during the applicable emission test cycles will be permitted if it is fully demonstrated that the measure does not permanently reduce the effectiveness of the emission control system. In all other cases, such strategy shall be considered to be a defeat strategy.

**5.1.2.3.** An auxiliary emission control strategy (AECS) that operates outside the conditions of use specified in section 6 will be permitted if the manufacturer fully demonstrates that the measure is the minimum strategy necessary with respect to environmental protection and other technical aspects. In all other cases, such a strategy shall be considered to be a defeat strategy.

### 5.2 WNTE Limits for Gaseous and Particulate Exhaust Emissions

**5.2.1** Exhaust emissions from an engine shall not exceed the applicable WNTE emission limits when the engine is operated under the specified engine speed and load points defined by the WNTE Control Area in section 7. These emission limits apply to engine use under the ambient conditions specified in section 6. The emissions are determined in accordance with the measurement procedures specified in section 7.

**5.2.2** For the purposes of section 5.2.1, the applicable WNTE emission limits expressed in g/kWh for an engine are defined, as follows:

WNTE Emission Limit =WHTC Emission Limit + WNTE Component (or Constituent)

where

"WHTC Emission Limit" is the emission limit (EL) to which the engine is certified pursuant to the WHTC test procedures expressed in g/kWh; and

"WNTE Component" is determined by equations 1 to 4 in section 5.2.3

**5.2.3** The applicable WNTE Components expressed in g/kWh shall be determined using the following equations:

| | | |
|---|---|---|
| for NOx: | WNTE Component = $- 0.0248 * EL^2 + 0.2946 * EL + 0.0963$ | (1) |
| for HC: | WNTE Component = $0.15 * EL^2 + 0.01 * EL + 0.09$ | (2) |
| for CO: | WNTE Component = $0.025 * EL^2 + 0.1 * EL + 0.2$ | (3) |
| for PM: | WNTE Component = $1.25 * EL^2 * 0.0875 * EL + 0.005$ | (4) |

The WNTE Component shall be rounded to the number of places to the right of the decimal point indicated by the applicable emission limit, in accordance with ASTM E 29-04.

Examples of WNTE Components for current emission limits are shown in Annex I.

## 6. Applicable Ambient and Operating Conditions

The WNTE emission limits shall apply at

- all atmospheric pressures greater than or equal to 82.5 kPa,
- all temperatures less than or equal to the temperature determined by equation 5 at the specified atmospheric pressure:

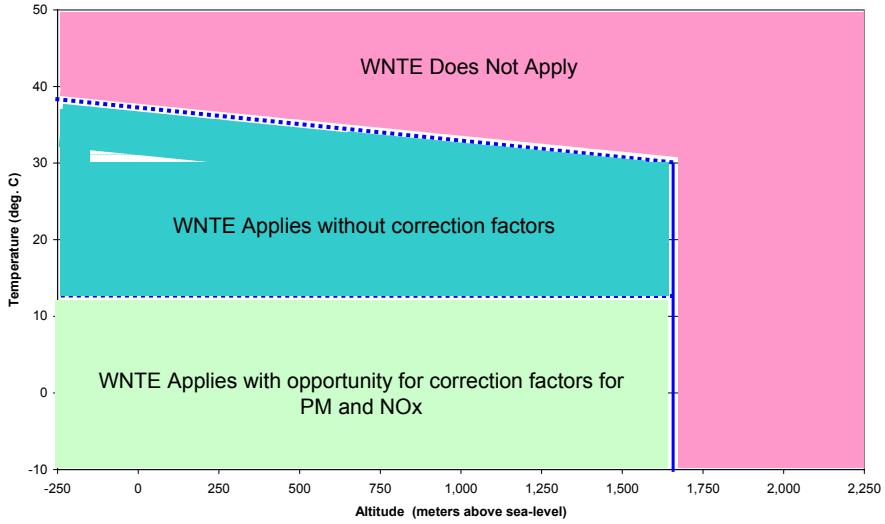
$$T = -0.4514 * (101.3 - p_b) + 311 \quad (5)$$

where:
$T$ is the ambient air temperature, K
$p_b$ is the atmospheric pressure, kPa

- all engine coolant temperatures within the range of 343 K to 373 K (70°C to 100°C).

The applicable ambient atmospheric and temperature conditions are sown in figure 1.

**Figure 1 : Illustration of Ambient Atmosperic and Temperature Conditions (figure to be adapted)**




## 7. WNTE Test Procedures

### 7.1 WNTE control area

The WNTE control area consists of the engine speed and load points defined in sections 7.1.1 through 7.1.4. Figure 3 is an example illustration of the WNTE control area.

In principal, any engine within a family with a unique torque/power curve will have its individual WNTE control area. For in-use testing, the individual WNTE control area of the respective engine shall apply. For type approval (certification) testing under the engine family concept of gtr n° 4, the manufacturer may optionally apply a single WNTE control area for the engine family under the following provisions:

- A single engine speed range of the WNTE control area may be used, if the measured engine speeds $n_{30}$ and $n_{hi}$ are within ± 3 % of the engine speeds as declared by the manufacturer. If the tolerance is exceeded for

any of the engine speeds, the measured engine speeds shall be used for for determining the WNTE control area.

– A single engine torque/power range of the WNTE control area may be used, if it covers the full range from the highest to the lowest rating of the family. Alternatively, grouping of engine ratings into different WNTE control areas is permitted.

**7.1.1 Engine speed range.** The WNTE control area shall include all operating speeds between the 30$^{th}$ percentile cumulative speed distribution over the WHTC test cycle, including idle, ($n_{30}$) and the highest speed where 70% of the maximum power occurs ($n_{hi}$). Figure 2 is a representative example of the WNTE cumulative speed frequency distribution for an example engine.

**7.1.2 Engine load range**. The WNTE control area shall include all engine load points greater than or equal to 30% or more of the maximum torque value produced by the engine.

**7.1.3 Engine power range**. Notwithstanding the provisions of sections 7.1.1 and 7.1.2, speed and load points below 30% of the maximum power value produced by the engine shall be excluded from the WNTE control area.

**7.1.4 Additional WNTE Area Requirements for Vehicles Using Continuously Variable Transmission (CVT)**. All operating speed and load points with brake specific fuel consumption (BSFC) values within 5% of the minimum BSFC value of the engine shall be included in the WNTE control area when the engine is used in a vehicle with a continuously variable transmission. BFSC shall be calculated under the general test cell conditions specified in [the WHDC gtr]. **[Editorial comment: include language to describe applicable test.**

**Figure 2: Example of WHTC Cumulative Speed Distribution**

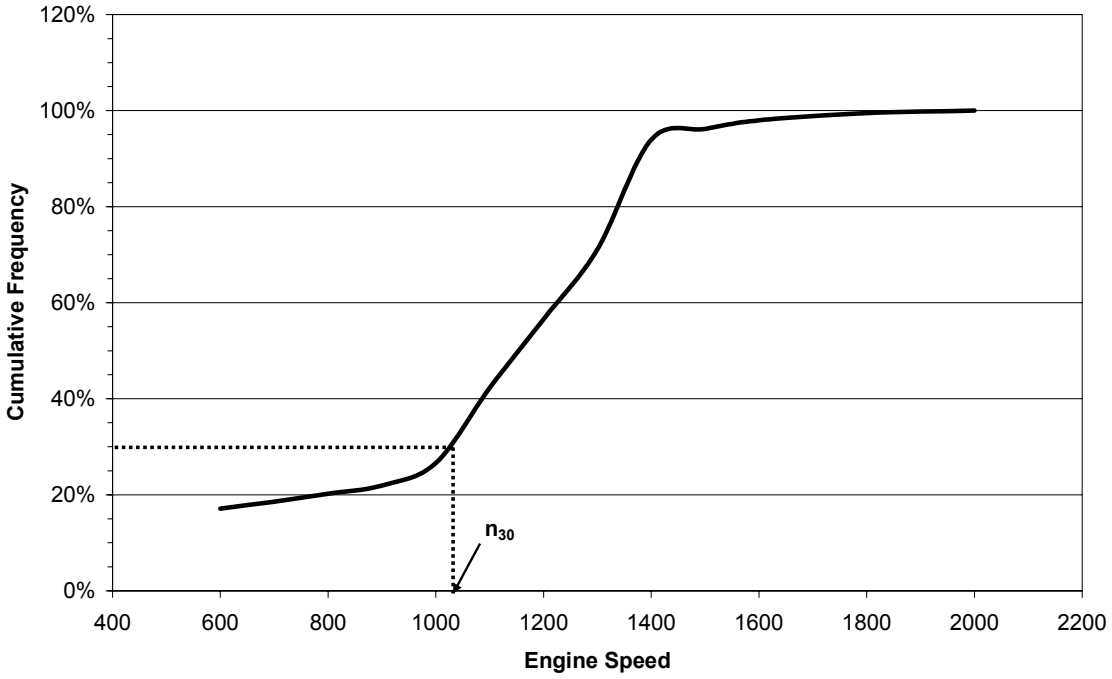
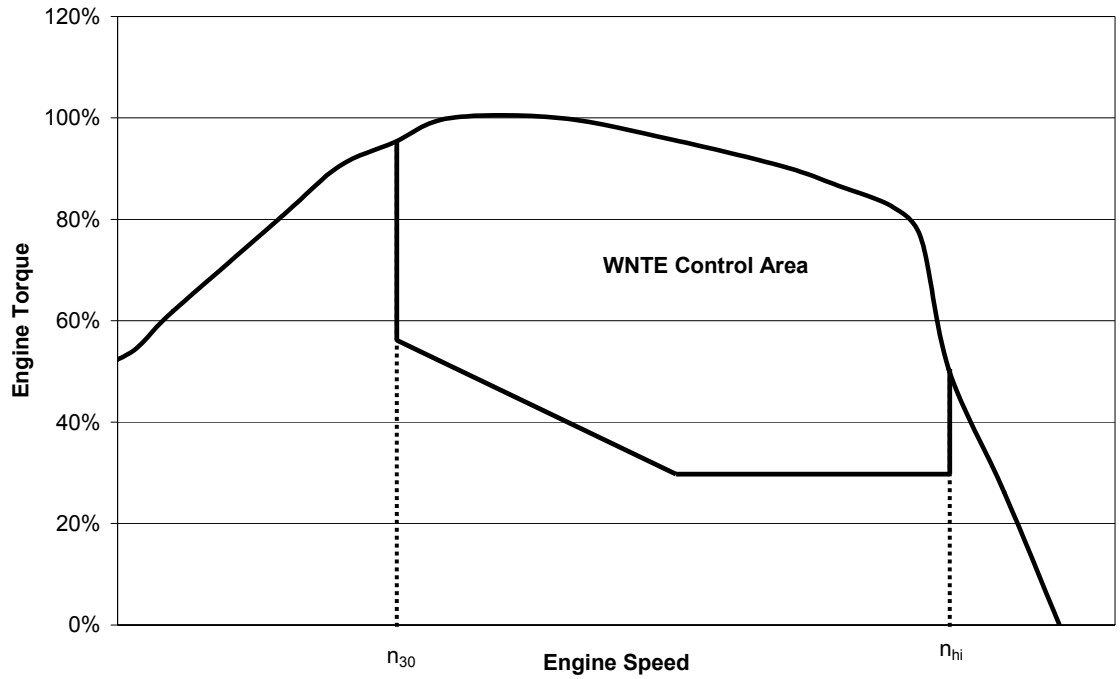


**Figure 3: Example of WNTE Control Area**




**7.2 General WNTE testing requirements**

**7.2.1** To determine compliance with the WNTE emissions limits specified section 5.2, the engine shall operate within the WNTE Control Area defined in section 7.1 and its emissions shall be measured and averaged over a period of time to be selected by the Contracting Parties in case of in-use testing, or in accordance with section 7.3 in case of laboratory testing. A WNTE event is defined as a single set of average emissions over the period of time.

**7.2.2**. If a regeneration event occurs during the WNTE test for engines equipped with emission controls that include periodic regeneration events, the averaging period shall be at least as long as the time between the events multiplied by the number of full regeneration events within the sampling period. The requirement in this section only applies for engines that send an electronic signal indicating the start of the regeneration event~~.~~

**Editorial Comment: EMA to draft additional language to clarify the regeneration requirements. EPA will also draft additional language to clarify these regeneration requirements.**

~~**7.2.3 WNTE Limited Testing Region Provision.**~~
~~Manufacturers may request that the Certification or Type Approval Authority approve a limited testing region in a single defined region of speeds and loads within the WNTE control area. Under this provision, testing would not be allowed with sampling periods in which operation within that region constitutes more than 5.0 percent of the time weighted operation within the sampling period. The 5.0 percent is calculated on a time-weighted basis, e.g. no more than 2 seconds out of a 40 second WNTE averaging period could be within the approved limited testing region. Such a defined region must generally be of elliptical or rectangular shape, and must share some portion of its torque/speed boundary with the torque/speed boundary of the WNTE control area. Approval of this limited testing region by the Certification or Type Approval Authority is contingent on the manufacturer satisfactorily demonstrating that operation at the speeds and loads within~~

~~that region is projected to account for less than 5.0 percent of all in-use operation (weighted by vehicle-miles-traveled or other weightings approved by the Certification or Type Approval Authority) for the in-use engines of that configuration (or sufficiently similar engines). At a minimum, this demonstration must include operational data from representative in-use vehicles.~~

**7.3 WNTE in-use testing**

If a Contracting Party selects this gtr as basis for in-use testing, the engine shall be operated under the actual in-use conditions. The test results out of the total data set that comply with the provisions of sections 6, 7.1 and 7.2 shall be used for determing compliance with the WNTE emission limits specified in section 5.2.

**7.4 WNTE laboratory testing**

If a Contracting Party selects this gtr as basis for laboratory testing, the following provisions apply.

7.4.1. The specific mass emissions of gaseous pollutants and particulate pollutants, if applicable, shall be determined in accordance with section 7.5 at 15 random check points uniformly distributed across the WNTE control area as defined in section 7.1 and in figure 3.

7.4.2. The random check points shall be selected by the type approval authority using approved statistical methods of randomization.

7.4.3. The 15 random check points shall be combined into three ramped steady state cycles each consisting of 5 random check points. The check points shall be connected in a way representing typical engine behavior. The final ramped steady state cycles shall be approved by the type approval or certification authority.

7.4.4. The average specific mass emissions over the cycle of gaseous pollutants and particulate pollutants, if applicable, shall not exceed the WNTE limit values specified in section 5.2 for any of the three random ramped steady state cycles.

**7.5 WNTE laboratory test procedure**

7.5.1. The warmed-up engine shall be preconditioned at mode 9 of the WHSC for a period of three minutes. The test sequence in section 7.5.3. shall be started 5 minutes after completion of the preconditioning phase.

7.5.2. The engine shall be operated for 2 minutes in each random check point, whereby speed and load shall be changed linearly within 20 seconds. The 20 seconds ramp is defined as the first section of each 2 minutes random check point.

7.5.3. The measurement of the three random ramped steady state cycles, as defined in paragraph 7.5.2., shall be carried out consecutively in accordance with paragraph 7.8 of gtr n° 4 (WHDC). The second and third ramped steady state cycles shall start with the 20 seconds ramp between the last check point of the preceding cycle and the first check point of the new cycle.

7.5.4 The calculation of the test results shall be carried out in accordance with paragraph 8 of gtr n° 4 (WHDC) for each individual random ramped steady state cycle.

**7.6 Rounding.**

The final test result shall be rounded in one step to the number of places to the right of the decimal point indicated by the applicable emission standard plus one additional significant figure, in accordance with ASTM E 29-04. No rounding of intermediate values leading to the final brake specific emission result is permitted.

## 8. WNTE deficiencies

### 8.1 General.

A WNTE deficiency allows an engine or vehicle to be certified as compliant with this gtr even though specific requirements, limited in scope, are not fully met. The provisions allow a manufacturer to apply for relief from the WNTE emission requirements under limited conditions, such as extreme ambient temperatures and/or severe operation where vehicles do not accumulate significant mileage.

For the first three years after an emission limit is implemented which results in a more stringent WNTE emission limit, a manufacturer may request from the Certification or Type Approval Authority a WNTE deficiency at the time of certification. The Certification or Type Approval Authority has the discretion to decide the duration of the WNTE deficiency, provided that the deficiency does not extend beyond the three year period.

### 8.2 Evaluation criteria.

Deficiencies will be granted only if compliance would be infeasible or unreasonable.

The certification authority shall take into consideration data from the manufacturer that details such factors as but not limited to:

- technical feasibility of the given hardware;
- lead time and production cycles including phase-in or phase-out of engines or vehicle designs; or
- programmed upgrades of computers.

A WNTE deficiency may be granted where unreasonable hardware or software modifications would be necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Certification or Type Approval Authority.

**Editorial Comment: Will look the EU 70/220/EEC – ANNEX XI, to see if additional evaluation criteria is available.**

**Editorial Comment: Explicitly state general criteria such as why the deficiency is needed, why the problem can not be solved without a deficiency, how much above the NTE does the deficiency cause emissions to increase, how frequently the deficiency will activate in terms of vehicle miles traveled and/or % of operation etc.**

### 8.3 Number of deficiencies.

The number of deficiencies allowed shall not be greater than three per engine family.

**Editorial Comment: Consider having an unlimited number of deficiencies, but a contracting party would have the option to cap the number of deficiencies granted per engine family.**

### 8.4 Deficiency Descriptions.

For each engine family, for which a manufacturer is applying for a WNTE deficiency, the manufacturer's application shall include, as a minimum:

- the specific power or torque rating(s) within the family for which the deficiency is being requested;
- the specific description of the deficiency;
- an explanation of why the deficiency is needed;

- the pollutant(s) for which the deficiency is being applied for;
- an explanation of the engineering efforts the manufacturer has made to overcome the need for the deficiency;
- the specific engine and ambient operating conditions for which the deficiency is being requested (i.e. temperature ranges, humidity ranges, altitude ranges);
- the frequency with which the deficiency will be used (i.e. % operation);
- if applicable, the specific emission control strategy parameters that are modulated in response to the deficiency and the purpose of that modulation;
- if applicable, a full description of the auxiliary emission control strategy which will be used to maintain emissions at the lowest practical level; and
- data on the lowest practical emission level.
- WNTE Exemptions

**9. WNTE Exemptions**

A WNTE Exemption is a set of technical conditions specified by a Contracting Party under which the WNTE limits would not apply. A WNTE exemption shall apply to all engine manufacturers.

A Contracting Party may decide to provide a WNTE exemption, in particular with the introduction of more stringent emission limits. A WNTE exemption may be necessary if a Contracting Party determines that certain operation within the WNTE cannot achieve the WNTE emission limits. In such a case, the Contracting Party may determine that it is not necessary for engine manufacturers to request a WNTE deficiency for such operation, and that the granting of a WNTE exemption is appropriate. The Contracting Party can determine both the scope of the exemption with respect to the WNTE requirements, as well as the period of time for which the exemption is applicable.

This provision for Contracting Party specified WNTE exemptions is considered to be a transitional measure during the period of time when emission limits are not harmonized. With harmonized emission limits the WNTE Exemptions shall be specified in the gtr or eliminated, furthermore, the exemptions specified by a Contracting Party in its regional legislation should come to an end.

**Editorial Comment: compare this language to WHDC and OBD gtrs regarding future amendments to gtrs and the establishment of global emission limits.**

**10. Documentation for Application for Compliance *(or Annex)***

**10.1 Statement of WNTE compliance.**

The manufacturer shall provide a statement in the application for certification that the engine complies with the applicable WNTE emission limits in Section 5, when operating under the conditions ~~which may reasonably be encountered in normal vehicle operation and use, and~~ which are subject to the requirements of the WNTE regulation. For contracting parties that operate a type approval system for vehicles and/or engines, this compliance statement is the beginning of the authorization procedure. In addition to this statement, contracting parties may require verification of compliance with the WNTE limits through the tests and certification procedures defined in section 10.3.

**10.1.1** Example statement of compliance.
The manufacturer shall provide a statement which affirms that the engines and the engines control strategies within this engine family complies with the applicable WNTE emission limits when operating under all conditions which may reasonably be encountered in normal vehicle operation and use, and which are subject to the requirements of the WNTE regulation. The manufacturer shall make this statement on the

basis of the engines emissions performance over a wide range of operating and ambient conditions.

The following is an example compliance statement:
"(Name of manufacturer) attests that the engines within this engine family comply with the applicable WNTE emission limits when operating under all conditions which may reasonably be encountered in normal vehicle operation and use, and which are subject to the requirements of the WNTE regulation. (Name of manufacturer) makes this statement in good faith, after having performed an appropriate engineering evaluation of the emissions performance of the engines within the engine family over the applicable range of operating and ambient conditions."

**Editorial Comment: status of compliance statement for the type approval process to be considered further**

**10.2 Basis for WNTE compliance statement.**

The manufacturer shall maintain records at the manufacturers facility which contain all test data, engineering analyses, and other information which provides the basis for this statement, where such information exists. The manufacturer must provide such information to the Certification or Type Approval Authority upon request.

The basis for the WNTE Compliance Statement shall be determined by the engine or vehicle manufacturer, and shall rely on data, engineering analysis, and other information sufficient for the manufacturer to have the confidence necessary to ensure compliance with the WNTE portions of the OCE gtr are met. As an example, the basis for the Compliance Statement could include WHTC data, WHSC data or other data from laboratory testing (e.g., an emissions map of similar resolution to the engine's base fuel injection timing map) under the conditions covered by the WNTE. Data generated from in-use highway vehicle testing could also be part of this combination, or depending upon the extent of the in-use data, it could be the primary basis for the Compliance Statement.

~~The contracting party may require a manufacturer to maintain records at the manufacturer's facility which contain all test data, engineering analyses, and other information which provides the basis for this statement, where such information exists. Upon request of the Certification or Type Approval Authority, the manufacturer shall provide such records to the Authority.~~

**10.3 Optional Type Approval/Certification WNTE Data Submission Requirements**

At the option of the Contracting Party, WNTE compliance may be based on the test results of sections 7.4 and 7.5 at the time of certification or type approval.

**10.4 Documentation requirements related to Emission Control System**

Editorial Comment: Include language in here about confidentiality (reference OBD gtr Section 8.1.1 Module B).
Editorial Comment: US EPA to review documentary requirements in the US regulations for comparative purposes.

The manufacturer shall provide a documentation package that describes any element of design and emission control strategy of the engine system and the means by which it controls its output variables, whether that control is direct or indirect.

When a contracting party adopts this gtr into its implementing regulation it is recommended they consider documentation requirements related to AECS, BECS, Emission Control Strategy … as described below:

(a) the formal documentation package, which shall be supplied to the technical service at the time of submission of the type-approval/certification application, shall include a full description of the emission control strategy. This documentation may be brief, provided that it exhibits evidence that all outputs permitted by a matrix obtained from the range of control of the individual unit inputs have been identified. This information shall be attached to the documentation required in [CERTIFICATION SECTION];

(b) additional material that shows the parameters that are modified by any auxiliary emission control strategy (AECS) and the boundary conditions under which the AECS operates. The additional material shall include a description of the fuel system control logic, timing strategies and switch points during all modes of operation. The additional material shall also contain a justification for the use of any AECS and include additional material and test data to demonstrate the effect on exhaust emissions of any AECS installed to the engine or on the vehicle. The justification for the use of an AECS may be based on test data and/or sound engineering analysis. This additional material shall be made available to the type-approval authority on request.

## Annex I

## Example of WNTE Limits for Selected Limit Values

| Pollutant | Emission Limit [g/kWh] | WNTE Component [g/kWh] | WNTE Limit [g/kWh] |
|---|---|---|---|
| NOx | 3.5 | 0.8 | 4.3 |
| | 2.0 | 0.6 | 2.6 |
| | 1.5 | 0.5 | 2.0 |
| | 0.70 | 0.29 | 0.99 |
| | 0.40 | 0.21 | 0.61 |
| | 0.30 | 0.18 | 0.48 |
| PM | 0.13 | 0.04 | 0.17 |
| | 0.10 | 0.03 | 0.13 |
| | 0.07 | 0.02 | 0.09 |
| | 0.03 | 0.01 | 0.04 |
| | 0.02 | 0.01 | 0.03 |
| | 0.01 | 0.01 | 0.02 |
| HC | 0.78 | 0.19 | 0.97 |
| | 0.55 | 0.14 | 0.69 |
| | 0.46 | 0.13 | 0.59 |
| | 0.25 | 0.10 | 0.35 |
| | 0.19 | 0.10 | 0.29 |
| | 0.16 | 0.10 | 0.26 |
| CO | 20.8 | 13.1 | 33.9 |
| | 5.5 | 1.5 | 7.0 |
| | 4.0 | 1.0 | 5.0 |
| | 3.0 | 0.7 | 3.7 |
| | 2.2 | 0.5 | 2.7 |
| | 1.5 | 0.4 | 1.9 |