World Fire Congress 2024 Proceedings Report

World Fire Congress

2024 | UNITED STATES

FEMA

U.S. Fire Administration

Working for a fire-safe America

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Message from Dr. Lori Moore-Merrell

It is my great honor to present the Proceedings Report from the Inaugural 2024 World Fire Congress held May 7-8, 2024 in Washington, DC. This historic meeting marked a significant milestone in the global fire service community, as representatives from 56 nations united for the first time to address the pressing challenges faced by fire services worldwide.

The World Fire Congress was established to foster international cooperation and understanding among fire service leaders, recognizing the common challenges that transcend national borders. This inaugural session served as a platform for sharing knowledge, experiences, and strategies – ultimately aimed at enhancing our collective ability to manage and mitigate fire-related risks.

Over the course of the Congress, attendees explored a range of critical issues, including the complexities of structure fires, the implications and fire risks of emerging energy technologies, firefighter health and safety challenges, and wildfires / community conflagrations. These discussions were framed within the context of a rapidly evolving landscape shaped by factors such as climate change and technological advancements.

The insights gained and the connections made during this Congress represent just the beginning of a sustained collaborative effort. Our work will continue as we build on this foundation, striving to address the challenges identified and to develop effective, practical solutions for the future.

I extend my sincere gratitude to all delegates, speakers, and guests for their participation and contributions. Together, we are shaping a safer and more resilient future for fire services and the communities we serve.

Thank you for your dedication and commitment to this vital cause.

Sincerely,

Dr. Lori Moore-Merrell

Dr. Lori Moore-Merrell
United States Fire Administrator

Agenda at a Glance

Optional Pre-Congress Events

National Fallen Firefighters Foundation Memorial Weekend

- **National Memorial Service**
- **Tour of National Fire Academy**

Cultural Tour of Washington DC

- **National Landmarks**
- **DC Fire and EMS Engine 3**

World Fire Congress: Day 1

Opening Session

- **Call to Order:**
  WFC Chair Dr. Lori Moore-Merrell, U.S. Fire Administrator
- **Honor Guard Axe Ceremony**
- **Opening Remarks:** Deanne Criswell, Administrator, Federal Emergency Management Agency
- **Moment of Silence for Firefighter Line of Duty Deaths in the Past Year**
- **World Fire Congress Statement of Founding Principles and Objectives:** Dr. Lori Moore-Merrell
- **Global Collaboration Statement:** UK WFC Co-Chair Mark Hardingham
- **Roll Call of International Delegates**
- **Rules of Order for Congress:** Chair Dr. Lori Moore-Merrell
- **Communities of Practice:** Co-Chair Mark Hardingham

Challenge 1: Structure Fire and Firefighter Response

- **Structure Fire Dynamics – Prevalence:** Dr. Daniel Madrzykowski (USA)
- **Firefighter Response:** Sabrina Cohen-Hatton (UK)
- **Global Fire Service:** Areas of Collaboration
  Facilitated Discussion – Michelle Royal (USA)
  - Forward Collaboration – Community of Practice
  - Implementing and Enforcing Building Codes and Standards
  - Community Risk Reduction – Building Resilience
  - Crew Size and Deployment
  - Firefighter Training and Personal Protective Equipment
  - Experience/Research Findings/Knowledge Exchange

Challenge 2: Climate Change Impacts

- **Wildfires/Community Conflagrations:** Dr. Gavin Horn (USA) / Derek Alkonis (USA)
- **International Fusion Center/AI:** Dr. Major Essa Ahmed Al Mutawa (United Arab Emirates)
- **Heavy Rains/Flooding:** Dr. Christoph Weltecke (Germany)
- **Extreme Weather Events:** Louie S. Puracan (Philippines)
- **Global Fire Service:** Areas of Collaboration
  Facilitated Discussion — Emily Saulsgiver (USA)
  - Forward Collaboration – Community of Practice
  - Improving Climate Literacy within the Fire Service
  - Rethinking Risk and Whole Community Preparedness
  - Opportunities for International Collaboration
  - Research Findings/Experience/Knowledge exchange

World Fire Congress Day 2

Call to Order and Day 1 Recap

WFC Chair Dr. Lori Moore-Merrell, U.S. Fire Administrator

Challenge 3: Fire Risk of Emerging Technology

- **Lithium-Ion Batteries / Solar Panels / Energy Storage / Micro-mobility Products (e-bikes/scooters:** Dr. Steven Kerber (USA), Dr. Nils Rosmuller (Netherlands)
- **Electric Vehicles:** Adam Barowy (USA), Michael Abraham (USA)
- **Fire Department Response:** Deputy Commissioner Ling Young Ern (Singapore)
- **Emerging Technology Safety and Regulations:** Fire Commissioner Laura Kavanaugh (USA)
- **Global Fire Service:** Areas of Collaboration
  Facilitated Discussion—Adam Thiel (USA)
  - Forward Collaboration – Community of Practice
  - Data Collection/Ongoing Research
  - Operational Response/Mitigation
  - Policy and Regulations
  - Public Education and Messaging

Challenge 4: Firefighter Health and Safety

- **Cancer:** Dr. Jaclyn Goodrich (USA)
- **Behavioral Health (Mental Health):** Dr. Sara Jahnke (USA)
- **Cardiovascular:** Dr. Denise Smith (USA)
- **Recruitment (DEI):** Dr. Jennifer Taylor (USA)
- **Global Fire Service:** Areas of Collaboration
  Facilitated Discussion —Sally O'Brien (USA)
  - Forward Collaboration – (Community of Practice)
  - Cancer – Knowledge Exchange
  - PFAS – Best Practices
  - PTSD and Mental Resilience
  - Peer Support Programs
  - Clinician Training
  - Cardiac – Knowledge Exchange
  - Recruitment – Diversity

Special Sessions

1. **Supporting Disaster Risk Reduction**
   Presented by the World Bank
2. **Addressing Wildfire Challenges through Public/Private Partnership**
   Presented by the Gordon & Betty Moore Foundation
3. **Innovative Technologies for the Fire Service**
   Presented by USA Department of Homeland Security (DHS) Science and Technology Directorate
4. **Firefighter Education and Training Challenges**
   Presented by the U.S. Fire Administration's National Fire Academy)
5. **Fire Safety through Building and Fire Codes**
   Presented by the National Fire Protection Association

Concluding Discussion and Overview of Evening Activities:

Chair Dr. Lori Moore-Merrell

World Fire Congress Delegate Recognition and Closing Ceremony

U.S. Library of Congress, Thomas Jefferson Building Grand Hall

- **Welcome Remarks:** Alejandro Mayorkas, Secretary, U.S. Department of Homeland Security
- **Signing of Statement of Founding Principles and Objectives**
- **Adjourn until 2026**

National Fallen Firefighters Memorial Service

Optional Activity

Each year, the National Fallen Firefighters Foundation sponsors the official United States national tribute to all firefighters who died in the line of duty during the previous year. Thousands attend the National Fallen Firefighters Memorial Weekend in Emmitsburg, Maryland.

Prior to the World Fire Congress, the United States Fire Administration (USFA), in partnership with the National Fallen Firefighters Foundation (NFFF), was honored to host more than four dozen attendees from the inaugural World Fire Congress in Washington, DC for the 43rd National Fallen Firefighters Memorial during which 226 fallen career and volunteer firefighters were honored.

World Fire Congress participants attending the National Fallen Firefighters Memorial Service included representatives of the Algeria, Australia, Austria, Belgium, Brazil, Canada, Chile, Croatia, Denmark, El Salvador, Estonia, Finland, France, Ghana, Hungary, Iceland, Jamaica, Japan, Korea, Luxembourg, Singapore, Taiwan, United Arab Emirates, United Kingdom, and others.

More about the NFFF Memorial Weekend:

National Fallen Firefighters Memorial Weekend
weekend.firehero.org

Learn about the Firefighters Memorialized at the 2024 Service:

2024 Roll of Honor – National Fallen Firefighters Foundation
firehero.org/2024-roll-of-honor


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National Fire Academy Tour

Optional Activity

After the National Fallen Firefighters Memorial Service, a walking tour was offered of the National Emergency Training Center (NETC), which is the home of the USFA's National Fire Academy and the National Fallen Firefighters Memorial.

The tour featured visits to the National Fire Academy classrooms, incident management simulation lab, fire investigation hands-on training lab, library and learning resource center (LRC), and National Fallen Firefighters Memorial Chapel.

The tour also included honoring our fallen firefighters at the "To Lift a Nation" 9-11 Memorial on campus and concluded at the National Fallen Firefighters Memorial, where a moment of silence was held, a wreath was placed by United States Fire Administrator Dr. Lori Moore-Merrell and World Fire Congress attendees. The ceremony concluded with the playing of *Amazing Grace* by a solo bagpiper.

World Fire Congress participants attending the tour included representatives of the Algeria, Australia, Austria, Belgium, Brazil, Canada, Chile, Croatia, Denmark, El Salvador, Estonia, Finland, France, Ghana, Hungary, Iceland, Jamaica, Japan, Korea, Luxembourg, Singapore, Taiwan, United Arab Emirates, United Kingdom, and others.

Cultural Tour of Washington, DC

Optional Activity

On May 6, 2024, participants of the World Fire Congress had the opportunity to embark on a memorable Cultural Tour of Washington, D.C., exploring the city's rich history and iconic landmarks. The tour began at Arlington National Cemetery, with visits to significant sites such as the Tomb of the Unknown Soldier, Arlington House, and the Kennedy gravesite, where President John F. Kennedy, Jacqueline Kennedy Onassis, Former U.S. Attorney General Robert F. Kennedy, and Senator Edward M. Kennedy are laid to rest. Following this solemn experience, attendees enjoyed lunch at District of Columbia Fire and EMS Engine Company #16, gaining insight into the daily lives of D.C.'s fire and EMS professionals.

The afternoon was dedicated to visiting some of the nation's most cherished memorials. Participants reflected on the sacrifices of the Greatest Generation at the World War II Memorial, honored those who served in the Vietnam and Korean Wars at their respective memorials, and admired the powerful tributes to leadership and equality at the Lincoln Memorial and Martin Luther King Jr. Memorial. This optional tour offered a unique blend of historical reverence and cultural appreciation, leaving participants with a deeper connection to the legacy of service and sacrifice that defines the United States.

Executive Summary

Day 1: 7 May 2024

2024-05-07 World Fire Congress – Part 1-MP3

The inaugural World Fire Congress (WFC) was called to order by Dr. Lori Moore-Merrell, United States Fire Administrator in Washington, D.C. USA on Tuesday, 7 May 2024. Dr. Moore-Merrell delivered opening remarks that outlined the need for the WFC, the purpose, and the goals of the meeting.

World Fire Congress Action Items

Goals that were discussed at the outset included:

- A Founding Statement of Principles to be signed by each nation
- Subsequent development of a charter for the World Fire Congress by 2026
- The need to create and coalesce a global network of national level fire service leaders.
- The plan to conduct a Closing Ceremony to include a Founding Principles signing ceremony for all nations present.
- Establish Communities of Practice that will sustain the momentum of the initial WFC to and through 2026.
- The intent to transmit a certified copy of the signed Founding Statement of Principles to additional nations to sign in 2026

The importance of international collaboration was emphasized across the conversation, particularly to address the increasing complexity and severity of wildfires and structure fires. Speakers highlighted the need for shared best practices and solutions, as well as the importance of global cooperation in fostering understanding, trust, and cooperative initiatives to promote peace and stability around the world. Countries shared their experiences and perspectives on the challenges faced by firefighters, including evolving risks from emerging technologies, climate change, and structural fires in high-rise buildings. The urgent need for innovation and collaboration to address the challenges of climate change and natural disasters was also introduced.

Opening Ceremony symbolism

- The Maltese cross symbolizes the fire service's valor and trust, echoing through centuries as a beacon of protection and duty.
- The fire helmet embodies the virtues of bravery, integrity, honor, and pride, defining the firefighting profession and its noble traditions.

Delegates and guests observed a moment of silence for fallen firefighters worldwide.

Federal Emergency Management Administrator Deanne Criswell welcomed attendees to the Congress and highlighted the increasing complexity of wildfires, impacting multiple countries. Wildfires, earthquakes, and floods worldwide have resulted in $250 billion in damages. Criswell also emphasized the importance of collaboration and innovation in reducing disaster risk and loss of lives globally.

Co-chair Mark Hardingham highlighted the need for a first-of-its-kind network of leaders dedicated to mitigating the effects of fires on people and first responders.

Global collaboration is crucial to address complex challenges facing fire services worldwide. Through the discussion, delegates agreed on the global risk of fires and responsibility to prevent and fight them. Common global challenges faced by firefighters, including evolving risks and emerging technologies were introduced along with the goal to share best practices, research, and policies on fire prevention and control.

About the Communities of Practice and Founding Principles

The global network of Communities of Practice to address shared challenges was introduced. These Communities of Practice aim to facilitate regular sharing and problem-solving among nations to reduce fire losses globally. It was agreed that in this global conversation on fire safety, all nations welcome.

Delegates were invited to sign the Founding Statement of Principles to confirm commitment for ongoing participation. The overarching goal is for a global World Fire Congress Charter to be developed over next 2 years. Delegates from delegate nations are invited to sign the Founding Principles and receive certificate at the WFC closing ceremony.

Topical discussion:

Global fire safety challenges and solutions, including accessibility, prevention, health, and recruitment.

Speakers emphasized the importance of protecting firefighters' health and well-being, including mental health support. Recruitment challenges were acknowledged worldwide.

Global wildfires, floods, and climate change challenges for firefighters.

There was an emphasis on the importance of collaboration and cooperation among countries to address wildfire risks. Delegates discussed global risks, including floods and wildfires. They emphasized the need for firefighters to adapt to changing risk environments. The importance of safeguarding lives and population was discussed as a global goal, with various delegates highlighting experiences and perspectives on fire safety challenges, including those in developing countries.

Fire safety and preparedness, fire safety challenges and solutions in various countries.

Barbados highlighted challenges of transitioning from fossil fuels to electric vehicles, including waste management and environmental impact, while Brazil discussed the importance of community awareness in disaster response, citing recent devastating floods as an example. Belgium discussed climate change impacts, including water shortages and firefighting challenges, while Japan described a data-driven approach to disaster preparedness. Croatia discussed experience with wildfires, supporting other countries despite challenges. It was agreed that firefighters worldwide face similar challenges, but regional differences impact operations.

2024-05-07 World Fire Congress – Part 2-MP3

During the event, delegates discussed various global challenges, including acknowledging each other's specific challenges and moving forward in an organized fashion. The need for active participation and collaboration among nations and organizations to address global fire safety challenges was deemed critical, as all speakers emphasized the need for ongoing engagement and collaboration to improve fire safety and reduce loss of life and property damage.

For the Communities of Practice (COP), delegates were asked to participate in at least one COP and indicate interest on provided cards. The United States will begin establishing the COPS and proceed within 30 days of the Congress, leading the COPs until 2026 World Fire Congress and deliver progress reports at that time; the UK will take over leading COPs from 2026-2028. COP leadership will rotate every two years between Congresses.

Communities of Practice will address agreed-upon challenges and maintain momentum after Congress.

Introduction of Delegates

Dr. Lori Moore-Merrell and Mark Hardingham introduced delegates from Algeria, Australia, Austria, Barbados, Belgium, Belize, Brazil, Bulgaria, Canada, Chile, Croatia, Cyprus, Denmark, Ecuador, El Salvador, Estonia, Finland, France, Germany, Ghana, Greenland, Guatemala, Hungary, Iceland, Israel, Jamaica, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Pakistan, Philippines, Portugal, Qatar, Romania, Singapore, Slovenia, South Africa, Sweden, Switzerland, Taiwan, United Arab Emirates, United Kingdom, and United States.

Operating Procedures for World Fire Congress

Dr. Lori Moore-Merrell introduced operating procedures to ensure a productive and respectful discussion, using the following framework:

- The facilitators and speakers will present the state of science for four challenges.
- The agenda emphasizes collaboration and interactivity.
- Delegates will have 3 minutes to speak when recognized, with timers and a countdown clock at the front of the room.

2024-05-07 World Fire Congress – Part 3-MP3

The conversation focused on pressing issues in fire safety and prevention, including the impact of climate change, new construction methods and materials, and the need for effective communication and decision-making. Dr. Lori Moore-Merrell emphasized the importance of understanding structural fire threats, while moderator Michelle Royal (USA) highlighted the role of technology and policy solutions. Speakers discussed the need for training, technology, and data-driven decision-making to enhance fire safety, and the challenges of implementing building codes in developing countries. They also discussed the importance of effective decision-making in emergency response situations and the need for international regulations to prevent the production and manufacturing of substandard materials globally.

Key Takeaways:

- Discuss building codes and ensure firefighter access in new developments.
- Consider sharing After Action Reports and lessons learned from significant fire incidents.
- Explore using technology like virtual reality for firefighter training on tactics and decision making.
- Address the challenge of informal settlements and alternative initial attack tactics like aerial firefighting.
- Consider international regulations on substandard electrical components to improve safety globally.

Challenge One: Structure Fire and Firefighter Response

Dr. Lori Moore-Merrell introduced speakers Dr. Dan Madrzykowski (USA) and Dr. Sabrina Cohen-Hatton (UK) to discuss fire as a threat to national and global security.

Madrzykowski presented the current state of science with fire safety and building materials. He noted that lightweight engineered wood I-joists can fail in 5 minutes or less when exposed to fire, compared to natural fuels like cotton or wood which take longer to ignite and generate less smoke.

The synthetic fuels used in modern homes such as polyester or polyurethane, can ignite and generate fuel for other fires in the house, leading to a faster and more intense fire progression. Fire physics and dynamics are key, especially with ventilation-limited fires. Fire gases contract when cooled, revealing importance of water entry points in firefighting. Firefighting strategies and tactics included using hose stream to cool surfaces and extinguish fire in apartment, the need for knowledge and experience to interpret data and make decisions.

Discussion stressed the importance of training and resources. There is a need for fixed fire protection systems and adequate training for firefighters.

Decision-making techniques for emergency responders were introduced with a personal story shared by Cohen-Hatton, describing a near-fatal incident, leading to research on human error and decision-making. The UK-based decision control process was developed to help commanders make better decisions in high-pressure situations. The process to improve decision-making in emergency situations, which increased goal-directed decisions by 35% and situational awareness by up to 5 times. It includes asking oneself why they're making a decision, what they expect to happen, and how the benefit outweighs the risk, and has been integrated into national operational guidance for incident command.

Cohen-Hatton described how group dynamics affect decision-making, leading to either exploratory or exploitative behavior. Recommendations included training to understand dynamics' impact on decisions and introducing decision controls to challenge assumptions and groupthink. The impact of uncertainty on decision-making can be a paradox where stressed individuals are more likely to rely on rules.

The UK study used biometric data, including heart rate and blood samples, to measure stress levels in firefighters during two scenarios: one uncertain and one with clear procedures Firefighters in the UK are given operational discretion to use their professional judgment in high-risk incidents, but this can be influenced by cultural factors such as perceived legitimacy. Training in human factors and resilience is crucial to help commanders make informed decisions under pressure, with a focus on practicing these skills ahead of time.

As delegate discussion commenced, Australia spoke of the impact of heat on decision making in the fire service, citing studies on professional sports. Cohen-Hatton explained how stress shuts down the thinking part of the brain, leading to intuitive decision making, and discussed the use of decision controls to reduce errors.

Madrzykowski noted that building codes and fire safety are interconnected, with concerns about affordable housing and secondary suites in properties. Research on fire dynamics and alternative methods for extinguishing fires without water are needed in water-scarce countries.

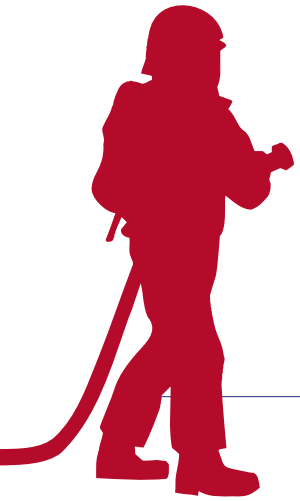
Fast response, access, and fixed appliances to delay fire spread in rural areas was emphasized. Delegates from Mexico and Guatemala discussed challenges with apartment rentals and the lack of a national construction standard. Brazil spoke about use of concrete structures and electronics and compared those to US building codes and fire sprinklers.

On the topic of fire prevention and safety measures in residential construction, Madrzykowski discusses fire safety measures in multifamily housing, including use of non-combustible materials and emergency plans. Others discussed challenges in fire safety measures in urban areas, including traffic congestion and cost. Other points of discussion included the smart home system that includes smoke detectors connected to a communication chip and fire station, alerting authorities in case of a fire.

In Fiji, building code compliance and occupant behavior pose ongoing challenges in fire safety. There is an annual average of 147 structure fires in Fiji, resulting in 5-6 fatalities and $18.2 million in property loss. There are challenges with substandard electrical components in Fiji. Delegates discussed fire safety in high-rise buildings, community preparedness programs, and education and fire safety challenges in informal settlements, including smoke alarm issues and limited access to water.

Denmark highlights the challenges of extinguishing fires in new materials and construction, emphasizing the need to question existing practices and tactics, while Taiwan commented the high fire test rates in residential buildings and government efforts to subsidize insulation and water conservation measures. Japan discussed the decreasing number of structural fires in the past 10 years, impacting firefighter training and experience. The UK spoke about the Grenfell Tower Fire and the need for a revised stay-put policy in the UK. Sharing reports on successful firefighting tactics and decision making through technology were deemed beneficial, and virtual training can supplement hands-on training for firefighters.

Discussion explored using virtual reality to simulate fire training environments, finding them similar across highly simulated, low-resource environments. Pakistan shared experiences with building codes and emergency services department inspections, highlighting economic challenges in developing countries. The delegate from France suggested international regulations to prevent substandard material production globally, and the delegate from Ecuador highlighted the importance of decision-making speed in emergency situations, citing the Mont Blanc crash in 1999.



Discussion then focused on the importance of developing tactics for dealing with incidents in the Community of Practice. Presenters spoke about looking at the development of guidance for dealing with incidents and emphasized the need for a deep understanding of the issue. The delegate from Austria thanked the group for bringing up trade-offs between affordable housing and new materials. On the topic of fire safety and incident command training, officer decision making training was discussed, highlighting the importance of proper training for firefighters.

Dr. Lori Moore-Merrell thanked the panel and encouraged those who didn't get to speak to write their thoughts on the provided delegate comment cards.

2024-05-07 World Fire Congress – Part 4-MP3

Challenge 2: Climate Change Impacts

During this session, the conversation centered around the growing intensity and destructiveness of climate change-driven wildfires, with a focus on understanding the interplay between fires and climate change. Dr. Moore-Merrell introduced panelists from multiple nations to discuss effects of climate change on emergency management: for Wildfires/Community Conflagrations, Dr. Gavin Horn (USA) and Derek Alkonis (USA); for the International Fusion Center/AI, Dr. Major Essa Ahmed Al Mutawa (United Arab Emirates); for Heavy Rains/Flooding, Dr. Christoph Weltecke (Germany); and for Extreme Weather Events, Louie S. Puracan (Philippines). The moderator for this challenge was Emily Saulsgiver (USA).

Speakers emphasized the need for scientific methods to comprehend the effects of climate change on wildfires and stressed the importance of gathering data from fire departments and associations globally to prioritize efforts to minimize fire incidents and reduce pollution.

The speakers also discussed the importance of preventing wildfire damage, improving disaster response and prevention efforts, and shifting from response to prevention. Interagency cooperation, international cooperation, and training and education were highlighted as crucial for the next generation of professionals.

Key Takeaways:

- Develop an advanced risk culture and public awareness programs on new climate change related phenomena.
- Establish a global research center dedicated to safety and security from climate change impacts.
- Share national wildfire reports and lessons learned to improve prevention, response and community recovery globally.
- Consider code equivalence for infrastructure projects funded by overseas development assistance.

Topical discussion:

Climate change-driven wildfires are increasing in intensity, size, and destructiveness. Panelists shared observations and learnings from events across their countries, focusing on frequency and impact of climate-related disasters. Gavin Horn described the destruction caused by wildfires in California and Colorado, highlighting the importance of understanding structure-to-structure fire spread. He showed images of the aftermath of the Woolsey and Tubbs fires in California, and the Marshall fire in Colorado, demonstrating the impact of climate change on urban interfaces.

Horn highlighted the need for research on respiratory protection for firefighters in long-term wildland fire operations, stressing that research is needed to understand how climate change will impact the ignitability of structures and other vulnerabilities in wildland fires. He also discussed the impact of wildfires on communities, including the transportation of embers and the need for research to understand how they move and how they can be prevented. Horn highlighted the importance of considering resilience concerns, including utilities underground, and the need for communities to recover and respond to wildfires more rapidly.

Derek Alkonis described the devastating Lahaina fire in Maui, Hawaii which spread rapidly due to high winds from Hurricane Dora—killing 101 people and destroying 2400 structures in a matter of hours. He described how the team conducted a comprehensive review of the Maui wildfires, including collecting data on preparations and response. They analyzed the data to identify what went wrong and how to prevent similar incidents in the future.

Dr. Major Essa Ahmed Al Mutawa then outlined multiple initiatives to combat climate change using AI and emotional intelligence and described how the Dubai Civil Defense leverages AI to improve fire safety awareness. He described how the UAE is using AI to combat global environmental challenges, including fire prevention and pollution reduction. Al Mutawa highlighted the importance of addressing fire incidents, which contribute to 21% of pollution globally, double the amount caused by cars.

Dr. Christoph Weltecke then reported on devastating flood disaster in Germany, highlighting vulnerability and resilience. He discussed how firefighters in Germany respond to emergencies in 10 minutes, with 1 firefighter for every 64 inhabitants and emphasized the need for better management and information exchange in disaster response.

Next, Louie S. Puracan highlighted climate change's impact on the Philippines' fire service, including increased earthquakes and typhoons. He explained how fire service in the Philippines shifts from structural firefighting to disaster response. Delegates from Philippines, UN, and other countries discuss challenges in responding to forest fires due to geographical location and equipment limitations.

The representative from the United Nations Speaker highlighted the evolving nature of wildfire risk, with climate change leading to more frequent and intense fires in Europe. He discussed how the consequences of wildfires include human economic losses, respiratory and cardiovascular issues, and a growing impact on public health. The speaker also highlighted the need for prevention and inclusive governance in disaster risk reduction.

The Taiwan delegate shared perspective on community of practice scope and scale, expressing gratitude for US support in disaster response and emergency preparedness. Romania shared two stories to illustrate the importance of educating the population on new phenomena related to climate change, such as tornadoes and floods, and emphasized the need to work with authorities to educate them on how to deal with these new phenomena and prepare for future events. Belgium discussed the topic of a sustainability lens for fire service officers' development program to structure discussions on climate change and sustainability. Mexico described a weather phenomenon in Mexico where a tropical storm went to a Category 1 and then became a Category 5 hurricane within 12 hours. The importance of community reflection and preparation was emphasized.

Speakers went on to discuss wildfires and floods linked by climate change, management strategies, and prevention. Derek Alkonis emphasized the importance of vegetation management and suppression strategies to prevent wildfires. He described how weather conditions in one area can influence others, using Hurricane Ophelia as an example.

United Arab Emirates suggested establishing a research center to address global challenges, leveraging AI solutions. Canada highlighted the impact of weather-related events on first responders, including increased call volumes and sustainability concerns. The Philippines discussed the need for training and structure to address the changing environment for firefighters. Presenter Louie S. Puracan highlighted the importance of international cooperation in disaster response, emphasizing need for code equivalence in developing countries. Chile discussed thermogenesis and the importance of the Chilean delegation, and expressed gratitude for the opportunity to speak and highlights the importance of the topic. Australia highlighted the increasing frequency and severity of bushfires in Australia, with longer and more extreme seasons affecting communities across the country. Discussion focused on the suggestion to sharing reports and observations to better understand correlations between events and improve warning systems.

El Salvador emphasized the importance of territorial sovereignty in the face of external threats. South Africa urged a proactive approach to wildfire risk management, emphasizing mitigation and resilience. Dr. Al Matawa highlighted the impact of fires on climate change and the need for data collection to prioritize fire prevention efforts globally.

Day 2: 8 May 2024

2024-05-08 World Fire Congress – Part 1-MP3

Challenge 3: Fire Risk of Emerging Technology

The conversation focused on emerging technologies such as electric vehicles, lithium-ion batteries, and smart buildings in relation to fire resiliency. Dr. Moore-Merrell introduced speakers Dr. Steven Kerber (USA), Dr. Nils Rosmuller (Netherlands), Adam Barowy (USA), Michael Abraham (USA), Deputy Commissioner Ling Young Ern (Singapore), and facilitator Adam Thiel, former Fire Commissioner of Philadelphia (USA) to lead discussion on emerging technologies and their impact on sustainability and fire resiliency.

Dr. Steve Kerber emphasized the need for sustainability and fire resiliency in the built environment, while Dr. Nils Rossmuller highlighted the importance of public awareness and education. Michael Abraham and Adam Barowy shared their insights on the role of technology in mitigating fire risks, and Deputy Commissioner Ling Young Ern discussed the need for effective response resources and regulation.

The conversation also addressed the increasing use of lithium-ion batteries and the critical role of the fire service in addressing safety concerns. Fire Department New York (FDNY) (USA) Commissioner Laura Kavanagh spoke about FDNY's experiences with EV battery incidents and related legislative advocacy efforts. Speakers agreed that regulation and mandating certification is necessary to prevent these batteries from becoming explosive devices in our homes. The urgent need for research and collaboration to address the increasing risk of EV fires was also emphasized.

Key Takeaways:

- Track battery fire incidents and data to understand risks.
- Develop multi-agency response protocols and train first responders on battery hazards.
- Research assessing state of charge in damaged batteries to inform safety procedures.
- Advocate for legislation mandating basic safety certification for consumer battery products.
- Encourage fire departments to track battery fires and join advocacy efforts.
- Include public safety stakeholders in product development to ensure infrastructure supports safe use.

Topical discussion:

Dr. Moore-Merrell noted that beneficial innovation poses fire risk, requires global response and introduced Challenge 3: Fire risk of emerging technology. Dr. Kerber highlighted the fire service's role in addressing new technologies, such as energy storage systems, solar panels, micro mobility, and electric vehicles, which pose new challenges for firefighters due to their explosive nature and portability. He noted that the fire service is not used to hydrogen as a byproduct of combustion, and the ability to have a fire start anywhere is new for them, making it essential to update their knowledge and response strategies. Lithium-ion

batteries are transforming various industries, including energy storage, transportation, and medical devices, with potential risks and challenges for the fire service. Consumer products, EVs, and energy storage systems are major causes of injuries and fatalities. Micromobility incidents have increased dramatically in the last 5 years, with 18 deaths in 2023. Kerber highlighted the need for firefighters to be continuous learners in response to evolving technologies.

Nils Rossmuller then discussed the impact of new fuels and chemistries on fire safety, including the need for proper staffing and best practices for extinguishment. Safety issues in built environment during energy transition was highlighted. Rossmuller described incidents involving alternative fuel vehicles in the Netherlands, including battery electric vehicles, and noted a 30-35% increase in annual basis but a relatively small absolute number of battery electric vehicles in the fleet. He highlighted an increase in fires in battery electric vehicles, despite a small percentage in the fleet, and categorizes incidents into crashes and fires.

Thermal runaway in batteries poses significant risk to firefighters, with incidents in Arizona (USA) and Germany highlighting the danger. In the Netherlands, solar panels are increasingly being used for renewable energy production, but early installations were prone to fires due to poor installation work. Rossmuller highlighted the risks of solar panel fires and their impact on firefighters and citizens and called manufacturers to take responsibility for safety in energy transition.

Michael Abraham described how ATF investigators work with fire service partners to determine causes of fires, including those involving lithium-ion batteries. Researchers at the ATF Fire Research Laboratory study the potential for battery failures to cause fires, using experiments like inducing thermal runaway in a battery pack. Vape products caused fires in Los Angeles, Hoboken, and St. Petersburg; Lithium-ion batteries in vape products contributed to fires, including one that resulted in two fatalities. Abraham described a vehicle fire that occurred in New Jersey, involving a battery pack from an electric vehicle. The fire reignited three hours after the initial fire was extinguished, highlighting the risk of continuing reignition issues for firefighters.

Adam Baroway highlighted battery safety concerns in consumer products and electric vehicles. He explained how a simple sprinkler system can contain a fire caused by an e-bike in a subway car, highlighting the importance of safety evaluations and manufacturer instructions. He referenced the *Take Charge of Battery Safety* campaign, which aims

to educate the public on choosing certified products and handling them with care to prevent fires and injuries. He advised being alert for warning signs of mechanical abuse in battery-powered devices, such as funny smells, sounds, and hissing. Researchers study how electric vehicle fires differ from internal combustion engine vehicle fires, focusing on vehicle construction and fire acceleration factors; Baroway discussed challenges in addressing electric vehicle fires, including lack of data on heat flux and occupational exposure hazards. He spoke of the experimentation being conducted to measure heat release rate, water contamination, and heat flux in electric vehicle fires.

Deputy Commissioner Ling Young Ern shared insights on preparing for electric vehicles in Singapore. Singapore is seeing steady uptake of EVs, but fires involving these vehicles are still relatively low. The Singapore Civil Defence Force was established to streamline EV fire response and promote safety and is equipping fire engines with tools to manage EV battery fires, including vehicle fire blankets and a battery fire extinguishing system. They conducted a full EV burn test to evaluate the effectiveness of new tools and techniques in handling EV battery fires. Discussion focused on emergency responders seeking better assessment methods for damaged EV batteries.

Delegates shared experiences and knowledge on EV battery fires and mitigation and discussed challenges and solutions for electric vehicles in the automotive industry, with UAE emphasizing training, protocols, and partnerships to address EV fires. Guatemala spoke of growing challenges, including from used equipment; Estonia discussed challenges in dealing with electrical vehicle fires, including cost and training for firefighters and the issue of reburn. There was discussion of researchers in Switzerland studying the toxic effects of electric car fires and found that ventilation systems can manage them, but extinguishing water is highly contaminated. Luxembourg urged fire services to advocate for regulations requiring car manufacturers to design access ports for battery packs in electric vehicles.

FDNY Commissioner Laura Kavanagh highlighted the dangers of lithium-ion batteries in New York City, citing 18 citizen deaths in the last year. She discussed her advocacy for basic certification for consumer products with lithium-ion batteries, citing the need for safety regulations. Kavanaugh emphasized public safety in new energy development and urged industry to include public safety at the table, calling for basic regulations and infrastructure to ensure safe use of new energy technologies.

Mexico discussed the culture and challenges of limited resources, indicating a hope for industry to serve as allies to the fire service. Delegates discuss experiences with EVs and renewable energy incentives in Australia and Barbados. Australia urged the COP to look at sharing commonalities in data and legislation for greatest efficiency. Barbados stated that EV product developers should invest in solutions to problems created by their products, and South Africa suggested that collaboration with developers is needed for immediate risk of no ignition in road traffic accidents.

Rossmuller emphasized the importance of thinking and strategizing in the industry. Cyprus raised the issue of installing charging stations for electric vehicles in basements, citing fire safety concerns; Slovenia suggested that battery and solar panel companies should allocate

part of their income for awareness campaigns and firefighter training. France described their experience with an officer embedded in a car manufacturer to ensure safe operation and maintenance of electric vehicles. Fiji highlighted the challenge of lithium battery thermal runaway and its impact on firefighters and suggested a generic policy for addressing the global problem of lithium battery safety, with input from the Community of Practice. New Zealand noted that the Community of Practice has the opportunity to share information, intelligence, stats, and the approach for trying to change legislation within the different countries, and that the World Fire Congress should have a voice in driving change. Germany urged that collaboration is key.

Dr. Kerber emphasized the need for more fire research organizations and collaboration to address the growing fire risk associated with electric vehicle innovation. He noted that the lack of data and knowledge on how to put electric vehicles (EVs) out is concerning, and there is a need to be involved in the manufacturing process early on to mitigate the risks and expressed worry about the potential ripple effect of successful certification requirements on products going to other countries.

Dr. Moore-Merrell suggests prioritizing research, policy, and regulation to address industry changes and ensure global consistency. Rossmuller highlighted the need for citizens to be aware of new risks in the home, such as energy storage systems and micro mobility. Abraham emphasized the importance of collecting data on the consequences of fires involving new products, such as electric vehicles and batteries, to inform product safety standards and regulations.

Baroway noted that research on safer battery technology and disposal methods after fires involving lithium-ion batteries is crucial. Mark Hardingham added that there is an increase in fires in waste and recycling centers due to new technology and discussed the impact of these fires on water scarcity and climate change.

2024-05-08 World Fire Congress – Part 2-MP3

Challenge 4: Firefighter Health and Safety

The final challenge discussion focused in on the current state of and data surrounding firefighter health and safety. Firefighters face elevated cancer risks due to exposure to carcinogenic substances during work. Dr. Lori Moore-Merrell introduced speakers Cancer: Dr. Jaclyn Goodrich (USA), Dr. Sara Jahnke (USA), Dr. Denise Smith (USA), and Dr. Jennifer Taylor (USA) along with facilitator Sally O'Brien (USA).

Dr. Jackie Goodrich discussed the link between firefighting and cancer, while Dr. Sara Jahnke and Dr. Denise Smith focused on mental health concerns. Dr. Jennifer Taylor emphasized the need for further research to better understand long-term effects, and Sara Jahnke discussed the health risks faced by firefighters, particularly increased incidence of cancer, and the need for a global effort to prevent it.

Dr. Jahnke highlighted mental health challenges, including PTSD, depression, and substance abuse, and emphasized the need for long-term solutions. Dr. Smith emphasized the need

for more research on underlying causes of cardiovascular disease in firefighters, while Dr. Taylor raised reflective questions on current organizational culture in fire departments. Dr. Moore-Merrell led discussion on the critical need to prioritize firefighter well-being and safety, addressing cultural and organizational challenges to create a more sustainable and supportive work environment.

Key Takeaways:

- Conduct further research on cancer risks for underrepresented firefighter groups and emerging hazards.
- Test interventions like reducing harmful exposures, blood donation procedures, and nutritional supplements to promote firefighter health.
- Ensure firefighters receive medical evaluations and treatment for underlying health conditions like hypertension and cardiovascular disease.
- Consider alternative shift configurations being piloted elsewhere to address work-life balance and recruit/retain diverse groups.

Topical discussion:

Dr. Lori Moore-Merrell discussed firefighter health and safety challenges, including elevated cancer and mental health risks. Dr. Jackie Goodrich presented firefighter cancer risks and prevention. Firefighting linked to cancer due to exposure to carcinogens. Firefighters face unique health risks, particularly from wildland fires. Dr. Goodrich discussed the Firefighter Cancer Cohort Study, a nationwide effort to collect data from 10,000 firefighters to reduce harmful exposures and promote health; the project team has worked on interventions such as improving respirator use and dermal decontamination to reduce exposures and protect firefighter health. Goodrich went on to describe plasma and blood donation to reduce firefighters' exposure to hazardous chemicals and noted that researchers are also studying the use of nutritional supplements, such as broccoli seed extract, to promote firefighter health.

Dr. Sara Jahnke discussed mental health impact of fire service, including chronic exposure to trauma and circadian rhythm disruption. Research shows that firefighters experience stress from acute events and repeated exposure to trauma, leading to long-term mental health impacts. She noted that repeated circadian rhythm disruption also has significant impacts on health, including cancer and cardiovascular disease. Fire service personnel experience high rates of depression and PTSD, but rates are not significantly higher than general population.

Jahnke emphasized the importance of understanding and addressing mental health issues in the fire service, recognizing that not everyone needs the same intervention. The conversation around mental health should shift from a focus on individual incidents to a long-term understanding of hypertension and the need for ongoing support. She highlighted the positive aspects of the fire service, such as camaraderie and social support, and notes that these are consistent

across countries and cultures. Jahnke also raised the challenge of recruitment and retention, particularly for women and other underrepresented groups, and suggests this is an area of new research. She noted that exclusion from the "kitchen table" (i.e., not feeling welcome) drives mental health challenges for women in the fire service. Jahnke and Dr. Denise Smith agreed that relationship building and coming together is key to success in the fire service.

Dr. Denise Smith noted that cardiovascular strain from firefighting persists for up to an hour post-activity. She highlighted the significant impact of firefighting on cardiovascular health, with fatalities due to burns being relatively low compared to cardiovascular events. Cardiovascular events are a major concern for firefighters, leading to non-fatal events, disrupting missions, and causing long-term disability and retirement; Smith noted that 80% of firefighters who died from cardiac events had both underlying coronary heart disease and hypertensive heart disease. Firefighters at high risk of cardiovascular disease, must be evaluated and treated.

Dr. Jennifer Taylor asked delegates to reflect on organizational culture in their country's fire service. She discussed engaging the next generation of firefighters through pipeline programs, partnerships with industry, and leveraging military experience. Taylor emphasized importance of work environment and work-life balance for retention; Dr. Lori Moore-Merrell highlights the importance of addressing work-life balance in the fire service to reduce exposure to cancer, heart disease, and mental well-being issues and called for data-driven strategies to measure progress in recruitment and retention and encourages sharing of best practices among fire chiefs.

Mark Hardingham highlighted the importance of considering the health, safety, and well-being of firefighters, who are not just staff but also leaders in fire and rescue services. He noted that the panel discussion emphasized the need for a unified foreign rescue service culture that addresses the challenges of demographics, inclusion, and mental health. He reflected on the collective challenge of embracing research and turning findings into tangible change in organization, and posed the rhetorical question of what a fire and rescue service designed by women to address gender disparities in leadership roles would look like.

2024-05-08 World Fire Congress – Part 3-MP3

For the discussion, delegates and presenters focused on the facts that firefighters face numerous health and safety challenges, including long-term stress, lack of diversity, and poor mental health. They discussed strategies to improve firefighter safety and wellbeing, including setting a culture of safety, providing positive feelings, and addressing mental health concerns. Speakers also emphasized the importance of quality training, certification programs, and mental health support.

Additionally, they highlighted the need for comparative studies, validated measures, and a national firefighter registry to better understand and reduce cancer in the fire service. Finally, the conversation addressed the importance of diversity and inclusion in the fire service, including recognizing and addressing discrimination and harassment.

Key Takeaways:

- Participate in the Communities of Practice being set up to share information and best practices.
- Contribute data and knowledge from Sweden's work on cancer to help others.
- Collaborate to have solutions tailored for small nations like Fiji based on discussions.

Topical discussion:

Dr. Lori Moore-Merrell called for delegates' comments on firefighter health and safety. Estonian firefighters plan to combine 24-hour and 12-hour shifts to attract more workers and reduce cancer risk. United Kingdom Wales highlighted the importance of addressing cultural factors and bullying in the fire service. Netherlands discussed the challenges of retaining firefighters due to primary employment and the impact on shift work and premature mortality rates. Denise Smith noted that age and fitness level, not just age alone, determine operational effectiveness on the fire ground.

Ecuador discussed the aspect of stress and importance of mental health, mentioning the need for a supportive community and the role of psychologists in mental health care. Canada shared their experience with mental health and its impact on first responders, highlighting the need for support and training from recruitment through retirement, with Jahnke thanking the delegation from Canada for their work in leading the conversation on mental health and cancer impacts. Taiwan discussed PTSD support and safety culture, and Finland discussed a project focused on mental well-being of firefighters, including post-trauma workshops and peer review training. Jamaica shared their experience with a 24-hour work shift system during the COVID-19 pandemic, with pros and cons compared to an 8-hour system.

UAE emphasized importance of providing firefighters with quality training and equipment; Swedish firefighters noted the prioritization of mental preparedness to reduce cancer risk. New Zealand discussed studying mental well-being of first responders, finds high rates of depression and PTSD. Delegates commented on different discuss shift lengths and their impact on health and safety for on firefighters and EMS workers; Fire departments experiment with shift changes to improve sleep. New Zealand noted that dispatchers can be the forgotten component in needing health and safety attention.

Australia discussed workflows for hygiene and decontamination in Australia, challenges in volunteer spaces, and presumptive legislation for cancer and fit for duty requirements across states and territories. They highlighted the need for inclusivity in workplace diversity initiatives; Japan mentioned the impact of discrimination on women's mental health in Japan. Responding to a question from Guatemala, Denise Smith suggested firefighters have slightly elevated obesity levels compared to general population; Dr. Jahnke added insight on the importance of addressing mental health challenges faced by firefighters, including excessive alcohol consumption and disrupted circadian rhythms.

Romania suggested that outsourcing health issues to medical companies can lead to a lack of understanding of the unique challenges faced by firefighters in their work and emphasized the need to examine the impact of shift work on firefighters' mental health and well-being, beyond just the time of their shifts. Korea commented on the importance of addressing the mental health of firefighters, who face unique stressors and challenges outside of their shifts. Belgium noted that their firefighters undergo tests to assess physical and cardiovascular preparedness. Dr. Smith emphasized VO2 max test as best measure of cardiovascular health, but not most sensitive for cardiovascular disease. El Salvador highlighted inconsistent issues in firefighter resources and noted that the need to maintain health and safety of firefighters can be overwhelming, while Switzerland shared initiatives for leadership certification and employer responsibility. Delegates from Fiji and Cyprus shared their experiences and concerns about firefighter health and safety; Cyprus discussed how their firefighters face musculoskeletal disorders, age limits, and logistical challenges. Romania noted a high rate of psychological unfitness among firefighter recruits (15-30%) and sought opinions on addressing this issue. Dr. Kenny Fent introduced the US Public Health Agency's national firefighter cancer registry, aiming to track and prevent cancer among firefighters.

Mark Hardingham commented on the common challenges across fire and rescue services, including mental health and wellbeing, sharing UK research on mental health and wellbeing, offering to share with communities of practice. He highlighted the complexity of cultural inclusion in the Fire Rescue Services, citing the need for a nuanced approach.

Victor Stagnaro and Lori Moore-Merrell provide instructions for the afternoon and evening events, with Dr. Lori Moore-Merrell thanking delegates for attending and expressing gratitude for their belief in the meeting's value, before recessing the session until the evening at the Library of Congress.

Transcripts

World Fire Congress—7 May 2024: Day 1

Dr. Lori Moore-Merrell

Good morning to our distinguished delegates, our international guests, our fire service leaders. Ladies and gentlemen, I'm Lori Moore-Merrell, the United States Fire Administrator, and the United States Fire Administration along with our Federal Emergency Management Agency, our Department of Homeland Security, and our federal partner, the United States Department of State, welcome you to the United States and to the inaugural World Fire Congress.

We're gathered here today for the first time in known history as the leaders of the Global Fire Service. We are decision makers, senior practitioners, emergency responders, fire chiefs, leaders of the national fire organizations, emergency managers, and policy makers—all gathered here to discuss our common challenges across the globe.

Together, we will seek to share knowledge and identify our best practices and bring solutions forward. The diversity in this room is apparent. And today we are translating the World Fire Congress into six languages in addition to English, so please use your translating devices and your headsets as needed for translation. During our short time together, we hope to establish relationships that go beyond this meeting. We want to establish the foundation of a global network made up of various Communities of Practice and will work together after this inaugural Congress to continue to learn from each other to collaborate to find solutions to existing and future challenges. As each nation of ours, we face the same and greater challenges from both natural and manmade disasters. Now I invite you to turn your attention to our firefighter Honor Guard.

Honor Guard

Ladies and gentlemen, please direct your attention to the corner of the stage. This display pays tribute to the courageous and selfless firefighters worldwide, who have given their lives in the line of duty while safeguarding their communities.

Their unwavering commitment and sacrifice deserve our utmost respect and gratitude. Let us take a moment to remember their bravery and honor their legacy. A missing firefighter gear arrangement, often displayed at memorial services or commemorative events is a poignant and symbolic tribute to honor firefighters who have fallen in the line of duty. This setup represents their absence and pays respect to their courage and service.

The Maltese Cross is known around the world as a symbol of the fire service. The Maltese Cross is revered, respected, and stands as an emblem of the fire service, echoing through centuries as a beacon of protection and trust. With its origins steeped in history, this timeless symbol serves as a testament to the valor and selflessness of those who wear it. Bunker gear, the quintessential attire of our brave responders, embodies a sacred vow to answer the call of duty, no matter the hour or location. It represents a solemn commitment to rush into danger, even if from the confines of their bunk to aid those in distress.

Today, as we gaze upon this point, the boots facing outward symbolizes a firefighter who has made the ultimate sacrifice, falling in the line of duty—unable to answer another call. The coat tenderly hung and reverently presented stands as a tribute to their valor, and selflessness.

The fire axe is more than just a tool. It is a symbol of strength, readiness and preparedness embraced by firefighters around the world. With its sharp blade and sturdy handle, the fire axe represents the firefighter's ability to confront and overcome any obstacle in the line of duty. It embodies the courage to face danger head on the determination to protect lives and property and the unwavering commitment to serve the community with valor and distinction. It is a reminder of the sacrifices made, the risks taken and the dedication to duty that defines the firefighting profession.

The fire helmet, an iconic emblem recognized worldwide, stands as a powerful symbol of the firefighters calling. Though styles may vary, its significance remains unwavering rooted in the rich traditions of firefighting. More than just a piece of equipment, the helmet embodies the virtues of bravery, integrity, honor and pride values that define the very essence of firefighting. It serves as a constant reminder of the noble traditions upheld by firefighters throughout history. It symbolizes the sacrifices made, the risks faced and the unwavering dedication to duty that sets firefighters apart.

May this helmet always serve as a beacon of courage, a reminder of the values we hold dear, and a source of inspiration, as we continue to answer the call with honor and pride.

Dr. Lori Moore-Merrell 10:52

Delegates and guests, please rise for a moment of silence as we recognize all our fallen firefighters around the world.

Thank you, you may be seated. We know that emergencies and disasters strike firefighters. They strike and firefighters respond. Your responders are first on the scene and often unexpected circumstances and unfamiliar surroundings. They are exposed to toxic chemicals and conditions that threaten their physical well-being and often their lives.

Although each of our nations has unique risk environments, our main and immediate priorities are very similar. Over the next two days, we will hear from international service leaders, researchers, subject matter experts and practitioners about for identified Fire Service challenges that we have currently looking for capabilities to handle them worldwide, and how we can collectively work to identify best practices and bring forward solutions.

Those four main challenges that we will consider during this Congress includes structure fire and the emergency response challenges to structure fires; and the increasing threat of climate change and climate-driven hazards, specifically focusing on severe storms and wildfire. We will look at fire risk from energy transition technologies like lithium-ion batteries, and we will look at firefighter health and safety challenges.

Following the speaker presentations, and each of these four challenges, all of the delegates gathered here will have the opportunity to engage in productive discussion, conversations about these challenges. These discussions will shape our next steps and how we work to establish Communities of Practice around this World Fire Congress so that we can continue our work together on each of these specific challenges. And there are many more details that will come about those opportunities as we move through the morning.

At this time, delegates and guests, I would like to introduce to you someone who has been supportive of the World Fire Congress concept from the very beginning. She has served as a career firefighter, both domestically and internationally. We have now with us, a leader of leaders, our Federal Emergency Management Administrator, Ms. Deanne Criswell. Please welcome Deanne to the stage.

Deanne Criswell 14:16

Good morning, everybody. Thank you, Lori, very much for that introduction. And it's really my honor to be able to be here and welcome you to the first World Fire Congress.

I want to thank you all for taking the time out of your busy schedules to join us here today. And this event could not have come at a more critical time. As a former firefighter myself, it is really astounding just how much the landscape has changed over the past few decades. We have already experienced mass brush fires on the outskirts of Washington DC, this past March and I remember watching the smoke settle over the city from my office. March also brought the largest wildfire in Texas history: thousands of miles of farmland burned in nearly a month. And over 870 civilians have lost their lives in residential fires so far this year, and it is only May. This is the unfortunate new reality that we face as we look to the future of our disaster landscape.

It feels so different from where I started my career back in Colorado in the 90s. Yes, fire can be unpredictable. But the events that we are facing today are so much more complex and more

challenging, and they are putting more stress on our firefighters than ever before. To put it in context: Last year, the United States experienced more than 50,000 wildfires and 1.2 million structural fires. It tested our workforce's capacity, and their mental health. And unfortunately, these challenges aren't going away, scientists are predicting that 2024 will be even busier and more complex than last year.

So, we need to take the time to revisit and refresh our playbooks and strengthen our workforce to better protect all of our communities. And we need to do this work together. Because fire, like other hazards, is a global issue. And it doesn't care about borders or politics.

More and more often, disasters are converging on an international scale, impacting multiple countries at the same time. Let me just give you a few examples. 2023 was Canada's worst wildfire year on record. Eight firefighters died, and more than 200,000 people were evacuated from their homes. For weeks, smoke from the Canadian fires moved south—blanketing huge parts of the United States in a thick haze. And thousands of miles away, gale force winds from Hurricane Dora increased the spread of massive wildfires on the Hawaiian island of Maui, becoming one of the deadliest in our nation's history. In November, more than 60 people found themselves trapped inside a mall in Pakistan when a fire broke out. At least 11 people were killed and 35 were injure. And spun up by a dry hot summer, wildfires began to rip throughout the Mediterranean. Burning through Algeria spilled over into neighboring Tunisia. Greece experienced Europe's largest wildfire since the 80s.

And so far in 2024, we've seen deadly wildfires burned through central Chile, killing more than 100 people. And at least 43 people lost their lives in a shopping mall fire in Bangladesh.

These are just a few examples of many that you are all experiencing. And of course, it's not just the fires that are putting the nations of the world on high alert. In the last couple of years, deadly earthquakes rocked Turkey and Syria and a heatwave suffocated Europe in North Africa. And just last month, earthquakes caused widespread landslides and Taiwan rainstorms drowned the UAE and Oman volcanoes exploded in Indonesia.

Last year, natural disasters cost us a collective $250 billion—the equivalent of the GDP of New Zealand or Portugal. The world has watched as our ecosystem, our shared home has been challenged at every turn.

And the reality is, we've never been more closely connected. A disaster in one nation can cause ripple effects across the globe. From the Philippines to Germany, these disasters are impacting our communities, and we are all feeling their effects in our day to day lives.

But to be clear, it is not all doom and gloom. Out of the immense challenges that we have faced as a global community have come some significant stories of success. For example, we had the privilege of co-organizing a wildland urban interface knowledge transfer with Greece in March. It was a great conversation between the US, Greece, Cyprus, and the UK on wildfire response and mitigation.

The US Fire Administration is already planning on a Western Mediterranean symposium in Spain next year. And FEMA was also proud to establish working groups with our partners in the UK focused on wildfire, lithium-ion batteries, and creating a framework that will reduce firefighter cancer in both of our nations.

And together with international partners, led by the United Nations Office for Disaster Risk Reduction, we are implementing the Sendai framework to reduce disaster risk and loss of lives around the world.

That's why this World Fire Congress is so important. It's an opportunity to build upon these relationships and continue to share knowledge and best practices with one another. Because at the end of the day, everyone at this table is here for a reason. We are united by the work that we do. And we are committed to building the more resilient nations and world that our communities all deserve.

I said earlier that fire is often unpredictable. That makes the path ahead all more difficult to chart, but all the more necessary. As much as we might like to, we cannot control the weather. But what we can control is how we work together to help people stay safe and protected from natural hazards.

I look around this room. And I see a first of its kind network of leaders dedicated to mitigating the

effects of fires on people on our first responders in on our planet. So today, we are committing to this collaboration to sharing ideas and best practices to growing the fire service and giving firefighters the resources they need to be successful—to ensuring the innovative green solutions of the future take fire safety and fire risk into consideration.

We are committing to a true partnership because we are stronger and more effective when we work together. Together, we can make sure our fire service has the right equipment, data, and training to fight the fires of the future. Together, we can innovate and explore new technologies that our firefighters can use to keep their communities safe. Together, we can assess the challenges of today and think through the challenges of tomorrow, so we can get ahead of them.

So, thank you all again for taking the time to be here. Forums like these push us all forward—together. They help us coalesce behind a shared mission so we can work in lockstep to create a safer, more resilient future for those that we serve.

I look forward to working with you, to learning from you here, both today and for years to come. Thank you again for taking the time to participate. And with that, Dr. Lori, I'll turn it back over to you.

Dr. Lori Moore-Merrell 23:31

Thank you so much, Administrator Criswell. We're grateful for your leadership, your support of America's fire service and now for our Global Fire Service Network.

Now it's my honor to call upon the co-chair, the president of the UK National Fire Chiefs Council Chief Mark Hardingham for his opening remarks.

Mark Hardingham 23:54

Thank you, Dr. Lori. Good morning, everybody. I'm going to speak briefly about the importance of global collaboration. And I do so conscious that global collaboration has already started.

When I look across the events of the last two days and when I look across the room this morning, and the impressive audience of people in and around fire and rescue services from nations across the world, global collaboration has certainly already started. Global collaboration is paramount in addressing the complex challenges that we face across humanity today.

Many of those problems—climate change, global pandemics, terrorism, economic instability—they transcend national borders and the impact on fire services across the world. They require coordinated efforts from multiple countries to find effective solutions. global collaboration allows for the sharing of resources, expertise, and technology across borders. By pooling those resources, and that knowledge, countries and their fire and rescue services can achieve more single significant results than they can if they do so individually.

Scientific research often benefits from collaboration amongst researchers from different countries. By sharing data, conducting joint studies, and collaborating on experiments, scientists can accelerate discoveries and find solutions to the pressing global fire service challenges we're going to be talking about this week. What happens in one part of the world can have a ripple effect across the globe. Collaboration fosters understanding and builds trust between us, and cooperative initiatives promote peace and stability in regions around the world. In times of crisis such as natural disasters or conflicts, international cooperation, often involving firefighters, is crucial for providing humanitarian aid to affected regions. Collaborative efforts ensure that assistance reaches those in need promptly and effectively.

Many issues that impact on fire services and others—such as trade, environmental protection, cybersecurity—require global governance mechanisms. International organizations like the United Nations, World Trade Organization, World Health Organization, all play essential roles in facilitating cooperation, and setting standards. In essence, global collaboration is essential for addressing the interconnected challenges of the modern world, and building a more peaceful, more prosperous, and more sustainable future for us all.

The United Nations recently hosted a conversation about the state of the world, launched as part of the organization's 75th anniversary. Views from people across 193 countries were sought about their priorities, and possible solutions to the planet's most intractable challenges. According to this research, most people want more global collaboration, not less. Almost nine in 10 respondents to the UN survey believe that international collaboration is vital to tackle contemporary challenges.

So, turning to this World Fire Congress, it wasn't difficult to find the common fire service themes for the first Congress. These are some of the most difficult issues that policymakers and fire professionals are currently dealing with. Whilst the challenges are immense, the answers are out there. The experience is out there, the expertise, and the great minds are out there. And they're in here too: global collaboration creates limitless opportunities for diversity of thought.

From my own perspective, the United Kingdom doesn't have all the answers. But we have some. The United Kingdom doesn't have all the resources or expertise to find all the answers, but we have some. And the United Kingdom doesn't have the time to wait while we try to find all the answers on our own.

This World Fire Congress and our global collaboration brings our collective intelligence together. Over the next few days, we will build new relationships and strengthen existing ones as we come together like never before, for the benefit of fire and rescue services for the benefit of firefighters and for the benefit of the communities and the people that we serve. Thank you.

Dr. Lori Moore-Merrell 28:59

Thank you, Mark. And with that, I will call into session the first meeting of the World Fire Congress. Delegates, if you will turn your attention to the screens. At this point we will review our Statement of Founding Principles and Objectives. This is your opportunity to review, and we'll go through this line by line so that we can understand together what we will have the opportunity to sign, to say that we are on this journey together. There's a hardcopy in the folder before you as well, but you're going to see it line by line on the screen.

The first point of the Founding Statement is that fire certainly—as we've already mentioned this morning—is a global risk. It impacts the security, the health, the prosperity of our citizens, our communities in every town, city, state, province and nation. It also represents a borderless threat to our environment. I trust that delegates around the room can agree that this statement is accurate; we will have time for discussion as we draw to the end. We'll go through this together and then we'll discuss together.

The next segment of our Founding Statement is that as leaders, we are responsible for preventing and fighting the fires that do occur. The delegates at this first meeting comprise a diverse gathering of firefighting agencies that share common goals are protecting our communities and our environment. Again, I trust that the delegates would agree with this statement as well.

We share common challenges throughout the world. These challenges are not only common, but they are evolving. And so, what we see today may not be the risk of tomorrow—because what we experienced today are not the same risk as yesterday. So, we, too, must evolve. And the challenges that we will take up at this meeting may not be the same challenges that we take up at meetings in the future. But for now, these four are what we will discuss over the next day and a half as we work together toward identifying best practices and solutions, firefighter health and safety—not only from a physical perspective, but a mental health perspective.

We must also consider the health and safety challenges on our firefighters and our responders as being one variable that might give us recruitment challenges. We will have opportunity to talk about firefighter recruitment as well.

Another challenge is emerging technologies. Today, as you all know, we are dealing with lithium-ion battery fire risk. We need the green technology, but it brings with it risks that were not anticipated. And the fire service is left to respond and to sort a solution. So, we will talk about emerging technology. But that's not the only technology we'll be facing in the future that may carry fire risk. And so, we must be dynamic in how we think about emerging technology as we go forward.

The next is climate change. Not one nation in this room is not impacted by climate change. It affects us all. From extreme heat to extreme cold to drought, to severe storms, rising sea level, wind, and of course fire. So, we are going to discuss together: how do we bring best practice? How do we bring solutions that we can share and elevate and help each other?

And then of course, as my co-chair mentioned: structure fires. Structure fires in many of our nations—particularly in high rise and multifamily dwellings—are a challenge. And so, as we look at structure fire and our capability as a fire service to respond to these fires, this is something that we must discuss together.

So, what are the common responsibilities of the delegates assembled here, and those who will join us as we go forward? First, we would be looking to partner to share responsibilities to do research, to gather and analyze information on all types of firefighting activities. Looking at the technical information around our building construction that may be driven in the future by climate change and other challenges; looking at the properties of building materials, understanding how fire-resistant materials may become an absolute necessity; and many of our nations' information on fire prevention and fire control—the laws and the policies and the regulations in our nations that we may find best practices and one nation that can share with all of us fire suppression systems methods, techniques, tactics, strategies, all of these things as we learn and share together.

And then, of course, our administrative structures that we might learn from each other, and then the information around the causes of fire behavior—the best method of control and suppression, including, of course, our forested areas—and where we have wildfire that can now spread to our communities. And so, looking at the responsibilities of sharing in these spaces, and certainly this first Founding Principle is meant to be dynamic, that as we go forward as the global World Fire Congress that we may adjust these Founding Principles and add to them as we move forward.

What is our purpose? The purpose of this Congress is that—in the spirit of friendship, and for the common benefit of each community represented by the World Fire Congress that its delegates are here—we intend to share together our collective knowledge with other partner communities, that we all come with the willingness to share and that the delegates gathered here have that spirit of collaboration in mind.

And what is our intent of Communities of Practice? We've made clear, I hope— this morning, and as you're talking together—that this meeting is not a "one and done." This meeting is only the beginning. We must live apart from here after our time together, but continue to talk together, build the relationships, and have more open and transparent, efficient sharing of information. And we will do so through established Communities of Practice.

We're going to be explaining that concept much more clearly, in just a few minutes, because we're going to ask each nation here to step up and participate in these Communities of Practice as we go forward. How will we enable our experts within our ranks to gather regularly not just every two years as is the plan for this Congress; but, as we gather regularly—monthly perhaps—that we talk together on the specific challenges that have been highlighted and bring solutions that we identify any new emerging problems that we can bring to the table and set priorities, that we monitor the progress, then, of our cooperative efforts together to reduce our fire losses around the world.

So, this is a very active intent for this Founding Statement—that it is not just today but beyond today, to tomorrow, that we come together. I want everyone here to know clearly that this is a Founding Statement of Principle, and it is not binding; your nations have been invited to participate. You are welcome to participate. We simply thought from the United States' perspective and from the UK's perspective, who stepped up in the initial collaboration from many of our regional fire service organizations who you will hear from in just a moment, that it was time that we have a global conversation. So, all are welcome.

It's through the common benefit of all our delegates and our communities that we share this information voluntarily, in accordance with principles of dignity, and respect, and equality for all our delegates. It's that manner that we come together, that we partner, as communities, and as people without restrictions on

your participation, or the sharing of information based on any gender, race, color, nationality, language, disability, or sexual orientation. This is voluntary, and all are welcome to participate from every nation.

Saying that it is voluntary, you are all also going to be invited—every delegate will be invited to sign, if you wish—the Founding Statement of Principles and Objectives that you've just seen. It will be an opportunity for you to come together and say, "yes, we believe in this Founding Statement of Principles." And yes, we want to participate going forward. We want to be part of the global conversation. We want to bring our solutions and we want to learn from each other.

And so, it's our opportunity just to make a statement together—a voluntary signing to confirm. And you'll be able to do that tomorrow night as we come together.

So, then what are the next steps for the World Fire Congress? Well, as we said, this is just the first, not the last. And once we have the Founding Statement that we will prepare tomorrow evening, then that Founding Statement of Principles will live on. Every one of your nations who sign will be transmitted a copy of the signed document; you'll have that to keep. Each of the signatory nations will receive that document, a duly Certified Copy.

Then our Founding Statements of Principles will be sent from the United States Fire Administration to the UK to the National Fire Chief's Council to be made available for additional nations to sign in 2026. And that continues to build as we add nations to this collaboration. And then we will attach a Charter between now and 2026. We hope that together, we can evolve and write together a charter for this World Fire Congress, that we can then establish this as a group as a new organization that goes forward in perpetuity. And so, we'll establish a Charter of Operation.

Because as we work together, we're going to identify different dynamics that we'll need to sort and build these relationships. And so, between now and over the next two years, we'll collaborate to write a Charter that hopefully all of our nations will then take that step, the next step to sign the Charter that establishes the World Fire Congress.

But at this meeting, only the Founding Principles have come forward that we believe in the nonbinding voluntary mission to participate as we move forward. First step here, hopefully the next step in the next two years.

As I said to you, tomorrow evening will be your opportunity to sign the Founding Principles that we've just reviewed. And as the delegates come together for the World Fire Congress closing ceremony tomorrow night, at our beautiful Library of Congress here in the United States, we'll gather, we'll share a meal together. And then together, each of your nations will be called on if you wish to come forward to receive your certificate for participating in this Congress, but also have the opportunity if you wish to sign the Statement of Founding Principles.

And so tomorrow night that will happen.

[Break]

2024-05-07 World Fire Congress — Part 2-MP3

Dr. Lori Moore-Merrell 07:28

Delegates, we will come back to order, please. At this time we are going to do the Roll Call of Nations. As we do the Roll Call of nations, or introduction of delegates, we will simply introduce your nation so that we can begin to recognize each other with our nation.

We'll ask the delegates to stand. I will also ask you to hold your applause until the end and we'll celebrate each other again. But we want to have you introduced with each of your nations so that again, we begin to recognize each other and our nations. I will begin with our delegates from Algeria.

Mark Hardingham 08:26
Delegates from Australia

Dr. Lori Moore-Merrell 08:33
Delegates from Austria

Mark Hardingham 08:41
Delegates from Barbados

Dr. Lori Moore-Merrell 08:48
Delegates from Belgium

Mark Hardingham 08:56
Delegates from Belize

Dr. Lori Moore-Merrell 09:05
Delegates from Brazil

Mark Hardingham 09:12
Delegates from Bulgaria

Dr. Lori Moore-Merrell 09:21
Delegate from Canada

Mark Hardingham 09:28
Delegate from Chile

Dr. Lori Moore-Merrell 09:35
Delegates from Croatia

Mark Hardingham 09:43
Our delegates from Cyprus

Dr. Lori Moore-Merrell 09:51
Delegates from Denmark

Mark Hardingham 09:59
Delegates from Ecuador.

Dr. Lori Moore-Merrell 10:07
Delegates from the European Union of Civil Protection and humanitarian aid operation, our DG ECHO

Mark Hardingham 10:21
Delegates from El Salvador

Dr. Lori Moore-Merrell 10:29
Delegates from Estonia

Mark Hardingham 10:37
Delegates from Fiji

Dr. Lori Moore-Merrell 10:44
Delegates from Finland

Mark Hardingham 10:52
A delegate from France

Dr. Lori Moore-Merrell 11:01
Delegates from Germany

Mark Hardingham 11:09
Delegates from Ghana

Dr. Lori Moore-Merrell 11:18
Delegate from Greenland

Mark Hardingham 11:25
Delegates from Guatemala

Dr. Lori Moore-Merrell 11:34
Delegates from Hungary

Mark Hardingham 11:43
Delegate from Iceland

Dr. Lori Moore-Merrell 11:50
Delegate from Israel

Mark Hardingham 11:57
Delegates from Jamaica

Dr. Lori Moore-Merrell 12:06
Delegate from Japan

Mark Hardingham 12:14
Delegates from the Republic of Korea

Dr. Lori Moore-Merrell 12:22
Our delegates from Luxembourg.

Mark Hardingham 12:32
Delegates from Mexico

Dr. Lori Moore-Merrell 12:39
Delegates from Netherlands

Mark Hardingham 12:48
Delegates from New Zealand

Dr. Lori Moore-Merrell 12:56
Delegates from Norway

Mark Hardingham 13:03
Delegates from Pakistan

Dr. Lori Moore-Merrell 13:12
Delegates from Philippines

Mark Hardingham 13:21
Delegates from Portugal

Dr. Lori Moore-Merrell 13:29
Our delegates from Qatar

Mark Hardingham 13:36
Our delegates from Romania

Dr. Lori Moore-Merrell 13:44
Delegates from Singapore

Mark Hardingham 13:52
Delegates from Slovenia

Dr. Lori Moore-Merrell 14:00
Delegate from South Africa

Mark Hardingham 14:08
Delegates from Sweden

Dr. Lori Moore-Merrell 14:14
Delegates from Switzerland

Mark Hardingham 14:22
Delegates from Taiwan

Dr. Lori Moore-Merrell 14:29
Delegates from the United Arab Emirates.

Mark Hardingham 14:40
Delegates from the United Kingdom

Dr. Lori Moore-Merrell 14:47
Delegate from the United Kingdom Wales

Mark Hardingham 14:57
Delegate from the United Nations

Dr. Lori Moore-Merrell 15:06
And delegates from the United States.

And with that, all delegates have been seated.

Dr. Lori Moore-Merrell 15:06

Welcome, again, delegates of the World Fire Congress. As we move forward, I'm going to ask you to turn your attention again to the screens. At this time, delegates, we'd like to talk through the Operating Procedures, so that we move forward in our discussion today and this afternoon. Together, that we have understanding, and that we have everyone who wants to speak have the opportunity to be heard.

So, delegates, we would like to be able to move forward in a way that we can all obviously be respectful, but we want to be heard, we want to make sure you have every opportunity. So, these are just some operating procedures. Again, it just helps us to do our daily agenda, and a much more organized fashion.

We will be opened and recessed at each of our breaks and for our meals. Throughout the Congress are credentialed delegates. As you can see, are all seated in a nation-specific areas. Our gallery and our observers, our facilitators, our speakers are all around the room in designated areas; we will operate as best as possible on the timing of the agenda that you have before you.

However, the agenda may be altered as we need to extend a conversation, or we have a subject that you want to spend a bit more time on. We can do that and will alter as we go through our delegate interactions, you are encouraged to use the green flags on your nation's insignia. If you wish to speak, we do have watchers around the room that are going to help my co-chair and me to see who wants to speak and they'll make sure that we keep it in order as best as possible.

It is understood that if we reach an area where we need to have some sort of vote on a best practice, or how we're going to move forward that we are unable to do that, we'll have a vote of two thirds if that's acceptable to everyone, I don't foresee that we're going to need to do that. As we discussed, this is more of our first step of gathering together. As we move forward on different issues and what takes priority, perhaps we'll need to do votes in the future. But for now, we will just have everyone be present and be prepared to speak when you wish.

For the facilitators and speakers, each of our four challenges that we've identified are going to be led by a group of speakers that have been assembled from international platforms, not just the US. And so, you're going to hear from researchers and subject matter experts throughout the afternoon today and all day tomorrow, as they bring forward the information or what we would call the state of science in some of these challenges.

And so, once we have that before you, then they'll provide various perspectives. We will then have a facilitator that will engage each of you to speak. We want this to be a conversation. We want this not just to be presentations like you would do in a conference, but more interaction—much more like a Congress as we've come together.

It is intended to be collaborative, and we wish you to engage and to speak. We may exchange knowledge, information, anything you want to bring forward from your nation. We want you to do that. And each of these subjects feel free to speak like you did this morning. And I compliment all of you who stepped up immediately to speak and to share your insights and your support for the concept. We want that to continue as we go through the challenges for the delegate interaction.

Upon the recognition of the chair, a delegate will be recognized to speak for three minutes. So there'll be timers, the smaller screens that are on the front here with the World Fire Congress logo now. We'll have a countdown clock will ask you to contain your remarks to about three minutes. If after three minutes you have more to say, we would ask that you respectfully stop for a moment to let us go to another delegate or perhaps two, and then we will come back to you. Is that fair? Everyone is in agreement, so we can stay with three minutes, and then another delegate or two will be recognized, and then we will return to you if you wish to speak again.

So again, we want this to be open. But we want to try to put some parameters around the speaking. And the comments that you deliver, we will waive the three minutes as we need to as we want this to be open, collaborative, and certainly interactive. So again, to provide as many delegates as possible the

time to speak, we will maintain that three minutes and you'll have a countdown clock at the front of the room. And we will defer and then come back to you if you have more to say.

So, with that, that is a very simple operating procedure. If everyone is in agreement with that, then we will continue to move forward with our next discussion. Any questions or comments about the way we will operate throughout today and tomorrow? All right, hearing or seeing none, then we will continue to move forward.

At this time, I'm going to ask the co-chair Chief Mark Hardingham to explain now our Communities of Practice, and how we will continue to work together after this meeting. We want to establish that precedent now. Because as we go into the challenges, we need you to be ready to perhaps commit to serve on one of these Communities of Practice. And so, it's best that you understand now, what the Communities of Practice are intended, and what they will deliver for us as a World Fire Congress going forward.

So, Mark, I'm going to now defer to you.

Mark Hardingham 21:49

Thank you, Dr. Lori. Just to set the scene on the Communities of Practice: before I start—and thinking about the first hour of our World Fire Congress today—Dr. Lori talked about the Founding Principles being built on the spirit of friendship. And for me, the Communities of Practice is the means by which we build on that friendship when we leave the World Fire Congress in a couple of days' time.

Dr. Lori also talked about active intent, and I think the Communities of Practice are the demonstration of the active intent that colleagues around the room will want to take forward as we bridge from one World Fire Congress to the second. And if I took nothing else from this morning, what I did take was the commonality of challenges that colleagues across the world are facing around fire and rescue services. And those challenges included, and are not exclusive to, recruitment, the role of the fire service, fires in tall buildings and other structure fires, the role of standards—but equally, the reality of a lack of standards in uncoded urbanization in developing areas around the world; recycling fires and waste management fires; high risk-low frequency events like datacenters, regional, national and international infrastructure, and the need for assistance inside and across countries; the use of water as an increasingly scarce resource; and finally, the one that came across, not surprisingly, most clearly was the impact of climate change, and weather events in pretty much every speaker this morning, and across the world.

So, as I step into the Communities of Practice, I think those are the key points from me, reflecting on this morning. I'd ask you all to think about what happens after we leave here tomorrow, to think about what happens before we come together in 2026. Again, to think about what happens in terms of how we fill the gap between that time—and to think about what happens in terms of how we maintain the momentum that has been started so ably by Lori and her colleagues today, because the Communities of Practice are going to need you. They're going to need your colleagues. And they're going to need your organizations and your nations to be involved and to take action once we leave here.

Essentially, the Communities of Practice are just a mechanism to share knowledge and ideas. They will be populated by subject matter experts who've got the knowledge and the insight to contribute. That may well be you, as a person in this room. It may well be somebody from your team, your organization, and certainly from your country. But it really does need to be somebody playing into these Communities of Practice.

Communities of Practice are needed, as the complexity and size of the challenges we all face through natural and manmade hazards are immense and only increasing. Whilst we've got strong relationships in regional networks, and we've heard about much of that this morning—our example in the UK being the work that we do very closely with colleagues in the Federation of European Union Fire Officers Association—we don't currently have a mechanism, a global mechanism that enables us to share this learning in a systemic way for every nation's benefit. Communities of Practice will therefore help us to move from the statement of principles and make them a practical reality.

In fire services in nations across the world, they will be based around the problem statements that we've established and spoke about this morning, with a separate Community of Practice for each theme. Meeting virtually, they'll bring people together and signpost conferences and events that take place across the globe, where colleagues can then meet up face to face outside of the formal World Fire Congress events.

We have some experience of operating similar networks, and spoke this morning about some of the work over the course of the last twelve months that the UK has been doing with colleagues in the US—where we've established a series of working groups around wildfire, emerging technologies, high-rise firefighter safety, and cancer. We've shared knowledge, best practice documents, and the learning from too-often tragic events. That contact between subject matter experts continues outside of this working group structure.

We've also attended conferences overseas to build relationships and networks. Equally similar work has taken place elsewhere with colleagues in the US, having arrangements in place with Romania and Sweden just to pick out two countries of note. We haven't always got it right, though. And I think there's definitely some learning.

It's important to appoint a chair for each Community of Practice, to give it a point of leadership, somebody who has the skills and experience in the area of work being undertaken. This is then incorporated into the overarching program that guides the work in each of those communities and clarifies the objectives so we make sure that we get the right people who can be brought into those discussions at the right stage to contribute to the learning.

So in the context of the World Fire Congress and the new Communities of Practice that have been set up and proposed, the intention is where they exist elsewhere, we try and fold those into the new single Communities of Practice, governed through the World Fire Congress, and then to actively meet on a regular monthly basis with representatives across the world. The first hub, the stakeholder engagement hub, stands alone as the hub to facilitate engagement across partner nations, intended to help us maintain the connections about what are our priorities, and what are our collective challenges.

Each of the Communities of Practice has a statement of concern captured on the screen that sets out the challenge being faced in that particular area. For the stakeholder engagement, the hub is intended to help with joint engagements. Joining up research and development is happening across the globe, sharing public messaging on risk reduction that we talked about this morning, and then exchanging knowledge and expertise amongst one another.

The Community of Practice for the **structure fire**: So, each of the themes of the World Fire Congress will have its own Community of Practice on structure fires. This will focus on economic loss impacts on the critical infrastructure, and public safety, deaths and injuries in what are largely preventable fires. And importantly, how fire and rescue services are resourced to properly and adequately respond to the risk that we're facing.

Second Community of Practice: around **climate change**. Again, the broad statement of concerns set out in front of you covers the broad effects of climate change wildfires, and their growing intensity, size, and destruction across nations. Drought, extreme heat, severe storms, cold weather, rising sea levels, and the firefighter response that comes in various forms across each and every one of those. And then increasingly catastrophic climate-related events that overwhelm fire service's capability and firefighter capability and come with the associated loss of life and massive socio-economic devastation for nations.

The fire risks from **emerging energy technology**: This statement of concern encompasses, importantly, the welcoming and embracing of innovation, whether it's electric vehicles, e-bikes, scooters, emerging energy technology in the built environment, and the intent to move away from a dependence on fossil fuels. But equally, most importantly, recognizing some of the unintended consequences that come with that innovation that's happening at such a pace. And from our perspective, particularly the fire and safety threats that come with that—and tackling that through a systemic approach, not just focused on how to fire firefighters and fire and rescue services respond, but the systemic approach that incorporates

an understanding of the threat environment, the policy and regulation that's needed, awareness and education of the public, and others' research. And then of course training, and how fire rescue services respond to those events.

Firefighter health and safety: The statement of concern, again, incorporating the breadth of health concerns that we're talking about this morning facing firefighters across the world: cancer and mental health and well-being being just two examples, amongst others; increasingly looking at where is the data? Where is the evidence, where is the research that underpins our understanding, not just on the problem, but how then we move to solutions? Recognizing we don't have all the answers across fire and rescue services and looking to other organizations with similar challenges—the military being a good example—particularly around PTSD. And then the health and safety links that that has, and how it plays into the recruitment of both career and volunteer firefighters that we talked about this morning.

And then the final Community of Practice around **firefighter education and firefighter training**, which encompasses all those that have gone before. The statement of concern encompasses the opportunity for increased consistency and collaboration where that's to the benefit of individual nations, sharing of skills required for firefighters to operate safely in the operational environment, and routes through which the skills of firefighters are adequately and properly developed. And then going beyond just the education and training for people in operational firefighting roles, but also in career opportunities and other development opportunities inside the broader role of the fire and rescue service. And, importantly, as more than 50 nations across the Congress today, the recognition that not everybody is in the same position, whether that's around resources, development opportunities, or just the context of your fire and rescue service in your nation.

So what you have on your table in front of you is an opportunity for you to indicate which Community of Practice you would like to be involved in from your nation. We'd certainly liked people to at least take one. Ideally, we'd like people to take all. The Communities of Practice give us a real opportunity to share and build on as soon as we leave the Congress later on this week.

There's also an opportunity for you to just note some remarks and comments down in terms of general observations about Communities of Practice as a principle, or some of the individual community practice Communities of Practice. Where you've got comments, matters, or thoughts that you would like to share, which we can then gather up and use to inform the first iteration of those Communities of Practice and how we share the observations of everybody more broadly across all nations.

So, how will it happen in practice? Well, Dr. Lori, and the US Fire Administration team will lead these Communities of Practice through to the World Fire Congress in 2026, when a final report on the progress that's been made will be presented back to the next Congress. The National Fire Chiefs Council for the UK will then take on the responsibility for managing those Communities of Practice through to the next World Fire Congress in 2028. In this way, we make sure that the momentum and the commitment that's been gained during the course of the event here in Washington will be translated into the sort of activity that we want from the Communities of Practice.

Picking up as I draw to a close on where I started: the Communities of Practice are all about turning the really good intent and the ambition that we'll be talking about over the course of the next two days into actions and outcomes, which enable everybody in this room to do something tangible and different in your country and your fire and rescue service, as a consequence of the World Fire Congress. Whilst colleagues in the US Fire Administration will host the Communities of Practice and support their ongoing work, it is going to require countries--us in this room, me included—to get involved with them, to support them, and to bridge the gap between the 2024 World Fire Congress and the 2026 event.

So, I'd ask that during the course of the next couple of days, take a look at the card, fill the card in. They will be collected. We look forward to seeing you on the Communities of Practice or seeing some of your colleagues invited to attend a Community of Practice in the future, and really establishing the sort of global network that I think we all aspire to from the conversations we've had so far today.

Thank you, Lori.

Dr. Lori Moore-Merrell 36:30

Thank you, Mark, I appreciate that. So, to reiterate a couple of items that Mark has brought up to you, you should have a series of these cards. And so, as Mark said, through this afternoon, and tomorrow, as you hear about the subject matter, as you want to bring forward solutions or you have additional comments, there's space for you to write in.

There are also two of the Communities of Practice that are not reflected on this card. These are our main four challenges—but the hub, our stakeholder engagement, main Community of Practice—is the one that will be our network and it is not reflected here. So, we're going to ask that you write that in if your nation wants to be in what we'll call the "Umbrella" Community of Practice that will hold all the other Communities accountable to meet and bring forward information. You can write in in the space that you want to be in the main stakeholder engagement Community of Practice.

The other one that is not on the card is the Education and Training. We have heard since we first established the four challenges that many of our nations are having challenges with firefighter education and training. And so, we want to add that as a Community of Practice. And so, you may also write in if you wish to communicate or participate in that COP.

So today, tomorrow, use your cards. If you want to leave your card, we will collect them so we have your notes, we have your points of contact. And the last thing is that perhaps it's not you who is the participant, perhaps you have in your nation, a subject matter expert on one of these challenges, or someone else that you want to put forward to participate. This is where you give us their information as well. So, it might be someone beyond the delegates in this room that you believe will be your delegate to one of these COPs. It doesn't have to be the delegates; you can bring forward your own subject matter experts. We want your nation to participate as Mark so eloquently put it in all the COPs. But if you select the ones that you believe are most important to you, that's your point of engagement, ongoing for the next two years until we come together as the whole Congress again in 2026. And we'll talk more about that.

So, we have just a few minutes before we are going to take a break for lunch. Let me see now if we have any questions or comments about the Communities of Practice, and how this will work, or any questions about the cards that are before you. I will just say that you'll be contacted. We will reach out to anyone who's given us a card or a point of contact. And we'll start to establish these in the next 30 days post-Congress and make sure that we start the conversation; I don't want to leave too much time between this meeting and getting the started, so it's going to happen pretty quickly. And then we'll begin what we will call a "battle rhythm" meeting with all of the COPs.

The US will continue to lead them until we hand off in the UK. And then we'll identify our next host for 2028. And then the UK will lead the Communities of Practice until we get to that host. So we believe as we think this operation through that each host nation will be responsible for leading the Communities of Practice until they hand off to the next host nation. That way we have some continuity from meeting to meeting.

Does that sound like a good plan? Good, good. I like that headshaking. Thank you.

Before we break for lunch, I want to invite Mr. Victor Stagnaro, who is our Chief Executive Officer of our National Fallen Firefighters Foundation to come and give you just a few announcements before we break for lunch. And then we will reassemble in this room at 1pm or 1300 hours. Victor, please take the mic.

Victor Stagnaro 41:41

Thank you, Dr. Moore-Merrell. We invite you to enjoy your lunch in the same room where we met for breakfast, in Columbia A B during the lunch break. You will also be invited to visit the exhibits. You also see device charging stations. So, if you have a cell phone that needs to be charged, they're set up in the area just outside the room.

The Congress resumes at 1300 hours. t this time, I would like for everybody to remain seated while our

delegates may be dismissed to have their lunch. Delegates, you're welcome to go and enjoy your lunch while everybody else please remain seated.

Dr. Lori Moore-Merrell 42:44

Thank you, Victor. Delegates, we are in recess until after lunch, please rise and your lunch will be in the room that you're familiar. Gallery international guests you'll follow out the delegates and then our US guests if you will remain until our international guests have taken their lunch.

[Break]

2024-05-07 World Fire Congress — Part 3-MP3

Dr. Lori Moore-Merrell 02:25

I'll call the World Fire Congress back in session. We'll begin now with our first challenge for the afternoon.

The first challenge that is before us is Fire as a Threat to National and Global Security. And this is our structural fire threat, the first challenge that we'll take up this afternoon.

As you all know, every year around the world, tens of thousands of individuals are seriously injured or killed in fires, and our nations experience billions of dollars in direct and indirect economic loss. Globally, fire threatens our critical infrastructure, our national security, and our public safety. Structure fires are the leading cause of civilian death and injuries—and most of these fires are preventable.

So far this year, the global headlines really tell the story—from Valencia, Spain, where nine bodies were found as they searched after a fire; here in Chicago, we've had high-rise building fires, where more than seven people hospitalized; and in Brazil, fire engulfs the building under construction in the coastal town. Even today, I'm sure if we looked at all the news, fires are making headlines in many of our nations.

I would like to introduce our facilitator for this session, Miss Michelle Royal from the Department of Homeland Security, Science and Technology. Our speakers for this session are Dr. Dan Madrzykowski from the USA and Dr. Sabrina Cohen-Hatton from the UK.

Please welcome our facilitator and speakers to the stage.

Michelle Royal 04:38

Good afternoon. My name is Michelle Royal. I have been supporting the Department of Homeland Security, working with emergency responders trying to identify capability needs and corresponding technology and policy solutions since early 2001. It is my incredibly great honor to be here with you as we talk about the fire service and how we can move forward addressing those capability needs that exist for both domestic and our international firefighters. So please let me turn it over to Madrzykowski to begin our session.

Daniel Madrzykowski 05:18

Good afternoon. Thank you for the opportunity to address such an honorable international contingent. Fire Dynamics is my life, and I want to share that with you as we discuss the challenges that all of us face around the globe.

As an ancient Greek once said, "Change is the only constant in life." And as you can see from the images here, we have a bare plot of ground and ten years later, it's developed into residential and commercial structures. And what you'll notice from the larger structure in the image, if you look at it from the top down, you can see that there's no access for fire trucks to get in there where people might be needing rescue or hanging out windows or things like that. So even though there have been some code changes that make that a safer building, in the case that a system doesn't operate, and the fire service is relied on to get a large number of people to safety, it's going to be very difficult to do.

As we move through our world, our built environment, the pressures of sustainability—as a lot of people spoke about climate change this morning—the pressures of the economy: what it costs to build a structure, what it costs to house people has changed the materials and the construction methods that are used in the US. This has resulted in the ability to make open-compartment buildings, larger buildings with less structural firewalls or fire divisions within them.

The materials that we put in our homes are made from foam plastics, which typically have a potential for a higher heat release rate than natural materials like cotton or wood, in order to get these larger, better structures to work with. We have wood trusses, and lightweight engineered materials that are very, very good for holding up the structure. But when exposed to fire, the lack of mass, and their geometry, they weaken and fail very quickly.

And in addition to that, we have emerging hazards that you hear about later, with regard to solar panels, electric vehicles and things of that nature. The lightweight engineered wood I-joists have become very commonplace in the United States in terms of a fundamental building block for residential structures, and some commercial structures. And what you'll notice due to its design, that if exposed to fire, it can fail in five minutes or less.

Here we have a comparison, where we have a room full of natural fuels, and then a room with synthetic fuels. In the natural room, everything is made from cotton, or wood or we have a wool carpet on the hardwood floor. On the synthetic side, everything is a polyester or polyurethane—things of that nature. You'll notice very quickly that even with the flame ignition for both the amount of unburned fuels, the unburned pyrolysis seats on burn carbon particles that you see in the smoke in the synthetic: that smoke is fuel. And that can ignite somewhere else in the house.

And what we'll see here is it's rapidly going to transition to a rollover, where the energy from that hot gas layer is then going to paralyze the remaining materials in that room and generate very rapidly into a flashover. That is very different than the fuels that we had in our homes fifty years ago. And the natural fuels you'll see take more time. There's less smoke. So, in terms of fire department response, they had more time to get there to effect a rescue.

In terms of fire department response, the fire that they showed up to was not as reactive to getting oxygen introduced into it. Because these fires would take a much longer time period to generate into a flashover—it's not that they wouldn't, they just take more time. And there you can see from a number of iterations of this that we've done, everything with the synthetic fuels was under five minutes and the others are on the order of 30 minutes or more were for the fire service. This meant new information they needed to understand fire physics fire dynamics a little bit better.

Where in the past they had just been taught about fuel limited fires, ignition growth and a fully developed fire, they needed to now move into an area where they had ventilation-limited fires to deal with—fires that might look like nothing showing upon arrival. Or it could be flames extending out of a window or a gable vent. In these fires, the fire would grow, it would consume the oxygen that was trapped in the building due to our well our good insulation for environmental purposes and economic purposes: we wrap our homes in plastic, and we have thermal pane windows. So, the air that's there is trapped, it gets consumed by the fire and the fire goes down.

When the heat release rate goes down, the temperature goes down, the pressure of the gases inside goes down. So actually, the structure is now at a pressure level lower than atmospheric pressure. And as a result, the smoke doesn't flow outside because air is trying to get sucked in through any gaps to provide energy to the fire. If a door opens or a window fails, the fire can react very dramatically and increase.

Let's take a look. So, you can see how that fire that had two of the components of the fire triangle, heat and fuel in the form of hot smoke—once it got additional oxygen introduced, reacted very quickly. Understanding the flow path, understanding how the fire is going to move through the building, is important for incident commanders and company officers to be able to predict or be able to have some sense of, because if you're working between where the fire is, and where the fire wants to go, that is a high risk operation and likely not to be as effective or successful as you might want it to be.

Fire service has always been taught that when water hits heat, when water gets heated, it expands 1700 times to turn into steam. But what they never told you is when fire gases get cooled, they contract. We're taking fire gases from 600 to 900 degrees centigrade and reducing them down to 100 degrees centigrade. And they contract. And so that's an important lesson with regard to the fact that the fire really doesn't know where the water is coming from.

In the United States, there has been a myth that you should never put water in from outside the building because you create harm, that you'll do damage to or hurt the victims. And we've conducted research to demonstrate that that's just not true. Understanding how to use your hose stream—again in the US the requirements that are in the standards say you need to get water out the end of the hose and basically pointed in a general direction and training stops. It's very important understanding the physics around your hose stream and how it entrains air or how the momentum of the water hitting a surface will distribute that water.

As you can see in the image on the left, the firefighter's holding the hose stream at a very steep angle, and it's dispersing water all around the surfaces of the room, cooling those surfaces of the room. Where in the photo in the middle, he's got a shallow angle, and the momentum of the water is hitting the ceiling, flowing along the ceiling, and all the water's running down the back wall.

If the fire is between that firefighter and the back wall, that fire's not getting any water and the surfaces aren't getting any cooling. So again, we've developed a prop to help teach that lesson plans to help get that across and you can access that on the QR code.

One of the key things when we asked firefighters and fire officers, "How much water do you need to control this fire?"—their initial response is that they need thousands of gallons. Really, we needed 185 gallons or 700 liters to knock down that fire and completely extinguish it so they're knocking down fire at the eaves trying to keep the fire out of the roof. They're basically going to shut the fire down by giving it a sweep of the source room here on the first floor and wetting all the fuel surfaces, they've cooled the gases. Now they need to move quickly and take the fire gases out of play in the room. Any part of the apartment above and the apartment below, and you see how effective that hose stream is. You see how effective that water application is. And because they're not making entry into the common hallway, they're keeping the end the apartment doors closed, they're keeping that common hallway clear.

So, they could effect rescues without having to utilize ladders or a slower process. They could be walking people down that central stair, because you'll see until they open the door, the central stair is fairly clear. So again, strategies looking at the system, better ways of doing things, better ways of being more effective.

To do this, we need to give good training to our fire officers, to our firefighters. They need to be able to get good information from a trusted source. That could be research information. That could be information about what's happening from the dispatcher on the fire ground. Again, good data from a trusted source.

But we need the firefighters' experience to complete the picture—because knowledge and experience are needed to interpret the data that they're receiving, whether it's data from a research paper, or whether it's data from the fire ground, that knowledge and experience account for that context to put everything together.

So, decisions on firefighting strategy and tactics size up is the basis of the incident action plan. That's their data on the fire ground, the impact of ventilation on event limited fire. And knowing that if you add air that will increase the heat release rate that will increase fire growth. That's a combination of knowledge and some of their experience, the existing flow paths when they're looking at the building where they're collecting data from others on the fire ground via their radio. That's data.

And then for them to process: What are the potential flow paths? Where do we want to vent? Where do we want to make entry for search; how's that going to affect the flow path? Again, that's a combination of knowledge and experience.

Fire Dynamics knowledge is needed to understand those observations, the data on the fire ground. High-energy materials, new construction methods, and bigger buildings that we're seeing built all around the world mean that we need more fixed fire protection systems. We're building buildings in terms of warehouses, high rises, that are honestly beyond the scope of what can be expected of a fire department initial response. So, we need fixed fire protection systems to give the firefighters a chance—to give them an opportunity to do their job saving lives and saving property.

Clearly, more firefighting resources are needed. Certainly, in the US, we hear from both the volunteers and the career side that there are not enough resources in terms of funding to support staffing, in terms of funding to support equipment, in terms of funding to support the repair of equipment and maintenance of equipment. And most importantly, in terms of funding to provide adequate training to our fire service.

I don't know how it is in your country. But here if there's a budget cut, the first thing to go is training. And honestly, that's probably the worst place to cut the fire service. They really need that training. All of these things combined—bigger buildings, different construction methods, different materials, emerging hazards in terms of batteries, and how we consume and use and store energy—these all result info "fire is getting faster."

We saw it in the transition between the natural products and the synthetic products. We're seeing it again and you'll hear more about that this afternoon, going into the lithium-ion batteries. This means that for firefighters, the boots on the ground, the fire officers, they have less time to make good decisions.

So, what can this body do? What can this group do? I challenge you to help give them some time or help enable them to make better decisions.

And with that, I will turn it over to my co-presenter, who would like to enlighten us about decisions. Professor Sabrina Cohen-Hatton. In addition to Sabrina's academic achievements, she is also the Chief Fire Officer with the West Sussex Fire and Rescue Service.

Sabrina Cohen-Hatton 20:01

Thank you so much. It's a pleasure to be amongst you today. Thank you so much for having me.

I would like to talk to you a little bit about some decision-making research that we've done in the UK. I started doing this research after an incident that I went to where another firefighter was severely burned. At the time, I was also a firefighter—and the person that we thought was burned, was my husband.

I had a reprieve that day: it wasn't him, although he was very nearly killed. And the reason for that was human error. It wasn't a problem with a piece of equipment. It wasn't a flaw with a policy, but a human mistake. And one of the realities that we all share is that if one of us makes the wrong choice in the wrong place at the wrong time, then somebody's loved one could get hurt. And although I was fortunate that day, somebody else's loved one wasn't.

That's why we started to do this work in the UK, to try to understand human error better, so that we could try to reduce it. Incredibly, 80% of injuries happen as a result of human error. So, it's a really important piece to get right.

The first study I want to talk to you about was one where we went out on operational incidents to collect data on people making life-and-death decisions. At the time, we weren't relying on an interview after the incident, we weren't relying on training data. These were real life decisions. And we discovered 80% of the decisions that people were making were very intuitive decisions, gut decisions, instant decisions made in the moment—not the analytical decisions, where people will weigh up the different options and choose the optimum one.

However, the problem that we had was all of our training, all of our procedures, all of our protocols—we're assuming that people would make a decision analytically. They actually happen in very different parts of the brain. So, it's very difficult to say to someone, I want you to make a decision this way—it doesn't happen.

And so, as a result of that, we developed some techniques to help people make better decisions, to make the most of the intuitive decisions that we know people would make. And I want to share with you our UK-based decision control process that we now train all of our commanders on to make decisions in the heat of the moment.

Now, some aspects of it, you'll recognize, because it's very simple situation, assessment, plan formulation, and then the action that you would take to implement the decision. And we recognize from this research, the opportunity that you have to intervene is not before somebody makes a decision but is after they've made it—but before they action it. And it's at that point, we now train our commanders to run through a very rapid mental checklist. We get them to ask themselves why they're making the decision. What's the goal?

Now that sounds incredibly simple, I appreciate. But when someone is making a gut decision, an instant decision, they're not thinking about the goal, they're seeing something and they're responding to that thing. So, by implementing that, we found when we tested this afterwards, that actually we had 35% more goal-directed decisions when people were using that simple decision control.

The second one is also incredibly simple. The second question they ask themselves is what do I expect to happen? When we did the initial research, we discovered that the majority of decisions that were being made were being made with very low situational awareness; it was a decision made based in the here and now, not in the what might happen in 10, 15, 20 minutes; an hour's time. When people were using that decision control, we saw up to five times more of the highest level of situational awareness, incredibly effective.

And the third one—regret—again, incredibly simple. How does the benefit outweigh the risk? The purpose of that decision control is when you're making an a very intuitive decision, you're not rationalizing it, you're just responding to something. So actually, using that decision control isn't just a very helpful risk analysis. But it also helps commanders to stand by the decisions that they're making, and not get caught in a decision loop where they end up with decision inertia, and they don't implement the decision.

That decision control process and the research that it's based on is now integrated into our national operational guidance for incident command. It's our national policy. It's taught and used all throughout the UK. And it's now implemented in something called our joint emergency services interoperability protocol, which is the policy that's used nationally for all emergency services, fire police and ambulance service, which I'll touch on in a moment. But one of the other things that we've done as a result of this is we're up to eight global research awards for this work as well, which was an intense privilege for us in UK fire, not only to be able to push on our practice a bit further, but also to be able to push on the science some further to.

Now I'd like to talk to you very briefly about another research study that we did based on multi agency working. So, the joint emergency services work that we do, when you're dealing with a significant incident, a major incident, we know that it's not just the individual decision making that's important. We come together as Strategic Commanders to make decisions that will affect an entire city. And it's important when we do that to recognize the joint decision making that we do.

And so, we did some work, where we coded video footage from 24 strategic coordinating groups, which is the group where we all come together to make those decisions, to try to understand better how people were making those decisions when they came together. And what we found was really interesting. We found that the dynamics in the group really affected the way that people were making a decision. And therefore, the decisions that they were making themselves. And we saw two particular traits. There were some groups that were real explorers, they would look for information, and then they plan something. But before they do anything, they go back and look for more information. Again, sometimes they would get to an optimal decision. But very often, they were going back and forth, back and forth, and not landing on a decision. And if they did, it wasn't made in a timely way.

We also saw the opposite extreme; we call them exploiters. They would get some information and jump straight to a decision. And they would make a decision very quickly. But it wasn't always the

best one. And so, the role of the person that's chairing the meeting is so crucial. And some of the recommendations that we made were to give more training to those people that are trained to chair those groups, so that they could understand the way that the dynamics could influence the decisions that they come out with.

So–some really exciting work that we did there in the UK. And as a result, if I go back to those decision controls, we developed some additional ones for people making a decision in that group environment. And the two additional ones were whether people have a common understanding and a position on things.

Let's do an experiment: I want you all to think about an apple. Raise your hand if you're thinking of a red apple. Now raise your hand, if you're thinking of a green apple. Who's thinking of a yellow one? Because that's just strange. But the point here, the point here is a really important one, we're all thinking of the same thing. And it's really simple. But you see how much variation there is within that. So actually, introducing these additional decision controls is a really effective way of getting people to challenge their assumptions.

And then the final one is challenging people's position as an individual to see whether or not they're agreeing with the group, or what they might need to introduce to try to get away from some of the group cohesion that can lead them to groupthink, and to really challenge the decision. So, some very exciting work that we were able to lead in the UK with this.

Now, there's another study that I'd like to tell you about. This is one that we did that was looking at the very paradoxical effects of decision making when you're making a decision under uncertainty. Now, one of the things that we all share, I think, is an expectation that we deal with the unexpected. But with the unexpected comes a huge degree of uncertainty. And I'm particularly interested in the impact of the stress that you experience through things like uncertainty on the way that you make decisions.

So, you'll see here in the in the photograph, there's me and a colleague of mine, he was one of my PhD students. He's now completed: Dr. Phil Butler. Now I wanted to know how stress was affecting people. Have you ever tried asking a firefighter how they're feeling under stress? They will not admit it. So, it was important to me that we looked at other measures. So we collected biometric data: I collected heart rate, breathing rate, but importantly, we took blood samples so that we could assess how stressed people were we used something called leukocytes, to see how people how much people had left in the tank, essentially how much stress they could still cope with. It was a great experiment, we put our firefighters through two scenarios: one of them was very uncertain, it was one where they would turn up and there was a sinkhole, a great big hole in the ground that had opened unexpectedly. And it had a group of children that had fallen down. But critically, they didn't have the right equipment or a real policy to deal with that. So, it was very uncertain and very unexpected.

The second one was much simpler. It was a high-rise fire with very clear procedures, everybody would turn up and know what to do. It was very standard: both stressful, one uncertain, one with more certainty.

And what we found—and you won't be surprised about this—is that when people were turning up to deal with something with very high uncertainty, they were more stressed. That I think we could all expect. But the paradox that we discovered is that when people were stressed, because it was uncertain, they were more likely to reach for a set of rules. Even if there wasn't a set of rules that applied, they would try to find something that would give them comfort in the certainty even when it negatively affected the operational outcomes of the incident. Whereas with the set with a with a high degree of certainty, the high-rise fire, some really clear procedures and protocols, but they were more likely to put them to one side, and to do other things that were more novel. So: a really interesting paradox for us.

In the UK, we introduced something called operational discretion. The point about operational discretion is that we recognize that there isn't always a perfect set of rules or protocols for everything that we go to. So, the concept with operational discretion is it's giving license to use your professional judgment where you recognize that there's a set of rules doesn't apply—all by applying a set of rules prescriptively.

The incident would escalate, and you could end up with something worse. So, it's a really interesting concept: the biggest driver for whether people will use operational discretion appropriately or not, is actually culture. It's how they think their decision would be perceived afterwards would affect whether they felt legitimized in using the discretion that we'd given them. So, some really interesting work.

As a result of this, we have a real focus on training our firefighters and our commanders in human factors. People know the procedures, they know the policy, we can give them experiences. But it's crucial that we give them the support and the opportunity to understand their psychology, and the way that they'll respond under pressure. It's a really effective way for us to help our commanders. Also, it was really important to us to help to build resilience in commanders.

And so, although operations probably only represent somewhere between 3 to 5% of our time, it is probably 99% of the risk. It's so important to give people that opportunity to practice these skills ahead of time, so that when they first turn out to those high-risk incidents, we know the impact of stress, we know the impact of uncertainty, we know the effect it will have on their decision making. But that additional practice means they're more prepared when they turn up to that incident.

All of the research that I've spoken to you about today, we have published through Cardiff University, there are the references there if anyone wants to take a photograph and read more on that information, please feel free. Thank you so much.

Michelle Royal 34:21

What we want to do for the next hour is talk about what issues your countries are facing your nations are facing as we look at the issue of structure, fire and fire as a threat. We've heard some very interesting discussions from Dan and Sabrina about both new materials, construction materials, as well as the mechanisms for decision making, both for commanders in the fire service and others as well. Now we want to hear from you what are other issues that you all are facing. As we talked about structure fire, I took some additional notes. We'll make sure we keep this discussion interesting. Recognize Australia.

Australia 35:35

I'm always interested in some of the studies about decision making. In Australia, with climate change, we're finding our turnout gear is really increasing temperatures internally. Professional sports are seeing how increased body heat is making bad decisions. For example, in cycling, did you do any studies with regards to heat impacts on decision making?

Sabrina Cohen-Hatton 36:10

We didn't do anything specifically looking at the impact of body heat. But the concept is the same.

When people experience a stressor, whether psychological or physical, the stress actually has an impact on your brain. And when your body is releasing cortisol and adrenaline as a result, there are particular receptors that we have in the front part of your brain and the prefrontal cortex, very specifically, a part called the dorsal lateral prefrontal cortex, that has receptors that those stress hormones like cortisol, for example, bind to, and it essentially shuts it down.

So, when you're experiencing stress, the reason that you resort predominantly to very intuitive decision making is the thinking part of your brain gets shut down. And that's why we found great success in using things like the decision controls, because it just pushes people back to the thinking part of the brain when they're making those decisions. And it helps to reduce your chances of falling into the decision traps and experiencing human error. But really great points. Thank you.

Michelle Royal 37:20

Let's go to Mark mentioned earlier, these Communities of Practice, this is how we, as this body that's come together, are able to make forward progress on the issues that we've talked about. What will the structure fire community of practice, talk and discuss through over the next two years? What are

the issues that you're facing? I have been seeded with some ideas. For example, building codes, were something that has been brought up. Does anybody want to discuss something like that? The delegate from Canada, please.

Canada 38:10

Good afternoon. And thank you, wonderful topic. I think as we speak of building codes. I know in our country, this notion of affordable housing, and increasing housing stock, the availability of homes, for the purposes of ensuring that every person is housed in some capacity, the risks we believe that will occur as a result of that is the not necessarily the same reliance on the building codes as we see today.

And we are concerned about things such as secondary suites in our properties, and the risks associated to that means of egress is in our structures when we're designing properties differently. So anytime that there's a cost question when it comes to housing, I would suspect that there is likelihood, a reduced level of safety in those applications. So, I would encourage us in our Community of Practice, to continue that conversation. Thank you.

Michelle Royal 39:06

That ties in so very nicely to what Dan was mentioning earlier as we talk about new construction methods, new construction, techniques, materials, things like that. We have issues of mass timber coming up different claddings that are being developed. All of these are going to impact the fire service as we move forward.

Does anyone else wish to comment on building codes or any other topics related to structure fire that they find of interest and would like to have the Communities of Practice pursue in the next two years? The delegate from Barbados.

Barbados 39:46

Good afternoon, everyone. The presentation on fire dynamics: basically, we saw the presenter made the point on the reduced level of resources, amount of water to extinguish the fire. And a lot of our countries are water-scarce countries. And as was the point was made this morning, we use the potable water to extinguish fires.

So therefore, we need to look for ways and means to extinguish the fire by using a lot less water. And as we go through our research, we probably need to not only look at how to use less water, but other ways of extinguishing fire, other than in the use of water.

Michelle Royal 40:44

Excellent, thank you so much. I believe the delegate from Romania would like to speak.

Romania 40:50

Yes, taking into consideration the first presentation, I think that what we are talking about is that we need to respond very fast, we need to have access, and we need to have fixed appliances to delay the spread of the fire. And these are all issues that we need to work on fast response, it means more nearby stations, rural areas are very sensitive. Rural areas usually take more time of response than the urban areas.

And the issue of the building code and Urban Code. It's not only the building code, it's the urbanistic code, the urbanistic planning, when you have buildings where you don't have access, as I said in the morning, because of the roads, or as we were shown, buildings which are built without access to the interior courtyard and where the firefighters cannot go in. I think that these are issues that need to come out from us in the next two years. And I insist on communicating them in a certain way to the politicians who take decisions. If it remains between us, there will be no change. If we go up to the legislative side so that they foresee the future legislation, then maybe we will be able to make a change for the future. Thank you.

Michelle Royal 42:06

Perfect. Thank you so very much. Anyone else have thoughts on this? I thought that Dan made such an interesting point earlier when he said that because of the synthetic materials, high energy materials, the new building codes, firefighters have a much-reduced time to make decisions, which ties in very well to what Sabrina was mentioning with the decision controls and things that need to happen while you're making these decisions.

So not only because of the materials that we're dealing with, you have less time to make decisions, but we need to make more effective decisions to keep everyone safer. What are other thoughts that you all have with regard to topics related to this to decision making to these materials that you would like us to cover? The delegates from Mexico please.

Mexico 43:01

One of the situations that is happening to us a lot in Mexico: As for fires, they are not structural fires, but we are faced with an issue of hydrocarbons in which many of the cases there are documented cases in which many people have died extracting these types of, well practically gasoline, diesel. They are not structural fires, but we are faced with an issue of hydrocarbons in which many of the cases there are documented cases in which many people have died. We have already detected by region what are the effects or what are the emergencies in terms of fires, not only structural, but also fires of hydrocarbons and others and other situations that put life at risk. So, I think that in order for our politicians to be able to make decisions, I think that fire departments in different countries have to give tools to our authorities that make visible the type of incidents and, in that sense, seek to strengthen departments and also the capacities and abilities.

Michelle Royal 44:28

Gracias thank you so much. Other thoughts other issues that you all are facing? The delegate from Guatemala

Guatemala 44:39

Thank you very much. Indeed, there is another issue that, at least in Guatemala, affects us is the fact that there is very little water. There was some talk about water in major cities; pumps have to have a lot of water capacity to be able to deal with the different fires.

Michelle Royal 45:48

Excellent. Delegates from Brazil.

Brazil 46:00

I would like more to ask a question to Dr. Murkowski. You mentioned a lot of data on the fire development. And it's all based on United States building construction methods. In Brazil, we have a whole different method we use mostly concrete in our structures and electronics. Do you have any data on this kind of building constructions in regarding prevention measures to help delay this this flashover development? How is that in place? Do you have any data on that? I know that US and Canada are way ahead on home fire sprinklers–how well does that work? Do you have any data on that? Or the building codes? Do they influence directly on the on this delayed fire development?

Daniel Madrzykowski 46:58

Granted, around the world, there are a lot of different construction techniques that rely on non-combustible materials, concrete walls, ceilings and floors. While we have those in multifamily housing in the US, typically we don't have that in in the single family or the smaller residential units. So, we do have some data that we've taken in high rise buildings and things of that nature to get some understanding of how the concrete block or the concrete ceilings will heat up and absorb heat and change the fire dynamics a little bit.

In some ways as those buildings can absorb more energy than gypsum board wall, they can delay some of the development at least or some of the extension of fire, but again, only for a limited period of time. So, we have some data but not as perhaps encompassing as, as you would like, in terms of prevention.

There are many organizations in the United States, led by the USFA, to speak with one voice to try to help consumers and our stakeholders across the country understand how to take better care of their lithium ion batteries, for example, so that they don't charge them or abuse them and result in a fire, or how to have an emergency plan to get out of the fire, how to deal with a fire, things like that. So, there is there are some efforts in that regard.

As you mentioned, the building codes: we have model codes in the United States. And the residential model code does require residential sprinklers and in occupancies, unfortunately, or fortunately, depending on your outlook. Those model codes are adopted locally. So, they're typically not adopted at a statewide level; they're adopted as a village or a town or a city. On a state level, there are only two out of the 50 states, Maryland and California that require residential sprinklers to be put in all new residential construction and I believe those codes have been in place for about 10 to 15 years now. Other states have not followed suit and in fact, some states in the United States have taken political action against residential sprinklers.

We do have a significant amount of data both from the research lab on how effective residential sprinklers are, as well as from incidents across the country and how effective they are at reducing death. And now we're just starting some research. We're involved in some research with the lithium ion batteries to show that while the residential sprinkler may not be able to stop that initial event, it does limit the impact of that event prevents flashover, limits the area of fire—and does something that no fire service in the world could do, because they just wouldn't know and be able to get there in the 20 to 30 seconds that you have to make that decision, or to make that response. So having sprinklers certainly is like having a firefighter, at some degree, with you 24 hours a day.

Michelle Royal 50:22

Thank you so much. The delegate from Sweden.

Sweden 50:28

On the topic of things we'd like to see being discussed in this Community of Practice, I'd like to bring to the table of fire prevention in our part of the world: a lot of new housing constructions are all connected, so lots of different sensors, as well as connected fire alarms. And how can we use that to the advantage of early response?

Michelle Royal 50:53

Excellent, thank you. The delegate from Switzerland.

Switzerland 50:57

Thank you. Yes, I would like also to add something I didn't hear until now, if I understand well, but in Switzerland, we have a conception with different principles, and one of them is the productive objective. And we said that in about 10 minutes, we have to reach a place where the fire, so for from middle to high risk, and then 15 minutes for low to medium risks.

But the problem is that there is so much traffic jam congestion in the city. And as I said before, we are many volunteers. So, the time they have to take to come to the cabin, and then to go to the place where the fire is, it takes so much time. And for us, it's really a difficulty.

And something new: They wanted in our parliament to make a change in law to make it possible to protect bikes, people with bikes taken on the road, which is made even more less place for the trucks or for the firefighters to go to the place because cows cannot go on the site to let them go. And so, we are facing these kinds of problems. And I want you to at this point, because I think it's also something important. Yeah,

Michelle Royal 52:30

I think it's a great point. And something I've definitely heard from both big cities, newer cities, as well as historic, more historic communities. I believe the delegate from Jamaica would like to speak.

Jamaica 52:43

Good afternoon, everybody. So, I have listened to the presentation by Dr. Daniel. And he speaks about fix for installation system, such as sprinklers. One of the challenges we have in Jamaica, and I think maybe around the Caribbean is the issue of cost. These devices are very expensive. So, is there something that can be done by the manufacturers of these equipment, in terms of cheaper costs? Because what we see is that persons will cut corners in not installing equipment that we know will prevent fires. So, the question is, how can we make these a little bit cheaper for persons, countries like developing states, so we can afford to have these installed in rise buildings and so on?

Michelle Royal 53:39

Excellent point. Thank you. The delegate from Cyprus.

Cyprus 53:44

Yes, thank you. I want to mention something that happened in my country about the arson fires. Nowadays, they use new methods to cause a fire. And when the firefighters arrive in the place they are, they don't know what to meet there and the fire expands quickly. And also, they use stops that were dangerous. So, it's something that we have to deal with it. And that's why in Cyprus, we start the training for the new hires, three years academy to be sure that they know everything about fires and what they are going to face in the future.

Michelle Royal 54:36

Thank you very much. Excellent. I know that the US Fire Administration yesterday had a webinar on fire as a threat directed at houses of worship. I think that's definitely an issue that is going to be increasing an emerging threat. And I am glad you brought it up. Thank you so much. The delegate from UAE

United Arab Emirates 54:56

Thank you regarding the home fires. I'd like to share our UAE experience. In our statistic 60% of the fires are home fires. So, we launched a system. And it's for homes, it's called [Arabic word] in Arabic, which is protection, and this is meant for the smoke detectors. So, the homes are protected by smoke detectors. And these smoke detectors are connected with a chip, which is like a communication chip with our own company and it is connected to the fire stations so if there is a fire at home and people are sleeping, we will get the signal at the fire station that there is a fire. So, we can respond even the owner of the home is not at home or maybe he is on vacation or for some other reason.

Also, the system is so smart. So, if there is a low battery in the smoke detector, and we know that this is one of the common problems, that people do not change the batteries at the right time or some sometimes they tamper the smoke detector's techniques that they use. So, it will give us a signal that somebody has tampered with the system, or somebody has removed the system or there is a problem with the battery or there is a problem with that smoke detector itself. So, we get these kinds of signals and information so we will talk to the owner of the home. And usually, it is like we've done this project with one of the of our communication companies, so they will take care of the system including the maintenance. So, they pay an amount, which is like an annual amount. And this is including also the maintenance of the system. So, this is one of the practices that I would like to share with a resource.

Michelle Royal 57:51

That is so interesting: fire detectors as an IoT sensor, providing more information to the fire service. That's fabulous. I believe that the delegate from New Zealand would like to speak

New Zealand 58:05

I think we're always going to be challenged by the speed of fire versus the speed of response. And we're not going to build fire stations on the corner of every street. So that's always going to be a challenge. And when I look at the strengthening we've done across the building codes and the challenge with builders and cheaper costs around being as compliant as they can without spending the least amount of money as they can—and you know, that's going to be a constant challenge.

But one of the things that we're really finding difficult at the moment is more about older building stock and the change of use. So, buildings have been designed for a particular purpose. Unbeknown to us, the practice of the occupants has to be changed the use of the building, which puts a quite a considerable risk than it was originally engineered for. So, you know, that's an ongoing challenge in the people behavior within buildings, and overcrowding. There's a multitude of different ways that people are living and using buildings in the way they were designed. So, it would be quite good to think about what that means for us alongside construction of buildings, and the time they go through structured construction until they're fully engineered. Thank you.

Michelle Royal 59:20

Excellent. Thank you. I believe the delegate from Fiji would like to speak.

Fiji 59:27

Thank you very much for the wonderful and educational presentation, to both presenters. And through you chair please allow me to share with the forum, what we are going through in Fiji and some of the things that we are actually doing to try and reduce the number of unwanted fires in Fiji.

On an annual average, we have about 147 structure fires around the world and on average and we also have 166 small fires meaning they were able to save 166 home fires the minimal minimum damage 1079 grass, and rubbish fire that also spill over to a residential building and 68 vehicle fires and on average of two ship and boat fires, and an annual average of one or more vehicle fires. We have about in terms of fatality, five to six fatality on an annual basis.

And when we look at the structural fires as I have alluded to earlier in the morning, the industrial and commercial fires is that control minimum residential fires on an increased trend and still rated higher, around 89% of the total structural fires. In the last five years, an average of one out of the five homes lost to fires, and around 640 people displaced every year. An average of 14 commercial business and three industrial complexes lost to fires every year. And we thought that strengthened the fire safety and legislation made will make a difference in terms of the studies that are present in terms of the cause of fires in Fiji. The highest causes of fire in Fiji is electrical, and out of the 21 causes of fire 31% of that is from electrical second to that is the acid and suspicious and there are two that is unattended cooking.

In terms of cost, we lost millions and millions of dollars in annual base. In our country, smallest Fiji, we have about $18.2 million lost in terms of for residential property. When we compare that to tropical cyclone, tropical Winston, which was a category five, which reads a category five will last 2.9 2.98 billions of loss.

The challenge is there with the substandard electrical components that are flooding the Fiji market. And another challenge that we that we are currently face here is the fire safety laws only apply inside the fire boundaries and it's limited to enforcement within the fire boundaries.

Michelle Royal 1:03:19

Thank you so very much. I believe the delegate from the United Nations would like to speak.

United Nations 1:03:25

Thank you very much to the panelists for the excellent presentations. It was very interesting to hear about the decisions for process. So just maybe a suggestion, have a role about that and be interested to build

the capacities of the firefighters and the professional actors to take the right decision. To me it correlates a lot with the perception of risk, with information about risk, and with the education about these risks.

And what is interesting is that the exact same parameters apply also to the entire populations and communities facing this risk. So maybe to some extent, the Community of Practice can extend a bit the discussion about how also to improve the perception of risk, the education and secure of risk that is being given to the population for taking the right decisions, even before the professional actors may come and help them.

Michelle Royal 1:04:24Also, regarding the

Excellent, thank you. I like how you mentioned at the education of risk: what I wanted to point out is how much these different Communities of Practice really are connected to each other.

We talked about the training Community of Practice and a lot of what we're talking about here is really related to that training. The delegate from the Republic of Korea, please.

Korea 1:04:51

Last time in Korea, [inaudible] was appointed as an advisory member of the Science and Technology Goku Future Vision Committee. I would also like to thank him here and ask for more resources in the future.

I'd like to say let's think about the high-rise apartment topic, a high-rise building, and the appointed representatives of the residents there. In the past, Korea actively announced that in order to reduce human casualties in the event of a fire, evacuate the fire first. Because of doing that, the staircase room became contaminated during the evacuation process due to the game, and human casualties occurred as a result.

For example, when people on the 13th floor were evacuated to the rooftop, for example, the game was polluted in the staircase room during the game, and a life meeting occurred because of that, so how do you look at it? Living in that trust blocks the game, and living in trust is safer, and even though people on the 13th floor were evacuated to the rooftop, for example. Recently, people's damage has occurred because it's an evacuation issue, and let's look far and evacuate.

So, for example, the emphasis is now on the area where residents determine whether they should evacuate on their own or whether they should live in trust.

This part is not only in Korea, but also in other countries. I gave my opinion because I was wondering if it would help us prevent human casualties in dealing with topics like this. Thank you.

Michelle Royal 1:07:52

And I'm really glad you were able to bring up the topic of human decision making and whether to evacuate or not evacuate. I know that's a topic that's being raised in many large cities in the United States right now. I believe the delegates from Denmark would like to speak.

Denmark 1:08:21

In Denmark, we have started to build much more in wood, as opposed to before where we build in concrete and bricks. We do it to reduce our carbon footprint. We are now building wooden buildings where the load bearing structures are also made of wood. This is a new challenge for us. And we have examples of wooden story constructions up to nine floors or even higher. This requires or will require us new procedures for the fire brigades to handle and tackle fires in these constructions. Thank you.

Michelle Royal 1:09:00

Thank you so much. On the topic of mass timber and how it's used high rise buildings, I think that will definitely be an emerging threat that we have to deal with in the future. The delegates from Australia, please.

Australia 1:09:15

Thank you, thanks to both the panelists for their presentation. So informative. Thank you very much in relation to the Community of Practice for firefighting. We would like to see the inclusion of community preparedness programs and education programs to ensure that there have been some significant inroads made in certain countries around the world in terms of the education of people in structures and how they should react in in case of fire, and in many cases prevent fire from occurring in their home in the first place.

And the opportunity it would seem to me in the Community of Practice to be able to share that occur loss are all the countries that are involved would be too good to miss. Thank you.

Michelle Royal 1:10:04

Excellent. Thank you so much. The delegate from Estonia,

Estonia 1:10:10

Thank you for very good presentations. Based on the fire statistics, by CTIF, Estonia is probably one of the most dangerous places where to live, or where to die. Because of fires annually, we have 1 million people, approximately 35 deaths, and the main cause of it is smoking indoors with the consumption of alcohol use. And what the new topic I will give here is years ago, we awaited the new standard of reduced ignition propensity, cigarettes. And what we found out that, although we do have that standard in Europe, it has, it hasn't reduced any fire fatalities, because the standard is maybe working only in some places, and maybe only during testing in industry. But in real life, it doesn't have any good impact. So, I suggest that we, we could press more on this topic also to reduce the number of fatalities. Thank you.

Michelle Royal 1:11:41

That's a very interesting point. Thank you so much. The delegate from South Africa.

South Africa 1:11:49

Thank you, very interesting presentations and well done. Again, my challenge pertains to the informal environment, shantytowns as they are also known, where your initial attack is normally compromised, in terms of response and water supplies. So, it's not, it's a unit trust factors that can be relied on. Apart from the unit, the engineering and enforcement aspects, that is not possible.

I would just like to basically, look at other alternatives in terms of integrating other resources into the tactics and strategy. For example, aerial firefighting, aerial resources, which could potentially be utilized are nowadays very little research in terms of aerial resource deployment on informal settlement for us. So that is certainly a topic that is of interest to me.

And regarding one of the colleagues mentioned, smoke alarms— we did some extensive research in the use of smoke alarms in the informal settlement environment, where we had a challenge also with batteries, and also with insect infestations into the actual alarm system. So, there's a lot of research and solutions that were actually developed as a result of that research, which is available. Thank you.

Michelle Royal 1:13:04

Thank you so much. The delegate from Luxembourg, please.

Luxembourg 1:13:11

Thank you. My Intervention joins intervention from colleague from Denmark. In fact, the problem we encountered over the last few years, with structural fires where we had the most problems to extinguish were, indeed, fires that involve new materials, new construction materials, and also installation materials. With fires where the firefighters sorted, the fire was extinguished, but somewhere beneath it was still

running. And some hours later, the fire started again, with more problem than before it started— being sure that fire was extinguished, and sometimes explained to the homeowners that we might have to tear down part of the house to find out if the fire is really extinguished.

So, I really think that our problems that we have to face for the coming years, and it had been discussed that tackling the questions through the construction codes is one way to do it. But I think you also have to see our procedures and our tactics and see in how far our tactics still apply for the fires—today's fires. It is not because we have done it like that, that it's still the most effective way to do it for the future. And also, maybe, look if our equipment that we use are still the most adapted for this new fire. So, my suggestion for the Community of Practice is also to question our practice and tactics. Thank you.

Michelle Royal 1:14:53

That's an excellent suggestion. Thank you so much. The delegate from Taiwan.

Taiwan 1:14:59

Yes. Thank you. For your presentation, in Taiwan, we suffer [inaudible] residential fire. So, the fire test rates is the highest one. [Inaudible] So, our government will try to subsidize for the insulation and the other hand is for the industrial fire and also for the way of house fire is a cause as a heavy damage. So, we try to install that larger value sprinkle, the best one as we are concerned about the ESG Environmental Assistance Governments and also water use units. Yeah, we work with the insurance company. So is the issue we are trying to do that [inaudible] industrial fire and also for the warehouse fire. Thank you.

Michelle Royal 1:16:06

Excellent, thank you so much. The delegate from Japan.

Japan 1:16:11

Thank you very much, good presentation. I'm really interested in then regarding the structural fire and firefighter response, and the capacity building of [inaudible] firefighter, it is essential that you refer to and then in Japan, we have seen the number of the structural fire so the they're [inaudible] in the past 10 years. However, that means is the firefighter losing the opportunity to get involved in the actual the fire incidents that went, is little chance for them to get data involved in the experience of the firefighting in the actual scene. This is data we have facing these kinds of data program. And indeed, we have data introduced these [inaudible] system, advanced firefighting data training system [inaudible]. This is the paradox aspects in our country. So, which [inaudible] share with you or take advantage?

Michelle Royal 1:17:22

Thank you very much. The delegate from the United Kingdom.

Mark Hardingham 1:17:29

I think on a debate about structural fires, for me not to remark on the cusp from the UK about to receive the most substantial report into a failure in the Fire and Rescue Service in the UK on the back of the 72 people who lost their lives, or Grenfell tower, would be slightly remiss.

So, there's a couple of observations and then a question to Dan and sorry, Sabrina as well. I was particularly struck by the colleague from the Republic of Korea, who raised the issue about what we in the UK called the "stay put policy," and the inevitable debate and recommendations that will come out in the Grenfell report about the concept of stay put. And we've seen some of that in the recent Valencia fire as well, of course.

So, I think there's an opportunity in the Community of Practice, to open up those sorts of conversations. As we look to be tasked through the recommendations with coming up with a revised statement policy in the UK. Equally, I would welcome the opportunity of the Communities of Practice, being a forum through which we can share, and also for people to speak about significant reports. And that might be

a Grenfell type report. It might be a report following the death of a firefighter or firefighters, it might be the report following a fire of a particular unusual nature in the structure of a building, but equally and it's difficult to prove a positive or prove or disprove a negative sometimes the opportunity to share reports about success, where firefighting tactics or a nature of a building construction had prevented something that could have got worse.

And then my last point is a question. And the question is about the use of training and development. And it's about the use of technology in training and development in relation to both firefighting tactics and also decision making, because there are significant benefits in the reach of the use of technology, particularly when we talk about a volunteer workforce and increasingly disparate workforce. But I think my question to the panel is accepting that is a benefit. Does the panel think there is a benefit in the quality of the training that can be provided on both firefighting tactics and decision making through different types of technology as compared to the traditional practical training environment?

Michelle Royal 1:19:54

Thanks. Excellent. I'm going to have Dan answer first and then Sabrina.

Daniel Madrzykowski 1:20:00

So certainly, sets and reps are a good thing. And I believe that there's data that shows for students or others, if they've done something virtually, and then did it with their hands on that they had a better opportunity to be successful when they're doing it that one time with the hands on. So, I think there are a lot of opportunities for virtual training or simulation training, to certainly add to the training.

But we can't forget that firefighting is a very physical job. And it is a team activity. So, at the end of the day, the firefighters need to get out there and really do move the hose lines, work in the dark, communicate with each other, coordinate their activities, whether it's ventilation, or suppression, or search. And that's how you really develop that successful team. And now I'll turn it over to the expert.

Sabrina Cohen-Hatton 1:20:58

We actually published a paper on this back in 2015. We looked at the decision-making processes in highly simulated environments using virtual reality, first and foremost, and then copied exactly the same scenario onto the training ground. And then the third scenario that we tried was, we took buildings that were due for demolition, and don't ask me how, but somehow, I managed to convince them to allow us to set fire to them. And that meant that we could have as realistic a training environment as we possibly could, it was essentially a real house fire. And we compared the decision processes across the three environments. And we found that actually, they were incredibly similar across all three environments.

So those highly simulated virtual reality training environments are really good ways of practicing and getting the additional practice that you need with a very low resource. Now, as Dan says, there are elements of those kinds of highly simulated training environments that can't replicate the activity that you get on a fire ground. So, it is important, I must stress to have a combination of all of these things. But as part of a package of training that provides you with the ability to do lots of scenarios very quickly without very much resource, it is an incredibly effective way to adopt technology into your training program.

Michelle Royal 1:22:28

Perfect, thank you so much. I would like to read that article. And thank you, Mark, I think you may have brought up the one topic of after action reports and lessons learned. All right, the delegate from Pakistan, please.

Pakistan 1:22:47

Yes, thank you very much. So, this is a very wonderful discussion going on. Regarding what we have discussed on the building codes and the decision making or the materials being used for the construction of structures, I would just like to touch upon a couple of things.

First is that in Pakistan, just want to share the experience that at federal level, we prepare, we facilitate preparation of the building codes. But again, the implementation of these building codes is the responsibility at a local level. So, our provincial governments have now enabled the emergency services department, so that they can carry out the inspection of those buildings, and to even to seal those buildings which do not have such facilities for firefighting.

Secondly, the point I want to raise is in developing countries like Pakistan, we are facing some economic challenges as well. So, the households and the commercial and industrial people who are doing that, regarding the electric using of electric wires, and generally the in the households, the extensions that we use for the laptops and computers, all that those are substandard are not up to the mark. Can there be international regulations so that no substandard material can be produced or manufactured across the globe? This is basically a suggestion.

Michelle Royal 1:24:04

Excellent suggestion. Thank you so much, since that's something we've heard from so many of the different member nations about—so I appreciate that. The delegate from France.

France 1:24:16

I want to speak about decision making and the problem of the time to make a decision. As you said, when we make a decision, it's very important to be trained. And as you said, also a visual training is very important because we can have a rapid analysis and then when you go on an accident, you don't discover something, but the timing is important also, for our team when you achieve the team is waiting for a decision.

And we didn't know, we'd never know how long we have time not to create the doubt into the mind of our team. And its workforce is very important. Because you need a chief. [Inaudible] And for me, it's very important to some time to after to be about decision making. It's also to the way we are conducting the operation, and for me is what we're seeing in France.

It's one decision we go on this second decision and it's the way we are conducting the operation which is very important because —especially for the forest fire—a people standing and waiting too long. They will never fight the fire because the site or it's not important where you don't do a fight.

Michelle Royal 1:26:37

Excellent. Thank you so much. The delegate from Ecuador.

Ecuador 1:26:44

Good afternoon. Ecuador is an extraordinary country that has always had natural problems such as volcanoes, floods, earthquakes, landslides, mountains that are falling apart and firefighters have been used to working on that. But today we have a new factor that in the last three years has really complicated the country's firefighters, which is the war between gangs and drug trafficking.

This issue that has forced us paramedics, firefighters who handle practically one hundred percent of the country's medical emergencies to think about going to work with bulletproof vests and ballistic helmets,

We have to get to the places to pick up the allies, where you suddenly find fifteen dead, thirty injured and you come to pick them up and you have to wait for the police, if they arrive, to secure the area and for the firefighters to enter. This is a topic that we didn't have before.

In addition, we come to the fires and the fires are houses that are burning of drug trafficking because they haven't paid for the drugs because the money has been stolen and it's up to us to deal with those types of fires as well.

And finally, something that has happened to us in the last three years, which is the riots in prisons, where firefighters have to come in and get rid of the dead. One afternoon we had 150 dead in a prison in the city of Guayaquil and that happened to us: both the physical effort of getting people out and the

psychological issue which we have had to work with our staff. Now we firefighters in Ecuador have to work with it every day and it has become very difficult for us. Thank you.

Michelle Royal 1:28:49

Thank you so much. Are you suggesting the Community of Practice then look at the development of tactics or guidance for dealing with those types of incidents?

Ecuador 1:29:01

Yes, for example, for the car bomb incidents, we had to change the procedure, because we parked the truck twenty-five meters. We put it on its side and work with the monitor in such a way that the firefighters do not get down to work directly.

The same applies to the fires that we arrived and that have been caused. We have to enter very carefully so as not to find the gas tanks for domestic use stuck in the houses because we have had to arrive at the houses with the gas tanks flying and the same if it's not a car bomb with a real bomb, it's a car in which five cylinders of gas have been put inside to explode.

We also need to change all procedures and we have been doing it little by little.

Michelle Royal 1:29:52

Thank you so much. The delegate from Germany.

Germany 1:30:00

Following the report from Ecuador, it is almost difficult for me to now go back to the minor problems we have in Germany

Germany has very, very strict building regulations, we attach great importance to preventive fire protection. Really critical situations are actually very rare in Germany.

The problem, however, is that construction in Germany is becoming more and more expensive, becoming ever more lengthy. Buildings won't be finished—the Berlin airport may be familiar to many, it took many years to build this airport, fire protection was becoming more and more important, so, there was no progress.

In Germany, we now have the situation that there are parties and countries that are trying to reduce

fire protection so that construction can be done faster and can be built more cheaply, because we urgently need more living space in Germany due to the large flows of refugees. We have to put people somewhere, and now they're starting to dismantle that. That is the problem Germany has.

But I would also like to comment on the presentation From England, the guided tour. We see it in a similar way to France. It is important that a decision must be made. An operations manager doesn't have much time to decide. He must decide.

That's the most important thing for now, but we've also realized that the decisions aren't always the right ones, of course. I find this approach from England extremely interesting, and we would very, very much like to exchange ideas, because there are similar efforts in Germany, too, how to better train managers, turn around more so that decisions are made correctly I found that extremely interesting and we will certainly reach out to the English comrades That was a great, great presentation for us thank you very much.

Michelle Royal 1:32:00

Thank you very much. I'm glad you brought up the tradeoff between affordable housing and new materials trying to make sure that that's available but yet making sure it's safe for everybody as it's being built. The delegate from Austria, please.

Austria 1:32:21

Thank you. Much of what Germany has discussed also affects us in Austria regarding the regulations. We have very strict standards but there is also a clear trend that construction must become cheaper and here, for example, fire protection is also a critical development as a price driver

But preventive fire protection must not be backed up, because defensive fire protection cannot compensate for preventive fire protection. But we must also be prepared for this, which means that in training tactics

perhaps one aspect also from Austria we only have six professional fire brigades in the whole of Austria; the remaining fire brigades we have in Austria are voluntary, which means that an operations manager jumps out of bed, comes from work, from wherever. This is no longer a trivial matter, it is a stressful situation.

And before that the presentation was excellent, because there is really a very special requirement profile here too, but also a major challenge for the future to actually find operational managers for the future, perhaps one or the other aspect from our point of view in Austria we have around, so far, up to 66,000 fire operations by Austrian fire brigades, from small fires to larger fires, the majority are smaller fires, because we have been in nationwide fires that can cover very, very well.

We have a fire department in every municipality at least once, but we would like to focus on this in particular: prevention and awareness raising We have also launched an educational initiative Safe Fire Brigade together so that cannot allow fires to start at all or at least handle the handling of a fire extinguisher correctly and much more about a home, smoke detectors and much more,

For living space in the forest wherever, that you behave correctly, we also want to put special. And a 2nd aspect that definitely becoming more and more common among us: the problem of carbon monoxide poisoning is also a very big issue due to different behavior. For us, that is to say a lot, we focus on prevention.

Michelle Royal 1:35:12

Thank you so much. I'm so pleased that you brought up the topic of volunteer firefighters and the need for those and how prevalent they are making sure we're including those, as well as the topic of incident command training, making sure that we have those leaders.

I know that we had comments waiting from the Netherlands, the Philippines, from the delegates from Portugal. And I believe from Chile. I'd like to remind you of the white cards that are in front of you. If the delegates from these nations or others involved here would like to add additional comments to this discussion, or suggestions for the Community of Practice, please, please use the white card that was provided to you and add those your thoughts there. Thank you so very much, I will turn it back to the Chair.

Dr. Lori Moore-Merrell 1:36:06

Thank you very much. Thank you, everyone for that engagement. That was an incredible discussion. And I think we could have spent the rest of the afternoon on fire. And your contributions are amazing to me, I have taken a full page of notes, in addition to all of our team is taking notes on everything you're saying.

One of the things that I particularly noted is the officer decision making training, that really became apparent. I think that rose, certainly for me—also, the firefighter security that Ecuador brought up. Yes, very stunning testimony from them. And then something that I heard: population migration. I think movement of people are likely challenges to your fire challenge as well. So, incredible discussion.

So, thank you very much to our, our panel. And to our facilitator. We're very grateful for you. I just want to reiterate those who did not get to speak your voice, we still want to hear it. Please write your note on the card in the space that's provided. That's why you have so many cards so that you can write as much

as you wish. We are going to gather those to make sure that we capture so that your voice is also heard in every discussion. With that, we're going to take about a 20-minute break. And just before 1500 hours, we'll stand in recess for a short break. Thank you to our panel.

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Dr. Lori Moore-Merrell 00:06

We'll call our Congress back in session.

You know, today—throughout, certainly, the United States and globally—climate change, and climate change driven wildfires are growing in intensity, size, and destructiveness. And our land area that we described, even in the United States is our wildland urban interface where human development meets or intermingles with vegetation, or vegetative lands. These are both fire dependent and fire prone in many of our areas.

Across the US, we are unfortunately building toward a lot of risk. And we are building communities, as many of you have noted in your nations not with building codes that are appropriate for that land, particularly it's fire prone. And so, as climate change, heat, extreme heat, drought become more and more of an issue. As we see, again, the climate change driven severe storms, the rise in sea level, and we can go on and on—these challenges become more and more apparent. For us. We saw this firsthand in the United States in August last year, when a wildfire not a wildland fire, not vegetation burning, but structured a structure fire spread, and what we have termed a suburban conflagration that occurred on the island of Maui in Hawaii, and a town called Lahaina, and we saw a wildfire that resulted in over 100 people being killed as they tried to evacuate.

Today with us in this room, I simply want to recognize the fire chief of Maui County, who is here today to listen to be present and to hear what you have to say about climate change because he has experienced it firsthand. Chief Brad Ventura, would you please stand? Thank you, Chief, for being here today.

At this time, I'd like to bring up the facilitators and the speakers of this next session. Our facilitator is Miss Emily Saulsgiver of the US Department of Homeland Security, Science and Technology. Our speakers are Dr. Gavin Horne from the US, Chief Derek Alkonis from the US, Dr. Major Essa Ahmed Al Mutawa from the UAE, Dr. Christoph Weltecke from Germany, and our Fire Chief Louie S. Puracan from the Philippines. Please welcome our facilitator and speakers to the stage.

Emily Saulsgiver 02:59

Thank you, and welcome to the second session. We will be focused on the effects of climate change and the impacts, therein we are also the largest panel. I welcome you all.

And as Dr. Lori Moore-Merrell mentioned, I am from the Science and Technology Directorate. So, I think from a parameter of science, I'd like to challenge the group to think with me through the scientific method. And as we go through this next conversation, the panelists here are representative of multiple nations and they will be sharing their observations and learnings from events across their countries. We will then hopefully inspire a wrote a rigorous conversation amongst the delegates so that we can hypothesize where the Community of Practice can go, when we're thinking about the effects of climate change.

When we're thinking through not only the events, how big and broad and massive, but the frequency at which they're coming, we're also going to be talking about how that affects our communities, how that affects our emergency management personnel, but also how that also affects the climate itself. Things are burning, and it's affecting the ozone. So, we'll be talking about advanced computational methods and other methods for understanding that threat, communicating it back to our community members, and then where to go forward from there. With that, I will turn it over to Dr. Horn.

Gavin Horn 05:20

So, what you've just seen and heard, is the experiences that our firefighters have, when responding to fires to wildfires as they're encroaching on our communities. And as climate change impacts our communities, making them hotter and drier and weather, and more windy. If this is not in your environment, and not in your response area, it will be sometime soon.

This is a fire that happened in Southern California and the Southwest of the United States. But it's similar and repeated throughout the United States and across the country.

Another example I want to share moving just north from the Woolsey fire was the Tubbs fire. In Northern California. You've probably seen pictures like this, that had the outline on a map of the extent of the wildfires, this one was a little over 36,000 acres. But I want you to also look at those dots that are on that map. Those are the structures that are damaged and mostly destroyed. Over 5500 structures and notice are not uniformly distributed within this map. They're located in very specific areas, such as you see in the bottom, a neighborhood called Coffee Park. And as we zoom in on this area, what you can see is how densely packed the structures are in this area as the wildfire encroaches into this urban interface, and look even closer, we can see these homes in the spacing 10s of feet between each within the trees.

And unfortunately, the damage afterwards the destruction of the homes of the vehicles, but also know that the trees are still standing green with leaves in those front yards and rear yards, indicating the importance of understanding structure to structure fire spread. California does not have all of the fires we have in the United States, we can go a little farther east to Colorado, the Marshall fire. When we talk about the change in environment and climate this occurred on December 30. In the mountains of Colorado, you can see the outline, and the dense packing of some of the structures that were damaged in this environment. And you can see the picture before—and then unfortunately after.

Once again, trees still standing well, structures around—but you also look in the very middle of the bottom picture there. There are some structures that survive, in this case on the corner with larger spacing from one structure to the other. You also notice the white on the ground. This is not ash that's left over. A couple of days after, high wind environments gusts over 100 miles an hour as a snowstorm came in and helped put this fire out, not what we traditionally expect in the climates where we have wildland fire.

We need to work with these, we need to understand these fires so that we can help reduce the risk for future communities and for our firefighters. There're multiple challenges but just want to spend a little bit of time talking about four of them, where there's currently ongoing research, and much more research that's needed.

You saw what happens as our firefighters responding to dynamic environments that they have to deal with the lack of breathing air and high temperature events. The personal protective equipment that our firefighters need to respond to these wildfires in urban environments and community confrontations needs dramatic research. When we work in structure fires, the bunker gear, and the self-contained breathing apparatus do a good job on relatively short-term operations. But when these operations start going into days, and weeks, we cannot use that same type of gear effectively.

Yet the wildland gear which you see right here has relatively little thermal protection and almost no respiratory protection. One of the biggest needs we have in the fire service around the world is respiratory protection for this long-term operations. Because this is not a wildland fire, there are risks from vegetation burning, but there are other risks when we get structures and vehicles and commercial and residential and industrial occupancies on fire.

You also heard Chris talk about the balls of fire. He described them as trees as bushes and as structures. There's a great deal of work that's been done in history looking at the structure, the vulnerabilities of the vegetation, particularly looking at the impact of different dryness or the impact of a drier climate. We don't have nearly as much research we look at these structures. What is the impact of a dryer hotter climate in terms of the ignitability when we have structures that are made out of combustible materials, and when we have structures are built so closely together, what about other vulnerabilities, like the windows? They will not burn but they can fail when they have heavy radiant heat loads applied to them. And the different materials that people have in their properties that can act as [inaudible] fuels, like

automobiles, like their decks, like their fences, all of which can contribute to that fire spread. Research is needed to understand what we have now but what also climate change can do to impact those risks in the future.

We go back to the view from the fire SUV, and I'll draw your attention to the streaks of light that are coming overhead in this picture. You also notice these little balls of fire that are grouping together and moving down the road almost like a river flame. These are firebrands sometimes referred to as embers and we know that firebrands can break off of vegetation. They can also break off of structures. And that creation of those embers will depend on the material, but also on the conditions. As we get to a hotter, drier climate, we can have challenges with these being formed.

We also know that these embers can be thrown hundreds 1000s of feet over a mile in some cases. And as we get to windier environments, we can find these firebrands a long distance away that can spot and create fires well ahead of the flame spread to the flame front where the firefighters may be working. We need research to understand how these move, how they transport, and how they can group into piles of firebrands and find a receptive fuel bed. And how does that receptive fuel bed get impacted by climate, especially in terms of dryness and heat?

And the last topic I want to share with you is how do we help the communities to recover and to respond, because eventually, the fires will go out. And eventually, communities will move back in. In some cases, there might be damaged structures like we saw.

In the Marshall fire in the middle there, there'll be many more that are destroyed. And it can take days or weeks for some of those damaged structures to be rehabilitated. It might take years for those that are destroyed. But what we've learned is that the recovery of these communities is not just what we can see above the ground, that damage that can be repaired when we rebuild these structures rebuild the community.

But there's also resilience concerns from the utilities that may be underground. We've seen this multiple times and fires around the US where individuals move back into their communities. Yet the water distribution system is so badly contaminated, even without the source water being contaminated, that they have to use bottled water or transported water for years.

So how can we look ahead of time at all of the different pieces of risk of hazards that are available that are present in our communities as wildfire advances to them? And how can we use that to reduce some of that risk in the front end to make our communities more resilient, and to recover more rapidly? But hopefully, we can also use this research to look at all of these events that have occurred in the past to help prevent some of these damages and from the risks from occurring in the first place.

So, I started off this presentation looking at the Tubbs fire. You recognize this map. Many of you have probably seen this map. It's about five years old now. The Tubbs fire was in 2017. We don't have to go too far back in history to look at the Hamley fire, which occurred in 1964. And if we look at the burn maps between each of those, you can still see a striking similarity. It's not just if wildfire is going to occur. It's when is it going to occur and how is climate change going to impact which communities are impacted by the wildfire in and what time that might occur. So, thank you very much for your attention. I look forward to receiving questions when we get to the end of the panel. And I'd like now to bring up my collaborator, Chief Derek Alkonis.

Derek Alkonis 14:40

Good afternoon I'd first like to applaud everybody for being here and for approaching this important topic of fire safety and understanding suppression opportunities to collaborate. I think it's fantastic. I'm going to speak on the Maui wildfires in our participation there.

And I also like to provide my appreciation to Chief Brad Ventura, who allows us to capture information and data that's so important to understanding the events of the Maui wildfires. Now, let me first give you a description of the state of Hawaii, our 50th state, it's about 2000 miles off the coast of California. The other coast, we're on the East Coast, it's on the West Coast. And it's a route, it's on around the 20th. North latitude

line, sort of near the equator. It's a tropical paradise. It's where many of us go for vacation. It's beautiful.

It was struck with tragedy in August, specifically on August 8, there was not just one wildfire there was for on a small island, about 720 square miles. What's that—about 1800 square kilometers. And at that time, a small county was held to deal with multiple four fires.

And I'm going to speak to, specifically, the Lahaina fire. And we should all have a measure of reverence, obviously, because this fire took the lives 101 people and really challenged everybody on that island. So, we were brought in by the state request, they wanted to do a comprehensive review and analysis of the Maui wildfires. We said well, let's start with Lahaina. Let's really get into the details there. And so, the first task is to prepare a report.

The Phase One report, as you see there is a capturing of the facts. [slide ref] What happened, create a timeline, get the details of not only the response, but also the preparations that went in from not only the fire service, but also the police department. The emergency management agencies both from the county and the state, the electric utility, and others. Phase two report will be an analysis. And this will come later. In fact, the Phase One report was just published on the 17th of April. And I'll give you a link later on in the presentation. So, you all can access that.

The second report will be an analysis looking at the facts, analyzing, explaining what went on taking a scientific approach to the preparations and to the response. In the phase three report is going to be a forward-looking report what can be done to prevent perhaps these type of incidents from occurring, especially in the state of Hawaii, but also in other areas as well, because we can all learn from these experiences.

So, the first task was ensuring that we had adequate data to really understand what went on prior to the event on August 8, leading up to it, and also during the suppression activities. So, when that we collected just like many of you do during an after action report, you get all the facts, collecting the radio communications, the computer aided dispatch information, capturing information from any folks maybe that were there any imagery, all of that isn't really important. We were there very early on, which is that the incident happened on the eighth. We were there just probably around August 20 or so. And we were on site for several months, collecting as much data as we possibly could.

We also engaged in technical discussions with all of the firefighters that responded to the hyena, the chief officers, elected officials, emergency managers, and we spent a lot of time combing the community and speaking with the residents to capture their experiences. The incident resulted in the evacuation of about 12,000 people. So, there was many people that had experiences that we wanted to ensure that we captured and understood we also provided a document that for all of the residents in 10 different languages.

The area of Lahaina, which consists of about 12,000 people, has folks from many different countries, and they speak 10 different languages. So, in order for us to gather that information, we reached out to them in their language. So, this right here is a series of three pictures, the one on the left was taken from Google Earth, a Street View in 2019. So, you can see on the far right in the cutout, you can see where that's taken from in the point of view. So, we're looking southwest there, down behind Aluna road, and you can see what type of construction you had on the left.

And then the very next image was one hour before the fire. Now, this is important, because just before they had the fire, and what created a lot of these conditions, is Hurricane Dora that spun off the coast of the state of Hawaii, several 100 miles it missed it. And it's not often that they get a direct hit from a hurricane in that state, even though it's in the tropical area. But nonetheless, this one missed it. But it created a pressure differential, where you had very high winds coming across the state, and racing toward the leeward areas, exposing those leeward areas to extreme winds.

As you can see there, it ripped the tops of roofs off, it toppled 29 utility poles, it blocked egress routes, it made a mess. And this was before the fire. So, during the fire, it started at 255. This one did. And they already had two fires before this going on the island. And you can see through the dots that are

appearing, where it started and where it progressed to. And it raised about just over a mile about two kilometers to the ocean in about an hour. And it spread very, very rapidly.

Our study starts with the point of ignition, and goes to the morning of the night, because the fire had pretty much made its run in that time period, very rapid, destroying about 2400 structures in its path. This data is important because from learning how, where the fires started in each area and understanding the fires progression, we can analyze the in some cases, the resilience to the fire with some structures, and others understanding why some areas burned. And so, we're taking each area in detail and looking at putting potentially finding what heat transfer method contributed most to that structure failure.

Was it direct flame contact? Was it radiation? Was it due to an ember cast? So finally, we have a report of the facts: a 375-page report that you can access using that QR code.

There's also a timeline of events that starts before the incident, the preparation work that was being done before that storm arrived off the coast and created those high wind conditions. And then also takes you through suppression through that next morning. There's 12,000 lines of data in that short period of time. It shows you how much, how many things were happening during that short period of time that needed to be processed by emergency responders. incredible amount of input to them, their stimuli reacting to conditions making decisions.

Now, why are we doing this? Because the understand conflagrations of this magnitude, even in this area that we live in this in these conditions where we understand many things, but fire is it rips through a community and takes out 2400 100 homes, causing the evacuation of 12,000 people causing 101 people to lose their lives. We still don't know enough. So, thank you, and I'm going to move to the next presenter.

Dr. Major Essa Ahmed Al Mutawa 25:12

Ladies and gentlemen, I stand here today before you tremendously excited, fond, profoundly honored to share with you a revolutionary concept that has the potential to alter our approach toward global environmental challenges. Today, I am going to share multiple initiatives that we have started, then I will explain how those initiatives could support the efforts of combating the climate change.

I will start with the [inaudible] Dubai civil defense readiness. We began by joining program training and prestigious universities such as El Penna, and these universities, they taught us how to combine between emotional intelligence and artificial intelligence. And they gave us examples about the biggest or [inaudible], and how those companies have maps, which they can see the whole country's using their software, and based on the data gathered from each country, the AI will analyze the data, then they will market it, then they will launch their marketing campaign targeting each countries with the society's need.

We add Dubai civil defense to acts similar strategy, but with a different goal. Our goal is to minimize fire incident. So, we have gathered five years' historical data related to fire incident, then we have this dashboard, we can see the critical KPIs in terms of our organization, such as time responding the most causes of fire, the most facilities under fire death, deaths and casualties.

And what we have learned as much as we gather data as much as the result from the AI will be more efficient. And Dubai, we always had a challenge. In terms of awarenesses, we have more than 7 million people living in Dubai. And to compare this number with the employee in Dubai civil defense, there is a very huge gap. So, to aware all these of people it will take years and years. And those 7 million people came with 200 different languages. So that will add more years and years to overcome.

But thanks to AI, and to our stakeholders, today we can see Dubai heat map categorized based on the number of fire incident, we can understand each area who's living in that area, the causes of failure, and the most nationality and that area. And based on that we can provide the best method and how we can become aware of them to prevent this kind of fire incident to occur in the future. So, for example, we have our officers here can speak in any languages we want. We have more than 180 languages. Our officers can speak using AI tools such as [inaudible] or more than 185 languages.

And today, thanks to the communication network department, we can send millions of messages

targeting each area with the causes of fire and the people living in that area are getting the most behavior which always lead to the fire incident simply what we used to do and years to deal with AI we can do the same.

And the second initiatives, it is the eco readiness. And it began when United Arab Emirates hosted COP 28. We thought, we want to leave a footprint and beautifying our planet how we are going to do that—we need to answer to question how, why and we conducted thorough academic research and the finding was that unexpected 21% of the pollution are attributable from fire incident and that's double the pollution caused by car.

So, it is very critical, and we need to bring all the attention from our own leaders around the globe here and this heat map we can see different continents countries, how much it contributes, affects the ozone layer, how much it's affecting the air quality animal living on land and the economic damages. As much as we gather data, as much as we can understand each region, the opportunities, the threats, and we can provide the best solution.

Finally, I am going to the UAE civil defense trial, UAE civil defense readiness we started as a city—now we transfer this platform to a full country. Integrated to each other, we can see historical data relate to fire incident, where there are houses, people living in that area, and so on. And the idea here is that we can bring this application for the whole globe, I believe this application is like a vehicle but without fuel.

Each one of you have the right fuel the valuable data so we can switch on our application to go forward to more sustainable, safer future. For us, for our children, and our children's children. I believe that the call of the US Fire Administration is simple, yet impactful: let us unite and let us do so before we reach a point of no return. Thank you very much.

Dr. Christoph Weltecke 31:34

Comrades, ladies and gentlemen, I'm here today as a representative of the German fire departments to report of one of the most severe natural disasters in recent German history, the devastating flood disaster in our valley in '21. This event not only deeply affected our communities, but also highlighted how vulnerable even a country like Germany can be when it comes to extreme natural events.

The floods resulted in extensional destruction, entire villages were flooded, infrastructure was destroyed. 196 people lost their lives and countless lives were changed. Firefighters were on the front lines, battling against the floodwaters, rescuing people and the animals and experiencing personal and collective tragedies. The experiences of this catastrophe have put our deployments, tragedies, equipment, and most importantly our understanding of community and resilient to severe test. It is my intention to share these insights here that together we will be able to better prepare for future challenges.

Germany is considered relatively safe from natural disasters on a global scale. We do not have major earthquakes or storms. Some of the most notable events in recent history includes a storm surge in Hamburg 9060 to the heatwave in 2003. The floods of 2003 and 2012, which affected large areas, but fortunately did not cause many fatalities.

Germany is characterized by a complex Risk Management System. Civil defense against wartime scenarios are regulated by the federal government, while the responsibility for natural hazards lies within 16 federal states. Unlike many other countries, Germany heavily relies on the involvement of volunteers. In total, more than 2 million people are active in various volunteer services.

The largest organization by far is the fire department. And almost 98% of the firefighters are serving in volunteer fire departments. So, they all work regular jobs on a day-to-day basis in case of a fire or emergency, they leave their workplace, drive to the fire station, get changed and rushed to the operation side. It all has to happen in about 10 minutes after someone called 911. In Germany, it's a 112. And even they are willing to—yes, they are all professional trained firefighters. So, we subpopulation approximately 83 million people. This corresponds to a ratio of about one firefighter to 64 inhabitants. This underscores strong community participation and engagement and fire protection and emergency

systems in our country.

The flood disaster in the valley was triggered by a low-pressure zone with a harmless name called bat. But as harmless as the low-pressure zone was named, they actually went far exceeded predictions. On Wednesday, July the fourteenth, the national alerting of emergency services began around noon, due to individual storm related incidents, primarily fallen trees, but the situation escalated quickly. And by 7pm, the last rescues were carried out at 7:30. Blackouts begin gradually, and from 8pm digital radio communication could only be used in emergency mode.

The mobile network phone broke down due to the heavy rainfall locally, led to precipitation among up to 250 millimeters per day, resulting in devastating floods with 196 fatalities. This was a deadliest water related disaster in Germany in 60 years. The damage is estimated at about 33 billion euros.

But the harm the tragedy cause to people's lives cannot put the numbers. The images you see speak for themself. Experts believe it could take up to a decade to repair all damages and restore infrastructure to full functionality. However, alongside damage repair, it is also important to draw the right lessons for disaster prevention.

It's essential that we develop an advanced risk culture, a general awareness of risk and prevention option is often insufficient among the population. We must move away from [inaudible] insurance; instead, promote more intensive individual preparation strategies. But also, the communication with the population needs to change.

We need to format especially in warning to reach all population groups, particularly vulnerable groups, and are understandable for them. There is also a point in crisis management that we need to discuss. How do we proceed when our firefighters and leaders are affected themselves? Does our current federal system work the way it should be? Is it prepared for a situation like the floods where several states are affected? How do we make sure that communication, as one of the most important tools in such a large operation, function even in case of power outages and overload and our resources, especially the fire vehicles, sufficiently equipped technically for the new threat scenario like this?

And last but not least, how do we involve the people who are not active members and existing aid organizations but want to contribute temporarily in such events? We've seen a lot of activism and support from all over Germany, people who want to help engage and contribute. But we're really hard to be organized efficiently, this question and align the urgent need for better management and improve information exchange. The expansion of population warning through cell broadcasting and modern sirens as well as a national resilience platform are the first milestones that have been implemented.

But the journey just begun, we will continue to work on this. Furthermore, we face a challenge to respond appropriately to the increasing and prolonged phenomenon of draught and forest fires, who often follows the floods. Scientific support and international exchange are indispensable, Germany's therefore actively involved in regional European and International Association. I would like to mention the Global Fire monitoring center, for example, which is currently being expanded to Global Fire Management hub, which is in support of the United Nations.

Ladies and gentlemen, comrades: Despite all preparations, we cannot overlook the fact that disasters will occur in the future as well. Therefore, let us work together to make our community safer and better prepared for future disasters. We have the responsibility to take the lesson from the past seriously and put them into practical action for future. Thank you very much.

Louie S. Puracan 40:16

Good afternoon, everyone. I'm going to share with you the climate change effect on the fire service in the Philippines [inaudible]. The Philippines is on the ring of fire. We had an average of 20 earthquakes a day. And we have an annual average of 18 to 20 typhoons per year.

Last year, we recorded 179 [inaudible] forest fires, and the damage is quite high. And as you can see, we

are expecting actually based on the Myers report, the Myers report is the [inaudible] Japan international cooperation study made in 2014, that there will be an earthquake with a magnitude of 7.2. And we call this one the big one and hopefully it will not happen.

In the location of the Philippines on Rangoon fire is on the left. And so, as you can see, we are facing the Pacific and time have changed really from 1960 to 1979. We recorded around five typhoons on the next 20 years; seven typhoons a year in the last from nine 2000 to 2019 recorded 11. And as you can see the temperature is going one degree higher from 1960s to 2000.

And the detract, the earthquakes that we had is getting stronger and stronger. And what we are going to do: we have now a shift from the traditional for structural firefighting of the fire service in the Philippines, we have expanded our rules.

The top for the Piper fire suppression fire administration the fire investigation, the Fire Safety and Enforcement. This is our previous rules that we add now. The Emergency Medical Services is now transferred to the fire service. These used to be a function under the Department of Health but transferred to the fire service starting last year. And we implemented a BAP FAST. The fast is the first eight service teams. The first added service teams is quite unique in Asian regions, because in Asia regions the traffic is so congested.

So, we made an initiative where the ambulance service is onboard motorcycles. And you can see this one in the Philippines in Hong Kong, Singapore and other Asian countries Bangkok. In Asian countries, this is very, very normal for us Asians. And the hazmat has been transferred also to the Bureau of Fire Protection. This used to be a part of the Department of Trade and Industry. We have regulatory function, then the [inaudible] is a new function to us.

And we have been undergoing training; up to now, we did the Part D U S disaster Threat Reduction Agency for the last seven years. And in addition to the new function that we have, and we're preparing because of this climate change is the technical rescue. We have trained people now on disaster response particularly on vehicular accidents, collapse structures, and the [inaudible] rescue. And most of our functions now is more on the humanitarian assistance and disaster response.

These days, particularly in the last five years, typhoons are getting stronger, and we at the fire departments are overwhelmed by the [inaudible] of these events. And as you can see, there has been a shift really from the structural firefighting we are now trained firefighters for medical responses. This is new to us.

Now, what are the challenges in the Philippines seeing? The challenge really is our geographical location. We are made up of 77,000 Islands. And these are quite far from the center of government, which is Manila. And this is really a challenge for us because there are areas we cannot respond to. And this area's quite far from Manila, is the most vulnerable areas.

Second concern that we had or challenge is the equipment. Because of the sudden change of responses. We cannot use anymore our traditional equipment; because of the forest fires, we need more equipment that can respond to this incidence. And our ways forward, we've been trying hard to have our capability, building efforts with a training and equipment.

We are very, very thankful to our Asia neighbors because they've been accommodating us for our training. We've been sending close to 50 trainees annually to Korea, for training, and Taiwan has been very, very generous to us. We've been sending close to 100 firefighters to Taiwan every year. And in Malaysia also, we have cross training with Malaysians, and Japan through the journey, the Japanese International Cooperation Agency when training also with us, and lastly with us through the US Forest Service, training us on the ICS program and the forest firefighting. And so, we the [inaudible] with the US disaster Threat Reduction Agency. And hopefully, we can meet the demands the challenges of the rural protection brought up by this climate change. Thank you and good afternoon.

Emily Saulsgiver 46:46

Thank you, panelists. Moving into the discussion amongst the delegates, the first comment will come from our delegate from the UN.

United Nations 47:13

Thank you very much. When I'm moderator, I would just maybe a recycled dimension made by the German delegate this morning.

What can we say after that? What can we say after the images from California from Maui from Germany after the figures from Philippines, everything looks a bit theoretical. But nevertheless, we try to put together some elements of context. And also gathering also some elements from a site event which was organized just yesterday in the UN headquarters in New York, by Portugal's the Republic of Korea, and India about the exact same topic.

So, what do we have: we have a nature of wildfire risk, which is evolving, evolving very rapidly, and very significantly, and especially because of climate change, the conditions are warmer, drier, windier, and the UN Secretary General, already called it the boiling era. It's quite meaningful.

In Europe, where I am based, we also call now the Mediterranean basin, climate change hotspot. My colleague from [inaudible] gave you this morning some figures about burned areas—2022 being the worst in history, and we are already starting to count the tropical nights and the tourist nights in Europe. I don't know if we can imagine.

In addition to that we have over exacerbating factors, we have luck in urban planning, in agricultural areas management, driving to river Exodus. We have also a bit paradoxical, a growing wildland urban interface where we have more secondary [inaudible] and people wanting to be closer to the forest. We have maybe human behaviors that we have to add to that and outdoor activities.

So, what this context leads us to: it leads us to increased and more intense fires, which are less and less in our control. Even if we have extremely outstanding and wonderful work doing done by firefighters. We have more northern areas being exposed to this risk. We can take the example of Sweden; unfortunately, we ever saw a fire season which is dramatically extended, is now it's no longer an exception to have fires in Europe in January or February. now what is and you know that already you'd like me, what are the consequences of course, human economic losses with greater impact in Europe a few years ago and decades ago, I think we had less than human losses.

And now, so it's similar so of the evolving nature of the risk. We have respiratory and cardiovascular issues, which is a very growing impact. Very well underscored yesterday is the same side event. Also, by Canada, we have transboundary issues. We were talking about the smoke coming from one country to another, it's something also, which is outstanding, we have a great loss of biodiversity, air pollution, and even internal displacement—someone raised this element as well.

So, this is part of what I would say the context. What can we do? I think everybody already converged also in the same direction, one way to do that is definitely to better and to further shift from response to prevention, from suppression to prevention. And here and the Sendai Framework, alights it very well: we are talking about governance, we are talking about collaborative governance for disaster risk reduction, we are talking about inclusiveness, bringing the communities, the beneficiaries to the discussion, not only as beneficiaries, but as actors, bringing the indigenous knowledge bringing the local knowledge to the discussions.

We are, of course, talking about further and better using the available data sharing—again, the example from Europe—we are very sophisticated tools and mechanisms coming from EU countries and the European Commission such as [inaudible] which can be used on larger scale, we are so talking about, of course, land use management, maybe incentives for having a better management of agricultural and forest areas, bringing maybe people back to these areas for better managing fuel, and for having less fires, which are now completely beyond control.

So, these are just some theoretical elements, which are very less, I would say, meaningful than these

images and these figures. But all together, it should help us actually to take the right decisions and actions and to work in this community of practices, which are extremely timely. And I really thank here, all the organizers, and US Fire Administrator for this initiative. Thank you very much.

Emily Saulsgiver 52:37

Thank you for the comments. This Community of Practice has a scope and scale that is overwhelming. And just running through the issues therein is a real challenge of how to scope what comes first from this group.

So, I would like to then open up remarks from the delegate from Taiwan to hear the Taiwanese perspective.

Taiwan 53:13

Thank you. Thank you for your presentation. I assume now for the fire is not only for fire, but also for EMT rescue and also nature and manmade disaster for fire service in Taiwan. It's kind of interagency cooperation.

So, of course, the central government and for the local government, we work on the same way. So, we are very appreciative for USAT support for the emergency support function: most for the change in local government, were conducted us in the core concept for the emergency support. And we are very appreciative for you, United States Fire Administration. You will support us, support the Homeland Security relation and exercise program. [inaudible] So we are very happy to invite the United States, Japan and also Philippines. And this year, we will invite Germany and [inaudible] to attend the International assistant for Taiwan and the US [inaudible]. So, we hope we may learn the lesson from United States and share the experience both in United States and also for the ACA. Patrick, thank you so much.

Emily Saulsgiver 55:23

Thank you. For information sharing, especially from countries who have experienced many of these catastrophic events over the course of their history, lessons learned for those that are now experiencing them for the first or a new time, I will move now to the delegate from Romania.

Romania 55:42

Thank you. When we talk about climate change, I think that we are talking also about what we are facing as new phenomena in some of our countries. And one of the most important parts of the equation, to have a successful prevention and response is the population.

I have very short two stories to share with you. About two or three years ago, we had a tornado, which appeared very near to a highway. Luckily, we had the recording from the interior of a bus to see how the driver and the occupants of the bus behaved when they saw that there's a tornado in front of them, they stopped. And then there was someone near the driver who turned to be a priest and the driver had confidence in him. And he told him, if you go with a very high speed through the tornado, for sure, we will pass through it. And what the driver did is he just went through the tornado, the tornado carried the bus, throw it away. And we had a few injured people with fractures and so on. And it was a big issue on the media. This is because we didn't have tornadoes, until then we have very few.

Our population doesn't know how to behave when there is a tornado. In the States, when you say there is a tornado, people know to go and hide, to go underground to go somewhere and hide. In a country which never saw a tornado, you will see people behaving differently because they are not trained, and they are not informed. So, for climate change, we need to start working with our population, on phenomena and how we need to deal with it. And we are doing this in Romania already.

The second story is a shorter one. A mayor kept on calling me until I could take his phone and talk to him. And he told me: Listen, six years ago, we had floods in our area and there is an order which forbids us from issuing construction authorizations in that area. But six years already passed, and we have no floods anymore. So, I request that you waive off the for the interdiction so that we can issue construction authorizations in that area, which is a very well-known floodable area.

So, from his point of view, six years were sufficient. And he doesn't believe that after one or two or three

years, that phenomenon will repeat itself. So, we need to work also on educating our authorities. So, on both ways, I think with the climate change, besides preparing ourselves, preparing our systems, we need to prepare our population and to make them aware of the new phenomena that we may be facing in the future. Thank you.

Emily Saulsgiver 58:33

Thank you. Many of our panelists hit that same point, sir. So, thank you: meeting populations, where they are from their perspectives and in their own language to understand that context and how they can act and behave appropriately. I'd now like to recognize the delegate from Belgium.

Belgium 58:54

Thank you. Also, thank you to the panel for the broad view on the problem. And I agree with the moderator that it's a complex and overwhelming task for the for the Community of Practice.

This is exactly also the challenge we had when we wanted to do our offices development program in Europe on the topic of sustainability and climate change. And what we did this we developed together with the University of Maastricht integral instrument, a sustainability lens. In order to tackle the challenge of the overwhelming and very broad discussion we were going to have; this instrument is tested already two times in the in the in the program. We're going to do it third time this year.

And the thing is that the sustainability lens looks at the external view. What can we do as a fire service in order to better protect our communities but also an internal view? So, what can we do as an organization to better prepare to the to the challenges ahead [inaudible]. So, the social part, the environmental part, the organizational part. And I think it's a very nice instrument is sustainability lens to start a discussion in the community of practice. So, from our officers' development program, we would really like to bring in this sustainability lens and maybe use it in the community of practice in order to structure the discussion, which is like you say, a very broad and overwhelming discussion if you don't have the right tools to start a discussion.

Emily Saulsgiver 1:00:30

Thank you very much. We have a number of flags raised around the room. Thank you. I'd like to move now to the delegate from Mexico.

Mexico 1:01:01

Yes, well, sharing with you: in Mexico last October of the year 2023 we had a rather interesting phenomenon that attracted the attention of meteorologists.

In Mexico we have earthquakes. Unfortunately, earthquakes are historically unpredictable. Fortunately, we already have an alert system that gives us a few seconds to be able to carry out some immediate evacuation actions.

However, on October 25, 2003, we had a tropical storm in the Pacific, in the state of Guerrero, in Acapulco. It was news where there was a tropical storm that had been forecast to be, that would go from a tropical storm to a Category One hurricane. What was surprising was that in twelve hours it became a Category Five hurricane. This was very surprising both for the authorities and the emergency forces, because the alert system and what had been planned, as it was practically exceeded.

This made a call to all emergency forces in the state of Guerrero. The impact was so strong that the Fire Department itself in the city of Acapulco, Guerrero, collapsed its structure. So that's the dimension we came to.

And I think it's a call to awareness and reflection that we have to be prepared and rethink plans and rethink the way in which we have to deal with these. Mexico was very shocked by this situation. The National Center for Disaster Prevention in Mexico is currently working on new protocols because, in the end, this is an atypical case, but it undoubtedly leaves us with great reflection because at any time we

can be vulnerable to this change

Making it go from a category of a tropical storm to a Category Five hurricane in twelve hours, I think, is something that should turn the eyes of all emergency forces and the authorities themselves. And what our counterpart from Taiwan said is an effort that we have to do with all institutions I leave it as a reflection. has already happened to us in Mexico and because I think it is well known that after the hot season, the phenomenon that has shaken some states, heavy rains are expected in various parts of the world.

So, I think that this table that the United States Fire Administration has convened is a great success so that we can prepare.

Emily Saulsgiver 1:04:15

Thank you. Moving now to the representative from Algeria.

Algeria 1:04:30

Thank you for these richer presentations on the impact of climate change. Question please for Dr. Gavin and Dr. Derek: if you make the first fires or the wildfires is not something new that we know in our countries, especially the Mediterranean ecosystem countries, whether due to human activities or natural in 1%. Yet the frequency and the intensity of these fires, which is a very important shift impact, especially with the mega fires is something that we didn't experience before yet it, it happens on a speed scale that that is very, very, very scary for most of the Mediterranean eco ecosystem.

So my question is, how does this influence the management strategy that you adapt to fight against wildfires on short term and long term specially with learned lesson and share an older learned lesson or the new? And I would like to add another point, I heard the presenter of Germany, he talks about the floods. And it's true. Before we use the link when we have big fires. Usually, we do have floods after but those couple of last years, we do have big floods then big fires then just right after in bigger, big floods, again, in terms of 24 hours, maybe 36 hours at top.

So that brings me to another question: is the link between measures risks and how they are linked together? Sometimes it's not the matter of climate change, change on a particular measure risk. It's a combination between all of major risks. Thank you.

Derek Alkonis 1:06:55

In terms of response, before we can respond, I think we have to talk about prevention, and preparedness. And that's paramount here. And it starts with (and we haven't talked about) vegetation management, which is a big element that goes along with climate change. And since we have these non-native, these invasive species of vegetation in many of our communities, and they have dominated the landscape, and they become very highly fire adaptive. So, they burn, they come right back.

And so having other forms of vegetation management, besides burning them, has to be an option and has to be implemented. And then we get to codes and standards, which is important. So those are two of the preventative things that definitely have to occur in terms of suppression, anticipating where you may have conditions that are elevating toward fire, we call them red flag conditions, having better forecasting capabilities, more remote automatic weather stations in locations, having better early warning devices located in areas that are more prone to fire are important.

And then when you get down to suppress its actual suppression, water puts out fire. And we saw that in Lahaina the firefighters that were positioned in the right place that could they only had so many firefighters, it's an island, they had other fires going on at the same time. But nonetheless, those firefighters that were positioned that did have water made a big difference. And as did the residents who had access to water, they also made a difference. And we'll be looking at that in more detail with the analysis.

But suppression, you can anticipate a little bit because you have forecasted weather. And perhaps we have to look at how we can improve our forecasting capabilities around the world instead of just regionally or by nation. But understanding how one could how conditions can in one area can

influence the other and I think about the hurricane Ophelia in 2017. That disrupted the East Coast, right where we're standing here in the United States, but it made its way north into the Atlantic Ocean off the coast of Portugal. And we know what happened in 2017 in Portugal, huge fires—devastating. So, understanding weather conditions and anticipating these can prepare our resources.

Emily Saulsgiver 1:09:43

Thank you, Derek. Christoph, anything to add for cascading events and risk management?

Dr. Christoph Weltecke 1:09:50

I allow myself to answer in German because it is easier. I want to build on what my colleague has said.

The topic of forecasts is a very decisive one when it comes understanding the combination of different environmental disasters—fire, flood, storm—and being able to make the appropriate, the combination of different environmental disasters forecasts.

A key point at this point is often wind as the decisive weather criterion, which plays into this. In fact, we must ensure that we can improve our forecasts and use the German example once again.

Predicted of this flood, which I have just reported, was a water level of 1.3 meters, in the afternoon the water level was raised, or the alert level was raised to 4.5, and in fact a water level of ten meters was reached afterwards. So, the question of forecasting is actually the central issue.

Emily Saulsgiver 1:10:52

Thank you, Christophe. I'd like to move to comments from the delegate from the UAE, United Arab Emirates.

United Arab Emirates 1:11:02

Thank you. Climate change challenges, we definitely know that traditional solutions will not help. We all know that. And we tried, like with different kinds of initiatives and initiatives coming from here, and there also will not help out our in our mission.

Our mission is to save our planet, we should think together, we should collaborate with our knowledge, and innovation. In kind of like a research center, I always complain that there are many research centers in different fields of the lives. But not much, and not enough research centers for protecting lives and property.

So, my suggestion is that we should go as a planet of Earth, to call for a research center to deal with these kinds of issues. And it seems like AI is the solution as a measure doctor recently mentioned today, regarding how to do awareness, in a country where you have more than 200 nationalities, with 7 billion population, traditional methods failed to tackle this kind of problem. So, he went and suggested an AI solution—artificial intelligence solution.

So, what I suggest that we should have a research center, and United States maybe is one of the best countries to take research in any field, especially that we are having many universities that are really pioneer in this field. So, if we need to save our planet, we should have a research center that is dedicated to providing safety and security to our generations. Thank you.

Emily Saulsgiver 1:13:34

Thank you. Coming from the part of the organization that oversees our research centers, I'm very excited by that contribution. Moving now to the delegate from Finland.

Finland 1:13:49

Thank you for interesting presentations that we have been discussing today about international collaboration, which is very important.

But I'd also like to highlight the importance of national cooperation between different authorities, and also with different actors, whether they are NGOs or actors at regional or local level, because they often have the knowledge of certain area and can bring their expertise and knowledge, for example, to risk assessments. We have had very good experiences of this kind of work regarding risk assessments, whether it's at national or regional level regarding preparedness for different kinds of scenarios, including climate change. That was just something I wanted to mention. Thank you.

Emily Saulsgiver 1:14:44

Thank you. You're talking about very local experiences and then moving up to a global level. You have to have that exchange. Moving now to the representor, the delegation from Canada.

Canada 1:14:58

Good afternoon and thank you again. I have the opportunity to share just a couple of perspectives. And first of all, Canada has done a very good job of collecting some data. And I can share with you that over 10% of all call volumes have increased as a result to weather related events. And we've heard it's beyond wildfires, which we've heard many times today in Canada was extremely impactful, but it's severe heat, severe cold, created some significant calls for our services.

I want to go back, however, to a point made by my colleague from Germany earlier, that spoke about the impact to us, the first responders. And I think that we can't overstate that, that the impact to the men and women of our communities that are dealing with these events have to be discussed and considered.

When we have done our roundtables and shared our concerns about recruitment and retention, I will assure you that we are losing some individuals as a result of the calls that they attend to daily. And daily these are not our everyday calls that we're talking about when we're dealing with weather related climate related calls. We are asking our men and women to go for several days, several weeks and in cases months at a time, and it's not sustainable. And I believe that we have to look at solutions for the sustainability of long, drawn-out weather-related events. And I think this is the right table to have that conversation. So thank you.

Emily Saulsgiver 1:16:23

Thank you. In our preparation for this panel, I know from the Philippines, the experience of firefighters also being called into dynamic events, that perhaps they weren't covered in their training came up as well. So, did you have any comments you'd like to provide structure the way towards that affect the changing environment for the workforce?

Louie S. Puracan 1:16:45

Actually, in the case of the Philippines, we need really to hug international cooperation through our neighbors, our closer neighbors, like Taiwan, Korea, Japan, and Malaysia, because in the event of big disasters, we cannot just do it alone.

There are instances wherein we have experience of big typhoons that we were overwhelmed. And we cannot just simply do it with our own resources. And international operations is really helpful. We had experience in Typhoon Haiyan in 2013, [inaudible] a tsunami-like typhoon which killed about 15,000. And we cannot just do it without the others. There were other countries helping us; what we did is to train with other nations, NGOs, we do have cross training with them. Because some countries are better than us. They have the technical expertise, so we trained with them.

And I do recommend also that this should be a part of the Community of Practice that we should go towards seamless world we're in with train with others, just like what we had and I'll go further, just like our problem really now in the Philippines. Our biggest concern now is the codes. Actually, this is out of the climate change, but I will just like to share if it's okay, our problem with the codes now is some developing countries do have some projects [inaudible] This is the overseas development assistance and when you have [inaudible] the donor agencies takes the lead on what codes to use. We have the first subway now

in the Philippines and the code is being used as Japanese code and the Philippines is patterned after the NFA codes, and then if a codes and the Japanese standards do not match with each other, and this is a problem.

So, I suggest that in the Community of Practice we should also consider about equivalence of the codes. Because if we cannot have code equivalence, it will be a problem for developing countries. Thank you.

Emily Saulsgiver 1:19:16

Thank you? Training and also education: what kind of demands on the next generation of professionals do we want them to receive through their education programs? I'm moving out to the delegate from Chile.

Chile 1:19:35

Very good afternoon. Thank you very much.

First of all, I congratulate the exhibitors for listening to interesting talks on topics that to our country, Chile, a long and narrow country, where we have a Chilean Fire Department, one hundred volunteers, we are fifty-seven thousand five hundred women and men volunteers who have been quite affected by, above all, climate change.

At the beginning of this year, we had a very big fire in the Valparaiso region, where more than one thousand two hundred homes were affected and more than one hundred and forty deaths, of this very special condition that was delivered wind, fuel and temperature last year and we are being affected in right now. I don't have a report, that there is a lot of rain and that there may be floods, as was the case last year when we had two firefighters dead, situations that were not common in our country before

Without a doubt, your presentation has allowed me to have a vision that not only is this climate change being given in our country, but that in the world we have this status of volunteering.

That's why it doesn't mean that we have a less effective job. We are one hundred percent professionals and today we are gathered together as firefighters from Chile. These fifty-seven thousand five hundred is a national system of operations that allows us to work together, when there are a large number of emergencies.

I also want to thank you for the solidarity help, especially from the United States of America, which you give us, through its ambassador, a large amount of help in beings and implements. Also, to Japan, China and different countries that have helped us to succeed in this scourge of different instances.

We are a country that has earthquakes, floods, forest fires, and that has not had to change the way we work as firefighters in Chile and without a doubt the experience that I have just acquired through the exposure of the experts who are in front. I appreciate it.

And without a doubt, these types of congresses allow us to have interesting exchanges so that we can benefit and hear and see experiences from other countries and understand that climate change is global and not only my country that I represent, which has been quite a soldier in different instances in recent years.

Thank you very much

Emily Saulsgiver 1:22:27

Thank you. Moving now to the delegate from Australia.

Australia 1:22:33

Thank you. And thanks also to the presenters again, for what is overwhelmingly becoming a more a more and more common presentations around these severe events that are occurring in many countries around the world and Australia is not immune to that.

We certainly have significant impacts from bushfire and particularly flood in more recent years, and they are having significant impacts into communities all the way across Australia. We're finding our bushfire seasons are becoming longer and more extreme. The actual extreme rates and days that occur each bushfire season they are that they are growing in number so we're having more difficult days. And a really good example of that is Queensland, which is in the northeast of Australia has not historically been prone to bushfire because it is in a subtropical area. And prior to 2019, in the 100 years prior to that, they'd lost around about 50 homes in bushfire in that 100 years. And since those since 2019, some 140 homes have been lost a bushfire and a number of lives as well.

And that just shows you the changes that are happening in the climate in Australia. These extended seasons from a bushfire point of view, they have an impact on training, which has been spoken about already the available time that's there for firefighters, whether they're volunteer or paid the available time for them to undertake the training. Also impacted is the review process.

So we were talking about the review that you're doing at the moment, but the ability to complete a review on these significant events and then have the time to work your way through you know 10, 15, 20 recommendations about how you can do your role better, is quite challenging for people—and people get really fatigued with that constant change as well as the response requirement.

Many people in Australia, large part of the population, live very close to the coast. And so, the impacts of coastal erosion and sea level rise and those sorts of things are also going to be significant for them. Also, that our seasons are starting to dry overlap more and more with the northern hemisphere. And we know that we do resource a lot of our aircraft out of the northern hemisphere to combat bushfire in Australia. And we're seeing it is becoming difficult, more costly, certainly. But difficult to get extended contracts for these for the aerial suppression capability to be able to meet the extended season that that is constantly being thrown at us. To combat some of this, we've undertaken a process. We've certainly got a research agency in Australia, which deals with sort of national base research pieces to help the community understand better their risks, but also improve some of our warning systems.

Emily Saulsgiver 1:25:47

Thank you. I think potentially what I'm hearing is also this Community of Practice should be sharing these reports that we're finding; the observations; and seeing where some of these events actually do correlate quite well. And with ISA is example of where this data could really be shared and the lessons learned from shared experiences, or at least similar experiences can be shared across the different participants. I'd like to move now to the delegate from El Salvador.

El Salvador 1:26:23

Hello, good afternoon, everyone

I would like to briefly comment on how climate change is a reality for El Salvador, but at the same time as well—wow is it seriously affecting the emergency response?

It is important to keep in mind that El Salvador is one of the countries most vulnerable to disasters in Latin America. For example, in recent decades, the average temperature has increased by more than one to three degrees Celsius. That has caused extensive droughts, an increase in forest fires.

But on the other hand, the country also faces the severe effects of tropical storms, rains, landslides and even sometimes, storms of a couple of hours or an hour in the capital city trigger a series.

We are, as I said, one of the most vulnerable territories. In fact, the Ministry of the Environment has declared that eighty-eight seven of the Salvadoran territory is susceptible to disasters and approximately ninety-five percent of the population lives in that area. And this, in turn, affects the form and resources available to the fire department for emergency care, mainly in the means available for answers in the types of responses, in the health and safety of the personnel and in the resources we involve.

For example, drought and water scarcity seriously limit our water availability, primarily for forest fire

response. Extreme events, such as heavy rains, are becoming increasingly mixed up, becoming more complex emergencies. Suddenly it is no longer a water rescue response, but that is also combined with emergencies, with hazardous materials, with fires from electrical hazards with vertical rescue, for example.

The increase in temperatures is not only affecting the availability of vegetation to burn, but it is also affecting the physical performance of firefighters, something that we will discuss later. So, it involves the issue of health, occupational safety, causes physical wear and tear, thermal stress and also the economic impact.

Increasingly, complex emergencies require greater investment, greater equipment, greater preparation of our firefighters.

So, climate change really is an increasingly important and complex challenge for those of us who protect our citizens.

Thank you.

Emily Saulsgiver 1:29:13

Thank you. Moving now to the delegate from South Africa.

South Africa 1:29:20

Thank you, I would like to look refer to the wildfire risk—and how do we move from purely reactive to proactive and predictive when we have created a culture where fire is seen as a risk and not as a fuel management tool? So, these are over emphasis and it's very controversial what I might say: it's these are over emphasis on separation. And that over emphasis on precipitation withdraws actually those resources away from proactive and risk reduction initiatives. And we should actually be seeing more fires within at outcomes and reduce the risk and outcomes at the correct time. So, these should be a more proactive move away from separation. I suppose the message is that there's over emphasis on separation, and we exclude fires. We shouldn't be doing so. Thank you.

Emily Saulsgiver 1:30:28

Any comments back to South Africa?

Dr. Lori Moore-Merrell 1:30:32

I will take that: I really appreciate that. Because I think it is. He's talking about putting fire on the land to mitigate. And I had a very interesting conversation with our European delegates, and as well as some that have leaned into the UN disaster and risk reduction.

If we do not start thinking about building resilience and preparedness, we are going to remain in suppression mode. And I think that's the point. We are never going to get ahead of this issue if we as the fire service, don't begin to think ahead and prepare and mitigate before an event–so that if wildfire, for example, is going to occur, it doesn't have to be a disaster. And I think that is the point that our delegate from South Africa was making. So, mitigation and building resilience, not just always staying in response mode is key.

Emily Saulsgiver 1:31:28

How do we give our resources that breath, that opportunity to pick their heads up and think about what would need to come about in order to make you give you the space to think ahead? Thank you. Moving now to the delegate from Austria.

Austria 1:31:51

Thank you. I would like to make a comment again on the subject of weather forecasting. We work very closely with the weather service in Austria together with [inaudible] Austria and at my office. Also in the

area of the state headquarters is a department of the meteorological service. We have a very, very close network here. We're just living a big problem.

Some events and severe weather fronts can be predicted predictably, but some events are not and even the weather service cannot make a reliable statement here because these are links between thunderstorm cells that connect and then trigger severe regional severe weather events.

So that means there is always a certain residual risk. Only these events are massively increasing here in Austria. This means that some areas in a district are massively affected.

Storm, hail, enormous amounts of precipitation, hailstones as big as a fist and all this concentrated in an area 20, 25 kilometers away is almost blue sky and the sun is shining. And these events are massive for us, challenging even for the emergency services, because they cannot be planned, they are not foreseeable, and there is a residual risk in the forecast.

We are working together here that we then return the empirical values with the weather service, then return the empirical values with the weather service, that the forecast models can be improved in order to ultimately become even more accurate here. One problem, however, is that the general weather forecasts and thus weather warnings are issued.

We must also build our society in terms of resilience. The only problem is to warn the second or third time without a storm having arrived, the population is more likely to become careless again and say well, it wasn't a problem with the last storm with the last warning either, just someone strikes, so the storm says relentlessly.

That is, this is a movement and a countermovement that must be countered, and we see this reinforced here, and I think it is absolutely crucial in science work closely together in research in order to develop reliable and accurate models here.

And ultimately, it is also about warning and alerting the population. Thank you.

Emily Saulsgiver 1:34:47

Thank you. So better data for modeling and better alerting so that people can trust what they're getting so that the next time they behave. Thank you. Moving to the delegates from Pakistan.

Pakistan 1:35:02

Yes, thank you very much. While climate change phenomena is a reality, so we need to adapt to the climate change. And for that, what National Disaster Management Authority Pakistan, the Government of Pakistan is doing that we have established a national emergency operation center where our technical teams are working around the clock and monitoring the data regarding the precipitation and temperature in various regions.

Like, we experienced the forest fire in one of [inaudible] where 1252 hectares of the pine nut trees are destroyed due to fire. So, these were due to the heat waves and the all the communities; the sole means of livelihood was those pine nuts. And the pine tree takes like 40 to 50 years for growth for its production. So, what to talk about: the economic losses of those communities.

Likewise, we have experienced the cyclone of [inaudible]. But for that we deployed the technology, we receive data from the satellite, and then through modeling our technical teams well before time, early warning to the communities, and we evacuated like 84,000 people from those hazardous areas.

So, a key is research and the use of technology, we believe. Thank you.

Emily Saulsgiver 1:36:21

Thank you. My organization is focused on bringing research as close as possible to the actual operational environment. So, I could not agree with you more. Understanding those variables across this landscape is going to be critical to this Community of Practice.

The fire loads; changing the effects on the community; how to communicate with that community; trust the data they're being presented with. That is going to be a big question for this group. Do we have any more questions from the delegates?

Dr. Lori Moore-Merrell 1:36:54

I'm going to raise one, since you don't have a delegate waiting. I would like for Dr. Al Matawa, to once again speak because you said something that I think is highly impactful. And it is about us understanding the impact of fire itself on climate change.

And I just want to make sure that we all understand that the fires are impacting the climate change, and it becomes very circular: then climate change impacts fire. We must break the cycle. You're using data to help us all understand the impact the fires in each of our nations have on the climate. So, can you tell us what can we do to contribute to this project?

Dr. Major Essa Ahmed Al Mutawa 1:37:45

Yes, that's a really good question. The idea about our application, the Eco randomness, that is to show the whole continents and how much it's contributed to affect the ozone layer. And what we really want from all the fire department/fire associations across the globe is to gather data.

Based on the historical data, we can understand the patterns for each continent for each country, and what the most things which lead to fire incident, then we can understand each continent and each country and how much it contributes to affect the ozone layer. And based on that, we can prioritize our focus on the countries, on the continent to minimize fire incident which will lead to minimize the pollution caused by the fire.

So basically, we need to harness the diverse expertise from different fire associations and fire departments across the globe. Thank you.

Dr. Lori Moore-Merrell 1:38:54

Thank you very much. And I want to thank this panel. We are drawing our afternoon to a close; it's been a full day. And I think that our collaboration has begun. Tthe conversations have been spectacular.

So, I want to just look around to the delegates and once again, show my gratitude to you for the conversations that have been had today on these two matters. And if you will, help us to thank our panel before we go into our final comments for the afternoon. So, panel, thank you very much and at this time, delegates, I am going to ask for CEO Victor Stagnaro to once again come and address us with a couple of announcements for this evening.

Victor Stagnaro 1:40:09

Wow, what an invigorating day. Thank you all so very, very much. I have a few a few housekeeping items that I want to remind some folks of. Please before you leave, if you would leave your linguist handset and your headset on the chairs. Tonight's dinner is back in our dining room from earlier: Columbia A B it starts at 1830 hours. We also invite you to visit the exhibits set up outside. They also will be set up until 1830 hours when dinner begins.

Remember to bring your badge for entry into the dinner and tomorrow as you enter into this facility. Tomorrow's breakfast, it will be at Oh 700 tomorrow morning. We will reconvene the World Fire Congress at 0830 hours. When Dr. Lori Moore-Merrell dismissing us this evening, we kindly ask that you exit the rooms as soon as possible so we can reset the rooms for tomorrow's session. Enjoy your dinner this evening. And Dr. Lori Moore-Merrell: Back to you. Thank you.

Dr. Lori Moore-Merrell 1:41:20

Thank you very much, Victor. So, delegates: this does conclude our first day of our Congress. And as you just heard, we will begin tomorrow earlier than we did today: 08:30 breakfast; we will also begin a

bit earlier. But tonight, we'll gather again together to spend some time getting to know each other over dinner at 1830.

So, with that I will recess this session of the World Fire Congress

DAY 2

2024-05-08 World Fire Congress - Part 1-MP3

Dr. Lori Moore-Merrell 04:28

Good morning, delegates and guests. We will call back into session our World Fire Congress for Day Two.

This morning, I want to give you greetings once again and I trust that you've enjoyed your evening; that you've met other colleagues and had conversations with your fellow delegates and that we all rested well. We have a long day ahead of us.

Today's agenda includes two additional challenges for presentation and discussion as well as a series of special sessions for you this afternoon. We'll close out our time together with an evening at the United States Library of Congress Grand Hall, where we will celebrate, and we will have a certificate presentation for each of our delegates. We will also have for you the opportunity if you wish to sign our Statement of Founding Principles and Objectives. But for now, we will move on to our next challenge that is before us.

Today, we'll talk about beneficial innovation, and innovation like electric vehicles, lithium-ion battery bikes and scooters, as we need them to move away from our dependence on fossil fuels. However, this innovation can sometimes lead to unintended fire risk and unintended consequences. These beneficial products also come with a threat when they're not used as directed or intended.

Globally, there is a need to share the information about the threat, realization about our policies and regulation. Our response resources, public awareness, prevention and education, research, firefighter training: this field is wide open. Our facilitator for this session is a former Fire Commissioner of the city of Philadelphia in the US; he is now serving as the city manager, the city of Philadelphia in the United States, Adam Thiel. Our speakers are Dr. Steve Kerber, Dr. Nils Rossmuller, Michael Abraham from the US, Adam Barowy from the US, and our Deputy Commissioner Ling Young Ern from Singapore. Please welcome our facilitator and speakers to the stage.

Adam Thiel 07:11

Good morning, and welcome to Day Two of this auspicious event. My name is Adam Thiel. I'm currently the city manager of the city of Philadelphia, the great city of Philadelphia, the home of American independence. So, thank you all for being here. I'm happy to be joined by our guest panel today. And I want to go ahead and kick it off with longtime friend and colleague, Vice President of UL Research Institutes Dr. Steve Kerber.

Dr. Steven Kerber 07:50

Thank you very much, Adam, and good morning.

I think the order of this session is perfect. We started out with the built environment and talking about the evolutions there, we move to topics of wildfire and conflagration. And as we get into emerging technologies, it fits very well because it fits into the system. As the buildings evolve, the emerging technologies evolve, they all play off each other, they all become very important. And we're going to talk a lot about that this morning.

So, as we try and balance sustainability and fire resiliency around the world, things that become positives also have the potential to come with risks for negatives. And you don't have to look too far

as the fire service as the, I would say, number one stakeholder that gets to see this firsthand. Things like energy storage systems that bring the promise of being able to eliminate brownouts and to give us the ability to store the renewable energy to use it when we need to.

We have incidents like Surprise Arizona, where four firefighters were seriously injured as they operated around that energy storage system. We've got solar panels, which are able to collect that energy to put into those energy storage systems. And it was just a discussion at breakfast this morning with the Washington DC fire chief talking about how they have had a series of solar panel fires that have put his firefighters in a situation where they've got to continually update what they know and how they respond and their appreciation of what the hazards are. Micro mobility: to have people to be able to move around at will or to support the delivery services that we need. And unfortunately, what we've seen around the world is many failures that have led to both fatalities as well as business interruption and other things as they fail in the fire service response. Same thing with electric vehicles: all of these things play an incredibly important role in sustainability. Yet, once you have these new technologies, and once humans are involved, you wind up with situations where the fire service is absolutely needed.

And they're everywhere. What an amazing technology. I think that this, this changes the game for the fire service in a few really important ways. The first one is, the fire service is not used to hydrogen as a byproduct of combustion like these batteries bring into play. So, the explosive nature of the gases that come off of these products and devices create a fire environment, which is much more dynamic than the already dynamic environment that Dan Madrzykowski introduced us to yesterday. The other is that as we take advantage of these and see them anywhere, the ability to have a fire start anywhere, is going to be new for us.

It used to be: well, I need to follow this product to the wall to see where it's plugged in to determine whether there was the energy there to be able to ignite this fire. Now, we've essentially taken the fire triangle and made it portable. So, we can now have a fire start in the middle of a warehouse in the middle of a rack in the middle of the building, and have it start there by itself without having to be given an energy storage somewhere else. It also has oxygen as a byproduct of combustion, which allows it to sustain burning in a way that we've never seen before. So, we see them everywhere, everywhere, from large energy storage systems to marine uses to electric vehicles of all shapes and sizes, down to many consumer products and of course, medical devices, we're also becoming very reliant on them in the fire service.

Our portable radio communication devices are now able to last longer. Because of this battery technology. Because of lithium-ion batteries, we're now able to have them as rescue tool power sources, powered fans, powered cutting tools. And of course, the apparatus itself is beginning to be electrified. So, we're also seeing it within our service as well as being important to understand the implications of it.

But at the end of the day, all powered devices are candidates for lithium-ion electrification. And it's going to continue to take over. There're also many challenges throughout the lifecycle of these batteries. The fire service doesn't just respond to finished products, you're going to see it in storage applications in massive warehouses, you're going to see it in semi-trucks as its moving over the highway to get from whatever part of the supply chain to where it possibly would be integrated into the finished product. And then of course, it's not just one, you have the potential to have entire parking garages full of electric vehicles next to each other and charging stations next to each other. So, the hazards are endless when it comes to the fire service, which makes continuous learning in the fire service that much more important.

Our colleagues at UL Solutions have been scraping the web looking for incidents around the world to get our understanding of where these are happening. And as you can see what this map right here, they're happening in all of your countries. They're happening all over the world. And I think this trend is going to continue. As you look at these, the bar chart right here, we can see that as we move from 2020 and beyond the growth of the number of incidents. And keep in mind, these are just the ones that are found in the news, not the ones that you are all responding to. So, we know there's many, many more.

But if you start looking at what's driving the fatalities, the injuries and the number of incidents, it's really consumer products are driving the numbers followed by EVs, and then energy storage systems as those become more and more popular around the world. If we dig in one more layer, we can see that injury

and fatality incidents mainly involve consumer products. So, you can look at the blue color in the top there and it dominates the incidents with injuries and fatalities. And if we go down another level Well, you can see that most of those consumer product incidents involve e-mobility devices. Absolutely half of the injuries and more than half of the fatalities. And I think there's an important message here as well.

We now have batteries that are not only able to cause a fire or light something else on fire to drive a room to flashover, but we now have batteries that are large enough to create flashover themselves in large rooms. So again, completely changing the response environment of what happens before the fire department gets there. If we have flashover that can happen in less than a minute, we don't have a fire service in the world that is going to be on scene to get involved in less than a minute. So, it's certainly going to change what happens before the fire service arrives.

And then no one has seen the micromobility incidents more up close and personal or seeing the impact of them more than the Fire Department of New York, as they share their statistics. And one of the great things there is they've got some of the best fire investigators in the world. And they they're resourced to dig into these fires and see why they're starting what the trends are. But if you just look high at the number of investigations, the number of injuries and the number of deaths, there's been a dramatic increase over the last five years going from zero deaths to 18 in 2023. And we're going to hear more about this soon.

What I want you to take away is that this is a moving target, there's going to be new fuels, there's going to be new chemistries, we're going to put them in different buildings, they're going to be different sizes, different form factors. So as soon as we figure out lithium ion, there's going to be the next chemistry. As soon as we go to hydrogen, there's going to be the next fuel source, highlighting the need for firefighters to be continuous learners and for the research to try and keep up with the hazards that are in your work environment.

We need to have proper staffing; we need codes and standards that are typically slow to be faster to keep up with the technology. We needed to develop best practices for extinguishment and gear cleaning. We need to understand the impact on building systems and all the evolutions that are happening in that space as well. And then, of course, community actions and public messaging because this is happening before the fire department is able to intervene. Not to mention all the do it yourself impacts that we're going to see throughout the lifecycle of all of these products.

And then finally, we've got to look at today and we've got to look ahead. The fire service understands how fire grows and spreads. And there's many levers that we can pull to be able to get ahead of this problem and really play catch up in this problem to have safe living and working environments.

The NFPA fire life safety ecosystem has a tremendous framework to look at as a starting point. Because it's not just the products, it's not just the environment that we put them in. It's a much more complex system. And these technologies need all of these components to be addressed. And then at the end of the day, we need to understand the impact on financial markets. If we can't move markets, and we can't understand how this impacts economies, then we're going to have trouble making the fire safety pitch it needs to fit in with all of the other important things that are happening. And with that, I'm going to pass it on to my colleague, Nils from the Netherlands.

Dr. Nils Rosmuller 19:01

Thank you very much, Steve. And thank you for being here and to be able to present some pieces of the work of my research group at the Dutch Institute for Public Safety.

We do research after a tremendous amount of emerging technologies dealing with the energy transition that in the Netherlands deals with getting rid of the fossil fuels and making more use of renewable energy produced by solar panels wind turbines and transported by hydrogen ammonia and also stored by battery electric systems and lithium ion. And there are a lot of safety issues going along with that and I am not going to touch upon all those issues, but I'm going to touch upon the battery electric vehicles issues and the solar panel safety issues.

But first, I will surely define what when we are talking about the built environment, what is meant by that, because in the built environment, we all live in this build: a farm, we live in hotels, we make use of infrastructure, built environment is sort of human made condition in which we recreate in which we live, in which we do our activities. So, what we do is we make buildings for you create public infrastructure, we build industries, we have agriculture. And what we are doing now is that in this built environment, we are introducing a new kind of safety issue.

We are developing activities systems within our homes, within our bonds within our parking garage, within our distribution centers, that creates safety issues, which are fairly new compared to what we were used to. And this energy transition, at least in the Netherlands, we are getting rid of the fossil fuels and try to make use of the renewable energies. Although I'm aware that in other countries in the world, they start to get use the oils and the gases and get rid of the coal energies. But we are now trying to make more use of sustainable sources, clean and green fuels, electrification, hydrogen, geo, bio, wind, solar, nuclear, it's all the all the varieties of the energy transition that we have to make use of in the Netherlands, to supply our energy demands.

And what we see here is that in the mobility industry, we have a big issue to face. It's not only the micromobility, it is also the passenger cars, the heavy trucks. And what we get often, the question from policymakers, is when there is an incident, but how often does these kinds of incidents happen? And my presentation will be on some Dutch facts and figures about alternative fuel vehicles, their incidents, and later on, on the solar panel issue. Because when we have the numbers, we can also pursue them to come into action, because that's a big point.

In my research group, we focus on three things regarding the energy transition. We focus on understanding the safety mechanisms: how can we prevent errors to occur? How can we take safe safety measures? That's the first thing we look at. The second thing is if something goes wrong, what does it mean for people in the environment, the third party safe? And the third one, of course, very important also in this area: How can we respond to those incidents, making the consequences reduce with also take care of the lives of the fire crew?

So, what we did is, we started to collect data regarding the alternative fuel vehicles. And we did that together with the fire investigation teams of the safety region in the Netherlands. And we collected the data of the incident in which the fire crews were on the incident scene. And what we see is that there are a lot of incidents, but we have to relate them to the amount of alternative fuel vehicles that are in the fleet. And what we see a couple of last years is that although there is a tremendous increase of alternative fuel, alternative fuel vehicles, in particular the battery, electric vehicles, we see a 30 to 35% increase on an annual basis. Still, there's almost 5% That is battery electric vehicle now fleet. So, there isn't a tremendous increase, but absolute number of battery electric vehicles relatively small in the Netherlands.

But what we see is that we have our incidents, and we categorize them in two types of incidents. We have the crashes, we call them the accidents. And we have the fires. And although the numbers are relatively small, we see an increase in the fires in the battery electric field. And that's particularly important because the fires, they make the big risks for the building infrastructure and for the fire services, because the thermal runaway in a battery pack is what drives the risk for the fire crew. The thermal, the thermal runaway, is a self-propagating mechanism in a battery that produces oxygen that produces an explosion and hazardous environment which can supply the fire crew. As Steve already said, that Arizona incident and two weeks ago in Germany there was this battery electric storage system that slowed to firemen were injured. So, the thermal runaway is really a big danger, a big game changer for the fire crew all around world.

And what we see is that dealing with the thermal runaway. In the Netherlands, at least for the mobility industry, we don't have much orders than putting a lot of water onto the car, or submerge the car in a container and drown it for a couple of days. And what we learned from all these fire investigation teams is that in case of a fire, we see that in about 30 to 35% of the fires, the cars are being charged at charging points, which means that the other 70 to 65%, tthe car is not on the chargers, so it's parked

somewhere or it's getting injured in the crash. The accidents we see there hardly result in the thermal runaway. But what we do see is an increase in deploying the submerging container. And that is because we made some procedures to apply these submerging containers. And the second point is that fire brigades in for providers' towing companies, they want to be prepared for the worst-case scenario in case of a thermal runaway. And finally, see every firefighter issues deal with the thermal runaway. We use copious amounts of water and produce a lot of contaminated water. That makes it a bit more difficult to deal with those kinds of incidents.

Let's proceed with the solar panels. The Netherlands is in increasing amount using solar panels for so producing renewable energy we see them lakes, we see them on for sites, we see them on roofs, we see them on distribution center, we see them on crops. And what we see from the figures, I show some here that in the early days of installing all this system, 80 to 90% of the systems were installed in case of a fire were installed by let's say, pretty poor installation work human errors using the wrong materials, causing fires. And what we see now is that these fires, they produce this really sharp edge pieces, and they select some parts, they get spread in the environment. And they cause secondary dangerous for the cattle for the crops, and also for human beings, children playing, getting these pieces and getting hurt by the sharp edge pieces. They are most of the time nontoxic, but they can cause different damage to people, cattle, and crops.

So, what we see is an increase of the solar panel fires and the deposition issues regarding those sharp edge pieces of the solar panels that come to five to 10 kilometers in the surroundings in case of a big fire. And now the relation between the solar panels and the battery electric vehicles: both create additional risk for the fire services. This is an umbrella effect, which keep the cooling water, the extinguishing water from the fire services to the ignition sources, we get the deposition of the sharp edge pieces, we get the thermal runaway, we get electrocution risks. So, these kinds of new developments got new risks for the fire services as well.

To end my presentation: We think that at least in the Netherlands, this making use of renewable energies, affects life safety of citizens, firefighters, and complicated the way we are able to suppress the incidence. We often hear that the firefighters take care of the mess in case something goes wrong, but that's not the right way to deal with it. The manufacturers, the designers, the OEMs have special plans; they have to take their responsibility for safety in this kind of energy transition. And that's not to say oh, the firefight will take care of the math. Now they have to get into communication with the firefighters. What do you need to suppress the new kinds of incidents in a safe and effective way?

And that means that we have to put maximum effort on prevention and legislature to better guarantee safety, which means that we as a firefighter community have to stand up and try to influence the policymakers, the regulators, to take the right actions to guarantee a safe energy transition, and the safe way of suppressing those fires. Thank you very much.

Michael Abraham 30:33

So alcohol, tobacco, firearms: most people consider those to be enjoyable recreational activities. And they often ask me, What does that have to do with fire? Well, in the United States, the ATF has federal jurisdiction and responsibility to prop to provide the resolution to arson and other fire related crimes. And the way we do that is by having a network of fire investigators around the United States, where we work with our fire service partners closely to help figure out what caused these fires.

We can do that on a local scene level. Or we can do that in a major incident response with the national response team. Recent activations have included calls like Maui, and the double line of duty death, fire on the ship in the north, the port of Newark and New Jersey. We also have an international response team where we've responded all over the world. Most recently, it's been Guyana, the Philippines, and Bulgaria for call outs.

We have the fire research laboratory, which is what I'm based out of where we have fire research engineers, and we have forensic engineers who aid in investigations and basically try to answer the toughest questions; and fire investigation to figure out why and how things are occurring that result in

fires. With the prevalence of lithium-ion batteries in the modern fire environment, it's one of the topics that we have an interest in to figure out how they contribute to fire development and growth.

We've done a lot of projects such as this, while revaluated the potential for failures and ejection of flaming material. That picture on the bottom right-hand corner of this slide shows a flaming cell that was ejected 60 feet from the point of failure. And the only reason it stopped was because of the block wall that was in our laboratory that prevented him from continuing further on its way. It dropped flammable liquids as a part of the electrolyte that was burning, almost mimicking ignitable liquids in other scenarios in which you're involving more fuels. So, fire investigators and the fire service have to be aware of that.

This was an example of some research we did with a battery pack, we induced thermal runaway by mechanically failing it. We did it on a piece of three-quarter inch highway road plate. It took about an hour and 45 minutes to burn out in its entirety. But one of the most interesting facts about this is that that battery pack was recovered from a salvage yard after had been out of the vehicle and not in service for two and a half years. So, you can see that it propagates through the pack and fully consumes it. At the end of the day, they were trying to figure out who was going to pay for warping that three-quarter inch steel of highway plate.

This typical room and contents fire that anybody here in the fire service may come across, right? Would you have guessed that this is how it started though? The dog is chewing on—it's actually a lithium-ion battery that was charging for vape and resulted in that fire. So, fire investigators in the fire service had no idea until the investigation was done after the fact to figure that out.

Everybody's familiar with this incidence in Los Angeles, scorching the cab of truck nine. This was the Boyd Street Fire in the city of Los Angeles, for firefighters [inaudible] the massive amounts of nitrous oxide, the massive amounts of butane that contributed to that fire event. Did you know that we had to contend with 1000s of disposable e cigarettes or which had pre-charged lithium ion batteries within them—first of all to consider if they actually contributed to the cause of the fire, but then after the fact considering the contributing factors of these failures in the fire development and growth? Similarly, in Hoboken, New Jersey, we also had another vape shop which was storing similar products. This one resulted in two fatalities for people that were living in the commercial occupancy. But we came across items like this. This is a rolling tray which people use to create tobacco products and other products these days that people are smoking, but there's a lithium-ion battery pack inside of this because it lights up. So, there were boxes and boxes with 1000s of these products, which I was able to disassemble that rolling tray by hand with no tools; fracture the plastic and you could potentially cause a failure resulting in a fire. So, we had to contend with that we had two fatalities that I was consulted on.

On the left there in St. Petersburg, Florida, is a vape failure that occurred while it was in use, ejecting the mouthpiece into the sinus cavity of its victim. On the right, is a vape user in a vehicle and this has caught on video from across the way where upon failure, it filled up the environment with the gases and byproducts of combustion, he had enough time to throw it into the backseat as you can see, and that was the end of that story. He was overcome that quickly before anything else occurred. And obviously because the vehicle was closed, it had limited fire development and growth.

Steve had mentioned portable radios. This is a fire that we worked on with the US Coast Guard and the NTSB. This is a portable radio that failed on the bridge of an oil tanker in New Orleans. This disabled vessel in the Port of New Orleans had an economic impact of $700 million per day while we were investigating what happened. This is a next town over from me and my hometown in New Jersey, in my home state of New Jersey. We had a vehicle that went off the road; obviously ruptured, the battery pack resulted in massive fire. Another interesting point I'd like to point out there as you can see that your immediate source of water was taken offline, because it ran over that hydrant on the way off the road. So now you have to contend with establishing a water supply from an alternate source in Boston. This is actually a service vehicle that was being retrofitted to be a field unit with a slide out shelf where the manufacturer punctured the actual battery pack in the vehicle. These are battery packs from electric vehicles being stored, not in use, at a dealership where they had a failure resulting in the images that you see there. This incident was at BMW [inaudible] in Washington State, the occupant was traversing a logging road up to

their new residence. They smelled something burning, stopped, tried to make a cell phone call; call 911, wasn't able to reach anybody. So, they walked the remaining two kilometers up to their house called the landline, to their emergency services. When everybody got there, this is what they found. They were driving across a road; that had boulders, they had to move logs out of the way, and we have the risk of potential damage to the battery pack, of course.

This is in New York City. NYPD reached out to me and said hey, we have a Ford Fusion Hybrid which has a lithium-ion battery pack in the backseat, you can see that there in the bottom right-hand corner. It caught fire sitting in our fleet service yard. This was a result of deployment of an extinguisher within the trunk compartment. And the contaminants introduced in there over time, about two and a half hours later resulted in the fire that you see there.

This is the other risk for the fire service. This vehicle was involved in a structure fire, where the entire house and all of its contents as well as this vehicle were consumed. The fire department did their job, they put that fire out. And that was back in February, the vehicle and the house remained untouched for three months. A joint examination amongst the private investigators convened in April. So about three months later, they removed the vehicle in order to conduct a further examination. They transported it to a vehicle storage lot and three hours later—so three hour, three months and three hours later—the vehicle reignited.

So, you have to be prepared as a member of the fire service to contend with issues like this where you had already assumed you had done your job, the fire was out. Be prepared to have to deal with continuing reignition issues.

I wanted to say thank you for the opportunity to share the room with so many distinguished members of the international fire service community and I'm going to hand it off to Adam.

Adam Barowy 39:04

Okay, so, Adam Barowy UL Fire Safety Research Institute. I think the last several presentations have demonstrated that the scope of the battery challenges is extremely wide. Steve made some points that the types of products are essentially the far ends of the spectrum of anything that can be manufactured and powered. And so, with that many numbers of products being produced, we have to understand: where do we put our time and energy?

We're pretty good at what we do. But we have limited bandwidth to study all these different types of problems. So, I'm going to bring you through a couple different projects and one public safety education campaign that we put together to tackle the most risky types of battery problems. So, the ones that are happening both the most frequently and the ones that could have the highest consequences; unfortunately I have to leave out energy storage systems. But I'll bring you through consumer products and electric vehicles.

So, this is some work we've conducted on e-mobility devices. This is a typical US residence that represents a ranch style house. This is an e mobility device, moped style, between the front door—

basically, between the people and the means of egress. So, you saw thermal runaway occur, a flammable gas cloud built up ignited, you may have noticed that the living room windows blew out. Now there's very rapid fire developments. So, Steve actually made a point that some of these devices are more than just an ignition source, they provide enough fuel to be the fuel source as well. And so, the work of Steve and Dan Madrzykowski over the last couple of decades has demonstrated that we're seeing what almost looks like a time lapse video here with lithium-ion batteries.

When we saw a transition to more synthetic materials over the last few decades, we saw our fire development timelines to flashover go from 30 minutes to three minutes. I'm speaking most about North America, I'm sure it's similar across the globe. What you see here in this instance, is because that battery is large enough in that in that case to be the ignition source, and then the fuel which extends to secondary items. Now we see flashover in as little as a minute. It also failed those windows.

So now not only has that, in that case, has that incident gotten to flashover more quickly. It's also self-ventilated, so the fire is even more quickly advanced by the time the fire department gets there than previous incidents we've seen. When we took a look at NFPA standard sprinkler systems, in that same scenario, we looked at bedrooms, we also did living rooms. In this case, we can see that just a simple sprinkler on the orders of 10 gallons per minute, was capable of holding that fire in check.

So, the e bike went into thermal runaway, extended to its own plastics, but we don't see extension to those secondary items. And you can see from the burn patterns, and the photo on the right, which is the after photo, that fire did not get very far; we still have to worry about the occupants. We're very worried about the tenability. And so that's why we're going to be looking into the loss of tenability in transportation settings like subway cars in the next few weeks with FDNY.

So that leads me to our public safety campaign. Last fall, we developed a public safety campaign called Take Charge of Battery Safety, where charge itself is an acronym. So, we worked on that with our partners at the Bureau of Alcohol, Tobacco, Firearms and Explosives, the Consumer Product Safety Commission, the Fire Department in New York City, and the US Fire Administration.

And what we developed was this acronym, where we say C's: choose certified products. In North America, we have UL standards and other countries, those are being adopted more. There're also some European standards. But the important thing is to see third party safety evaluations of the products themselves. The incidents that Steve showed in New York are largely driven by unregulated micro mobility products, so no safety evaluation whatsoever. So that's our first piece of advice.

The second is handle with care, which means following the manufacturer's instructions. They're not all great instructions, but most of the manufacturers are interested in providing guidance, which means using it in the right environment, so not too hot, not charging it in cold temperatures, using the charger that it came with most critically, and not modifying the products.

A is always stay alert for warning signs. So, we were looking to educate owners of these devices to make sure that they are looking out for signs of mechanical abuse things like funny smells, funny sounds, hissing, popping—the things that precede thermal runaway, and those aren't always perfect piece of advice. But just being alert is a big step.

Recycling devices properly: it's our means not throwing these into the traditional waste streams, making sure that they're disposing of them in accordance with guidance from their local waste management authority, thus preventing recycling center fires getting out quickly if there's a fire. There's a debate as to whether extinguishers should be used on battery powered fires. And the advice we have basically is that based on what you saw on that first video: it's safest to get out quickly and call 911.

The last is just educate others so just propagate this piece of information. So, you can find more at batteryfiresafety.org. We have a series of videos we put out related to that guidance and we did a focus group to demonstrate the hazard to New York City residents.

So last I'm going to cover EV research at FSRI. This is a hard thing to condense into just one slide. But the scope is our hazards changing with transition to electric vehicles. We can see from incidents like Mike showed: some incidents that they don't burn the same as an internal combustion engine vehicle. But the hype is to jump to that they are far worse. They're uncontrollable, the fires are bigger, faster, hotter. This is essentially the refrain that happens every time there's a change in fire behavior, some new technology comes out we have to deal with.

We're focused on studying internal combustion engine vehicles, those have changed significantly in the last several decades. And baselining those to understand: what is the difference? That's due to vehicle construction, more plastics, whole glass roofs that can fail and cause increased ventilation and fire acceleration versus what's attributable to the battery.

And then part two is, what fire control strategies can firefighters use to mitigate demonstrated hazards? I could stick on this point for a very long time. But I ran actually some quick numbers on my commute here

today. Just to support this point, there are countries which I think don't have the scale challenge that we have in North America. And that is, if we were to look at fire blankets, they may be a useful tool, they can provide some functionality, but at a cost of about 2000 US dollars. If we expect every fire department in North America to have one of those, that's 34,000 fire departments. So, we're looking at potentially single use devices costing the United States $68 million.

If we look at a tool, which there are several which may be used to penetrate a battery, if I estimate that on the order of 30 to $40,000, that's $1.4 billion. We still don't know the scope of these tools, whether they're working, how effective they are, under what situations we should use them. So, it's necessary for us in our project, which we are conducting with international partners, to look at the basics.

First, every fire department in the United States has a truck that can carry water hoses and firefighters. So, what can we do with those tools? First, anecdotally, there's this challenge in North America; there are two opposing strategies. One is to let it burn, and the other is to use copious amounts of water. Both are kind of driving the new cycle on electric vehicles.

If we look at copious amounts of water, we know that the water is not getting inside the battery to where the thermal runaway is propagating. We're not taking the heat away. So essentially, we're letting it burn with water. The other strategy of letting it burn while we're in Washington, DC, that cannot happen on Route 495. Every hour that that shutdown is millions, if not billions of dollars. We could also look at tunnels, bridges, airport parking garages, there are limitless scenarios where let it burn is not a viable strategy. It may be viable in some.

So, we need the data to inform incident commanders of when should you be making a decision? And when can you not make that decision? Frankly, we don't have that kind of data right now. So that's why we're conducting what you see in some of these photos or some of our measurements. We're conducting experiments in two phases where we just burned the vehicle. We look for heat release rate, essentially the rate of fire development, its peak size and its duration. How long can these events last?

We're looking at water contamination. So, after we do our free burn scenarios, we're looking to understand what ends up in the water: is that environmental hazard, is that a groundwater pollution hazard?

And then we're also looking at heat flux. This is a fundamental approach. We can't test right off the bat electric vehicles and parking garages and bridges and tunnels; we need to understand what is the risk thermally from that vehicle to the structures around it or other vehicles? What's the fire spread risk, essentially?

And then finally, occupational exposure hazards. So, what are the vehicles emitting in terms of gases, vapors and particulates? And how does that end up on turnout gear? We know that there's turnout gear contamination from structure fires. So, what of those constituents are ending up on our firefighters' gear? And then, do we have the effective means to remove that in such a way where that gear can stay in service? We could go on about that for quite a while, but hopefully we'll answer any questions you have. And I'm going to turn it over now to Deputy Commissioner Ling.

Deputy Commissioner Ling Young Ern 49:39

Thank you, Adam. Good morning, ladies and gentlemen, I'm Ling Young Ern from the Singapore Civil Defence Force. And I'd like to say that we have had a great Day One yesterday with a lot of insightful sharing by many countries around the table. I'm also very thankful to Dr. Lori for inviting the SCDF to this Congress. Really glad to be here to be able to contribute to the discussions.

Singapore is city state and the SCDF is the main emergency service provider handling firefighting rescue, emergency medical services, civil emergency response, and disaster management. Along with our operational duties, we also oversee fire safety regulations, and civil protection. Singapore has a population of about 5.9 million, and a density of 1000 people per square kilometer. In terms of the land area, we are comparable to New York City. But just to be clear, it's New York City, not the state of New York, which is very many times larger.

The SCDF has about 5100 personnel and about half our full-time national servicemen who served with us for two years. So, on any given day, we have around 800 firefighters and 200 EMS responders, our paramedics and EMTs per shift. So, like many of you, we have a lot going on with very limited manpower. Now with that in mind, I'll be sharing how we are preparing for the challenges posed by electric vehicles in our country. And where we are focusing our research and development efforts.

Singapore aims to achieve net zero by 2050. We have an SG green plan to do this. And we hope to have 100% of our vehicles to run on clean energy by as soon as 2024. So, while the proportion of EVs to conventional petrol or diesel driven vehicles in Singapore, is still relatively small for now, we are already seeing steady uptake of EVs since 2017, and this trend will continue.

Over the next few years, we will also be building up our infrastructure to support such a future. This push for cleaner and greener roads through electrification is a vital one. But we also have to acknowledge that the road ahead isn't going to be smooth, especially when it comes to the challenges and risks of EV battery fires. We know how quickly an EV battery fire can spiral out of control, and it is clear that hazardous materials can be released.

This means responders need to keep a close eye on the situation, especially if it happens in a confined space. It is going to be tough for emergency services anywhere, but it's even more challenging in dense urban cities where the space is tight. traffic is heavy, and multi-story and underground parking are common.

Although Singapore is seeing more electric vehicles on the roads, fires involving these vehicles are still relatively low. Last year in 2023 out of 215 vehicle fires; only two were related to EVs. In 2022 there are six cases, and in 2021 three cases. So, these statistics kind of agree with what Nils earlier shared; I think in the Netherlands is about 3% from your slides. This year, we had one case so far in January. Fortunately, the incidents that were dealt with have not led to any persistent thermal runaway but we know it is just a matter of time. So, we do need to be ready.

And that is why our government set up the interagency EV battery task force last August. There are a few objectives here. Since several agencies are involved in responding to an EV fire, we want to streamline our coordination and incident response. While we keep promoting the adoption of EVs.

We also want to raise awareness about the risks involved so that people fully understand them. As our knowledge of EVs and battery technology improves, we hope to make changes upstream to enhance our infrastructure and regulations. Now this slide is a little bit busy, but it was one of the first products developed by the EV battery safety task force. It outlines the process flow for managing an EV fire incident, including where it occurs, who responds first, and their priorities for ensuring safety. It also covers how SCDF deals with the incident and considers downstream aspects like post incident management, including whether vehicle pounds and workshops are prepared to handle potential reignition risks. This is our vision of how a full blown EV battery fire should be managed. And we know we'll need to refine these processes as we learn and gain more experience in the field.

Now when it comes to fire safety design, every EV charging station, or a group of charging stations must have at least one emergency main isolation shutoff switch. The switch will allow first responders to quickly and safely cut off the main power supply to the entire EV charging system on that floor. This switch should be easily accessible, so no one has to travel more than 15 meters from the charging station or its parking lot to activate it.

Our approach to fighting an EV fire it's probably similar to what's being tried in fire departments around the world. It's important to recognize that there isn't a perfect solution for handling an EV battery fire. But there are tools that can help us manage the situation better. For instance, since late 2022, we have been equipping our frontline light fire engines, also known as red rhinos, with vehicle fire blankets. While these blankets can't put out an EV battery fire, we believe they can help contain the release of toxic gases, especially when used alongside a water stream. We are aware of the growing research supporting the use of direct water introduction into a burning EV battery to stop thermal runaway.

So, we are investing in technologies that enable us to do this. We have gotten a few units of the battery fire extinguishing system, which allows us to puncture an EV battery compartment pneumatically and flood it with water to cool the system. The SCDF will also equip our latest fire engines with an ultra-high pressure water extinguishing lands which should be available by the end of this year.

I wanted to share that the SCDF recently teamed up with our partner agencies to conduct a full EV burn test on the April 11. Just recently, here is a QR code to bring you to the link with the video of the burn test. The vehicle [inaudible] this test had a 30.5-kilowatt NMC lithium-ion battery.

It's important to specify the type of lithium-ion batteries because different types of lithium-ion batteries have different runaway thermal runaway temperatures. During the test, we use our new tools such as the fire blanket and the battery fire extinguishing system to see how effective they are together. The trial was successful overall as it confirmed the SCDF concept of operations for handling EV fires. It also reviewed potential issues and challenges that responders might face in these situations.

We are gearing up for bigger challenges, especially with larger electric vehicles like buses, where the battery array might be spread throughout the vehicle and sometimes in hard-to-reach areas. Right now, there are about 60 electric buses running all across Singapore and we are planning to have 400 electric buses by 2025. In cases where a battery module catches fire, and the undercarriage battery fire extinguisher isn't an option, we're hoping that the introduction of the ultra-high-pressure [inaudible] can help us bridge the gap.

An EV battery that has been affected by a fire can still pose a risk of re ignition even weeks later, which impacts our quarantine measures. We are interested in researching ways to help emergency responders assess the state of charge in a damaged EV battery, assuming the vehicles instrument panel is compromised and can't provide this information. Now without this knowledge, we might have to be overly cautious with safety measures during quarantine. However, if we can better understand the battery state of charge, we could adjust our measures, particularly for batteries at lower charge levels that present a lower risk of ignition. And this will be crucial for the sustainability of our efforts as EVs become more common on our roads. We also need to explore more cost-effective methods of EV quarantine, especially solutions suited for dense cities where space for a safety buffer is very limited.

Right, let me wrap things up the clock is ticking fiercely away. Thanks to advances in science and technology, EV batteries and cars are safer and more advanced than ever. However, we are still working hard to prepare for EV fires because they do present unique challenges for emergency services when they happen.

The visuals of these fires on social media can also lead to heightened media coverage that may skew public perception of the frequency and severity. And in our country, we have developed a multi-agency preparedness and response ecosystem. But we also need to work together in the international community like this, to strengthen our collective capabilities, both operationally and through research into EV battery fires and the appropriate mitigation methods.

We desire to be faster, to be safer, and to be more effective when dealing with such fires. Events like this really help us connect the dots, share knowledge, drive valuable discussions, and strengthen our network. And the SCDF is very honored to be a part of this effort. And I wish everyone a most fruitful World Fire Congress. Thank you.

Adam Thiel 1:01:00

Okay, thank you all for this great information. And now with the permission of our esteemed chairs, let's hear from our delegates about your experiences and your nations. While we're doing that, I know that colleagues here will be happy to take any questions you might have about the content of their presentations. Who wants to start? Well, let me talk while we're getting going here. It's never a problem for me. I feel very fortunate that over the past years, I've had the opportunity to visit many of your nations and visit conferences and speak with many of you and I know that a lot of these issues are very similar and your countries. So kicking it off here, the delegate from the Republic of Korea.

Korea 1:01:57

Yes. First of all, I would like to thank the panelists who made the presentation in front of that and thank you very much for giving me the opportunity to present it. Recently, due to the spread of eco-friendly energy use, there has been a lot of talk about electric vehicles, UPS selling batteries, and energy storage devices in data centers. Those panels occurred earlier, and as the panelists announced, it was difficult to extinguish the fire due to the thermal runaway phenomenon of the ET commissioner's battery, and even if it took a long time to extinguish the topic, it is true that there were quite a few errors in the activities of our firefighters.

Recently, if there is an electric vehicle charging facility or this ES fact in the building, it is determined that research is also being carried out on prevention and ways to respond to this topic in the country. By reference, if you look at the statistics for the year 23 in Korea, the general contents, agencies, and vehicles were distributed to about 27 million units, and the number of parcels in these three years was 1,3800.

If you look at that ratio, it was about one zero point, four hundred and forty thousand electric cars are currently in use, but in '23, seventy-two became a hot topic. So, if you look at the rate of fire occurrence, it's about zero point zero one day three pro, so if you look at the ratio of the number of topics generated by a vehicle, there's no difference between a normal internal combustion engine, car, electricity, or vehicle fire.

Now, as I said earlier, a little while ago, there is now a problem with suppressing methods that are now a hot topic, that part is now a problem. The way to extinguish electric vehicle fires in South Korea is that the panels are heavily waterproof, as I mentioned earlier, use a gun, or do mathematic by putting in an [inaudible] to use a room in the vehicle, or do mathematic by filling a separate container with water. But actually, that method, many people now have questions about whether it's an appropriate method, but first, that part is now a problem.

We are planning to conduct research now to develop fire response technology for all electricity-based mobiles, Ts, and related facilities or components with a budget of about 1.6 billion dollars from this year to year 27. Therefore, as we proceed with the research, we will seek a lot of advice from various stocks around the world

Thank you.

Adam Thiel 1:05:26

Thank you. And next we have the delegate from the United Arab Emirates.

United Arab Emirates 1:05:36

Thank you, thank you for the valuable presentations regarding this challenge that everybody is facing; actually their electrical vehicles. Again, people spend a lot of money, a lot of budget and developing the EVS and, unfortunately, very little budget in how to deal with the risks of this of these kinds of vehicles. But we are here for this mission to complete this cycle.

First of all, I just wanted to talk about training the firefighters, it's very essential that all firefighters get that training, how to identify, first of all the electrical vehicles, how to deal with cutting the cables, and how to deal with such fires. Because not everybody is aware of these kinds of fires. The second thing is protocol, we have to write a protocol. So, everybody who is involved in responding and decontaminating these kinds of fires, they should know the rules and the risks, and they should follow the protocols for this. And third issue. And the gentleman who talked about the costs of these kinds of techniques used to suppress these kinds of fires and the budget that we need to provide each fire station to deal with such accidents. I think the solution for this as we see it in UAE is to build partnerships with environmental agencies. So, they will be equipped with these kinds of machines. They are the experts and decontamination and to save our environment from these toxic fumes and etc. cetera, so a partnership will make it easier for us. So, a professional body will come and deal with such issues. So, our job is not complete. In just extinguishing

the fire. Our job is complete. Once we remove and decontaminate the materials from the scene. And in UAE, we use all the three techniques, and the container is the most useless. Thank you very much.

Adam Thiel 1:08:30

Thank you. And next we have the delegate from Guatemala.

Guatemala 1:08:40

Thank you very much for the opportunity to be at this conference. Basically, I think I speak not only on behalf of Guatemala, but of Central America in general.

As for emergency services, the issue of lithium-ion batteries and, in general, electrical energy is a very big [inaudible]. First, because when it comes to vehicles and equipment, we are generally receiving used equipment from Guatemala.

There is great forgiveness from the United States. There is a great deal of handling of vehicles that have already been crashed or that have been in an accident to our countries for a second use, and that is given the statistics that were presented today. We realize that, well, problems can also come later on.

I think that there is also no policy regarding the installation management of all these equipment, chargers, charging stations, parks, etc. That may also create problems for us in the future, with an increase in the number of cases of fires and accidents that we may have and therefore, our firefighters are not yet prepared.

They still don't know about these new technologies as we were seeing in the presentation, where the problem is not only going to occur immediately after the fire, but it can happen many hours later, even in the management of [inaudible], so I think that in Central America we need a lot of training on this subject and maybe right now it's not such a big problem because of the number of vehicles we have or equipment, but in in the coming years, it could become a growing problem

Thank you.

Adam Thiel 1:10:45

Thank you. And next delegate from Estonia.

Estonia 1:10:51

First of all, thank you for the panelists for sharing the information and for the opportunity to share some back in Estonia.

Luckily, we don't have many electrical vehicle accidents at the moment, only five, but two of them are fires. But we are already preparing because this is the future, we have an experience with gold card system coming from Sweden, thank you to the colleagues from Sweden and it's actually working system, it's an opportunity to drill a hole in the battery pack and extinguish the battery fire in with 200 litres of water.

But the problem is two hours after it starts burning again. So, you have to submerge it. We are implementing this system in our fire station and fire engines. But the cost of the system is pretty great. I mean, it's 1/5 of the fire engine, so it's not going to be easy to implement the system into the fire service. The other point and experiences after the submerged Boresha Daikon it was we took the samples from the water and sent it to the laboratory, and it consisted almost 20 different chemical elements and most of them were over the norm. And our sewage system in Estonia doesn't take it.

So, it's going to affect the filters and everything. So, we had to send it to Germany, to burn it and get rid of it. So, it's different kinds of problems we are facing and also the training of the firefighters to deal with everything. So, it's going to be a big cost to deal with the fires with electrical vehicles in the future. But it's important to start thinking about before it's going to happen in our countries already.

Thank you.

Adam Thiel 1:12:46

Thank you, and next delegate from Switzerland please.

Switzerland 1:12:51

Thank you very much. I would like to say thank you for all these very impressive presentations this morning. It was really interesting. And in addition to what has been already said, I would like to mention a specific study about fire and battery cells we made in Switzerland.

So, in Finland we have the Swiss Federal laboratories for materials science and technology, the E M P a, which conducts research in various fields including materials design, energy, environment, health and mobility. And in 2020, the EMP, researchers conducted a study where they set fire to battery cells of electric cars in order to analyze values aspect of the resulting fire, including the distribution of soot and smoke gases as well as the chemical residues in the extinguishing water.

They have made us three scenarios in tears and underground. The first scenario was a fire in an enclosed space the second one fire in a room with sprinkler system. And the third one very intentional with ventilation. By conducting these experiments, I learned that fire produced toxic soot containing metals test showed ventilation system can manage this kind of fires extinguishing water is highly conserved, contaminated and requires treatment before disposal. And finally, the contamination after an electric car fire requires professionals due to the SIR Sciver allergy risk. This study is a is available on the internet in English and there is also a video filming the different experiments to see the reactions. For sharing purpose, I will put all this information on our paper if maybe there is interest and possibility to share something like that. We are really interesting of that; I would like to thank you.

Adam Thiel 1:15:09

Thank you. And thank you for highlighting, again, the Communities of Practice is an important way of carrying this work forward. Next, the delegate from Luxembourg.

Luxembourg 1:15:19

Thank you very much.

I think one of the panelists raised one very valid point concerning the cost of tackling these fires, to the costs for the fire services. And the question is, do we need a special tool for each fire? I think that is not sustainable and not possible. And what we all have is a truck, personnel, and water. So, we should lobby with our policymakers that we find solutions that rely on the techniques that are available for all of us. For example, for the car fires, there's a French manufacturer who actually designed a solution with the code, so-called fireman access, which is an access port, which makes it possible to pour water directly into the battery pack. And also, other studies found out that the most effective way of dealing with EV fires is to pour water directly into the water pack, which so makes me ask the question, why don't make car manufacturers, have not made or are obliged to, to foresee such access for the battery packs?

So, I think the problem is that the fire services, they don't have a voice to make themselves heard for imposed safety regulations, which in some kinds are seen as being in opposition to the commercial interests of manufacturers of these devices. So, I think that also forums like this one, where we gather fire service from all around the world, should also use this forum to impose or try to impose such regulations on the manufacturer. Thank you.

Adam Thiel 1:17:17

Well, thank you for those comments. And certainly, I know from my former role, and in my current role, that frequently exactly what you're talking about. These are not necessarily top of mind thoughts, for the other folks in this very complex policy and regulatory environment. That's true here in the States. It certainly sounds like it's true in your nations. And we have another colleague here with some experiences in that area. And I'm going to ask the Fire Commissioner for the city of New York. Commissioner Laura Kavanaugh, who's here with us to share some of her thoughts on this topic. Commissioner.

Fire Commissioner Laura Kavanaugh 1:17:56

Thank you very much. And good morning. I think after that pretty extensive presentation, I don't think anybody here needs me to tell them how dangerous these are.

But I will say just in terms of our real life fire service, and obviously, a very large and prominent one, I want to give you just a sense of how frequent this is. In New York, we have a fire caused by a lithium-ion battery. Nearly every other day in New York City, we have a fire in which a lithium-ion battery is involved—nearly every day in New York City. In fact, last night, in the middle of the night, there was a fire in a high rise building on the 66 and 67th floor of a building under construction—so you can imagine how difficult that was to fight—caused by lithium-ion batteries and power tools from the workers that were there during the construction. So, this is a very, very real daily danger for our members.

We have had 18 citizens killed in the last year from these batteries. That is the leading cause of fire deaths in New York City. That is extraordinary. Fire deaths typically come from the causes we all know: human activity, cooking, smoking. For a new technology to come into being and be the number one cause is truly extraordinary.

So, this is a very, very real, everyday challenge for us. It is actually why I am here in DC. I've seen many of you today. But many of you I have not seen, and you've asked where I was. I was on the Hill. I had about a dozen meetings yesterday with legislators. And I will leave straight from this meeting to go back to the Hill to advocate for legislation to do exactly what we're all talking about here. This will require and mandate that there is basic certification for consumer products that have lithium-ion batteries in them coming into the US.

That certainly should have happened a long time ago but as is so common here, FDNY in New York City ends up being the tip of the spear. We did not see this danger coming until it was here with us and so we have been the champions of leading the charge and saying that this must have basic regulation. And I think everything we've heard here today would convince you that that's true.

I will also say that it only cost a few cents to make any lithium-ion battery, a certified battery. There are certainly many other challenges even with certified batteries, but on a very basic level, we should not have anything in our home that is effectively an explosive device when we do not need to, when it takes only a few cents to make that battery certified, that should be a basic mandate for those who are making these products.

And you know, I will say we get asked a lot, are we against lithium-ion batteries? Are we against this move towards greener power? Of course not. You know, not only do we all have to grapple with a world of emerging technology, but this also affects the fire service directly. The panel directly after this one is about firefighter health and safety and cancer is one of the rising threats to our firefighters.

And so, we have a vested interest in making sure that we have opportunity for cleaner power. But that does not mean it has to come at the expense of our first responders or citizens. In fact, with our traditional forms of power, there are already existing models. You would never let people store gasoline on propane in their bedroom, you would never let them meddle with those materials on their own, without certification and training.

That's no different here. We are asking for basic regulations for these green energies. And we think that it's really something that can be done. And we plan to set the model here in New York City and for the US. And I think what I leave you with is the call to action is for those departments who haven't seen this yet, we really encourage you to track this, it's possible that you are seeing it and may not be standing out and your data. Join with us and make sure that you too are tracking this and understanding what these things will confront once they do reach your city and your fire department.

For those who are in this with us who have already seen these tragic fires, we ask that you join with us, not only locally in advocating for this federal legislation, but in whatever municipality you come from, and making sure that your government understands that basic regulation is part of this. And beyond that, the basic infrastructure is part of this. And the gentleman from Luxenberg pointed that out that these

new technologies, as they're introduced, should come with the infrastructure that makes them safe, we should have outdoor charging for e bikes; taking a battery outside does 99% of the work of making it safer. When we get an electric vehicle, it should come with a suppression system that our first responders can count on.

And so finally, what I'd say is the final call to action is to industry: have public safety at the table. We say that in every meeting we're at, in every meeting with Congress that it is: whether or not you have thought about this, when someone has to call 911 in the middle of the night, it will be us who responds, not you. It is our members who will be crawling down a hallway at 1:00 am wondering what is at the other end.

And so, we urge them to include public safety at the table at the beginning as we develop not only these new types of power, but frankly, as the world moves faster, and new technology comes into our everyday consumer space. We should all be at that table.

So, I thank you all for being advocates with us on that I hope you'll talk to us and with us, if we can help be partners. I think the greatest pressure we can bring is by joining together, so thank you. Thank you to Lori and everybody that made this happen. Certainly, we are here to help however we can—so please come talk to us.

Thank you

Adam Thiel 1:23:52

Thank you, Commissioner, for your leadership on this issue. And now back to our table here with the delegate from Mexico.

Mexico 1:24:04

Thank you very much to the panelists. Excellent presentation to each of them. Thank you, Dr. Lori, for this great opportunity.

Mexico recently announced the creation of the Tesla plant in the city of Monterrey, Nuevo León. We already had a first case, eh? Indeed, we were limited and my participation is focused on supporting our delegate from Luxembourg, which is very [inaudible].

We have thought that if the most developed countries have sufficient economic resources; a country like Mexico, as the Guatemalan company said, we are limited in resources.

We are limited in training, and I believe that this Congress is the appropriate forum to be able to primarily guarantee the safety of our firefighter sisters and brothers. If we talk about the amount: I was listening to the data on how many billions of pesos are required to be able to acquire these new technologies. I believe that the companies in the industry that are dedicated to the manufacture of these should be our main allies of the first responders.

I join and agree that we can generate this type of alliance through this Congress, this committee so that in future forums we can interact with them and obviously also think about everything that this implies. The challenge of recycling.

There are many products that arrive in Mexico that go to Central and South America and this is also a fact that we have an obligation to document. Currently there is no hard data that tells us how many vehicles with this type of new technology exist in our country, and I think that is our challenge.

And above all, because looking for those alliances that allow us to generate funds and public policies that can make this problem visible and address this problem.

Adam Thiel 1:26:33

And next our delegate from Australia, please.

Australia 1:26:40

Thank you and good morning.

Our experiences in Australia are reflected in all of the presentations today and latest stats are showing we're getting about five EV fires, lithium-ion battery fires a day at the moment, there's a great opportunity for the COP to look at best practice and share the knowledge across multiple aspects and namely data collection and statistics.

And how do we have consistent data points from around the world feeding research legislative controls that have been successful elsewhere, and that we can apply consistently building codes around garaging and charging for of consumer products and retrofitting of buildings for charging stations, etc.? Community messaging, how are we getting into target audiences in Australia; we're really focusing on food delivery e bikes, where we're trying to influence large sectors that are storing these bikes in high density housing and impacting on egress out of high-density housing.

So, I think if the COP could look at sharing commonalities, so we're not over investing and reinvesting in areas that we can learn from, I think that's a really positive aspect of the COP. Thank you.

Adam Thiel 1:28:11

Right, thank you. And next, the delegate from Barbados.

Barbados 1:28:23

Good morning, everyone. In Barbados, our prime minister has given an incentive for every citizen to actually own EV vehicle, and to install these PV systems on your homes, that people get clean energy by 2030.

But come in with all of these incentives, there's a problem and there are difficulties coming with them that we have all heard here this morning. And I personally believe that the developers and the large industries create problems by date and (inaudible] interventions or inventions. And then the fire departments have to find solutions to these problems.

And all the developments that we have seen an EV is one of those. And it should be essential that as you develop your new product, you should also be investing in the development of the solution to the ills and the challenges that are presented by the product that you develop, because you're going to be selling them to the citizens. They're going to be put in in their homes and you expect them to purchase and use your product. So, then you should be able to put some of the money, there should be some planning gains to the citizens from these products that you prepare.

And then, I believe that you should also be invested in training for the respondents who have the rest their lives to protect the integrity of your product and the lives of persons who will be using them and the responders. So, therefore, some monies and some resources should be placed there for training of these individuals as opposed to the fire departments now having to and the responders have to look for a lot of funds to purchase equipment to develop techniques, research, and development to solve the problem that you create.

Adam Thiel 1:30:42

Thank you. And next the delegate from South Africa.

South Africa 1:30:49

Thank you, yes. My question or remark relates to the road traffic accidents where there's no ignition; within 10 minutes with his extrication needed. That is in my opinion, one of the areas that still needs a lot of work, and they should be collaboration with the developers of this specific product, and they should come to the to the phone assist with it. And that is the immediate risk not only to the occupant of the vehicle but also to the rescue [inaudible]. There is no ignition and there is a structural damage or

component damage to the actual electrical system. So it just that should possibly also be added as a point of interest to the COP.

Thank you.

Adam Thiel 1:31:36

Thank you. And next, the delegate from Taiwan

Taiwan 1:31:38

Good morning. In our experience for the parking lot underneath, we saw the type B fire. Now we change this concept for the type A for EV fire.

So, we install a sprinkler as a parking lot instead for the extinguisher. And for the training courses we provide at our training center, we provide the fire with blanket and the co extinguish underneath when we cover the blanket. And we use a CO2 as a extinguish. Yeah, is a meal one and the meal tool.

We use a spike underneath, and we use the water spread underneath to pull out the EV fire is a method tool for the EV fire. And also, we find the water tank as instead, we pull the IUV fire in the tank and we try to put out the EV caught fire and we, our firefighter fire a new method as we know. We have our barrier and put the barrier as a pool and feel the water inside. So, we put the fire in the pool. Is there way instead? So, we share our just training opportunity with [inaudible] and also with Philippines. We try our best to find the best solution for our EV five.

Thank you.

Adam Thiel 1:33:21

Thank you. And next the delegate from Austria.

Austria 1:33:27

Thank you. Thank you for this interesting and very exciting start to today. Thank you for very, very interesting talks.

I have two points that I would like to address on the one hand, and it has now been raised again and again in the individual statements and I believe in presentation by Dr. Nils Rossmuller. It was also addressed that the position of industry, and industry should definitely also committed to thinking through their developments here and that something good is not only happening with this, but something can also happen. Only this strategy is usually ignored, and I would perhaps like to an example from Austria that seems quite curious.

In Austria, we have our reaction to the fact that e-mobility can also cause problems especially with vehicles. We have procured a few of these quarantine containers and have also strategically distributed them, also strategically. It didn't take very long for us to get two patent lawsuits from abroad, exactly one lawsuit from Germany, because the container looks similar to a company that also produces such a product.

That was a problem. The container was only many times more expensive than ours was. The second and the much more curious thing about this story was that the process of putting the vehicle or a battery in a water bath was also protected by patent law; the vehicle or a battery in a water bath was also protected.

This means that every process that we have to use to delete in order to avert the risk would be protected by patent law, and every process we make would be an infringement of patent law. A law firm would have to take many thousands of euros into our hands and then not really be able to avert this lawsuit but could at least avert parts of it. A lawsuit would have cost us around 200,000 euros in the best-case scenario, so that you can see what developments are needed here. A clear, central demand

on industry and politicians must also think through. A strategy has to be fully thought out and a great deal of knowledge has already been created here, and I would like to deliberately mention the ZDF Committees here for this exchange as well.

A great deal of knowledge and information is stored here, and great deal of knowledge and information.

There are many experts here who exchange ideas here. I think this knowledge is also available on ZDF and should be used in this forum. An important issue and, above all, a clear positioning in the direction of politics, but also industry, is necessary.

Thank you.

Adam Thiel 1:36:27

And next, the delegate from Cyprus.

Cyprus 1:36:34

Thank you. I noticed in Dr. Nils Rosmuller presentation that 25 up to 35% of fires accused during the recharging time of the car segment. And I want to ask, are there any building codes that include charging points in buildings? And more specifically, what are your thoughts regarding installing charging stations for electric vehicles in basements, having in mind that the fire, where he goes, and the fire miss is very difficult to reach the fire in basements? And if a fire expanded, then there is a danger to goes to the apartments to people living there? And what is your opinion of view if we ask for the [inaudible] to be on [inaudible] open any areas?

Thank you.

Adam Thiel 1:37:33

Some brief remarks on that. And then other colleagues might want to weigh in briefly.

Dr. Nils Rosmuller 1:37:40

Thank you very much. It's a big issue in the Netherlands as well: parking electric vehicles in basements. We took some additional measures in policymaking.

So, we prohibited the kind of parking for electric vehicles in those, let's say, buildings where people sleep, hospitals, and so on. So that's sort of precaution.

And we have also made some safety measures to enhance the firefighters to suppress the fire. So, there should be one single point to switch off all the charging points. And in the case, it is possible, we prefer them to locate the charging points near the exit.

But we are, let's say, realistic enough that in a couple of years, or parking lots are fully employed with charging points. So that's not an issue anymore. But in the starting, and we are still learning how to deal with these kinds of mechanisms, this is a preferable position of the charging points.

Adam Thiel 1:38:55

Okay, thank you for that. And next we have the delegate from Slovenia.

Slovenia 1:39:01

Good morning. Our opinion is that the attitude of battery and solar panel companies towards society should also become social responsibility. By this we mean that part of the income from sale should be allocated for the awarenesses of the inhabitants and the equipment and training of firefighters.

Thank you.

Adam Thiel 1:39:26

Thank you. And next the delegate from France.

France 1:39:32

First, thank you very much for the for the presentation this morning. Very, very interesting. And to go a little bit further for the colleague from Luxembourg, getting the engagement of the fire department in the industry.

We are the exemplar in France, in the area of Versailles, of having an officer seconded to the one of car manufacturer in order to help them, and to assist them in the conception of the car and to have this access for the firefighters and for the know that. So, they are creating SOPs that are available to all the firefighters in order to know how to operate in these kinds of vehicles and to do it safely.

And it's not only the fire, it's also corroding the car during the car accident in order to not create the fire or not create electroshocks there. So, everything is from the beginning of the conception of the vehicle with this manufacturer, with this officer embedded there. Thank you.

Adam Thiel 1:40:31

Merci beaucoup. And next, the delegate from Sweden.

Sweden 1:40:36

Thank you, an interesting discussion. And I think I do agree with the commissioner about consumer product, because those are things that needs to be safe.

But I also sitting here and considering we are all carrying these batteries around with us, I will [inaudible] one in my cell phone, I do charge it overnight, even though I shouldn't, but I consider it safe. So, we can't really say that all these batteries are that dangerous, can be looking at cost statistics, at least in our part of the world.

Electrical warfare vehicles burn more or less than traditional vehicles. And in that case, vehicle as a group has become safer than before. So, I think we also need to take that in consideration that every vehicle, for example, that burns is a dangerous fire. All smoke from all vehicles, for example, is dangerous. And that's things we need to take in consideration and not fault and blame everything on the batteries. Yes, we need to follow the development of new products, we need to be careful, and we need to study them. But we need to be part of that journey.

Thank you.

Adam Thiel 1:42:04

Thank you. And now the delegates from Fiji.

Fiji 1:42:10

Thank you very much. Having listened to all of the presenters today. What comes into my mind is the concluding remarks from the chair Lori yesterday in challenging us in how can we break the cycle.

At one point in time, the global family was looking for a solution to try and reduce the carbon footprint. So we made the transition from fossil fuel to renewable energy and the birth of renewable energy came the lithium-ion battery. And with that, also the birth of the new challenge that we are currently facing: the lithium battery, thermal runaway. And that is a big problem that we are currently facing now.

So directly this is affecting our firefighters. Honestly speaking: Fiji, we don't have this expertise that can help our firefighters, we don't have the expertise for that. And to answer the question that was posed to this forum by the Executive Chair of this forum. How can we break the cycle? And listening to the presentation this morning, Dr. Steven actually gave us the solution for that and that is to maximum effect, maximum effort on prevention and legislation to better guarantee safety.

But who is going to do that for us? That is the question that I want to pose to this for who's going to do that for us? Well, the challenges that are there for us in Fiji is the government initiative in introducing greener energy. And what I can say to this forum is that the tourism industry in Fiji is taking the lead role in terms of introducing greener energy, and they have created a policy to have all the transport to be EV and only speaking if you are one of those that are having a tick on the box to make Fiji. So you're one of your destination [inaudible] holiday in Fiji, you could be one of those that could be affected in this.

So, this is a global problem including Fiji and all of those that are sitting here. So, I would suggest that through the Community of Practice, we are addressing at least a generic policy that can work for all of us. We cannot design a policy that can save Fiji from this from this problem; I think it is a global problem. And I think that you hold the expertise in this.

And it is right in this forum, we will all sign the world chapter. And I believe that we are all in it. And we have to take ownership of it. And we have to design a policy that will work for all of us. And then we can, from that policy, we can design our own. At least we have a generic policy that can all help us.

Thank you very much.

Adam Thiel 1:45:54

Thank you, Fiji. Great opportunity for our Communities of Practice. And next, we have the delegate from Ecuador.

Ecuador 1:46:07

Good morning to everyone. Definitely, the imports that we have in Ecuador of electric motorcycles that arrive without any regulations, are starting to become a problem for us. A problem, because they are motorcycles that sell for three hundred and four hundred dollars and are bought by people [inaudible]. And these people don't even have a formal electrical connection in their house, but are in many cases connected to the light pole without having a meter.

And those motorcycles are on fire. The cables are setting fire to cables, patching up stuck together cables and their [inaudible] is becoming a problem for us and there are thousands of motorcycles that are being driven indiscriminately, without a license, without controls and without anything.

And on the other hand, we, with the AMB body is Guayaquil, with the company Quía: The company built us a service and maintenance station for electric cars at our academy. He handed us an electric car and took us to Korean instructors to train us to put out fires in electric cars. I believe that all fire academies should ask manufacturers to also share this type of technology and investments with firefighters in each of [inaudible].

Gracias.

Adam Thiel 1:47:29

Gracias. And next, we have the delegate from New Zealand.

New Zealand 1:47:36

Firstly, thank you for the panel today. And thank you to all the other speakers have come before.

Like all of the other countries, New Zealand's got that same evolving challenge around the lithium-ion batteries, the stored electricity, all the different challenges. But I think from this forum—it's the first forum, but the question I have is, do we have a voice? Do we have a voice as a world forum?

And I listened to the foreword to the chief of [New York] and the amazing work that she's doing at the Capitol at the moment. And the underlying problem here, it's not about the lithium-ion batteries or the EV cars; it's actually about new technology, and who has the voice of safety around fire across the world and the world voice and bringing that together.

So, we're now looking at the Community of Practice, and sharing information, intelligence, stats, approach to how we're moving or trying to change legislation within the different countries is going to provide real support across the different legislative environments that we all operate in to actually drive that change.

But at some stage, I'd say the World Fire Congress must have a voice, someone has to stand up for the voice of safety around fire, or climate change, or whatever it must be. And you know that something will evolve as time goes on. But that's the real point that I wanted to make here around the underlying problem. That's what we need to address, which is changes in legislation or standards or approaches across governments.

Thank you.

Adam Thiel 1:49:19

Thank you, and next the delegate from Germany.

Germany 1:49:25

In Germany, too, the challenges of new technologies pose major difficulties for fire brigades we are standing. We are trying to get in touch with the German automotive industry, which plays a not insignificant role in the ECT of vehicles. We are trying to obtain information from automotive manufacturer associations about the critical points in these vehicles It's not always easy.

However, we reach committees through the standards, where we then also have the power of the state behind us and then access information. We have various research projects that run, like fires with such vehicles, but also with batteries in many thousands of devices we've already talked about deleting, can we try to create instructions for our fire departments. But we attach great importance to cooperation, and if many countries are moving in this direction, then it makes a lot of sense if we also work out everything we put together, to have a common voice, have a common voice, because political support is also needed.

When we demand safe batteries, it costs more money, and we can only do that if politicians also get involved, and that is why it is extremely important for us to work on something together here.

We are very happy to share our knowledge, including our contacts with the automotive industry, order to find mutually agreed solutions end. However, I would like to say that these techniques are not the work of the devil. Of course we'll get it under control. Of course, we also have the opportunity to fight such fires.

I may have a little anecdote I told our guide fire department leaders at a big [inaudible]. The first firefighting trains in Germany, which was around 1900, were equipped with electrically powered vehicles. If they had told the fire departments back then that we wanted to use petrol-powered vehicles now, they would have said "Are you insane?" Even in our [inaudible], we can't park a vehicle with 200 liters of premium gas in the tank, the whole house is in the air when the car [inaudible].

In addition to this point of view, one should perhaps also approach this topic. I certainly see opportunities for them to get a grip on that as well. And what is also a major issue in Germany is changing the infrastructure. It's not just enough that they get more and more electric vehicles, these vehicles also have to be charged, the cities are being completely rebuilt. We have charging stations everywhere, we have huge amounts of electricity that are routed into the cities so that these vehicles can also be charged.

No one knows what the consequences are for us. No one knows what effect this has on claims, so, we still have a lot of work to do here, but I'm sure we'll get there.

Thank you

Adam Thiel 1:52:26

That is the last question we have in queue from our delegates. I will turn it back over to our chairs for some concluding remarks.

Dr. Lori Moore-Merrell 1:52:39

Absolutely. I'd like to have the panel engaged just a couple more minutes. We've got a few more minutes until we get to break; I would like to talk just a bit.

First of all, we've heard that we must have green technology. I think the chief of Fiji, Sweden, Switzerland, we just heard Germany, everybody—this technology is going to be necessary for innovation and for us to maintain the climate change reversal, if at all possible in our lifetime.

But how do we move forward to address fire risk associated with that innovation that is necessary to stop this cycle, as was eloquently said again by the chief of Fiji? So, what is the role now of research to get us there? I'd like the panel to address that. Where are we lacking in research? And how do we come together to bring forward great ideas? Having the manufacturers involved, having us take policy regulation, stand together—the solidarity message is absolutely key from the fire service: protect our firefighters in the midst of these risks.

And then pulling all this together, I will say regarding the innovation: We want the innovation, but we want it to be firesafe. Panel: Let me hear from you for just a couple of minutes, please. Dr. Kerber.

Dr. Steven Kerber 1:54:00

Thank you, Lori. And I think what we're hearing is we're way behind, right? So, we need to catch up first, because this is not something that's going to go away on its own; it's actually going to continue to build momentum and head where it's going to head.

So first off, there's not a lot of countries here that have fire research organizations. So, we need more of those. And through networks like this, we need to be talking more, we need to be collaborating more. And because we need to be smart about the research that we do. It's expensive, it's dangerous. It takes a lot of time, as our colleagues from Australia pointed out. We need good data coming in so we know what the greatest challenges are, what the greatest risks are, so we can tailor that research to the greatest risks and do our best to try and get ahead.

The fact that no one knows how to put these things out but there's millions of them out there is disturbing. How did we get here? And I think that, at the same time, we can have a vision where we can be ahead of this, we can be on the other side of this challenge here, where we are involved at the table early on in the manufacturing process; early on in the conceptualization.

And there's plenty of technologies that are already over the horizon that are probably going to be on us faster than we realize. So, it's really hard to catch up and at the same time, build the infrastructure to be ahead. So, we've got our work cut out for us. I mean, right now, I don't think there's a fire research facility in the world that can burn an EV bus. And yet, there's EV buses being rolled out for all of you to meet all of your goals that you have set for your various countries on different dates. And we don't even understand that full hazard. So yeah, we've got a lot of challenges.

But having done this for 20 plus years, it feels like we're catching up in many aspects. But the challenges are certainly getting more complex because they're building on each other as well. So, if we figure out the battery thing, well, then the battery has to go in the tall wood building; all right, now we have to figure that out and keep going—but think collectively is our best shot.

Dr. Lori Moore-Merrell 1:56:23

And thank you, Dr. Kerber. I think prioritizing everything that we heard this morning for the Communities of Practice and what they will deal with first. Perhaps being able to define the problem for all of us, being able to create this model, policy or regulation for all of our nations that they can then leverage in their nations based on what we do know from research, where can we intervene—and then I think trying to remain active and continue to understand the industry.

Because as we all know, the batteries are changing what is coming in, they're evolving. Those changes

we have to monitor, because that is the only constant really in this space is change. And so, I think the research will stay prominent. Any last words from the panelists; any final words that they would like to have? Each of them can have just about a minute if they'd like to do that? Perfect.

Dr. Steven Kerber 1:57:18

One minute, really quickly. And as this discussion has evolved, it's made me look at the collective of who we have here. And one of the worries I have is when Commissioner Kavanaugh is successful, and we go ahead and we require certified devices to come into countries like the United States, where are all those products then going to go that they can't come here? They're going to go other places. And we've heard a lot of countries talk about second use and hand down and things like that. I worry that we're going to create this terrible ripple effect. So, I'm wondering if there's a way that we can get ahead of that possible ripple effect, so that what we're experiencing doesn't become a tremendous burden for all of the other countries that might not even have the resources that we have dealing with it now.

Dr. Nils Rosmuller 1:58:10

Yes, one thing to add is that, apart from the battery, electric vehicles, the micro mobility and the in-home energy storage systems, which we have to make, let's say, the citizens be aware what they are carrying in their home and how to treat those, let's say, new kinds of risk in the home. Because in the early days, we had industry and big energy plans beyond the cities, putting the energy into the houses. And now we are becoming our private energy companies, storing energy, selling it to the neighbors. We make the risk ourselves. And so, we should make the citizens aware about the risks that they are facing, and they are producing themselves as well.

Michael Abraham 1:58:58

Yeah, for us at the ATF, we're going to try and do what Dr. Kerber mentioned, where we're going to continue doing research and testing that the fire service can benefit from to deal with the ongoing issue. We hope to be able to share that information with other research facilities from around the world and have a continuing growing data set to address the problems and be able to deal with them in a more efficient and effective manner.

Adam Barowy 1:59:24

My answer is pretty similar to what Steve said and what Mike just said. But I think to move forward, we need tangible data on risk.

I'm sensitive to what the gentleman from Sweden said, which is that—well, I think he's implying that in a vacuum, we assume the worst. And I think it's reflected in some of the comments that things are going to change, the fires are going to be incredibly severe.

So, I work more specifically on getting data on the consequence side. What will be the consequence of a new bike? Fire will be the consequence of an electric field, vehicle fire; how can we reduce those? We definitely need more data, as you saw from Steve's presentation, on the sort of scraping the web for incidents. We need better data on what products are failing, where they're failing, how they're failing. So, we can identify and target those products, come up with product safety standards, regulations, and go after those. And so, we have some ongoing efforts to do that.

Deputy Commissioner Ling Young Ern 2:00:20

Just two quick points to add, I think on the research, that is required at two levels. The first, we need to figure out the battery, right. And that is probably at the industry level, because we see that cobalt-based lithium-ion batteries have a higher risk and a higher thermal runaway temperature. But the federal phosphate base lithium-ion batteries have a lower risk, lower thermal runaway temperature, and so even cars can now be using the lower risk batteries. And increasingly, even manufacturers are using these safer batteries.

So, this is something I think: more recent research can be done. And car manufacturers or battery manufacturers gotta figure this out. The second point is for the fire service. You know, we need to figure out the aftermath of the battery, when the battery has is burned, involved in a fire, how much charge is there left, how to deal with this disposal, you know how to prevent ignition, and those things also needs to be figured out and more research has to be done so that we can handle the incident very safely. So, two things: figure out the battery, figure out the aftermath of the battery. Thanks.

Dr. Lori Moore-Merrell 2:01:32

Thank you very much. I'm going to turn to my co-chair for a comment.

Mark Hardingham 2:01:36

Thank you very much, Dr. Lori. I think quite rightly, today, there's been a focus on the production of these devices and the use of these devices and the impact they have on people that are using them. I think picking up on Dr. Kerber's point about how do we try and get ahead of the curve, an area that concerns me is what happens when these devices are no longer used. I mean, we are seeing an increase, certainly in the UK, around fires in waste, and recycling centers, places that tend to be poorly regulated, and often poorly managed, if they're regulated and managed at all.

I think this is relatively new technology. So, the percentage of the quantity of those waste and recycling sites that are lithium-ion batteries is relatively low at the moment, it is causing us as a significant issue in two, five, ten years' time, that percentage will increase significantly, as will the size of those sites.

And yesterday on the climate change discussion, we talked about the impact of the scarcity of water. And these fires use a significant amount of water over an extended period of time. And we also talked with colleagues from the UAE on the data they have on the impact of the products of combustion from fire on climate change. And these fires burn hot and hard for an extended period of time.

So, I think if there is an opportunity to get ahead of the curve, that might be one place where we could focus some attention.

Dr. Lori Moore-Merrell 2:03:00

Excellent. Thank you so much. So, at this point, many have been asking about the slides from all the presentations. We are going to make those available to you, all of the delegates. And then I want to remind you of the Community of Practice cards. So those are there for you. You can leave them on your tables. If you've written notes, we will come around and gather those, particularly for this Community of Practice, if you have additional notes you want to share.

At this point, we are going to first of all thank our panel and then we're going to take a 20-minute break. We will recess and come back here in 20 minutes at 1015.

And one last note. The hydrogen vehicle is appropriate now for this conversation. We've talked lithium ion; now we're going to we'll see what's next but there is an example of a hydrogen vehicle cell rescue truck. For lunchtime, you'll have time to go out and take a peek at that which is our next energy innovation. So, join me in thanking our panel and then we will take a recess.

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Dr. Lori Moore-Merrell 03:55

All right, delegates will come back into session. And this is our fourth and final challenge before us at this Congress. This is our firefighter health and safety challenge.

We all know that across all of our nations, our firefighters struggle with several health concerns including elevated rates of cancer and mental health conditions. Firefighters are known to have a 9% higher

risk of developing cancers and as much as a 14% of dying from cancers compared to the general public. Firefighters and other rescue personnel also develop post-traumatic stress at a similar rate to our military personnel.

The health and safety of our firefighters is certainly a vital topic of our discussion here at this Congress and our facilitator for this particular panel is Miss Sally O'Brien from the US Department of Homeland Security, Science and Technology. Our speakers for cancer will be Dr. Jackie Goodrich from the US. Dr. Sarah Jahnke on behavior health from the US, Dr. Denise Smith for cardiovascular from the US and Dr. Jennifer Taylor on recruitment, also from the US. Welcome to the stage, ladies. It is all yours; I'll hand it to you.

Sally O'Brien 05:29

Thank you, Dr. Lori. Good morning. As Dr. Lori said, I'm Sally O'Brien with General Dynamics Information Technology. And I've supported the Department of Homeland Security's Science and Technology Directorate for nine years, mostly working in first responder technology. So, this is a near and dear session to my heart. We'll be starting off today with Dr. Jaclyn Goodrich, talking about firefighter cancer.

Dr. Jaclyn Goodrich 06:02

Thank you. So, we've heard a lot in the last few days about immediate dangers that firefighters face. And now we're learning more and more in recent years about risks for cancer and other diseases that take a long time to develop, but which are just as important to prevent and to protect our firefighters against. So today I'll be giving a really short overview on what we know about cancer risks in the fire service—and more importantly, how we can work together to protect against these risks and where we can go from here.

It's no surprise to anyone here that firefighters are exposed to a ton of different things that are known to cause cancer. Individually, things like combustion byproducts, diesel exhaust, even shiftwork and ultraviolet radiation all cause cancer. And these are things that firefighters commonly encounter on the job. The extent of which exposures in individual firefighter has, how much, and when depends on whether they're working on a structure fire, a wildland fire, now new emerging things like lithium-ion battery fires, and responses to disasters. And we don't know yet about how each of these individual exposures contributes to risk for disease. But what we do know is that combined, all of these things can lead to cancer in the fire service.

So, the World Health Organization has a process that uses a really systematic method to evaluate all of the evidence that's out there in the world to determine if something causes cancer. And in 2022, there was a workshop through the World Health Organization that I was part of that looked at firefighting as a whole and if there's enough evidence to say this is linked to cancer. So we looked at all of the exposures that they have, which I just mentioned; we looked at biological mechanisms, or subtle changes that happen in the body that when enough of them accumulate, can turn healthy tissues into cancerous tissues. we've only weighted 10 of these mechanisms that we call them, and six of them had strong evidence that they can occur and firefighters. These include DNA mutations; epigenetic alterations, which are things that turn your genes on and off; oxidative stress; constant inflammation; and also activation of receptors, things that your hormones should normally activate.

So, there's strong evidence for these biological mechanisms that we know can lead to cancer in the long term. There was also strong evidence in human studies following firefighters over time, that showed firefighters had higher rates of mesothelioma and bladder cancer, as well as evidence for things like higher rates of colon cancer and prostate cancer. In when we evaluated all of this evidence together, using a standard metrics, the working group decided that there was enough evidence to say firefighting does cause cancer. And this came out about a year ago.

So, I'm sure most of you have heard about this. But what's really important now is, where do we go from here? We need our firefighters, and we want them to have long and healthy lives. So, what do we do next? So, there are some key take takeaway messages from this process. There's a lot of information that's missing, that we still need to figure out. And then there's a lot we need to do in the prevention and intervention space.

Some of the key takeaways for me are that most of the evidence we have is really from firefighters who work on structural fires. We don't know a lot about emerging risks from what happens when your primary duty is to fight wildland or forest fires and also fires at the wildland urban interface. What are the risks when you're responding to disasters from climate change, and chemical factories burning and other things like that? We don't know that as well.

We also weren't really able to evaluate unique risks for firefighters that are underrepresented in all of these studies. So, a lot of the research that's been done, really has been primarily with male firefighters from mostly white or European type backgrounds. And we don't know as much about the risks for female firefighters, for firefighters from countries outside of places like the US, and also even volunteers. What are their unique risks compared to paid or career firefighters? And then something important that my team has been trying to work on too is what can we do with this knowledge about these biological mechanisms that are happening? They happen in people that are healthy; this means it's a point of intervention and prevention, when we need to find ways to reverse these mechanisms before they actually lead all the way to disease.

And with that in mind, I think a lot of the work going forward needs to focus on interventions and making firefighters healthier, reducing the harmful exposures, but also promoting health. And this is something I'll just tell you really briefly about. I work with United States' national study called the firefighter cancer cohort study. Several people in this room work on this with me. And our mission is to address some of these knowledge gaps and, going forward, to test some of these interventions too. So our goal is essentially cancer control and prevention in the fire service through research. But we're doing this by collecting data from hopefully up to 10,000 firefighters that we can follow for up to 30 years from all over the United States. We collect biological samples, so we can measure health effects and also exposures and a lot of survey data about their job duties, too.

So where do we stand right now? Right now we're at about half of our goal, we have 5000 firefighters enrolled from 29 states, the ones colored in red in the map here. And we've tried to enroll fire service members that are typically underrepresented in this work—like female firefighters, volunteers, wildland firefighters. And for any anyone else who's interested in doing this kind of work in your country, I just want to point out too, it takes the conglomeration of a lot of resources to do this.

So here we are fortunate to have a grant funding mechanism through FEMA, that funds for health research. And we've been linking together these different funding sources, working on different groups of firefighters at time to build our study over the last 10 years. But it takes a lot of coordination and resources to do this type of work and collaboration.

So real briefly, what are some of the neat things that we're doing now and that we want to continue to do? Our team has worked on preventing and reducing exposures. While you can't necessarily reduce what you're exposed to at the fire scene, you can reduce what gets into the body. And of course, we think gear should prevent all of that from happening. But that's not always the case; certain things can still get past gear. So, some of the interventions for reducing exposures that the team has worked on include things like improving respirator use, and dermal decontamination right after fires. And these simple things can really have a great impact on reducing exposures and protecting firefighter health.

And now we're getting into some more interesting intervention strategies on the health side of things. So, following some work our colleagues in Australia did that found giving blood or giving plasma reduces the burden of PFAS, which are very hazardous chemicals some firefighters are exposed to from the body. We're now testing this plasma and blood donation procedure in US firefighters too, and seeing is this an easy way to get rid of some of these chemicals in the body that doesn't really cause harmful effects.

And then we're also doing things like giving firefighters nutritional supplements such as broccoli seed extract that are known to be anti-inflammatory, anti-cancer, pro health overall. And seeing, is this a way we can promote firefighter health and combat against the impact of those exposures that they have? And then long term, we're also using some of these biological markers such as changes to the DNA that we can screen quite easily in blood samples to see if we can use these as risk markers. If you have a certain marker, we can measure in your blood sample, you are at a higher risk for cancer than another individual.

So maybe we should do something to change your job duties or protect you in some other way.

And this is all the work that we're doing going forward. But I think we definitely need a global effort to work together to prevent firefighters from getting cancer. And our partners here in the United States at NIOSH are also running a National Firefighter Cancer Registry that'll help us to collect data beyond just the 10,000 people in this study, too; hopefully 1000s and 1000s of people; have firefighters by getting access to their medical records. So, we can track these trends over time. And I think this is something that could be implemented in other nations as well. And hopefully we can share data on what we find in best practices and work together on this big problem.

So, if you have more questions about the research specifics, please feel free to contact me or the overall director of our study, Jeff Bridges. And I'd like to thank especially FEMA, here in the US for funding this work, and Dr. Lori, for bringing us here to this panel.

And of course, there's many other problems other than just cancer when it comes to health impacts in the fire service. So, I'd like to bring up my colleague, Dr. Sarah Jahnke, to talk about mental health in the fire service.

Dr. Sara Jahnke 15:59

Thank you. It is an honor to be here, and I appreciate the invitation. I'm going to talk about mental health in the fire service. And I appreciated the comments from Canada yesterday, kind of teeing up this conversation. We do know that there are a lot of risks that firefighters face, and it's a physically dangerous job. But as you pointed out, there's the mental health impact. And we need to also focus on—and researchers continuing to focus on—the mental health impact of being on the job for firefighters.

So, when we look at the stresses of the job, one of the challenges is that it's a very complex interplay. We've long looked at acute exposures, a line of duty death, something very dramatic, a major disaster, and said, Okay, we understand that that's a stressor for our firefighters. But what research is showing us is that it's not just those acute major events, but this chronic repeated exposure to trauma. Having to show up to everyone's worst day and solve their problems comes with a weight for the firefighters. We know that injury and disability, both the risk of experiencing an injury or disability is creating some stress, but also the impact once that happens, for firefighters who are injured and taken offline. Are they supported in the time that they're trying to return to work, for those who are disabled, particularly early disability and separated from the service? Are we supporting them as they're transitioning into a life that's not part of the fire service?

We also know that there are home life stressors, and we all have home life stressors. Every single one of us; there's always challenges and opportunities at home for building communication. But I do think what we're seeing with the fire service is it's a little bit different. When you are called to everybody's worst day, when you are called to very traumatic events, sometimes those minor things that happen at home don't hit your radar. And most of the firefighters that we've talked to and collected data from say, you know, I'm a different person now than I was before I saw these exposures. So, there's that stress on top. There's the circadian rhythm disruption.

And I know that my colleague, Dr. Goodrich talked about that as the as a risk factor for cancer. We know that shift work is classified as a to b and by the World Health Organization. But the impact of the repeated wakening is in the night. Unfortunately, we can't make a nine to five schedule for emergencies. There's no "please leave a message and we'll get back to you when we wake up" type of scenario. So, people are going to be awake in the middle of the night. And the impact of that repeated circadian rhythm disruption has significant impacts for everything from cancer and cardiovascular disease to mental health.

We know that often, as a coping mechanism, we're seeing substance use and misuse. In the fire service when we do studies, particularly of alcohol use, it tends to be relatively high, at least here in the US. And it's something, when you think of that in terms of cancer and cardiovascular disease and all the other

things that we need to be talking about and paying attention to. Also, epigenetic changes; we know that chronic stress doesn't change the genes that you have but can change what's turned off and on. And again, there's a significant relationship between repeated exposure to stress and trauma and that heightened sense that the fire service lives with on a day-to-day basis, and risk for things like cancer and cardiovascular disease likely due to inflammation.

It's not surprising given the myriads of stressors that we see high rates of things like depression in the fire service. When we survey and look at the literature, anywhere between about 10 and 30% of people report experiencing symptoms of depression in the last 30 days; general population is about 10, less than 10%. If you ask: last 30 days, how are you feeling similar with post-traumatic stress? As Dr. Ray mentioned, it's similar to what we see in military and people who have been deployed. And it varies again, based on the study you're doing, that sample you're looking at, how active their fire department is, those types of things. But it's just hire in general than the general population.

But I will say that I think that a success of this is that the rates aren't higher. If you think about what people in the fire service are exposed to on a daily basis, the fact that being exposed to that trauma and being exposed these really horrific incidents, that those rates are not significantly higher, speaks to what we're doing right in the fire service when it comes to mental health. And we used to really consider it, mental health is more of a heart attack. And now we're looking at it more as hypertension, with the thought being that initially it was a mental health issue; as a heart attack, there's a specific event that occurs, and we treat it immediately. And then people are able to return to duty.

But what we know now from the literature and from practice is that different incidents affect different people at different times, for different reasons. And the intervention is not the same for all. The challenge and the opportunity here is that not everyone needs the exact same thing. It is prescribed, set at a prescribed time, and the impacts not always immediate. Sometimes, it's not a command: we'll do this one thing, and then you'll move on. It can be months, sometimes years, and often at retirement, that people really start struggling with these things that they've experienced, because they spend so much time trying to push those things away.

We also know that sometimes the interventions we do, if they're forced in a way that is not effective for that person, they can be more harmful and helpful. So instead of that heart attack/one thing, and we do one thing to fix that, we're really moving to understanding it more as hypertension—that this is a long term problem and opportunity, and that we need to start looking at long term solutions, basically shifting the conversation at the kitchen table at the firehouse, is shifting the conversation on the [inaudible], shifting the conversations with our families, helping people to understand what it's like to respond to everybody's worst day. And really creating awareness around to the fact that you might struggle, or you might not struggle. And it's okay if you're struggling, and it's okay, if you're not struggling. And just because you're not struggling today doesn't mean you're not going to be struggling six months from now, a year from now, or when you are when you retire. And so really helping people to just understand that no matter where you're at, in this process, you're okay.

It's important to monitor symptoms, know what to look for, and to make sure that you're getting treatment as appropriate. Not everyone needs to be full time under medical care in the fire service, because so much of what we do we do with each other, right? So much of what's resilience-building is being in the fire service. Sometimes it moves beyond that the pure approach and people being able to talk to you about "here's how I'm feeling, how are you feeling? That one seemed to really kind of hit you hard." It moves beyond that.

And then we need to make sure that we have resources set up in the appropriate level of intervention, experts who have experience with empirically validated treatments for people who are struggling with things like post-traumatic stress and depression. I mentioned that I think the more shocking piece of the data earlier is that the rates are not higher. There is so much about the fire service that is going right. There is so much. It's the camaraderie, it's the dark humor, sometimes slightly off-color jokes are pretty common here in the US. And given my experience last night at the dinner and bar, I would say that that's probably consistent in most countries, of the people I met at least. And the social support, and the

debriefing, that informal "Hey, how are you doing? Hey, I noticed you're acting a little bit different." That type of stuff, the family support—that once you're in the fire service, you're in the fire service. Right? And you are—and your whole family. I have never been a firefighter, but my dad was. And anywhere in the country, anywhere in the world that I've been now that I'm like, Oh yeah, I grew up in the fire. They're like, Oh, come in, come in, come in. You want some coffee?

There's also that shared experience, and really that fire service identity. And I'll say, when I was invited to this, I admittedly was a little bit nervous. And I thought, a lot bit nervous. And I thought, oh, no, the people from the US. But when I get in that room, like, what about? I don't know, maybe it's different all the way around the world. I was about half a day. And when I'm like, oh, no, this is our people. This is our family. It doesn't matter that we don't all speak the same language. We are all in this together. And that's what's going right now.

The one challenge—and this is a new area of research that I think we need to pay attention to—is that there are some times that it's not going right, when we talk about recruitment and retention. And I know that Dr. Taylor is going to talk about some of the challenges. As we're looking at retention issues, a lot of people are looking at, hey, why do we have such a low rate of women in the fire service? What can we do to recruit and broaden our recruitment to other groups? Right? When we looked at some of the data for women in the fire service, we see overall mental health rates of things like depression and anxiety actually being a little bit higher than we do for men in the fire service, which really wasn't consistent with what we saw from these really high performing women that we were doing qualitative data collection with. And what we found was that the driver of those, more so than the calls, was actually this workplace incivility or not feeling welcome at the kitchen table.

So, when we took that same data and we divided it we did [inaudible], so low, medium and high, never moderate, and often experiences discriminate, issue harassment. We actually found that the major driver for the mental health challenges for people who are not welcome at the kitchen table is that exclusion, not being part of that, not having been part of the family. If you look at the far-left depression, you're at three times the risk of having symptoms of depression, if you're kind of robbed at that kitchen table experience. And I think the other thing that this slide tells us is that we know now what it would be like if we didn't have the kitchen table, right?

If we were excluded from the kitchen table, almost half of our firefighters would be struggling with depression. It also increases line of duty injuries and lost workdays. So, where we used to think of "oh, workplace incivility; those issues are really only an HR issue"; we used to think that and people would say," oh, talk to the HR department." Now we know it's a recruitment and retention issue, and a safety and health issue. But at the end of the day, I think the best piece of all of this is that the magic is us, right? There's no like secret formula. It is this. it is the relationship building, it is the coming together, working together, knowing each other, to do what's the best job in the world.

Now, I would like to introduce my good friend, Dr. Denise Smith, who was recently named Head of Research at USFA.

Dr. Denise Smith 26:29

Thank you, Dr. Jahnke. Let me say what an honor it is to be with a group of world leaders who are absolutely committed to addressing the challenges facing the fire services.

Today, I'll be speaking on cardiovascular risks associated with firefighting. And I want to acknowledge that a great deal of work has happened around the country—excuse me, not just our country, but around the world on this issue. And I've had the great pleasure to work with colleagues from the UK, from across the European Union, as far as Brazil, Israel, South America, most recently South Africa. So, we have all recognized that firefighting itself involves very strenuous muscular work, is performed in dangerous conditions. And it's done while wearing heavy protective PPE. And while that PPE is absolutely essential to protect our firefighters, it also imposes a tremendous physiological strain. And our firefighters experience that most notably through thermal strain, and cardiovascular strain.

So, when we think about the cardiovascular strain: on one hand, it's quite obvious. Everyone who's been involved in firefighting knows that your heart rate will reach near maximal levels very quickly, after receiving the tones and when you're operating on the fire ground. But research tells us it's not just the elevated heart rate. We can actually use sophisticated measures to look at the work of the heart. And when we do that, we find that not only is the work of the heart elevated during and shortly after firefighting, but it will remain elevated for up to an hour post firefighting activity. And this is the sort of documentation we've needed in the US in order to pass legislation—presumption legislation about what's happening following a fire, as well as what's happening on the scene.

So, the workload of the heart remains elevated. But it's not just the heart itself, but the vessels that distribute blood through the bodies. Of course, the vessels have to accommodate in order to supply more blood flow to the heart itself, to the muscles into the brain, so that we can support cognitive function. But we realize now that the stress of firefighting is so great that the neurological activity is actually causing the blood vessels themselves to stiffen. This is a dramatic change in the cardiovascular system. And of course, because of the cardiovascular load and the thermal load, there's a loss of plasma volume, the loss of plasma volume secondary to sweating. But this means we're changing not only the blood volume, further exacerbating the cardiovascular strain; but we're also changing the electrolytes, which affects the electrical stability of the heart and changes the blood clotting.

So why do we care about all of these physiological changes? In part because it affects the ability to do the work, right? This is directly related to fatigue and the act that we can no longer continue operations when we need to. And we also care, because although most people recover from firefighting—most people recover, we know that we should say that—but we also know that far too many do not. And despite all the hazards that firefighters face, it's the body's own response to the stress of firefighting, that claims far too many firefighters' lives.

So, if we look at this slide—and what you see here is I'm presenting data in the US just from 2009 to 2019; I've excluded some of what has happened to our data based on the recent COVID pandemic. But what you see is a consistent trend here. Despite the hazards of the thermal environment and the smoke, our fatalities due to burn in a speciation are relatively low. We work diligently to make sure they're that low, and we want them to be lower.

And yet cardiovascular events are far greater than either burner's speciation in most every year. But even this is just the tip of the proverbial iceberg. Cardiovascular events are imposing a far greater burden. It's not just those few, relatively few but far too many firefighters that are dying from cardiovascular. We have many more who are suffering non-fatal events on the fire ground, which can be devastating to them, and may disrupt the mission. We have even more who are receiving cardiac interventions to treat long standing disease. And of course, there's cardiovascular disability leading to retirement and shortened retirement for our firefighters.

And so, we've worked to try to understand a framework that shows not only the acute stress of firefighting, which we know to be great—and I'll say again, most people recover. We need more research to understand have they fully recovered. We know they're going back in service. But we don't know if there's long term exacerbation of underlying cardiovascular disease. But we do know that this magnitude of cardiovascular strain coupled with underlying disease, whether that disease is coronary artery disease—we sometimes call that atherosclerotic disease, the disease where plaque builds up in the vessels and makes an individual vulnerable to heart attack. We must be looking for coronary heart disease.

We must also understand that if an individual has hypertension—and Dr. Jahnke, thank you for that very nice analogy. Hypertension is not an okay condition. I want to say that a different way: hypertension is of great concern. Hypertension damages the vessel and causes changes in the heart muscle itself. It changes shape and structure, making it more vulnerable to an arrhythmia and a sudden cardiac arrest.

So why do we need information like this? We need information so that we can understand: what is the underlying cause of the fatalities in the fire service? And I'm proud to say we actually did a study alongside the National Fallen Firefighters Foundation, where we reviewed autopsies, all the autopsies that were available for the US firefighters for a 20-year period. And we could compare those who died

from cardiac events to those who died from other traumatic injuries. And what we found was that a stunning 80% of the cardiac fatalities had both underlying coronary heart disease and hypertensive heart disease. The heart itself had changed shape and structure because of the hypertension and other comorbidities. 80% of the firefighters had both. And now this guides us into developing policies.

If we know that these conditions are undiagnosed, the firefighters are not aware of them. We must be looking at medical evaluations to determine the underlying health of our firefighters. Because we can't responsibly ask firefighters to face that magnitude of physiological strain if they're not healthy enough to do so. And much of this can be predicted; we can see the people who are most at risk with relatively simple cardiovascular disease risk factors. I'm sorry to say, looking around this room, that anyone who is over 45 does, in fact, have an increased risk of cardiovascular events. In fact, it's an eighteen-time increased risk of a cardiovascular event. And so, we must make sure we have proper programming and evaluations in place to protect our firefighters.

I'd also call your attention on the slide to hypertension; that stands out as a 12-fold increased risk. And I say this because I know many firefighters, along with our general population, know they have hypertension, and they're reluctant to treat it. They somehow feel like taking the medication is saying they're unhealthy. It is the hypertension that's unhealthy and must be treated. Because if we treat hypertension, if we get your blood pressure down, then the heart does not change its size and shape. I will also say that a previous diagnosis of cardiovascular disease carries a tremendous increased risk. So, we must be careful about the return-to-duty evaluations.

Let me just end quickly by saying we've learned a great deal about the cardiovascular health; in fact, the cardiovascular strain and physiological strain. But we need to do more, we need to make sure our firefighters are properly evaluated, that we aggressively treat these cardiovascular disease risk factors when they're found. We provide proper programming for fitness; fitness will increase overall health, decrease risk of cardiovascular disease and cancer, and improve operational performance. And we must continue to invest in research to protect the health of the firefighters who are protecting our communities. Thank you.

It's now my privilege to introduce my colleague and good friend, Dr. Jennifer Taylor.

Dr. Jennifer Taylor 37:39

My presentation's going to be a little bit different. And it's going to ask you a series of reflective questions. I encourage you to meditate on them over lunch. Yes, I am giving you something to chew on. Because I know that there are best practices occurring around the room on recruitment and retention that we've not yet talked about.

So, my first question for you is: what does the current organizational culture look like in your country's fire service? And within those fire departments? How do you know? Have you measured it?

In the United States, we're very fortunate because we have the FEMA Assistance to Fire Grants Program, which partners with scientists to develop tools. For example, in the United States, we have the fire service, organizational culture of safety assessment, and if you scan this QR code, you can learn more about it. It tells you how things like the mental stress that Sarah talked about from poor culture can create environments where people tend to leave the profession. We also have the American Metro Fire Chiefs Association and their representatives here, the DEI departmental assessment. And in our development of this instrument we found that 70% of the chiefs in the United States felt that they had a very positive climate for inclusion in their fire departments. But only 50% of those people felt that they were ready for change.

These two tools—and there are many others— can be modified for other countries, if that isn't a desired outcome of this Congress and its Communities of Practice. These tools came about in the United States from priorities expressed in our national life safety initiatives and in our most recent national fire service research agenda. The significance is that they are fire service-led and scientist-supported

So, my next question for you is, what does the culture of your fire service look like in the future? Does it remain as it is? Top down hierarchical? Or does it flip to be bottom up in an organizational culture where

there is shared governance? And that expertise is recognized as arising from any rank, and any years of experience? Is it flexible, inclusive, and diverse?

We know from this conference already that climate change and wildfires and the wildland urban interface are current hazards that you are experiencing. But I have a question for you of the delegates in the room. How many of your fire departments are responding to this hazard? To EMS, if you could raise your hand so I could see emergency medical services? Okay, this may not be your current, but it could be a part of your future.

So now that you know about your past and your future, who does that culture include? This is where we begin to talk about DEI. Does it include men, women—who are 50% of the world's population? What about sexual and gender minorities are the LGBTQ community, of which 20% of Generation Z people identify? What about different generations: the very young, the newest folks to the workforce, and the very experienced? This is up to your country's individual culture to decide.

But it will definitely affect your recruitment and retention strategies in terms of who comprises your culture. What skills do you want them to have to address your present and future hazards? Once you've identified the who, how do you engage them? And this is where we start to talk about recruitment.

Are you employing social media as a way to engage? Are you relying on families and tradition and legacy to create more interest in joining the fire and rescue service? Many of your fire services are run by government entities. Some are decentralized to states or provinces. But how can government service or government work experience be something that you can leverage to engage people to bring those skills into your fire service? What about pipeline programs? In your secondary education systems or high school, your trade schools, your colleges and universities? How are those programs preparing people with new skills like analytics, GIS data management and response to the new engineering hazards that we've been talking about?

What about partnerships with industry? How can they help you engage your next generation of firefighters? And one of the things that I've learned from the volunteer fire service in the United States is how those members bring their experience as pilots for airlines, manufacturers, and people supervising offshore drilling rigs. How do they bring that safety knowledge to their volunteer service? And then finally, what about military? It's not on the slide. What about people who have honorably discharged from your military and are looking for their next their second act? And in the United States, we have some municipalities that have preferential hiring for veterans, and they can bring the rigor dedication to the job.

Once you have them, how do you keep them? And that's something that I've heard in the Congress so far. If you're going to talk about keeping people at work, you need to think about the work environment that you create, and work-life balance. And I'm going to say a couple things that might be a challenge. Work environment is really where we start to talk about—and Sarah showed us some beautiful data about—inclusion, and what happens if you feel you're not. Are there people who are not in in your fire service? Do you want them to be there? If they become part of it, are they segregated? Or do they become an included group? Meaning not all? Are they there, but they feel seen and heard, they feel that their lived experience and the skills that they bring are valued, wanted, and desire to be retained?

When you have inclusion, you have the ability to be unified in the approach to whatever hazards your fire department is dealing with. Work-life balance, work, can be incredibly demanding. And if we don't give people rest and recovery, they exhibit signs of burnout and depression, decreasing job satisfaction and lack of engagement with work. And, as Sarah talked about, they have huge family demands that may be different in Generation Z than in generations before.

Last year, I had the privilege to attend the Federation of European Fire Officers diversity meeting. And I learned a lot at that meeting. And for the first time, I started to think about a curse word that I'm not allowed to say in the fire service shifts the structure of your work and how you do it. And I learned about in this meeting, that there are pilots in the countries of Iceland and Sweden, to look at offering different shift configurations to recruit and retain the who that's in your fire departments. A eight-hour shift; something in the middle, 12 to 14; and a 24-hour shift. And some of the emerging data from these pilots

that are going on are saying that women and Generation Z are choosing the eight-hour shift.

I know it's complicated, and I hope we get to talk about it after lunch. But it is a really critical thing for us to think about, not just for recruitment and retention, but for all of the wonderful things that the scientists on this panel have talked about. It reduces exposure for cancer, heart disease, and mental well-being. And that is the future of the fire service, is asking us to change the way we organize its work for the work-life balance of the people who are in it. This is in an incredible challenge, a financial and operational and an organizational challenge. But I wanted to put it out there because it is what is occurring to me as a scientist. What woman, if you will, wants to leave her family for 24-48 hours? And the thing is, even in the non-gendered frame, young people are partnered with other young people who expect them to share equally in the work of home and life. And that's the future. It may not have been ours, but it is the future generation's.

So, we have to address our traditions. And that means we have to address our culture. And so, to measure our progress, we need data. You need to start with data, you need to identify your levers for change in the recruitment and retention frame. You need to strategize and test those strategies with the workers and the communities they serve. And then you need to measure again with data.

And the thing that I will say to you is share your best practices. Share what works, because oftentimes, fire chiefs keep that in-house and they're not sharing it. So, we're all reinventing the wheel. We don't need to do that here.

And the last thing I want to say is that we are here to help at the Center for Firefighter Injury Research and Safety Trends. We are in Philadelphia, right up the road here from DC. And you can scan this QR code and see our projects on our website and connect with us on social media. Bon appetit.

Dr. Lori Moore-Merrell 49:00

Thank you very much. I think that panel was depressing and inspiring, if that's possible. So, you have heard of lot of information. And I want to turn to Chief Hardingham. I said I want to come to you because he and I have had these conversations about this particular panel. We're going to have a few words, Chief Mark, if you will, and then I'll close this before lunch.

Mark Hardingham 49:23

Thanks, Dr. Lori. What a fantastic panel to pick up our final challenge and to take us into lunch. You've given us all plenty to think about over lunch. And then perfect way to finish, with Jen to give us some actual questions to go away and think about over the course of lunch as well.

I also think that the sequencing of the challenge is right as well, because it's right that as we approach this our fourth and final challenge, we look internally in the organizations that the people who work in our fire and rescue services, and we look at the immerse firefighters as staff in many other roles across fire and rescue services—but also leaders in those fire and rescue services as well. And we look at their health, their safety, and their well-being and our focus and responsibility for that.

And I also congratulate colleagues for thinking about it from the perspective of the whole life of all of those people, from recruitment, through the career, and then into, hopefully a long, happy and healthy retirement as well. And the responsibility we collectively have for all of those different elements in those roles. Picking up on Jen's points really, and certainly culture inclusion, demographics in fire and rescue services are very much to the fore in the UK. Dr. Taylor and I have spoken about this many times. And only today, the National Inspectorate of Fire and Rescue Services in the UK have published their annual report into the fire rescue services in England. And a significant element of that will be about culture, inclusion, demographics and misconduct in fire and rescue services as well. And of course, that's inextricably linked to mental health and well-being.

And it's important because all of the other challenges we've looked at today are going to be solved by the people who are going to be working in our foreign rescue services over the next 5, 10, 15, 20 years. And they won't realize their full potential and be able to deal with those challenges, unless they work in

a foreign rescue service that is unified. Looking at Jen's last slides there, it caused me listening from the slightly depressed aspect that Dr. Lori talked about—to reflect on having attended the National Fallen Firefighters Memorial over the weekend, and the 226 families who were there, and a significant number of those there because of cancer, respiratory illnesses, or mental health, and there's a stark lesson in there for us. That's, of course, a US thing. But I think it rolls across most fire and rescue services across the world.

So, I think my final reflection, and then one anecdote I'll share with you, as we go into lunch is I think we have a collective challenge. And I think it's important that we have the debate after lunch about that collective challenge. And the challenge is: how do we embrace the research? How do we actively involve ourselves in studies that take place? And then importantly, how do we turn the findings of those into something tangible, and change in our organization, so people in our fire and rescue services, people coming into our fire and rescue services, feel an organization that is different to what it is now different to what it's been in the past? Because of that research.

And my final anecdote, and I share this because I was having a conversation with an academic colleague back in the UK about six months ago. And we were talking about the fact that there is a disruption of agenda perspective, there are women in fire and rescue services, there are women leading fire and rescue services, there are women in governing roles over fire and rescue services. But they are enrolled in fire and rescue services, which were largely designed historically by men. And if we were to start now, with a blank sheet of paper, the question she posed me was: what would a fire and rescue service look like, if it was designed by a woman?

Dr. Lori Moore-Merrell 53:24

That was a very nice hand off. So what I would like to say to you is we are going to come back for our discussion, just like we have with the other challenges, but we know that we're going to need to give you some sustenance in the meanwhile. So, we are going to break for lunch.

But as we do, I want you to think about what aspect of this do we need to prioritize for our Communities of Practice? And then as Mark said, and what you've heard here: you have to begin to think of how these things are linked. How much does the health and safety impact on our firefighters contribute to our recruitment problem? And our challenges there? And are they linked in your nation? Perhaps you have a best practice that we all need to learn. So, begin to think about what your best practices are that can come forward. What should our Community of Practice take up? Of course, you have your cards in front of you to make your notes, but we are going to engage in our discussion just like the other challenges when we return from lunch. With that, I will remind you that we're going to give you just a couple of extra minutes. We are going to reconvene here promptly at 1300 hours. The agenda is a little bit earlier, but I'm going to give you a couple of extra minutes because those that want to go see the hydrogen ion vehicle outside. You're welcome to do that. But delegates, I kindly ask you to be back in and ready in your seats at 1300 so that we may start on time and keep our day on time today.

So, with that, let's thank our panel and I'll recess until 1300

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Dr. Lori Moore-Merrell 02:34

Delegates and guests, please be seated. And I will call us back into session for the final session of our World Fire Congress as we are gathered this afternoon to have our discussion on our final challenge, the health and safety of our firefighters and recruitment, as we discussed before your lunch. And now we want to engage the delegates in the conversation. So, delegates around the room, please be ready. Prepare your comments if you wish to speak. And I will turn it back over to our facilitator, Miss O'Brien.

Sally O'Brien 03:10

Thank you, Dr. Lori, I hope you all had a wonderful lunch. I know you were talking about this panel the

entire time. So hopefully you'll do us the favor of letting us in on all of your lunch table conversations about firefighter health and safety. Is there anyone who would like to start? I see as Estonia.

Estonia 03:30

Thank you all very much of these very, very important topics and the wide overview of these important areas, I'm going to change or share some Estonian practices on the similar topics.

One of the topics is changing the shift system. We're also planning to combine our very regular 24-hour shifts, 12 hour shifts together, both of the systems will be used and there are quite many purposes why we are doing this.

One of them is definitely to be more attractive for different people, as you said, for more attractive for women, more attractive for the internet generation. And also, we need to use the shorter shifts for periods than we have made maybe more work, maybe more operational work and reduce probably the shift system and the working hours during that period than we have less operational work.

The question of how to reduce the cancer risk for firefighters: One of the new things we're using is the concept of a contamination free station. So, every new station we are building, and we have quite a lot of new stations in recent years, we'll have the solutions that firefighters who come back from the fire, they don't have the access to all rooms in very quickly, they have to change, they have to clean everything. And some and most of the station will be hauled clean. And one more opportunity about or solution for the mental health, we have gotten the award of supporting mental health. And we are supporting our organizational culture to do that thing. So, thank you very much. We got very much good information from your fantastic [inaudible].

Sally O'Brien 05:58

Thank you so much. The delegation from United Kingdom Wales.

United Kingdom Wales 06:06

Thanks very much. And great to have the opportunity really, to not only digest our food, but digest all the information as well.

So, a lot we covered this morning, and that was really helpful. A lot of parallel issues were suffering or experience, I think in United Kingdom, Mark made reference, as we attended the National Fallen Firefighters Memorial event on Sunday and making those links in terms of occupational health and particular focus. For myself, it was around the cultural factors, the bullying, harassment issues we are also experiencing, and I'm sure they're common across all nation states as well. And as we're trying to be more diverse and reflective of the communities we serve. That's a significant challenge for us; we're trying to address these issues, and also trying to make ourselves more attractive, particularly to underrepresented groups.

So, a double challenge; there are some areas of good practice, particularly in the UK, around contaminants and identifying some of the issues that the research is telling us. And there are sort of green shoots, I suppose in terms of changing practice where we're getting away from dirty kettles being a badge of honor and that sort of thing. So, we're seeing that people are coming through and identifying that they are really interested in some of the work on shift work, circadian rhythms, premature mortality rates, and that sort of thing.

So where I come from, we are heavily reliant on retained or volunteer firefighters—paid, but still primary employment elsewhere—and the impact of them when they turn out for us, and then have to go back to their primary employment. So, a double hit for them and very difficult for us to, to maintain and monitor those challenges.

And I think the holistic problems we face do require holistic solutions as well. We can't just look at these things in isolation, when you look at it as people as a whole. I'm really pleased to see this sort of

empirical, peer-reviewed research that we can all benefit from. Thank you all. Really interesting. Thank you very much, indeed.

Sally O'Brien 08:13

Thank you so much for that. Next up the democratic delegation from the Netherlands.

Netherlands 08:20

Well, thank you. The problems with diversity is, of course, nicely shown today. We're in this morning, we had six men talking about technology. And in the afternoon, five women talking about health. So, we are not there yet.

However, I think we all share the desire that our firefighters are as healthy as possible and go into happy and healthy retirement. And thanks for the insight you gave; that is not always the case with our personnel. In the Netherlands, we are conducting currently quite a nationwide big research about what factors operational people suffer from both physically and mentally, so that they can see how it progresses during their life. And what they can do to make that work—so to say easier, so that they can live longer.

Now I have two questions. Acknowledging that health is an individual case, I have two questions also for the panel. One is that in any study, giving insights as to what age it is, let's say operational responsible to stay in operational services. Because I think at 65, it will be quite difficult. 45 years maybe a bit young. So, is there any evidence and the research done about age?

And second one is a question about what they would call long-term, committed contamination with stress. It's not always big traumas, which impacts our people. It's also everyday stress, everyday call outs in a CPR work, etc. And then the bucket gets full because every day a drip of stress falls in the bucket. Sooner or later. The bucket falls down and now people get knocked out so to say. So, is there any research or something done on that issue?

Sally O'Brien 10:05

Thank you so much. First, on the operational age issue?

Dr. Denise Smith 10:16

Thank you for the question. It's a very difficult question.

As I alluded to in, in my short presentation, we know that age is associated with increased risk of cardiovascular events, we know that age is associated with a decrease in cardiorespiratory fitness. So, age is an important consideration.

But it's been my experience that around the world, there has been an unwillingness to accept age as a criteria for an absolute cutoff point. Because age alone does not tell us when an individual can no longer be operationally effective. It's some combination of age, heredity, and fitness level, combined with your experience that allows people to operate effectively on the fire ground.

So, I would say we know that there's increasing risk, but we have not found a threshold beyond which we're willing to say, everyone should be taken out of operational work.

Sally O'Brien 11:38

Thank you. And for our second question on long-term stress.

Dr. Sara Jahnke 11:41

Thank you for the question. I would say that at this point, we have some big answers, but not the specific answers. We have a lot of qualitative work that we've not quantified, like a predictive algorithm for who's going to develop some of these mental health disorders. Traditionally, we've looked at major events and looked at outcomes of that.

One of the things that there is a new area, is looking at the impact of events and having people rate specifically how much that would bother them, and then how often they've experienced it. So, I feel like we have the big picture and now we're trying to get down to the smaller picture and really measuring that so we can identify people early on. It's going to take a lot of a lot of time and a lot of data collection points, but we will get there.

Sally O'Brien 12:27

Thank you. Ecuador.

Ecuador 12:30

Thank you very much, good afternoon.

I really believe that Ecuador separates us from the reality of many of the Latin American countries and why say the rest of the world when it comes to diseases, maybe we haven't been in Guayaquil. The Guayaquil Fire Department does not have accurate statistics on what a patient or one of our firefighters is who suffers from cancer. However, we have patients, or we have firefighters who have suffered from cardiovascular problems, from metabolic problems, which is a cause of their death.

After they retired, then concerned about this, were established, several health programs, including precisely a nutrition program. We have a nutritionist who stops by each of our stations to see control weight and a series of states that are managed. In turn, a physical training program was also established to avoid the risk that exists, which exists, could exist in addition to supporting and placing his gym in the barracks and being able to have an adequate program, because neither is it to pick up and adequate program, exercise and end up doing strenuous exercises because he also stresses himself. Concerned about this, these programs were integrated and, therefore, there is also a health control.

Today, we have medical professionals within the institution and why not say we are in Ecuador, being the [inaudible] body, here we already have a group of psychologists who are precisely responsible for what is the mental health of the staff, not so much the volunteer staff as the paid staff. We are more than two thousand volunteers and more than six hundred of us are paid.

And this causes us to have this concern because stress involves not only stress on the part of phenomena that occur due to the practice of firefighters, but also because of general practice or because of what is happening in our country. And this causes us to have certain problems on the mental side. And this we have guards or shifts of psychologists who are in the morning, afternoon, and we even have a group of psychologists who come to emergencies to be able to act as a response team to be able to contain them.

When there are very large events we don't do it; let's say, with small things or when they require it. We have these in an office, in a specific company, but when there are very large events, a group of psychologists are appointed who come to the emergency today, not only that we have provided the service at the level of Guayaquil, but we have gone to other cities, to other provinces, where we had the death of a forest firefighter and they were with their colleagues giving psychological support in Baba, today another city also nearby In the city of Guayaquil, there was an accident and then we also had a hit man from some firefighters and there were firefighters, psychologists.

These programs have been historic. We have been with these programs for almost three years, and we are going further. Perhaps we want to obtain certification to be able to provide help, not only within the country, but outside the country.

In this regard, thank you very much.

Sally O'Brien 15:34

think so much. I think that's a fascinating forward deployment of your psychological resources. The delegation from Canada, please.

Canada 15:45

Again, good afternoon, and thank you so much for this tremendous work. There's been a day and a half of some a lot of important conversations. And I might suggest that this is one of the most: without our men and women, the rest will seem quite minute in comparison. So, first of all, a thank you to you for the work that you do to support the men and women in the field.

Dr. Jahnke, you have dedicated a great deal of time to us in Canada for the work that you're continuing to help us with. And I thank you for that most sincerely. I think that Canada is leading the way in some facets of the mental health conversation. We are doing what we can to ensure that we offer opportunities of training for recruits through to retirement, and more importantly, now focusing on the impact of family of first responders. And I think that that is an area that as a Community of Practice, we shall and should continue that conversation as I move to another important topic, which is the cancer impact of firefighting.

And again, I'd like to give credit to our colleagues with the International Association of Firefighters, which with the Canadian Association of Fire Chiefs were very successful in our country to pass legislation, Bill C 224. That requires a framework to be to be developed on determining cancers that shall be covered through legislation. And in our country, different cancers were recognized differently in provinces or territories. And so, this framework indicates that what is recognized in one province or territory shall be recognized in another province or territory. And we've got a lot of work to do on that front.

But we will continue down that path as we carry on that conversation. Again, I think it's important that we recognize the impacts of the risks both mental and physical, to being a frontline firefighter. And we'll encourage you to continue this good work, and we're here to help in any way we can. So, thank you.

Sally O'Brien 17:55

Thank you so much. The delegate from Taiwan.

Taiwan 18:01

Our honor to attend this Congress, for the fire service, organization, culture of safety. We totally agree for that. But I knew is a difficult one. It's very hard to set out the culture of safety, and especially positive feelings. I think will be the top issue for us. And last year, we [inaudible] firefighter on the duty. So, we named the incident from [inaudible] and also Tokyo Fire Department for the safety culture for that.

So, on this five years, there will be a meeting for the occupational safety in Taiwan. And then you will be carried out around Taiwan and for the local government. And there's a budget will be funded by a federal government. And for that issue, [inaudible] we will provide for the [inaudible] PTSD issue. It was also upon by central government, and the last year we got 561 cases for that issue. And then the [inaudible] mission found that when they come back to Taiwan, they meet with PTSD issue. So, we provide the assistance for the urban search and rescue team for the recovery and for the firefighter issue. It's quite important. So we set up the memorandum just like as a fire service college and the National Emergency Management in your Chinese center.

So next year, we will create our scenario, [inaudible] similar to you, our foundation, what you have done is quite important for the [inaudible] firefighter and also for the family. I hope you will be [inaudible], but then I knew is very difficult for them to recover from, for the victim, from the tears. Thank you so much.

Sally O'Brien 20:09

Thank you so much for that. Next up, the delegation from Finland.

Finland 20:16

Thank you very much for this presentation and for the very important topic.

I'd like to give you two small examples from our country. The first is mental fire fifth concept, which started

as a project and then was sort of bigger thing in the end. It was a project where the focus was on the mental side of the firefighters. And what was done in that project, it was about to better and faster, get the firefighters to recover from traumatic situations in their work. Post trauma workshops were organized in this concept and, and also training of peer reviews was organized. And that worked quite well.

The second example is a bit more or less similar than what Estonian colleagues already explained. We call it the clean fire station concept. And it is about building different zones at the fire stations where the firefighters when they returned to the station from their mission, they leave the equipment and clothes at certain zone, and only after that enter into the fire station. So, this was done to reduce contamination. Thank you.

Sally O'Brien 21:50

Fantastic. I think I heard a lot of people mentioned decontamination procedures, in discussions, I think that's a great area to share some best practices. All right, next up is the delegation from Jamaica.

Jamaica 22:05

Thank you very much, moderator, and thank you very much presenters for presenting such rich information at this conference. Now, I just want to use a minute to share with you our perspective in Jamaica as it relates to the work shift system.

In Jamaica, we operate an eight-hour work shift system, and that has been going on from the early 1970s. So that is what we are accustomed to predominantly. However, during the COVID 19 pandemic, we use the opportunity to change the work shift system for two years. And so, we shifted to a 24 hour work shift system, 24-72. Now, having completed that, we did our comparative analysis between both work shifts, and then we realized that there are some pros and cons as it relates to both work shift system.

Some of the disadvantage that we found out with the eight-hour work shift system is that it is very costly. People travel to work quite often, and it comes at a great cost. But we look at some of the advantages, though, of that interaction system. And then we realized that it limits occupational exposure, it reduces stress and things like those. So having exposed our firefighters, the board work shift system, I think now it is a great opportunity for researchers who are interested in understanding [a] virtual system could come join forces with us to look at the perception of a firefighter's work in two different workshops system. Thank you very much.

Sally O'Brien 23:51

Thank you; what a great case study to share. Appreciate that. All right. Next up: the delegation from the United Arab Emirates.

United Arab Emirates 24:01

Thank you for bringing up this issue. This is very important to all of us and thank you for the presenters and the valuable research actually that has been done in this regard.

Any job could be stressful. The problem is how to deal with this kind of stress. One of the doctors told me even flipping burgers could be a stressful job; you know fast restaurants—so this is something that we have to live with, providing the firefighters with the quality, the best kind of training. I think this is the masterpiece here, to make them a professional and to make them very professional in knowing how to protect themselves and protect to others and thanks to NFPA and thanks to all these bodies, FSOC that provides us with certified kind of standards for training, the gears, we always should provide them with the best gears, with the best equipment with tools. We'll help them to protect our firefighters.

Also, we should guide them regarding their lifestyle, their habit, the food habit, and we should, as we mentioned also, that we should provide them with the facilities so they can keep their fitness level, provide them with the best medical treatment, provide them with social support, and pay them well. Try to do the best to pay them well, because this is a very risky kind of job.

We need also to do some research regarding the gears. Are these gears the best can we develop, these gears to make sure we see them as firefighter, or fire brigades? We see them that we are covered all over from top to bottom. But we are not sure now that these gears are protecting them.

So, we need some research regarding this issue. And we always do questionnaires: what is the best shifts, for example, for them? We take their feedback to make sure that really, it is the best shift for them.

And one last thing, our friends in Civil Protection: they should do their best to prevent fires, and to minimize the number of fire accidents so the risk will be to the minimum. Thank you very much.

Sally O'Brien 27:09

Thank you so much. And thanks for the reminder that training is one of the Communities of Practice that we need to be considering today. I think you highlighted some good training gaps. And reminder that you have cards in front of you to make sure you're jotting down additional thoughts there. For our next presentation, the delegation from Sweden.

Sweden 27:30

Thank you so much for a very interesting and informative panel. I want to circle back to the cancer issue.

We've been working in Sweden very hard for last 20 years in a structured way to make sure that our firefighters are healthy and safe. And through the studies done in Sweden, we can see that there's an elevated risk for cancer within our firefighters. The cancer they get is actually due to other factors, lifestyle factors, example males drinking beer, having barbecues—I don't know if you recognize them, but anyway. And it all starts with mental preparedness and approach to the job and how we handle the risks.

And it starts with methods, it starts with tactics—example always wins on the backs. It starts with short exposure times, cleaning procedures, decontamination, and the gear is actually our last line of defense. We're working forwards, not even have the need to have gear because we don't want to be exposed. And we are more than willing to contribute to the Community of Practice and share our knowledge and our know-how, because we've come quite a long way when it comes to cancer. So, we're more than willing to contribute. Thank you so much.

Sally O'Brien 28:53

Thank you so much. And data sharing will certainly be a big part of the Communities of Practice going forward. Next up: the delegation from New Zealand.

New Zealand 29:04

Thank you, and thanks to the panel, very interesting presentations and in particular Dr. Taylor. Your presentation sort of resonated with me, because we're nearly completing a study in our organization back in New Zealand, looking at those in particular organizational factors that are impacting on the mental well-being of our first responders.

We acknowledged attendance at critical incidents, and what's going on, and people's personal lives in at home, contribute to mental well-being issues. But organizational work away from the incident ground and some of the concepts that we've been exploring about are people's perceptions of support, accountability from management and senior management, and competence of the leaders. How much psychological safety they experience in the workplace, and how much they and feel involved in decision making.

And you know, we commenced this study, not that long after quite a challenging industrial dispute that resulted in partial strike action from our workforce. And so that makes things kind of extra challenge if you're part of the management, and I know one of the panel's use that [inaudible] other words, co-governance as well. So, it does take a very mature and collaborative approach to sort of get people back on board.

But the results are, our survey results were quite confronting. We had nearly one in three of our career firefighters meeting the criteria for one or more mental ill health indicators, including moderate to severe depressive anxiety, and probable post-traumatic stress disorders. So, we're hopeful; we're now applying a number of interventions. And then we'll re-survey our people and see whether we're making inroads and improvements in that.

But one particular group whose results were very confronting was our control room, center staff, our communication center, our call takers, our dispatchers. And I know that's probably implicit in your presentations, but sometimes they can be the forgotten sector of the workforce. And they don't always have the same stress-relieving outlets that some of our frontline staff have as well. So yeah, just wanted to point that out that our communication center people were really doing it tough and still, and we're trying to wrap appropriate support around them as well. Thank you.

Sally O'Brien 31:37

Thank you. That's a really important consideration. I know 911 staff here in the United States experience a lot of stress and mental health. All right, our next delegation is Iceland.

Iceland 31:50

Yes, thank you very much for your lectures; it is very good for us to have this experience, and to get this knowledge from the resources.

But one thing I want to mention: in Iceland, we have shifts, 10 hours, eight hours and six-hour shifts. And the question to the panel is, do you have any research about the length of the shifts regarding to health and safety of the firefighters and EMS people? Because I think we all agree as these occupations are very dangerous work and very stressful, like you've been talking about. What we haven't heard about, the length of his shifts, I think, would be very nice. Or to look into that, at least. Thank you.

Sally O'Brien 32:56

Thank you so much. Dr. Taylor, do you have anything on that?

Dr. Jennifer Taylor 33:02

The answer is Iceland; you're in Jamaica, right? I don't know how many people are experimenting or using different shift patterns, but we have to actually study it. So that's something that I hope we discuss in these Communities of Practices. How do we do these comparative studies across countries to figure out what works for everyone's individual context? We can look at other industries and talk about, for example, in health care: what might be the right time? But we've not done, to my knowledge, those studies in the fire service yet.

Dr. Sara Jahnke 33:40

We do have some projects that are underway currently with couple departments that are shifting. Unfortunately, most of the departments aren't doing like a 10 or eight; they're doing, do we do 24-48 versus 48-96. We're collecting some data with departments that are doing 2472. One of the big things that came out of a study that was funded by FEMA was looking at what we thought was going to be a comparison to 24-48 versus 48-96. And the interesting piece of it: the takeaway was that people are coming to work short slept, and they're leaving short slept because of an early shift start time. So, most departments here changed about 7am. So, people are coming in and then waking up early to trade.

So that's another area where we're looking at: even if we're not changing the structure, could we change, where you're coming in at seven or eight or, or eight or nine; couple departments are interested in doing a 6pm change to be able to improve the sleep. Most firefighters come to work with about 5.6 hours of sleep and leave with about 5.8. So, it's just another area; as we research that, there are a million different iterations, but definitely more research is needed.

Sally O'Brien 34:52

Thank you so much. Out of curiosity, how many nations are currently experimenting with some variety of shift changes? So, Australia, we know Jamaica. Okay, so a couple of you—interesting research. All right--our next delegation is Australia.

Australia 35:12

Thank you. And thank you, for the presenters, for their presentation is really informative. I'm going to speak quickly and then Megan will talk to some of the diversity work being done in Australia.

In Australia, their extensive work has been done on workflows in station to manage hygiene as opposed to decontamination. So, from a hazardous materials point of view, we refer to decontamination whereas actually cleaning yourself after an incident is referred to hygiene. So starts at the incident: bag and tag PPC; we use wipes to wipe the neck and the armpit and the groin areas, return to station, and then have a workflow through the station that sees you going into a hygiene shower, before you're entering into the green zone or the station where the rest of the station is seen as a clean area.

So that has its challenges in the volunteer space with such a large country that population's dispersed out into country areas where we've got volunteers. It can be difficult to really manage that from a volunteer point of view, because they're returning back to work as soon as they as they finish the particular incident.

In relation to presumptive legislation for cancer, it is different across the different states. Some states have got 12 cancers; in Western Australia, where I'm from, we have 20 cancers. But the last eight cancers have been added on in the last eight to 10 months as well as PTSD. And some states have that as well. From a presumptive point of view. fit for duty requirements is also not uniform across the states and territories. Some have it, some don't. We don't in Western Australia, and when we see it leads to the final years of people's careers ended up being a really poor experience for them, because they go into a worker's compensation, they sometimes have really poor health and have really combative last two years, where they're fighting around particular supports that they think that they should be getting but they're not necessarily getting. I'll just hand over to Megan.

Thank you. I think it's important to recognize our conundrum that many of the things that we celebrate as our culture is actually creating monoculture. And it's actually not about gender, race, and diversity. It's about anyone who is different, is isolated and separated. So, we need to have a much broader conversation just about getting women in, and we need to talk about how we reflect our communities.

The other thing I think we need to discover when we're doing attraction is who we think is attractive about us isn't resonating with the new generation. And we have to reinvent how we sell ourselves as a career option so that we become an employer of choice again. And until we do that, we're going to really struggle. Anything that we achieve within Australia to open up the acceptance of diversity in our workforce is actually benefiting the bulk of our workforce, which is male; flexible work rosters; ability to care for your children and your elders when you're male is a very real challenge for male firefighters. So, we have to broaden the subject and make it inclusive of men and women, race and creed. And until we do that as a collective, we're going to struggle attraction retention, and the well-being of our people.

Sally O'Brien 38:56

Thank you so much. That's very insightful. Next up, the delegate from Japan.

Japan 39:04

Thank you very much. Thank you very much the importance of these points, of remembrance to refresh my mind and in our thoughts and then the among the diversity, the presentations the topic, [inaudible] astonished about the impact of the discrimination and the harassment of the women. The mental health data given by the Dr. Jahnke and then the diseases are not viewed acceptable from the viewpoint of our countries.

In Japan do we have data introduced [inaudible] women as the security in fire service and [inaudible] management. So I direct operations to work together with all the members to seek resolution about this issue. Thank you very much.

Sally O'Brien 40:06

Thank you so much. Next up is the delegation from Guatemala.

Guatemala 40:14

Thank you very much. Dr. Smith in her presentation spoke about the problems of hypertension and atherosclerosis that exist in firefighters, who have some studies. I am in doubt if there are any studies regarding obesity and the eating habits of firefighters, because indeed, in Guatemala, we already have some problems with this type of firefighters who are very careless with the issue of their diet, that there are no strict habits for their diet.

And I have also observed it here, in some stations, some companies that I have visited in the United States, where I see already obese firefighters, so I don't know if there are any studies. I would like to know if there are any studies on that, what increase or what decrease there has been in obesity in firefighters.

Thank you.

Dr. Denise Smith 41:34

There has in fact been a fair bit of research on obesity levels in the fire service. And depending upon the research that you look at, we may see that firefighters have slightly elevated levels of obesity compared to the general population, suggesting that they are more obese than the general population. And obesity is a problem in the population at large. I think some of the largest studies show that the fire service actually is very similar to the general population.

But importantly, firefighters are doing work that the general population doesn't do. And being obese carries with it cardiovascular risk, and perhaps some operational impairments. From my own way of thinking, this is a very complex problem, because excess body weight has a great deal to do with individual decisions. It's individual habits at home. But it also overlaps with work in the fire service because eating together is a critical part of the culture of many fire service communities. And so, firefighters gather around the kitchen table, they have meals in which they find comfort, they share in this time together. And then as Dr. Jahnke spoke about, there's also some behaviors that firefighters engage with, perhaps around socializing and drinking. And perhaps we'll let her speak a little bit to some of this research that talks about just the number of calories, the amount of calories that are consumed with some of the behaviors off work that are related to managing some of the stress from on work. So, I would say that this is an area that deserves a great deal more attention. But it's a difficult issue to parse through.

Dr. Sara Jahnke 43:45

Denise is right as always. And we do see that if you look at where calories are coming from, the second on the list is from alcohol use. And on average, when firefighters drink, they drink about a Big Mac, like a McDonald's double hamburger worth of calories. So, I think that is the piece that wraps it into the mental health.

But there are also some other challenges that I think it does make it more difficult to be healthy as a firefighter. And it's everything from food availability to timing of eating. I mean, if you're up in the middle of the night, and you come back and you know the neighbors have brought brownies and you're going to eat brownies in the middle of the night, which is the worst time to eat them. So, I think it's food availability, its portion sizes; we see relatively large portion sizes when we're [at] most firehouses. And I think that it's all of those things kind of wrapped together on top of the interrupted circadian rhythm, which in and of itself is a is a predictor of obesity. It's all of them wrapped together.

Sally O'Brien 44:47

Thank you. Next up, it's the delegation from Romania.

Romania 44:54

Thank you, and thank you very much for this theme, which I think is one of the very important ones for us, talking about our people who are working and without them, the five services wouldn't exist. Of course, it's useless to buy equipment and everything if we don't have the healthy fire service through its people that are working in it.

Now, regarding to the health issues, I think that one of our problems is that in many countries, the people who are dealing with the health issues of the firefighters looking at prevention aspects and the treatment aspects and so on, they don't know what is the work that the firefighters are doing. So if we are outsourcing the health issues, especially the preventive and the screening, to health companies, to medical companies, which are doing a lot of corporate companies and so on, and they do also the fire service, we can expect that they don't know what the fire service is confronting and what is the difference between them, and those who are sitting in offices and so on.

So, I think that one of the issues is that we need to establish what are the screening tests that would be obligated from a certain age up to the firefighter that are different than the ones that we give to the general population or to other categories of population. So of course, there needs to be some screening tests extra from what is done, usually to the general population.

The other issue on the prevention is that this is an ongoing issue. I know fire services, and at least I know, the Paris fire brigade years ago, they already had an infirmary, which was doing a lot of preventive work, testing, testing by age, examining, giving advice to the firefighters who are becoming obese or so on. So, there are such practices in Romania; we used to have physicians for every fire inspector, in every county responsible for the firefighters. The big mistake was that we cancelled them. And we took a collective approach together with other entities of the Ministry of Interior who don't have the same risks as the firefighters. And I think we have to rethink this issue.

Now, from other points of view, we were talking about shifts, and I think we need also to think of the work the firefighter is doing out of the shift. If we have shifts, we should not be expecting, in a certain moment, that the firefighter is having a free time. There are many if they are not paid well—and here I will echo what was said by our colleague from the United Arab Emirates—if we don't pay them, well, they will search for other work outside their shifts. They will come back to their shifts tired, more stressed, and they will go into the stress of the shift and maybe to go to this to respond to fires to medical emergencies and so on.

So, we need to analyze it beyond just looking at the time of the shift. Also what is happening outside the shift and how we can support them so that they can rest? And this is I think, very important whether it is a 24-hour shift, the 12 hour shift, the eight hour shifts—will have a different issue that means changing in the night, the shift that means waking very early and going every day to work. I think an eight-hour shift will be much more stressful in my opinion because you will be going to work every day, every day, every day except that you will be going on a different time. And we need to look at these issues and examine them more thoroughly.

Sally O'Brien 48:54

Thank you so much. All right, our next up is the delegation from Korea.

Korea 49:05

Yes, thank you. I would like to thank all the fans who revealed it, and in particular to Dr. Sarah for revealing about that mental health. I'm going to test Dr. Sarah.

At a fire rescue emergency site, any firefighter whose chief of staff witnesses the scene or takes care of the situation at the scene can suffer from mental illness. Therefore, I believe that management at the national level is essential in order to treat these diseases. So, I'd like to introduce a mental health

management program for firefighters in Korea. In Korea, the expression mental illness was used, but when I wrote this, Korea took it as an expression that was a bit insane, so the firefighters themselves tried to hide it rather than reveal it to the outside. So now I'm not using the expression mental illness, I'm using the term mental health. We have sixty-seven thousand firefighters, or officers, in Korea.

So, every year, we are now conducting a mental health survey for all employees. According to the survey, in the case of the year 2023, for example, people who experienced PTSD had 1 6 point 1 pro, then 1 6 point 3 pro for employees who felt depressed and depressed, followed by supporters who had alcohol problems that they felt like they had about 26 points, and then employees who felt a sleep disorder were about 1 or 20 points pro, so I think 1 out of 3 employees had at least one such experience.

So, our Korean government is now running a program to manage this. First, counseling experts go directly to all employees to conduct consultations, and they also run a stress-related violence enhancement program to nourish those employees' mental muscles, and then the country bears all hospital treatment costs for employees who are classified as high-risk groups need to receive treatment at hospitals.

So, in the past, this mental health management was not recognized by employees when dealing with daydreaming or simply processing them, but now they handle all of them.

Sally O'Brien 51:54

Thank you, thank you so much for that. Wow, those statistics were really remarkable. Thanks for sharing. Next up, we've got the delegation from Belgium.

Belgium 52:06

Thank you. Yeah, we all are concerned about the safety of our firefighters during interventions. But concerning the physical and cardiovascular preparedness of our firefighters in Belgium, every firefighter has to succeed us in a couple of tests. And they have a yearly test and as a test, where there are firefighters' task related tests.

But some of the fire regions in Belgium add some other tests. And that's field to max test, the test where you the amount of oxygen you can absorb in your blood per liter per minute, per kilogram of body mass. And from the from the external company doctors, they say this is the best test to see if the firefighter's able to do to perform at a high level and do the intervention in a safe manner. And it's adapted in Belgium, it's different for men and women. And it's also according to your age.

But that gives a lot of discussion with volunteers. And because that's not so easy to raise the baby because we raised the bar, and they have to jump over the bar. And some of the volunteers are dropping out. But the advantage of this screening is that we already discovered some heart problems before they occur. So, it's a very good tool to prevent problems in the future. And then we help them with a diet, and we give them training and so on.

I have a question for Dr. Smith. There's some discussion about this test. Is it the best tests you can do? Or other alternatives? Because then it's the company doctor takes all these parameters, body mass index, the test of you to max the fat percentage, and also on and then decides if you're faithful fulfilled duty.

Dr. Denise Smith 54:10

Well, thank you for those comments and for the question. I wish I had a very simple answer, but maybe you would let me make a slight distinction.

I do believe that the VO two max test is the single best measure of overall cardiovascular health. In our country, the American Heart Association has actually recommended that it be considered as a vital sign because it's the best predictor of all-cause mortality and of cardiovascular disease risk. So, I want to applaud you for measuring VO two max or cardio respiratory fitness. It's actually the capacity of the body the cardiorespiratory system, the ability to take in oxygen, transport it and use it. It's an integrated measure of health. So, I am thrilled that you are measuring that on each firefighter.

Now your question of is it the best test is a little bit complicated because it's the best measure of health. But if you're looking for cardiovascular disease, arguably, it is not the best measure. There are other tests that are more sensitive, or specific. And then finally, just one last distinction I would like to make if you want to know about operational effectiveness. Many would argue that operational effectiveness should be measured by the ability to do the job of physical performance test. Now, there's a tremendous correlation, or at least a very significant correlation, between cardiorespiratory fitness, and the ability to do the test. But it's not a perfect correlation, because other factors like skill and training and body mechanics will affect it.

Belgium 56:10

They have to do both of them. Fantastic.

Dr. Denise Smith 56:12

Thank you.

Sally O'Brien 56:14

Excellent. Thank you. Next up, El Salvador.

El Salvador 56:21

Good afternoon, everyone. This is without a doubt, the one when we talk about the health and safety of our firefighters, because it is definitely an issue that overwhelms us. Well, this is all when we talked about cancer or when I heard about cancer, when we heard about mental health and also about cardiovascular problems.

We, as the fire department of El Salvador, are only eight hundred fifty operational firefighters and we say that we have people with cancer. We have people, we have done an evaluation, a diagnosis of all our operating personnel and from eight hundred operational people, one hundred and forty-three people have been psychologically affected, forty of them to be able to serve as a priority with code red. As the psychological team explains to us, we have had deaths due to cardiovascular problems, firefighters who have died in houses have died, because practically also carrying out internships, they died then.

Without a doubt, we are clear that the labor [inaudible] is one of the jobs or one of the tasks that brings the most risk, without a doubt. So, in view of this and in view of the problems that our firefighters are practically on a daily basis, we have done certain actions, such as requiring physical conditioning, also changing work schedules, because in El Salvador the working hours were forty-eight hours [inaudible], forty-four off. Now they are working twenty-four for seventy-two hours of rest.

We also have within these one hundred and fifty operational firefighters, one hundred and fifty to one hundred and sixty women, who are also worth saying that we are working with her so that they can plan their pregnancies and not be in trouble as such.

So, the question I want to ask the panelists is if there is any model of a lifestyle that a firefighter should lead because we know very well that we can select them. We have a profile to be able to select it, but not a lifestyle that the firefighter must lead. So that's the query I wanted to ask.

Thank you very much.

Sally O'Brien 59:38

Do any of the panelists have any insights to share?

Dr. Sara Jahnke 59:45

I don't think there's a one answer. I think there are a lot of great resources out there and it seems like a lot. I it's amazing how consistent some of the issues are here that we're hearing. I think it's a lot of different resources, and then things that people can use then, and take and apply the way they need to. There's

some research that we've just done in miscarriage and the rates of miscarriage among firefighters, which is double that [of the] general population. It's taking information like that, and then transferring it to the policies that work for your department. But I don't think there's one answer to it. At least that I know.

Sally O'Brien 1:00:28

All right, thank you so much. Next up: the delegation from Switzerland.

Switzerland 1:00:34

I would like to thank you for your presentation, it was very interesting. Thank you. And I would like to have a reaction about the topic of recruiting. Because retention of firefighters as well as gaining having new firefighters is an important subject in Switzerland.

And for that, I would like to share with you two inputs that we do in our country. And first of all, we create a certification of leadership and manage a natural scale with the organizations, with leaders. And that is really for firefighters, officers, and [inaudible] to recognize the skills learned in the activity, that could be also helpful in the job.

And the second thing input, we also create a partner, employer. And the idea is around the companies that employ volunteers, firefighter. And that is really important because I think it's the kind of social responsibility that an enterprise can have for the society, and also an interest in the safety and personnel and organization, a sign of modernity, and commitment and add to show that the employer is attentive about these topics.

Sally O'Brien 1:02:13

Thank you. Thank you. Next up, the delegate from Fiji.

Fiji 1:02:21

First of all, we would like to thank the panelists for such a wonderful presentation. Just hearing what they had to say and research that have been done in this area of firefighter health and safety, we believe that Fiji has a long way to go.

We are not exempted from these health issues. For the past few years, we've had one death per year related to cardiovascular disease and asthma. And so, we thank the panelists for sharing the knowledge and the information they have shared today, and some of these firefighters have been in the service for over 20 years. So even though we don't have the resources to do the research, we can imply from the exposure that they attend to during the fires, that it's directly related to their demise. And even though we provide professional counseling as well.

Looking at the research that has been done in hearing from other countries, we need more collaboration in this area. And for us, we believe that sitting and having a voice on this table, we can collaborate to have a global solution and can it be tailor fitted for us, especially as a small nation, and trying to protect our firefighters for the future. And thank you.

Sally O'Brien 1:03:45

Thanks so much. Next up the delegates from Cyprus.

Cyprus 1:03:52

Thank you very much for your presentation. I won't be asking any questions today upon it. So, I just like to share a few of our practices in the Republic of Cyprus.

First of all, the way that we work in our shifts is like [inaudible]. So, we have this kind of, let's say, shift program and seems to be working for us. We're considering if toward in order to, let's say, to work a few hours is we create more problems for us logistically—because you can imagine if you are working in a wildfire that you need to replace the personnel—is going to create huge logistics problems for us.

Also, firefighters seem to favor to work more hours, like 24-hour shifts, because it will bring down the costs for them, because going back to work and things like this. So, I don't think working eight hours, maybe it's not that like the best scenario.

Also, you know that during wildfires we're working in very difficult terrain, very high temperatures and things like this. And there has been research by the University of Cyprus in collaboration with some professors from Harvard University. I don't know if you're familiar with this. And it shows that firefighters, at least in Cyprus, they have huge problems with muscle and skeletal disorders. I guess this is from the working environment, having to, the minimum, is just going up and down the big fire trucks is not that easy.

And in comparison, and also, in addition to that, the age limit for us is a huge problem, because it has shifted from the 50-55 years old you get to retire, now it's up to 62. So, is this a huge problem?

Because at the end, really, the real question that we want to ask ourselves is that if my family is in danger, well, I want to go and save them. Yeah, who is going to rescue the rescuer? I don't want to be a liability to my team.

And also, another practice that we have been using for many years now that we have biannual tests, and blood analysis and things like this, to check lung capacity so as to be able to use a breathing apparatus. Okay. That's just all your thoughts. Thank you very much.

Sally O'Brien 1:06:27

Thanks so much. Appreciate that. Next, the delegate from Austria

Austria 1:06:38

Thank you, very interesting the many statements that have now been heard here It is about health, it is about the safety of our emergency services and the focus is on people at the center of attention. Our organization also doesn't function without people.

It is very important that we have a high standard from head to toe, the outer shell is [inaudible] with standards, internal protection usually has no standardization and although this is probably difficult to implement, so to speak, to standardize internal safety, but there are essential approaches behind it that must definitely be pursued.

Maybe a small outline now from Austria and I've already mentioned that 99% of us are volunteers. This means that no one gets anything for their work in the fire department, but it is essential that they always return healthy from an assignment and that they ultimately have the best possible protection.

In the professional fire department, it is of course also possible to have fitness, sports lessons, etc., in the work environment. The location is different there. Volunteers have many factors of the environment that you have to consider, but that you can't so neglect either. Everyone takes this into the organization for themselves and then finally starts implementing it. How do you deal with commitment, hygiene? The ability to just wash your hands at the deployment site is important. Let's implement by creating opportunities in emergency vehicles to create black and white areas in the fire station, but also the opportunity to have reserve clothing and this is often a financial challenge for many fire brigades, but also for municipalities, which is then not implemented.

There is also something we only know, in particular the preventive check-up, for the wearer of respirators, and that's the case there. This is such a [inaudible] protection investigation that is standardized. Provided for this, however, the individual must pay fire costs between 150 and 350 euro, roughly speaking, the municipality should pay, but pays often, in this way, the volunteer fire department itself should make this possible with donations. For example, there is an examination, a free preventive examination. You could initiate this, but it is rather strictly rejected that you do not want this from public authorities. Yes,

we do a standardized test; I'm looking at Finland. We have the so-called Finn Test, which we have taken on, which shows fitness once a year, is very valuable and is an area that we rely heavily on.

Managing stress after stressful assignments, here we have created a very, very dense network to really ensure internal safety here too, these are many factors that we rely on, but there are also many uncertainties in there, which would actually need to be resolved in order to really give people that focus.

Thank you.

Sally O'Brien 1:10:02

Thank you so much. It sounds like there's a lot of areas for sharing best practices, and particularly looking at some of those career versus professional firefighter areas. All right, I know we had to cut off Romania earlier, would you like to provide some additional remarks where we had to cut you off earlier?

Romania 1:10:24

Thank you. I'll be short regarding the mental health. In Romania, we have in every county psychologist who is assigned and hired by the fire service, to work on debriefings, and to work on talking to the firefighters and so on.

But also, we have another issue, which is during recruitment, we have a psychological evaluation, we lose between 15 and 30% of the recruits who pass all other tests, deemed unfit psychologically by the psychologists. Now, I don't know if this is normal or not, I don't know if there are such percentages in other countries; we see it as very high. And losing 15 to 30% of your recruits, after they passed all the tests, when you have a problem to recruit people is very high. So, I don't if there's any opinion about this, or how we should approach this in the future? Thank you.

Sally O'Brien 1:11:29

Thank you so much. That's the final name on my list. Are there any additional final comments? We have a couple more minutes. All right, well return back to the Chair. Thank you so much.

Dr. Lori Moore-Merrell 1:11:42

Thank you so much, facilitators and our panel. So, I have a guest that I want you all to meet. I've asked Dr. Kenny Fent, who is here from the United States public health agency, and he is here as our leader of our National Firefighter Cancer Registry. So, Kenny, if you would, just to tell the delegates assembled here, what is the purpose of this registry? And how do you anticipate it working?

Dr. Kenneth Fent 1:12:14

Thank you. Good afternoon; glad to be here. And so, the national firefighter registry for cancer is the largest effort in the United States to try to better understand and reduce cancer in the fire service. It is a voluntary registry of firefighters in the United States.

The way it works is, when a firefighter registers, they provide information about themselves and their work as a firefighter. And then, God forbid, if they're ever diagnosed with cancer, even 20 to 30 years down the road, we're able to link their cancer diagnosis with the information they provided about themselves and about their work, which provides a very robust data set that we can then use to try to understand what specific occupational factors relate to the cancer outcomes and which types of cancers are elevated in firefighters in the United States.

And it just started about a year ago. It's an ongoing effort to enroll firefighters here because it is voluntary; it requires a lot of messaging and communication. But we currently have close to 13,000 firefighters who have registered. We're going to keep working until we have over 100,000 firefighters. But we can learn a lot.

And like I said, the ultimate goal is to use the information that we gain to ultimately help reduce cancer in firefighters through initiatives that we talked about today: exposure prevention, other efforts looking at behavior to try to lessen the cancer risk. And that's very, very important work for us.

Dr. Lori Moore-Merrell 1:13:54

Excellent. Thank you so much, Kenny. And Dr. Jahnke, I want to come back to you for just a moment and if you wish to answer [Romania's] question about the tremendous level of pre diagnosed mental illness in our recruits.

Dr. Sara Jahnke 1:14:13

I don't have exact numbers on that; I know that in the US, we don't have a validated measure that looks at the predictive validity of those tests. There are some psychologists who do those tests, but it's typically based on what's done in law enforcement.

So, there has been discussion about validating something specific to the fire service because we know that fire's different than law enforcement, but I don't know off the top of my head what percent that they tend to rule out with that—but I would love to talk to you about what tests they're using.

Dr. Lori Moore-Merrell 1:14:41

Excellent. So, I want to turn now to co-chair to see if he has any closing summary remarks.

Mark Hardingham 1:14:50

Thank you, Lori. So, first of all, thank you to the panel. Thank you for your presentations at the start but also your contribution in that debate that has gone forth since; we've covered a broad range of ground in the last 90 minutes or so. What's come across really clearly is the extent to which, amongst the other challenges, many people have remarked on this being the key focus for your fire and rescue service in your country at this point in time, and there's been common areas that have come across clearly in the discussion.

But equally, there have been some different challenges and some different approaches that have played out as well. And I think those will be useful to share across the Communities of Practice once we get those up and running. The challenges are similar, but sometimes different. Whether we're talking about volunteers, or part time colleagues in fire and rescue services, career firefighters, or the staff in foreign rescue services, or people in leadership roles, right up to the most senior leadership roles, these issues are issues that affect all staff. One of my reflections from the UK, listening to what's played out, particularly so in terms of mental health and well-being, really interested in the research work that's been done in the US and in other places as well.

We have our own academic research and frameworks and toolkits, and work with other blue light partners, partly through the royal foundation, which has support from the Prince of Wales—so, has quite significant senior leadership support into the work around mental health and wellbeing in the UK, and happy to share that through the Communities of Practice as well. But particularly as well, around the issues around cultural inclusion, and the link—but sometimes the slight difference—between what we talk about as organizational culture, and what we talk about as misconduct related to culture in the fire rescue services. And the two things are linked, but sometimes quite different, as well.

And again, as I touched on earlier, that's a significant focus, politically, professionally, through the national news media through the inspectorate. And there is not a fire and rescue service in the UK that is not doing work around cultural inclusion, and frankly, finding it quite difficult as they work their way through it. so keen to share some of that as well.

And then the last one I'll pick up on is we talked about shift systems. And I was writing down as we were listening to colleagues in the room. I mean, according to my sums, we've got shifts systems that are six hours, eight hours, nine hours, 10 hours, 11 hours, 12 hours, 13 hours, 15 hours, 24 hours or 48 hours. So, I think the answer is in there somewhere. I'm just not quite sure where it is. But I guess it's the research that will determine which it is.

And one of the other things we didn't talk about is that the focus of what is the most appropriate shift system often has a focus on the question into people who already work inside the organization, as opposed to people we are trying to encourage to work in the organization. And often, it's the shift from

one shift system to another shift system that can cause stress for those who are already working in the organization. So, there's some additional factors just to consider which play into mental health and wellbeing, as well.

Dr. Lori Moore-Merrell 1:18:12

Thank you very much, Mark. If you'll join me in thanking our panel. Thank you very much, ladies—excellent job. At this time, I'd like to invite Victor Stagnaro to the stage, Victor is going to give us some very important instruction for the rest of the afternoon and our evening together. So, Victor, if you will please.

Victor Stagnaro 1:18:53

What an amazing day. Thank you so very much. I have a few announcements to help guide us through the rest of the afternoon and this evening. The special sessions and Library of Congress event will be in English. if you need translation, please take your linguist receiver and headset with you. All others, please leave it at the seat or the chair where you're currently sitting. If you do not have a number on your badge, you will we will see you this evening at the lobby in the lobby for transportation to the Library of Congress.

Those who are registered for a special session have a number at the bottom of your badge. This indicates your session. Session one through four are in the South Tower here in the hotel. Session Five is across the street at the firehouse. As you walk out of this session, look for the World Fire Congress ushers holding a number that matches your special session. The officer will escort your group to your location.

For tonight, transportation to the Library of Congress is being provided; all attendees must have your badge to get on the bus. Please note that there's a security screening and metal detectors at the Library of Congress. As you enter the shuttles to the Library of Congress, we'll run beginning at 1700 hours.

This evening signing's ceremony will have some very precise timing requirements. Please be cautious and make sure that you know that at the Library of Congress, the polished floors can be very slippery. At the end of the evening, we must depart the Library of Congress promptly at 1030. Please be patient as we run the shuttles through the loop to bring you back to the hotel.

Madam Fire Administrator, I turn it back to you.

Dr. Lori Moore-Merrell 1:20:47

Thank you very much, Victor, I will reiterate just a couple of those items, your numbers on your badge. Indicate your session for this afternoon, your special session. You will have World Fire Congress leads or ushers who have the numbers, and you'll follow them; they'll escort you to your special sessions. One of those sessions is, of course, across the street. So, follow your ushers this afternoon.

The buses, again, will depart at 1700. Your sessions will end at 1600. So, you have an hour to go refresh however you want to spend that hour until the buses begin to leave for the Library of Congress for this evening.

As we head to the Library of Congress: we'll have our reception, then you will spend some time together in a reception, and then we will seat for dinner. After dinner, we will again proceed for the delegates to be seated for our closing ceremony, where we will do your certificate presentation by nation and also allow you the opportunity if you wish to sign our Founding Statement of Principles.

So, with that, I want to express my deep gratitude to every delegate in this room. I want to thank you for believing that this meeting would have value that you would travel to the United States to sit and have a conversation with firefighters from across the world. This, I believe, has been significant.

And I want you to know it has been my great honor to sit in the same room and have conversation with all of you,—so thank you. I will recess us until we join together again tonight at the Library of Congress.

We're in recess.

Library of Congress

Closing Ceremony & Signing of World Fire Charter Agreement

The 2024 World Fire Congress concluded with a historic evening at the Library of Congress, the oldest federal cultural institution in the United States, the largest library in the world, and home to the U.S. Copyright Office. Housing more than 168 million artifacts, including books, photographs, and newspapers, the Library served as a fitting venue for this momentous occasion. The event began with a grand dinner in the Library's Thomas Jefferson Building Grand Hall, where delegates and guests were inspired by remarks from Dr. Lori Moore-Merrell, United States Secretary of Homeland Security Alejandro Mayorkas, and Mark Hardingham of the United Kingdom National Fire Chiefs Council (NFCC). The elegant setting and thoughtful addresses set the tone for the evening's milestones, celebrating the Congress' achievements in advancing global fire safety and collaboration.

The evening culminated in the Closing Ceremony and Signing of the World Fire Charter Agreement. During this historic moment, delegates signed the Founding Statement of Principles, solidifying shared commitments to fire safety, resilience, and prevention. As the ceremony concluded, the 2024 World Fire Congress was officially adjourned, and the ceremonial gavel was passed to the United Kingdom, the host of the 2026 World Fire Congress. This transition symbolized the continuation of international cooperation in addressing critical challenges and opportunities in fire safety and emergency response.


World Fire
Congress

Presentations

Fire as a Community Risk and a Global Threat

Fire is a risk that impacts the security, health, and prosperity of citizens and communities in every town, city, state, province, and nation. It also represents a borderless threat to our environment.

Fire Service Leaders with Common Goals

As leaders responsible for preventing and fighting fires, the delegates at this first meeting of the World Fire Congress (WFC) comprise a diverse gathering of fire-fighting agencies that share common goals of protecting our communities and our shared environment.

Common Challenges

Communities throughout the world face common and evolving challenges, including ...

- *firefighter health and safety*
- *fire risks associated with emerging technologies*
- *climate-change driven wildfires*
- *structural fires*

Dynamic Challenges

Common Responsibilities of Delegates

The partner agencies of the WFC share responsibilities to

- *[Research] gather and analyze information on all types of firefighting activities, including ...*
  - *technical information related to building construction;*
  - *the fire properties of materials;*
  - *information on fire prevention and control laws,*
  - *[fire suppression] systems, methods, techniques, and [fire department] administrative structures; and*
  - *information on the causes, behavior, and best method of control of other types of fire, including, forest fires.*

Purpose to Share Knowledge

In a spirit of friendship, and for the common benefit of each community represented within the WFC, its delegates intend to share their collected knowledge with other WFC partner communities.

Delegate Intent Through Communities of Practice

WFC delegates plan to meet to build relationships that will allow a more open, transparent, and efficient sharing of information through communities of practice;

- *... to enable experts within our ranks to gather regularly to share strategies;*
- *to bring forward possible solutions to common challenges;*
- *to identify emerging problem areas and set priorities; and*
- *to monitor the progress of cooperative efforts and programs to reduce fire losses.*

Voluntary Participation (Non-Binding)

- *It is to the common benefit of all delegates and the communities they represent to share this information voluntarily, and*
- *...in accordance with the principles of Dignity, Respect, and Equality for all delegates, partner communities, and their people,*
- *...without restrictions on participation or the sharing of information on the basis of gender, race, color, nationality, language, disability, or sexual orientation.*

Voluntary Signing to Confirm

The Statement of Founding Principles shall be confirmed by the signatory nations present at the inaugural meeting of the World Fire Congress and in accordance with their respective processes.

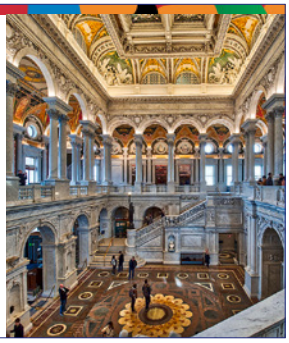
The signatory nations will become the Founding Delegates of the World Fire Congress.

World Fire Congress Next Steps

- *The signed Statement of Founding Principles shall be deposited with the United States Fire Administration, which*
- *...shall transmit copies thereof to all the signatory nations.*
- *A duly certified copy shall be transmitted by the United States Fire Administration to the National Fire Chiefs Council of the United Kingdom to be available for additional nation delegate signatures at the 2026 meeting of the World Fire Congress and...*
- *To be attached to the subsequent Charter of the World Fire Congress to be developed by the delegates between meetings of the Congress.*

Opportunity to Sign the Founding Statement

In Faith Whereof the Delegates of the World Fire Congress have signed the Statement of Founding Principles completed in the city of Washington, D.C., on the 8th day of May, two thousand and twenty-four.



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- Itzik Oz
- Marco Antonio Guerrero Sanchez
- Juan Carlos Field
- Milan Dubravac

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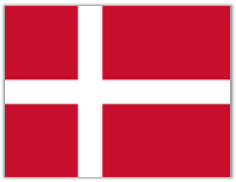

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Ecuador

Delegates

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European Union Civil Protection and Humanitarian Aid Operations (ECHO)

Delegate

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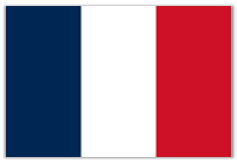

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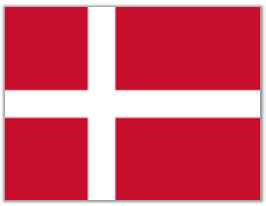

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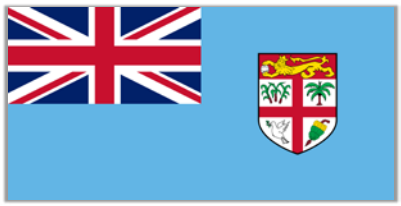

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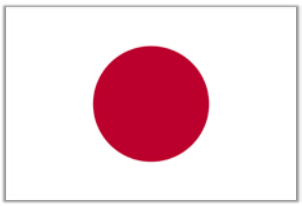

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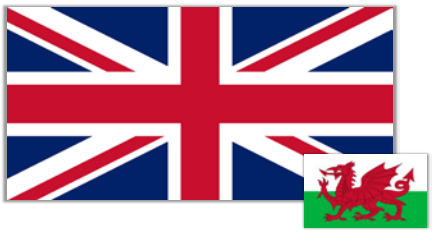
United Kingdom

United Kingdom - Wales



United Nations

UNDRR
UN Office for Disaster Risk Reduction

United States

Zambia

World Fire Congress
2024 | UNITED STATES

Operating Procedure

Delegate Interaction

Structure of Official Program

- The official program of the Congress will be opened, recessed, and adjourned by the Chair.
- **Credentialed Delegates are seated in nation-specific areas** at the main table.
- Gallery observers, speakers, facilitators, and invited guests are in supplemental seating.
- The timing, order of presentations, and delegate discussion will be guided the **daily program agenda**. The agenda may be altered by the Chair as necessary to complete the objectives for the meeting.

Delegate Interaction

- **All Delegates are encouraged to be present** for each plenary session.
  - It is understood that conflicts occur, however, and the Congress proceedings will continue as long as 2/3 of registered Delegates are present.
- Delegates wishing to speak should raise the **green flag** on their nation's table marker to indicate the request to the Chair.

Facilitators and Speakers

Each Challenge Session will involve subject matter expert presentations and **facilitated discussion among delegates**.

Speakers will provide presentations on **various perspectives** of the challenge.

Once all speaker presentations on the matter are complete, a **facilitator will engage delegates to speak.**

Delegates may **exchange knowledge** by asking questions of the speakers, offering additional information, solutions, or best practices to the Congress.

Delegate Interaction

- Upon recognition by the Chair, a delegate or recognized speaker will have three minutes to deliver their question or remarks.
  - The Chair may waive the three-minute limitation as circumstances dictate.
  - Based on overall program time constraints or other circumstances, the Chair may indicate additional limitations on the time allowed to each speaker.
- To provide as many delegates as possible the opportunity to speak, if a Delegate uses their three-minutes, they will not be given another opportunity to speak until a minimum of three other Delegates have had the opportunity to speak on the same or related topic.
  - This limitation may be waived by the Chair if no other delegates are waiting to speak.

Community of Practice Defined

A community of practice (CoP) is a group of people who share a common concern, a set of problems, or an interest in a topic, and who come together to collaborate on strategies, solutions, and goals.

Communities of practice often focus on sharing best practices and creating new knowledge to advance a domain of professional practice.

Keys to Successful CoPs

- *Participants share a concern*
- *Participants desire to make it better*
- *Participants interact regularly*

Interaction on an ongoing basis is an important part of these efforts.

World Fire Congress CoPs

The inaugural World Fire Congress will establish at least five communities of practice during the 2024 meeting in Washington, D.C., USA ...

In addition to a main *Stakeholder Engagement Community of Practice* which will serve as a hub for all other CoPs

Stakeholder Engagement = The HUB

Statement of Concern

It is critical for the global fire service to stay connected to be aware of each other's strategic priorities, challenges and needs.

This connectedness enables WFC to identify common objectives to

- Design joint engagements
- Support joint investments in research and development
- Support community risk reduction through joint public messaging … saving limited resources.
- Identify strategic engagement opportunities and exchanging knowledge and expertise.

#1 Structure Fire

Statement of Concern

- Nations experience billions of dollars in direct and indirect economic loss.
- Globally, fire threatens critical infrastructure, national security, and public safety.
- Structure fires are a leading cause of civilian fire deaths and injuries, and most fires are preventable.
- Many fire departments do not have adequate resources to respond safely, efficiently, and effectively.

#2 Climate Change

Statement of Concern

- Climate change has a broad range of observed effects and is changing the baseline risk environments for fire departments across the globe.
- Climate change driven wildfires are growing in intensity, size and destructiveness.
- Drought, extreme heat, floods, severe storms, extreme cold, and rising seas levels all affect the emergency events to which firefighters respond.
- Climate change effects on communities can be catastrophic including overwhelmed firefighter response capabilities, tragic loss of life, and socioeconomic devastation.

#3 Fire Risks from Emerging Technology

Statement of Concern

- Beneficial innovation like electric vehicles (EV) and Lithium-Ion battery bikes and scooters are needed to move us away from dependence on fossil fuels.
- Innovation can sometimes lead to unintended consequences like a fire threat.
- Globally, there is a need to share information on threat realization, policy and regulation, response resources, public awareness and prevention education, research, and firefighter training.

#4 Firefighter Health and Safety

Statement of Concern

- The fire-fighting community struggles with several health concerns including elevated rates of cancer and mental health conditions.
- Firefighters have a 9% higher risk of developing cancer and a 14% higher risk of dying from cancer compared to the general public.
- Firefighters and other rescue personnel develop PTSD at a similar rate to military service members returning from combat.
- To exacerbate the health and safety challenges, many nations are struggling to recruit firefighters.

#5 Firefighter Education and Training

Statement of Concern

- Firefighters have become universal around the world. However, consistency in firefighter training has not.
- Initial firefighting skills are normally taught through local, regional, state, or nationally approved fire academies or academic institution training courses.
- The skills required for safe firefighting operations should be regularly practiced during training evaluations throughout a firefighter's career.
- Depending on the requirements of a fire department, additional skills and certifications may be acquired throughout a firefighter's career for promotional opportunities to fire officers.
- Many nations experience lack of basic firefighter training resources and most certainly lack advanced officer training opportunities.

Indicate Interest in a CoP


United States of America
Community of Practice Recommendations

Which session does your recommendation relate to?

Challenge 1: Structure Fire & Firefighter Response
Challenge 2: Climate Change Impacts
Challenge 3: Fire Risk of Emerging Technology
Challenge 4: Firefighter Health & Safety

Recommendations & Considerations for the Community of Practice:

Point of Contact (Optional):

Name

Email Address

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Structure Fire & Response: Fire Dynamics

Daniel Madrzykowski, Ph.D., PE
Daniel.Madrzykowski@ul.org
May 7, 2024


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2024 | UNITED STATES

Communities of Practice

Establishing a Global Network

"Change is the only constant in life"

Heraclitus, 535 – 475bce

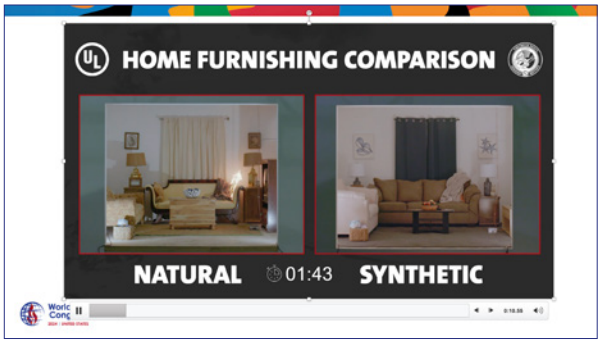
No access for Fire Ladder Truck

New Materials and Construction Methods = Faster Fire Growth

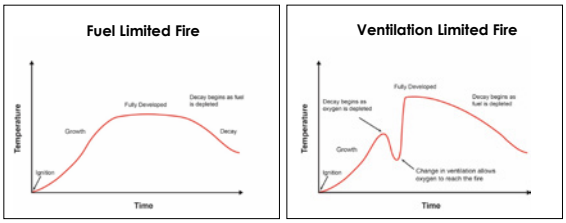
- Faster fire propagation
- Shorter time to flashover
- Rapid changes in fire dynamics
- Shorter escape times
- Shorter time to collapse
- Increased exposure problems
- Emerging hazards

Lightweight engineered wood I-joist supported floors can collapse after less than 5 minutes of burning.

Floor Support Type	Ventilation Description	Time from ignition of the fuel load to collapse	Time from ignition of floor assembly due to fire spread to collapse
Nominal Dimension 2 x 12	On-plane vent open at ignition	11:09	7:11
Nominal Dimension 2 x 12	On-plane vent open at 8:30 after ignition	12:45	10:45
Lightweight Engineered Wood I-Joist	On-plane vent open at ignition	6:00	2:45
Lightweight Engineered Wood I-Joist	No vent	6:49	4:06
Lightweight Engineered Wood I-Joist	No Vent	8:27	4:42
Lightweight Engineered Wood I-Joist	On-plane vent open at ignition	6:49	2:29

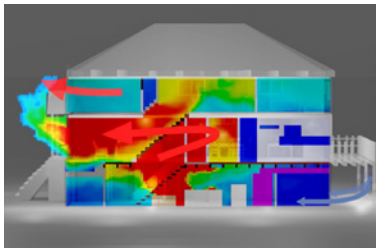


Recognition of ventilation limited fires



Providing oxygen to a ventilation limited fire

Understanding the flow path in a building is key to an effective fire attack.



Improved understanding of suppression tactics: gas contraction due to cooling

Hose Stream Mechanics

- Water distribution in compartments
- Air entrainment due to stream type & nozzle motion
- Water impact on fire flow & fuel surfaces

Fire Dynamics Knowledge & Hose Stream Mechanics = Effective Suppression

1 ¾" (45mm) Handline: 185 Gal (700 liters)

Good decisions require:

- Good information (data) from a trusted source
- Knowledge & Experience to interpret the data
- Knowledge & Experience to account for the context (the system)

Decisions on Firefighting Strategy and Tactics

- Size up is the basis of the Incident Action Plan (DATA)
- Impact of ventilation on a vent-limited fire = Increased Growth (HRR) (KNOWLEDGE & EXPERIENCE)
- Existing Flow Paths (DATA)
- Potential Flow Paths (KNOWLEDGE & EXPERIENCE)
- Fire dynamics (KNOWLEDGE) needed to understand observations (DATA)

High Energy Materials, New Construction Methods and Bigger Buildings mean that

- More fixed fire protection systems are needed
- More firefighting resources needed
- Less time to make decisions

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Daniel Madrzykowski, Ph.D., PE
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FSRI.ORG

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Fire as a Global Threat: Human Factors and Consequences

Professor Sabrina Cohen-Hatton
Chief Fire Officer, West Sussex Fire & Rescue Service
NFCC Improvement Lead
Hon Research Fellow, Cardiff University

Fire as a global threat:

Human Error

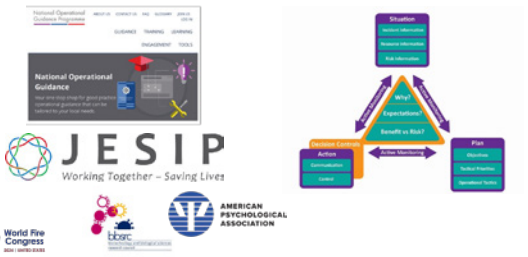
80% of firefighters are injured from human error.

How Decisions Were Made

80% Intuitive

20% Analytical

Decision Control Process



Fire as a Global Threat: Multi-Agency Working

Assessment, Planning and Execution

Little consideration of powers, policies, options or contingencies

Explorers and Exploiters

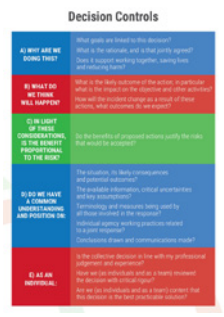
Some repeatedly search for information, seeking optimal option. Others take a bet to make a decision quickly, not optimally.

Pivotal Role of Chair

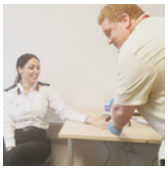
More understanding about nuances of individual decision making and impact on the group to avoid decision traps.

Decision Controls for Group Decision Making

JESIP
Working Together – Saving Lives



Fire as a global threat: Paradoxical effects of decision making under uncertainty



Uncertainty

Emergencies are by their nature extreme. Information can be limited and uncertainty high.

Impact of stress

Stress reduces processing capacity and limits that available for processing information and making decisions.

The paradox

Uncertainty increased stress, which increased tendency to rely on rules. Even when no rules were appropriate because the situation was so novel.

References

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Cohen-Hatton, S. R., & Honey, R. C. (2015). Goal-oriented training affects decision-making processes in virtual and simulated fire and rescue environments. Journal of Experimental Psychology: Applied, 21(4), 395.

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Butler, P. C., Bowers, A., Smith, A. P., Cohen-Hatton, S. R., & Honey, R. C. (2021). Decision making within and outside standard operating procedures: paradoxical use of operational discretion in firefighters. Human factors, 00187208211041860.

Wilkinson, B., Cohen-Hatton, S. R., & Honey, R. C. (2022). Variation in exploration and exploitation in group decision-making: Evidence from immersive simulations of major incident emergencies. Journal of Contingencies and Crisis Management, 30(1), 82-91.

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Decision Traps

Situational Awareness

Decision Inertia

Paralysis by analysis sees decisions either not made (decision omission) or deferred (choice deferral).

Wicked Problems

Problems exist that are incomplete, are in flux, and have no right answer. Some require you to find the least worst option.

Confirmation Bias

Seeing the truth that you want rather than finding the truth that is there.

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Professor Sabrina Cohen-Hatton
Chief Fire Officer, West Sussex Fire & Rescue Service
NFCC Improvement Lead
Hon Research Fellow, Cardiff University

West Sussex Fire & Rescue Service | NFCC National Fire Chiefs Council | CARDIFF UNIVERSITY | PRIFYSGOL CAERDYDD

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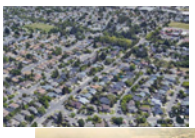
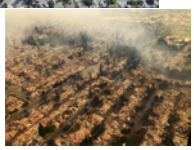
Wildfires / Community Conflagrations

Gavin Horn
UL Fire Safety Research Institute

Tubbs Fire (2017) – Sonoma & Napa (CA)

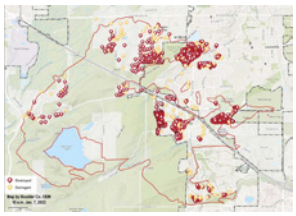
https://www.latimes.com/projects/la-me-northern-california-fires-structures/





https://account.sacbee.com/paywall/subscriber-only?resume=17822365&article=ab_archive

Marshall Fire (2021) – Boulder (CO)



https://wildfiretoday.com/2022/01/07/marshall-fire-updated-damage-assessment-1084-residences-destroyed/

https://wildfiretoday.com/2022/01/05/photos-before-and-after-the-marshall-fire-in-boulder-county-colorado/

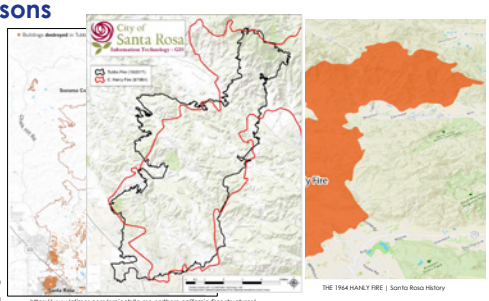
Wildland Urban Interface (WUI) Firefighting PPE

Structure-to-Structure Heat Transfer

Firebrand Heat Transfer

Resilience and Recovery After the Fires

Lessons



https://www.latimes.com/projects/la-me-northern-california-fires-structures/

THE 1964 HANLY FIRE | Santa Rosa History

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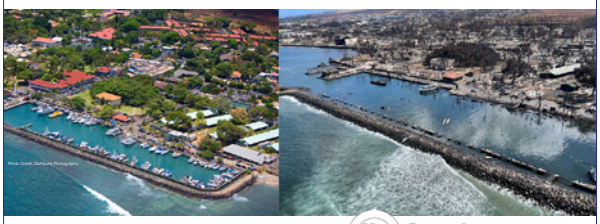
Lahaina Fire Comprehensive Report & Timeline

Dr. Steve Kerber
Derek Alkonis
UL Fire Safety Research Institute



UL Research Institutes

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Lahaina Fire Reports

Phase 1 Report

Comprehensive Report & Timeline to describe the progression of the fire that destroyed much of Lahaina Town on August 8, 2023, and August 9, 2023, starting where the origin and cause investigation concludes.

Phase 1 Output
Fact-based report and minute-by-minute timeline of how the fire unfolded from August 8, 14:55 to August 9, 08:30.

Phase 2 Report

Incident Analysis Report to provide detail on conditions influencing the original fire situation, attempts to stop its rapid progression through Lahaina Town, and evacuation efforts.

Phase 2 Output
Analysis of the data, determining how various fire protection systems functioned in this fire incident.

Phase 3 Report

Forward-Looking Report to answer the critical question, *"How do we prevent this from happening again?"*

Phase 3 Output
Best practices that incorporate additional data and recommendations for Hawai'i to act toward prevention.

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Data Collection

FSRI captured all available recorded facts relating to preparedness and response of the Lahaina fire incident August 8, 2023 through August 9, 2023.

Written Requests for Information

Collected radio communication logs, transcripts, recordings, and other preparedness and response time-stamped data. (Information request process was agreed upon by Maui County Department of Corporation Counsel and FSRI.)

Listened to and transcribed radio transmissions on multiple channels from Maui County 911 calls, Maui Fire Department, and Maui Police Department (MPD), and MPD Dispatch.

Listened to Hawaiian Electric dispatch communications.

Site Visits

- Toured the exclusion zone from late August 2023 through January 2024.
- Captured high-definition imagery (stills and video) of un-damaged, damaged, and destroyed structures and remaining vegetative fuel components.
- Surveyed the area via helicopter, capturing aerial imagery of all burned and adjacent unburned areas.

Technical Discussions (TDs)

- Engaged in TDs to capture experiences and imagery (stills and video) from individuals present August 8, 2023 through August 9, 2023, including:
  - Local and State Leaders;
  - County Employees (PD, FD, MEMA, Department of Water Supply);
  - Residents; and
  - Hawaiian Electric

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Pre-Fire Conditions: Lahaina PM Fire

Looking west down Lahainaluna Road from Luakini Street. Source: Google Earth (2019).

Image captured at 13:46

Report Figure 4.2.3.4 August 8, 2023, civilian photo taken at 13:46 showing roof damage, looking west down Lahainaluna Road from Luakini Street. (Inset at right: represents camera operator's approximate visual scope.)

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Lahaina PM Fire Progression

Report Figure 4.3.1.1 Comprehensive fire progression map of the greater Lahaina and western Maui areas. Arrows indicate the general direction of fire spread based on the data collected.

Lahaina PM fire
August 8, 2023 14:55 to August 9, 2023 08:30

Animation of Report Figure 4.3.1.2 *Fire progression map of western Maui with detailed data from various sources.*

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Fire Progression

16:42 to 17:42

Report Figure 4.3.1.9 *Fire progression map showing particularly fierce fire spread in the Waineʻe Street area from 16:42 through 17:42. (Inset above: represents the approximate map area within Lahaina.)*

After Lahaina PM Fire Starts

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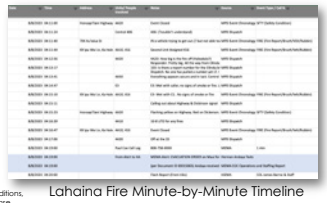
Download the Lahaina Fire Comprehensive Report & Timeline

Lahaina Fire Report

375-page narrative about pre-fire conditions, fire progression and emergency response



Lahaina Fire Minute-by-Minute Timeline

12,000+ records from every organization represented in the report.

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Derek Alkonis

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UL Fire Safety Research Institute

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International Fusion Center

Major Essa Almutawa
Head of Monitoring and Inspection Department
Dubai Civil Defense

The Problems

1 Emissions from fire incidents have peaked drastically in 2021 to a record high of 1.76 billion tons.

2 Climate Change is the defining issue of our time, and we are at a defining moment.

3 Each decade is becoming hotter than the past.

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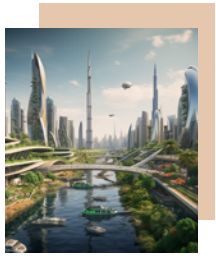
A brief about:

COP28 UAE

A project of Civil Defense under the title of the Global Alliance to Reduce Fire Emissions to participate in the Conference of the Parties "COP 28" held in the United Arab Emirates, Dubai, Expo, with the participation of 198 countries and more than 140 heads of state and state.



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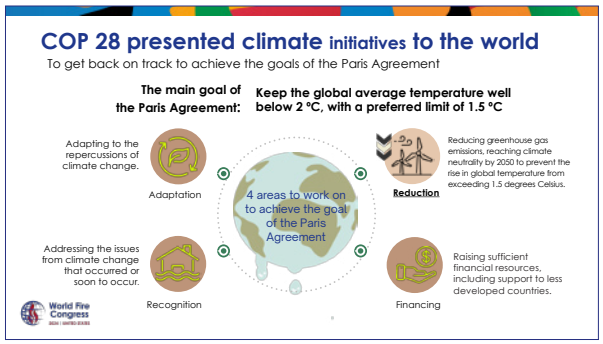
COP 28 presented climate initiatives to the world
To get back on track to achieve the goals of the Paris Agreement
The main goal of the Paris Agreement:
Keep the global average temperature well below 2 °C, with a preferred limit of 1.5 °C
Adapting to the repercussions of climate change.
Adaptation
4 areas to work on to achieve the goal of the Paris Agreement
Reduction
Reducing greenhouse gas emissions, reaching climate neutrality by 2050 to prevent the rise in global temperature from exceeding 1.5 degrees Celsius.
Addressing the issues from climate change that occurred or soon to occur.
Recognition
Financing
Raising sufficient financial resources, including support to less developed countries.
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Introducing Eco Readiness
The main dashboard displays the total carbon emissions emitted by countries worldwide from fire incidents.
It also includes the impacts of carbon emissions on agriculture, air quality, and the economy.
World Fire Emission Reduction Alliance
Main Objectives
Effects of Carbon emissions
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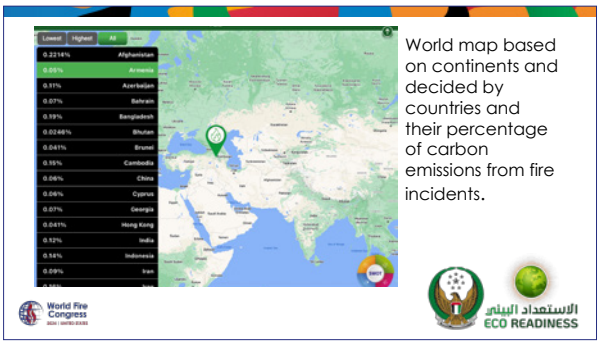
الاستعداد البيئي
ECO READINESS


KPIs of fire associations and their compliance with the goals of COP28 to reduce carbon emissions from fire incidents.
World Fire Emission Reduction Alliance
World Fire Congress
الاستعداد البيئي
ECO READINESS


World map based on continents and decided by countries and their percentage of carbon emissions from fire incidents.
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الاستعداد البيئي
ECO READINESS


World Fire Emission Reduction Alliance Building
World Fire Congress


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Major Essa Almutawa
Head of Monitoring and Inspection Department
Dubai Civil Defense

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Climate Change: Impact on the Fire Service in the Philippines

FIRE DIRECTOR LOUIE S PURACAN, CEO VI
Chief, Bureau of Fire Protection

PH AT THE RING OF FIRE

DAILY AVERAGE 20 Earthquakes

7.2 Mag Feared "BIG ONE"
based on MMEIRS JPN-PH Joint Study in 2014

ANNUAL AVERAGE 18-20 Typhoons

TOTAL 2023

179 Forest Fires
16,433 Fire Incidents
5.88 Php 87M Estimated Fire Damages (USD)
20B Php 345M Estimated Damages from Natural Disasters (USD)

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PH AT THE RING OF FIRE

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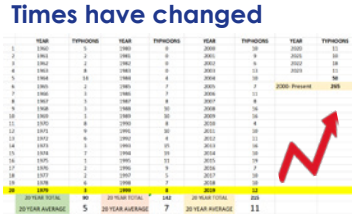
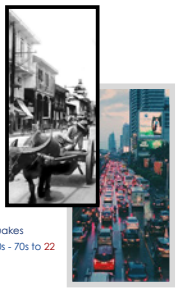
Times have changed





- Temperature - 1 degree higher from the 60s to 2000s
- **5 Average** Typhoons between 1960-1979
- 7 Average Typhoons between 1980-1999
- To **11 Average** Typhoons between 2000-2019.
- 4 destructive earthquakes recorded from the 60s - 70s to 22 from 2000 to present

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THE SHIFT:

Government Firefighters' Expanded Roles in the Philippines

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Roles of Government Fire Fighters in the Philippines

Fire Suppression
BFP is the primary response agency for fire suppression, operating side by side with a fleet of auxiliary groups and volunteer brigades in the country

Fire Investigation
BFP with other law enforcement agencies like the national police & bureau of investigation work on fire case & arson

EMERGENCY MEDICAL SERVICE & BFP FAST
BFP together with the health units of local government units (LGUs) provide immediate medical response & ambulance selvce & motorcycle unit

HAZMAT & CBRNE RESPONSE
BFP with law enforcement agencies like the national police & armed forces collaborate on HAZMAT & CBRNE response

Fire Administration
BFP is governed by the National Headquarters with 17 administrative regions led by its respective Regional Directors & a National Fire Training Institute

Fire Safety & Enforcement
BFP is a regulatory agency in the issuance of Fire Safety Evaluation Certificate & Fire Safety Inspection Certificate on all buildings & facilities

TECHNICAL RESCUE
BFP provide immediate response for technical rescue such as vehicular accidents, collapsed structure & high angle rescue

HUMANITARIAN ASSISTANCE & DISASTER RESPONSE
BFP during times of disasters work with the LGUs and the Department of Social Welfare & Development for services such as packing of relief goods, water rationing, mobile kitchen & evacuation center management

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Challenges

GEOGRAPHY

Philippines is an Archipelago

Access to some areas are limited to available means of transportation

EQUIPMENT

Foreign Fire Equipment Market

Access to manufacturing, purchase, repair and highly technical maintenance rely on foreign market support

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WAYS FORWARD

BFP's Capacity Building Efforts

Training & Equipment

International Cooperation

Policy Development

BFP to 2034

Highly Trained, Well Equipped

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Thank you for listening! Maraming Salamat Po!

Connect with us.

+63 02 84264399

www.bfp.gov.ph

ofc@bfp.gov.ph

BFP National Headquarters, Quezon City, Metro Manila Philippines, 1105

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Fire Risk of Emerging Technologies

Steve Kerber, PhD, PE

Fire Risk of Emerging Technologies

Steve Kerber, PhD, PE

World Fire Congress

May 8, 2024

FIRE SAFETY RESEARCH INSTITUTE

UL

Balancing Sustainability and Fire Resiliency

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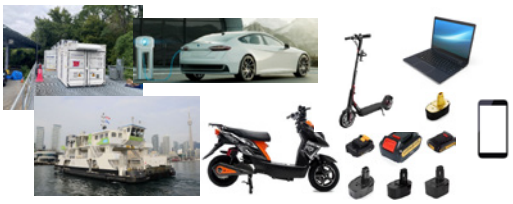
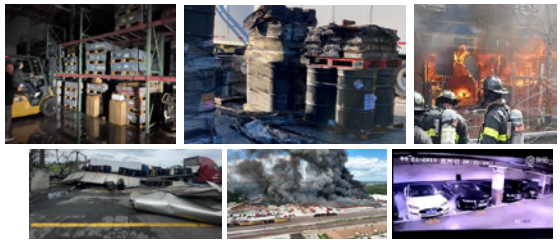
Lithium-ion battery adoption and the fire service

ESS – Marine – EV – Consumer Products - Medical



All powered devices are candidates for lithium-ion electrification.

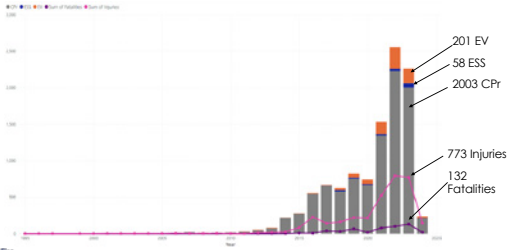
Many challenges throughout the life cycle



Global trend of lithium-ion battery incidents

Source: Google Maps, UL Solutions R&D (Veronica Kimmerly)

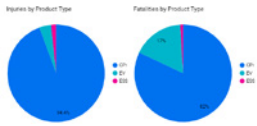
Lithium-ion battery thermal runaway incidents



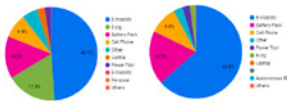
Source: UL Solutions R&D (Veronica Kimmerly)

North America's biggest challenge

Most injury and fatality incidents involve consumer products*



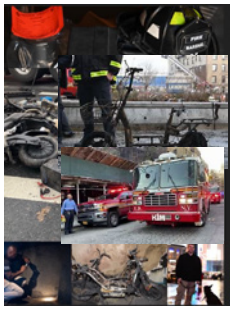
Most consumer products incidents involve e-mobility devices



*EV data inflated by fatalities as a result of crash

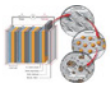
Bureau of Fire Investigation
Lithium Ion Fire Stats
(As of 12/31/2023)

	Investigations	Injuries	Deaths
2019	30	13	0
2020	44	23	0
2021	104	79	4
2022	220	147	6
2023	267	150	18



Moving target

- New fuels, new chemistries, new boxes
- Determining which hazards extend outside scope of first response
- Staff development to the new fire environment
- Codes and standards are slow, technology is fast
- Developing best practices for extinguishment and gear cleaning
- Impact on building systems and evolutions
- Community actions to eliminate secondary incidents
- Public messaging and the fire service role goes beyond operations
- DIY impacts



Addressing the challenge today and into the future

World Fire Congress 2024 | UNITED STATES

Energy transition in the built environment: Dutch facts and figures for AFV and PV

Dr. Nils Rosmuller
Applied Professor,
Energy and Transportation Safety

1. The built environment

The term "**built environment**" refers to human-made conditions and is often used in architecture, landscape architecture, urban planning …

These curated spaces provide the setting for human activity and were created to fulfil human desires and needs

Buildings, public infrastructure, industries and agriculture

1. The built environment

High-rise buildings

Car parks

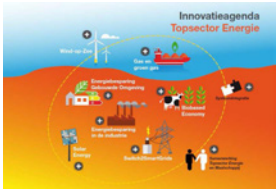
Infrastructure

Warehouses, barns

Industries

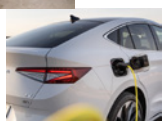
2. The Energy Transition

- Sustainability
- Clean/'green' fuels
- Electrification
- Hydrogen
- Geo, bio, wind, solar…
- Nuclear

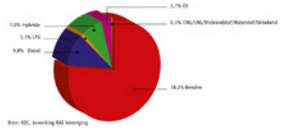


3a) Dutch F&F: Alternative-fueled vehicles (AFV)

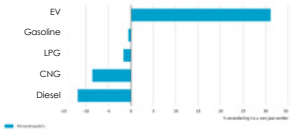
- Database (The Netherlands)
- Start: 1 januari 2021
- Alternative (clean(er)) Fuels:
  - **BEV**, **(P)HEV**, FCEV, CNG, LNG
- Type of vehicles:
  - Everything with 4+ wheels
- **Fire brigade on the incident scene**
- Data collection: Questionnaire



Fuel type passenger cars (% in 2023)

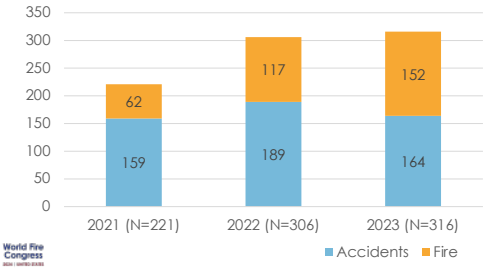


Development passenger cars per fuel type (% in 2023)

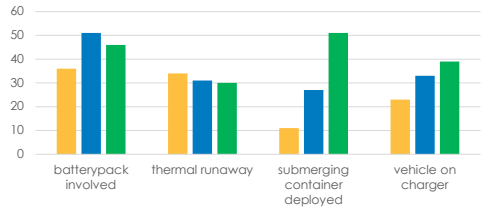


EVs in The Netherlands in 2023

Number of AFV-Incidents



Incident Characteristics (in absolute numbers)



3a) Key lessons: AFVs

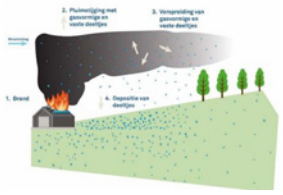
- **Incidents** (fire and accidents): Despite the +30% EV, the absolute incident number (fire and accident) remains the same (2021-2023)
- **Fires**
  - In case of fire → EV at charger in about 25%-35%
  - Battery in about 35% in thermal runaway
- **Accidents**
  - Substantial increase in deploying the submerging container
  - Battery hardly in thermal runaway
- **Serious fire fighter issues**
  - TR, copious amounts of water, contaminated cooling water, explosions, HF

3b) Solar energy

3b) F&F Solar system fires in NI
(TNO and ECN , 2019)

- **24 fires in 2018**
  - 20 private houses
  - 4 others
- **80-90% in-roof systems**
- **Causes:**
  - 70% installation error
  - 10% junction box
  - 20% heat development

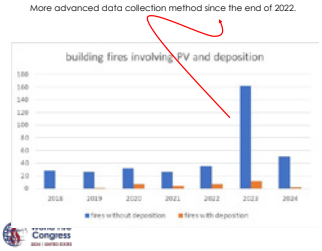
3b) Building fires involving solar panels

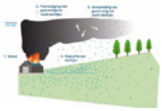


Deposition of sharp-edged, (non-toxic) solar cell fragments
→ danger to human, animals, and crop
(NIPV (2020, 2021) and RIVM (2022))

3b) Building fires involving solar panels

More advanced data collection method since the end of 2022.





- 349 building fires involving PV
  - 361: no deposition
  - 33: deposition
- Deposition characteristics:
  - buildings with fire load and 100s of PV panels
  - solar cell fragments
  - distance: several kilometers

3b) Key lessons PV-panels

- Solar panels complicate firefighting:
  - Deposition of sharp-edged pieces
  - 'Umbrella effect' in case of fire suppression
  - Electrocution risks

4) Key message ET in built environment

- Energy transition (ET) affects life safety of citizens and firefighters due to 'new' fire risks in the built environment, complicating fire suppression
- Designers, OEM's, spatial planners have to take their responsibility for safety,
- Communicate with the FRS, rather than passing the responsibility for safety to them (suppressing the accident consequences)
- **Maximum effort on prevention and legislation to better 'guarantee' safety**

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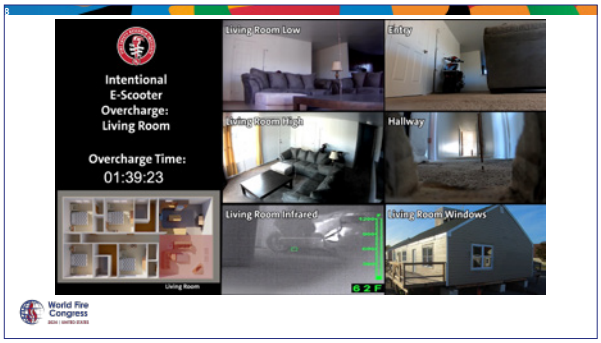
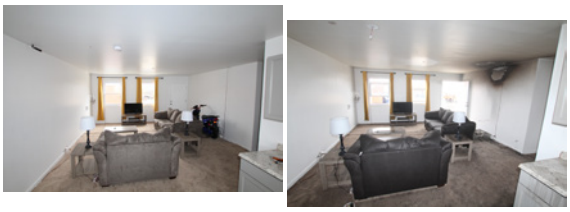
Fire Risk of Emerging Technologies

Adam Barowy
UL FSRI



Impact of Residential Automatic Fire Sprinklers



ATF | U.S. Fire Administration

What can you do to "Take C.H.A.R.G.E. of Battery Safety"?

www.batteryfiresafety.org

- **C** — Choose certified products.
- **H** — Handle with care.
- **A** — Always stay alert for warning signs.
- **R** — Recycle devices and batteries properly.
- **G** — Get out quickly if there's a fire.
- **E** — Educate others on safe practices.

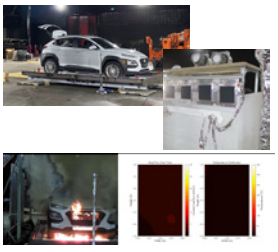
EV Research at FSRI

1. Are hazards changing with a transition to electric vehicles (EVs)? If so, how?
2. What fire control strategies can fire fighters use to mitigate demonstrated hazards?

Courtesy: Boston Fire Department (MA)

EV Fire Measurements & Methodologies

1. Heat Release Rate
2. Water contamination
3. Heat Flux
4. Occupational Exposures
   1. Gases, Vapors, and Particulates
   2. PPE Contamination
   3. PPE Decontamination



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Lithium-Ion Battery/ Electric Vehicle Fire Incidents Around the United States

Michael G. Abraham, PE
Bureau of Alcohol, Tobacco, Firearms, and Explosives
Fire Research Laboratory

ATF -Certified Fire Investigators (CFI)

- ATF is the primary agency investigating fires affecting interstate or foreign commerce.
- ATF has approximately 110 Certified Fire Investigators nationwide.
- Two-year, full-time training program involving fire scene examinations, in-person training, and a research project.
- IAAI CFI certification

ATF National Response Team (NRT) & International Response Team (IRT)

- Mission to investigate large fire and explosion incidents anywhere in the U.S.
- 15 full-time Special Agents, 115 part-time Special Agents, Fire Protection and Electrical Engineers, Chemists, Accelerant Detection Canines, etc.
- Over 900 callouts nationwide since 1978.
- 43 International callouts to countries in Europe, Africa, Asia, and South America.

ATF Fire Research Laboratory (FRL)

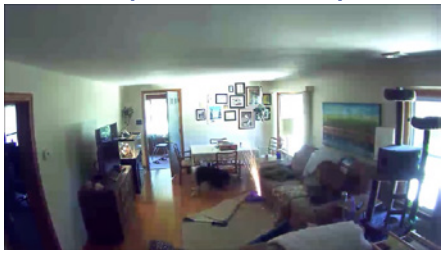
- Support fire investigations and the resolution of fire-related crimes for Federal, State, Local, and International Authorities
- On-scene Support and Evidence Examinations
- Full-Scale Testing
- Research, Training, and Education

SSA/CFI Silva Research Project

Spokane, WA - 2018 Tesla Model 3 Battery

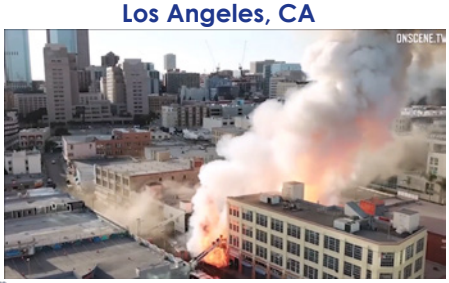
Neptune, New Jersey

Neptune, New Jersey



Neptune, New Jersey

Los Angeles, CA



Los Angeles, CA

Hoboken, NJ

Hoboken, NJ

Vape Failure Fatalities

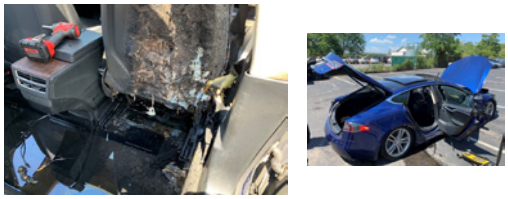
St. Petersburg, FL

Chewalah, WA

New Orleans, LA - Oil Tanker Bridge Fire

Franklin Township, NJ

Boston Metro Area, MA



Palo Alto, CA

Washington



New York City – Ford Fusion Hybrid



Pittsburgh, PA - Tesla Model X

Fire occurred in February • Joint Scene Exam in April • Vehicle Removed & Transported • Three hours later…

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Michael G. Abraham, PE
Forensic Engineer
ATF Fire Research Laboratory
Bureau of Alcohol, Tobacco, Firearms, and Explosives
U.S. Department of Justice

michael.abraham@atf.gov

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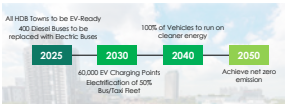
EV Battery Fires

SCDF's Current Response, Challenges, and Areas for Further Work

Ling Young Ern
Deputy Commissioner (Future Technology & Public Safety)
Singapore Civil Defence Force

SG EV Landscape

Singapore aims to achieve net zero emissions by 2050



SG Green Plan

Energy Reset → SG GREEN PLAN

2025 – New Registration of Diesel Cars to cease, HDB towns to be charger equipped

2030 – Car/Taxi Registration to be cleaner energy models, 60,000 island chargers

2040 – All vehicles to run on clean energy

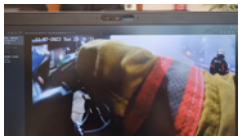
Risks Identified

Thermal Runaway
Phenomenon in which the Lithium-ion cell enters an uncontrolled, self-heating state of propagation.

Off Gassing
Occurs during thermal runaway and involves production of smoke, usually grey or white in color, that issues from the battery.

Vapour Cloud Explosion
EV batteries undergoing thermal runaway will release toxic/flammable gases due to the combustion of electrolytes

EV Fires – Recent Cases in Singapore



Case 1: Sembawang Wharves (Jul 23)
Fire involved a battery module stored in the storage compartment of a Porsche Taycan. Fire was extinguished with a water jet.

Case 2: Kaki Bukit (Jan 24)
Premises was a workshop housing three vehicles: a Porsche Taycan (fire involved the battery pack) and 2 hybrids. Fire was extinguished within 15 mins with a water jet.

Government's Response to EV Incidents

LTA and SCDF established the EV Battery Safety Taskforce (EBST) in August 2023 to develop matters related to strengthening Singapore's response to EV incidents. The EBST specifically looks at:

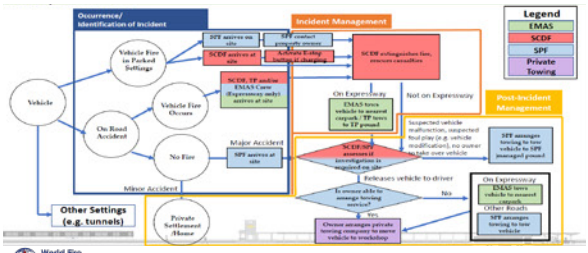
- *Enhancing incident response framework to support Singapore's transition to EVs*
- *Building good public understanding on EV batteries and associated risks*
- *Promoting knowledge sharing among agencies in area of EV batteries*
- *Reviewing sufficiency of existing capabilities, infrastructure, and regulations to manage EV incidents*

Land Transport Authority
We Keep Your World Moving

S&TPPO

HTX

Government's Response to EV Incidents



Fire Safety Provisions for EV Charging

Indoor & Outdoor Chargers – 60,000 by 2030

- Each EV charging station shall have an e-stop button within 15m.
- Regulated under the Fire Code (Clause10.4.2) and national EV charging standard (Technical Reference 25).

SCDF's EV Firefighting Tools

Vehicle Fire Blanket

SCDF recently introduced vehicle fire blankets to **slow fire spread and any release of toxic gases**, to buy time while a water jet is prepared.

Water Injection

Piercing: Recently operationalised tool with a hardened lance that **pneumatically pierces the EV battery compartment** to flood it with water.

Ultra High Pressure (UHPS) cutting: Latest generation of fire engine will be equipped with **UHPS extinguishing tools to inject water into EV battery compartment**; further trials will be conducted upon delivery in end 24.

EV Burn Test

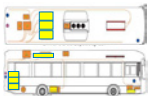
- **An EV burn test (Hyundai Ioniq 1st Generation) conducted on 11 April 2024**
  - Validated SCDF's EV firefighting response plan
  - Deployment of vehicle fire blanket in tandem with water jet and battery fire extinguishing system

EV Firefighting Challenge – Large Vehicles

Vehicle batteries for electric buses and heavy goods vehicles are mounted in areas other than the vehicle floor.

Accessing the batteries and applying water effectively will be a challenge.

Linkker ST12MSD (single decker)



Yutong E12 (single decker)

BYD K9 (single decker)

More Research Needed on Reignition Risk and Quarantine Methods

01. State-of-Charge is a good means of estimating reignition risk

However, EV instruments display battery related information, but this is often damaged during the incident. Better tools needed to help responders quantify reignition risk.

02. Quarantine of damaged EVs

More research needed on cost effective means of quarantining EVs, if required. For example, to enable safe containment within the vehicle workshop. **Difficult in Singapore due to limited space!**

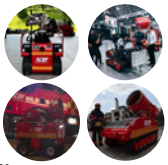
Conclusion

1.Science & Technology Advancements:
- Safer, superior EV battery & car designs
- Lower incidence of EV fires worldwide compared to ICE vehicles

2. Unique Challenges for Emergency Services:
- EV fires present distinct challenges
- Rare occurrences can skew public perception

3. Confidence Building for a Greener Future:
- SCDF and partner agencies building robust capabilities
- Establishing an ecosystem for comprehensive preparedness

4. Research Opportunities:
- Focus on EV battery fire mitigation approaches
- Aim to enhance global response effectiveness



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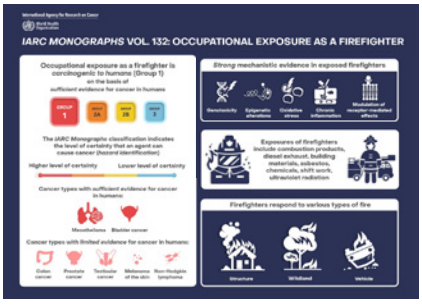
Cancer in the Fire Service: What We Know and Where to Go from Here

Jackie Goodrich, PhD
Dept. of Environmental Health Sciences
University of Michigan
Co-Lead of the Fire Fighter Cancer Cohort Study



Demers et al. 2022 *Lancet Oncology*

Ongoing Needs after IARC to Understand and Prevent Firefighter Cancer

- Most evidence was based on structural or municipal firefighters
- **Unique risks** of firefighters responding to certain fire types (i.e., wildland and wildland-urban interface fires) not well understood
- Could not evaluate unique risks for firefighters **underrepresented** in most studies (women, non-white racial backgrounds, volunteers)
- **Mechanisms** of carcinogenicity observed in firefighters (epigenetics, genotoxicity, etc.) can develop well before disease. Can we reverse or prevent these?
- What **interventions or screening tools** can be developed to protect firefighters at risk?

Fire Fighter Cancer Cohort Study (FFCCS)

MISSION
To conduct community-engaged research with the fire service to advance firefighter cancer control and prevention, as well as evaluation and prevention of other health conditions.

TARGET GOAL
10,000 firefighters enrolled and followed over 30 years.

FIRE SERVICE PARTNERSHIP
Fire Service Oversight and Planning Board and firefighter research champions in each research project.

BIOLOGICAL SAMPLES
Collect blood, urine, and other biological samples at enrollment, every two years, and as needed after exposures. Report back results to firefighters.

EXPOSURE DATA
Collect exposure data from firefighters at the fireground, during training activities, and at other locations.

DATA INTEGRATION
Integrate exposure, biological and health survey data through a centralized data center. Data protected by a Certificate of Confidentiality.

FFCCS Enrollment

- >5,000 total participants
  - >100 departments
  - 29 states
  -
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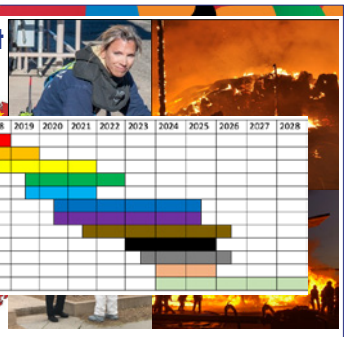
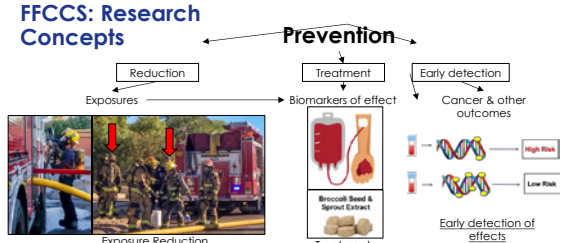


Grant	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0) Pre-FFCCS														
1) Framework														
2) Expansion														
3) PFAS														
4) WUI														
5) Women (2)														
6) Volunteers (2)														
7) Wildland (2)														
8) Arizona PFAS														
9) High Risk														
10) N Carolina PFAS														
11) NIEHS WUI														

FFCCS: Research Concepts



Exposure Reduction
Improved respirator use
Dermal decontamination

Treatment
Blood/plasma donation Broccoli extract

Early detection of effects
Epigenetic biomarkers
Ovarian reserve (AMH)

FFCCS: Contact Information

Contact:
Jackie Goodrich, PhD
gaydojac@umich.edu

Website: ffccs.org

Director:
Jeff Burgess, MD, MS, MPH
jburgess@arizona.edu

Funding: **FEMA** EMW-2014-FP-00200, EMW-2015-FP-00213, EMW-2017-FP-00860, EMW-2018-FP-00086, EMW-2019-FP-00526, EMW-2019-FP-00517; EMW-2020-FP-00430; EMW-2021-FP-00141; EMW-2021-FP-00416; EMW-2022-FP-00774; EMW-2022-FP-00711; **NIEHS** P30 ES006694, P30 ES017885; **NIOSH**; **IAFF**; **Fire Departments**; **NCI**; **Arizona Board of Regents**

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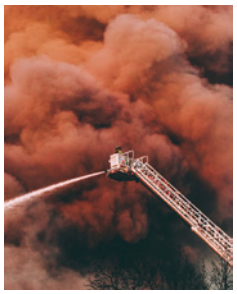
Mental Health Among Firefighters

Sara Jahnke, Ph.D.
Center for Fire, Rescue & EMS Health Research
NDRI-USA, Inc.
Science to the Station
Jahnke@ndri-usa.org

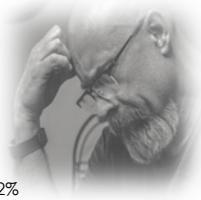
Stresses of the Job

- Acute Exposures
- Chronic Repeated Exposure to Trauma
- Injury & Disability
- Home/Life Stressors
- Circadian Rhythm Disruption
- Substance Use/Misuse
- Epigenetic Changes
- Cancer & CVD

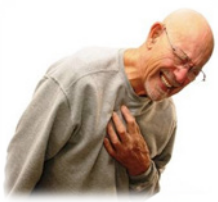


Outcomes

- **Depression**
  - 12-27% in the range of concern in fire service samples
  - Typically <10% in general population
- **PTSD**
  - Wide range but as high as 13-22%
  - 3.5% in general population

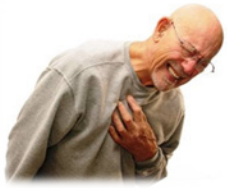


Shifts in Understanding Mental Health: Heart Attack to Hypertension



VS

Shifts in Understanding Mental Health: Challenges to Existing Paradigm

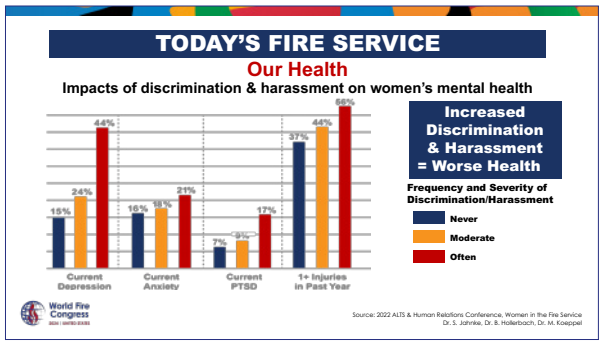


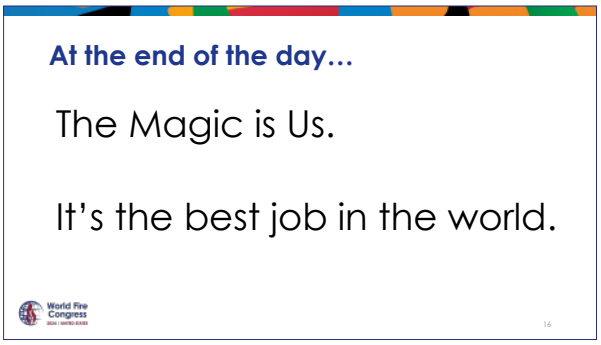
- Different incidents effect people differently
- Intervention is not the same for all
- Impact not always immediate
- Sometimes, it's more harmful than helpful

Shifts in Understanding Mental Health: What We Know Now

- Long-term problem, long-term solution
- Shift in lifestyle/culture
- Awareness
- Monitor symptoms
- Treat as appropriate
- Appropriate level of intervention

- Camaraderie
- Dark humor
- Social support
- Debriefing
- Family support
- Sharing experiences
- Fire service identity


TODAY'S FIRE SERVICE
Our Health
Impacts of discrimination & harassment on women's mental health
Increased Discrimination & Harassment = Worse Health
Frequency and Severity of Discrimination/Harassment
Never
Moderate
Often
15%
24%
44%
16%
18%
21%
7%
9%
12%
37%
44%
56%
Current Depression
Current Anxiety
Current PTSD
1+ Injuries in Past Year
World Fire Congress
Source: 2022 ALTS & Human Relations Conference, Women in the Fire Service
Dr. S. Jahnke, Dr. B. Hollerbach, Dr. M. Koeppel


At the end of the day…
The Magic is Us.
It's the best job in the world.
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16


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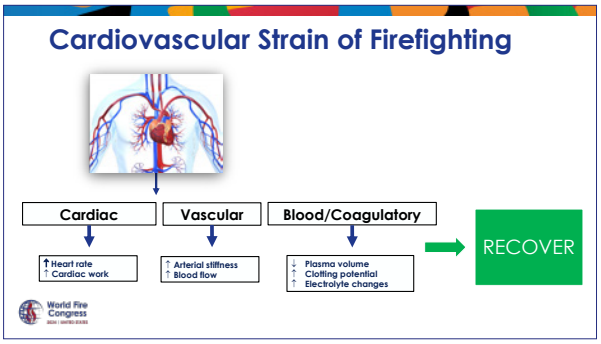
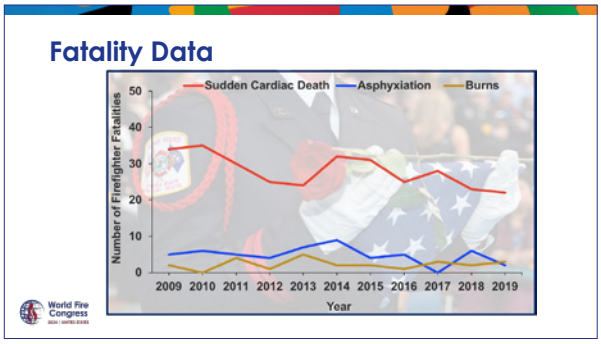
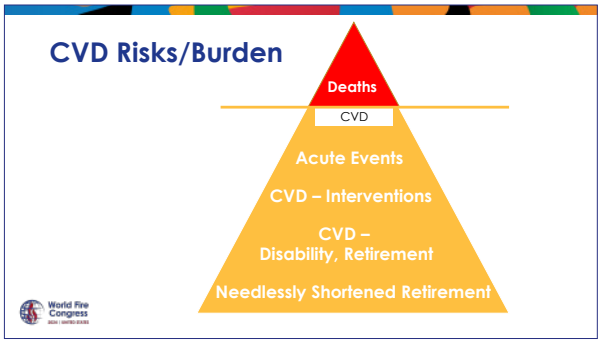
2024 | UNITED STATES
Sara Jahnke, Ph.D.
Center for Fire, Rescue & EMS Health Research
NDRI-USA, Inc.
Science to the Station
Jahnke@ndri-usa.org


World Fire Congress
2024 | UNITED STATES
Cardiovascular Risks Associated with Firefighting
Denise L. Smith
United States Fire Administration
Director, Fire Data Center and Research Division


Firefighters Do Strenuous Work, In Dangerous Environments, While Wearing Heavy PPE
World Fire Congress


Cardiovascular Strain of Firefighting
Cardiac
Vascular
Blood/Coagulatory
↑ Heart rate
↑ Cardiac work
↑ Arterial stiffness
↑ Blood flow
↓ Plasma volume
↑ Clotting potential
↑ Electrolyte changes
RECOVER
World Fire Congress


Fatality Data
Sudden Cardiac Death
Asphyxiation
Burns
Number of Firefighter Fatalities
50
40
30
20
10
0
2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Year
World Fire Congress


CVD Risks/Burden
Deaths
CVD
Acute Events
CVD – Interventions
CVD –
Disability, Retirement
Needlessly Shortened Retirement
World Fire Congress

Founding Principles

World Fire Congress

Statement of Founding Principles and Objectives

Fire is a risk that impacts the security, health, and prosperity of citizens and communities in every town, city, state, province, and nation. It also represents a borderless threat to our environment.

As leaders responsible for preventing and fighting fires, the delegates at this first meeting of the World Fire Congress (WFC) comprise a diverse gathering of fire-fighting agencies that share common goals of protecting our communities and our shared environment.

Communities throughout the world face common and evolving challenges, including firefighter health and safety, fire risks associated with emerging technologies, climate-change driven wildfires, and structural fires.

The partner agencies of the WFC share responsibilities to gather and analyze information on all types of firefighting activities, including technical information related to building construction; the fire properties of materials; information on fire prevention and control laws, systems, methods, techniques, and administrative structures; and information on the causes, behavior, and best method of control of other types of fire, including, forest fires.

In a spirit of friendship, and for the common benefit of each community represented within the WFC, its delegates intend to share their collected knowledge with other WFC partner communities.

WFC delegates plan to meet to build relationships that will allow a more open, transparent, and efficient sharing of information through communities of practice; to enable experts within our ranks to gather regularly to share strategies; to bring forward possible solutions to common challenges; to identify emerging problem areas and set priorities; and to monitor the progress of cooperative efforts and programs to reduce fire losses.

It is to the common benefit of all delegates and the communities they represent to share this information voluntarily, and in accordance with the principles of Dignity, Respect, and Equality for all delegates, partner communities, and their people, without restrictions on participation or the sharing of information on the basis of gender, race, color, nationality, language, disability, or sexual orientation.

The Statement of Founding Principles shall be confirmed by the signatory nations present at the inaugural meeting of the World Fire Congress and in accordance with their respective processes. The signatory nations will become the original Delegates of the World Fire Congress.

The signed Statement of Founding Principles shall be deposited with the United States Fire Administration, which shall transmit copies thereof to all the signatory nations. A duly certified copy shall be transmitted by the United States Fire Administration to the National Fire Chiefs Council of the United Kingdom to be available for additional nation delegate signatures at the 2026 meeting of the World Fire Congress and to be attached to the subsequent Charter of the World Fire Congress to be developed by the delegates between meetings of the Congress.

In Faith Whereof the Delegates of the World Fire Congress have signed the Statement of Founding Principles completed in the city of Washington, D.C., on the 8th day of May, two thousand and twenty-four.

United States Fire Administration (USFA), U.S. Fire Administrator

United Kingdom National Fire Chiefs Council (NFCC), NFCC President

Organization of American Firefighters (OBA), OBA Executive Director

Australian and New Zealand National Council for Fire & Emergency Services (AFAC)

Federation of European Fire Officers (FEU), FEU President

International Association of Fire and Rescue Services (CTIF), CTIF President

Mexican Association of Fire Chiefs (AMJB), AMJB Commandant

Israel Fire and Rescue Authority (IFRA) Commander, Second District

Algeria

Australia

Austria

WFC Attendee List

Australia
Darren Klemm AFSM
Megan Stiffler

Austria
Raphael Koller
Robert Mayer

Barbados
Errol Maynard

Belgium
Bert Brugghemans
Hans Das
Wim Van Zele

Brazil
Thiago John

Bulgaria
Aleksandar Dzhartov
Martin Nikolov

Canada
Ken McMullen

Chile
Juan Field

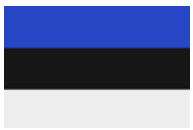
Croatia
Ante Sanader
Slavko Tucakovic

Cyprus
Nicos Logginos
Dimitris Touvannas

Denmark
Jarl Hansen
Jes Andersen
Peter Kragh

Ecuador
Martin Cucalón de Icaza
William Munoz

El Salvador
Ana Cea
Erick Vásquez Hernandez



Estonia
Margo Klaos
Viktor Saaremets

Fiji
Esala Radio
Puamau Sowani

Finland
Pauliina Eskola
Veera Parko

France
Eric Flores
Sebastien Penzini

Ghana
Julius Kuunour

Guatemala
Otto Mazariegos Pinzón
Greetel Meng

Hungary
Márton Ábrahám
Zoltan Gora

Iceland
Jon Matthiasson

Jamaica
Stewart Beckford
Andrew Russell
Dr. Hezedean Smith

Luxembourg
Tom Barnig
Paul Schroeder

Malaysia
Hoong Ta Lim

Nederlands
Tijs Lieshout
Ijle Stelstra

New Zealand
Kerry Gregory
Russell Wood

Norway
Ann Christin Olsen

Philippines
Wilberto Rico Neil Kwan Tiu

Portugal
Marco Martins

Qatar
Hamad Al Dehaimi
Hamad Alabduljabbar

Romania
Raed Arafat
Claudiu-Florentin Zamfir

Singapore
Young Ern Ling

Slovenia
Janko Cerkvenik
Milan Dubravac

South Africa
Etienne du Toit

Sweden
Peter Arnevall
Marcus Vilhelmsson

Switzerland
Luc Bruttin

Taiwan
Huan Chang Hsiao
Ming Yuan Shih

The Republic of Korea
Taehyun Cho
Whayeong Nam

United Arab Emirates
Jasim Almarzooqi

United Kingdom
Muhammad Chattha
Sarah Gawley
Mark Hardingham
Roger Thomas

United States of America
Eriks Gabliks
Tonya Hoover
Lori Moore-Merrell

Organizations Represented

World Fire Congress Sponsors

NFPA

IAFF

NFSA
NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry

NASFM

FACETS CONSULTING

GORDON AND BETTY MOORE FOUNDATION

FireDex

CPSE Center for Public Safety Excellence

IFE The Institution of Fire Engineers USA Branch

XPRIZE

World Fire Congress Partners

National Fallen Firefighters Foundation

U.S. Department of Homeland Security DHS at 20 Science and Technology

GFDRR
Global Facility for Disaster Reduction and Recovery
Administered by the World Bank

District of Columbia Fire and EMS

Food on the Stove

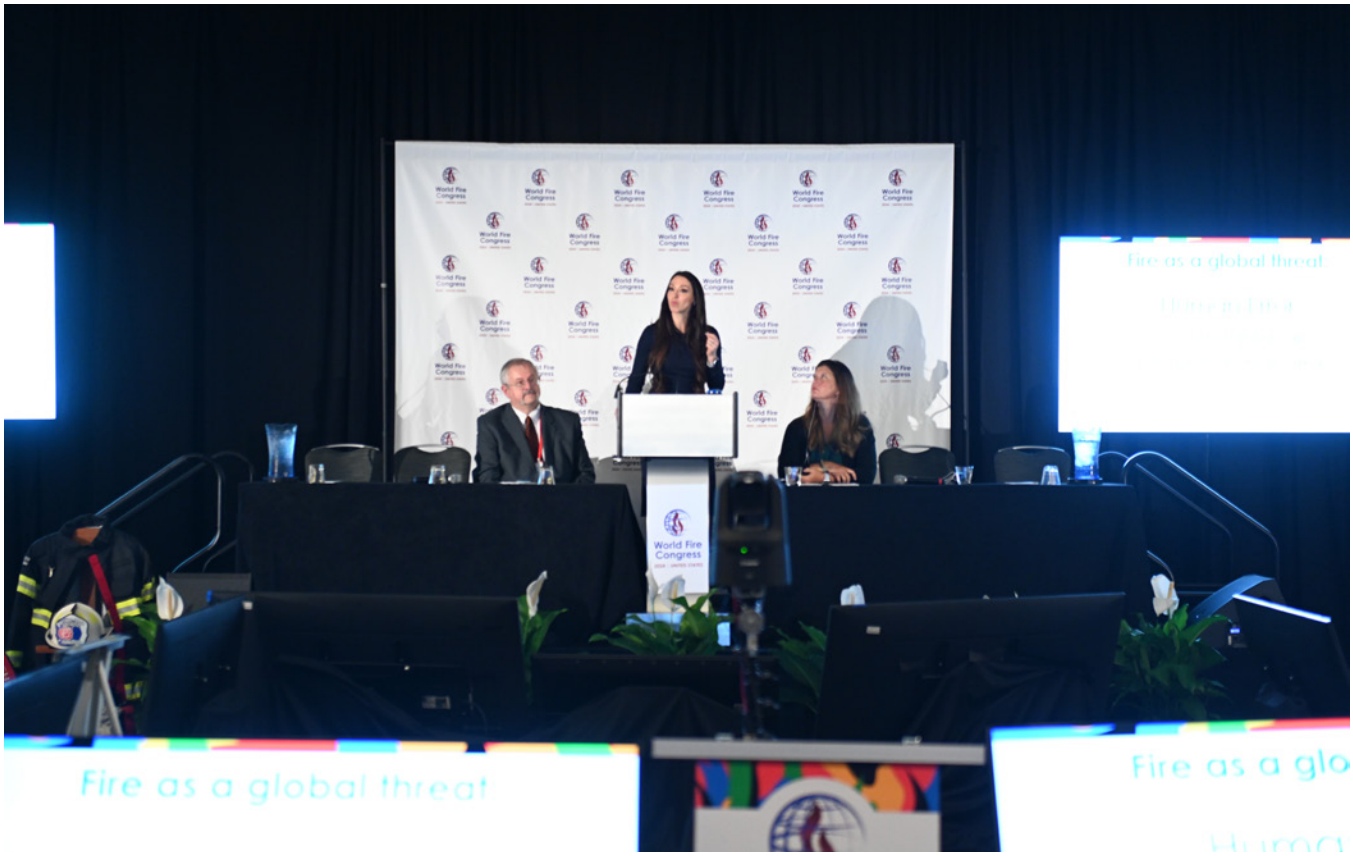
WFC Website

firehero.org/world-fire-congress

Photo Gallery *5/5 Memorial*

5/6 Cultural Tour and Welcome Reception

5/7 Day One


Fire as a global threat
Fire as a glo


Republic
Republic of Korea


Canada
Mexico


Pakistan
Pakistan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World Fire Congress
2024 | UNITED STATES


Germany


Israel


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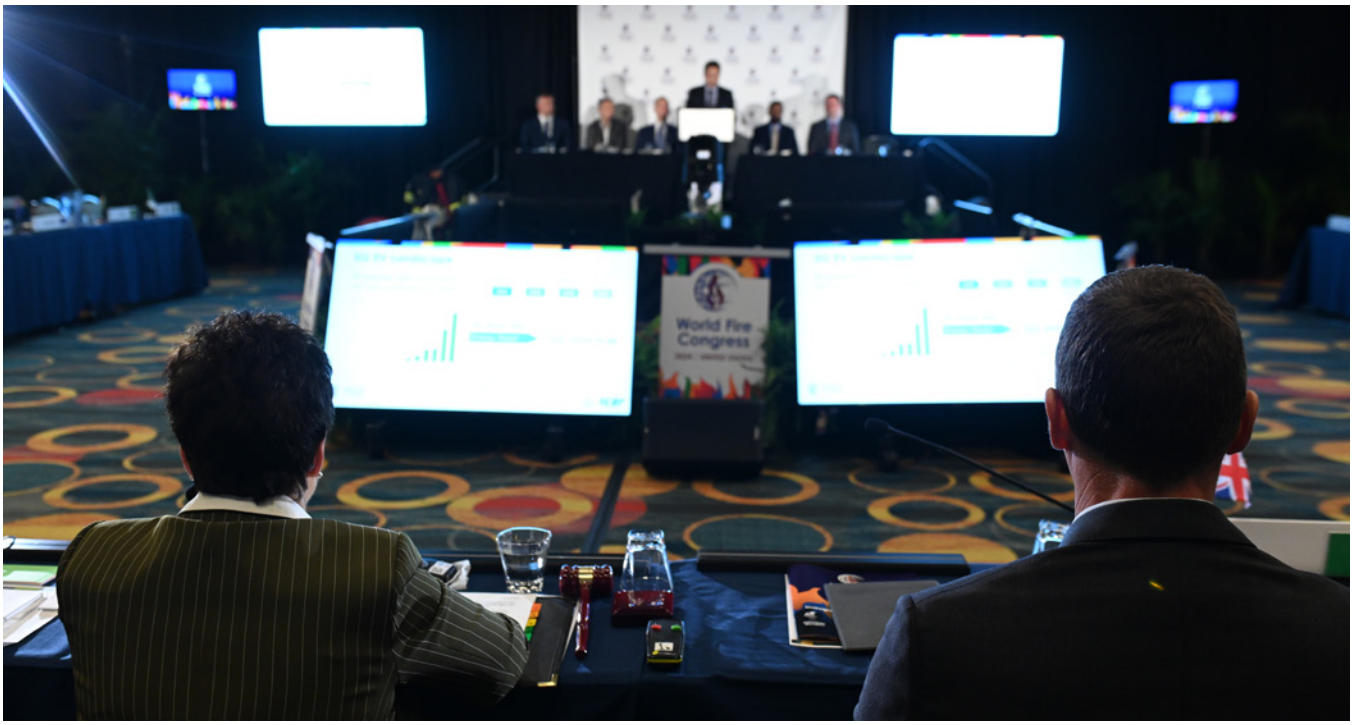
World Fire Congress


Fiji


Australia

5/8 Day Two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Iceland
Greenland


World Fire Congress


Energy transition
in the built
environment:
Dutch facts and figures
for AFV and PV
World Fire
Congress


Canada
Mexico


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5/8 Library of Congress Closing Ceremony


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2026

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FEMA | U.S. Fire Administration
Working for a fire-safe America