

Highlights of the NIOSH Engineering Control Evaluation

Evaluation of Control of Carbon Monoxide (CO) Exposures from Houseboat Generators

This sheet summarizes investigations performed by NIOSH researchers at the request of Fun Country Marine whose boats were located at Lake Mead, NV. This investigation was conducted in June 2001, to evaluate control of carbon monoxide (CO) concentrations on houseboats.

What NIOSH Did

- # NIOSH evaluated the performance three generator exhaust system configurations for control of CO exposures on houseboats: a dry stack extending above the upper deck; side exhaust; and rear exhaust configurations. These exhaust configurations were evaluated on a single boat while it was stationary and in motion; and while several boats were tied together.

What NIOSH Found

- # The concentration of CO measured inside the exhaust stack of a generator averaged 81,000 ppm. This level is 67 times greater than the concentration considered by NIOSH to be Immediately Dangerous to Life and Health (IDLH). Therefore, it is important for houseboat manufacturers/owners/users to be aware and concerned about the location of the exhaust terminus.
- # While evaluating a single stationary boat, average CO concentrations on the lower rear deck of the houseboat, an area where occupants frequently congregate, were reduced by about 99% by the use of the stack compared with the rear exhaust.
- # When the boat was in motion, much higher CO concentrations were measured on the lower rear deck due to the CO produced by the drive engines. Thus, regardless of generator exhaust configuration, peak CO concentrations on the swim platform exceeded the NIOSH Ceiling limit of 200 ppm. However, the dry stack system resulted in lower average CO concentrations when compared to the side and rear exhaust with reductions on the lower rear deck of 50% and 85%, respectively.

- # When three boats were tied together and with the generators exhausting out of a combination of rear and side locations, the CO concentration peaked at levels above the IDLH (1,200 ppm) on the swim platforms of 2 of the 3 boats. The peak CO concentration measured on the swim platform of the same boats was 84 ppm when all boats were emitting the generator exhaust gases through the stack.
- # The CO concentrations measured on the top decks of the houseboats were much lower than those on the lower deck. There were no peak concentrations above the NIOSH Ceiling limit. The stack resulted in the lowest average CO concentrations across all sampling locations when compared to the rear and side exhaust.

What Should be Done

- # The cavity below the swim deck and the area directly around the houseboat swim platform (on boats with gasoline generators that exhaust into these areas) should be redesigned to reduce CO hazards when the generator/motors are in operation.
- # Houseboats with gasoline-powered, generators should be retrofitted with control systems to reduce the hazards of CO poisoning.
- # Based upon the data that NIOSH has collected to date, an exhaust stack that extends well above the upper deck of the houseboat appears to be a reliable, cost-effective solution that is capable of dramatically reducing the CO hazard.
- # Additional testing should be performed to evaluate the side exhaust under worst case ambient and operational conditions, including the tying of multiple boats together while exhausting towards each other.
- # The CO poisoning awareness campaign should continue to inform boaters about boat-related CO hazards.