The Professional Captain

Taking on Fuel
Let's Do It Safely
By Captain Don Fleming

Almost every boating season a needless tragedy occurs. We hear or read about someone or several people) getting killed as their boat explodes and burns while taking on fuel. I have already witnessed one boat burning to the waterline early this spring, totally engulfed in flames in the Hudson River a few miles north of the George Washington Bridge. Many of the victims turn out to be fellow boaters with many years of experience.
Many of the tragedies are the results of carelessness rather than ignorance. As we approach the mid-season point with this August 1992 issue, I think it is important to raise and renew everyone's awareness of the inherent dangers and necessary precautions associated with taking on fuel in the hope that more tragedies can be prevented.

EXPLOSIVE POWER AND BURNING CHARACTERISTICS OF FUEL

Gasoline, or more correctly, gasoline vapors are the most dangerous of all boat fuels. This is due to two important properties. First, the explosive power of gasoline is quite severe. The fumes from one cup (8 oz.) of gasoline has the explosive power of 5 sticks of dynamite! A concentration of gasoline in air as low as 1 and 1/4% (a few tablespoons of gasoline) can create enough explosive power to blow up a large boat. Second, gasoline vapors are heavier than air. As they collect in the various carts of the boat, these fumes tend to seep to the lowest point of the boat which is usually the bilge area of the compartment. Unless they are safely exhausted, they lie in this enclosed space until a spark ignites them. Perhaps we tend to get careless in fueling our boats because we have become so complacent about fueling our automobiles. It would be good to remember that the engine compartment of a car is open at the bottom so that these heavier than air explosive fumes drop to the relatively safety of the ground. This is not the case in the totally enclosed hull of a boat.

Because gasoline is significantly more volatile than diesel fuel, the major thrust of this discussion is centered around it. However, those of us who own and operate diesel powered vessels would be foolish to become cc mp lucent at this point. Although diesel does not explode, diesel fuel does burn. It happens to have a higher ignition point and will therefore not ignite as quickly as gasoline, but diesel fires can kill and destroy just as easily as gasoline. Once they get out of control, they are extremely difficult to extinguish. Therefore, the same precautions are necessary.

SAFETY PRECAUTIONS BEFORE TAKING ON FUEL

These procedures should be followed carefully and completely every time the boat is fueled. Remember, accidents happen primarily due to carelessness.

Before approaching the fuel dock, check the wind direction, and if you have a choice as to which side to land on, choose the windward side, (the side the wind hits first). This will allow the wind to blow the fuel fumes from your own boat and other boats away from you, giving your boat the best. ventilation possible (See Figure 1).

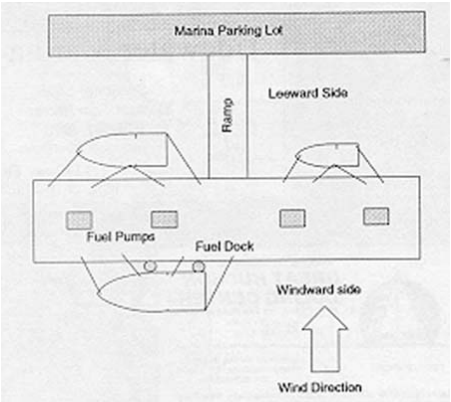

FIGURE 1: The windward side of the fuel dock is preferable when a choice is possible because it allows for better ventilation as fuel vapors are actually blown away from the boat.

Be sure your boat is properly tied up with the four standard docking lines: bow line, forward spring, aft spring, and stern line, so that it does not shift or drift out from the dock during the fueling process (See Figure 2).

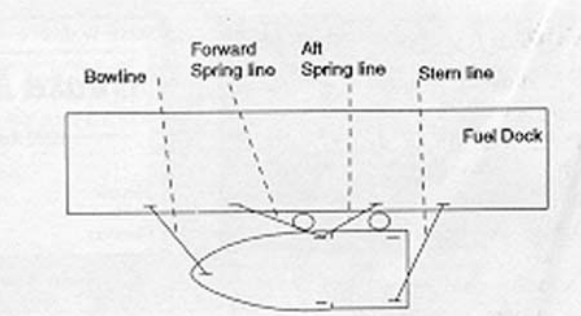

FIGURE 2: Proper arrangement of docking lines prevents boat from shifting or drifting away from dock during fueling process.

Shut down your engine(s) and generator, if you have one. Shut off all circuit breakers individually as well as the main battery switches so as is prevent any stray sparks from jumping from one contact point. to another.

Be sure to shut off the blower. This should automatically go off when you shut off the circuit breakers. Some people, however, misunderstand the use of the blowers and leave them on while re-fueling, thinking that they are properly ventilating the engine compartment. Not only does leaving them on develop the possibility for an electrical spark, but more importantly, they pull the gasoline fumes surrounding the boat into the engine compartment through the air intake ducts.

Close all the hatches, ports, windows and doors and don't forget the small window or port in the head. Get your money, credit cards, deck fuel cap opening key, etc. out of the cabin beforehand so that no one has to open the boat up once fueling starts. Check to see that the stove or any live flames from lanterns, etc. are extinguished below.
Ask your guests and crew members who are not essential to the fueling process to get off the boat. Remind them not to smoke or open any flames while on or near the fuel dock.

Have a fire extinguisher nearby and hope you don't need it.
Measure fuel in tanks beforehand and estimate as accurately as possible how much fuel each tank will take in order to avoid spills.

Finally, be sure to order the proper type of fuel by clearly specifying gasoline or diesel. It is a good idea to check the run of the fuel hose to be sure it is running to the proper pump for the type of fuel you need.

These preliminary procedures may sound basic and obvious, but it is very easy to make a careless and costly mistake. I was once delivering a motor yacht to Edgartown on Martha's Vineyard. The owner who was on board with me was a sports car "aficionado" and collector. He was fond of using the expression "gas her up" at the fuel dock in spite of the fact that he now had a diesel boat, and in spite of the fact that I had warned him about this numerous times. Needless to say, at the end of a long, tiring, run from Montauk when I was down in the engine room checking fluid levels, he must have had a slip of the tongue again because he put 500 gallons of gasoline into the fuel tanks before the mistake was discovered. This cost him a tremendous amount of money to get the tanks drained and cleaned, not to mention to the serious danger of explosion created during this process. He later tried to blame the young dock attendant and to persuade me to go along with the scheme. I refused, and we parted company shortly thereafter. So much for the adventurous life of a professional captain.

SAFETY PRECAUTIONS WHILE TAKING ON FUEL

After removing the fuel cap be sure to make and keep contact with the end of the fuel nozzle and the rim of the fuel deck pipe. This will prevent any static electric charge from building up in the hose and jumping across the gap between the nozzle and the rim. This is the same static electric charge that builds up as you walk across certain carpets. Yes, that little spark can blow the whole boat up.

Do not spill gasoline by overfilling the tanks. Filling the tank until the fuel flows out of the air vents is dangerous. It is far safer to estimate carefully how much the tank should hold and monitor the pump meter shutting it off a gallon or two beforehand to allow for expansion when the fuel warms up to the ambient temperature of the interior of the hull. Listening to the fuel flow and watching the fumes expel from the air vents will also give you a clear idea when you are nearly full. Besides the safety factor, this procedure is environmentally sound, and it can save you from being subject to some rather heavy fines for polluting. However if in spite of all precautions you should spill some fuel into the water, squirt some liquid soap on to the spill. This will coagulate the spilled fuel and send it rapidly to the bottom keeping the spill from spreading on the surface of the water.

When filling small portable outboard tanks, it is better to remove them from the boat entirely and fill them on the dock. Be sure to wipe them off before refitting them in their holders.

SAFETY PRECAUTIONS AFTER TAKING ON FUEL

Close all fuel fill pipes by tightening the caps moderately, but not overly tight. The idea is to get them tight enough so that rain

water or sea water washing up on the deck cannot leak into the tank and contaminate the fuel, and so that no vapors escape.

Next, turn on your main battery switch and your blower circuit breaker. The reason why you should shut off all individual circuit breakers and switches beforehand is so that when you switch over to the main you are not able to create any unnecessary spark by activating other equipment before the boat can be properly ventilated. Let the blower ventilate the engine compartment from 4 to 5 minutes. Then, sniff for fumes at the exhaust vents for the blower. These are usually located at the side of the boat. You should be able to feel a strong stream of air being expelled by the blower fan through the grill of this exhaust vent. Put your nose right into the exhaust flow and smell for gasoline fumes. Wait until it smells clean but realize that a "clean" smell may very well be the normal smell of a warmed up engine room and learn to distinguish this "clean" smell from traces of actual gasoline vapors. This is the best way to tell if the engine compartment is clear of gasoline vapors. If it is not, wait. Do not turn on the ignition or start the engine(s) until it smells clean.

This foolproof method of detecting fumes in the engine compartment depends on one important factor. The blower exhaust hose must be securely connected all the way from the very bottom of the bilge to the fan motor and to the exhaust grill on the side of the boat. These large diameter thinned wall reinforced hoses are somewhat flimsy. They tend to get easily crushed and disconnected when they are inadvertently stepped on while we are poking around in the engine room. It is important to make them part of your regular daily engine room check, and repair them and reconnect them as necessary.

Do not allow any impatient boats waiting to get fuel to rush you into starting prematurely. However, on the other hand, be thoughtful enough to turn on your blower right after you close the deck plate so as not to waste everyone's time with your delay. If you do forget to turn the blower on immediately, however, don't worry about wasting time. Always ventilate properly before starting.

While the engine compartment is ventilating, hose off and wipe up any spills and dispose of the rags on shore. Never keep them on the boat. If you have been fortunate to land on the windward side of the fuel dock, you are now in an excellent position to open all your hatches and ports, etc., to ventilate the boat with fresh air. This is important in case any vapors have seeped through the cabin door or hatch onto the floor of the cabin. These vapors will eventually work their way through the carpeting and/or floor boards into the bilges and the engine compartment. However, if you are on the leeward or downwind side of the fuel dock, or if conditions are very still with no wind blowing, and other boats are taking on fuel and their vapors are blowing towards your boat or hanging in a cloud over the entire fuel dock, it would be senseless to open your hatches and ports until you are clear of the area. Some people like to open the engine hatch and sniff in the compartment. I prefer to use the exhaust grill method discussed above because you have to get your head all the way down to the very bottom of the engine compartment to check for these heavier than air vapors, and on many boats this is extremely difficult, if not impossible. Obviously, it would be foolish to open the engine hatch under the conditions discussed in this paragraph.

After being sure the blower exhaust is "clean" prepare the crew to be ready to cast off the docking lines as soon as you start the engines so that you can clear away from the area as soon as possible.

Before starting, double check the wind direction and traffic around the fuel dock and plan a safe departure. Start your engine(s) with a "hot start," meaning do not bother to pump the throttle(s) on a gasoline boat as the engines are already warmed up and should start up simply by turning the ignition key(s). Control your own departure by signaling the dock attendant and crew as to which lines you want released and in what sequence. Do not let the attendants and crew untie you at their discretion.

Hopefully, by following these tried and true procedures in careful and consistent manner many tragic accidents can be avoided. If eve-.)-one thinks of gasoline vapors which are of course colorless as a heavy thick fog hanging over the fuel dock ...if diesel boat owners remember that they too are subject to fire and are exposed to this fog of gasoline vapors even though they are not taking on gasoline directly ...if everyone uses their common sense and exercises some patience and caution - maybe there won't be any more of these tragedies. Wouldn't that be nice.

Captain Don Fleming is a licensed USCG Operator with over 25 years experience in sail and power vessels up to one hundred tons in both local area as well as ocean voyaging and racing from Maine to Grenada. He is well know throughout the area for his hands-on training programs that range from close-quartered docking and maneuvering to navigation, electronics, and ocean passage making skills. Questions or inquiries to Captain Don may be addressed to: Don Fleming Yacht Services Inc., 506 Eagle Bay Drive, Ossining, N.Y. 10562 914-941-3998.
