Engine Manufacturers Association

Nonroad Engines & Fuels
Future Regulations

Presented to MSTRS - Nonroad Work Group
January 16, 2001

Discussion Topics

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  - Test Procedures
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Background Information
Nonroad Industry Complexity

- Regulation of the nonroad industry is complicated by the complex nature of the industry

- The nonroad industry includes:
  - Loose engine suppliers, independent equipment builders, and integrated manufacturers
  - Domestic, foreign, multi-national, joint ventures
  - Large capital goods manufacturers and small businesses
  - Producers of a single product for worldwide consumption
  - Direct sellers and those with multiple, complex distribution channels

Background Information
Nonroad Industry Complexity continued

- Nonroad engines are produced:
  - In very low volumes (10-20 units), for specialized applications
  - In higher volumes (4000 - 5000 units), for common applications (e.g. backhoe, skidder, loader, agricultural tractor)
  - In power ranges from < 5 kW to 2500+ kW (<8 Hp to 3000+ Hp)

- Relatively small number of engine manufacturers with thousands of equipment manufacturer customers around the world

Background Information
Operating Characteristics of Engines

- Regulation of the nonroad industry is complicated by the broad range of operating characteristics of nonroad engines

- Nonroad engines power the equipment's function and often move the equipment

- Nonroad engines operate:
  - In adverse environments
  - At steady state and transient operating modes
  - At high power and low speeds
  - In urban and non-urban settings
  - At slow speeds with no ram air effect

Key Nonroad Issues

- Key nonroad issues:
  - Technological Feasibility
  - Leadtime
  - Stability
  - Test Procedures
  - Harmonization
  - Flexibility
  - Customer Satisfaction
  - Systems Approach to Future Regulations / Role of Fuels
- These principles were recognized by EPA and ARB in the Nonroad Statement of Principles (SOP)
- EPA adopted these principles as the governing criteria for the 2001 Feasibility Review

Key Nonroad Issues
Technological Feasibility

- Regulations must take into consideration the need to:
  - Provide engine and equipment manufacturers an adequate period in which to recoup the capital investment required to achieve the previous standards
  - Provide engine manufacturers no less than four full model years leadtime
  - Assess the costs and leadtime associated with redesigning equipment to accommodate new standards
  - Assess the suitability, effectiveness and cost of transferring on-highway engine technology to nonroad engines and equipment

- Regulations must recognize the integral link between fuel specifications, emission standards, and engine system technology

Key Nonroad Issues
Leadtime

- Sufficient time is necessary to allow engine manufacturers to cost-effectively research, develop and produce lower-emitting engines with assurance of compliance, durability, performance, and customer satisfaction

- Additional leadtime is necessary for equipment manufacturers depending on:
  - The need for equipment redesign
  - The cost and technical difficulty of equipment redesign
  - The number of equipment models affected
  - The availability of equipment flexibility provisions

Key Nonroad Issues
Stability

- Regulations should be stable for a sufficient time to allow manufacturers to recoup capital investment in technology required to achieve previous standards

- SOP recognizes that the adequacy of the period of stability between the previous regulations and the regulations under review, is premised on the new regulations not requiring significant equipment redesign

Key Nonroad Issues
Test Procedures

- The introduction of new test procedures imposes significant burdens on engine manufacturers:
  - Capital cost of new test cells and equipment
  - Time and resources (financial and human) associated with developing new test cells and equipment (e.g. transient test, NTE, all conditions)
  - Time and resources (financial and human) associated with developing engines on new test procedures
  - Risk of losing harmonized test procedures

Key Nonroad Issues
Harmonization

- EMA seeks worldwide harmonization of emission standards, test procedures and certification protocols

- Harmonization:
  - Promotes a level, competitive playing field in the world marketplace
  - Recognizes the international nature of the nonroad industry and market
  - Ensures consistent treatment of product
  - Avoids unnecessary drains on limited human, capital and financial resources
  - Minimizes the potential for localized limitations of product offerings
  - Reduces complexity of manufacturing, marketing, distribution and servicing
  - Provides the most cost-effective emission reductions

Key Nonroad Issues
Flexibility

- Flexibility provisions, including staggering of standards, engine and equipment manufacturer phase-ins and averaging, banking and trading, are vital to facilitating a smooth progression to more-stringent emission standards
- The diversity of engine models and equipment applications, many with small markets, make it difficult to rapidly and frequently implement design changes across wide product lines
- Changes in engine designs can create major difficulties for equipment makers with low volume models, diverse product lines, or inadequate leadtime to respond to the changes
- The possible elimination of engine or equipment models creates the potential for market disruptions

Key Nonroad Issues
Customer Satisfaction

- Customer satisfaction with the level of performance offered by nonroad engines and equipment is critical
- Dissatisfaction will foster mistrust of new technologies
- Dissatisfaction may result in:
  - Diminished turnover of old, higher emitting engine technology
  - Prebuys of older, less advanced engine technology
  - Failure to achieve anticipated emission benefits

Key Nonroad Issues

Systems Approach to Future Regs / Role of Fuels

- Fuel specifications, emission standards, and engine system technology are integrally linked:
  - Current nonroad fuel sulfur levels - 3300 ppm average
    - supports most internal engine changes
    - barrier to the use of EGR due to durability issues
    - prevents significant PM reductions
    - barrier to emissions reductions below Tier 2 levels
  - Current on-highway fuel sulfur levels - 500 ppm
    - allows the use of EGR
    - fails to eliminate durability concerns associated with EGR
    - on-highway engines equipped with EGR will operate the majority of their life on 15 ppm fuel
  - Future on-highway fuel sulfur levels - 15 ppm
    - reduces PM emissions from the entire fleet
    - enables the use of EGR and NOx and PM aftertreatment technologies
    - enables the use of retrofit technologies

Conclusions

- New emission control technologies can only be applied to the nonroad market if they are technologically feasible taking into consideration:
  - Leadtime
  - Stability
  - Costs
  - Equipment redesign
  - Impact of transferred technologies
- Changes to test procedures can only be made if there is:
  - Harmonization
  - A well-planned and well-coordinated test program to establish the need, adequacy and accuracy of test procedures
  - Leadtime
  - Stability

Conclusions continued

- Future regulations must promote global harmonization. Manufacturers must be able to:
  - Design once
  - Certify once
  - Sell worldwide
- Flexibility provisions must be provided
- Fuel quality improvements are required