FIRE PROTECTION ENGINEERING

INTRODUCTION TO SELECTED RESEARCH TOPICS IN MECHANICAL ENGINEERING II

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- Mechanical Engineer, 2000, YTÜ
- Fire Protection Engineer, M.Sc., 2003, Worcester Poytechnic Institute
- Disaster Management M.Sc., 2006, İTÜ
- Modelling Fires in Tunnels, Ph.D., 2017, Mechanical Engineering, YTÜ

- Occupational Safety (İş Güvenliği Uzmanı-A), NEBOSH-UK, OHSAS
- Consultant (Design, Code Compliance)
- Lecturer (Teknik Bilimler MYO, Sivil Savunma ve İtfaiyecilik Programı)

Content

- Fire Engineer?
- Relation to Mechanical Engineering
  - Fire Mechanism
- Life Safety Concept
    - Tenable Conditions
      - Heat Flux
      - Smoke Ventilation
      - Visibility
- Application of Fire Protection Engineering
- Research Topics
- Conclusion

Fire Protection Engineer – Design (Atlanta)

- Design fire suppression systems including sprinkler, and special hazard systems
- Hydraulic calculation in support of FP design
- Life safety system designs
- Conduct fire flow tests and water supply evaluations
- Conduct building and fire code reviews and analyses
- Perform modeling of fire, smoke, water distribution, and other related variables
- Attend client meetings and jobsite walkthroughs
- Maintain a working knowledge of relevant fire protection, risk, building codes, and construction technologies

Background

To succeed in this role, you need to meet the following basic requirements:

- BS Degree in Mechanical or Fire Protection Engineering
- 3+ years of FPE experience working in commercial, retail, medical, and industrial buildings
- Strong working knowledge of building, plumbing, and fire codes
- Experience with **AutoCAD and REVIT** design software

Attributes of Top Performers

If you have some of the following characteristics and experience, you'd be an especially good fit:

- Excellent verbal and written communication skills
- Ability to multitask and work on a wide variety of project types simultaneously
- Strong desire to grow into a leadership position within a growing department

Fire Engineer –Manager Position (WSP, Ottawa Office)

Qualifications

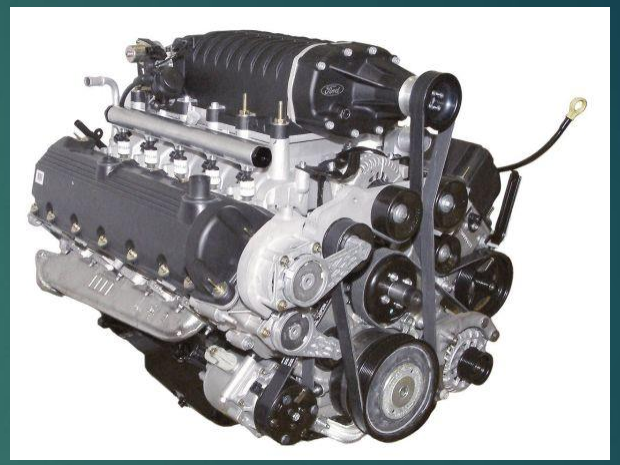
- Fire Protection Diploma from a recognized college or equivalent experience;
- 5 years of experience with a sprinkler contractor performing sprinkler system designs;
- Able to conduct field inspections independently;
- Fluent with HydraCalc and HydraCAD software;
- Good working knowledge of AutoCAD;
- Must have strong knowledge of building/fire/life safety codes;
- Broad knowledge of building construction methods and techniques;
- Experience dealing with contractors, architects and engineers;
- Technically oriented; good analytical and organizational skills;
- **Excellent English verbal and written communication skills.**

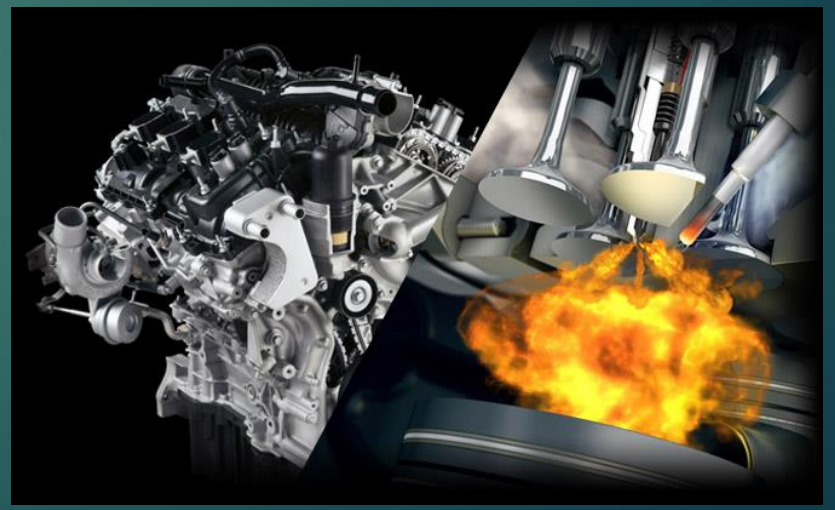
Fire Protection Engineer

- Designer
- Consultant
- Researcher
- Corporate Engineer
  - Boeing, Chrysler, Dow Chemical, Kodak, IBM, Mobil, BP, Hilton
- Insurance
  - Risk Engineer

Relation to Mechanical Engineering – Fire Mechanism

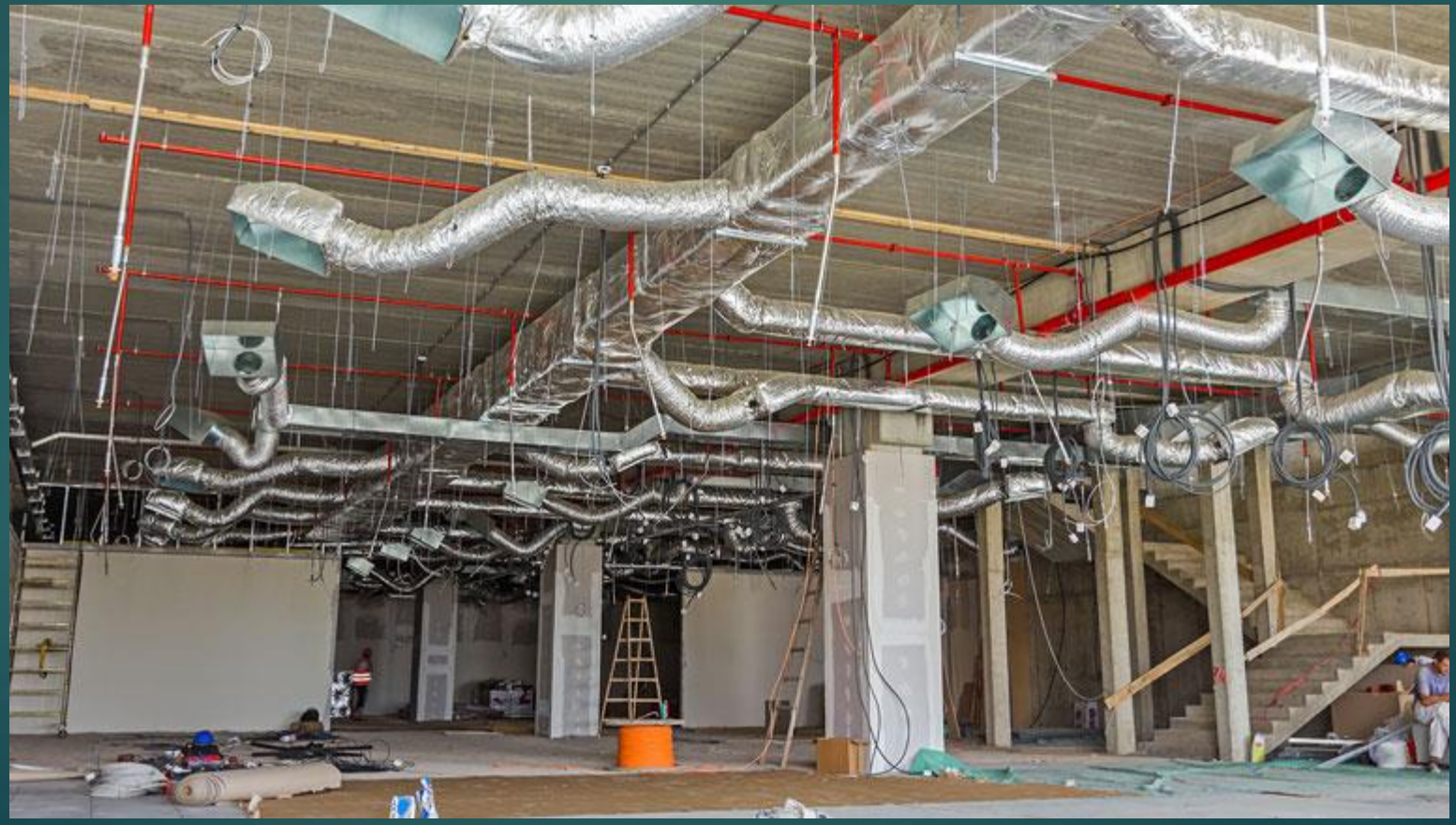
- Internal Combustion Engines
- Boiler Burners



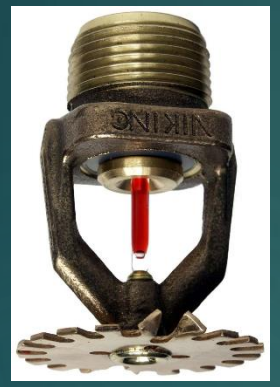


Relation to Mechanical Engineering

- Plumbing – Sprinkler Piping Design

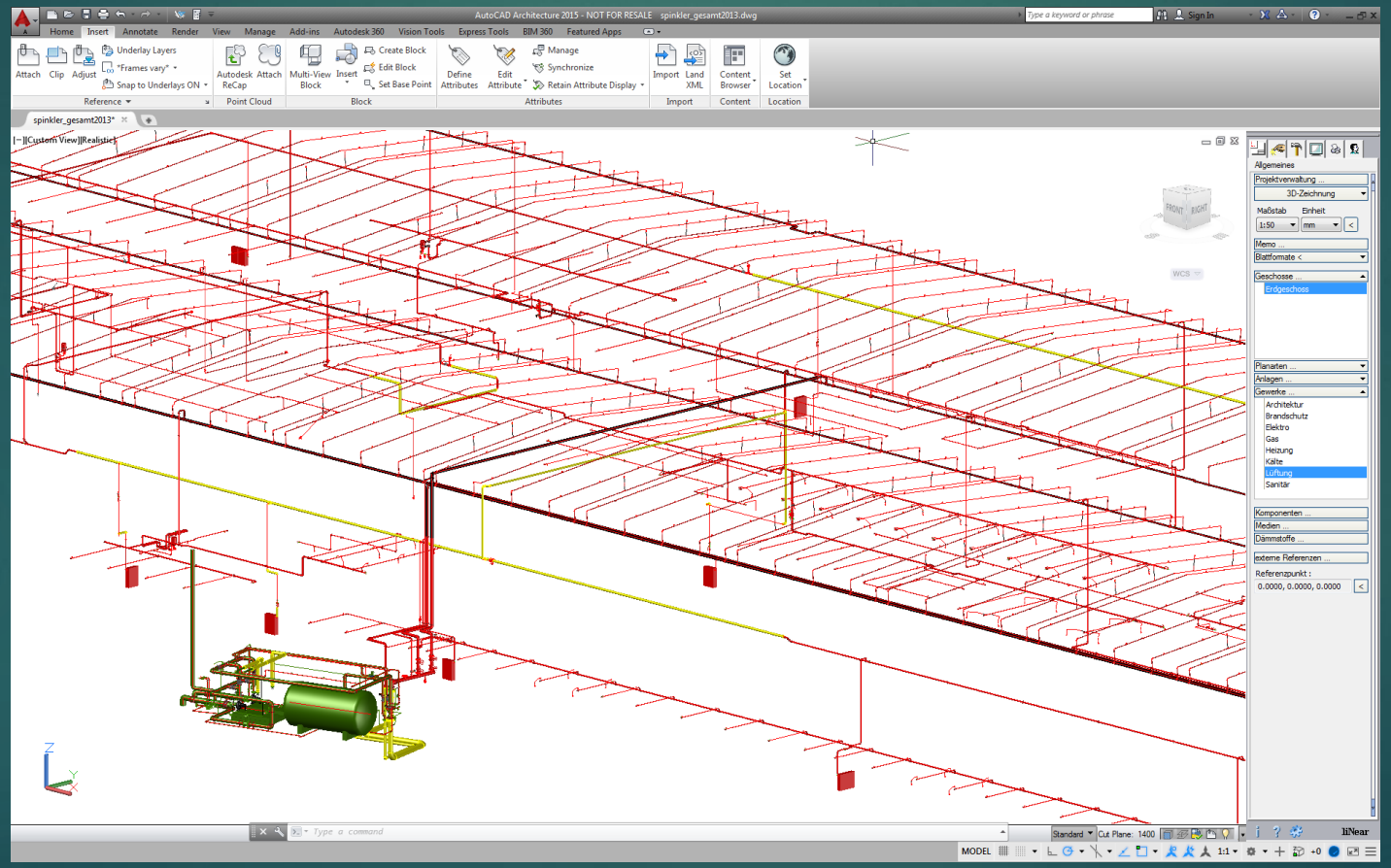


Plumbing – Sprinkler Piping Design



Normally, sprinkler heads don't operate like this

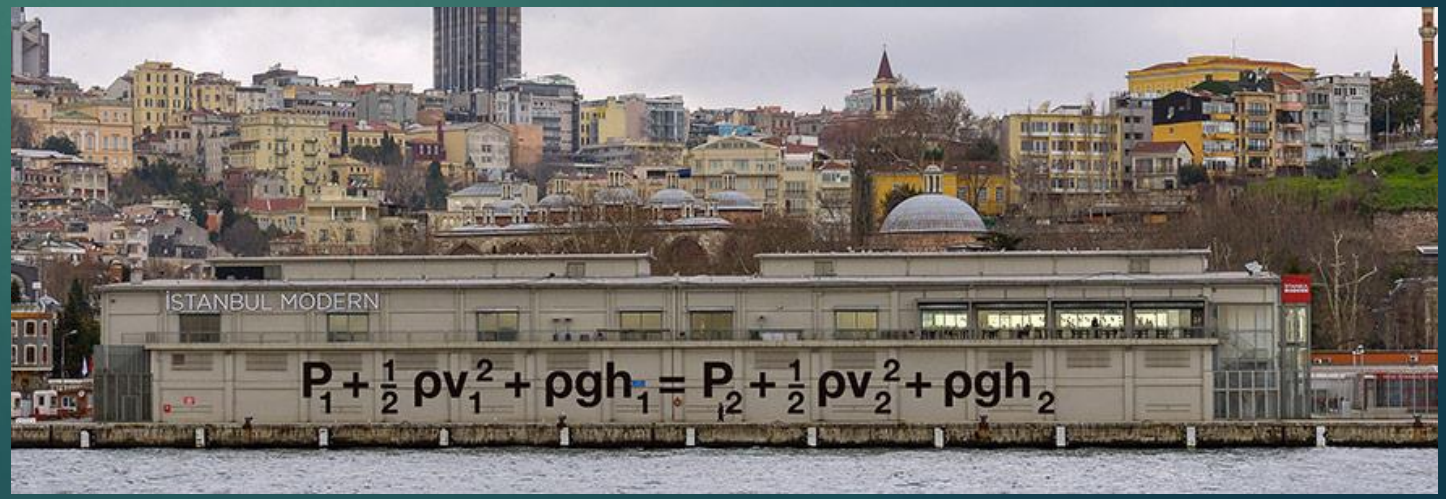
Plumbing – Sprinkler Piping Design



Plumbing – Sprinkler Piping Design

Calculation of Pressure Losses

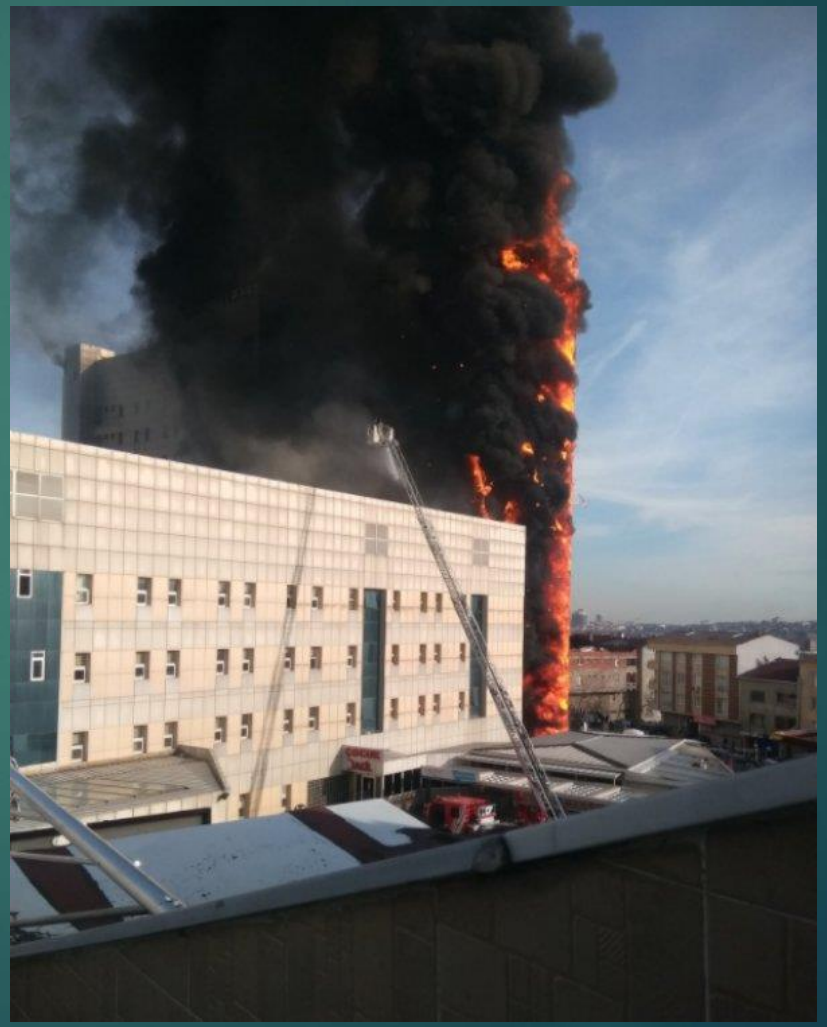
- Fluid Mechanics



Fire Spread

Greenfel Tower, London

Taksim İlkyardım Hastanesi - İstanbul

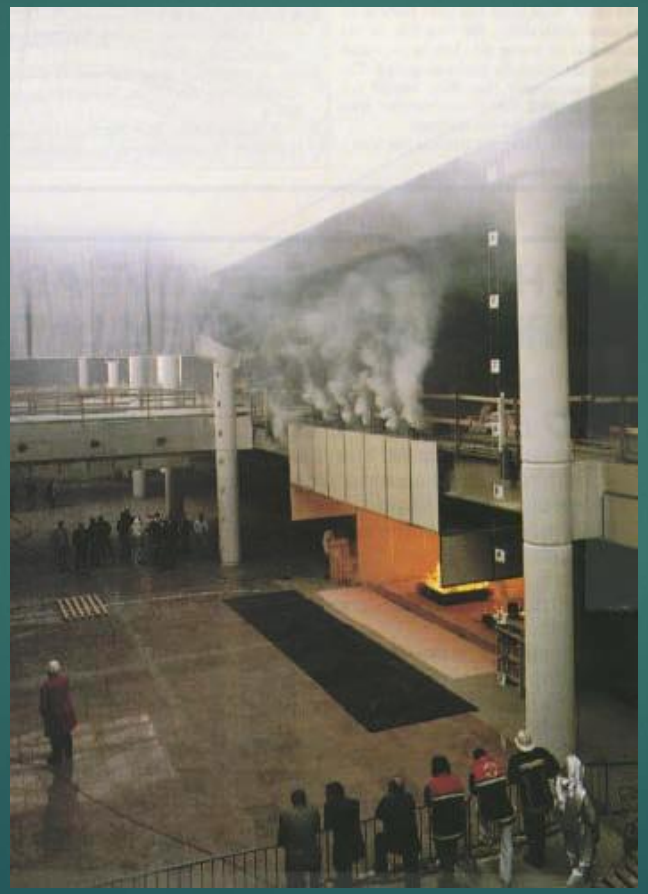


Taksim İlkyardım Hastanesi - İstanbul

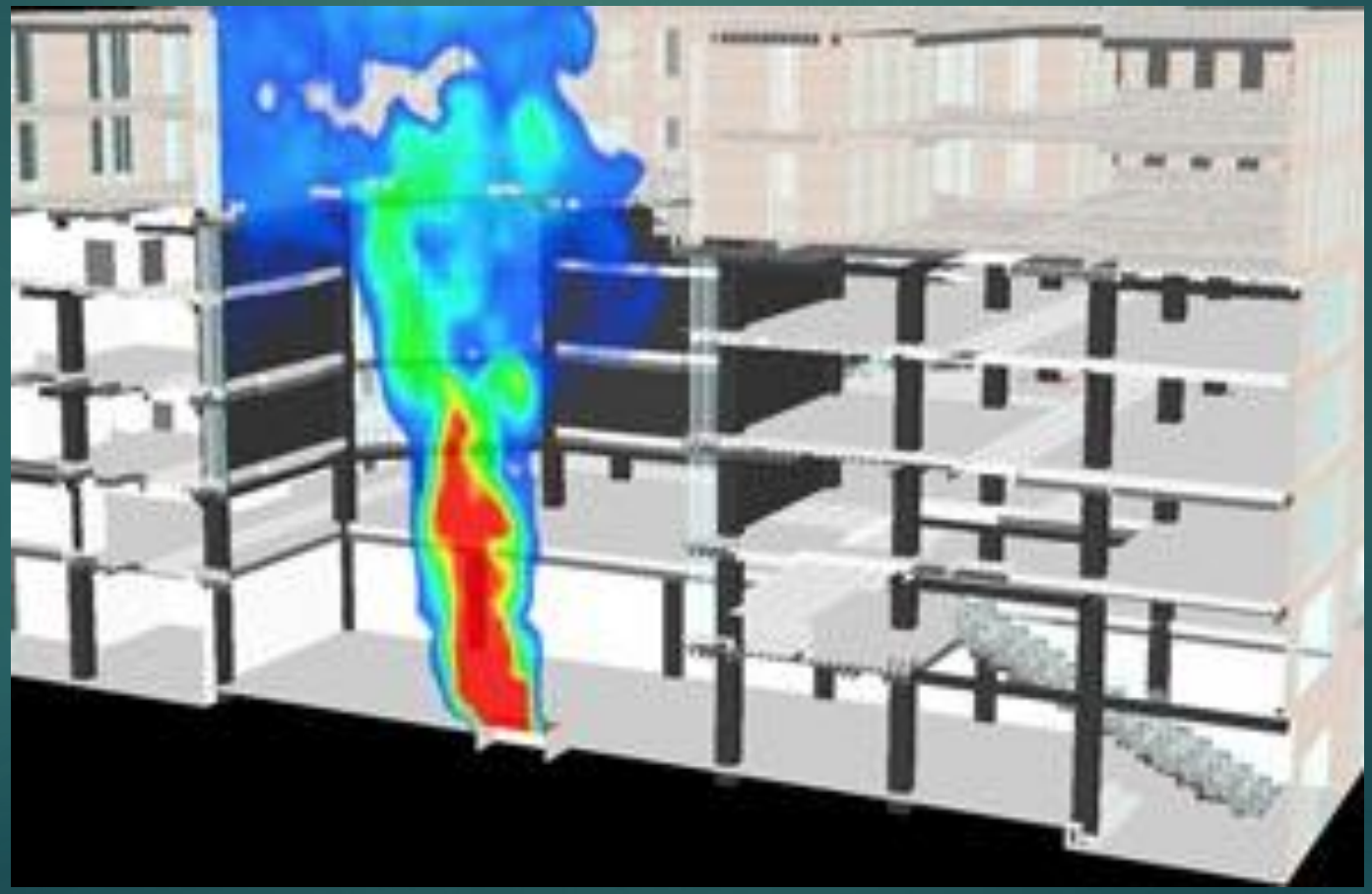
Fire Spread

- Calculation of fire spread on surfaces either vertically or horizontally
  - Thermodynamics
  - Heat Transfer

Smoke Ventilation



Smoke Ventilation

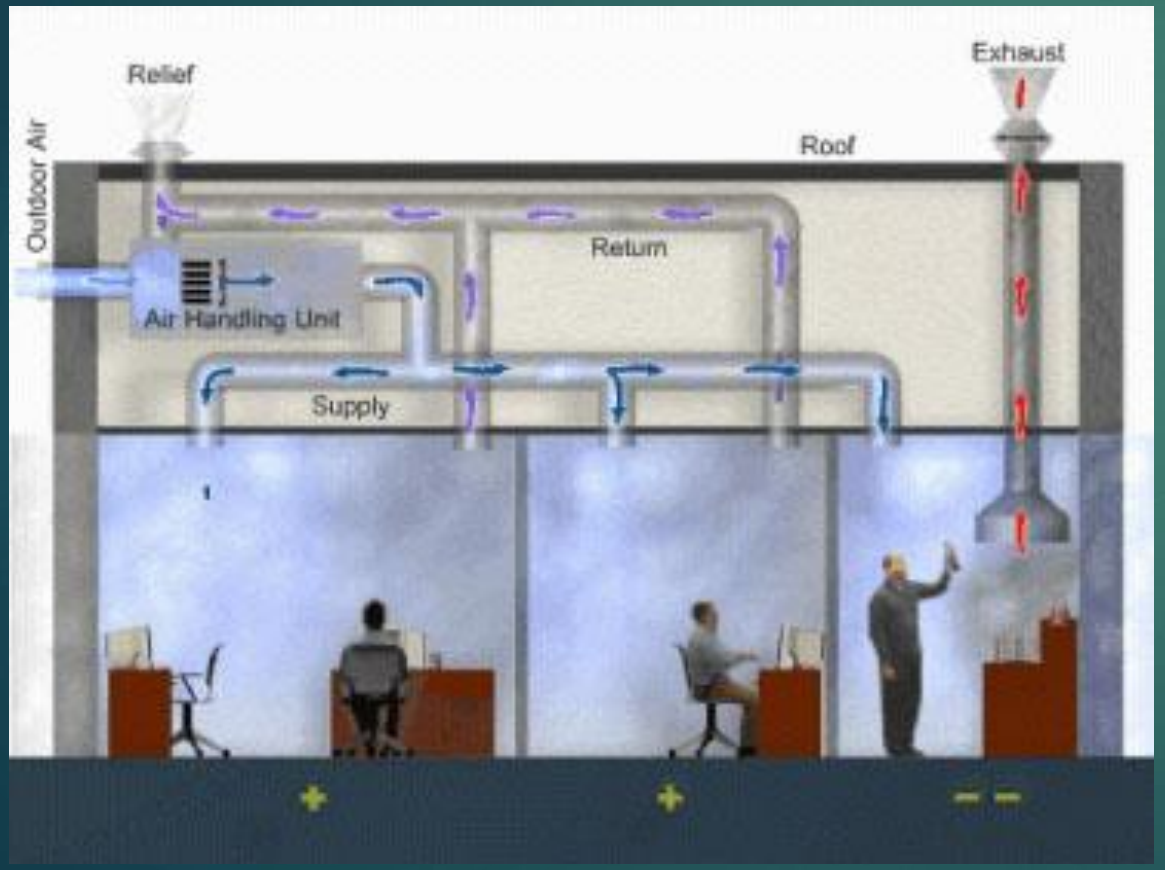


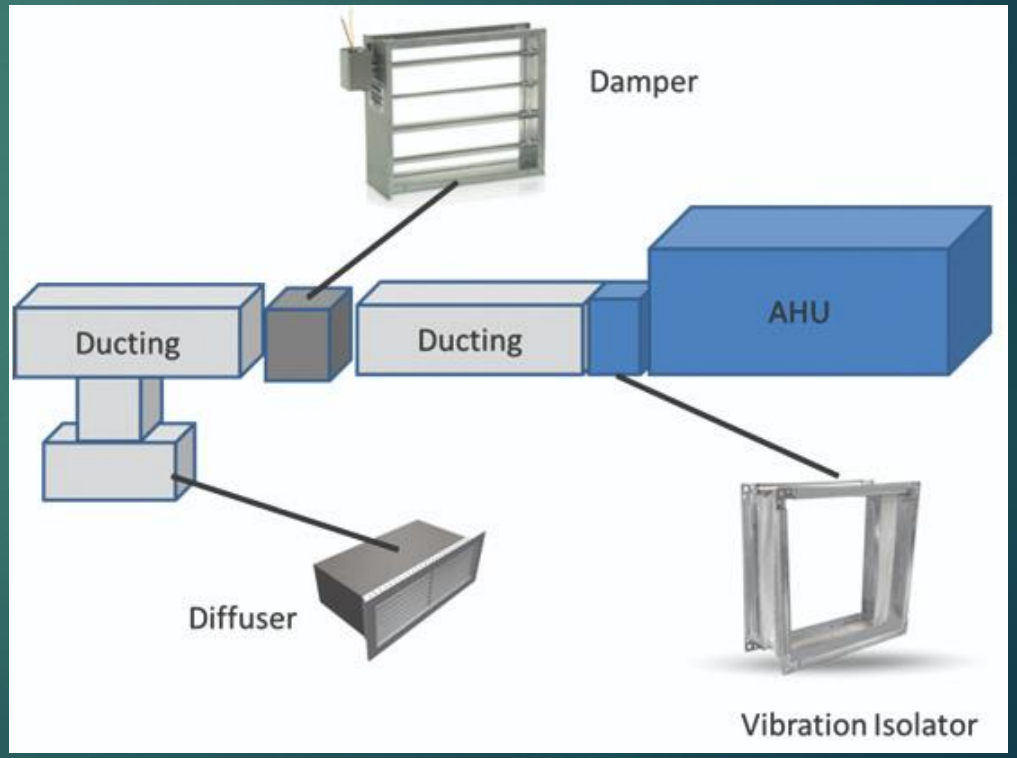
Smoke Ventilation

Smoke Ventilation

- Calculation of smoke dispersion along buildings
  - Fluid Dynamics, heat transfer
- Design of smoke dampers and smoke exhaust fans
  - Construction
  - Manufacturing techniques
  - HVAC Design
  - Automation controls

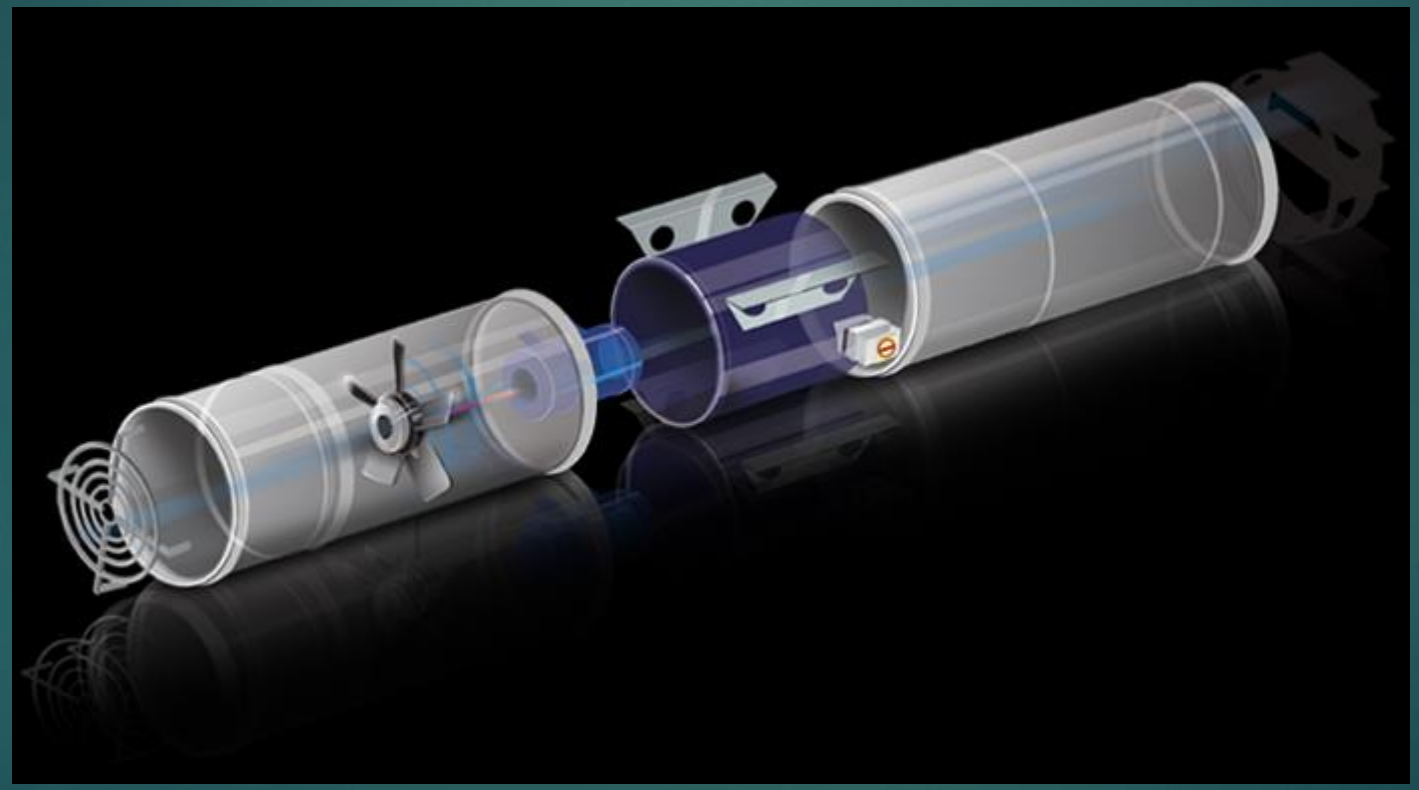
Smoke Damper





Jet Fans

Jet Fans



Life Safety Concept – Tenable Conditions

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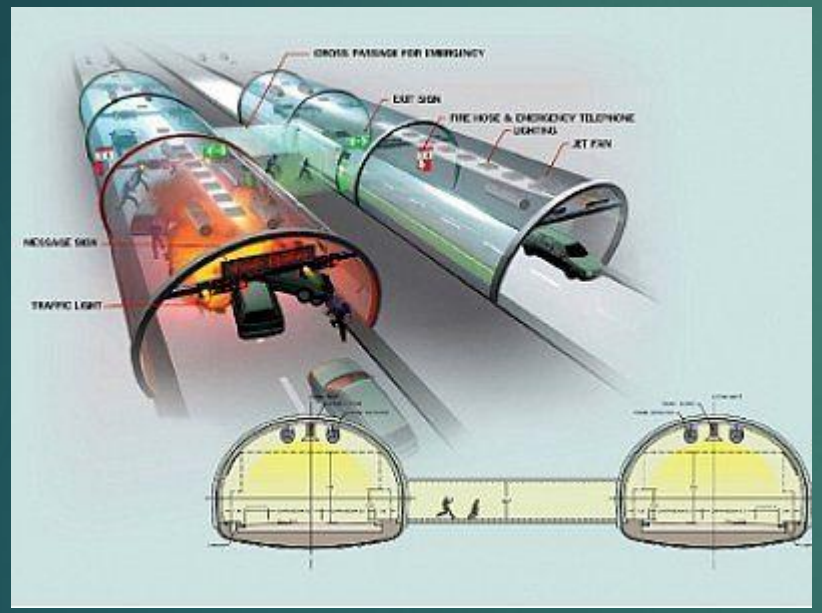
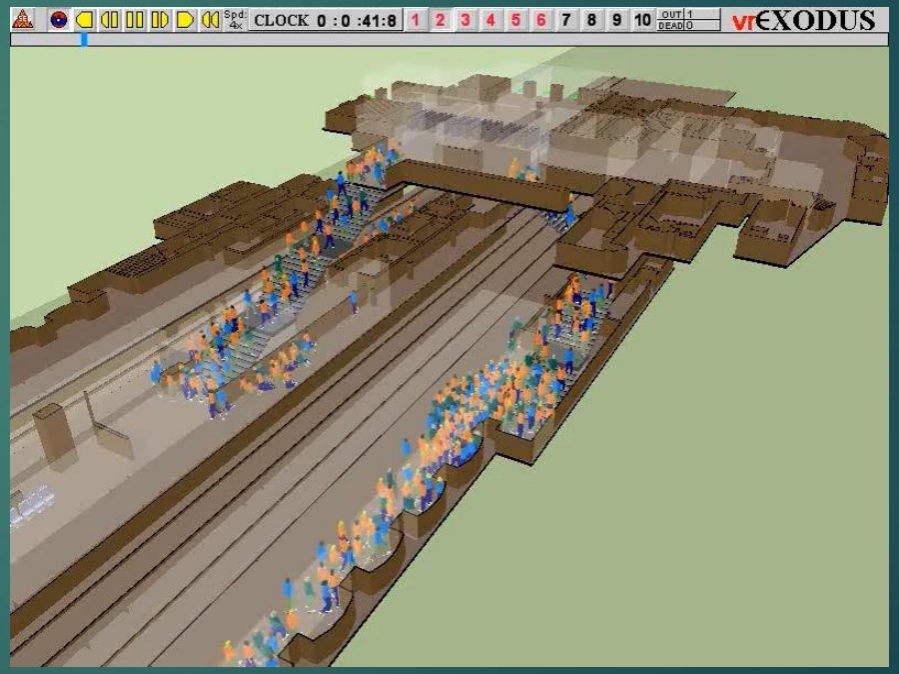
Life Safety Concept – Tenable Conditions

- Temperature ~ 800 - 1200 °C
- Heat Flux > 2,5 kW/m^2
- CO concentration > 2000 ppm
- Visibility less than 10 meters

Time for Evacuation





Time for Evacuation

Time for Evacuation

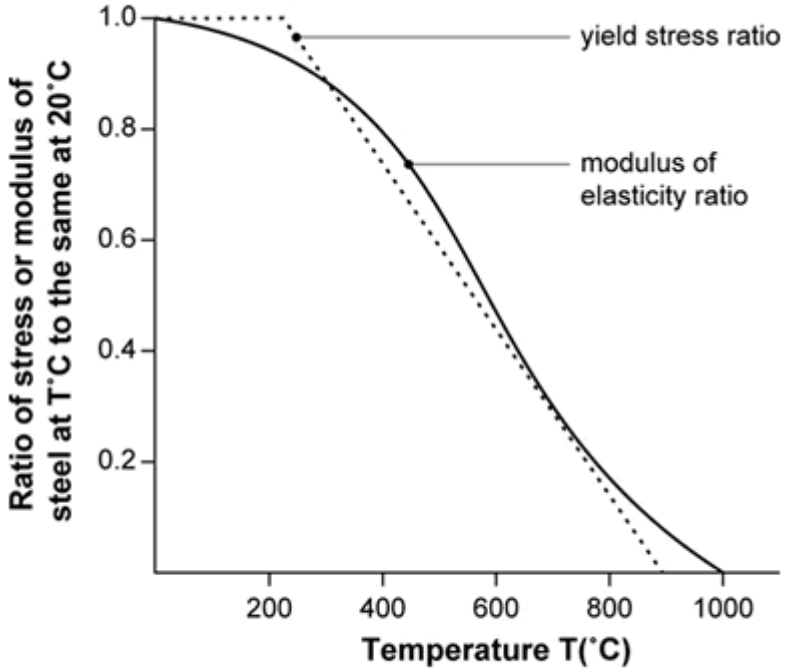
During evacuation :

- Steel in concrete structure should withstand
- Doors should maintain its integrity
- Smoke should be kept away

Resistance of Steel

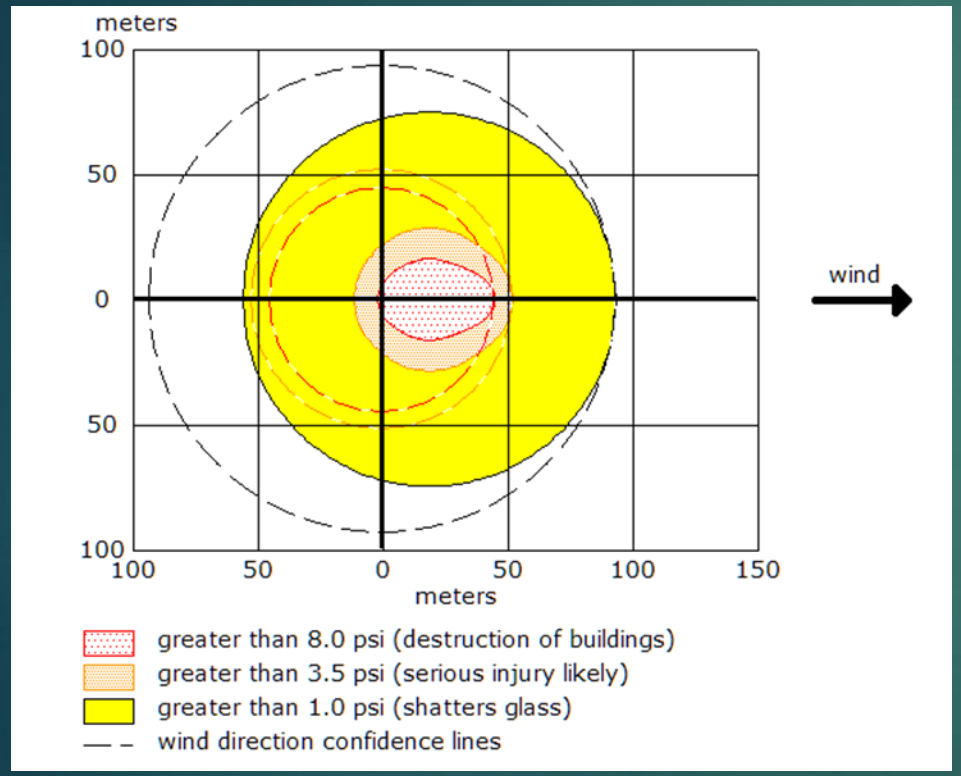
- Materials

Figure 1: Steel loses strength at elevated temperatures



Source: *Fire Engineering Design Guide*, University of Canterbury, New Zealand, 1994

Real World Application: Hydrogen Gas Release

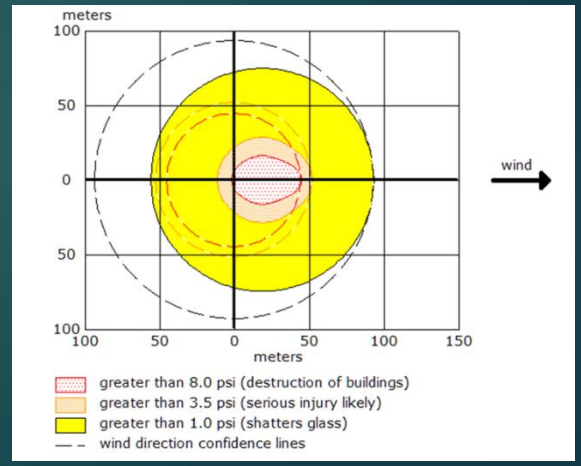


Real World Application: Hydrogen Gas Release

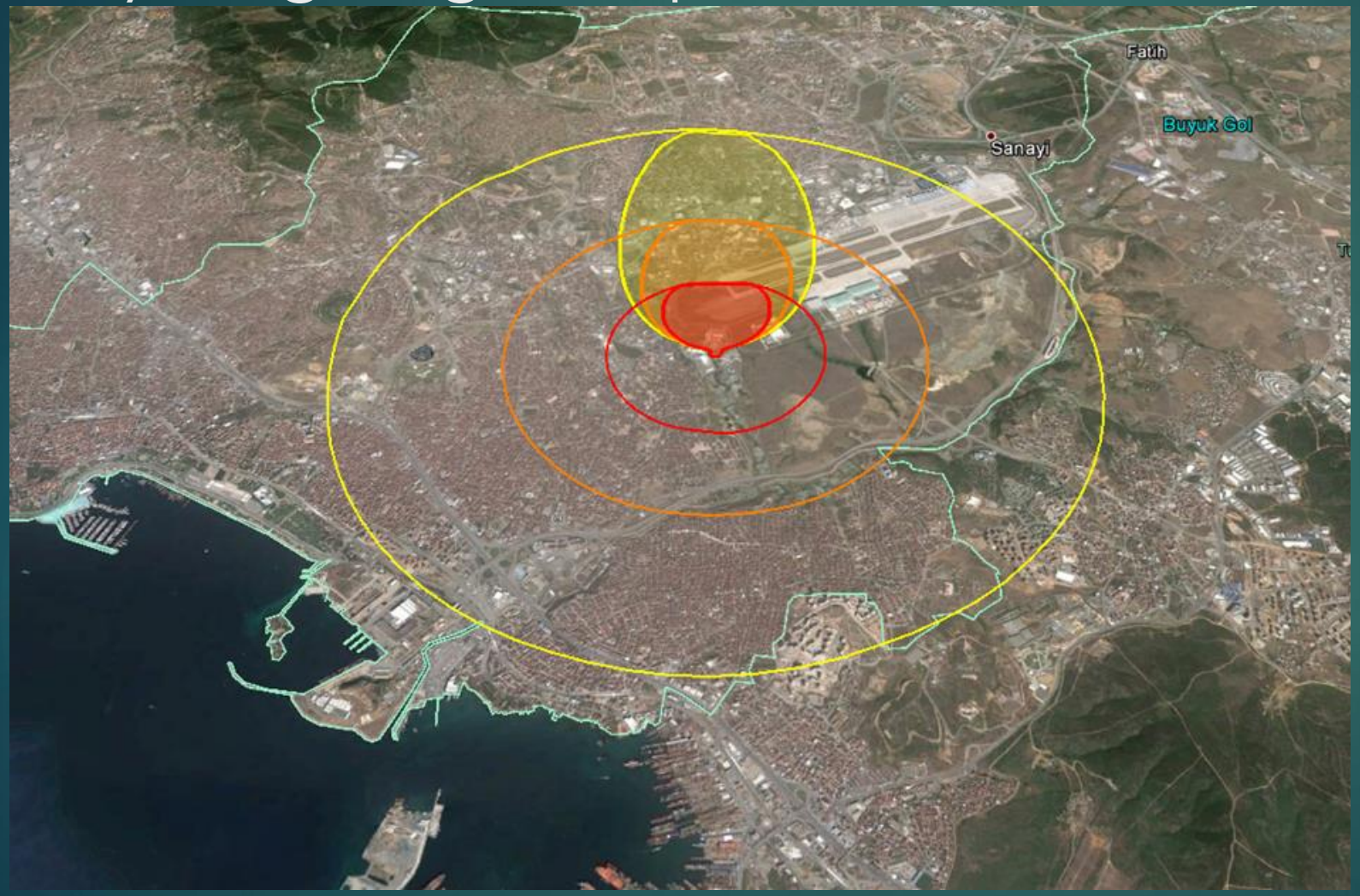
Scenario

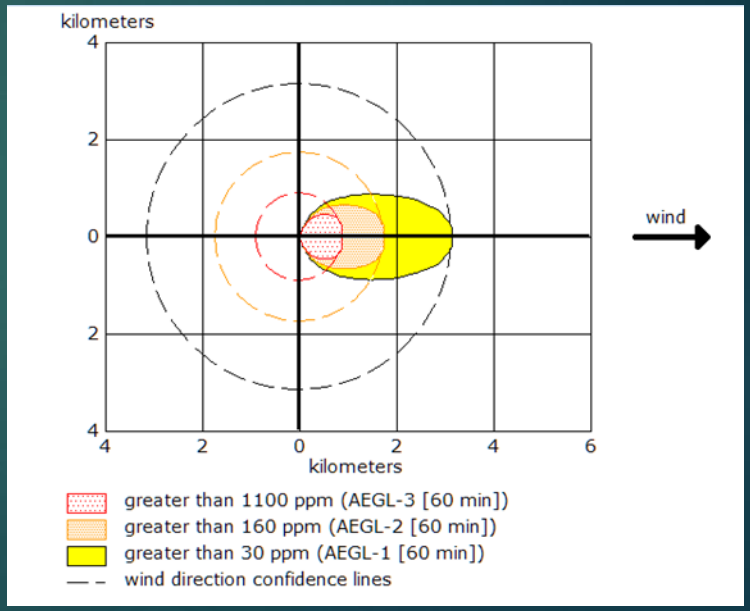
- Compressor malfunction - resultinghydrogen gas release to atmosphere with a flow rate of 128 m^3/h

- When gas explodes, blast wave breaks drain pipe of neighbouring tank which contains 13 tonnes of ammonia that is highly toxic for livings.



Real World Application:
Hydrogen gas explosion, Ammonium gas release





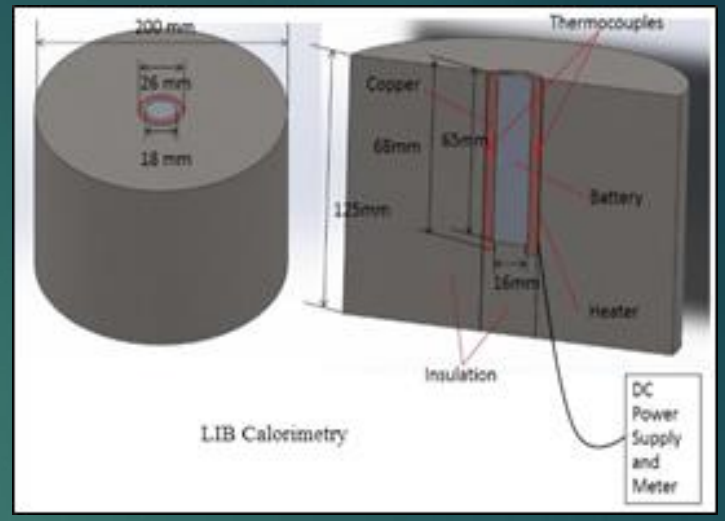
Research Topics

- A Standard Methodology to Characterize Composite Materials for Pyrolysis Models

Composite materials investigated as part of this project

Research Topics

- An Investigation of Thermally-Induced Failure of Lithium Ion Batteries

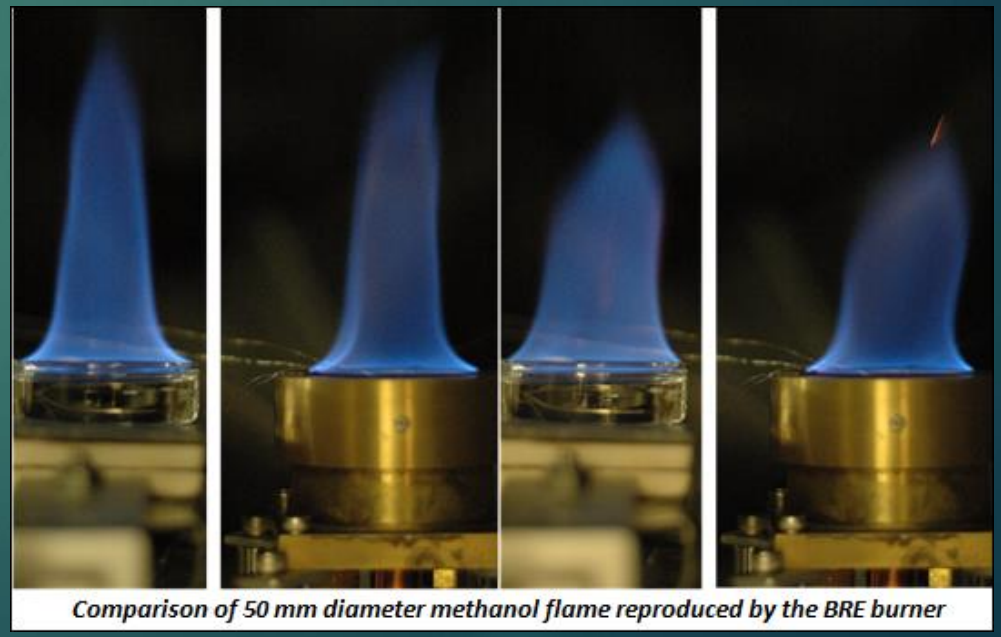


LIB Safety Venting (top) and Thermal Runaway (bottom).

Research Topics

- Burning Rate Emulator
- Material Ignition, Burning, and Extinction in Microgravity

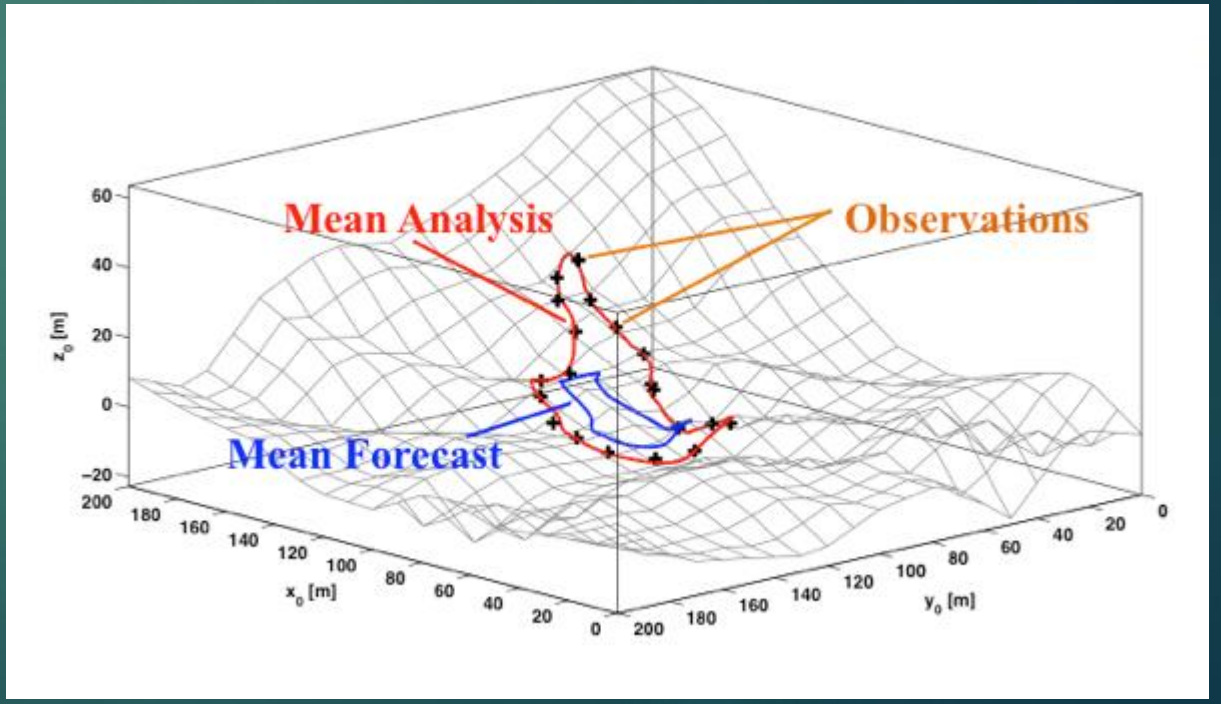
- Fire in ISS?



Comparison of 50 mm diameter methanol flame reproduced by the BRE burner

Research Topics

- Data-Driven Wildland Fire Spread Modeling



Education in Fire Protection Engineering

- The following schools offer Bachelor of Science or Master of Science degrees in fire protection engineering:

- Carleton University— (Canada)
- California Polytechnic State University– (USA)
- Case Western Reserve University– (USA)
- Ghent University– (Belgium)
- University of Greenwich– (England)
- University of Leeds– (England)
- University of Maryland, College Park— (USA)
- University of New Haven— (USA)
- University of Queensland — (Australia)
- University of St. Thomas– (USA)
- University of Waterloo — (Canada)
- University of Western Sydney– (Australia)
- Worcester Polytechnic Institute— (USA)
- Hong Kong Polytechnic University— (Hong Kong)
- International Master of Science in Fire Safety Engineering– (Europe)
- Karlsruhe Institute of Technology (KIT)—(Germany)
- Lawrence Technological University — (USA)
- Luleå University of Technology– (Sweden)
- Lund University— (Sweden)
- State Key Laboratory of Fire Science– (China)
- Stord Haugesund University College— (Norway)
- Technical University of Denmark— (Denmark)
- Ulster University— (Northern Ireland)
- Universidad de Cantabria– (Spain)
- Universidad Pontificia de Comillas– (Spain)
- University of Canterbury— (New Zealand)
- University of Coimbra– (Portugal)
- University of Edinburgh— (Scotland)

Conclusion

- Fire is an inter-disciplinary problem
  - mechanical, chemical, electrical, civil Engineering
- Heat transfer, fluid mechanics, thermodynamics, differential equations, materials, automation and control are the core courses
- CAD and BIM software knowledge is a must.
- Should be fluent in English.

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- **Also on Linkedin**