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The Invisible Risk: Why Air Quality Inside Fire Appliances Is the Next Frontier in UK Emergency Services Safety

Firefighters have long operated with a clear understanding of the risks associated with their profession. Heat, structural instability and toxic smoke are immediate and visible hazards that are managed through training, equipment and operational discipline. Increasingly, however, attention is being directed towards a less visible but more persistent threat: long-term exposure to carcinogens.

Cancer is now widely recognised as one of the most significant occupational health risks within the fire and rescue service. The International Agency for Research on Cancer, part of the World Health Organization, has classified occupational exposure as a firefighter as carcinogenic to humans, reflecting a growing body of evidence linking repeated exposure to hazardous substances with increased incidence of serious illness. In the UK, the Fire Brigades Union continues to highlight the scale of the issue and the need for further protective measures across the operational lifecycle.



While meaningful progress has been made in areas such as personal protective equipment and on-scene decontamination, one aspect of exposure remains comparatively under-addressed: the environment inside the fire appliance itself.

Exposure Does Not End at the Scene

Modern fires produce a complex mixture of airborne contaminants, including polycyclic aromatic hydrocarbons, benzene, fine particulates and a range of toxic combustion by-products. These substances adhere to protective clothing, equipment and surfaces, and are frequently transported back to the vehicle following an incident.

Within the enclosed space of a fire appliance cab, these contaminants can become re-aerosolised, particularly during transit when movement and airflow disturb settled particles. As a result, firefighters may continue to inhale hazardous substances during what would otherwise be considered a period of reduced risk.

This secondary exposure pathway has become an increasing focus for the sector, not least because it sits outside many of the controls that have been successfully implemented on the fireground. While procedures have evolved to limit contamination at source, the in-cab environment can still allow exposure to persist in a less visible but equally consequential way.

From Clean Cab to Controlled Air

The industry response to date has centred on the development of the “clean cab” concept. Measures such as the segregation of contaminated PPE, improved on-scene decontamination and revised handling procedures have all contributed to reducing the transfer of harmful substances into crew areas. Vehicle manufacturers such as Rosenbauer have incorporated these principles into vehicle design, reflecting a broader commitment to reducing risk.

However, as understanding of exposure pathways has evolved, it has become clear that containment alone does not fully address the risk. Even where clean cab protocols are rigorously applied, airborne particles and gases can persist within the cabin or enter during vehicle operation, particularly when crews are transitioning between contaminated and controlled environments.



This has led to a shift in thinking, and the question is no longer limited to how contamination is reduced, but how the internal environment itself can be made consistently safe to breathe.

Managing the Air Inside the Appliance

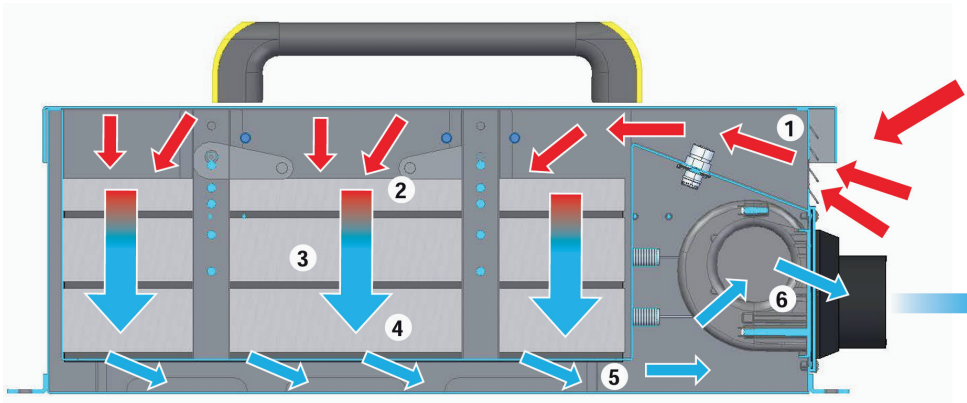
Addressing this challenge requires a more engineered approach to the cabin environment, one that treats air quality as a controlled system rather than a by-product of operational procedures.

Pressurisation and filtration systems offer a practical means of achieving this. By drawing in external air, passing it through multiple stages of filtration and introducing it into the cabin under positive pressure, these systems create a protective internal environment. In doing so, they prevent unfiltered air from entering and significantly reduce the presence of harmful particulates, gases and aerosols.

One example of this approach is the Autoclima BOB AP40 pressurisation and filtration system, which is designed to ensure that operators are supplied with clean, safe air even when external conditions are compromised.

Installed externally on the vehicle, the system draws in ambient air through intake grilles and processes it through a series of filtration stages. A pre-filter removes fine particulate matter, followed by a high-efficiency HEPA filter that captures microscopic contaminants. An activated carbon filter then absorbs gases, odours and vapours before the air is delivered into the cabin.

A fan unit maintains a continuous flow of filtered air, creating a positive pressure environment that prevents contaminated external air from entering the cab. Sensors monitor pressure differentials to ensure that this protective state is maintained through-out operation.



The result is a controlled internal atmosphere in which the presence of dust, harmful gases and aerosolised particles is significantly reduced, supporting both immediate respiratory comfort and longer-term health protection.

From an implementation perspective, systems of this type can be integrated into both new vehicle builds and existing fleets. In new appliances, they can be specified as part of the overall vehicle design in collaboration with manufacturers and bodybuilders.

For in-service vehicles, retrofit installation is achievable through specialist converters, with the filtration unit interfacing with the vehicle’s HVAC system to ensure that conditioned air remains both clean and breathable.

In the UK, Fischer Panda UK | Power Solutions is the exclusive supplier of Autoclima systems, supporting the integration of pressurised air filtration into specialist vehicle applications, including those within the emergency services sector.



AIR PRESSURE
SYSTEM



	BOB AP40 24 V - 15180001 pressuriser	BOB AP40 12 V - 15180002 pressuriser
Air flow (*)	1150 m³/h	1200 m³/h
Supply voltage	24 V cc	12 V cc
Current draw	8.5 A	8.5 A
Power consumption	204 W	102 W
Maximum overpressure	300 Pa	300 Pa
Casing and cover material	AISI 304 stainless steel	AISI 304 stainless steel
Weight	38 kg	38 kg

(*) Static pressure = 0 Pa

P1 Dust Filter

This type of filter offers protection from dust inhalation with MAC (Maximum Acceptable Concentration) value of more than 10 mg/m³.

Structural material: Aluminium
Filter class: P1 / G4

P3 HEPA Filter

The P3 HEPA filter offers protection against the inhalation of fine toxic fibres, asbestos, spores, bacteria, viruses, proteolytic enzymes and substances classified as carcinogenic to humans, with a MAC value of 0.1 mg/m³.

These substances are normally included in the 2c dust class.

Structural material: Aluminium
Filter class: P3 / H13

Active Carbon Filter

Type A carbon filters work by attracting and binding contaminant molecules. They are particularly suitable for filtering aromatic hydrocarbons.

B, E, K and Hg filters (a combination of them) are used for contaminants other than hydrocarbons, such as mercury or acids.

ABEK filters are certified under standard EN 14387.

A Natural Next Step in Crew Protection

The fire and rescue sector has already demonstrated its ability to adapt in response to emerging risks. Improvements in PPE, hygiene protocols and operational procedures have materially reduced exposure on the fireground.

The growing focus on in-cab air quality represents the next stage in that progression. By extending protection into the vehicle environment and adopting technologies that actively manage the air firefighters breathe, there is an opportunity to address a critical but often overlooked exposure pathway.

As expectations around duty of care continue to evolve, ensuring a clean and controlled cabin environment is likely to become an increasingly important consideration in vehicle design and specification.

The fire appliance is not only a means of transport, but an integral part of the operational environment. Ensuring that it provides clean, breathable air throughout the entirety of an incident response is a logical and necessary step in protecting firefighter health over the long term.

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