PetrolPLAZA

Fueling Marinas: Not Just a Gas Station with a View

When it comes to safety and environmental protection, the differences between fuel operations at marinas and service stations are just as important as the similarities. John P. Hartmann explains, in this first of a three-part series on marina operations, some of the key differences and the rules and standards covering them.

Extra perils of recreational marine fueling
This is the first of three articles on marina fueling systems and their many challenges for petroleum equipment professionals. These articles will address fueling systems at marinas serving small, private recreational watercraft. We will not address the fueling of boats on trailers or in storage on land; fueling watercraft from portable containers; or fueling systems on barges.In this first article, John Hartmann introduces you to the basic regulations, codes and standards for marine fueling systems and the rationale for them. Future articles will deal with some of the special conditions and events that have occurred at marinas and how the regulations, codes and standards are applied. Some marinas have begun using intermediate bulk containers (IBCs) for storage near or on docks. Use of IBCs will be covered in a future article.

Dual suction pump with hose reel to manage up to 75 feet of hose

Millions of small boats are fueled at marinas on our rivers, lakes and seashores. Modern marinas offer fuel, food and beverages essential for recreational boating, much like modern C-stores do for motorists. Marinas also often sell boats and accessories and provide maintenance and repair services.

With these activities come the usual fire safety and environmental protection considerations associated with storing and dispensing motor fuel. But the nature of the refueling activities and the proximity of the facilities to water create some extra perils and heighten environmental concerns.

Misplaced confidence
Marina owners, operators and users tend to believe that the design, construction and operation of their fueling systems are done correctly. Experience has shown, however, that this confidence is sometimes misplaced. A five-year National Fire Protection Administration (NFPA) study shows that 90 percent of personal injuries and 75 percent of property damage at marinas resulted from fires fed by flammable and combustible liquids (Service Station Fires: 1991-1995, November 1998).

Marina fueling is subject to the same fire safety and environmental regulations as are automotive service stations. However, marine fueling is subject to special rules because the water bodies used for recreation are often the source of drinking water. Other concerns include the protection of wetlands and wildlife from fuel spillage damage, and the heightened concern of the impact of oxygenates (such as TAME and MTBE) now used in boat fuel.

Fire safety regulations are written to protect lives and property, with consideration given to preventing environment damage. Fires and explosions at docks and on boats occur very quickly, often doing extensive damage before efforts to extinguish them can be initiated. Damages include destruction of property, personal injury and substantial environmental contamination.

In addition to the general requirements, fire codes specifically address unique aspects of marina fueling: aboveground piping vulnerable to damage; moving docks; boaters fueling from awkward positions; ignition from static electricity discharge; pooling of vapors in boat compartments; differences in elevation between the tank and dispenser; and filling and handling of portable containers.

In addition, at least to the casual observer, spillage of fuel at marinas is more likely to result in damage than spills of comparable quantities at land-based automotive service stations. A few drops of motor fuel spilled into water results in a conspicuous sheen on its surface, which, even if the quantity is too small to actually pose a contamination hazard, is highly undesirable.

Performance standard

The marina fueling system designer, whether it is the owner, the contractor, an engineer or a fuel supplier, has many decisions to make to achieve design objectives. The most basic performance standard for marina fueling design is to provide a safe, efficient and economical system for storing and dispensing a reasonable quantity of fuel into watercraft. This minimizes the potential for damage to people, soil, water and air. The system designer must meet three distinct sets of rules: fire safety, environmental protection, and worker health and safety. The requirements for addressing unique conditions at marinas are dictated by the regulations.

In numerous issues of PE&T, we have discussed the pros and cons of the use of aboveground tanks at retail fueling facilities, spill and overfill prevention, corrosion protection, regular and emergency venting, and many other related topics. While these articles were written with automobile fueling primarily in mind, they also apply to marine fueling. While some safeguards are incorporated into a system’s equipment, complete protection requires educated boaters and oversight as they refuel. Improved plan review, permitting and code enforcement are also important parts of the picture.

Prescriptive rules

The basic rules that must be followed at marina fueling facilities include:

• **Federal and state environmental regulations that apply to all fueling systems.** While usually associated with service stations, the federal UST regulations (40 CFR 280) and their state counterparts, apply to most marinas with underground tanks.

Virtually all marinas are also subject to US EPA Spill Prevention, Control, and Countermeasure (SPCC) regulations (40 CFR 112), which apply to any AST larger than 1,320 gallons, or to one or more USTs with a total capacity greater than 42,000 gallons, if located where a release might reach “navigable waters.” In most jurisdictions, this means any water body or waterway, including storm sewers, creeks (even if usually dry) and road drainage ditches. State and federal air quality regulations may also apply, but only to very few high volume installations.

• **State and local fire or flammable and combustible liquids codes.** There are some differences between the NFPA 30A, Automotive and Marine Service Station Code and the Uniform Fire Code (UFC), but they are essentially in agreement on most points.

• **Worker safety.** The OSHA regulations (29 CFR 1910) apply—in particular, those sections on handling flammable and combustible liquids, (which are generally adopted from NFPA 30, Flammable and Combustible Liquids Code).

• **Government-owned marina facilities.** They generally must conform to EPA and OSHA regulations. Department of Defense and military standards also apply to military facilities, while non-military government-owned marina facilities must also meet standards specifically covering them.

A thorough identification of interested agencies and authorities having jurisdiction is an essential preliminary step in any design effort.

What the rules require
What are the key requirements for marina fueling system components?

Tanks—Unlike your typical automobile service station, tanks at marina facilities are usually aboveground, because the soil conditions, water table, presence of rock and the relative elevations at waterside make underground storage tanks impractical.

Marina ASTs are subject to the same location restrictions as ASTs at automobile service stations. Acceptable locations are influenced by the tank’s construction. Set-back and separation distances are typically reduced if the tank has enhanced fire protection. To varying degrees, fire codes permit fire-resistant tanks to be located nearer to public-use areas than uninsulated tanks. Double-wall tanks may eliminate the requirement for diking as a means of secondary containment. These options may simplify the layout or permit a facility to be built on a smaller property. Information on these topics is included in NFPA 30A, Section 2-4 and the UFC, Articles 52 and 79.

Third-party certification—Tanks, valves, pumps, vents, piping systems and virtually every other tank system component must be third-party certified for use with flammable and combustible liquids. Among the most common testing organizations are Underwriters Laboratories Inc., Southwest Research, Inc., and Factory Mutual. There are other specialists in certain components, particularly gauging and monitoring systems (e.g., Ken Wilcox and Associates, Midwest Research, Inc., and Vista

Corporation).

Venting—Every AST must have an adequately sized emergency vent to release excessive internal pressure in the event of fire exposure. Without an adequate vent, internal pressure can cause a tank to explode—a most serious event. An emergency vent is also required for the interstice of double-wall tanks. For normal operations, a pressure/vacuum vent is required for some tanks and an atmospheric vent for others, depending on air quality regulations.

Pumping—Fuel must always be transferred by pumping, regardless of the relative elevations of the tanks and dispenser, and inherent gravity flow. Dispensers measure fuel sales and provide inventory control, along with the means to control liquid flow. Pumps may be located at or in the tank, at the bulkhead or, in some cases, on the dock. The location depends on the number and location of fueling points.

Piping—The standards for onshore piping at marinas are the same as for any fueling application. Cathodically protected steel piping, fiberglass and listed plastic piping may be used underground. If steel piping is used aboveground, it must be protected from environmental corrosion, usually by painting or coating exposed surfaces.

In general, low-melting-point piping materials (e.g., aluminum, copper and brass; plastics that soften in a fire; or nonductile material like cast iron) may be permitted aboveground if the material is:
"(a) resistant to damage by fire,
(b) so located that any leakage resulting from the failure would not unduly expose persons, important buildings, or structures, or
(c) located where leakage can be readily controlled by operation of accessible remotely controlled valve(s)." (NFPA 30, 3-3.4)

Antisiphon devices—As mentioned, fire codes prohibit siphon flow from elevated tanks, whether intentionally (as would be the case if dispensing was done by gravity or accidentally (as from a leak in the piping or dispenser). Using ASTs or locating USTs above the elevation of the dispensers results in the fuel in the piping being under pressure, even when the pump is not running. Without precautions, the entire contents of the AST could be fed by gravity into a fire through a ruptured hose. Even a small leak can result in a substantial release unless it is detected early. Simple antisiphon devices should be installed at the high end of the piping at the tank to prevent siphoning in the event of a piping leak.

Block valves—Block valves are required to control the flow of fuel for maintenance purposes, or in case of a hose or pipe rupture. Each storage tank must be equipped with a block valve at the tank outlet and another at the shore end of the flexible connector between the shore and dock piping. All block valves must be equipped to relieve excessive pressure back to the tank due to thermal expansion of the product.

Liquid flow control—A vacuum-operated control valve is required at the base of each suction pump.

To my knowledge, the only valve used for this purpose is made by Tokheim. These valves operate in conjunction with a solenoid valve at the tank outlet, downstream from the block valve. Normally-closed, zero-back pressure solenoid valves do not rely on back pressure of the liquid in the piping above the valve to close. This makes them essential in any AST installation in which a low liquid level in a tank would produce insufficient back pressure to close a conventional solenoid valve.

This vacuum-operated valve and solenoid valve open together when the pump is turned on, allowing the flow of fuel; they close when the pump is turned off. The vacuum-operated valve has a shear section to control the point at which the piping will break if the pump is hit. Shearing causes the valve to close automatically, stopping the flow of fuel.

Breakaway valves—While not a legal requirement, a precaution against accidental release from flexible connectors is to install double-poppeted, normally-closed emergency breakaway valves at the upstream end of each flexible connector. In case the connector is over-stressed, the valve shears and the twin poppets stop the flow of liquid from both directions. In a fire, the fusible link melts, causing the valve to close. No manual actions are necessary, although most valves can also be manually tripped.

A 2,000-gallon capacity, double-wall marina gasoline tank. (The facility is not yet open and areas around the tank are currently being used as winter storage.)

These precautions are to minimize the release of product from piping or components made of low-melting-point materials. I believe that using such precautions would qualify the piping for use aboveground.

Flexibility—A major design consideration is how to provide flexibility in the piping to accommodate fluctuations in water levels and lateral movement from wave action. This differential movement between piping on land and the dock, and between articulated elements of the docks, is also affected by boat traffic, vehicular traffic and numerous other causes.

The need to provide flexibility conflicts with the need to prevent the release of fuel. Fire codes permit this transition to be made with “oil-resistant hose”—definitely a low-melting-point material—provided liquid flow can be controlled by a “readily accessible valve on shore” (NFPA 30A, 10-3.3). This valve may be a manual quarter-turn ball valve, a gate valve or an electrically-operated solenoid valve that can be operated remotely to stop the flow of liquid in an emergency.

All-metal flexible connectors up to eight feet long, listed for use with flammable liquids aboveground, may be an alternative in fresh water, but are not recommended for use where exposed to salt water because of rapid corrosion from contact with chlorides.

Some manufacturers discourage the use of their listed aboveground connectors for marina use because constant or excessive flexing could result in premature failure of their products. Listed flexible connectors are tested for 50,000 cycles: pumps starts, stretching, bending in all directions, and vibrating. Metal fatigue from excessive cycling, over-bending or abrasion might result in failure of the fuel-containing internal metal tube.

Some manufacturers are interested in developing and testing a suitable product for marine application, but they will undoubtedly be more expensive than lengths of oil-resistant hose. The person making the final equipment selection should weigh the cost against the enhanced fire resistance and environmental risks.

Physical Damage—System components must be protected from being damaged by collision and abrasion and, to the extent reasonably possible, from vandalism and intentional abuse. This may be done by locating the components in low-risk areas away from traffic or by protecting them with bollards or barriers. Piping, dispensers, hoses and nozzles must be protected from collision damage from vehicles and watercraft. It is not unusual to hear of a boater tying up to the fuel line or next to a hose draped over the edge of the dock.

Dispensing—Dispensing fuel from a moving dock to a moving boat is more likely to result in spillage than fueling cars, unless extra care is taken by the person working the dispenser. At least one marina insurer prohibits the marina operator from working the dispenser, because the boat is under the operator's care and custody during fueling, which adds to the operator's liability. The operator is always responsible for providing instruction and oversight of the boaters' use of the marina fueling system.

Hoses—Dispensing hoses should be listed for motor vehicle fueling. This ensures they are equipped with a grounding wire that provides a safe path to ground any residual electrical charge. The hoses used at marinas are the same as those used at service stations, only longer—and in some cases, really long. One colleague told me of a marina where he saw about 300 feet of dispensing hose lying on the dock—an obvious circumvention of the requirement for a safe piping system. The fire codes require that hoses longer than 18 feet be controlled, usually by using a hose reel. Allowing long hoses and nozzles to lie on the dock or in the water is not acceptable.

Nozzles—NFPA 30A requires automatic nozzles, but prohibits conventional hold-open clip. The boater is sometimes forced into an awkward position between the moving boat and the dock. Substitutes ("cheaters") for hold-open clips may prevent the nozzle from operating properly. Thus, the attempt to improve fire safety and keep the water body clean may actually have the opposite result. Under UFC, hold-open clips are optional. (See Note at end of article.) I recommend a low-cost addition to the automatic nozzles (with or without hold-open clips) which can prevent small releases that otherwise occur when a nozzle is removed from the boat's fill pipe. The device is a non-drip check valve, at the tip of the nozzle spout, which opens during fueling and closes when the nozzle is shut off. The few drops of fuel left in the nozzle spout are prevented from dripping out onto the boat or into the water.

Static—Static electricity is a problem during any fueling operation. The metal nozzle must be in contact with the boat's filler pipe to prevent a static discharge which could result in a fire. Portable cans with less than a 12-gallon capacity should be placed on the ground during filling. Larger cans should be grounded before being opened.

SPCC rules—Spill Prevention Control and Countermeasure (SPCC) regulations require that the marina operator train employees on the safe use of the fueling gency. The regulations require safety and corrective action plans prepared by a registered engineer, familiar with marina requirements. They also require that materials be on hand to contain and absorb spillage. The regulations, which also contain reporting requirements, have been in effect since the early 1970s. They apply specifically to recreational boating marinas, a point that is lost on many operators and regulators who believe that they apply only to large facilities. Several SPCC requirements may be hard to implement at small marinas. One is to contain an amount equal to the capacity of the truck transport during a delivery and another is for an oil/water separator to be utilized.

Stay tuned

Marina fueling systems involve all of the issues and problems that characterize regular automotive fueling stations. As I have explained, marinas also present some significantly different conditions that are not found elsewhere. As small recreational boating activities continue to grow, so does the need to ensure that marina fueling systems and their operation are safe and environmentally acceptable. Next month’s PE&T issue will clude another article on the unique problems at marina facilities and how to cope with them.

Note:

The merits of hold-open clips have been debated since the introduction of the automatic nozzle over 40 years ago. Clips were not permitted originally and still are not allowed at self-service stations in some states, in the belief that requiring the fueler to hold the nozzle handle open will reduce spills. I disagree with this assumption for practical reasons. In my experience, many fuelers will find something to wedge the latch open (e.g., their keys, the gas cap or a rock) that will not work as well as the clip provided by the nozzle manufacturer. In one infamous case, an ingenious fueler used his propane lighter to hold open a nozzle handle. When he tried to remove the nozzle, he inadvertently “flicked his bic” and the resulting fire was widely reported.