IFP INTERVIEW

IWMA Award goes to young Australian Scientist

This year's International Water Mist Association (IWMA) Young Talent Award winner is Haydn Lewis who has been invited to attend the 21st International Water Mist Conference, taking place in Madrid on 9–10 November, to introduce his master's thesis.

International Fire Protection magazine took the opportunity to speak with Haydn to discuss 'Why fire engineering?', 'Why watermist?' and the road ahead for this award-winning scientist.

IFP: From where does your interest in fire safety engineering derive?

HL: I think like a lot of people in the fire-safety-engineering industry, I kind of fell into it initially. What has kept me here is the collaborative and technical elements associated with fire engineering within the built environment. To me, fire safety engineering is the convergence of knowledge from many disciplines to solve a particular problem focusing on the community and their social practices. I love being able to walk or drive through structures knowing that I played a part in making them safe, user friendly and efficient.

▼ Bags will soon be packed for the trip to Madrid.

IFP: On your first day at university, did you know that you would be writing your master's thesis about watermist?

HL: No, not at all. I knew that my master's thesis was a fantastic opportunity to properly explore an idea I was curious about (without knowing what exactly that idea was) and I wanted to make the most of it. I spent a significant amount of time brainstorming and reading journals looking for something that I wanted to understand in more detail. I came across some studies which noted changes in the concentration of products of combustion with activation of suppression systems. I wanted to explore a little deeper how various combustion and suppression properties influence changes in toxic species production. Watermist was the most appropriate means through which to explore this phenomenon.

IFP: Lund – where you have studied – is a lovely town in Southern Sweden, but I suppose that is not the reason why you went there to study/finish your studies?

HL: I did my master's through the International Master of Science in Fire Safety Engineering (IMFSE) programme. This degree is a collaboration between a number of internationally recognised universities in the field of fire safety that capitalises on the respective strengths and expertise of each.

I spent six months studying at Lund University, Sweden, and then chose to return to undertake my thesis. The fire-engineering expertise in Lund is incredibly well rounded and had the ideal facilities and support to realise my research. And you're right, the town of Lund itself formed a lovely backdrop in which to be based for a year. The people and pace of life made this a fantastic temporary home.

IFP: Have you been to other universities before you moved to Lund?

HL: I completed my undergraduate degree in Mechanical Engineering and Applied Physics at the University of Technology, Sydney. As part of the IMFSE, I also spent semesters studying at Ghent University, Belgium and the University of Edinburgh, Scotland.

IFP: How was your interest in watermist aroused?

HL: As I touched on earlier, my interest came from wanting to quantify how various properties of suppression and combustion alter the rate of generation of toxic species production. It was really important for me to focus the suppression on the gas-phase chemistry of the fire, and watermist was the most appropriate means of facilitating this.

IFP: What do you think are the great advantages of watermist technology?

HL: To me, the greatest advantage of watermist systems is the ability to tailor the mode of suppression to the specific fire scenario when used in conjunction with a performance-based design approach. Watermist systems provide another useful design option when developing the most appropriate and cost-effective holistic solutions.

IFP: How was the time during which you wrote your thesis? How will you look back at it in years to come?

HL: The time writing my thesis can be seen in two distinct halves. The first half was spent reading, brainstorming and safely 'playing' in the laboratory to determine what was feasible and how exactly I would measure what I hypothesised I may see. It was a very interesting and creative experience. The second half was characterised by significant uncertainty as the extent of the Covid-19 pandemic was realised across the world. Being an Australian in Sweden as the world started to lock down was a stressful experience. In March 2020, the same week as I concluded my set of experiments, I made the trip back to Sydney to write up my thesis remotely. I have to thank my supervisor Nils Johansson and the IMFSE board for their efforts in making that process as smooth as possible in very trying times.

IFP: What do you think the future of watermist looks like?

HL: I'm excited by the continued advancement of watermist technology. There seems to be a lot of interesting research being published in this space and I expect that this will result in an increased adoption of watermist systems.

IFP: What are your personal plans for your future regarding your career?

HL: I'm currently working in Sydney at SGA Fire a Jensen Hughes Company, with a specialisation in major infrastructure works. I really appreciate the variety that comes from consulting on complex projects that demand more flexible and creative approaches, underpinned by first-principles. I see myself continuing to develop along these lines, with perhaps a small detour back into the research field at some point down the line.

IFP: Will watermist be a part of your future?

HL: Absolutely. I believe that it is important that we continue to explore the influence of suppression systems on combustion processes. I hope I've played a small part in furthering that with regards to toxic species production and I'm excited to see how the research develops from here.

Summary

Preventing loss of life is the primary purpose of fire safety engineering. Fire safety engineers commonly undertake occupant tenability assessments to ensure that occupant egress within a fire emergency is facilitated. Fire suppression systems are a commonly utilised tool to reduce the degree of fire exposure to occupants within a compartment.

In a fire, flames and high temperatures pose a serious hazard. However, two-thirds of all deaths in building fires result from exposure to carbon monoxide (CO).[1] Increased CO exposure leads to a reduced level of physical and mental performance, inhibiting a person's ability to safely evacuate. As such, exposure to CO is one of the tenability criteria commonly considered within fire safety engineering assessments. Typically, the variable factors in the calculations of CO production for different fuel types are based on how compartment ventilation (and thus availability of oxygen) influences the completeness of combustion.[2]

Incomplete combustion occurs where there is an insufficient quantity of oxygen relative to the availability of fuel. Despite not being commonly considered in current-day applications, other factors within the fire scenario will contribute to the efficiency of combustion. Active fire suppression systems, such as sprinkler and mist systems, influence combustion as water droplets interact with the fire and the fuel. Currently, the contribution of suppression to the levels of toxic species generation within the fire environment is not well established.

My research, conducted with Nils Johansson at Lund University through the Erasmus IMFSE programme, tests the hypothesis that the application of water droplets to fire influences the CO production and tests the influence of various suppression and combustion factors.

This study consisted of a series of experiments where water-spray scenarios were applied to fires, and the resulting CO production measured.[3] Properties of the watermist sprays used were altered and fires varied by size and fuel type (solid, liquid and gaseous). The water-spray variables were droplet size and flow rate, which were controlled through adjustments in system pressure and nozzle type. The results of this study showed that the concentration of CO generated increased by as much as 250% when mist suppression was applied.

This research demonstrated that under lab conditions there is an increase in CO generation during partial suppression of a fire. It serves as a proof of concept for the potential for significantly elevated levels of CO in environments beyond what is currently considered by standard yields within fire-safety assessments. Where the suppression system may not always significantly reduce the fire size, there is a need for fire engineers to consider more conservative yields until further investigations can be undertaken.

▲ Safely playing in the laboratory.

For more information, go to www.iwma.net

References

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