

# 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 Industries representatives (conducted in June 2001). This investigation was conducted on houseboats at Lake Mead, Nevada, to evaluate control of carbon monoxide (CO) concentrations.

### What NIOSH Did

- # We evaluated the performance of an emission control device (ECD), interlocking device, and dry stack for controlling CO exposures on houseboats.

### What NIOSH Found

- # The open space under the houseboat swim platform or area directly around the back of the swim platform can have CO concentrations above the Immediately Dangerous to Life and Health (IDLH) level if the onboard gasoline generator and/or boat engines are operating and discharge exhaust into this area.
- # Mean and peak CO concentrations were reduced by two to three orders of magnitude by the ECD at numerous locations on the houseboat. Average CO concentrations near the rear swim deck of the houseboat, an area where occupants frequently congregate, were reduced from an average of 395 ppm to less than 1 ppm, a reduction greater than 99%.
- # A five gas emissions analyzer indicated that the ECD reduced mean CO concentrations in the generator exhaust by several orders of magnitude (from 4,534 ppm to approximately 13 ppm).
- # When the ECD and stack were used together, redundancy was provided to the system. CO concentrations measured when both systems were operating were reduced further than when the ECD alone was used. The observed reductions were relatively minor in absolute terms; however, system redundancy provides an additional level of safety to individuals on the houseboat.
- # The evaluated interlock was capable of shutting down the generator when the swim ladder was placed into the water, and the hazardous CO concentrations near the lower rear deck

dissipated within two or three minutes; however, the system could be easily circumvented or bypassed.

### What Should be Done

- # Houseboat manufacturers should be informed of design concerns related to CO poisonings around the rear deck of boats that have gasoline powered generators/motors that exhaust into the area beneath the swim platform or out the back.
- # 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.
- # The ECD performed well during the current evaluation; however, additional testing is recommended to determine its long term performance under conditions that may be less than optimal. If houseboat manufacturers decide to install the ECD onto their generators before additional research has been conducted, it is recommended that the ECD be used in conjunction with either a stack, or side exhaust with a warning device, and that periodic air sampling and emissions testing be performed.
- # The interlocking system performed as designed and provides some protection; however, it may create additional hazards and is easily bypassed. Individuals who utilize these systems need to be fully cognizant of its shortcomings.
- # The CO poisoning awareness campaign should continue to inform boaters about boat-related CO hazards.

### What To Do For More Information:

We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513/841-4252 and ask for EPHB Report No. 171-27a

