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MTAS
Municipal Technical Advisory Service
In cooperation with the Tennessee Municipal League

TECHNICAL bulletin

03-01-06

DRINKING FROM A FIRE HYDRANT:
The Fire Department's Role in Protecting the Public Water System

Gary L. West, Fire Management Consultant

A revised state regulation concerning fire hydrants is causing concern for fire department leaders, providers of public water supplies, and public health officials across the state of Tennessee. The new regulation is the final result of the 1996 Amendments to the Safe Drinking Water Act with the emphasis on contamination prevention. This new regulation became effective in Tennessee on *January 1, 2006*.

The original rules in Tennessee were adopted in June 1974 and have changed at least four times over the past 32 years. In the summer and fall of 2005, as discussions and drafts of possible new regulations were discussed, it became apparent that these rules would affect both public health and public safety. On October 29, 2005, the Tennessee Department of Environment and Conservation, Bureau of Environment–Division of Water Supply, adopted the final version of the rules. The rules and regulations are issued under the authority of Public Acts of 1983, Chapter 324 where the Division of Water Supply is responsible for the supervision of all public water systems. These new rules require all communities having or installing water systems to be protected against contamination and to properly identify and notify all fire departments of fire hydrants that do not meet the minimum requirements. The purpose of these rules and regulations is to provide guidelines for the interpretation of T.C.A. § 68-221-701 *et seq*. and to set out the procedures to be followed by the department in carrying out the state's primary enforcement responsibility under the Federal Safe Drinking Water Act.

The rules apply to all public water supply systems that provide water for human consumption through pipes or other constructed conveyances, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.

According to the revised rule, Paragraph (18) of Rule 1200-5-1-.17 Operations and Maintenance is amended in its entirety and substitutes the following so that as amended the paragraph shall read:

> (18) All community water systems planning to or having installed hydrants must protect the system from contamination. All water mains designed for fire protection must be six inches or larger and be able to provide 500 gallons per minute with 20 pounds per square inch residual pressure. Fire hydrants shall not be installed on water mains less than six inches in diameter or on water mains that cannot produce 500 gpm at 20 psi residual pressure unless the tops are painted red. Out of service hydrants shall have tops painted black or covered with a black shroud or tape.

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Existing Class C hydrants (hydrants unable to deliver a flow of 500 gpm at a residual pressure of 20 psi) shall have their tops painted red by January 1, 2008.

The water system must provide notification by certified mail at least once every five years beginning January 1, 2008, to each fire department that has reason to utilize the hydrants, that hydrants with tops painted red (Class C Hydrants) cannot be connected directly to a pumper fire truck. Fire departments may be allowed to fill booster tanks on any fire apparatus from an available hydrant by using the water system's available pressure only (fire pumps shall not be engaged during refill operations from a Class C hydrant).

A MATTER OF PUBLIC HEALTH

Clean, safe drinking water is something we take for granted, but some fire departments may unknowingly operate in a manner that would threaten our public drinking water. Ensuring our water is safe is the responsibility of everyone, including the fire department.

The cheapest, best, and most readily available extinguishing agent is within one of those strategically placed fire hydrants which, of course, is connected to the public water system as a convenient and effective means to supply water for firefighting. Fire departments routinely connect apparatus to fire hydrants and use the public water supply for fire protection. Most fire apparatus are filled either at a fire hydrant or in a fire station using the public water system. In fact, based on the history, frequency of use, and availability of water from fire hydrants, it would be unconscionable for a water provider to design a public water supply without providing for the need for fire protection.

In recent years there has been much work done to improve water quality in public water systems. Most of this work has been a result of federal and state laws that have been enacted to ensure that the public water is safe to drink. Congress passed the first legislation regulating drinking water at the national level in 1974. The Safe Drinking Water Act provided the basis for national requirements for water quality standards and water supply operation. Tennessee has used this model to set state regulations concerning public water systems. Probably the biggest areas of concern have been cross connection and backpressure contamination.

In the residential setting, a cross connection is a direct link between a household water line and a contaminated source such as a garden hose, toilet tank or laundry tub. The most common contaminants, such as pesticides, sewage and detergents, can enter the public drinking water system through cross connections in home water lines. Hoses create most household cross connections. Under certain conditions, the flow in household water lines can reverse and siphon contaminants into the water supply. For example, using a garden hose to spray pesticides is normally harmless, but if the city's water supply is interrupted while you are spraying, you may have a problem. If water main pressure is reduced due to a water main break or nearby firefighting, a back siphonage effect is created. This can draw water from the garden hose into the home water

supply. If you have a pesticide or fertilizer sprayer attached to your garden hose, the chemicals can contaminate your water supply.

The public water system can also be contaminated by an effect called backpressure. Backpressure results when the water supply is connected to a system under high pressure, such as a hot water boiler for home heating or a portable automobile pressure washer. Since the pressure in these devices is higher than the normal home water supply, water can sometimes be forced backwards. Contaminants in these systems, such as cleaners or soaps in a pressure washer, can then enter and contaminate the public drinking water supply.

During fire department operations, cross connections occur when a residential hose or fire hose is submerged into the water tank when filling a fire truck, when pulling the residual pressure too low on a fire hydrant (below "0" psi), and even, in rare instances, when a fire engine is being filled directly from a fire hydrant. These are only three examples, but many more exist. Just like in the residential setting, there is either a cross connection or backpressure problem that causes the system to become contaminated.

So what does the fire department do? Let the house burn down or risk the contamination of the water system? Either way it is a matter of public health and safety, and it is a very difficult decision for any fire officer to make.

These are very important issues and should be decided prior to responding to a building on fire. A coordinated effort between the fire department and the water utility is essential to protect public health in these situations. In many cases, this cooperation hasn't always existed between the two departments. Issues related to locating fire hydrants have caused problems in many communities for years. One problem is locating fire hydrants strategically for fire department operations. The fire department's view is typically not the same as the water utility's view especially in allowing for water system flushing. Who has the authority for properly locating fire hydrants? Different jurisdictions have different interpretations of this question. The best solutions occur when the fire department and water utility work together on such issues.

By January 1, 2008, fire chiefs will be notified by certified mail that certain fire hydrants cannot be used for firefighting. Most fire chiefs would say that this is pretty strong, but in the event of an emergency, decisions to use or not to use fire hydrants must be made. Who will assume the liability at the time of a fire where a hydrant is available but the fire department is not allowed to use it? Who will assume the liability if the water system becomes contaminated? Water officials can be held personally liable for knowingly allowing the system to become contaminated. Many fire service leaders are saying this requirement is too unreasonable especially in the event of a possible victim rescue.

In a recent discussion with the Tennessee Department of Environment and Conservation (TDEC), I was told that the regulation change was intended to improve the ability of a fire department to identify inadequate fire hydrants.

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A previous Tennessee regulation did not follow the nationally recognized standard for color coding of fire hydrants (NFPA 291). The process of color coding allows the fire department to immediately know the available water supply from a fire hydrant by its color markings. If the water supply is limited or inadequate, the fire officer can make immediate changes to fire suppression tactics. According to the TDEC representative, a fire department can still use the fire hydrant to fill the truck but cannot connect the truck to the fire hydrant with a direct connection where a possible cross contamination could occur. A fire department can, however, fill a dump tank from the hydrant and then pump from the dump tank as long as there is an air gap between the hose coming from the fire hydrant and the water in the dump tank. This seems to be a lot of trouble, although necessary, to prevent pulling a vacuum on an inadequate fire hydrant. It is already the policy of many fire departments not to connect to Class C fire hydrants, and almost any experienced fire commander would agree that it is dangerous to use these limited flow hydrants.

Where main sizes, hydrant spacing, or distance from the water supply contributes to the lack of available water supply for fire protection, the fire department and the water provider should work together to prepare a plan of corrections and a timetable to fix these problems.

So, can people actually get sick from the fire department connecting to a Class C fire hydrant? Will this actually contaminate the water system? According to several recognized articles by the federal Environmental Protection Agency, there have been documented cases where water contamination occurred due to something that a fire department did or did not do. This type of contamination is quite difficult to pinpoint although a backpressure situation could occur any time fire apparatus is connected to almost any fire hydrant.

Most cases of waterborne disease outbreaks, have resulted in nausea, diarrhea, and cramps; however, it is possible for some cases to result in very serious illness and even death. Experts believe that most waterborne disease outbreaks are not recognized, so in truth, there may have been many times more than reported. According to the American Water Works Association (AWWA), "Cross-connection contamination can provide an opportunity for large amounts of biological material to enter the distribution system. These events generally result in noticeable change in water quality, including turbidity, increased content of solids, and undesirable tastes and odors." However, in a report released by TDEC entitled "Tennessee Rural Water Needs Report," it states that only a very small percentage (less than 1 percent) of the domestic water used in a typical household is for drinking purposes. If contamination does occur, there is only a small chance that people will be adversely affected.

The other argument from fire officials is that fire departments seldom connect hard suction hose to fire hydrants capable of causing a backpressure in a water system. This was the old way of pumping water from the hydrant. Today's operation in most fire departments is accomplished by laying 4-inch- or 5-inch-diameter hose (LDH) from the hydrant to the emergency scene. An LDH operation is like laying a water main from the

hydrant to the fire scene using existing flows from the hydrant at the present residual pressure. This hose is made of a soft vinyl material and is not capable of being used for suction purposes. The hose will simply collapse as the residual pressure is dropped. Occasionally there could be a need for suction hose on a large fire but most fire departments no longer even carry suction hose. The exceptions to this are in rural areas where drafting from ponds and swimming pools is necessary and in tanker shuttle operations where a fire engine is used to draft from a dump tank. Regardless, using suction hose is a last resort for most fire departments.

The time has come where a cooperative effort between fire departments and water utilities is necessary. The need to provide required fire flows with a goal to maintain good public health is paramount. Fire hydrants must be properly marked and identified. The public also needs to be educated in this area. If fire hydrants truly cannot be used, then why not remove them? What happens to homeowners who have an insufficient flow on the fire hydrant in front of their houses? Should they not be notified also that the hydrant is inadequate? One thing is certain: insurance requirements state that adequate water flows must be available within 1,000 feet of structures to provide full credit for fire hydrants. If not, insurance premiums will skyrocket.

Where fire hydrants are properly marked, most fire departments only connect to a Class C hydrant as a last resort. The fire department needs a reliable water source and according to Insurance Services Office (ISO) on community water systems, a minimum of 500 gpm is needed to fight a basic residential structure fire. Actually, depending on the distances between structures, the necessary fire flow is much higher. ISO also does not recognize hydrants on water mains less than six inches in diameter. So, it has been known that connecting into a red top hydrant will not supply basic needed fire flows and is only done as a last resort. However, ISO will recognize a fire hydrant in a rural setting where tanker shuttles are necessary that have a minimum flow of 250 gpm and a residual pressure of 20 psi.

This new rule should actually benefit fire departments by alerting them to the locations of unreliable (Class C) fire hydrants. The fire department should identify areas where red top hydrants exist and request reliable and appropriately sized water lines be provided that supply the needed fire flow. The ideal situation is where the water supply system is originally built to meet needed flow requirements. Many times this needed amount cannot be obtained from a single hydrant or single water distribution line. Alternatives include looping of multiple sources as needed as well as multiple hydrants. Buildings should be designed to determine needed fire flows. Hydrants should be flow tested and maintained in accordance with AWWA standards.

In actuality, the fire service should recommend that the rule become stricter by requiring all hydrants to be color coded to National Fire Protection Association (NFPA) standard colors.

Two things fire departments should do immediately are to get correct ISO hydrant flows

on all hydrants, and second, make sure all hydrants are adequately marked and color coded. When this is done, risk assessments and preplanning should be conducted in areas where inadequate flows are available. Alternative water sources can then be used or the water system improved to meet basic standards. Providing tanker shuttles becomes very expensive but may be an alternative to inadequate public water supplies.

FIRE HYDRANTS—TODAY AND TOMORROW

The first thing to consider is that fire hydrants that are inadequate for firefighting today have probably always been inadequate for firefighting. So why were they installed inadequately?

Water systems are expensive and fire hydrants are required by state planning regulations. Needed fire flows are not always available during the design phase of a water system project. Many other factors help determine actual flows and water main sizes to certain areas. Fire hydrants are also used to flush public water systems and many hydrants have been installed solely for this purpose. Nevertheless, inadequate and unmarked fire hydrants provide a false sense of security to fire departments and property owners.

MARKING OF FIRE HYDRANTS

To effectively fight a fire, firefighters must be able to determine hydrant flows immediately upon arrival. Fire hydrants should be color coded to the NFPA 291 standard so that firefighters can immediately have a visual indication of hydrant flow. Otherwise, without color coding they won't have any idea of a hydrant's flow potential.

NFPA 291 Marking of Fire Hydrants says that fire hydrant bonnets and caps shall be coded as follows:

COLOR	CLASS	AVAILABLE FLOW @ 20 psi residual
BLUE	AA	1500 GPM or more
GREEN	A	1000-1499 GPM
ORANGE	B	500-999 GPM
RED	C	Below 500 GPM

Fire hydrants should be immediately recognizable to firefighting forces as well as to the general public. The NFPA specifies that fire hydrants are to be painted chrome yellow; however, it accepts other body colors that were already in use at the time the standard was adopted in the 1970s. Other highly visible colors that have been used include white, bright red, chrome silver, and lime yellow. In jurisdictions where no standard color has been established, the most important aspect is consistency. Standard colors should be adopted that, preferably, are the same throughout the region.

NFPA also recognizes that there often are functional differences in service provided by municipal and private hydrant systems. Therefore, NFPA specifies that nonmunicipal hydrants be painted a color that distinguishes them from municipal hydrants. Violet has been established as the international color code for nonpotable water. Therefore hydrants supplied by nonpotable sources should be painted violet (light purple).

The following body colors are recommended for fire hydrants:

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SUPPLY	BODY COLOR
Municipal System	Chrome Yellow
Private System	Red
Nonpotable System	Violet (Light Purple)

One of the biggest mistakes made in color coding a hydrant is the failure to reduce the residual flow pressure to 20 psi. Many departments will color code the hydrant at whatever the flow was without taking time to chart or calculate the actual flow at 20 psi. This requires extra work but can mean the difference in color coding up to 50 percent of the hydrants in a given system.

HOW TO PROPERLY FLOW TEST A FIRE HYDRANT

Many fire departments and water utilities don't know how to properly flow a fire hydrant. According to TDEC, there is not a state regulation on how to properly flow a fire hydrant; however, they do recognize the American Water Works Association pamphlet No. M-17 as the recognized standard. This pamphlet is also what both ISO and NFPA recognize as the approved method for flowing fire hydrants.

According to this standard, the proper way to test a hydrant and water main is to put a cap gauge on the test hydrant and take a static reading. Then proceed downstream to the next flow hydrant and back upstream to the closest flow hydrant and flow both at the same time. Use as many ports and sizes of discharges to make the largest drop in residual pressure. Pitot each flowing port and then record the residual pressure back at the test hydrant.

When the test is complete, you will use three pieces of data to determine the flow of the hydrant: the static pressure, the residual pressure, and the flow pressure, which will be converted to gallon per minute by using a calculator or flow chart. The residual pressure will need to be charted to record the flow in gpm at 20 psi. According to water experts, this way of flow testing a fire hydrant is the best and most accurate method. Doing single hydrant flow tests is one reason so many communities seem to have so many red top hydrants.

CONCLUSION

Fire departments and water providers in Tennessee have come a long way over the past several years. Both groups now recognize that they contribute to the economic development and stability of the communities they serve. With the willingness to work together, each industry needs to strive to understand the responsibilities to the public and the needs of the other, without reservations. Neither sector is more important than the other. Both serve to protect the health and safety of the public; both must do so without undermining or disregarding each other or any other health and safety agency. The water industry has a responsibility to provide safe drinking water to all consumers served by public water supplies. The fire department has a responsibility to fight fires.

Yes, we all do drink from fire hydrants, and fire departments do have a responsibility for keeping our drinking water as safe as possible. Water providers have an equal responsibility to provide the needed fire flows for the types of structures that are being built in various parts

of the community. Everyone can benefit from this cooperative effort with reasonable water rates and lower insurance premiums where adequate water supplies are available and the fire department is trained to make safe connections to the water system.

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