THE NEXT STANDPIPE INITIATIVE

THIS OR THAT?

KNOW THE DISTANCE

An Executive Brief from The Next Standpipe Initiative

HOW FAR IS TOO FAR FOR A FIREFIGHTER TO REACH AIR?

High-rises create vertical distance. Big-box buildings create horizontal distance. Both increase physical workload, air consumption, and the demand on department capacity.

MEASURE IT. STAFF IT. PLAN FOR IT.

Executive Summary

A truck company climbs 20 flights of stairs to reach a high-rise fire. An engine company advances hose hundreds of feet into a 650,000-square-foot big-box store. A search team works deep inside a multilevel fulfillment center. The buildings are different, but every crew faces the same limitation: the firefighter enters with a finite supply of breathing air.

For generations, the fire service improved how water reached firefighters. Hydrants, fire pumps, standpipes, and sprinkler systems all recognize the same reality: at some point, building height, depth, size, or complexity can exceed what firefighters can reasonably support from the street. Air has not followed the same path.

The Rule of Air Management remains essential. Firefighters must know their air, manage it from entry, protect the emergency reserve, and account for the trip out.[7][9] Distance, however, introduces another problem. Every floor climbed and every foot traveled requires work before firefighters reach the assignment. That work raises heart rate, increases breathing, consumes cylinder air, and begins the fatigue process before search, fire attack, rescue, or overhaul begins.[10][13]

At some point, departments may discover they do not have the capacity to move enough air, far enough, for long enough, while sustaining the firefighters performing the work and continuing to staff every other critical fireground function.

The Next Standpipe Initiative brings this conversation into fire departments before the first alarm sounds. It encourages departments to examine their buildings, evaluate their resources and capabilities, understand the physical and logistical demands created by distance, and determine whether current air-resupply practices can keep pace.

BEFORE THE FIRE SERVICE CAN ANSWER “THIS OR THAT?”, IT FIRST MUST KNOW THE DISTANCE.

The Same Firefighter. The Same Cylinder.

A firefighter may work a residential fire and later be assigned to climb 20 flights in a high-rise or advance hose hundreds of feet into a 650,000-square-foot big-box store. The firefighter brings the same lungs, SCBA, cylinder, and Rule of Air Management. What changed is the building, the travel distance, the work required to reach the assignment, the route back out, and the manpower needed to sustain replacement air.

Distance Increases Workload

Distance is not empty space.

Every floor climbed and every foot traveled requires work before firefighters reach the assignment. That work raises heart rate, increases breathing, consumes cylinder air, and begins the fatigue process before search, fire attack, rescue, or overhaul starts.

Firefighter physiology research summarized in the Fire Engineering Firefighter Air Supplement and supported by the underlying peer-reviewed study demonstrates that demanding fireground tasks rapidly increase air consumption and cardiovascular strain.[10][13] The research reported peak minute ventilation near 90 liters per minute during hose advance and search and approximately 74 liters per minute during stair climbing. The authors calculated that, if those peak rates were sustained, a nominal 30-minute cylinder could be depleted in approximately 14 to 17 minutes, with about nine to 11 minutes before the low-air alarm. The authors cautioned that peak rates are not normally sustained throughout an operation, but the findings demonstrate how quickly hard work can reduce practical cylinder duration.[10][13]

During a second bout of simulated firefighting, work output declined by approximately 10 percent during stair climbing, 22 percent during hose advance, 27 percent during search, and 18 percent during overhaul, while physiological strain continued.[10][13]

Taken together, these findings point to a compound operational problem. Firefighters work to reach the assignment; that work consumes air, and accumulating fatigue reduces what they can accomplish once they arrive. At the same time, the department faces increasing demands for cylinder movement, crew rotation, relief, rehabilitation, and replacement personnel. This is the Firefighter Air Coalition's operational synthesis of the published findings.

High-Rise Distance

In a high-rise, distance is measured vertically. Firefighters may climb multiple floors carrying PPE, SCBA, hose, tools, and other equipment before beginning the assignment.

In his Fire Engineering article, Capt. James Davis of the Chicago Fire Department compares the equipment burden carried during a stairwell-only high-rise deployment to hauling a 135-pound barbell up the stairs. Davis explains how stairwell ascents increase physical workload, delay personnel and equipment, and complicate sustained operations.[12]

Davis summarizes research suggesting approximately one minute per floor through the first 10 floors, with climbing rates slowing beyond that point as fatigue and equipment burdens increase. He also explains that delayed secondary movement affects the arrival of relief crews, logistical support, and fresh cylinders needed to sustain committed firefighters.[12]

For departments, the practical question is not simply whether cylinders can be carried upstairs. It is whether the department can sustain the air, staffing, crew rotation, rehabilitation, logistical support, and firefighter endurance required for an extended high-rise operation.

Big-Box Distance

In a big-box or large-footprint building, distance is measured horizontally. Firefighters may advance hundreds of feet while moving and controlling charged hose through smoke, storage racks, machinery, partitions, and limited visibility. The farther crews travel, the more physical work is required before the assignment begins.

A Firefighter Nation operational analysis calculated that the final 100 feet of charged handline weighed approximately 144 pounds for 1¾-inch hose, 180 pounds for 2-inch hose, and 274 pounds for 2½-inch hose under the assumptions used in the article.[11] Actual weight will vary with hose construction, diameter, length, and water volume. Dorgan notes that heavier handlines require more personnel to move, leaving fewer firefighters available for other fireground assignments.[11]

When a crew reaches reserve air, the crew must leave the work area, reach a location where replacement cylinders are available, change bottles, and travel back before resuming the assignment. Full cylinders move forward. Empty cylinders come back. Firefighters must sustain that movement for as long as the incident continues.

For departments, the operational question is whether available staffing and resources can sustain the air, workload, crew rotation, and logistical support required to keep firefighters operating effectively in large-footprint buildings.

Distance Creates Demand

Firefighters do not experience building growth as a number on a site plan. They experience it as distance and work.

- Physical work required to reach the assignment
- Air consumed before work begins
- Air required for the trip out
- Time needed to rotate crews
- Movement of full and empty cylinders

- Firefighters committed to air resupply
- Availability of crews for search, attack, rescue, and rapid intervention
- Ability to sustain an extended incident
- Resources remaining to protect the community

Taken together, the evidence shows that distance is more than a travel issue. For departments, it becomes a workload, air-consumption, staffing, time, and operational-capacity issue.[10]-[13]

The Buildings Have Changed

Departments are protecting mega-warehouses, multilevel fulfillment centers, high-rises, underground facilities, cold-storage buildings, and industrial occupancies that would have been uncommon a generation ago. Firefighters have adapted, but the cylinder on the firefighter's back has not grown with the building. A 20-floor climb does not add air to the cylinder, and a 650,000-square-foot big-box store does not add firefighters to carry replacement bottles.

The Scale of Growth, 2000-2026

A secondary source citing JLL data reports that the average U.S. warehouse grew from approximately 65,000 square feet in 2000 to approximately 210,000 square feet by early 2024.[1] CBRE defines an industrial big-box facility as a traditional warehouse or distribution center of at least 200,000 square feet and reports that a record 413 million square feet of North American big-box construction was completed in 2023.[3]

The U.S. Energy Information Administration reported that from 2003 to 2018, the number of U.S. commercial buildings increased 22 percent while total floor space increased 35 percent, meaning growth in building size outpaced growth in building stock.[4] Site Selection Magazine, citing Cushman & Wakefield research, reports that warehouse clear heights have also increased, with 32 feet typical for newly constructed facilities larger than 300,000 square feet, 36 feet common in mega-sized buildings, and some clear heights exceeding 40 feet.[2]

Commercial sources report Tesla's Giga Texas facility at approximately 10 million square feet and Amazon's U.S. warehouse footprint at approximately 445 million square feet.[5][6] These figures are not presented as government-verified measurements. They illustrate the scale being reported in today's logistics and industrial market.

For departments, the practical implication is longer travel, larger search areas, extended hose stretches, greater physical work, and increased air-resupply demands.

The Capacity Question

DO WE HAVE THE CAPACITY TO MOVE ENOUGH AIR, FAR ENOUGH, FOR LONG ENOUGH, WHILE SUSTAINING THE FIREFIGHTERS PERFORMING THE WORK AND STILL ACCOMPLISHING EVERY OTHER CRITICAL FIREGROUND FUNCTION?

Every department has a finite number of firefighters, cylinders, apparatus, and support resources. The Firefighter Air Coalition's concern is that, in some buildings, the manpower and time required to sustain conventional air resupply may begin competing with search, fire attack, rescue, rapid intervention, accountability, relief, incident support, and response to additional emergencies.

The problem is not that bottle brigades do not work. They do. The problem begins when the number of firefighters and the amount of time required to move air start delaying operations or reducing the department's ability to perform other essential assignments. Departments should evaluate whether that point exists locally before an emergency exposes it.

Water Has a Standpipe. Why Not Air?

When buildings became too tall, deep, or large to move enough water from the street, the building began helping deliver it. The water standpipe did not replace firefighters, hose, pumps, training, or tactics. It placed a critical resource closer to the point of operation.

The Next Standpipe asks whether breathing air should follow the same principle. Not necessarily the same solution. The same operational discussion. The 2021 International Fire Code includes Appendix L provisions for fire fighter air-replenishment systems, demonstrating that this engineering concept is already addressed in model-code language.[8] The fire service must still determine where and when such systems are appropriate.

The Rule of Air Management Remains Essential

Nothing in The Next Standpipe changes the Rule of Air Management.[9] Firefighters must know their air, manage it from entry, protect the emergency reserve, and account for the trip out. NFPA 1404 addresses respiratory-protection training and air-management requirements.[7] ROAM manages the air carried by the firefighter, but it does not shorten a stairwell, shrink a warehouse, move charged hose, carry replacement cylinders, or provide the staffing needed to sustain air resupply.

Know the Distance. Know the Demand.

Measure It

Walk the actual route between the anticipated point of operation and reliable breathing air. Account for stairs, turns, obstructions, storage, and the physical work of moving hose, tools, equipment, and replacement of cylinders.

Staff It

Determine how many firefighters are required to move cylinders, maintain staging, support cylinder exchange, rotate crews, and preserve search, attack, rescue, rapid intervention, accountability, and relief.

Plan for It

Decide what the distance, workload, air consumption, and staffing commitment mean for incident duration, mutual aid, rehabilitation, additional calls for service, and community response capacity.

Before We Can Answer, “This or That?”

THIS

Continue relying on firefighters to carry breathing air to the point of operation.

THAT

Explore ways to bring reliable breathing air closer to where firefighters need it.

The purpose of Know the Distance is not to prescribe a universal answer. It is to bring the conversation into fire departments and encourage each department to examine its structures, resources, firefighter workload, and operational capabilities.

BEFORE THE FIRE SERVICE CAN ANSWER “THIS OR THAT?”, IT FIRST MUST KNOW THE DISTANCE.

The Mission Has Not Changed

Firefighters enter buildings to search for victims, rescue occupants, control fire, protect property, and help other firefighters in trouble. Every one of those responsibilities depends on breathing air and the physical capacity to perform the work.

The mission has not changed. The oath has not changed. The buildings have. This is not a question that should be left for the fireground to answer.

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Source note: Market, property size, physiological, and operational figures are presented as reported by the cited sources. Departments should use verified local building information, staffing, equipment, training observations, and pre-incident plans when evaluating their own capabilities.