

<b>Institution:</b> University of Central Lancashire		
<b>Unit of Assessment:</b> UoA 12 Engineering		
<b>Title of case study:</b> <u><i>Protecting people from toxic fire residues</i></u>		
<b>Period when the underpinning research was undertaken:</b> March 2012 – end 2020		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b> Prof. Anna Stec	<b>Role(s) (e.g. job title):</b> Professor	<b>Period(s) employed by submitting HEI:</b> 2007 – present
<b>Period when the claimed impact occurred:</b> 2013-2020		
<b>Is this case study continued from a case study submitted in 2014?</b> N		
<b>1. Summary of the impact</b> (indicative maximum 100 words)		
<p>Stec undertook two significant investigations, the first identifying carcinogens in the working environment and Personal Protective Equipment (PPE) of firefighters, the second identifying carcinogens and other toxicants in soil and debris around Grenfell Tower. The firefighter work has resulted in a comprehensive guidance document, distributed to all UK firefighters, on steps to minimise contamination. This guidance, published in November 2020, is being adopted internationally. The Grenfell contamination study was featured on the front page of <i>The Guardian</i> every day for a week and led to the Prime Minister setting up a Scientific Advisory Group on Grenfell Environmental Contamination with Stec as the leading expert, and resulting in a detailed programme of environmental and health monitoring around the Tower. Stec was called to give evidence to the House of Commons Environment Audit Committee and her work was featured heavily in the committee's <i>Toxic Chemicals in Everyday Life</i> (July, 2019) report.</p>		
<b>2. Underpinning research</b> (indicative maximum 500 words)		
<p>Stec's research highlights the prevalence of chronically toxic fire effluents, and the associated health risks. It has led to new protocols for the protection of firefighters' and to health and environmental monitoring to protect the victims and local population exposed to the Grenfell Tower fire.</p>		
<b><u>Protecting Exposed Communities: Grenfell Tower</u></b>		
<p>The aftermath of the Grenfell Tower fire (2017) revealed serious deficiencies in the management of post-fire environmental contamination. This exposed the community around Grenfell Tower to carcinogenic fire residues and put firefighters' health at risk. Results of Stec's environmental monitoring have shown that residents in the area around the Tower are being exposed to carcinogens and other toxicants. Soil samples from six locations up to 1.2 km from Grenfell Tower, together with char samples from the balconies of nearby residences, were collected one and six months after the fire [1]. Levels of carcinogenic contaminants, including polychlorinated dibenzo-dioxins (PCDD), benzene, and polycyclic aromatic hydrocarbons (PAHs), were significantly (40 to 160 times) greater than in UK urban reference samples.</p>		
<b><u>Characterising firefighters' occupational exposures and diseases</u></b>		
<p>Stec quantified the levels of carcinogenic polycyclic aromatic hydrocarbons (PAHs) found in several locations such as offices, workstations, PPE rooms, and fire engines, at two UK fire stations [2]. Contaminants collected by surface wipe and air sampling suggested an increased risk of cancer for exposed firefighters. Further wipe samples collected from the personal protective equipment (PPE) and skin of trainees and instructors pre- and post- live fire training demonstrated a significant build-up of contaminants. This demonstrated that</p>		

firefighting exposes participants to these contaminants. Levels of carcinogens recorded on the skin indicates dermal absorption as the main route of exposure for UK firefighters and not inhalation as previously believed.

This work initiated an ongoing collaborative relationship with the Fire Brigades Union (FBU), resulting in a major project investigating occupational diseases in firefighters. Firefighters' indoor working environments were screened for a range of harmful contaminants including PAHs, volatile organic compounds (VOCs) and particulates. The study assesses the health risks associated with exposure to measured levels of contaminants and communicates these risks back to affected Fire and Rescue Services (FRSs). To date, 18 stations across the UK have been tested with the majority of these stations exceeding the safe level of contaminants. As part of Stec's work, around 32,000 currently serving UK's firefighters were surveyed and over a third provided complete responses. Although this work is ongoing, it showed that 4.1% of respondents had already been diagnosed with cancer, compared with less than 1% of the general population, 75% of whom had served for at least 10 years before their diagnosis. More than half were under the age of 50 and a fifth were under 40. Of those diagnosed, 26% have skin cancer, followed by testicular cancer (10%), head and neck cancer (4%) and non-Hodgkin's lymphoma (3%) [3]. This preliminary review has led to the creation of the UK Firefighter's Cancer and Disease Registry (FCDR). This was released in February 2021, to enable a better understanding of the increased occurrence of cancers and diseases among firefighters in the UK.

Stec's research was used to draft a comprehensive guidance document for all UK Fire and Rescue Services (FRSs), which details best practice for the minimisation of firefighters' exposure to harmful contaminants [3]. The document was released in November 2020 and has also been distributed to all firefighters through the FBU.

### 3. References to the research (indicative maximum of six references)

[1] Stec, AA, Dickens, KE, Barnes, JLJ and Bedford, C, Environmental contamination following the Grenfell Tower fire, *Chemosphere* (2019). DOI: 10.1016/j.chemosphere.2019.03.153

[2] Stec, AA, Dickens, KE, Salden, M, Hewitt, FE, Watts, DP, Houldsworth, PE & Martin, FL, Occupational Exposure to Polycyclic Aromatic Hydrocarbons and Elevated Cancer Incidence in Firefighters, *Scientific Reports*, volume 8, Article number: 2476 (2018). DOI: 10.1038/s41598-018-20616-6

The above articles are peer reviewed.

[3] Stec, AA, (2020). *Interim Best Practice Guide to Minimising Firefighters' Exposure to Toxic Fire Effluents*, Fire Brigades Union URL: <https://www.fbu.org.uk/download/file/fid/5392>

### 4. Details of the impact (indicative maximum 750 words)

#### **Raising awareness of soil contamination caused by the Grenfell Tower fire**

Stec's investigation into the persistent environmental contamination caused by deposition of particulates from the Grenfell Tower Fire was the first analysis to be conducted at or near the site. Public Health England had previously only conducted air quality monitoring, targeting the most common atmospheric pollutants: an approach insufficient for uncovering the full extent of contamination caused by the tragedy. Where Public Health England had concluded a 'consistently low' risk to public health, Stec's findings uncovered an overlooked and considerable risk to residents and firefighters' health and the urgent need for investigation. Her preliminary findings, showing high concentrations of potential carcinogens in the area, were shared with PHE, NHS England and government officials in February 2018. They were reported on the front page of *The Guardian* every day for a week, in October 2018 [A]. This

led to Prime Minister Theresa May calling on her chief scientific advisor, Sir Patrick Vallance, to establish a Scientific Advisory Group (SAG) on Grenfell Environmental Contamination, onto which Prof Stec was invited as the leading expert (Prof Chris Witty was a member of the group) [B]. The SAG commissioned comprehensive soil analysis as well as a GBP50,000,000 programme of health screening for affected residents [C]. Stec was called to give evidence on both the Grenfell Contamination and firefighter cancers to the House of Commons Environmental Audit Committee (EAC) [D], and her work featured heavily in their report [E]. Stec's Grenfell contamination work was one of six final nominees for the Times Higher Education Research Project of the Year Award in 2020 [F].

### **Protecting firefighters from exposure to toxic fire effluent and residues**

Stec initiated a meeting in the European Parliament for the Members of the European Parliament (MEPs) Against Cancer Group in September 2017 to raise awareness of firefighters' occupational exposure to toxic fire effluents and increased risk of cancer and disease. Pavel Poc, MEP Vice Chair of the MEPs Against Cancer Group, summarised: **"It is clear that it is time to take action both on national and EU levels to ensure that our firefighters are no longer left alone in their battle with cancer. I call on upon the Euro commission and member states to take a strong and necessary lead on this issue and I call on all colleagues in the European parliament to support us, to support this initiative with only objective in mind the safety of our firefighters and all EU citizens."** [G]. This work was also presented to UK Members of Parliament and peers at the All-Party Parliamentary Fire Safety & Rescue Group and to the Government's Industrial Injuries Advisory Council. It was also discussed at the British Standards technical committee (Firefighters' PPE, PH/14). Stec's research findings directly led to representation by counsel for the Grenfell Tower fire victims, and also counsel for the FBU, arguing that cancers and other chronic diseases should be included in the Grenfell Tower Public Inquiry led by Sir Martin Moore-Bick [H].

The utility and potential of the contamination study [2] for protecting firefighters' health has been recognised by the Environmental Audit Committee in Recommendation 15 of the Report on Toxic Chemicals in Everyday Life: **'Recommendation 15: We also recommend that the Health and Safety Executive monitors the progress of the Fire Brigades Union research and provides assistance in implementing recommendations which seek to improve the work environments of UK firefighters. This should include measures to minimise contamination from clothing and equipment and reduce the overall exposure of firefighters, their families and the public'** [I, J]. The UCLan guidance document, commissioned by the FBU, *Minimising firefighters' exposure to toxic fire effluents Interim Best Practice Report* responded to and set out the strategies for addressing the issues raised in Recommendation 15 [K1].

Research undertaken in collaboration with the FBU has already had significant impact by raising awareness of, and reforming, fire contamination control practices within UK FRSs. The best practice report [3] aims to help protect firefighters' health by highlighting the risks and common sources of contamination. It also suggests preventative measures for minimising exposure to contaminants and best practice for the decontamination of FRS personnel and firefighting equipment after exposure to toxic fire effluent. It provides background information, statistics, resources and actions vital for improving firefighters' health and well-being, keeping them safe and preventing the contamination which otherwise will lead to serious health conditions resulting in either life-changing problems and/or premature death. This is the first time such guidance has been provided to UK FRSs.

Matt Wrack, FBU General Secretary, says in his foreword to the report that it **"not only provides evidence of the heightened risk faced by firefighters through their work, but also delivers clear and authoritative guidance to fire and rescue services across the UK about the measures they can take to minimise firefighters' exposure to contaminants. The report details how firefighters face danger from breathing and**

**ingesting contaminants long after a fire has been extinguished – and how these toxic fire effluents can be absorbed by the skin. It demonstrates where current Fire and Rescue health and safety practices are failing, builds on existing good practice and sets out a path to a safer future.” [K1]**

The report made a series of practical recommendations, supported by the FBU, for changes that could be implemented by both the fire service and firefighters themselves. One firefighter commented: **“I believe if the current recommendations had been in place when I first joined the service, I am in no doubt that they would have made a difference to me and my colleagues. If we’d known and we’d had these measures, we’d have used them and fewer of us would have got sick.” [K2, K3]**

The UK government’s Industrial Injuries Advisory Council (IIAC) is planning to publish their review on firefighters and cancer imminently (March 2021) and have expressed interest in referencing the best practice recommendations made within the guidance document [L].

### **Distribution and best practice adoption in the UK and abroad**

The impact of the guidance document is having a positive influence on the health of firefighters internationally. Fire Services in Poland have already adopted the document. The Firefighters Union KSP NSZZ "Solidarność" have said they **“recommend this document to be used by all firefighters in Poland.” [M]**. The Chief of the Fire Brigade in Olsztyn-Gutkowo, stated that the best practice report **“has some impressive, radical, provoking and stimulating suggestions that are really needed in our sector in order to make any change. Our Fire Brigade is on board with all your findings in your report.”** Zapadka also confirms that the **“document was distributed across Polish Fire Stations, and I am sure that there are more Fire Brigades using and adopting your document.” [M]** Following publication of the guidance in November 2020 emergency services and fire professionals in the USA, Australia, Netherlands, Norway and Ireland have expressed interest in the guidance [M].

The best practice document was welcomed by the FRSs in the UK, many of them incorporating the recommendations into their practice. Examples include fire services from London, Scotland, Greater Manchester, East Sussex, Essex, Hampshire, Avon, Lancashire, Merseyside and the Isle of Wight. In a letter to Matt Wrack, Martin Blunden of the Scottish Fire Rescue Service states that their Contaminants Control Group **“has implemented action planning in all key areas where contaminants can present, this includes station design, appliance design, firefighting operations, PPE, Occupational Health, culture & behaviour, training and record keeping. In support of this work, the Service published a general information note in June 2020 which outlines in detail the standards, processes and behaviours expected in relation to these key areas.”** Furthermore, Blunden reports that **“This work will continue to be of high importance for the Service and the CG are currently scoping the recommendations from the UCLan Interim Report to ensure that any learning and recommendations are incorporated into the ongoing work of the CG.” [M]**

### **5. Sources to corroborate the impact (indicative maximum of 10 references)**

- [A] Hopkins, N. (2018). ‘Huge concentrations’ of toxins found in Grenfell soil, study finds’, The Guardian, 12-10-2018 to 17-10-2018. <https://www.theguardian.com/uk-news/2018/oct/12/toxins-found-in-grenfell-tower-soil-study-finds> ; <https://www.theguardian.com/uk-news/2018/oct/15/grenfell-tower-fire-survivors-demand-answers-ministers-soil-toxins> ; <https://www.theguardian.com/uk-news/2018/oct/16/grenfell-survivors-demand-immediate-action-on-toxicity-of-soil> ; <https://www.theguardian.com/uk-news/2018/oct/17/nhs-act-promptly-grenfell-tower-fire-toxicity-concerns-anna-stec>



- <https://www.theguardian.com/uk-news/2018/oct/26/grenfell-ministers-order-soil-tests-amid-concerns-over-toxins> ; [All accessed 12 March 2021]
- [B] Worrell, H. (2018). 'Grenfell Environmental Contamination - Science Advisory Group' [email to Prof A. Stec sent 06-11-2018.]
- [C] NHS to provide long term screening service for Grenfell Community, NHS news, 09-10-2018. Available from: <https://www.england.nhs.uk/2018/10/nhs-to-provide-long-term-screening-service-for-grenfell-community/> [Accessed 1 April 2019].
- [D] Environmental Audit Committee (2019) Smoke Toxicity hearing <https://www.parliamentlive.tv/Event/Index/02213e37-0dfe-47c3-89eb-b487ab5b0d86> [Accessed 12 February 2021]
- [E] Environmental Audit Committee. (2019). Toxic Chemicals in Everyday Life: Environmental contamination around the Grenfell Tower. <https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/1805/180507.htm> [Accessed 12 February 2021]
- [F] Times Higher Education Awards 2020 Shortlist and Nomination
- [G] *MEPs Against Cancer* YouTube video <https://www.youtube.com/watch?v=XiJirDiFOGY&feature=youtu.be>
- [H] Grenfell Tower Public Inquiry - Procedural Hearing 21 March 2018 <https://www.grenfelltowerinquiry.org.uk/sites/default/files/inline-files/grenfell210318.pdf> (p159 et seq) [Accessed 1<sup>st</sup> April 2019].
- [I] House of Commons Environmental Audit Committee. (2019). Environmental Audit Committee Toxic Chemicals in Everyday Life: Government Response to the Committee' s Twentieth Report of Session 2017 – 19. <https://publications.parliament.uk/pa/cm201919/cmselect/cmenvaud/160/160.pdf> [Accessed 12 February 2021]
- [J] Creagh, M. (2020). 'Fire toxicity (and its effect on people and environment)' [email to Prof A. Stec sent 10-09-2020]
- [K] Research commissioned by the Fire Brigades Union (FBU) into firefighters' exposure to toxic fire effluents
- [K1] Stec, A. (2020), *Minimising firefighters' exposure to toxic fire effluents Interim Best Practice Report*, Fire Brigades Union. URL: <https://www.fbu.org.uk/download/file/fid/5392> [Accessed 12 February 2021]
- [K2] FBU news article announcing findings, 23rd November 2020: "Urgent action needed to protect firefighters from cancer, scientists find" URL: <https://www.fbu.org.uk/news/2020/11/23/urgent-action-needed-protect-firefighters-cancer-scientists-find> [Accessed 12 February 2021]
- [K3] FBU Blog recommending practice changes in response to report, 23rd December 2020: "Keeping you safe from cancer-causing contaminants" URL: <https://www.fbu.org.uk/blog/keeping-you-safe-cancer-causing-contaminants> [Accessed 12 February 2021]
- [L] Starbuck, S. (2020). 'Industrial Injuries Advisory Council Firefighters Cancer' [email to Prof A. Stec sent 02-09-2020]
- [M] Letters from emergency services and fire professionals acknowledging the best practices