

October 20, 2017

Shri Abhay Damle
Joint Secretary (Transport)
Ministry of Road Transport and Highways
Transport Bhawan, Parliament Street
New Delhi - 110011

SUB: Comments and suggestions on draft notification of Bharat Stage (CEM/TREM) IV and V emission standards for agricultural tractors, construction equipment vehicles, and combine harvesters

Dear Mr. Damle,

I am writing to express the strong support of the International Council on Clean Transportation (ICCT) for the Government of India's proposal to adopt Bharat Stage (CEV/TREM) IV and V emission standards for new diesel driven agricultural tractors, construction equipment vehicles, and combine harvesters by 2020 and 2023 respectively. **India should be congratulated and recognized as a global leader for establishing a pathway to Euro Stage V equivalent standards.**

The ICCT is an independent research organization that provides unbiased technical research and analysis to regulators focused on improving the environmental performance and energy efficiency of the transportation sector. The ICCT promotes best practices and comprehensive solutions to improve vehicle emissions and efficiency, increase fuel quality and sustainability of alternative fuels, reduce pollution from the in-use fleet, and curtail emissions of local air pollutants and greenhouse gases (GHG) from international goods movement.

The proposed BS (CEV/TREM) IV and V standards are an important step forward in India's efforts to reduce harmful emissions from non-road sources and mitigate the impacts of air pollution on human health. The proposal is consistent with other recent actions taken by the government to control emissions from new on-road vehicles through the adoption of Bharat Stage VI emission standards and to ensure nation-wide availability of low sulfur diesel fuels. The proposed BS (CEV/TREM) IV and V standards would extend these efforts to new agricultural tractors, construction equipment vehicles, and combine harvesters. Our research has shown these sources to be an important, and growing, source of air pollutant emissions in

the country. Thus, these actions are welcome and a necessary component of India's ongoing efforts to reduce the negative impacts of poor air quality on its citizens.

The proposed standards are in general alignment with the Euro Stage IV and V standards for engines used in non-road mobile machinery. Euro Stage V standards, which will be in force beginning in 2018, represent the current international best practice for controlling emissions from non-road diesel engines. Importantly, Euro Stage V standards include stringent particulate matter and particle number emission limits for engines with rated power between 19 and 560 kW. These limits are set at a level which will ensure diesel particulate filters, the key technology needed to effectively control particulate matter emissions from diesel engines, are applied in Stage V engines in this size range.

If the draft BS (CEV/TREM) IV and V emission standard proposal is adopted, India will become the first region outside of the EU to adopt Stage V equivalent emissions standards for non-road diesel engines. Under the proposed implementation timeline, India will, by 2023, move ahead of countries such as the United States and China in its control of emissions from new diesel powered agricultural tractors, construction equipment vehicles, and combine harvesters. The Indian government should be commended for taking this step.

Several elements of the proposed BS (CEV/TREM) IV and V regulations have not been defined fully in the draft regulations even though they are fully specified in the Euro regulations. These elements refer to a forthcoming Automotive Industry Standard (AIS) no. 137. Due to the significance of these elements to the overall integrity of BS IV and V regulations, it is important that AIS 137 should faithfully adopt the corresponding elements from the Euro regulations, and a draft of AIS 137 released for public comments as soon as possible.

Specific **comments on the draft notification** are as follows:

1. Table 1: No Stage IV emission standards are proposed for engines with rated power less than 37 kW. Our interpretation is that agricultural tractors and construction equipment vehicles using engines in this size range will continue to be subject to Trem IIIA and BS-III emission limits, respectively, until the implementation of BS (CEV/TREM) V standards in 2023. As engines in this size range are widespread in the Indian market, particularly in the agricultural sector, we recommend supplementing proposed Stage IV standards with additional emission limits for these engines. Our detailed recommendation is included below.
2. Table 2: Proposed BS (CEV/TREM) V emission limits follow those adopted in the Euro Stage V regulation, with the exception of a number instances where the number of significant digits does not match. As this affects the relative

stringency of the standards, we recommended adopting the Euro Stage V limits exactly. This would mean changing the PM limit for $P < 8$ and $8 \leq P < 19$ engine categories from 0.4 to 0.40 g/kWh, the NO_x limit for $56 \leq P < 130$ and $130 \leq P < 560$ engine categories from 0.4 to 0.40 g/kWh, and the NO_x limit for the $P > 560$ engine category from 3.5 to 3.50 g/kWh.

3. The draft notification includes ammonia emission limits for engines equipped with SCR systems of 25 ppm for engine power categories less than 56 kW and 10 ppm for engine power categories above 56 kW. While we acknowledge that it is unlikely that SCR systems will be used in engines smaller than 56 kW to meet BS (CEV/TREM) IV and V emission norms, we recommend adopting an ammonia emission limit of 10 ppm for all engine sizes, as is the requirement in Euro Stage IV and V regulations.
4. In-service conformity test requirements are proposed only for those vehicles manufactured after 1st April 2026. In-service testing using portable emission measurement systems (PEMS) is an important regulatory component and necessary to verify that real-world emissions are in line with emission norms. As such, all BS (CEV/TREM) V certified engines should be subject to this requirement.
5. The draft notification allows for a 6-month **grace period** following the implementation dates of BS (CEV/TREM) IV and V standards, during which vehicles produced prior to the implementation date can be registered. While some flexibility should be provided to manufacturers, we believe the proposed 6 months period is not necessary given the relatively low sales volumes of non-road engines as compared to, for example, on-road vehicles. **We recommend shortening this period to 3 months.**
6. A number of important provisions are not fully specified in the draft notification. These include, but are not limited to, in-service conformity testing using PEMS, off-cycle emissions testing, conformity of production procedures, and technical requirements for NO_x and PM control measures. These elements are critical to ensuring the effectiveness of the regulation. The importance of in-service conformity testing using PEMS and off-cycle test requirements, in particular, has been demonstrated by the relative success of the Euro VI regulation in controlling emissions from on-road heavy-duty vehicles in Europe. The EU has supplemented the Stage V regulation for engines used in non-road mobile machinery with delegated and

implementing regulations addressing these regulatory components^{1,2,3}. It is critical that the AIS 137 adopt these provisions faithfully.

The proposed BS (CEV/TREM) IV and V emission standards are a strong step forward in India's efforts to reduce the environmental impacts of non-road vehicles and equipment. However, we take this opportunity to point out a number of areas where further action is needed to better control emissions from non-road diesel engines:

Control of emissions from engines smaller than 37 kW

Proposed BS (CEV/TREM) IV standards follow Euro Stage IV standards for non-road mobile machinery. In setting Stage IV standards, the EU did not adopt new standards for engines between 19 and 37 kW (engines below 19 kW were unregulated in the EU prior to Stage V). Likewise, the proposed BS (CEV/TREM) IV standards do not include new emission limits for engines in this power category. Relative to Europe, engines in this size range are much more prevalent in the Indian market, particularly in the agricultural sector. In this case, simply adopting European standards does not provide an effective solution for India. Under the current proposal, no further control of emissions from new agricultural tractors and construction equipment vehicles equipped with engines smaller than 37 kW is required until 2023, when BS (CEV/TREM) V standards come online. This will substantially delay the introduction of effective emission control solutions for engines used in the majority of Indian agricultural tractors and other, similarly sized non-road equipment. To address this shortcoming, we recommend that India supplement the proposed BS (CEV/TREM) IV standards with US Tier 4f equivalent standards for engines smaller than 37 kW. Specifically, we suggest amending Table 1 of the draft notification with the following rows:

¹ Commission Delegated Regulation (EU) 2017/654 of 19 December 2016 supplementing Regulation (EU) 2016/1628 of the European Parliament and of the Council with regard to technical and general requirements relating to emission limits and type-approval for internal combustion engines for non-road mobile machinery. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R0654>

² Commission Delegated Regulation (EU) 2017/655 of 19 December 2016 supplementing Regulation (EU) 2016/1628 of the European Parliament and of the Council with regard to monitoring of gaseous pollutant emissions from in-service internal combustion engines installed in non-road mobile machinery. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R0655>

³ Commission Implementing Regulation (EU) 2017/656 of 19 December 2016 laying down the administrative requirements relating to emission limits and type-approval of internal combustion engines for non-road mobile machinery in accordance with Regulation (EU) 2016/1628 of the European Parliament and of the Council. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R0656>

	Applicable with effect from	CO	HC	NOx	PM	Test Cycle
Category, kw		g/kWh				
P < 8	1 st October, 2020	8.0	7.5 (HC+NOx)		0.4	NRSC
8 ≤ P < 19		6.6	7.5 (HC+NOx)		0.4	NRSC
19 ≤ P < 37		5.5	4.7 (HC+NOx)		0.03	NRSC & NRTC

Expansion of regulatory scope to unregulated non-road equipment types

India's approach to regulating non-road sources excludes important construction equipment types, which are not subject to emissions standards. The proposed BS (CEV/TREM) IV and V standards apply to agricultural tractors, construction equipment vehicles, and combine harvesters. In the Central Motor Vehicle Rules, construction equipment vehicles are defined as:

"Means rubber tyred (including pneumatic tyred), rubber padded or steel drum wheel mounted, self-propelled, excavator, loader, backhoe, compactor roller, dumper, motor grader, mobile crane, dozer, fork lift truck, self-loading concrete mixer or any other construction equipment vehicle or combination thereof designed for off-highway operations in mining, industrial undertaking, irrigation and general construction but modified and manufactured with "on or off" or "on and off" highway capabilities".⁴

Tracked equipment, such as crawler excavators and crawler dozers are not considered to be construction equipment vehicles under this definition and are thus excluded from emissions regulation. In 2015, crawler excavators accounted for 23% of the construction equipment market and are projected to be the fastest growing equipment type through 2020⁵.

As construction equipment vehicles are controlled through increasingly stringent emission standards, the relative contribution of these unregulated equipment types to emissions of harmful air pollutants will increase substantially. Indian regulators should take action to extend the requirements included in this proposal to these unregulated equipment types. We recommend revising the definition of construction equipment vehicles in all pertinent regulatory documentation as follows:

⁴ Rule 2[(ca) of the Central Motor Vehicles Act, 1989 (http://morth.nic.in/writereaddata/linkimages/SSL_rule1_26983462054.pdf) and AIS-053 Automotive Vehicles – Types – Terminology (https://araiindia.com/hmr/Control/AIS/11292016102244AM AIS_053.PDF)

⁵ Off-Highway Research. The construction equipment industry in India: Mid-year review. August 2016, Issue 104.

*“Means rubber tyred (including pneumatic tyred), rubber padded [, **track laying,**] or steel drum wheel mounted, self propelled, excavator, loader, backhoe, compactor roller, dumper, motor grader, mobile crane, dozer, fork lift truck, self loading concrete mixer or any other construction equipment vehicle or combination thereof designed for off-highway operations in mining, industrial undertaking, irrigation and general construction [.] ~~but modified and manufactured with “on or off” or “on and off” highway capabilities.~~*

Next generation standards

While Stage V emission standards for non-road diesel engines are the current international best practice, they continue to lag behind world class standards for on-road engines. In particular, Stage V NOx standards for small engines do not match the stringency of Euro VI regulations for on-road vehicles. Without further action to address these shortcomings and bring emission requirements for non-road engines in line with those for on-road vehicles, India will be limited in its capacity to deliver long-term reductions in NOx emissions from non-road agricultural tractors and construction equipment. Future rulemaking should be undertaken with the goal of bringing emissions standards for non-road vehicles and equipment into alignment with those for on-road vehicles.

In summary, we reiterate our strong support of the International Council on Clean Transportation (ICCT) for the Government of India's proposal to adopt Bharat Stage (CEV/TREM) IV and V emission standards for new diesel driven agricultural tractors, construction equipment vehicles, and combine harvesters.

Sincerely,

Anup p. Bandivadekar

Anup Bandivadekar

Passenger Vehicles Program Director and India Lead

CC:

1. Shri Nitin Gadkari, Minister of Road Transport and Highways
2. Secretary, Ministry of Road Transport and Highways
3. Director, Automotive Research Association of India