53-Year-old Sergeant Dies from Cardiac Event While Asleep in Station During Duty Shift – Indiana

Executive Summary

A 53-year-old male was hired by this FD in 1995 and at the time of this incident held the rank of SGT at this fire department (FD). On April 13, 2025, his unit responded to three medical calls—two were canceled en route, and the third at 1900 involved a chest pain patient who was assessed and transferred to an ALS unit for transport. The remainder of the shift was uneventful, and he went to bed around 2200 hours. On April 14 at 0730, he was found deceased in his quarters after missing the 0700 shift change. Resuscitation was not initiated due to clear signs of rigor. An autopsy found the cause of death was a blood clot in one of the arteries of the heart with diffuse narrowing of the heart arteries due to buildup of cholesterol plaques as a contributing factor.

Notably, on March 19, 2025, the SGT had an echocardiogram (heart ultrasound) conducted by an external contractor sponsored jointly by the FD and IAFF union local to conduct whole body ultrasounds as voluntary screening examinations. The echocardiogram showed a new finding of aortic valve dysfunction, a condition that can affect blood flow from the heart. The contractor advised him to follow-up with his cardiologist. He was seen by his cardiologist on April 11, 2025, where he reported new shortness of breath and exercise intolerance. The cardiologist's notes cite the reason for his visit were new symptoms and the abnormal echocardiogram. The date of onset of these new symptoms was not noted but his physical exam at that visit was normal. The cardiologist arranged for additional testing on April 25, 2025, to better assess his new aortic valve dysfunction. The SGT had also been diagnosed with a seizure disorder in January 2023 but had been cleared by his neurologist to work as a firefighter.

Key Recommendations

NIOSH offers the following recommendations to reduce the risk of heart attacks and sudden cardiac arrest among firefighters at this and other fire departments across the country. Many of our recommendations cite relevant National Fire Protection Association (NFPA) standards which are periodically updated. Please note that it is our practice to cite the version of each standard in effect at the time of the fatality.

- *Key Recommendation #1: Consider implementing return-to-work policies consistent with NFPA recommendations [2025 NFPA].*

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- *Key Recommendation #2: Consider placing information regarding components of required annual medical examinations as per NFPA 1582/1580 recommendations and the contact information for their occupational health provider in a location where this information is easily accessible to all members.*
- *Key Recommendation #3: Encourage members to promptly report new or changing medical conditions to the department as they occur so they can be evaluated by a physician aware of NFPA guidelines to ensure their safety and that of their coworkers.*

For further information, visit the program at www.cdc.gov/niosh/firefighters/fffipp or call toll free 1-800-CDC-INFO (1-800-232-4636).

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Introduction

A 53-year-old male firefighter was hired by this fire department in 1995 and held the rank of SGT at the time of his death. During the SGT's tour of duty on April 13, 2025, the station responded to three emergencies, all of which were medical. Two of these calls were cancelled en-route and the Engine A crew (SGT, Company Officer, and 2 other firefighters) returned to station. The third call occurred at 1900 for a patient complaining of chest pain. The Engine A crew conducted an initial assessment and then transferred the patient to an ALS unit for continued treatment and transport to a hospital. Upon returning to the station, the rest of the evening was unremarkable, and the SGT retired to his bunk at approximately 2200 hours. Coworkers stated they did not hear the SGT report any pain or discomfort and did not observe any unusual or abnormal behavior. On April 14th, 2025, at 0730 he was found deceased in his living quarters after not being present for shift change. Resuscitation was not initiated due to clear signs of rigor and he was declared deceased on scene.

Fire Department

This FD is a career municipal fire department with approximately 142 uniformed personnel. There are 42 to 44 firefighters working between 7 stations on each shift. The department services a coverage area of over 32 square miles and serves a population of over 70,000 residents. Firefighters work a 24-hour shift starting at 0700 and then are off for 24 hours before working another 24-hour shift. After the third 24-hour shift, they are off for 4 days before starting the cycle again. Approximately 90% of their annual calls are for medical emergencies.

Membership and Training

The department's policy document refers to the Indiana Code 36-8-3.5-12 for eligibility criteria. This code states that appointees to the fire and police department must be "a citizen of the United States, a high school graduate or equivalent, and be at least twenty-one years of age but under 40 years of age. However, the age requirements do not apply to a person who has been previously employed as a member of the department." Applicants must also pass a "general aptitude test" that covers the "essential functions of the job."

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Preplacement/Annual/Return-to-Work Medical Evaluations

Pre-placement Medical Evaluation

The SGT's pre-placement medical evaluation was conducted in August 1995. The only positive finding on this evaluation was a self-reported history of asthma triggered by "grain dust and certain pollens." This was noted under "excludable conditions." The examiner commented that his asthma was stable with use of his albuterol inhaler as needed and his chest x-ray and pulmonary function testing were normal, so he was cleared for duty.

Annual Medical Evaluations

We asked for the SGT's records from 2019–2025 and found that the department's occupational health provider changed in 2024 from Company A to Company B.

According to a 2023 departmental flyer, the mandatory annual medical evaluation components included a physical examination, vital signs, "respirator/medical review," and pulmonary function testing. A baseline chest x-ray was required for all new personnel but only divers were required to have chest x-rays done every 2 years thereafter. Optional components paid for by the department annually included blood tests (complete blood count, metabolic panel, lipid panel, and thyroid stimulating hormone levels; a prostate specific antigen test for males 40 years of age or older), urinalysis, and an electrocardiogram (EKG). Company B was not provided with the prior medical evaluations conducted on the department members by Company A.

In 2024, when the department transitioned to Company B as their new provider for their annual medical evaluations, the medical evaluation included the same components, but all were now mandatory. The annual medical evaluations are scheduled by Company B during duty hours and were conducted by a nurse practitioner. Abnormal results or concerning history items were flagged for physician review.

In March 2025, the department and union jointly hired an external contractor to conduct whole body ultrasound scans as a voluntary screening program. This screening program was separate from the required annual medical evaluations and not conducted under the oversight of Company B. The contractor sent result reports directly to each participant and members were advised to see their own healthcare provider to follow up on any abnormal results. Company B was not automatically provided with the results of these screening scans.

Return-to-Work Evaluations

Prior to April 2025, department policy required a return-to-work letter from a healthcare provider if a member was out sick for two or more duty shifts. No fire department physician review of return-to-work clearance letters was required. This policy was changed in April 2025 following the SGT's death to require all return-to-work clearance letters from any healthcare provider to be reviewed by Company A for consistency with NFPA policy. Note that the FD stated that Company A was reviewing return-to-work clearances as a separate, objective reviewer from Company B, which was responsible for the pre-placement and annual medical evaluations.

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Wellness/Fitness Programs

This department has wellness and fitness programs outlined in their 2025 policy manual. Each station has workout facilities. The specific equipment varies between stations. In Spring 2026, the International Association of Fire Fighters (IAFF) anticipates the release of the 5th edition of its Wellness Fitness Initiative (WFI) that fire departments may use as a guide for setting up these programs for their staff. The current WFI edition can be found at https://www.iaff.org/wfi/.

Investigation

The SGT fulfilled the role of Engineer/Driver. The other 3 firefighters who had worked with the SGT during his last shift had known him for at least a year. The President of the local union had known the SGT for over 25 years. They reported that the SGT did not complain of illness and were unaware of any instance in which he was unable to complete firefighter tasks while on duty. The interviewed firefighters said the SGT appeared fit for his 53 years of age and performed well in all essential functions of the fire service.

During the investigation, NIOSH investigators interviewed the following people:

- Department Chief
- President of Local IAFF union representing this department
- Three coworkers who worked with the SGT on his last shift
- Medical director, nurse practitioner, and regional director of Company B, the occupational medicine providers overseeing annual medical evaluations at the time of this fatality

The NIOSH investigators reviewed the following documents:

- Department Standard Operating Procedures (SOP) and Guidelines (dated 2024)
- Department Policy Manual (versions dated 11/9/23, 11/11/24, 4/28/25, 12/1/25, and 1/12/26)
- Collective bargaining agreements between the City and the local branch of the IAFF (covering 1/12/21–12/31/24 and 1/1/25–12/31/28)
- Autopsy report and death certificate
- Departmental annual medical evaluations and injury reports from Company A (2019–2023) and Company B (2024–2025)
- The SGT's medical records covering 2019–2025 from his:
    - Primary care provider
    - Cardiologist

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  - Neurologist
  - Emergency Department visits
- Results of the whole body ultrasound scan conducted in March 2025 on an elective basis by an external contractor

Medical Findings

The autopsy noted that the cause of death was coronary artery thrombosis with atherosclerotic cardiovascular disease as a contributing factor. Additional autopsy findings included enlargement of the heart (640g), with dilation and hypertrophy of the left ventricle. Pulmonary congestion and edema were noted in both lungs. A mitral valve replacement (from 2014) was noted. Atherosclerosis of the coronary arteries ranged 10–40% stenosis (narrowing of the vessel lumen due to cholesterol plaque buildup). There was a new blood clot in the distal portion of the left main coronary artery blocking approximately 60% of the lumen. He was found to have coronary artery ectasia of the left main, left anterior descending, and right coronary arteries. Ectasia denotes a vessel diameter > 1.5 times normal. Ballooning of the blood vessel due to ectasia may result in non-laminar blood flow thereby increasing the risk of blood clots [Eid et al 2023].

Reviewing the SGT's medical records along with the autopsy report, the SGT had 3 medical issues of concern with respect to his work as a firefighter.

Cardiac Issues

The SGT underwent replacement of his mitral valve in 2014 due to damage sustained from rheumatic fever. He was under a cardiologist's care and had periodic follow-up echocardiogram (echo) scans after the repair. These were stable and showed cardiac function within normal parameters with only trivial mitral valve regurgitation. No work restrictions were placed on the SGT following successful replacement of his damaged valve.

In April 2020, the SGT's body mass index (BMI) was 30 kg/m^2 which placed him in an obese category. He went to a weight loss clinic to assist his weight loss efforts and was referred back to his cardiologist due to an abnormal EKG. The weight loss clinic likely did the EKG as a screening precaution as some weight loss medications they planned to prescribe can have cardiac side effects. He was cleared by the cardiologist following an echo which was unchanged from previous scans. By August 2020, he lost 28 lbs. to achieve a weight of 189 lbs. resulting in a BMI of 25 kg/m^2.

The SGT had a transthoracic echocardiogram (TTE) done on March 19, 2025, as part of the voluntary whole body screening scan jointly sponsored by the department and the union. This scan package included ultrasounds of the carotid arteries, thyroid, heart (TTE), abdomen, pelvis/scrotum, and bladder. This scan package was separate from the department's annual medical evaluation, so Company B was not involved in this testing and did not receive the results. The TTE showed new dilation of the aortic root, mild to moderate aortic regurgitation, concentric hypertrophy of the left ventricle, and mild dilation of the left atrium. The company conducting these screening tests referred participants back to their own healthcare providers to follow up on any abnormal findings reported on these scans which was what likely prompted the SGT's visit to his cardiologist on April 11, 2025. At

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this visit, the cardiologist noted that the SGT provided the results of his March 19, 2025, TTE and reported new onset of episodes of shortness of breath and exercise intolerance. It was not noted when these new symptoms started. His cardiologist scheduled him for a stress echo on April 25, 2025, for cardiac risk stratification and to obtain a better assessment of possible aortic valve prolapse. The cardiologist's notes do not indicate that any duty restrictions were placed at that time as he felt that "if he is just developing mild aortic valve insufficiency and everything else looks good, we will have him back in 3 years and probably repeat an echo then." According to previous notations in his records, the cardiologist was aware of the SGT's occupation as a firefighter. The SGT died on April 14, 2025.

Seizures

On January 8, 2023, the SGT was seen in a local emergency department after his daughters witnessed him having 2 seizures while at home watching television. Additionally, the SGT reported having 5-minute episodes of being sweaty, nauseated, and dizzy that would occur intermittently. His head CT scan was negative and neurological exam nonfocal. The neurology service was consulted but no antiepileptic medications were started as the consulting neurologist stated they usually do not start antiepileptic medications after the first seizure event. He had another seizure around 2100 that night after getting home from the Emergency Department, at which time neurology started him on a medication for seizure prevention.

An electroencephalogram (EEG) and brain MRI were completed on January 18, 2023, and both tests were negative. On January 17, 2023, the neurologist switched him to a different antiepileptic medication due to reported side effects with the first medication; the new medication was well tolerated. Notes from a May 19, 2023, visit to the neurologist state that he had returned to his "regular duties at the fire department."

No additional seizure activity was noted until December 10, 2023, when he had 3 seizures and was taken to the ER. The SGT was seen by neurology in May and November 2023 for routine follow up appointments. In November 2023, he was scheduled for his next follow-up appointment in one year. However, he was seen by the neurologist about a month later on December 20, 2023, as the SGT reported he had 3 seizures on December 10, 2023, in the morning following a busy night shift. The neurologist reported that the SGT attributed these seizures to not having slept due to multiple calls overnight and had not had a chance to take his morning dose of his anti-epileptic medication. The neurologist increased his medication dose, gave him a prescription for a nasal spray of valium (this medication is used to abort seizure activity once it occurs while the other medication is used to prevent seizures), and "advised against driving, operating heavy machinery, or working altitude until seizure free for 3 months." At his next follow-up appointment on January 24, 2024, the SGT denied any more seizures and stated, "he has not been working as he is a fireman but is considering going back to light duty until he is cleared to drive."

On March 13, 2024, the neurology group provided the department with a letter stating that the SGT was stable on his antiseizure medication and able to return to work without restrictions. The notes from his last neurology office visit from May 9, 2024, states that the SGT has been seizure free since December 2023, and that he was "now back to driving and work full-time." Records from the

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department, Company A, and Company B, did not include documentation of the SGT taking extended sick leave with respect to his seizure disorder; only the return-to-work letter was documented.

The autopsy report noted there was no trauma to the tongue indicative of perimortem seizure activity and his antiseizure medication was within therapeutic range.

Raynaud's Syndrome

Raynaud's Syndrome of both hands was noted on his December 2021 annual medical evaluation with a note to follow-up with his primary care provider (PCP). But no specific follow up was reported in the PCP records. There was no assessment of the involved digits other than a notation that the "extremities are without edema." There was no mention of treatment with medications typically used to prevent vasoconstrictive episodes.

Annual Medical Evaluations/Injury Reports

We asked for medical records covering the last 5 years. During this period Company A was the department's occupational medicine provider 2019–2023 while Company B took over that contract in 2024. The SGT had annual medical evaluations in December of 2019, 2020, 2021, 2023, and 2024. No records were provided for 2022 or 2025. The December 2021 review of systems was positive for Raynaud's in both hands but there was no statement regarding safety with essential job tasks, treatment, or rheumatology follow up. The December 2023 evaluation conducted by Company A noted "seizures in January → unknown cause" but no statement regarding evaluation safety with essential job tasks. In the records from the SGT's December 17, 2024, annual evaluation, the examiner from Company B acknowledged the seizures in 2023 and noted he was under the care of a neurology group and that he had "no work restrictions". Past surgical history of mitral valve repair and rotator cuff repair noted. The records from this annual medical evaluation include a review of systems which reported the SGT denied any shortness of breath, chest pain or tightness, or irregular heartbeat.

There was only one injury report in his file. The report (dated May 6, 2024) was regarding the acute onset of left flank pain while providing ventilatory assistance with a bag valve mask during a patient resuscitation on May 1, 2024. He was diagnosed with muscle strain and advised to apply ice/heat packs to the area as needed, use NSAIDs for pain, and report any change in his condition to his employer.

The SGT's annual medical evaluations confirmed that he lost considerable weight going from weight of 223 lbs. and height 72 inches resulting in a BMI of 30.2 kg/m^2 on December 12, 2019, to a weight of 178 lbs. and height 72.5 inches resulting in a BMI of 23.8 kg/m^2 on December 7, 2023. These BMI calculations were done using the CDC BMI calculator. The CDC classifies a BMI of 18.5–24.9 kg/m^2 as a healthy weight, 25.0–29.9 kg/m^2 as overweight, and a BMI of $\geq$ 30.0 kg/m^2 as obese.

Return-to-Work Medical Evaluation Findings

The department's Sick Leave Policy in effect at the time the SGT was diagnosed with seizure disorder (dated January 6, 2023) states that "Any member absent from duty for two (2) consecutive duty days or two (2) days within a working set, must have a signed release to full duty by their physician." This

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policy also defined "extended sick leave" as any absence for three (3) or more duty shifts. Those members taking extended sick leave were also required to complete a Time Off Request form and to have their healthcare provider complete a Return to Duty form. This policy was updated on April 28, 2025, to state that employees returning from any absence of more than nine (9) consecutive duty days "shall be required to obtain written medical verification from the employee's medical provider and the Department's medical provider prior to returning to duty. The Fire Chief will designate the Department's medical provider."

The SGT's file contained the following Extended Sick Leave notices:

- November 22, 2019: Letter from Indiana University Health stating he was seen at an urgent care center on November 22, 2019 and needs to be excused from work through November 24, 2019. The letter does not specify what the medical issue was or any return-to-work restrictions.
- August 30, 2022: Certification of Health Care Provider for Employee's Serious Health Condition under the Family and Medical Leave Act (FMLA) signed by the SGT's orthopedic doctor, stated the SGT will need extended sick leave September 9, 2022, through December 12, 2022, to have and recover from right shoulder surgery. This form stated: "the employee is not cleared to return to work for administrative duty because of R shoulder surgery, No use of right upper extremity. No driving."
- September 8, 2022: Letter from the City's Human Resources department confirmed this leave was approved.
- December 27, 2023: Letter from the SGT's neurologist stated: "He has experienced recent breakthrough seizures. He has been advised against driving, operating heavy machinery, or working at altitudes until seizure free for three months."
- January 3, 2024: FMLA form signed by the SGT's neurologist stated that the start date for his condition of seizure disorder was on or about January 8, 2023, estimating lifetime duration, and as a chronic condition, will need treatment visit at least twice a year. Under Part C: Essential Job Function, the neurologist noted: "Due to this condition the employee is not able to perform one or more of the essential job function(s)" and specified "No heights or driving until seizure free for 3 months (March 10, 2024)."
- January 17, 2024: Letter from the City's Human Resources department confirmed approved extended sick leave for his seizure disorder December 27, 2023–March 10, 2024.

The SGT's file contained the following Return to Duty/Return to Work clearances:

- February 6, 2023: Return to Duty Without Restrictions form completed by SGT's orthopedic physician stating he could return to work without restriction on February 7, 2023.
- February 11, 2023: Return to Duty with Restrictions form completed by the SGT's

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neurologist stated he could answer phones, do light lifting (<20 lbs.), conduct department supply inventory but "no driving, working at high altitude until seizure free x 3 months, no climbing roof x6 months" and his expected return to full duty date was April 8, 2023 "if remains seizure free."

- March 1, 2024: Return-to-work letter from the SGT's neurologist stating "His seizures are currently under good control. He is released to work without restrictions on March 13, 2024".

No records were provided by the department stating the SGT had taken extended sick leave in 2025.

The March 1, 2024, return-to-work letter from the neurologist was sent directly to the department and at the time, there was no policy requiring review of this letter by a fire department physician/occupational medicine provider familiar with NFPA standards. There is no departmental policy regarding self-reporting of new or worsened medical conditions that did not require extended sick leave outside of the medical history review obtained during their annual medical evaluations.

Discussion

Cardiac Issues

Cardiac valvular issues

The SGT underwent replacement of his mitral valve in 2014 due to damage sustained from rheumatic fever. Rheumatic fever is an infection caused by *Streptococcus pyogenes*. Patients with rheumatic fever are at risk for heart damage as this organism produces proteins that mimic some that appear normally on the cells that make up structures inside the heart. This mimicry results in the body's immune system attacking those structures along with the invading organism. The mitral valve is a common heart structure impacted by this infection [2004 Guilherme and Kalil]. Subsequent post-repair assessments by his cardiologist repeatedly noted that echocardiography showed the mitral valve was functioning well without any backflow (regurgitation). As shown in Figure 1, the mitral valve is located between the left atrium and the left ventricle. The left atrium receives oxygenated blood from the lungs. During the first part of the pumping cycle, the mitral valve opens, and the aortic valve shuts to allow oxygenated blood that just returned from the lungs to flow from the left atrium into the left ventricle. The mitral valve closes, and the aortic valve opens as the left ventricle pumps blood into the aorta to be distributed to the rest of the body. As soon as ventricle contraction is complete, the aortic valve closes to prevent backflow.

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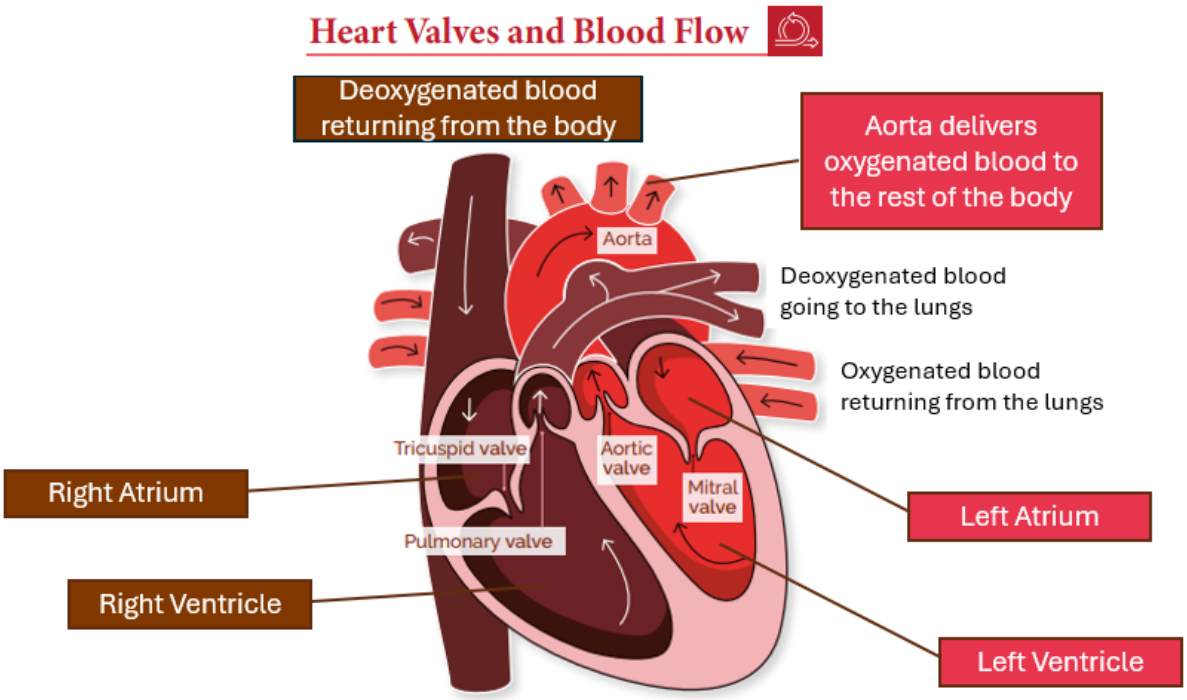

Figure 1. Location of the valves inside the heart
(*Adapted from CDC Explaining Heart Valve Disease*)

When valves in the left side of heart fail (i.e. aortic and/or mitral valves don't close securely in the correct sequence) then backup of fluid into the lungs may occur which can manifest as shortness of breath and exercise fatigue such as the SGT reported shortly before his death. A transthoracic echocardiogram (TTE) around that same time showed new aortic valve insufficiency with findings that could support a diagnosis of new onset congestive heart failure including a decreased ejection fraction (EF). EF indicates the left ventricle's pumping strength. The SGT's EF had dropped from 60-65% in 2020 to 55% in 2025 (normal range is 52-72%). This TTE also showed enlargement of the muscle of the left ventricle and dilation of both the left atrium and aortic root. Regurgitation of blood due to aortic valve insufficiency can result in fluid backup that can stretch out the chambers on the left side of the heart and weaken their pumping ability. There were autopsy findings of congestion and edema in both lungs that could also be consistent with new onset congestive heart failure.

Notes from the April 11, 2025, office visit the SGT made to discuss his new symptoms and abnormal TTE result described a normal physical examination with no evidence of fluid overload in the lungs or extremities. The cardiologist did not recommend restrictions for the SGT to return to duty as a firefighter while awaiting the next steps in his diagnostic workup for the new aortic valve insufficiency. The next test was scheduled for April 25, 2025. Company B was not aware of the TTE findings as this test was conducted by an outside contractor completely separate from the required

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annual medical evaluations they oversaw for the FD and the contractor was not required to provide the results of the scans to Company B. There was no documentation from Contractor B that the SGT had reported his new symptoms to them and colleagues working with him on his last shift did not recall him mentioning these new symptoms or appearing short of breath.

Atherosclerotic cardiovascular disease, coronary artery ectasia, and blood clot risk

The coronary arteries start as openings in the aorta just above the aortic valve. They continue as blood vessels that wind around the heart providing oxygenated blood to the heart muscle itself. The left coronary artery splits into the left anterior descending artery and the left circumflex artery. The coroner noted mild to moderate buildup of cholesterol plaques, known as atherosclerosis, and a blood clot obstructing 60% of the left main coronary artery. Mature cholesterol plaques may have necrotic centers and any disruption of these plaques resulting in exposure of the necrotic core to the blood traveling next to them can trigger blood clot formation [2024 Młynarska et al].

The SGT had an additional risk factor for blood clot formation that was discovered during his autopsy called coronary artery ectasia (CAE). CAE is defined as a dilation of the vessel > 1.5 times the diameter of the normal adjacent vessel. It occurs in about 1.2–4.9% of the population [2016 Devabhaktuni et al]. When the walls of a blood vessel balloon out in CAE, smooth laminar flow of blood may be disrupted. Red blood cells that aren't kept moving by blood flow can aggregate and form clots. CAE can also result from rheumatic fever. Primary autoimmune disorders demonstrate this type of autoimmune response when there is no underlying infective process as a trigger. Therefore, CAE is often found in primary autoimmune disorders such as Kawasaki's disease [2024 Jone et al; 2013 Weiler et al]. Aortic valve insufficiency that results in backflow or regurgitation of blood across the incompetent valve, as noted in the SGT's TTE, can also disrupt laminar blood flow and increase risk for blood clots. Vessel obstruction due to blood clots, ballooning of vessel walls due to ectasia, and narrowing of coronary artery vessel lumen from buildup of cholesterol plaques can be diagnosed through angiography. This is a specialized imaging study conducted by inserting a catheter into the artery then injecting dye to highlight the blood flow in real time.

The SGT needed to have his mitral valve replaced in 2014 due to damage sustained from an episode of rheumatic fever. It is possible that this infection also caused the CAE found on autopsy. Although mitral valve damage following rheumatic fever is more well known, CAE associated with rheumatic fever has been recognized for decades [1935 Gross et al;1934 Karner and Bayless]. There is also some evidence that atherosclerotic buildup itself may induce CAE. [2017 Bogana Shanmugam et al]. One study found CAE in 0.3–4.9% of patients who underwent emergent coronary angiography for an acute heart attack, but there was no mention if any of these patients had a history of rheumatic fever [1983 Swaye et al]. It is not uncommon for CAE cases to be identified at autopsy if coronary angiography had not been performed before death. There is no way to determine the specific contributions of CAE, atherosclerosis, and his new aortic valve insufficiency, if any, to the formation of the blood clot that caused the SGT's death.

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Seizures

Seizure disorder, also known as epilepsy, affects approximately 0.65% of adults worldwide. After the first unprovoked (not associated with head trauma, disease, or underlying illness) seizure, the risk for recurrence is higher over the next 2 years with some studies estimating that risk up to 60%. [2021 Smith]. There are 3 major factors that neurologists use to categorize risk of recurrent seizures into low, medium, and high categories: abnormal neurological examination, abnormal electroencephalograph (EEG) findings, and a second seizure. The probability of recurrence after the first seizure with no abnormalities on neurological examination or EEG falls into the low risk category at 0.19 for the 1st year, 0.28 over the next 3 years, and 0.30 over the next 5 year period. However, once the patient has a second seizure, even while still having a normal neurological exam and EEG, their recurrence risk increases significantly to 0.35 for the 1st year, 0.50 over the next 3 years, and 0.56 over the next 5 years placing the patient in a moderate risk category. Add on a 3rd seizure or an abnormal neurological exam, and/or abnormal EEG, then the patient enters the high risk criteria as the risk climbs further to 0.59 for the 1st year, 0.73 over the next 3 years, and 0.56 over the next 5 years [2021 Smith]. An EEG is most likely to yield helpful data if done within 24 hours of the seizure activity.

Initiation of pharmacological therapy to prevent seizures is a careful decision weighing likelihood of seizure recurrence with possible adverse effects of the antiepileptic medication. Additionally, many of the common medications used to prevent seizures, such as Dilantin (phenytoin), Depakote (valproic acid), Tegretol (carbamazepine), Trileptal (oxcarbazepine), etc. have specific therapeutic blood levels. Patients taking these medications require periodic blood tests to ensure drug levels are maintained in the therapeutic range (i.e. guide dosing) and to monitor for possible drug toxicity on other organs [2021 Smith]. The SGT was only started on antiepileptic medication after his second seizure and later required switching to a different medication due to side effects from the first medication. Post-mortem blood level of the antiepileptic medication he was taking at the time of his death was shown to be within the therapeutic range.

Notes from his visit with neurology on January 12, 2023, indicated the neurologist “advised against driving, operating heavy machinery, or working at altitudes until seizure free for 6 months.” The EEG and brain MRI were completed on January 18, 2023, and both tests were negative. Notes from a May 19, 2023, visit to the neurologist state that the SGT had returned to his “regular duties at the fire department.” No additional seizure activity was noted until December 10, 2023, when he had 3 seizures and was taken to the ER. There was no evidence that his seizure disorder contributed to his death. However, he continued working as a firefighter after developing the seizure disorder in 2023, followed by recurrent seizures and changes in his medication regimen. Under NFPA 1582/1580 standards, these conditions would have generally precluded continued duty as a firefighter. It is unknown if a medical retirement in 2023 or later would have altered the outcome of his death in 2025; however, it is mentioned as a possible missed opportunity for intervention.

Raynaud’s Phenomenon

Raynaud’s Syndrome, more commonly referred to as Raynaud’s Phenomenon (RP) in the medical literature, is used to describe a condition of vascular compromise primarily in the fingers. It is purely a clinical diagnosis in that there are no specific tests on which to base the diagnosis. Patients report

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blanching of fingers due to vasoconstriction when exposed to cold temperatures or other triggers (Figure 2). This neurovascular condition may compromise the patient's ability to grasp objects during flares of Raynaud's, so it may have compromised the SGT's ability to safely complete essential firefighter tasks as delineated by the NFPA [2019 Pauling et al; 2016 Wigley and Flavahan]. It is estimated that RP occurs in about 5% of the population and it is divided into primary and secondary RP. Primary RP is attributed by a defect in the body's normal thermoregulatory system, as it is normal for blood vessels to constrict in cold temperatures to retain body heat, but this response gets locally exaggerated in primary RP. Secondary RP is due to effects of other underlying medical conditions and may be associated with autoimmune disorders such as systemic sclerosis [2020 Herrick and Wigley]. There is no evidence that his RP played a role in his death. However, it is noted here because it could have been reviewed by the medical director of the occupational medicine contractor who oversaw the 2021 medical evaluation when this condition was first noted and during subsequent evaluations to ensure his RP was not progressing and/or preventing him from safely performing the essential

firefighter tasks as defined by the NFPA.

Figure 2. Examples of Raynaud's Phenomenon
(Photo by stock.adobe.com)

Departmental Documentation

This department has a core annual medical evaluation requirement consisting of vital signs, physical examination, OSHA medical screening questionnaire, and pulmonary function test. Only a one-time, baseline chest x-ray is required for members who are not assigned to a FD dive team. Prior to 2024, the department funded several optional tests such as blood tests, urinalysis, and EKG that members may elect to undergo as part of their annual medical evaluation. In 2024, all testing components were made mandatory for the annual medical evaluation. It may be helpful to have this information included in the departmental SOP along with the contact information for the occupational medicine group providing these services where it can be more easily found by all FD staff.

NFPA Return-to-Work Guidance

Both 2022 NFPA 1582 and 2025 NFPA 1580 (the consolidated standard 1580 that includes previous standards 1581-1584) state that the Fire Department Physician "shall report to the AHJ [Authority

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Having Jurisdiction] any applicable job restrictions associated with special essential job tasks that cannot be safely and effectively performed by the individual due to a medical condition(s) or physical fitness." The standard states it is the member's responsibility to "report to the fire department any medical condition that could interfere with the ability of the individual to safety perform essential job tasks, such as injury or illness, use of prescription or nonprescription drugs, and pregnancy." These essential job tasks, as defined by the NFPA, are listed in Appendix A and this department includes a version of them on their Return to Work form. The healthcare provider is required to sign the Return to Work form in 2 locations: one to attest to the medical condition and a second to attest that they have read and are familiar with the listed essential job tasks. The essential job tasks are detailed in Section 5.1.1 of the standard [2022 NFPA]. The 2025 consolidated standard 1580 refers back to the 2022 NFPA 1582 in their section on the essential job tasks [2025 NFPA].

Aortic Valve Insufficiency

As the 2025 NFPA 1580 was in effect at the time SGT was diagnosed with this condition, we are citing this version of the standard here. Section 13.7 uses staging "determined by symptoms, valve anatomy, valve hemodynamics, and hemodynamic consequences" based on the 2020 American College of Cardiology and American Heart Association (ACC/AHA)'s Guideline for the Management of Patients with Valvular Heart Disease. The staging is denoted as A-D which is outlined in Table 4 of the guideline. For aortic valve insufficiency, the NFPA standard denotes ACC/AHA stages C or D as requiring restriction due to likely impairment of job tasks #1,2,4,5,6,7,8 and 13. The 2020 ACC/AHA guideline indicates that stage C includes asymptomatic severe valvular heart disease (VHD) with or without decompensation of the right or left ventricles and stage D includes patients with symptoms consistent with severe VHD [2021 Otto et al]. There are no conditions listed in the standard for unrestricted duty in members with symptomatic, severe VHD. The SGT could have been considered to have symptomatic, severe VHD in April 2025 due to his new shortness of breath and exercise intolerance combined with the new findings of aortic valve insufficiency with regurgitation and enlargement of the left ventricle on the March 2025 TTE.

Seizures

The 2022 version of NFPA 1582 was in effect at the time he was diagnosed with this condition in 2023. Section 9.12 of this standard addresses neurological issues including seizure disorders. Table 9.12.1 states that epilepsy with a high risk of recurrence must meet the following conditions for return to duty without restriction: "(a) had no seizures for the most recent consecutive 10 years, (b) is currently on a stable regimen of antiepileptic drugs for the most recent 5 years with no side effects impacting the performance of the essential job tasks or on no antiepileptic drugs for the most recent 5 years, (c) has normal neurological examination results, and (d) has a signed statement from a neurologic specialist indication that the individual meets the provisions specific in (a)-(c) and can safely and effectively perform the essential job tasks." The NFPA standards specifically cite essential job tasks #1,6,8,9,10,11,13, and 14, as posing possible safety risks in a firefighter with a seizure disorder [2022 NFPA].

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The SGT's first seizure was on January 8, 2023. On January 17, 2023, the SGT's antiepileptic medication was switched due to side effects. On December 20, 2023, he had 3 breakthrough seizures and was started on another medication to stop active seizures, so he did not meet conditions (a) or (b).

Three months later the department received a letter (dated March 1, 2024) from the neurology group who was managing his case that stated: "His seizures are currently under good control, He is released to work without restriction on March 13, 2024." At that time there was no department policy requiring occupational health provider review of return-to-work letters. However, the SGT did report his seizure disorder as part of his medical history during his December 7, 2023, annual medical evaluation with Company A and during his December 17, 2024, annual medical evaluation with Company B. He was cleared both years for full duty. As per NFPA guidelines, his recurrent seizures and recent change in antiepileptic medication regimen should have triggered his removal from duty until he met the time criteria defined by the NFPA 1580. This standard states that in order for a firefighter with epilepsy to return to unrestricted duty, they must meet the following conditions:

- have no seizures for the most recent consecutive 10 years
- for the most recent 5 years:
    - be on a stable regimen of anti-seizure medication WITHOUT side effects that could impact performing essential job tasks safely OR
    - not be on any anti-seizure medications
- have a normal neurological exam
- have a signed statement from a neurologist that the firefighter meets the first 3 conditions and can safely perform essential job tasks [Table 13.12 NFPA 2025].

Raynaud's Phenomenon

The 2022 version of NFPA 1582 was in effect at the time he was diagnosed with this condition in 2023 but there is no specific mention of RP in Section 9.7.24 Vascular Disorders. However, if the SGT had developed pain, decreased mobility, and/or decreased grip strength during vasoconstrictive episodes, it is possible those would have affected job tasks #1,4,6,7, and 10 [NFPA 2022].

Recommendations

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in injury or fatality. There is no evidence that the following recommendations would have prevented this fatality, but they are being provided here as a reminder of good practice.

Recommendation #1: Consider requiring the department's occupational health provider to review all return-to-work releases completed by members' primary care physicians and/or medical

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specialists to ensure the member can safely complete all essential firefighter tasks as defined by the NFPA and meet NFPA standards for specific medical conditions.

Discussion: NFPA consensus standards translate general medical and occupational health principles into fire-service-specific requirements governing medical evaluations, fitness for duty, exposure mitigation, and risk management. The NFPA highlights the importance of ensuring physicians handling initial and subsequent return-to-work clearances be well versed in the essential tasks of firefighting as well as the consensus standards to ensure firefighters do not place themselves or their coworkers at risk due to underlying medical conditions. NFPA 1500, Section 11.6.3 states that "The fire department physician shall be a licensed medical doctor or osteopathic physician qualified to provide professional expertise in the areas of occupational safety and health as they relate to emergency services." Because occupational safety and health in the fire service is defined by NFPA standards, physicians overseeing firefighter health during every phase of their career (on-boarding, annual, and return to duty evaluations) must understand these standards to be properly qualified for their role.

Although primary care providers and medical specialists such as cardiologists and neurologists may be experts in their respective fields, they may not be familiar with the essential firefighter tasks as defined by the NFPA or the specific NFPA standards. Return-to-work clearances issued by non-departmental contracted physicians may not take those specific activities into account when clearing the member for return to duties without restriction. As of April 28, 2025, the department requires an occupational medicine provider, currently Company A, to review return-to-work documents provided by the member's healthcare provider(s) to ensure consistency with NFPA standards as an additional safeguard. This change was formally noted in the update of the department policy document dated December 1, 2025. It is likely that a review of the SGT's 2023 return-to-work clearance letter from his neurologist regarding his seizure disorder would have been flagged as not meeting NFPA safety standards to allow him to return to work as a firefighter. Discussions with Company B indicated his report of a seizure history during his 2024 annual medical evaluation was not flagged for physician review as per their policy and they have instituted procedural changes to prevent similar future oversights.

It is commendable that the department's return-to-work form includes a listing of essential firefighting tasks that the evaluating healthcare provider must read and attest to in addition to confirming the relevant medical issue for the leave. However, a review of this list alone is not equivalent to direct familiarity with these duties and may not fully convey the physically demanding nature of these tasks. The December 1, 2025, update to the department policy that requires the return-to-work forms to be reviewed by a designated fire department physician who does have experience with these tasks provides another level of oversight to ensure the return to work is consistent with NFPA standards.

The alignment of specific circumstances of new potential cardiac-related symptoms (shortness of breath and exercise intolerance) that could be due to the new findings of aortic valve insufficiency also are a factor in this case. The SGT did not report these symptoms to the FD, the provider of the screening tests in March 2025 was not required to copy Company B on the test results for the participating firefighters, and the SGT did not take extended sick leave requiring a return-to-work assessment. Therefore, the FD had no way of knowing he had met criteria for severe VHD and should

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have been removed from duty. At the time this event occurred, there was no requirement that return-to-work evaluations done by external providers be reviewed for adherence to NFPA policy. Therefore, even if the SGT had taken extended sick leave and his cardiologist had provided a return-to-work notice, it would not have been reviewed by a physician for adherence to NFPA standards, similar to the situation with his return-to-work letter from his neurologist regarding his seizure disorder. Lastly, even if the SGT had been removed from work right after developing the new symptoms, an abnormal TTE in March 2025, or even after his visit to his cardiologist on April 11, 2025, it is unknown that removal from work would have prevented the development of the blood clot in his coronary artery that caused his death, but these issues may play an important role in other firefighters' circumstances.

Recommendation #2: Consider placing information regarding components of required annual medical examinations as per NFPA 1582/1580 recommendations and the contact information for their occupational health provider in a location where this information is easily accessible to all members.

Discussion: Although the SGT did have his own primary care physician (PCP), not all firefighters do. The provider of the annual NFPA medical evaluation may be the only physician those firefighters without a PCP see regularly. Section 9.1.2 of this standard states*:* "The occupational medical evaluation shall include a medical history, examination, and any medical tests required to assess medical conditions that can affect an individual's ability to safely and effectively perform the essential job tasks" [NFPA 2022]. Section 11.3.1 of this standard states*:* "All members shall receive a baseline medical evaluation after hiring and prior to performing firefighter emergency functions and at least annually thereafter." Components of the annual medical evaluation are outlined in Section 11.4.2 as "Each medical evaluation shall include a medical history, including exposure and behavioral health histories; physical examination; blood tests; urinalysis; vision tests; audiograms; spirometry; chest x-ray, as indicated; ECG; cancer screening, as indicated; and immunizations and infectious disease screening, as indicated" [NFPA 2025].

This department requires annual medical evaluations, but its components and provider contact information are not readily accessible. It should be noted that Company B, the current FD contracted provider for annual medical evaluations, maintains a network of primary care providers to whom department staff may be referred if they do not have an established PCP. It would be beneficial to make Company B's contact information more readily accessible to department staff and inform them of these additional services. The FD should encourage members who do not have a PCP to obtain and establish a patient relationship with a PCP before they get sick, rather than waiting until their annual medical evaluation that may identify issues that could have been addressed sooner with a PCP. Early identification of new medical issues and initiation of treatment often improves treatment outcomes and reduces risk of potential permanent adverse health effects. This FD is proactive in obtaining whole body ultrasound tests for cancer screening and it could take the additional step of reminding members, that keeping track of cancer screening testing that often includes other modalities than ultrasounds, are one of the aspects of care managed by a PCP along with immunizations and sick care visits with a provider who already knows their medical history.

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Recommendation #3: Encourage members to follow NFPA guidance stating that they have a responsibility to notify the department of any new and/or worsening medical conditions so they can be evaluated by a physician familiar with NFPA guidelines to ensure their safety and that of their coworkers.

Discussion: Although it is understandable that members may have concerns regarding reporting new or worsening medical conditions to the department, the NFPA standards states it is the member's responsibility to "report to the fire department any medical condition that could interfere with the ability of the individual to safely perform essential job tasks, such as injury or illness, use of prescription or nonprescription drugs, and pregnancy"[2022 and 2025 NFPA]. The SGT reported his new 2023 diagnosis of seizure disorder during his 2023 and 2024 annual medical evaluations, but the department was unaware of his new symptomatic cardiac issues in 2025.

The SGT participated in the voluntary whole body ultrasound scan in March 2025 where new aortic valve insufficiency was noted on the included TTE. He did follow up with his cardiologist on April 11, 2025, and at that office visit reported new episodes of shortness of breath and exercise intolerance. The cardiologist's records did not include a statement from the SGT as to when these symptoms started. There was no return-to-work clearance letter required since he had not taken sick leave. Although the cardiologist scheduled follow up testing for April 25, 2025, and did not mention work restrictions in his notes, this may represent a missed opportunity for intervention. If the SGT had reported these new symptoms along with the new TTE findings of aortic valve dysfunction to the department and had an assessment done by a physician aware of NFPA regulations, he would not have been allowed to return to duty as he would have met the definition of severe valvular heart disease.

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Investigator Information

This incident was investigated by the NIOSH Fire Fighter Fatality Investigation and Prevention Program's Medical Team based in the Division of Field Studies and Engineering in Cincinnati, Ohio. This investigation was conducted, and this report co-authored by Judith Eisenberg, MD, MS, and Matthew Silliman. Dr. Eisenberg is a board-certified Emergency Medicine physician and Mr. Silliman is a Technical Information Specialist. Mr. Silliman has served 13 years in the fire service, including 10 years as an Active-Duty Air Force firefighter. Mr. Silliman has filled roles such as Company Officer, 911 call center supervisor, and Assistant Fire Chief of Training. He holds a Master of Arts degree in Emergency and Disaster Management.

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Disclaimer

The information in this report is based upon dispatch records, audio recordings, witness statements, and other information that was made available to the National Institute for Occupational Safety and Health (NIOSH). Information gathered from witnesses may be affected by recall bias. The facts, contributing factors, and recommendations contained in this report are based on the totality of the information gathered during the investigation process. This report was prepared after the event occurred, includes information from appropriate subject matter experts, and is not intended to place blame on those involved in the incident. Mention of any company or product does not constitute endorsement by NIOSH, Centers for Disease Control and Prevention (CDC). In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.

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Appendix A: Essential Job Tasks as Defined by the NFPA

The essential tasks a firefighter needs to be able to perform their job safely are defined in the 2022 version of NFPA 1582. The 2025 version of NFPA 1580 cites the 2022 NFPA 1582 standard in Section 10.1 where the essential job tasks and their descriptions are listed. In both versions, the NFPA standards have a chapter "Occupational Medical Evaluation of Members" that specify various medical conditions using a chart which indicates by each task number which tasks may be a safety risk in each listed medical condition, so it is important to know each task by their assigned number. The following text lists the essential job tasks as they appear in 2022 1582 Section 5.1.1.

"The fire department shall evaluate the following essential tasks against the types and levels of emergency services provided to the local community by the fire department, the types of structures and occupancies in the community, and the configuration of the fire department to determine which tasks apply to individuals:

(1) Wearing personal protective equipment (PPE) and self-contained breathing apparatus (SCBA) while performing firefighting tasks (e.g., hose line operations, extensive crawling, lifting and carrying heavy objects, ventilating roofs or walls using power or hand tools, forcible entry), rescue operations, and other emergency response actions under stressful conditions, including working in extremely hot or cold environments for prolonged time periods

(2) Wearing the respirators required by the jurisdiction (e.g., N-95, half-face elastomeric, PAPR, SCBA), which includes a demand-valve-type positive-pressure facepiece or filter respirator, achieving a successful fit-test and tolerating increased respiratory workloads

(3) Exposure to toxic fumes, irritants, particulates, biological (i.e., infectious) and nonbiological hazards, or heated gases, despite the use of PPE and SCBA

(4) Climbing at least six flights of stairs or walking a similarly strenuous distance and incline in jurisdictions without tall buildings while wearing PPE and SCBA, commonly weighing 40–50 lb. (18–23 kg) and carrying equipment/tools weighing an additional 20–40 lb. (9–18 kg)

(5) Wearing PPE and SCBA that is encapsulating and insulated, which will result in significant fluid loss that frequently progresses to clinical dehydration and can elevate core temperature to levels exceeding 102.2°F (39°C)

(6) Working alone while wearing PPE and respirators required by the jurisdiction, searching, finding, and rescue-dragging or carrying victims to safety in hazardous conditions and low visibility

(7) While wearing PPE and SCBA, advancing water-filled hose lines up to 1 3⁄4 in. (45 mm) in diameter from fire apparatus to occupancy [approximately 150 ft (50 m)], which can involve negotiating multiple flights of stairs, ladders, and other obstacles

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(8) While wearing PPE and SCBA, climbing ladders, operating from heights, walking or crawling in the dark along narrow and uneven surfaces that might be wet or icy, and operating in proximity to electrical power lines or other hazards

(9) Unpredictable, prolonged periods of extreme physical exertion as required by emergency operations without benefit of a warm-up period, scheduled rest periods, meals, access to medication(s), or hydration

(10) Operating fire apparatus or other vehicles in an emergency mode with emergency lights and sirens

(11) Critical, time-sensitive, complex problem solving during physical exertion in stressful, hazardous environments, including hot, dark, tightly enclosed spaces, that is further aggravated by fatigue, flashing lights, sirens, and other distractions

(12) Ability to communicate (i.e., give and comprehend written or verbal orders) while wearing PPE and respirators required by the jurisdiction, under conditions of high background noise, poor visibility, and drenching from hose lines or fixed protection systems (e.g., sprinklers)

(13) Functioning as an integral component of a team, where sudden incapacitation can result in mission failure or in risk of injury or death to members of the public or other team members

(14) Working in shifts, including during nighttime, that can extend beyond 12 hours

(15) Performing EMS tasks, such as CPR or lifting or moving patients, while wearing PPE and respirators required by the jurisdiction. [2022 NFPA]”