



**Hampshire
& Isle of Wight**
FIRE & RESCUE AUTHORITY

HIWFRA Full Authority

Purpose: Approval

Date: **10 OCTOBER 2023**

Title: **MANAGING FIRE CONTAMINANTS**

Report of Chief Fire Officer

SUMMARY

1. Hampshire and Isle of Wight Fire and Rescue Service (HIWFRS) has proactively monitored the developing research and awareness of impacts for fire and rescue personnel, of the products of combustion from fires (fire contaminants).
2. This report updates the Fire Authority on the work and action taken to date and continued action required to further mitigate and manage the complex impacts of fire contaminants.
3. Approval of recommendations is sought to enable and enact further change to assets, facilities and practices directly impacting the health and safety of fire and rescue personnel.

BACKGROUND

4. Fires produce a mixture of toxic, irritant, and carcinogenic chemicals – the composition of which varies depending on the specific materials burning and the fire conditions. They can be released in the form of particulates which will include aerosols, dusts, fibres, smoke and fumes or gases and vapours. Contaminants released resulting from the products of combustion should not be confused with chemical contamination for which there are dedicated PPE and procedures.
5. Harm to health depends on the toxicity of the contaminate and the exposure pathway. Toxicants can be classified according to the specific types of adverse effects they can have on health, for example:

- a) **Carcinogens:** substances which cause cancer.
 - b) **Teratogens:** substances that can harm the foetus if exposure occurs during pregnancy.
 - c) **Sensitisers:** substances which result in an allergic type of hypersensitivity reaction.
 - d) **Irritants:** substances which react in contact with moisture on/within the body and cause an inflammatory response.
6. Fire and rescue personnel may be exposed to toxic contaminants via multiple exposure pathways, including inhalation, skin absorption and ingestion.
7. Studies and research have provided insight and information (specific to the role of fire and rescue) into the types and forms of contamination, toxicity of contamination and the adverse effects on health.
- a) In **2020** the University of Central Lancashire (Uclan) produced a “best practice” report commissioned by the fire brigade’s union (FBU) to aid fire and rescue services in minimising fire and rescue personal exposure to fire contaminants. The report notes that building regulations are designed to ensure that exposure to materials within residential, commercial and industrial buildings are safe. However, there are currently no requirements to consider how the safety of those materials might change in the event of a fire ie., there are no requirements to measure and quantify the toxic fire effluents produced by burning materials. Firefighters are at an increased risk of exposure to toxic fire effluents and subsequently at an increased risk of suffering adverse health outcomes.
 - b) In **2022** a declaration was made from the International Agency for Research on Cancer (IARC) (a body of the world health organisation WHO) that occupational exposure as a firefighter was classified as carcinogenic to humans on the basis of sufficient evidence for cancer in humans. There was sufficient evidence for the following cancer types: mesothelioma and bladder cancer. In addition, there was limited evidence for cancer in humans for the following cancer types: colon cancer, prostate cancer, testicular cancer, melanoma of the skin and non-Hodgkin lymphoma.
 - c) In **2023** findings were released into Scottish Firefighters Occupational and Disease Mortality Rates 2000 – 2020. The method of research considered mortality rate from cancer and other diseases in Scottish

male firefighters compared with the general Scottish male population. The result detailed overall excess cancer mortality rate was found for Scottish firefighters compared with the general population. Scottish firefighters were nearly three times more likely to die of malignant neoplasms (cancerous growth of tissue).

- d) In **2023** a four-part scientific report was published into Firefighter: Cancer Incidence, PPE & Workplace, Mental Health, Culture & Awareness. The report details that heavily contaminated PPE has significant implications for firefighters who remain in contaminated PPE for considerable lengths of time. Remaining in contaminated garments increases the window of exposure to fire toxins, via both inhalation (while toxins continue to off-gas) and skin absorption (as toxins permeate through fabric to the skin). In addition, the report states that failure to implement procedures which control cross-contamination and/or firefighters' personal contamination were also associated with a significantly increased likelihood of developing cancer. These include procedures/policy which target cross-contamination eg. keeping clean/dirty PPE separately, designating specific clean/dirty zones within the station etc. Interventions which target personal contamination (eg. avoiding eating while wearing PPE, changing PPE/workwear as soon as possible after an incident etc.) should also be considered as both a means of reducing the incidence of cancer in firefighters, and of promoting compliance with less tangible, (community-level) workplace decontamination practices.

8. Through dedicated resource and internal/external engagement, HIWFRS has reviewed current practices vs the information and recommendations made available through research.
9. Similarities can be drawn to the challenges faced by fire and rescue services to manage the impacts of fire contaminants to those experienced by the construction and built environment sectors in managing the impacts of asbestos. The fire and rescue challenge is increased by the emergency and dynamic nature of managing incidents.

CURRENT ACTIONS UNDERWAY

10. The Service has tackled the challenge of fire contaminants for many years, the proposals outlined within this report build on this good initial work while taking stock of the new research and understanding of contaminant behaviour and impacts on personnel.
11. A dedicated resource has been temporarily funded to maintain links with national and international research to enable HIWFRS to keep pace with a

complex and evolving landscape and to continually assess our progress to ensuring best practice mitigations are in place to protect against the risks of fire contaminants. A sample of actions already implemented are detailed within this section.

12. **Our People.** A comprehensive risk assessment completed in collaboration with teams from across the Service and Rep Bodies, has been made available specific to the control measures for mitigating toxic fire effluents. This has resulted in a consistent, comprehensive guidance document being published, available to all staff, outlining best practice to minimise risks. To complement this work, an awareness campaign has been undertaken to share the learning and best practice. This also includes targeted input to new firefighters as they begin their careers and ongoing fire contaminants training packages for all operational staff. These measures are continuing to evolve as we continuously learn and improve our training and best practices through Operational Assurance visits which ask specifically about the management of contamination and a cross-service working group who work together to monitor and improve the risk assessment mitigation and management of contaminants including collaborative work across Corporate Services support functions to identify and improve the management of PPE (a large source of contaminants) including electronic PPE logbooks which will enable live information and detailed reporting functionality on usage data to ensure PPE is managed proactively.
13. **Our Workplaces.** This work is well underway, with the Healthy and Inclusive Design Principle detailed within our Estate Strategy (approved by the Fire Authority in September 2018) and the Retrospective Design Principles Programme (approved by the Fire Authority in April 2022) implementing our approach to managing contamination risk within the estate by controlling the flow of equipment and people through the building. This essentially divides stations into separate 'clean', 'transition' and 'dirty' zones.
14. **Our Equipment and PPE.** Several items of PPE have been replaced with new versions with enhanced properties to improve the cleaning of items, such as firefighting gloves replaced with more resilient machine washable versions. Additionally, a specific vehicle will be available during incidents to support the provision of welfare by offering additional water for hydration, additional rations, a toilet capability and the ability to provide an air conditioned and heated space for a crew. Equally, new PPE items have been issued including:
 - a) Redesigned individual fire helmet bags which allow safe storage of fire helmets and other ancillary PPE items such as fire gloves, spare tee-

shirts, flash-hoods and other smaller PPE items. The design of the bag limits the opportunity for cross contamination between PPE items.

- b) Half mask respirators which are individually fit tested and personally issued to all firefighters to provide protection against particulates in addition and as a different option to traditional Breathing Apparatus.
- c) Gas Monitoring capability issued to all frontline appliances to provide firefighters/personnel the ability to continuously monitor the levels of oxygen, toxic and combustible gases within a hazardous area, allowing the correct level of PPE to be worn.
- d) Additional and dedicated cleaning and hygiene items to assist within initial post incident decontamination and the management of contaminated garments have been added to all frontline appliances and Officer response cars.

IDENTIFIED FUTURE ACTIONS REQUIRED

- 15. Much work has been completed to date to understand the complexity and impact of the evolving research into fire contaminants and our response to this challenge. Continued work and change activity is required to ensure that we remain agile and effective in our response to frequent forms of new information, and proactive in providing medium and long term strategy.
- 16. **Our People.** National research and development to health screen firefighters within a criteria range across a number of fire services is being run. This report seeks funding to participate in this programme and allow the collection (with individual's consent) of data on the presence of persistent fire effluents and biomarkers of common diseases and cancers. The main potential goal of the programme is preventative medical screening leading to crucial evidence to benefit future research and screening.
- 17. As we learn more about toxic fire effluents and the associated impacts, it will be necessary to track exposure both with regard to the methods utilised and the types of incidents attended. Exposure recording has been present for a considerable period of time within the fire and rescue sector, although this has focused on attendance at incidents where chemical materials exposure was a concern. Digital solutions are being explored to achieve ease of reporting for users and greater ability to report and monitor. The report seeks funding to bring these digital tracking systems into use.
- 18. **Our Workplaces.** The Retrospective Design Principles Programme Phase 1 (approved by the Fire Authority in April 2022) is currently implementing our approach to managing contamination risk within the estate by controlling

the flow of equipment and people through the building. However, this work is currently focused on wholetime stations only with further work and funding required to address the challenge across the On Call estate (Phase 2). This report does not seek funding specifically for the On Call station investment, but instead asks the Fire Authority to note the need for investment in the future, subject to a further report being presented for consideration. The report does seek additional funding as part of the Retrospective Design Principles Programme Phase 1 to adapt current investment to accommodate the equipment and laundry changes outlined within this report across wholetime stations.

19. Research and evidence continues to support the need for soiled and exposed PPE and equipment to be thoroughly cleaned to ensure potential damaging contaminants to be removed. The frequency of both workwear and PPE garment washing will continue to increase as a mitigation to the risk of exposure to the wearer. Increased washing will put a greater strain on workplace washing and drying facilities and garments will be unavailable for use more frequently impacting availability. The ability to grow washing and drying capacity within workplaces is limited due to the size and internal layout at a large proportion of sites. In addition to garment washing, equipment exposed to toxic fire effluents such as respiratory equipment, thermal cameras and positive pressure fans, will require deep cleaning cycles to prevent the build-up of contaminate load on surfaces and within traps and crevasses. This report seeks funding to install additional, specialist PPE storage solutions on fire stations to accommodate additional PPE which will reduce the risk of PPE being unavailable during cleaning cycles.
20. In addition to the work being completed on fire stations to improve the health and safety of staff by managing the contamination risk within the estate, work has also been identified within the Fleet & Equipment Facility to better control the flow of equipment and people through the building. This report seeks funding to implement these physical changes across the facility.
21. A feasibility assessment is required to fully consider options for a centrally provided and managed PPE and equipment care facility to include the ability to decontaminate, launder and deep clean garments and equipment with supporting logistics capability to efficiently collect and return assets across HIWFRS. This report seeks funding to commission a feasibility study into this provision, with a further full business case report being presented back to Fire Authority for consideration on the completion of this study.
22. **Our Equipment and PPE.** New research and evidence has identified new best practice PPE which this report seeks funding to adopt. Namely:

- a) Particulate Flash Hoods – Firefighters wear a protective garment over their heads known as a flash hood. The flash hood purpose is to provide thermal protection and offer flame resistant properties to exposed areas of the head face and neck. Research has identified the head, face and neck areas as vulnerable to contaminate absorption. The flash hoods currently utilised by HIWFRS (and most UK FRS) are designed to provide thermal protection and not to protect against the absorption into the skin of particulate matter into this potentially vulnerable area of skin. Manufacturers are bringing to the marketplace flash hoods that retain their thermal protection properties with an additional layer added beneath the thermal layer specifically to protect against the particulate matter and provide a blocking capability.
- b) Lightweight PPE – Traditionally, firefighters wear a PPE ensemble (structural) designed to provide protection when completing internal firefighting operations within a compartment or structure and when operating within the risk area requiring smoke, heat, flame or chemical barrier protection. Research has highlighted that there are a significant percentage of incident types attended by firefighters where the structural fire protection is not required. To provide the protection level required, structural PPE is constructed of different layers which means there is a natural weight and bulk to the garments.

A lightweight PPE will provide firefighters with an ensemble option that is manufactured in a single layer, is breathable and retains heat resistant properties to allow use during incidents where structural PPE is not required. The lightweight PPE will offer an alternative wear during periods of high temperatures or following internal firefighting operations where this PPE can aid the cooling process whilst allowing the continuation of external firefighting operations. This additional PPE option may also allow an appliance to remain operational for selected incident types should structural PPE be contaminated and unavailable. This report, therefore, seeks funding for the future and ongoing lifecycle replacement of lightweight PPE as part of the Operational Assets Equipment Reserve.

- c) Structural PPE – Increased awareness of fire contaminants, and the associated impacts means that PPE is being washed more frequently after use. Firefighters are issued with two full sets of structural PPE as standard. Structural PPE is bulky in size meaning the ability to wash multiple garments is limited within a washing machine and further limited by the amount of washing machines available at a location. The layering make-up of the PPE also means that the drying time for each garment is long (the PPE must be fully dry before it be considered available for use). Increased washing will impact operational

availability if not properly managed as an appliance cannot be mobilised to all incident types without structural PPE.

Irrespective of the final solution for longer term maintenance of PPE (for example within a centrally managed system or pool system) there will need to be enough PPE capacity to enable a cycling of PPE and to compensate for the loss of PPE garments in the system not available due to cleaning and maintenance. Therefore, this report seeks funding to increase the number of sets of structural PPE available to aid cleaning of kit and to avoid the unavailability of appropriate garments due to cleaning and drying times.

- d) Rescue PPE – To further mitigate the challenges of PPE type and availability. Rescue capability PPE will be considered as an option to complement other PPE options. A key element of this work will consider helmet provision for firefighters. Structural PPE includes a structural fire helmet. Much like the structural garments, the helmet is designed primarily to be worn in firefighting scenarios and is therefore subject to contaminate exposure. A rescue helmet option may provide functionality benefits for selected incident types and limit the use and contact required with structural helmets.
- e) Workwear – An increase in the washing frequency of workwear is expected post incident and encourage as a mitigation to the potential of cross contamination and further spread. It will be necessary to consider the scale of issue of workwear which could result in an increased amount of workwear being issued.
- f) Equipment Cleaning – Advancing at pace is the development by industry of dedicated washers for fire and rescue equipment. Washers are being developed for breathing apparatus (BA) sets (both the BA set with cylinder and face mask) and fire helmets. Dedicated dryers are being produced in support of the washers as the equipment needs to be dry as quickly as possible to return to operational use. Both the BA set and fire helmet are stable items of equipment when undertaking firefighting operations and are therefore exposed to the products of combustion. BA sets are complex in construction with a mixture air regulated and electronic components so any deep clean must be controlled and effective. Fire helmets are challenging to deep clean due to the construction of the internal pieces. This paper seeks funding to purchase dedicated washers and dryers for these items which will provide a deep clean option not currently achievable.

23. Our Fleet:

- a) Clean Cab – As the work to progress the on-boarding of new fleet of frontline fire appliances continues. An opportunity has been taken to explore the possibilities of removing items of equipment known to make regular contact with the products of combustion, from within the open vehicle cab area to dedicated locker space. Some items of equipment have traditionally been stowed within the cab area of fire appliances with breathing apparatus sets often located behind specifically designed seats. This work will allow a significant amount of the fleet to operate with a cab area principle designed to keep exposed equipment outside the cab area; thereby reducing the exposure risk to our people. This paper seeks funding to make physical adjustments to vehicles currently in-built to achieve this clean cab concept.
- b) Deep Clean Capability – As we look to develop and enhance the ability to deep clean equipment and PPE, we must look at options for fleet. Build-up will occur during the life cycle of fleet vehicles, particularly within locker and pump-bay areas. This paper asked the Fire Authority to note that this research and work will be ongoing and that a future requirement may be identified to clean the interior to vehicles post-incident.

24. Increase to the services provided and delivery of new and enhanced capabilities to manage fire contaminants will likely require an increase to staff establishment with associated recurring staff salary costs. This paper seeks funding to establish one position to support the management of the equipment and PPE management outlined above. Additionally this paper seeks funding to establish one position lead our research and development in this evolving space. This latter role also provides an opportunity to utilise the newly establish expertise to lead and influence, including via the National Fire Chiefs Council and wider fire sector.

SUPPORTING OUR SAFETY PLAN AND PRIORITIES

25. ***Our People:*** *We look after each other by creating great places to work and promoting the health, wellbeing, and safety of our people.*

- (a) The proposals within this report seek to enhance the health and safety of our people by reducing the exposure to fire contaminants and improving the management of contaminants across our buildings, vehicles, PPE and equipment.

26. **Public Value:** *We plan over the longer-term to ensure our decisions and actions deliver efficient and effective public services.*

- (a) Continued investment in our management of fire contaminants over the long-term will ensure that the Service adopts best practice now and into the future.

27. **Learning and Improving:** *We have the support of policy and guidance with the freedom to use our discretion to do the right thing, learning from ourselves and others.*

- (a) The proposals within this report seek to adopt best practice, identified through extensive academic research and practical evidence alongside lessons from other fire and rescue services and the National Fire Chiefs Council.

COLLABORATION

28. The holistic organisational impact of managing fire contaminants means a collaborative 'whole Service' approach has been adopted throughout the work completed to date across all levels of the organisation and with representative bodies.

29. Equally, the proposals are based upon collaborative approach with other fire and rescue services, shared approaches and learnings from the National Fire Chiefs Council working groups.

RESOURCE IMPLICATIONS

30. The financial resource implications of the proposals are summarised below and are split by financial year, noting that some of the sought funding is capital funding and some is revenue.

31. In the 2024/25 financial year £1.3m is sought to undertake a range of activities including:

- a) Health Screening Research Participation for up to 100 Firefighters (see para. 16).
- b) Additional funding as part of the Retrospective Design Principles Phase 1 project to adapt current investment to accommodate the equipment and laundry changes outlined within this report (see para. 18).
- c) On station PPE storage for operational staff (see para. 19).

- d) Feasibility study for PPE and Equipment Care Facility business case development (see para. 21).
 - e) To establish a Research and Development Lead role and an Equipment Maintenance Technician role (see para. 24).
32. Differently provided and or enhanced services delivered to manage the risks posed by fire contaminants may require additional staff capacity. Details of which will be provided upon completion of business cases in a further report to the Authority.
 33. Cost management and specialist detailed design support will be provided externally and funded through the requested budget cost.
 34. A more detailed summary and funding requirements for future years beyond 2025 can be found at Appendix A (Managing Fire Contaminants – Exempt Funding Detail) which is a confidential/exempt appendix.

IMPACT ASSESSMENTS

35. Initial impact assessments have been completed in support of managing fire contaminants work completed so far.
36. Further impact assessments will be completed as mitigating work develops if funding is approved. These will be assessments for each individual project/workstream as required.

LEGAL IMPLICATIONS

37. The organisation is required to comply with Health and Safety law to manage risks and take practical steps to protect workers and others from harm. The proposals within this report adopts best practice to ensure the Service is also deploying the latest approaches to keep people safe.
38. As research and evidence evolves, the fire and rescue sector may experience litigation with reference to how organisations have sought to protect people from the risks posed by fire contaminants. The proposals within this report seek to ensure that the Service is in the best possible place to evidence its proactive approach in protecting the health and safety of our people.

OPTIONS

39. **OPTION 1 – Continue to invest in contaminate management and mitigation through available revenue and asset management plans –**

This option will only allow for change and enhancements to facilities and assets within available revenue budgets and allocated capital reserve funding. This approach would result in limited ability to make significant change to facilities, assets, and ways of work to support the findings of ongoing research. Utilising funding from allocated assets management plans would delay or cease planned asset replacement incurring costs to maintain functionality of existing assets.

40. **OPTION 2 – Provide initial investment and explore means of further, on-going investment (RECOMMENDATION)** – This option provides a commitment to continually evolve and develop our facilities, assets and ways of working as research and scientific findings provide guidance for best practice to manage and mitigate fire contaminants.

RISK ANALYSIS

41. The holistic risk of fire contaminants is recorded within the organisational risk register (Register Reference ORG0042). Work to mitigate risks has identified future actions detailed within this report and therefore funding of the proposals within this report contributes to the management of this risk.

EVALUATION

42. It is important that Service activities are evaluated to identify what or how the Service can learn, understand, plan and improve for the organisation and our communities.
43. The proposals outlined within this report are Service-wide and therefore evaluation method for each will necessitate a different approach. However, the Health & Safety Committee and the Corporate Services Management Board will both act as forums to monitor the successful delivery of these proposals.
44. Continued evaluation of the best practice adopted will be undertaken through dedicated resource and internal/external engagement. This will allow HIWFRS to continually review current practices vs the information and recommendations made available through ongoing research.

CONCLUSION

45. HIWFRS has proactively monitored the developing research and awareness of impacts for fire and rescue personnel, of the products of combustion from fires (fire contaminants).

46. This report updates the Fire Authority on the work and action taken to date and continued action required to further mitigate and manage the complex impacts of fire contaminants.
47. Approval of recommendations is sought to enable and enact further change to assets, facilities and practices directly impacting the health and safety of fire and rescue personnel.

RECOMMENDATION

48. That £1.3m funding be approved for inclusion in the 2024/25 budget subject to affordability by the HIWFRA Full Authority to implement 2024/25 improvements.
49. That the creation of two new establishment posts, to manage the equipment implications and to continue research and development, and their associated revenue budget be approved for inclusion in the 2024/25 budget subject to affordability by the HIWFRA Full Authority.
50. That the ambition to utilise the new capacity within research and development to lead and influence, including via the National Fire Chiefs Council and wider fire sector be noted by the HIWFRA Full Authority.
51. That the funding for equipment and PPE is considered as part of the Medium Term Financial Plan to be reported to the Authority in February 2024 be noted by the HIWFRA Full Authority.
52. That the need for future investment for On Call fire stations, subject to a further report being presented for consideration, be noted by the HIWFRA Full Authority.
53. That the need for future investment in the management and decontamination of vehicles, subject to a further report being presented for consideration, be noted by the HIWFRA Full Authority.

APPENDICES ATTACHED

54. Appendix A - Managing Fire Contaminants – Exempt Funding Detail (confidential/exempt appendix)

Contact: Matt Robertson, Director of Corporate Services,
matt.robertson@hantsfire.gov.uk, 07918 887532