Draft Outline for NTE GTR
September 8, 2004

A. Statement of Technical Rationale and Justification- A summary of the report that the working group is required to prepare when it recommends the global technical regulation (GTR), including a synopsis of the GTRs:

1. Technical and economic feasibility;
2.Anticipated benefits; and,
3. Potential cost effectiveness

B. Text of Regulations

1. Scope an purpose - A statement that appears at the beginning of the gtr that describes the particular aspect of the environment addressed by the GTR.

2. Application - Description of the types of wheeled vehicles that are subject to the GTR

3. Definitions - ADD AS NEEDED.

4. General requirements - This section should be short and apply to all vehicles covered by the regulation. This section could include labeling requirements.

5. Performance Requirements NTE emissions standards

5.1 1.5 times the applicable emissions standards specified in STANDARDS SECTION

5.1.1 NOx
5.1.2 PM
5.1.3 HC
5.1.4 CO
5.1.5 Convention for rounding emissions results (***describe convention applied by U.S.***)

5.2 General applicability

5.2.1 Engine operation within the load and speed range specified by Section 5.2
5.2.2 Ambient operating conditions specified in Section 7.0
5.2.3 Test procedures described in Section 10.0
5.2.4 For EGR-equipped engines, NTE limits not dot apply under conditions described in Section **10.6**

BACKGROUND: *(Please Note: U.S. bias in testing descriptions in this outline....as part o editorial effort we should strive for neutral language or describe both)* FTP and SET apply averaging standard over the prescribed cycles. NTE designed to limit maximum emissions a wide variety of engine operation where the averaging period can be as short as 30 seconds NTE multiplier adjusts FTP standard create a reasonable limit. As FTP standards are significantly reduced 2007-2010, 1.5 multiplier replaces the 1.25 multiplier to maintain a reasonable absolute maximum emissions limit.

6.0 Documentation for Application for Compliance *(or Annex)*

6.1 NTE compliance statement

6.1.1 EG. "These engines will comply with the NTE limits specified Section 5.1 when operated under all conditions which may reasonabl encountered in normal vehicle operation and use

6.1.2 Manufacturer must maintain all records which contain all test engineering analysis, and other information which provides the basis the statement

6.1.3 Records made available upon request

BACKGROUND: NTE compliance statement submitted at certification in lieu of actual N testing data. Manufacturer may be asked to demonstrate basis on which it made compliance statement. Demonstration may be made by providing laboratory data and extrapolating resu NTE conditions not represented in the lab.

6.2 For EGR engines, description of control system used to comply with co temperature operating exclusion in Section 5.2.4

6.2.1 Includes but not limited to how control system will identify the conditions described in Section 10.6 and limit to access the exclusion during normal vehicle operation.

BACKGROUND: Manufacturer must demonstrate the cold operation carve-out is limited to the operating conditions where allowed.

7.0 Applicable ambient operating regions

7.1 Option A: All humidity and temperature with altitude limit

7.1.1 Altitude limit = 5,500 feet

7.2 Option B: All humidity w/ altitude limit, ambient temperature as functio altitude

7.2.1 Altitude limit = 5,500 feet

7.2.2 Temp = -0.00254 x Altitude + 100

7.3 Temperature and humidity correction factors Section 10.5

BACKGROUND: Conditions cover the predominance of vehicle miles trav Emissions control has been demonstrated effective at least up to these condi

8.0 NTE deficiencies

8.1 General
- **8.1.1** Allows NTE compliance without meeting every requirement
- **8.1.2** Applies to model years 2007 - 2013 (USA)

8.2 Approval criteria
- **8.2.1** Compliance unreasonable or infeasible given
  - **8.2.1.1** Hardware
  - **8.2.1.2** Lead time
  - **8.2.1.3** Production cycles including phase-in and phase out c engine, vehicle, and computer designs
- **8.2.2** Results in only minor deviation from NTE compliance
- **8.2.3** Occurs only under limited conditions, such as extreme ambien temperatures and/or severe operation where vehicles do not accumul significant mileage.
- **8.2.4** Engine equipped with functioning emissions control hardware needed for compliance

8.3 Process to apply
- **8.3.1** Deficiencies considered during engine certification
  - **8.3.1.1** Requests suggested/required 2 years prior to model y being certified
  - **8.3.1.2** Requests made on engine model or power rating basi
- **8.3.2** Deficiency descriptions
  - **8.3.2.1** Nature of deficiency
  - **8.3.2.2** Pollutants affected
  - **8.3.2.3** Engineering efforts to overcome deficiency
  - **8.3.2.4** Specific operating conditions where deficiency neede
    - **3.3.2.4.1** Altitude, temperature, humidity, engine loac speed, etc.
  - **8.3.2.5** Auxiliary emissions control devices involved and use maintain emissions to lowest practical level, emissions level
  - **8.3.2.6** Lowest practical emissions levels
  - **8.3.2.7** Other

8.4 Limitations and Prohibitions
- **8.4.1** Each deficiency limited to one model year unless
  - **8.4.1.1** Unreasonable hardware or software modifications necessary
  - **8.4.1.2** Acceptable level of effort towards compliance demonstrated
- **8.4.2** Not granted retroactively for engines already certified
- **8.4.3** Only 3 deficiencies per engine family for model years 2010-2(
- **8.4.4** More than 3 deficiencies may be approved upon complying wi
  - **8.4.4.1** Criteria in Section **8.2** and any additional criteria dee appropriate
  - **8.4.3.2** Additional conditions as deemed appropriate

BACKGROUND: Intended for temporary, unforeseen events beyond the control of the eng

manufacturer such as the readiness of an emission control system supplier’s product, the lea
time needed to integrate a new emissions control system design in to vehicles, or limitation
the capabilities of state-of-the-art emissions control systems under limited operating condit

9.0 Smoke opacity requirements

9.1 Smoke standards for traditional FTP full and partial smoke opacity tests incorporated by reference (See 40 CFR Part 86.004-11 for standards and 40 Part 40 Subpart I for test procedures) (USA)

9.2 Optional smoke standards for filter-type smoke meters during operation defined in Section 10.2

9.2.1 Steady-state operation filter smoke number of 1.0; or

9.2.2 30 second transient test average opacity limit of 4% for a 5 inc path; or

9.2.3 10 second steady-state test average opacity limit of 4% for a 5 path

9.2.4 Emissions generated under conditions in Sections 10.1 through and calculated using procedures in Section 10.7

9.3 Refer to test procedures (40 CFR Part 40 Subpart I) for full and partial s opacity meters as described in traditional FTP regulations for heavy-duty en

9.4 Refer to test procedures for filter-type smoke meters as described in Sec 10.7.2

10.0 NTE Test Procedures

10.1 Purpose and general overview

10.1.1 To monitor emissions performance within a broad range of e speed and load points under conditions which can reasonably be exp to be encounter during normal vehicle operation and use.

10.2 NTE control area (see Appendix 1)

10.2.1 Operating speed

10.2.1.1 Operating speeds greater than speed calculate by

$$n_{lo}+0.15x(n_{hi}-n_{lo})$$

where n_{lo} and n_{hi} are defined by the SET or Euro III test proc

10.2.2 Operating load

10.2.2.1 All engine load points greater than 30% or more of maximum torque value produced by the engine

10.2.3 Operating power

10.2.3.1 All speed and load points greater than 30% of the maximum power value produced by the the engine

10.2.4 5% minimum BSFC requirement

10.2.4.1 NTE zone must include all operating load and spee points within 5 percent of minimum BSFC.

BACKGROUND: Minimum speed, load, and power determined by desire to employ a sin NTE standard over entire NTE zone. Nature of break specific emissions causes emissions increase significantly as power decreases. 5% BSFC requirement designed to ensure NTE captures emissions performance during operation where emissions control is most likely an significantly traded for fuel economy gains.

10.3 Exclusion from certain NTE operating points

10.3.1 Natural gas and other non-diesel fuel

10.3.1.1 Manufacturer may petition if can demonstrate engir not expected to operate at such points in normal vehicle oper and use

10.3.2 Petroleum-fueled diesel cycle engine

10.3.2.1 Manufacturer may petition if can demonstrate engir not capable of operating at such points in normal vehicle ope and use

10.3.3 5.0% NTE carve-out

10.3.3.1 Manufacturer may designate a region of operation v the NTE zone where it demonstrates that engine operates no than 5% of the engine's total in-use operation.

10.3.3.2 Any NTE sampling period which contains more tha of its operation within the designated region will not be consi when evaluating whether the engine complies with the NTE standard

10.3.3.3 5% interval is calculated on a time weighted basis; more than 2 seconds out of 40 seconds

10.3.3.4 5% boundary must be generally elliptical or rectang shape and touch an outer limit of the NTE zone

10.3.3.5 Manufacturer demonstration must include in-use operational data at a minimum

BACKGROUND: In order to manage the stringency and feasibility of the standard, manufacturers should not be required to optimize emissions control under conditions where vehicles are incapable of operating, or where normal operation is rare. FTP provides for su consideration through an averaging standard where high and low emissions occur over vari parts of the test cycle.

10.4 Emissions limits within NTE control area

10.4.1 When engine operates within region defined by Section 10.2, emissions may not exceed limits defined in Section 5.1 when operati averaged over an interval of 30 seconds or greater, unless a long peri dictated by Section 10.4.2

10.4.2 NTE averaging period when a particulate filter regeneration occurs

10.4.2.1 Averaging period must be at least as long as the tim between the events multiplied by the number of full regenera events with in the sampling period

10.4.2.2 Requires engines be equipped with filters having di regeneration events and use an electric signal to indicate the a regeneration event

BACKGROUND: Intent is to ***provide an averaging period of sufficient length to allow f instantaneous emissions spikes that may accompany regeneration events.*** EPA guidance

issued **DATE** explains this process more fully.

10.4.3 HC and NOx NTE limits during warm-up of NOx or HC aftertreatment

10.4.3.1 Applies to engines using aftertreatment system(s) to reduce NOx and/or NMHC emissions

10.4.3.2 NTE NOx and NMHC limits do not apply when exh gas temperature, measured within 12 inches of the outlet of th aftertreatment, is less than 250 deg-C

10.4.3.3 For multi-bed aftertreatment system, the temperature the outlet of the device with the highest flow rate is used to determine whether 250 deg-C criteria has been met

BACKGROUND: Address currently available aftertreatment devices generally not effectiv reducing NOX and/or NMHC below exhaust gas temperature of 250 deg-C.

10.5 Ambient emissions corrections for operation within the conditions spe in Section 7.0

10.5.1 Measured data is corrected based on the ambient conditions u which the NTE test is conducted

10.5.2 NOx humidity correction

10.5.2.1 Corrected to a standard humidity level of 50 grains (g/kg) if humidity of intake air below 50 grains

10.5.2.2 Corrected to 75 grains (10.71 g/kg) if humidity of in air above 75 grains

10.5.3 NOx and PM ambient air temperature correction

10.5.3.1 For use with Option A described in Section 7.1

10.5.3.1.1 Corrected to 55 deg-F (12.8 deg-C) for am temperatures below 55 deg-F

10.5.3.1.2 Corrected to 95 deg-F (35.0 deg-C) for am temperatures above 95 deg-F

10.5.3.2 For use with Option B described in Section 7.2

10.5.3.2.1 Corrected to 55 deg-F (12.8 deg-C) for am temperatures below 55 deg-F

10.5.4 Operating Conditions where no correction allowed

10.5.4.1 Humidity between 50 and 75 grains

10.5.4.2 Temperature between 55 and 95 deg-F

10.5.5 Process for determining correction factors

10.5.5.1 Good engineering judgement subject to approval

BACKGROUND: both high and low temperatures may be corrected when the all-temperat up to 5,500 ft NTE (Option A) is selected. Correction at higher temperatures (above 95 deg 34.0 deg-C) is not allowed with Option B because the altitude requirement is less stringent compared to Option A at higher temperatures.

10.6 Cold ambient temperature NTE exclusion for engines using EGR techn

10.6.1 Definition of cold temperature operation

10.6.1.1 Intake manifold temperature (IMT) criteria

10.6.1.1.1 IMT less than or equal to the temperature defined by the following relationship between IMT an absolute intake manifold pressure (IMP)

P = 0.0875 x IMT - 7.75

Where P = absolute intake manifold pressure in bars
IMT = intake manifold temperature in deg-F

10.6.1.2 Engine coolant temperature (ECT) criteria

10.6.1.2.1 Engine coolant less than or equal to the temperature defined by the following relationship bet ECT and absolute IMP

P = 0.0778 x ECT - 9.8889

Where P = absolute intake manifold pressure in bars
ECT = engine coolant temperature in deg-F

BACKGROUND: Cold ambient temperature exclusion addresses intake system corrosion condensation of EGR gases can cause. Cold temperature control strategies still subject to auxiliary emissions control device approval under defeat device provisions.

10.7 Smoke measurement test procedures

10.7.1 Procedures for full-flow opacity meters

10.7.1.1 Applicability: Steady-state and transient operation

10.7.1.2 Required equipment

10.7.1.3 Percent opacity equivalent reporting requirement fo flow opacity measurements

10.7.1.4 Zero and full-scale (100% opacity) span adjustment

10.7.1.5 Post-test zero and full-scale span check requiremen

10.7.1.6 Opacimeter calibration and linearity checks

10.7.2 Procedures for filter-type smoke meters

10.7.2.1 Applicability: Steady-state operation only

10.7.2.2 Recommended equipment

10.7.2.3 Filter smoke number (FSN) reporting requirement

10.7.2.4 Calibration requirements

10.7.3 Procedures for partial-flow opacity meters

10.7.3.1 Percent opacity equivalent reporting requirement fo Partial-flow opacity measurements

10.7.3.2 Opacimeter calibration and linearity checks

10.7.4 Optional replicate smoke test procedure

10.7.4.1 Purpose

10.7.4.2 Run 3 tests and report emissions as average of all va tests

10.7.5 Minimum transient averaging period

10.7.5.1 30 seconds

10.7.6 Minimum data sampling rate
10.7.6.1 One sample per second
10.7.7 Spacing of emissions data sampled
10.7.7.1 Equally spaced

Appendix 1 – NTE Control Area