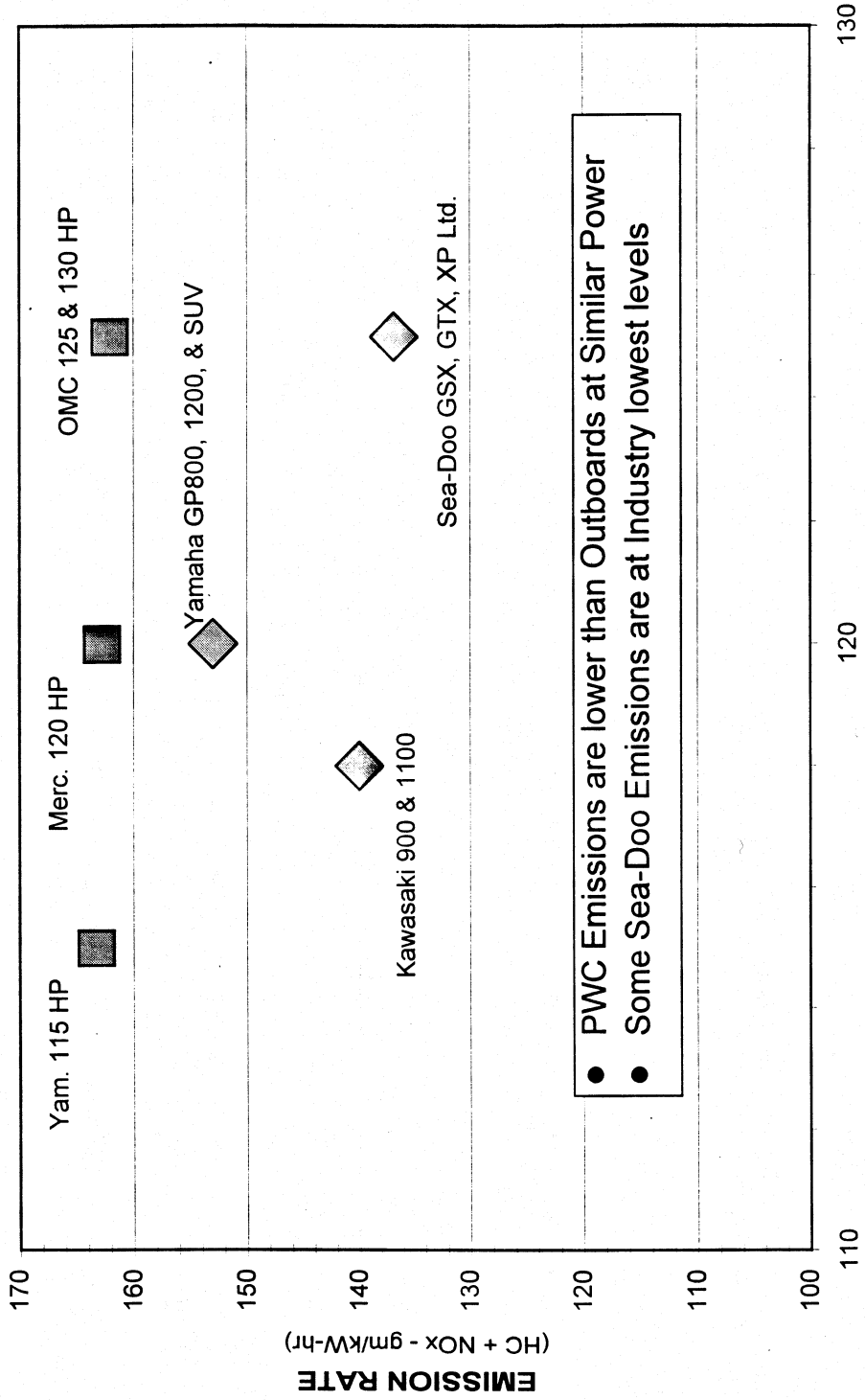


Marine Carburetor Engine Emissions (EPA Certification Website Data - May '00)

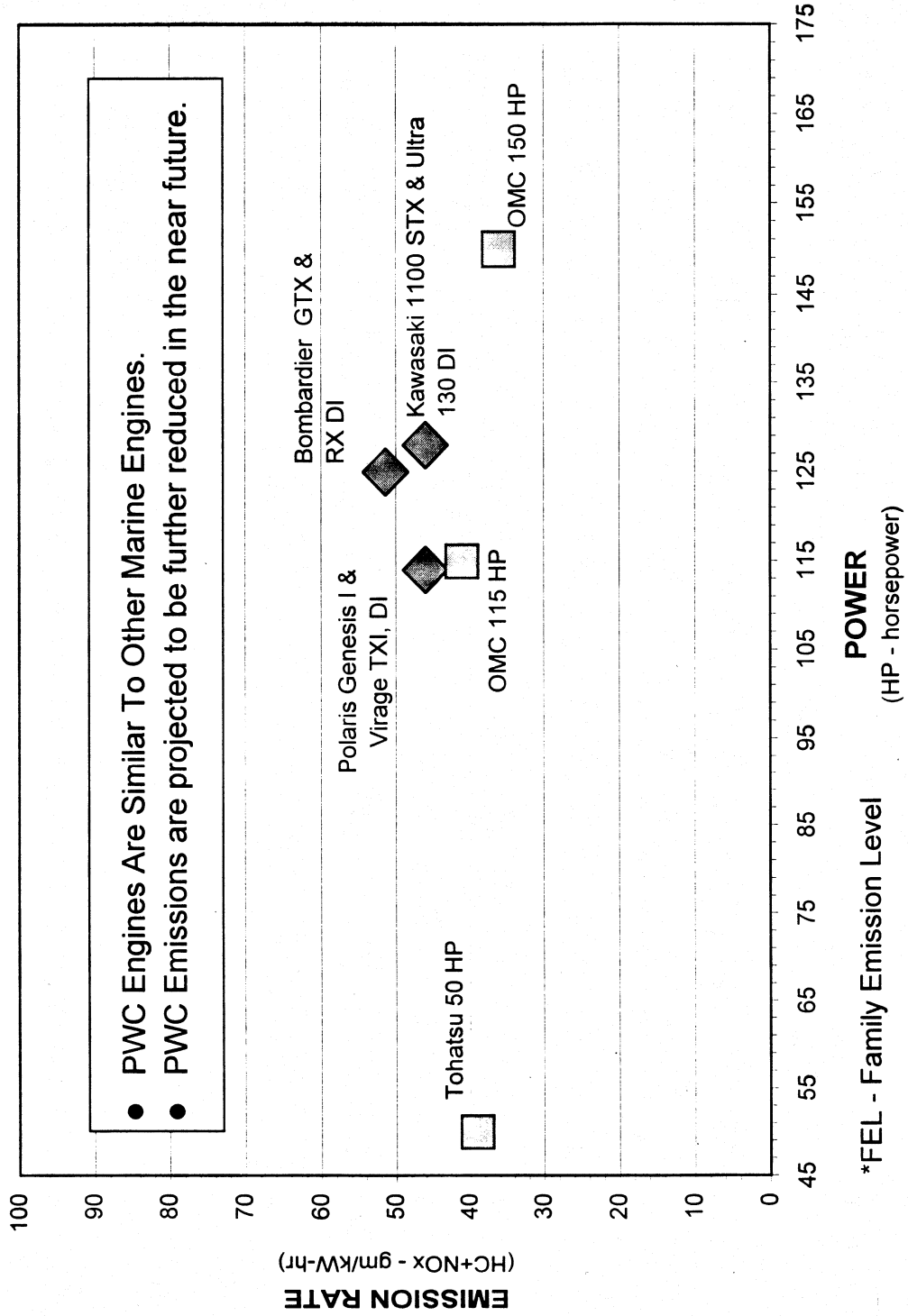


● PWC Emissions are lower than Outboards at Similar Power
● Some Sea-Doo Emissions are at Industry lowest levels

◆ PWC 2-Cycle
■ Outboard 2-Cycle

*FEL - Family Emission Level (HP - horsepower)

Marine Engine Emissions * - New Technology (EPA Certification Website Data - Dec.'00)



United States
Environmental Protection
Agency

Air and Radiation

EPA420-F-96-012
August 1996

Office of Mobile Sources

EPA Environmental Fact Sheet

Emission Standards for New Gasoline Marine Engines

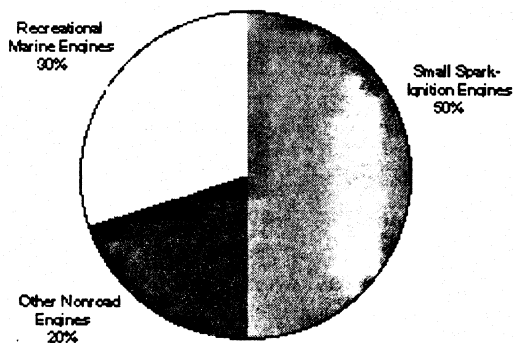
Working cooperatively with the marine industry, the Environmental Protection Agency (EPA) is issuing regulations that will bring forth a new generation of marine engines featuring cleaner technology and providing better engine performance to boat owners. Controlling exhaust emissions from new gasoline spark-ignition (SI) marine engines will result in an unprecedented 75 percent reduction in hydrocarbon (HC) emissions from these engines by the year 2025.

Emissions from Marine Engines

Because states are finding it increasingly difficult to maintain the quality of air citizens have come to need and expect, efforts to improve air quality throughout the nation are shifting focus to controlling pollution from sources other than on-highway vehicles and engines. Until recently, emissions from nonroad engines and vehicles have been essentially uncontrolled. The results of a study conducted by EPA, however, proved the need for control of air pollution to reach into the nonroad engine and vehicle arena.

Of nonroad sources, EPA has determined that gasoline marine engines are one of the largest average contributors of HC emissions. As illustrated in Figure 1, of all categories of nonroad engines, recreational marine engines contribute the second highest average level of HC exhaust emissions. Only small gasoline engines used in lawn and garden equipment emit higher levels on average.

The statistics in Figure 1, however, include some areas in which marine engines are not in use because there are no nearby lakes or waters. Marine engines contribute higher levels than reflected by this average for areas in which marine engines are used. Depending on the specific area, the contribution may be in excess of ten percent of the total HC inventory, not just of nonroad sources.



[Figure 1 - Pie Chart: Nonroad Sources of Hydrocarbons]

Nonroad sources as a whole on average contribute ten percent to average HC inventories. HC contributes to ground level ozone which is known to cause irritation to the respiratory system. Controlling emissions from these engines will help reduce adverse health and welfare impacts associated with ozone.

New Emission Standards Established

The gasoline marine final rule, published in August 1996, establishes emission standards for new SI gasoline marine engines. Covered by the rule are outboard engines and gasoline marine engines used in personal watercraft and jet boat applications.

Emission standards are not set for sterndrive and inboard engines due to the inherently clean nature that the technology of these engines provide. Manufacturers may begin introducing these new, clean technology engines as early as 1997. Boat engines currently in-use are not affected by this regulation.

Cleaner and Better Performing Engines

The new generation of outboard and personal watercraft (OB/PWC) marine engines will be over 75 percent cleaner than current marine engine technology. That is, once the program is fully implemented, hydrocarbon emissions from these engines are expected to be reduced by over 75 percent from present levels. Since the reduction in the inventory depends on sales of these newer technology engines, EPA expects to achieve this reduction in HC emissions from marine engines by the year 2025. EPA expects a 50 percent reduction to occur by the year 2020.

In addition to being more environmentally friendly, the new OB/PWC engine technology will provide boaters with many performance advantages. The engines will generally provide easier starting, faster acceleration, quicker throttle response, and a reduction in smoke, fumes and noise. Significant improvements in fuel economy could provide hundreds of dollars in fuel savings. Furthermore, the new fuel systems and engine designs will relieve boaters from the hassle of mixing fuel and oil. As an added benefit to the boat owner, the emissions performance of these new OB/PWC marine engines will be covered by a three-year or 200 hour warranty, more than double the warranty currently provided by most engine manufacturers.

Flexibility Provided to Engine Manufacturers

With the cooperative efforts of marine engine manufacturers, EPA has developed regulations that are not overly burdensome or costly to manufacturers or consumers, while still achieving the overall pollution reduction goals of the program. This regulation requires manufacturers of OB/PWC marine engines to achieve the appropriate yearly emission reductions by meeting a corporate average emission standard which allows them to build some engines to emission levels lower than the emission standard and some engines to emission levels higher than the standard, provided the manufacturer's overall corporate average is at or below the standard.

Manufacturers have the flexibility to develop their own technological solutions to achieve these results based on market demand. The result will be a wide range of new products that this regulation will encourage. Likely options for achieving compliance include converting current OB/PWC 2-stroke engine technology to 4-stroke, direct-injection 2-stroke, or possibly equipping engines with catalytic converters in some applications.

Responsibility of Current and Future Boat Owners

World Wide Web: <http://www.epa.gov>

Information is also available by calling 734-214-4333 or writing to:

U.S. EPA
Office of Mobile Sources
2565 Plymouth Road
Ann Arbor, Michigan 48105