Svetlana Tretsiakova-McNally

Dr Svetlana Tretsiakova-McNally is the principal investigator of InToxFIRE project. She is a Senior Lecturer in Chemistry within Belfast School of Architecture and the Built Environment at Ulster University.

Svetlana is a polymer/material chemist with more than 15 years of post-doctoral experience in organic, polymer and fire chemistries, as well as material science.

Ulster University

InToxFIRE

The InToxFIRE Project: A Review of the First Year

Dr Svetlana Tretsiakova-Mcnally

ON-LINE WORKSHOP, MS TEAMS

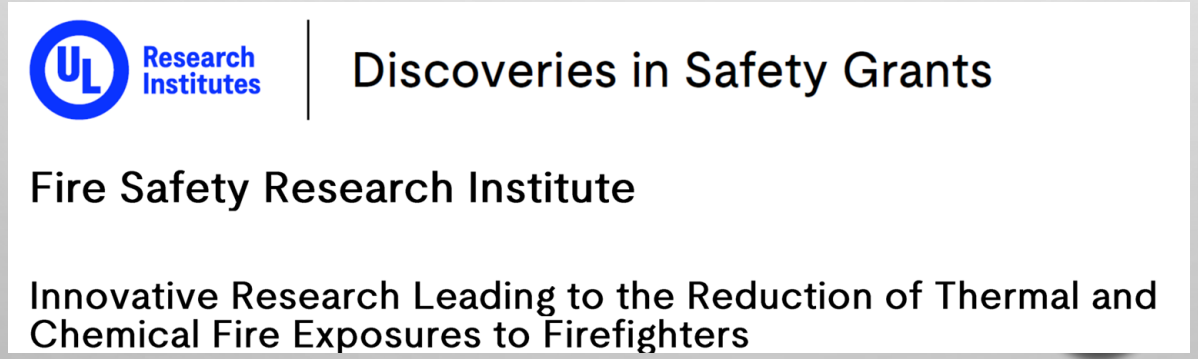
12 AUGUST 2025, 6 PM

HTTPS://WWW.INTOXFIRE.NET/

UL Research Institutes

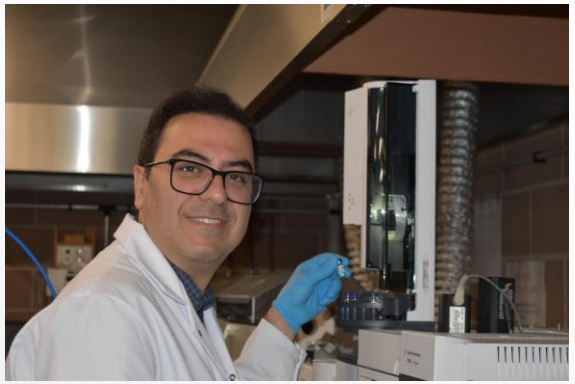
RESEARCH PROJECT

- **"INVESTIGATION OF TOXIC CHEMICALS TRANSFER THROUGH CLOTHING LAYERS OF FIRE SUITS" (INTOXFIRE)** PROJECT
- **FUNDER: UL RESEARCH INSTITUTES (USA), DISCOVERIES IN SAFETY GRANTS**
- **DURATION: 3 YEARS**
- **PROJECT OFFICIALLY STARTED: 1ST SEPTEMBER 2024**
- **KICK-OFF MEETING: 6TH SEPTEMBER 2024**
- **POST-DOCTORAL RESEARCHER IS WORKING FULL-TIME FROM 3RD FEBRUARY 2025**
- **PROJECT WEBSITE [HTTPS://WWW.INTOXFIRE.NET/](https://www.intoxfire.net/) LAUNCHED ON 21ST FEBRUARY 2025**



FIRESERT RESEARCH TEAM

Principal Investigator – Dr Svetlana Tretsiakova-Mcnally



Research Associate – Dr Hamed Rasouli Sadabad

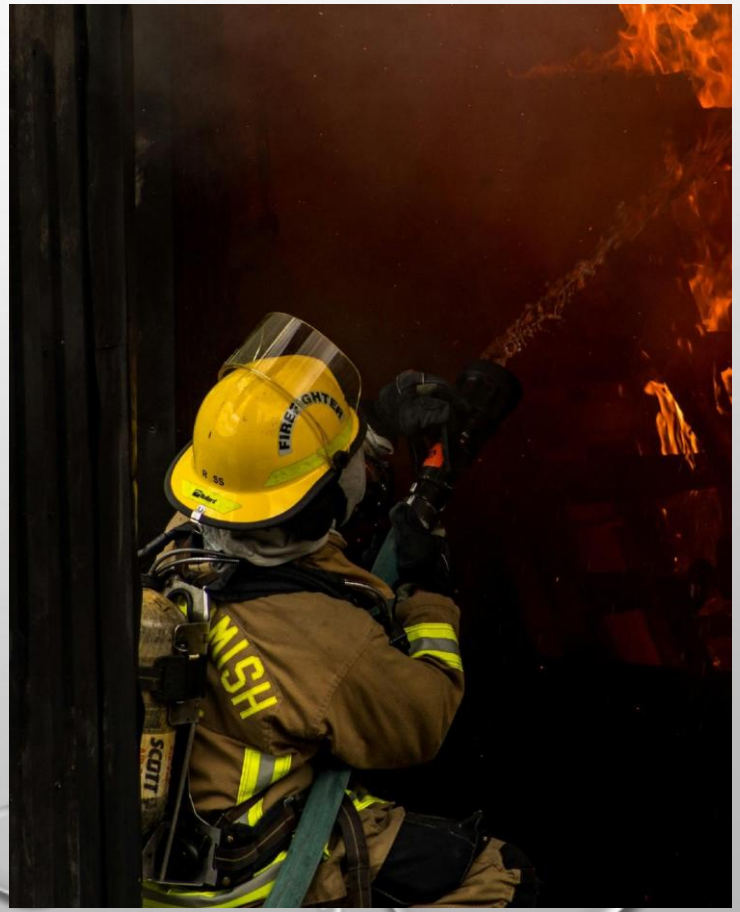
Co-Investigator 1 – Dr Jianping Zhang

Co-Investigator 2 – Prof Ali Nadjai

PhD student to start in September 2025

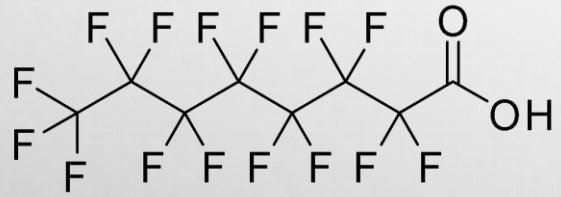
RESEARCH BACKGROUND

- 40,100 career firefighters, 19,000 part-time and 1,400 voluntary firefighters in the UK.
- Repeated/regular/long exposure to different classes of toxic agents:
  - **Asphyxiants** (CO and HCN)
  - **Irritants** (hydrogen halides, organics, etc.)
  - **Polycyclic Aromatic Hydrocarbons** (PAHs)
  - **Volatile Organic Compounds** (VOCs)
  - **Per- and Poly- Fluoroalkyl Substances** (PFAS);
  - **Metals**
  - Fine **particulates**
  - **Fire retardants**
  - and others



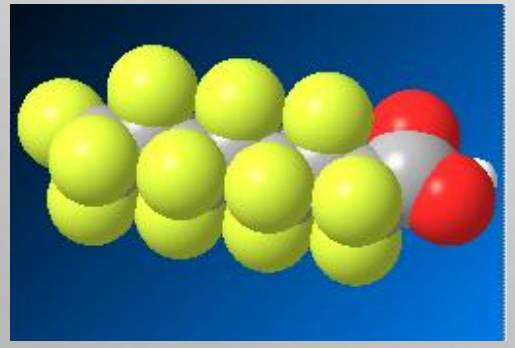
PFAS IN FIRE SUITS

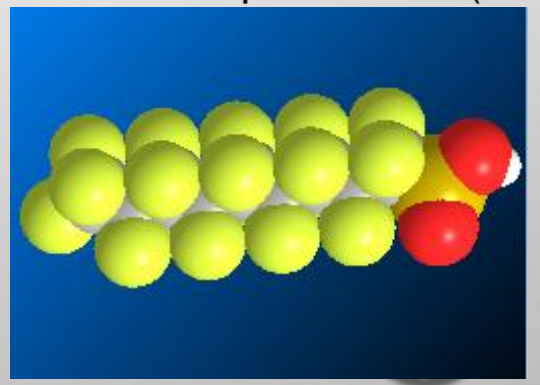
- **PFAS, "FOREVER CHEMICALS"**, LINKED TO HEALTH AND ENVIRONMENTAL CONCERNS.
  - ENVIRONMENTALLY PERSISTENT, WITH HIGH TENDENCY TO BIOACCUMULATE.
  - DISCHARGE OF PERFLUOROOCTANOIC ACID (PFOA), A KNOWN CARCINOGEN (GROUP 1).
  - PFAS CAN BE EMITTED FROM NEW, USED AND WASHED PFAS-BASED FABRICS.
  - SAN FRANCISCO IS THE FIRST US CITY TO BAN PFAS IN TURNOUT GEARS.
  - EUROPEAN UNION BEGAN CONSIDERING PFAS BAN IN FEB 2023.



Perfluoro-Octanoic Acid (PFOA)

Perfluoro-OctaneSulphonic Acid (PFOS)





THE IMPACT ON FIREFIGHTERS' HEALTH

- **THE INCREASED MORTALITY RATES**
- **RISKS OF MESOTHELIOMA**
- **DIFFERENT AND MULTIPLE CANCERS AMONG FIREFIGHTERS**
- **MENTAL HEALTH ISSUES**
- **SIGNIFICANTLY HIGHER CHANCES OF DIAGNOSIS FOR:**
  - ACUTE ISCHEMIC HEART DISEASES
  - STROKE
  - INTERSTITIAL PULMONARY DISEASES
  - RENAL FAILURE
  - MUSCULOSKELETAL SYSTEM DISEASES

PROJECT AIMS

- To investigate whether elements of firefighters' clothing allow the transport of toxic chemicals from the fire effluent towards the skin of firefighters
- To determine the nature of toxic chemicals and their concentration levels using appropriate analytical techniques
- To use heat transfer and advanced computational models, along with developed analytical methods, to fully quantify the transfer of toxic chemicals through the layers of fire suits

PROJECT WORK PACKAGES

- **WP1 – PROJECT MANAGEMENT & COORDINATION, MONTHS 1-36.**
- **WP2 – SMALL-SCALE TESTING, MONTHS 1-20.**
- **WP3 – MEDIUM-SCALE TESTING, MONTHS 21-33.**
- **WP4 - NUMERICAL MODELLING, MONTHS 21-34.**
- **WP5 – DISSEMINATION & COMMUNICATION, MONTHS 1-36.**
- **WP6 – RECOMMENDATIONS & GUIDELINES, MONTHS 1-36.**

FIND OUT MORE ABOUT OUR PLANS ON OUR WEB-SITE: https://www.intoxfire.net/about/

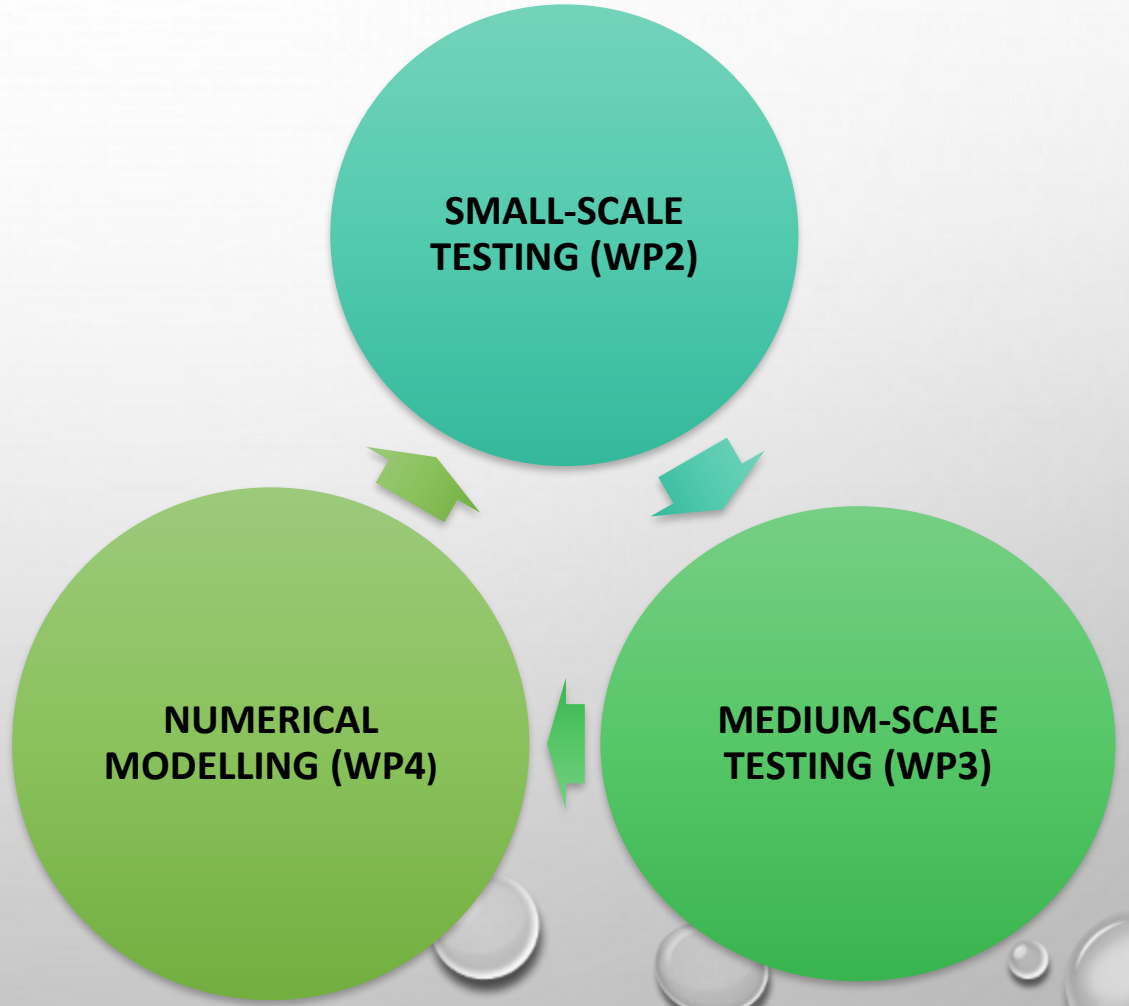
MILESTONES SET FOR THE FIRST YEAR:

MS1 – THE PROJECT WEBSITE (MONTH 12)

MS7 – THE ON-LINE DISSEMINATION WORKSHOP (MONTH 11).

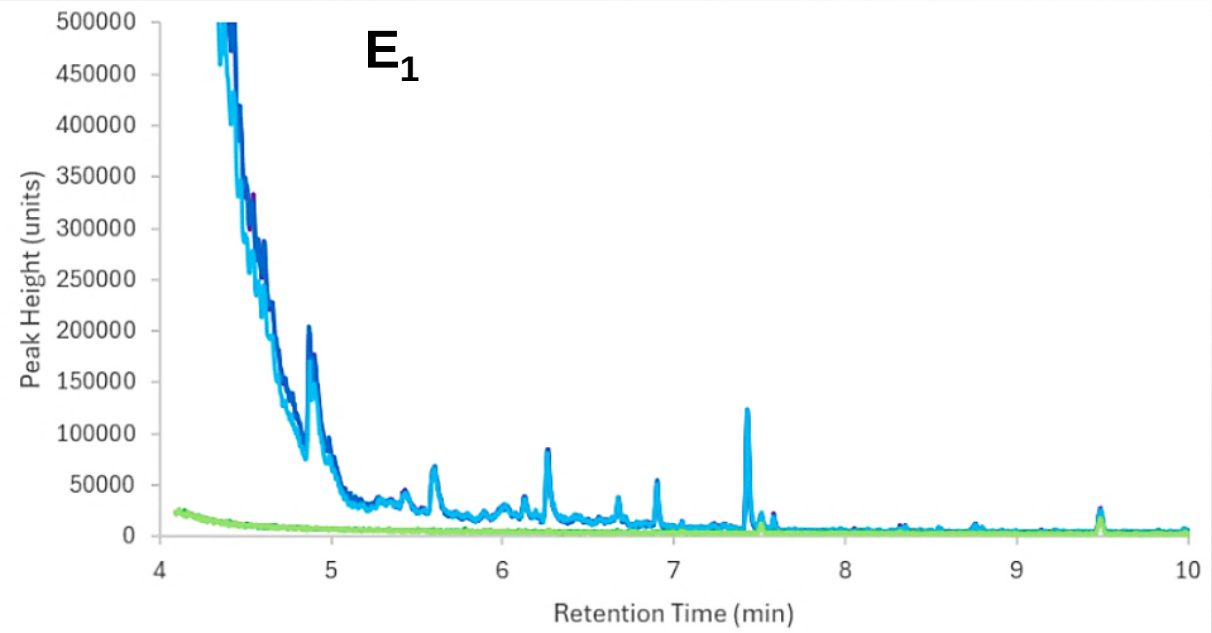
EXPERIMENTAL PROGRAMME

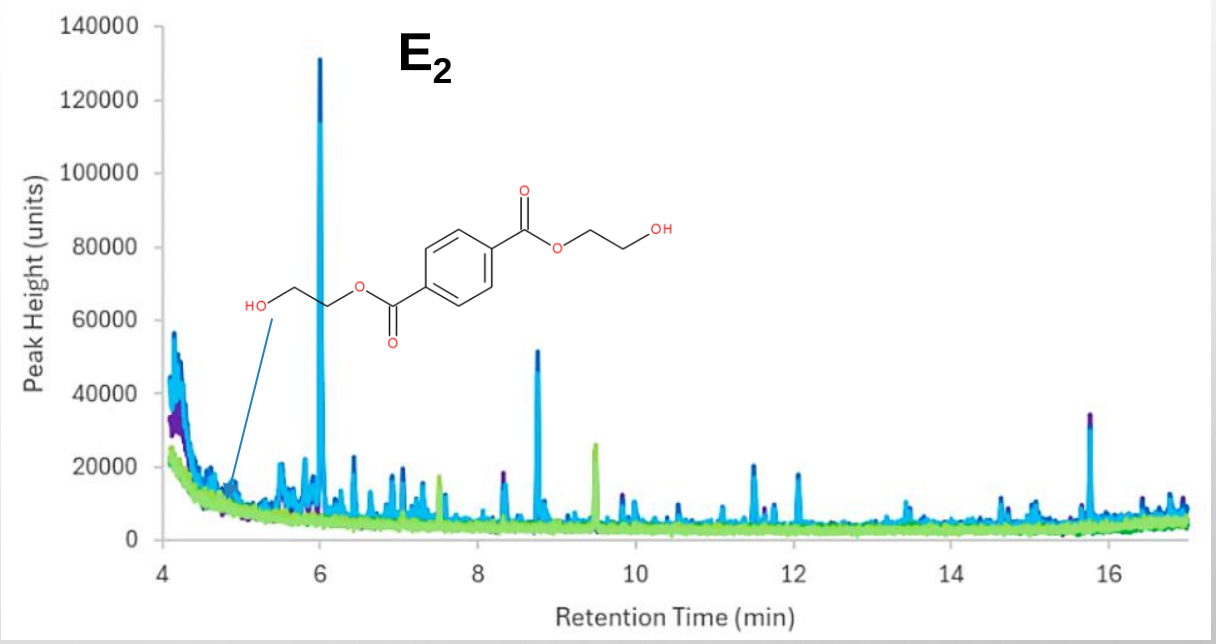
is to enable a quantification of toxic chemicals moving through the layers of fire suits.



INITIAL RESULTS

A comparison of GC patterns of fire condensate, organic phase



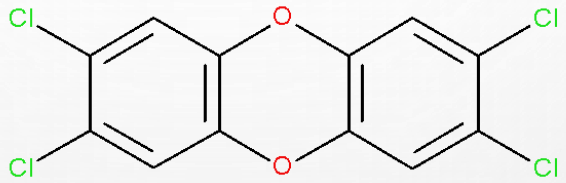


Both new (unused) ensembles effective in preventing the permeation of compounds soluble in organic phase

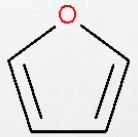
INITIAL RESULTS

Compounds detected via LC-MS in fire condensate, aqueous phase:

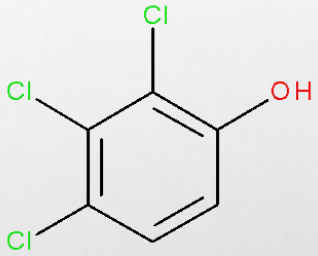
- Aromatics (C_7H_8O and furans)
- Oxidized ($C_6H_{12}O_2$, $C_{16}H_{30}O$ and $C_{18}H_{38}O$)
- Isocyanates ($C_3Cl_3NO_2$)
- N-containing ($C_8H_{17}N$, $C_9H_{17}N$ and $C_8H_{19}N$)
- Cl-containing (1,1,1-TRICHLOROETHANE, polychlorophenol ($C_6H_3Cl_3O$), polychlorinated biphenyl PCB-126 ($C_{12}H_5Cl_5$), and dioxins (2,3,7,8-TCDD)
- Br-containing (Bromochloroacetic acid, heptabromodibenzo-*p*-dioxin $C_{12}HBR_7O_2$)
- PFAS (CF_4 and $C_{12}F_{26}$)



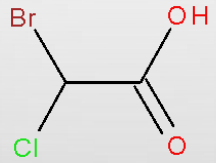
2,3,7,8-TCDD



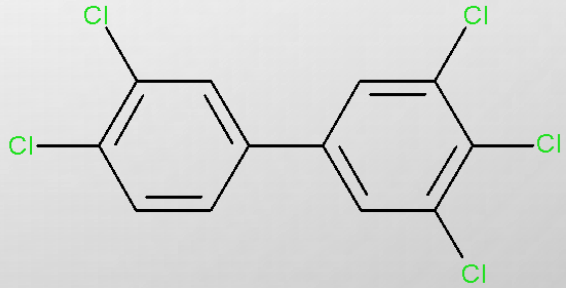
furan



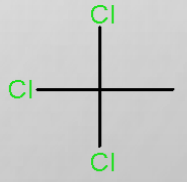
trichlorophenol



bromochloroacetic acid



PCB 126 (3,3',4,4',5-Pentachlorobiphenyl)



trichloroethane

INITIAL RECOMMENDATIONS

- IMPROVED PPE DESIGN, WITH NO, OR MINIMUM, GAPS.
- SUITABLE ALTERNATIVES TO PFAS-CONTAINING ENSEMBLES.
- CORRECT ROBING/DISROBING.
- UPDATED AND REGULAR TRAINING FOR FIREFIGHTERS AND THEIR TRAINERS.
- SKIN WIPING, HAND WASHING AND SHOWERING AS SOON AS POSSIBLE AFTER INCIDENTS TO REDUCE DERMAL EXPOSURE DOSES.
- TIMELY & REPEATED LAUNDERING OF CONTAMINATED TURNOUT GEARS.
- PPE CLEANING USING LIQUID CARBON DIOXIDE.
- ESTABLISHED LEVELS OF CLEANLINESS.
- CREW ROTATION FOR PROLONGED OPERATIONS.

YEAR 1 ACHIEVEMENTS

- Working project web-site https://www.intoxfire.net/
- Established protocol for testing fire suit ensembles.
- Analytical methods developed to quantifying naphthalene, toluene, total PAHs.
- Discussion groups with: fire & rescue services (Northern Ireland, Ireland, England, Italy, USA and Australia), decontamination specialists, National Fire Chief Council and PPE manufacturers in the UK).
- Success in delivery of the symposium IFIRESS https://www.ulster.ac.uk/conference/ifiress2025
- The online InToxFIRE workshop https://www.intoxfire.net/intoxfire-online-workshop-final-program/
- A survey of firefighters in the UK, Europe, USA and Australia on PPE decontamination, contaminated PPE handling procedures and training.

PROJECT OUTPUTS: YEAR 1

Conference papers:

TRETSIAKOVA-MCNALLY, S, RASOULI SADABAD, H, ZHANG, J & NADJAI, A. 2025, ANYONE FOR A COCKTAIL? UNDERSTANDING THE IMPACT OF TOXIC CHEMICALS ON EXPOSURE OF FIREMEN TO POST-FIRE CONDENSATE. IN *5TH INTERNATIONAL FIRE SAFETY SYMPOSIUM (IFIRESS 2025),*106, PP. 490-500. HTTPS://DOI.ORG/10.21251/03828A0D-6CEB-4FCE-BA02-E93CCB60D4FC

TRETSIAKOVA-MCNALLY, S, CHEN, YK, ZHANG, J, RASOULI SADABAD, H & NADJAI, A. 2025, THE NATURE OF TOXICANTS MOVING ACROSS THE LAYERS OF FIRE SUITS. IN *16TH INTERNATIONAL CONFERENCE AND EXHIBITION ON FIRE SCIENCE AND ENGINEERING (INTERFLAM 2025).* VOL. 1, 118, ROYAL HOLLOWAY, UNIVERSITY OF LONDON, UK, PP. 331-342.

Presentations:

TRETSIAKOVA-MCNALLY, S. 2024. THE FATE OF TOXIC COMPOUNDS TRAVELLING THROUGH LAYERS OF FIRE SUITS. THE INSTITUTION OF FIRE ENGINEERS, FIRE SAFETY CONFERENCE: IGNITING INNOVATION – THE ENGINEERING BATTLE AGAINST FIRE. 17TH OCT 2024, DUBLIN, IRELAND.

TRETSIAKOVA-MCNALLY, S. 2025. A PERMEATION OF TOXIC SUBSTANCES THROUGH LAYERS OF FIREFIGHTERS' CLOTHING. THE SOCIETY OF FIRE PROTECTION ENGINEERS (SFPE). 19TH MAR 2025, BELFAST, UK.

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