



Westlands Water District

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FAX MEMORANDUM

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 2 Pages

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Subject: Ag/Urban Water Quality Issues, Recreational Boating Emissions

Recently there have been concerns about potential impacts of boat emissions and discharges. Getting data to evaluate this issue, potential toxicity and generate some order of magnitude loading numbers has however been extremely difficult, until the last couple of weeks.

Attention has recently been placed on exhaust emissions and other discharges from boats. In the CALFED Program a cursory discussion has revolved around illegal human waste discharges. In the state and national arenas, the California Air Resources Control Board and USEPA have focused on atmospheric emissions of engine exhaust. None of these processes has seriously considered loading and impacts of of boat engines discharging exhaust and exhaust by-products into the water.

Two cycle engines are used extensively in boats and personal water craft (jet skis). Exhaust from these engines consist of combustion by-products, oil mixed with the fuel for engine lubrication and unburned fuel. These materials are discharged into the water on the majority of marine engine applications to eliminate the need for a muffler.

Data from the USEPA off road engine emissions laboratory in Ann Arbor, Michigan, shows that about 25% of the fuel used by two cycle engines is exhausted as unburned fuel. The USEPA also found that significant amounts of the engine lubricating oil, mixed with the gasoline at ratios that range from 16:1 to about 50:1, remains unburned. Combustion by-products from two cycle engines are also 25 to 100 times greater then for four cycle engines of equal power.

DMV data indicates there are about 100,000 boats and personal water craft operating in the Bay/Delta region. The exact numbers of jet skis versus boats is not known at this time. Other data indicates jet skis are operated an average of 77 hours per year and use an average of 3.0 to 3.5 gallons of fuel per hour. The average two cycle powered pleasure boat is 70HP, operates 34 hours per year and uses about 4 to 6 gallons of fuel per hour.

Using the above data and assuming 15% of the 100,000 water craft are jet skis provides some startling order of magnitude estimates of loading.

Unburned Fuel Loading to Bay/Delta (two cycle engines only):

Lower Range:

$$\begin{aligned} 15,000 \text{ jet skis} \times 3 \text{ gal/hr} \times 77 \text{ hrs} \times 0.25 \text{ (\% unburned fuel)} &= 866,250 \text{ gal/yr.} \\ 85,000 \text{ boats} \times 4 \text{ gal/hr} \times 34 \text{ hrs} \times 0.25 &= \underline{2,890,000} \text{ gal/yr.} \\ \text{Total} &= 3,756,250 \text{ gal/yr} \end{aligned}$$

Total fuel used = 15,025,000

Upper Range:

$$\begin{aligned} 15,000 \times 3.5 \times 77 \times 0.25 &= 1,010,625 \text{ gal/yr.} \\ 85,000 \times 6 \times 34 \times 0.25 &= \underline{4,335,000} \text{ gal/yr.} \\ \text{Total} &= 5,345,625 \text{ gal/yr.} \end{aligned}$$

Total fuel used = 21,382,500

Now consider the engine lubricating oil mixed in the gasoline. Assuming an average blending ratio of 40:1 with 100% of that in the unburned fuel going into the water plus 50% of that in the fuel which is burned also going into the water:

Lubricating Oil Loading to Bay/Delta (two cycle engines only)

Lower Range

$$((3,756,250 \text{ gal.} / 40) + ((15,025,000 - 3,756,250)/40) \times 0.50)) = 234,765 \text{ gal}$$

Upper Range

$$= 334,100 \text{ gal}$$

Keep in mind that this does not include the effects of combustion by-products in the water OR the exhaust from all of the four cycle marine engines, which have no emission controls, going into the water.

The unburned fuel and oil products are lighter than water, thereby floating on the surface and driven around by currents and wind. They would also tend to be transported to the delta and bay from use areas farther upstream.

Studies conducted in Denmark (1994) have found water surface concentrations in the parts per trillion range are causing physical abnormalities, reduced fecundity, lower reproductive success, DNA disruption and a host of other problems on a variety of fishes. Concentrations in the parts per billion range can be acutely toxic to many species including flat head minnow. There has been virtually nothing done to evaluate this matter in the Bay/Delta. The limited amount of information that has been collected has found a number of possible instances of water surface hydrocarbon concentrations in the range of hundreds of parts per billion in the main stem of the river during the spring, summer and fall.

I think a 4 to 5+ million gallon gasoline spill or a 200,000 to 300,000+ gallon oil spill would get a lot of attention no matter where in the estuary it occurred. Given that the last 10-15 years has seen large increases in boating use in general and the especially large increase in boating use in the delta during the last 8-10 years I think we need to give this some serious discussion

Regards

