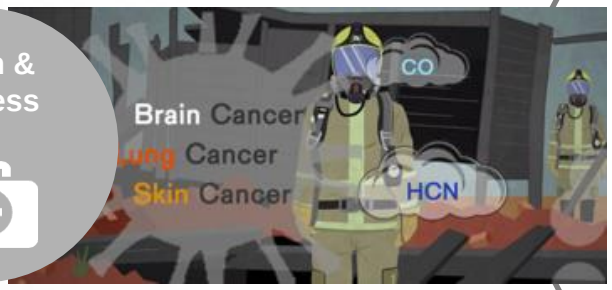
Health Risks for First Responders

Cancer Awareness
Bogota, Sept. 2019, Christoph Feyerabend

Health Risks for First Responders

The challenge – why it matters

Health & Wellness



The challenge

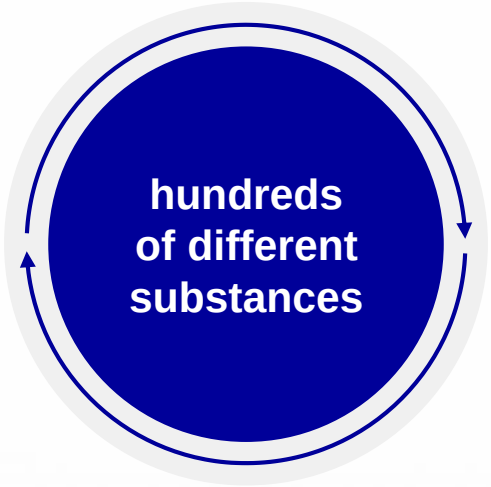
- Medical studies show a strong increase of cancer cases within fire departments during and after active duty.
- The cause is seen in First Responders' exposure to various hazardous substances, but especially smoke. Modern materials form a more hazardous mix of gases and particles when on fire than before. These substances cannot only be inhaled, but also absorbed by the skin

Health Risks for First Responders

Common hazardous substances from incident sites

Toxic or carcinogenic substances

- Asbestos
- Arsenic
- Benzene
- Benzopyrene
- Cadmium
- Carbon Monoxide
- Chlorphenols
- Chromium
- Dioxins
- Ethylen Oxides



- Formaldehyde
- Glutaraldehyde
- Ortholuide
- Polycyclic Aromatic Hydrocarbons
- Polychlorinated Biphenyls
- Vinyl Chlorides
- Sulfur dioxide
- …

» Increased hazards from new building materials, insulation, fuels, paint, flooring, electrical equipment, rubber, dyes, cleaning agents, solvents, etc.

Battery electric vehicles – additional fire hazards?

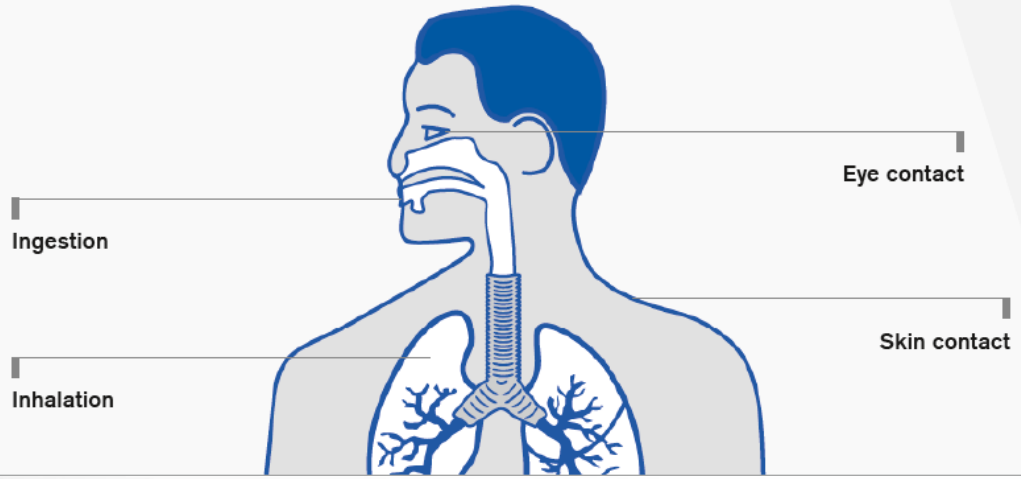
vehicles. In the immediate vicinity and in unfavourable ventilation situations, however, electric vehicle fires lead to new and potentially more severe chemical hazards. The pollutant analyses point to critical concentrations of the heavy metals cobalt and manganese as well as lithium in the form of aerosols. These pollutants do not occur in such high concentrations in conventional vehicle fires and are toxic to humans and the environment. It is assumed

Research Project: Electric mobility and road tunnel safety – hazards of electric vehicle fires (Switzerland, publ. 2018)

» Battery chemistry may add to the hazard, but depends on the battery technology used!

Health Risks for First Responders
Routes of intake

How can toxic substances enter the body?



What determines the severity of a toxic effect?

- Hazardous substance concentration
- Exposure time
- Aggregate state of the hazardous substance
- Frequency of exposure
- Ambient temperature

Health Risks for First Responders

Contamination risks present in all major applications

Training

- direct exposure to the harmful substances in smoke and soot
- indirect exposure via contact with contaminated equipment and personal

Incidents

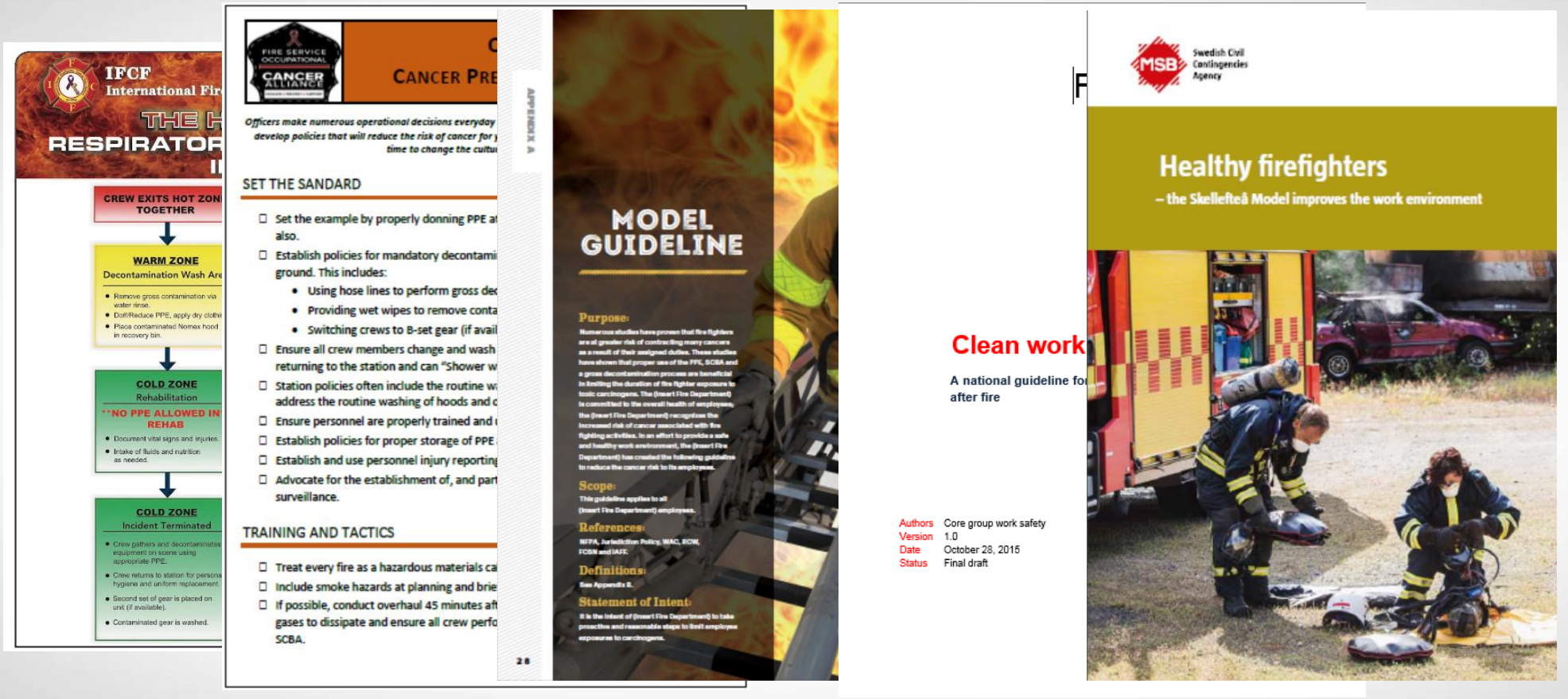
- direct exposure to the harmful substances in smoke and soot
- indirect exposure via contact with contaminated equipment and personal

Readiness (Logistic, maintenance and cleaning):

- indirect exposure via contact with contaminated equipment and personal

Health Risks for First Responders

Solutions – strict implementation of SOPs



Training – select suitable training methods

- Apply cleaner training methods, e.g. gas-fuel systems
- Only use wood-fueled systems if the training goal cannot be achieved otherwise
- Treat contaminated material with care and limit exposure to it

» Clean but realistic training allows to reduce the exposure to harmful substances to trainees and trainers

Health Risks for First Responders
Solutions – Incident

Incident – select suitable equipment and follow SOPs

- Select equipment that will minimize dirt traps, reduce uptake by repellant or low absorption materials and will facilitate service tasks
- Wear PPE and breathing protection for as long as possible
- Transport contaminated equipment in closed bags or boxes
- Perform pre-decontamination and personnel hygiene on site

» Avoid as much decontamination to teams and equipment as possible during incident, pre-decontamination, and monitoring/entering “cold” fire sites

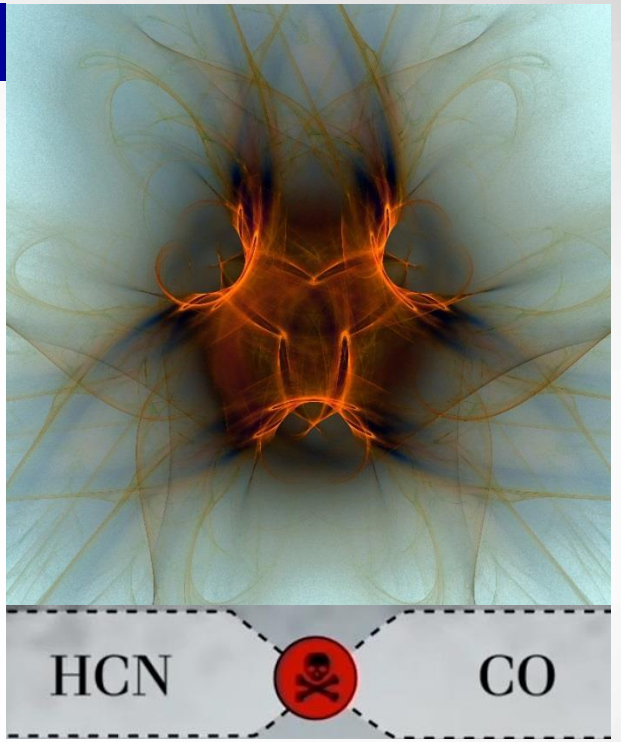
CO + HCN: Toxic Twins

Research(1) shows that the combination of CO and HCN is more harmful than exposure to either one individually, due to synergistic effects

CO prevents oxygen from reaching vital organs

HCN attacks the central nervous system and the cardiovascular system, causing fire fighters to become disoriented and confused.

(1) *„Effects of exposure to single or multiple combination of the predominant toxic gases and low oxygen atmospheres produced in fires"* from *Barbara Levin*, *Maya Paabo*, *Joshua Gurman* and *Steven Harris, 1987*



» If both gases are present, the alarm threshold for each gas needs to be lower!

State of the art – combination alarm calculating the combined threshold level

Readiness – carefully evaluate your cleaning and inspection process

- Clean PPE routinely after use at any incident
- Treat contaminated material with care and limit exposure to it
- Use suitable PPE when working with contaminated equipment

» Don’t forget to protect the people cleaning and handling contaminated equipment and clothing

Best Practice: Rio Tinto – BARRIO system

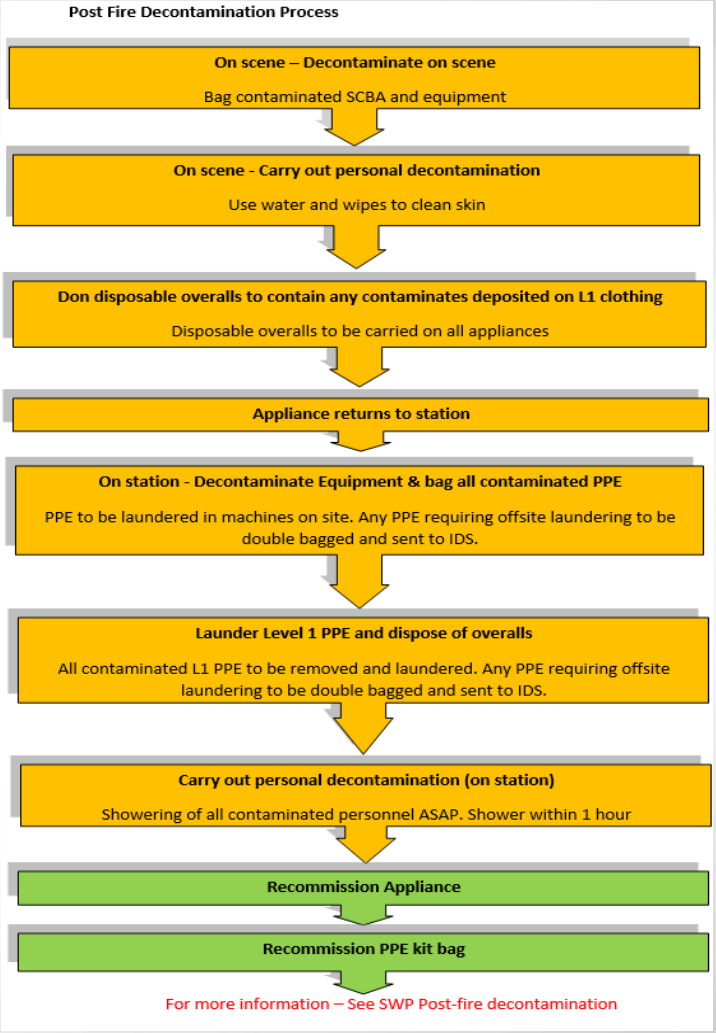
- **B**est practice, **A**ir borne contaminants, **R**isk, **R**eduction, **I**nitiative and **O**peration
- Evaluation tools and operating procedures as well as modernized equipment
- 2018 Systems and People Award by the Department of Mines, Industry Regulation and Safety in Western Australia

On scene Decontamination

Doff SCBA and don P2 mask

Don nitrile gloves

Bag PPE and contaminated gear



Source: Screenshots courtesy of Rio Tinto Iron Ore

Health Risks for First Responders
Best Practice

Stow in lockers not cab

Clean equipment

Carry out personal clean

Return to station

Arrive on station – truck cab clean

Don gloves and P2

Wash BARRIO garments

2 stage wash

SCBA lockers let open to allow for drying

Allow garments to dry, avoid UV. Turn inside out to expedite drying process

Wipe down surfaces in cab, Including seats, seatbelts, door Trim and foot well

Shower within 1 hour

Log use & reinstate kit

Conclusion

- Studies show an increased risk of cancer for first responders due to increased exposure to air borne contaminants
- SOPs and guidelines exist to significantly reduce the exposure during and after the incident, but also during training and the logistic chain
- A lot of measures can already be implemented by changing processes and with a limited budget that can be extended to a complete system
- Implementing a culture to support it is key!

Everyone home safe…and healthy!

Skelleftea Model - https://www.msb.se/siteassets/dokument/publikationer/english-publications/healthy-firefighters-the-skelleftea-model-improves-the-work-environment.pdf

Research Project: **Electric mobility and road tunnel safety**

Dräger Hot Topic website on cancer awareness, workshop design, Toxic Twins and more - https://www.draeger.com/en_uk/Fire-Services/Hot-Topics

Rio Tinto Barrio System – Presentation + Video

Thank you for your attention.

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