

Dante's Inferno:

Fighting Fires in Tunnels and Underground Structures

By

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In the fire service we frequently refer to the interior of a burning building as Hell, or Hades as it is sometime called. We envision fire as a dragon or as the devil and we use the image in contrast to our efforts to control the blaze.

But it is not the first time the imagery has been used.

Among the classics of literature is a story called *Dante's Inferno* (Italian for "Hell"). This is the first part of Dante Alighieri's 14th-century epic poem titled *The Divine Comedy*. It is an allegory telling of the journey of Dante through Hell, guided by the Roman poet Virgil. According to Dante, Hell is not above ground, but rather below ground and it is a dangerous place to be for anyone that enters. As Dante enters the gates of Hell he references an inscription over the opening: "Lasciate ogni speranza, voi ch'entrate!" or "Abandon all hope, ye who enter here!" According to Dante there are nine levels of hell and he went into great detail to describe them.

If you are a firefighter in a metropolitan area, there is a possibility that you may understand Dante's admonition better than most. There is a possibility that you may be required to fight fire underground. That is an important scenario that the fire service must be prepared to deal with. Many railways and subways are constructed underground. Many of these facilities also involve subterranean building structures that must be accessed underground. The challenges these structures present can be daunting.

The Emerging Problem

Tunnel systems are enclosed areas that typically become packed with people at predictable times during the day, usually during commute hours. Air currents above ground, as well as those generated by the movement of cars or trains through the structure, accelerate the spread of smoke or gases through the tunnel and up to street level through the ventilation system, exposing many people to toxic fumes. This presents significant challenges in a fire emergency, but also during any kind of incident in which air quality is compromised, such as the Sarin gas attack in the Tokyo subway in 1995.

The problems facing underground transit systems are becoming increasingly complex. Many involve age, neglect, and mismanagement.¹ One thing they share is a staggering repair bill. The meltdown of the nation's subway system and its infrastructure is sending a direct warning to federal lawmakers that the

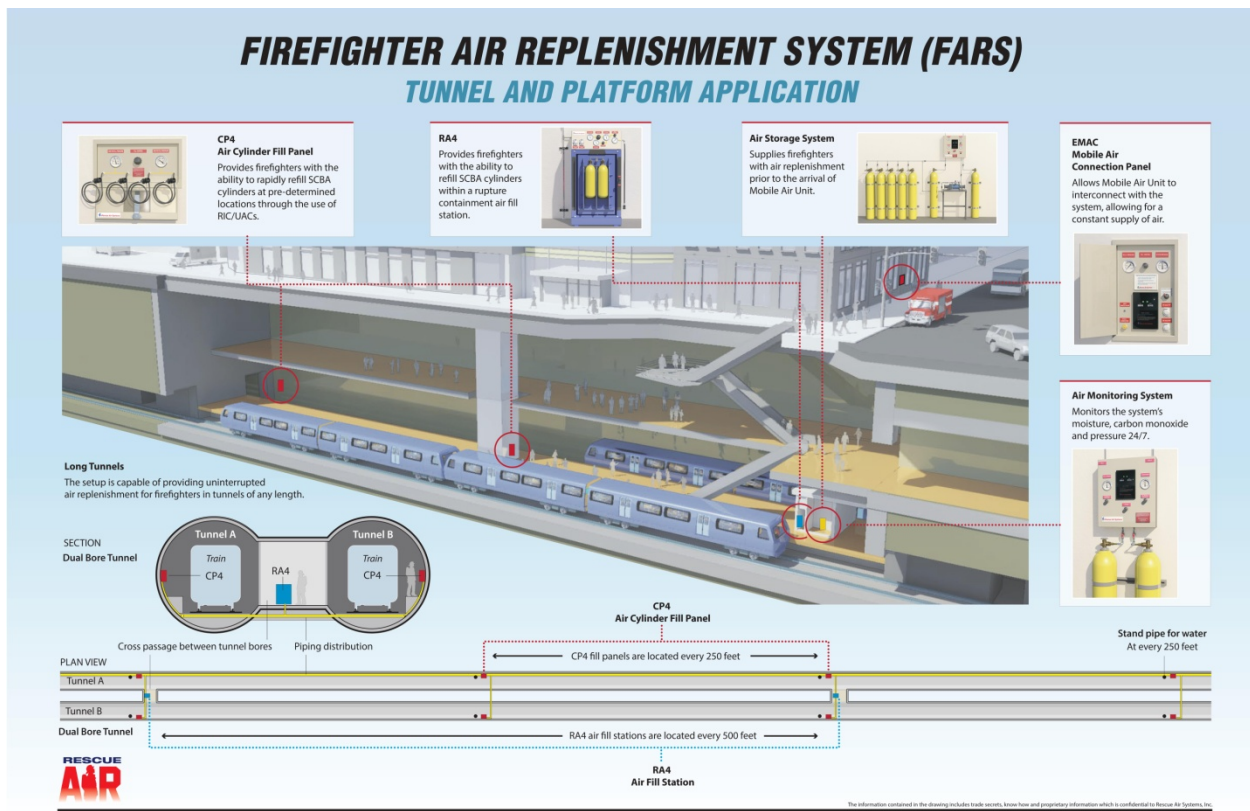
¹ Nuckols, Ben, Poor Maintenance Lead to Fatal DC Subway Fire, 05-03-2016

country's aging mass transit systems need billions of dollars in repairs that, if unmet, pose a genuine safety threat to the public. And this is occurring at the same time that more of these structures are on the planning boards for the future.² One scenario under discussion is a subway system in the Los Angeles area with five new transit lines and at least six extensions that are already built or under construction. This new project is estimated to cost somewhere between 7 and 9.5 billion dollars.

Incident Records

Fortunately, we don't experience a subway fire often. The track record includes some special events such as the Baku Metro Fire, and the Kings Cross Fire. It is a type of fire problem that is out of sight, and therefore out of mind. Yet the potential for these types of fires is increasing almost daily as a result of the deterioration of existing facilities and development of new line extensions. The logistics of delivering personnel, equipment and replacement SCBA deep inside these structures, while fighting fire and conducting search and rescue operations, should be a primary consideration of the authority having jurisdiction.

One solution that should be considered by communities that have these transfer systems is the use of the firefighter air replenishment system (FARS) tunnel and platform application.



² Nelson, Laura J., Los Angeles Times, no date

This system should already be familiar to those who are managing risks in high-rise buildings. The tunnel and platform application of FARS has the same components as the high-rise application. Those components are clearly illustrated in the graphic above. They include:

- An air monitoring system
- A mobile air connection panel
- An air storage system
- A compressor
- Air cylinder fill panels

The spacing for these components is on a horizontal distance rather than by number of floors, as specified in a high-rise.

This system can be installed retroactively in subways and tunnels as they undergo upgrades and repairs, and should definitely be considered for all new installations. There is no better option for delivering air to firefighters in a complex underground structure. Extending underground lines increases the risk that a fire or serious event will occur. A FARS system would be instrumental in limiting danger to firefighters by reducing the risk of running out of air underground.

Summary

Modern risk management means that if we have identified a problem, we should initiate mitigation. Fighting fires in subways is complex and requires specialized tactics. Installing FARS into subterranean occupancies and subways means that aggressive firefighting tactics can occur and be sustained with a minimum external impact on the department. That way we will not have to put Dante's warning sign at the entrance of these types of fire scenarios.

Ronny J. Coleman is a 50-year veteran of the fire service. He is the Past President of the International Association of Fire Chiefs and the Fire & Emergency Television Network, which features career development and succession planning in its Command Transfer series. He served as the Fire Chief in Fullerton and San Clemente, CA, and was the Fire Marshal of the State of California from 1992 to 1999. He is a certified fire chief and a master instructor in the California Fire Service Training and Education System. A Companion Fellow of the Institution of Fire Engineers, he has an associate's degree in fire science, a bachelor's degree in political science and a master's degree in vocational education. In 2014, Chief Coleman received the Tom Brennan Lifetime Achievement award from Fire Engineering. In 2015 he was awarded the International Public Safety Leadership & Ethics Institute Honors Award.