

Podcast Transcript: Protecting Firefighter Health

[Theme music]

Ashley Ahearn (AA): You're listening to Environmental Health Chat – a show from the National Institute of Environmental Health Sciences that explores the connections between our health and our world.

I'm Ashley Ahearn.

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Firefighters risk their lives saving people from burning buildings or raging wildfires. But, for some, the true costs of this brave work don't emerge until after the flames have been put out...

Jeff Burgess (JB): If you go to any firefighter meeting, and you ask the firefighters did they know someone who's gotten cancer while a firefighter – not even in retirement – you know you are going to see a ton of hands being raised.

AA: Dr. Jeff Burgess is a physician and professor at the Mel and Enid Zuckerman School of Public Health at the University of Arizona. He's devoted his academic career to studying the health risks firefighters face, and how to make their dangerous work safer.

Firefighters are exposed to smoke, first and foremost, which you might think of as a vehicle for all kinds of harmful chemicals, like polycyclic aromatic hydrocarbons and benzene, for example.

JB: And there's a ton of other both known human carcinogens and suspect human carcinogens in smoke. They get exposed to that not just from breathing it in but being absorbed through their skin.

AA: Firefighters may be exposed to formaldehyde, asbestos, and other chemicals used in buildings. They also come into contact with per- and polyfluoroalkyl substances – commonly known by the acronym P-F-A-S, or “pea-fas.” These chemicals show up in the foams used to put out fires, the smoky environment firefighters work in, and in the protective gear they wear.

PFAS break down slowly, if at all, and with repeated exposure, blood levels of some PFAS can build up over time.

All these mixed exposures, Burgess says, make firefighting one of the most hazardous jobs out there.

JB: Some people call it a chemical soup that firefighters go into, and we really don't have much information on what that combination of chemicals does to them. We actually do know information about the effect of smoke, but you know, when you look at the combination of individual chemicals, that's an important area of research in and of itself.

AA: In 2022, the World Health Organization International Agency for Research on Cancer determined that firefighting was a group one carcinogen – basically, that occupational exposure as a firefighter can lead to cancer. More specifically, the agency said there was sufficient evidence to associate two types of cancer with the occupation of firefighting. These are

mesothelioma, a cancer affecting the lungs that is linked to asbestos exposure, and bladder cancer, which is linked with exposure to polycyclic aromatic hydrocarbons, found in smoke.

Burgess' research contributed to the agency's evaluation. But he doesn't take too much credit because he says he couldn't have done the research without the help of the firefighters, whom he sees as collaborators.

JB: Firefighters are wonderful to work with. And I think as long as they see value in what you're doing, they're happy to support it. But we've learned a lot more over the years about how to effectively work with firefighters and what you would call community-engaged research.

AA: Burgess started working with the Tucson Fire Department 30 years ago, first as an emergency medicine resident and then as a medical toxicology fellow. He would ride along with the firefighters, ask them about their work, the gear they wore – how they do what they do. And that helped him focus his research and build long-term, trusting relationships with firefighters.

JB: They're helping us in all phases of the research. They help us analyze and write up the results and [are] really critical in disseminating the research to other firefighters. So, whenever we're doing a presentation now, the firefighters are co-presenting with us.

AA: As the years went by, firefighters started coming to Burgess with research questions – instead of him going to them with something he wanted to explore.

For instance, Captain John Gulotta of the Tucson Fire Department asked Burgess for help. One of his fire-cause investigators had developed leukemia. Leukemia is a blood cancer associated with exposure to benzene, a common hazard for firefighters. But the state worker's comp system turned down the man's case. He was fighting for his life while fighting to get the support he needed for cancer treatment. Captain Gulotta knew he needed sound, evidence-based science to help his firefighter make his case.

JB: John said we want three things, we want to know what firefighters are exposed to, because the workers comp is asking for that. We want to know what those exposures are doing to the firefighters to lead to cancer, because again, the worker's compensation wants to have that information to be able to support the claims. And then the third thing, what are we going to do about it? How do we reduce exposures and reduce the risk of cancer to start with, so he came to me with these questions, which could directly be translated into aims of a research project.

AA: And it was based on these three core questions – What are firefighters exposed to? What do those exposures do to them? And how do we reduce those exposures? – that shaped what's now known as the Fire Fighter Cancer Cohort Study, which is funded by the Federal Emergency Management Agency.

The study started with the Tucson Fire Department in 2015. Burgess and his academic and firefighting colleagues collected blood and urine samples from firefighters when they joined the force, with a goal of following them throughout their careers. They wanted to see what health outcomes might occur in the decades ahead. The study has since grown as firefighting departments all over the country have joined – adding thousands of participants.

JB: Yeah, almost 3,500 and we anticipate getting up to 5,000 firefighters by the end of the year. Our goal is 10,000 firefighters.

AA: With funding from NIEHS, Burgess and his fellow investigators explored changes to DNA structures in study participants. The team is focusing on DNA methylation markers which may help predict the development of cancer. And sure enough, analysis by his colleague, Dr. Jackie Goodrich at the University of Michigan, uncovered changes within the first two to three years of firefighting.

JB: And we found a change in a number of those different DNA methylation markers were directly related to the number of fires or the number of cumulative fire hours that they had during that two-year period. So, it was in a really good strong dose response relationship.

AA: This research will help firefighters who in the future might become sick and need to make a strong case for worker's compensation. But Burgess and his co-investigators are also helping firefighters stay safer today. After closely analyzing current practices, they found that if the firefighters who drive the engines and operate the pumps on the trucks wear a self-contained breathing apparatus during a fire, their exposures can be reduced by about 40%.

JB: And we showed that for the firefighters that go inside the fires, if you do a wash down of their gear before they take it off and in addition to that you take a shower as soon as you can when you get back to the station, you take the dirty gear and segregate it – either put it in a plastic bag inside the vehicle or outside the vehicle – that that kind of combination of interventions reduced exposures by about 33%.

AA: With results like that, it's perhaps not surprising that study participants understand the value of this research – and they're eager to get involved. Some participants have even taken training so that they're qualified to enroll new study participants and gather biological samples like blood and urine. They are the real champions of research, Burgess says.

JB: Having the firefighters working with you – they call it badge-to-badge – there's much more trust when you have that. And then when it comes down to sharing results with other firefighters, which is critical to dissemination of the results and helping firefighters use the information to make changes to protect their own firefighters in each of the departments. Having the firefighters out there and presenting it and knowing the proper language to use, knowing what messages really get across well. That's been just critical.

AA: Burgess sees firefighters as "occupational athletes" who put their bodies through strenuous, risky activities to save people's lives and property. And their input into every phase of the research process makes the study successful, he says. They are his teammates on this project.

He hopes this collaborative science can help protect firefighter health by making them safer on the job – and help us all understand the long-term risks that come with it.

JB: I'm a strong believer in the importance of teams. You have epidemiologists, you have toxicologists, you have occupational health people, etc., that are part of teams. And so, I think that personally, I can make contributions working together with the firefighters, right, given my experiences, and they bring their experiences and together, it's just it, it really works well.

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AA: I'm Ashley Ahearn. Thanks for listening to Environmental Health Chat.