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Water Pollution by Outboard Motors,  
and a Useful Control Device*

*By: Barbara Rennick  
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Water Pollution by Outboard Motors,  
and a Useful Control Device

by

Dr. Barbara Rennick

Summary

Most of the outboard motors currently in use spill gasoline and oil into water through a crankcase scavenging valve. This wastes from 10% to 50% of the fuel and pollutes the water. A fuel recycling device can be put in place of the scavenging valve to prevent this spillage and save fuel. The R.C.S.I. knows of only one maker of such devices. The installation of a Goggi fuel recycling system or its equivalent on every outboard motor is evaluated as a good pollution control measure.

Background

Two-cycle engines, such as the outboard motors used on boats, were designed to deliver the most power with the least overall weight. One weight-saving feature required the fuel to enter the cylinder from the crankcase. On the way, some of the fuel and oil mixture condensed in the bottom of the crankcase. Standard two-cycle outboard engines discharged this condensate through a crankcase scavenging system, which emptied through the exhaust into the water. About 10% of the fuel and oil mixture used to power outboard motors is spilled overboard in this way. This is a conservative estimate, because the spillage becomes greater as the engines lose their tuning and become worn out. An old outboard motor may spill over half of the fuel it uses.

Spillage of fuel in the exhausts of two-cycle engines may be a significant source of pollution of recreational waters in our region. It certainly is a growing source of water pollution. In 1959 there were 5.8 million outboard motors in the United States, with an average power of 23.7 hp. In 1961 there were 7.1 million outboard motors, averaging 33.1 hp. The number and the power of the engines continued to grow, reflecting the growth of recreational boating and especially of water skiing. Bigger motors spilled more fuel. In 1968 the annual spillage from motorboats in the U.S. was estimated at 100 million gallons of oil and gas, worth some 50 million dollars (1).

Crankcase spills can be controlled and the gas and oil saved by means of a fuel recovery device. This device was invented in 1964, and has been manufactured since then under the trade name Kleen-X-Zaust. Monroe County residents can buy fuel recovery devices by mail from the Goggi Corporation (2). A small attachment, called a "Drain-off Kit", (and priced at about \$12) is designed to hold the fuel spilled from small engines (under 20 hp). The complete Kleen-X-Zaust attachment, priced at about \$50, recycles the spills back into the fuel tank of any outboard motor that does not have a built-in recycling system. These fuel recovery devices were tested and found effective in a study sponsored by the E.P.A.

### Experimental Data

The fuel recovery system was tested on outboard motors at the Rensselaer Polytechnic Institute in Troy, N.Y. (3), in a study sponsored by the U.S. Environmental Protection Agency. The results were summarized as follows.

From 7% to 30% of the fuel used by standard outboard engines was found in the crankcase condensate.

The amount ranged from 3% to 26% when the same engines have been recently tuned.

The spillage was greater as the engine speed was lowered.

Without the fuel recovery device, the crankcase condensate was spilled into the water. With the device attached, it was recycled into the fuel tank.

The running time of a 33 hp motor on a fixed load of fuel was increased by 68% by the fuel recovery device (at 1000 RPM).

The spilled fuel and oil put a significant load of waste into the water. Approximately 85% of the waste was biodegradable, and the average discharge volume was approximately 800 ml per hour of running time. One day's operation of such an engine would put as much BOD into the water as the sanitary wastes flushed in a day from a population of 400 people.

Bacteria disposed of much of the spill with time, but biodegradation was slow, and the remaining wastes accumulated principally on the surface of water. They consisted of heavy and light hydrocarbon fractions contaminated with phenols, aldehydes, and compounds of lead. The crankcase condensate was biodegraded less readily than the chemicals found in exhaust fumes of burned fuel.

### Discussion

We have been alerted to the damage done by major oil spills, by the pollution of swimming beaches with globs of grease, and by the controversies over Federal licenses for pipelines, tanker terminals, and offshore drilling rigs. Meanwhile, much of the oil that pollutes our waters continues to come from small spills by many careless misuses of oil.

The spillage from outboard motors is one example. The spillage could have been easily controlled since 1964 by adding a small attachment to the engines, but the manufacturers of outboard motors chose instead to deny that their motors were polluting the water. One manufacturer publicized an elaborate study of a lake which was used for testing outboard motors. This lake was in no way damaged by the spilled fuel as compared to a control lake (3). In scientific terms, the study only showed that a healthy lake could recover from a significant load of pollution. It did not show, what such a load would do to a lake that was already burdened by other pollutants, and did not mention such nuisances as finding gasoline-flavored fish in one's skillet (4). Another manufacturer advertised a device that kept outboard engines from dripping at the dock. The advertisement did not mention the much larger spills from an engine operating away from the dock. Until 1969, the major makers of outboard motors made no move to save the spilled fuel and oil.

A change was finally forced by conservationist legislators. In New York State, Assemblyman Glenn Harris introduced two bills in 1972, which mandated that all outboard motors be equipped with a recycling device. In the Senate of the U.S., Senator Gaylord Nelson introduced a bill imposing strict fuel emission standards on two-cycle marine engines. Neither of the bills became law (Governor Rockefeller vetoed the Harris bill), but they had an effect: new models of outboard motors are now being offered for sale with a built-in fuel recycling device.

This leaves some seven million older outboard motors still equipped with the crankcase scavenging devices that spill fuel into water. The R.C.S.I. knows of only one maker of a fuel-recycling device that can retrofit these motors.

We conclude, that owners of two-cycle outboard motors will benefit the environment and save money on fuel by making sure, that their motors are equipped with a fuel-recycling device of the Goggi type.

#### References

- (1) Alex Muratori, Jr. "How Outboards Contribute to Water Pollution", The Conservationist, June-July 1968.
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- (3) Bio-Environmental Engineering Division, R.P.I., Project 1502OENN, for the Environmental Protection Agency, September, 1971. "Control of Pollution from Outboard Engine Exhaust", U. S. Govt. Printing Office, Washington, D.C. 20402
- (4) J. N. English, 1963, Journ. of Water Pollution Control Fed. (p. 1121), "Pollutional Effects of Outboard Motor Exhaust. Field Studies".