Closing the Gap

Concerns over firefighter safety are no longer casual conversations. Increasingly, the emphasis on firefighter safety is moving from an afterthought to the forefront of everything from tactical to strategic decision-making processes. It is becoming part of the priority dialogue with fire marshals and fire protection engineers because they are the ones who are creating the environment in which firefighters are being asked to perform. Modern building technology now produces structures that are more complex than ever before and it is incumbent upon us as fire service members to come to consensus on what building technologies and practices are undeniably necessary for the life safety of firefighters in today's world.

This consideration is altogether timely and appropriate because the death of firefighters at the scene of a fire is an industrial accident in a classical sense of the word. The fire ground is our workplace. As IAFF leader Sean DeCrane has stated publicly, "a fire station is the staging area for us."[1] The significance of this consideration is increasing the need to review traditional approaches regarding all practices that affect safety.

Among these is the consideration for firefighter safety in the wearing of self-contained breathing apparatus (SCBA). There are multiple standards that have been promulgated to address the various aspects of this safety. Some of these considerations are on the fire ground. Others have to do with the infrastructure and support of SCBA programs.

One of the ideas that have come forward in the last few years to improve firefighter safety has to do with rules on air management. This concept, conceived in Seattle,[2] places a tremendous emphasis on firefighters never running out of air. This is a fundamental consideration. If a firefighter runs out of water they can back away from heat production. But if they run out of air in an atmosphere that is toxic they are likely to be unable to care for themselves.

The nature of this discussion is evolving with the creation of Firefighter Air Systems that are now being installed in structures. These systems provide firefighters with a readily available, safe and reliable source of breathing air replenishment inside the building structure to assure that fire attack crews and other emergency responders never run out of air.

[1] Vision 20/20

[2] Gagliano, Phillips, Jose, Vernocco, "Air Management in the Fire Service", *Fire Engineering,* Pennwell Publisher, 2008, Tulsa, Oklahoma

NFPA 1500 standards established for SCBA breathing air replenishment within the fire station were naturally transitioned to the Mobile Air Unit in NFPA 1901, bringing the technology for breathing air replenishment closer to the site of an emergency event. This capability has now moved into the next logical phase by being able to provide SCBA breathing air replenishment within the complex structures themselves via the installation of a Firefighter Air System.

Unfortunately, past practices and policy considerations on how SCBA replenishment could and should be done contain certain inconsistencies and create the need to properly evaluate how firefighters replenish their air in an emergency within a complex structure.

In past practice, the process was real simple. When you ran low on air, you changed your bottle. For the most part, that still remains true. When the cylinder is empty it needs to be replaced. In the past, the filling of SCBA cylinders was normally done back at the maintenance facility and brought to the scene in a support vehicle where firefighters could exchange out their empty bottles. In contemporary agencies refilling SCBA cylinders is typically done with an on-scene compressor within a Mobile Air Unit.

There is no question that there was an absolute necessity to protect operators of air supply units at the maintenance facility and the operator of an MAU. The rules that first applied to this are straightforward, "during the filling of SCBA cylinders, all personnel and operators shall be protected from catastrophic failure of the cylinder."[3] This is accomplished by requiring a Certified Class II Rupture Containment Station designed to prevent a ruptured cylinder from resulting in injury or death to the operator. That is a very specific engineering environment.

NFPA 1500 Annex A section A7.14.5 states, "it is recommended that the industry develop an inexpensive, lightweight chamber or other means to provide protection at the fire scene during routine cylinder filling. There is no current commonly accepted standard or specifications for protected enclosures in which to fill SCBA cylinders. Until such a standard is defined, such equipment should comply with the standards defined for fragmentation tanks in NFPA 1901, *Standard for Automotive Fire Apparatus*."

Unfortunately there is no product that meets Section A7.14.5. There is a device called a Portable Explosion Containment/Fragmentation Deflector (sometimes called a "Pop Can") that has been suggested as a potential solution. Also referred to as "frag deflectors" or "frag chambers," these stations "may" provide a small measure of protection for an air refill operator when refilling high pressure breathing air cylinders but, as manufacturer product data states, they are really only "one step up from having no operator protection, when refilling SCBA cylinders." The primary function the Pop

[3] NFPA 1500, Section 7.14.5

Can tube serves is to hold round-bottom cylinders in the upright position for added ease of air refilling. Pop Can Stations *do not* meet NFPA, NIOSH or OSHA requirements for the protection of firefighters during the SCBA refilling process. It doesn't make any sense to ask a firefighter to remove an SCBA cylinder from his/her back merely to put it in a vessel that doesn't provide adequate protection or meet any standard. In a risk assessment world, this is an unacceptable risk.

Times have changed with respect to breathing apparatus utilization. With the advent of more and more emphasis on safety and the number of accidents that have resulted in firefighter death because they ran out of air, an innovation was created called the RIC/UAC[4] technology. This mechanism is placed on individual breathing apparatus for the very specific reason of being able to refill a cylinder while it is on the back of a firefighter who is operating in a dangerous environment. This environment is normally considered to be an IDLH. By putting the RIC/UAC fitting on the breathing apparatus there is acceptance of the fact that this is an emergency scenario and that using a rupture containment station may be both unlikely and unreasonable to expect.

Notably, NFPA 1500 recognizes this.[5] Sections 7.14.7 and 7.14.8 both address the need to identify these key scenarios. Section 7.14.8 states that rapid filling of SCBA while being worn by the user shall only be used under the following conditions:

(1) NIOSH approved fill options are used
(2) The risk assessment process has identified procedures for limiting personnel exposure during the refill process and has provided for adequate equipment inspection and member safety
(3) An imminent life-threatening situation occurs that requires immediate action to prevent the loss of life or serious injury.

Section 7.14.9 further states "in an *emergency*[6] situation where an individual becomes disoriented, runs low on air, is trapped or injured and cannot be moved to a safe atmosphere, and danger of serious injury or death is likely, rapid refill, air transfer, or a supplied-air force shall be an approved method to provide a source of breathing air."

Current thought is that a certified class II rupture containment station is absolutely required when refilling SCBA cylinders. No one can doubt that when refilling SCBAs the use of cylinder protection measures that are compliant with NFPA standards is an appropriate safeguard. The presence, however, of a Firefighter Air System within any complex structure requires a reassessment of how rapid refill processes are integrated with firefighting operations.

[4] RIC/UAC = Rapid Intervention Crew/Universal Air Connection

[5] NFPA 1500 Standard of Fire Department Occupational Safety and Health Program

[6] Italics by Author

At one level, it is all together reasonable to protect firefighters against cylinder rupture. That is a theoretical safety concern. At another level, removing the possibility of rapid refill in conjunction with a Firefighter Air System under emergency conditions exposes firefighters in combat to a real threat. They can run low on air and have to abandon the fire fight and wait for breathing air cylinders to be manually brought to help them. Or they can run out of air and need to be rescued by a Rapid Intervention Crew; which, in the worst case scenario if the crew cannot reach them in time, will result in tragic death.

A complex structure that is on fire is an emergency condition. It is an imminent threat to those who are entering that environment. Tall buildings, large complex structures and subterranean scenarios tax the physical demands of a firefighter and impose logistical requirements on incident commanders for effective air management. Firefighters need every technological advantage they can obtain in order to survive and successfully contain not only fires, but also the effects of other natural disasters such as an earthquake that may cause a toxic environment, or even a chemical or biological threat.

There are conditions within a complex structure in which firefighters do not have time to remove their air cylinders to use rupture containment stations. They need air and they need it right now. Many fire departments today consider rapid refilling to be appropriate for their tactics and strategy when they are functioning in an emergency or IDLH atmosphere, and have already opted to use the RIC/UAC fitting in conjunction with a firefighter air system. It is assumed that these fire departments have "identified those unique emergency situations where rapid refilling shall be permitted to occur."

It should be stipulated that in no way is this argument aimed at removing the criterion that SCBA cylinders being refilled in a non-emergency condition should be revoked. Such policies and procedures should have the maximum amount of safety that can be incorporated.
There needs to be rational discourse between fire prevention and fire suppression that are on the leading edge of this issue to determine what is in the best interest of the firefighters.

Shouldn't there be a compromise in this discussion, one which incorporates both technologies—rupture containment and rapid fill use within complex structures?
This requires that there be some form of review of the technical standards that are risk-assessment based. Ultimately, there needs to be a resolution of this issue within the standards setting community.

The reason firefighter air systems are being installed in buildings is to increase firefighter effectiveness and reduce the possibility of firefighter injury or even fatality as a result of running out of air. There has to be a balance point somewhere that leverages the use of the rapid fill RIC/UAC and rupture containment technology. The standard already allows that "in an emergency situation" rapid refill is allowed. Although firefighter air systems are designed to refill SCBA cylinders under any conditions, their primary function is for use in complex structures during emergency events. If the rapid fill RIC/UAC was standardized to save firefighter lives, why is it not good enough to serve as a methodology used

with firefighter air systems when firefighters are directly faced with emergency conditions? Does it take a firefighter down because they have lost all of their air to justify the use of rapid refill? This seems a bit too dangerous when there is an option that is readily available. That option is to use the rapid refill RIC/UAC technology with firefighter air systems.

SUMMARY

Firefighter life safety must always be of paramount concern. With respect to complex structures, the firefighter air system which utilizes both rupture containment and rapid fill RIC/UAC technologies provides the optimal solution for firefighter safety. Both technologies play an important role and are not mutually exclusive. This paper provides the facts which can close the gap between the use of rupture containment refill and rapid refill RIC/UAC technologies. What is needed is the formulation of the appropriate codes and standards to ensure that both of these vital technologies are readily available to firefighters when an emergency incident occurs.

This is not a trivial matter. It is a philosophical point that must be resolved as more and more firefighter air systems are considered for installation. There needs to be rational discourse between fire prevention and fire suppression that are on the leading edge of this issue to determine what is in the best interest of their firefighters. There needs to be a resolution of this issue within the standards setting community.