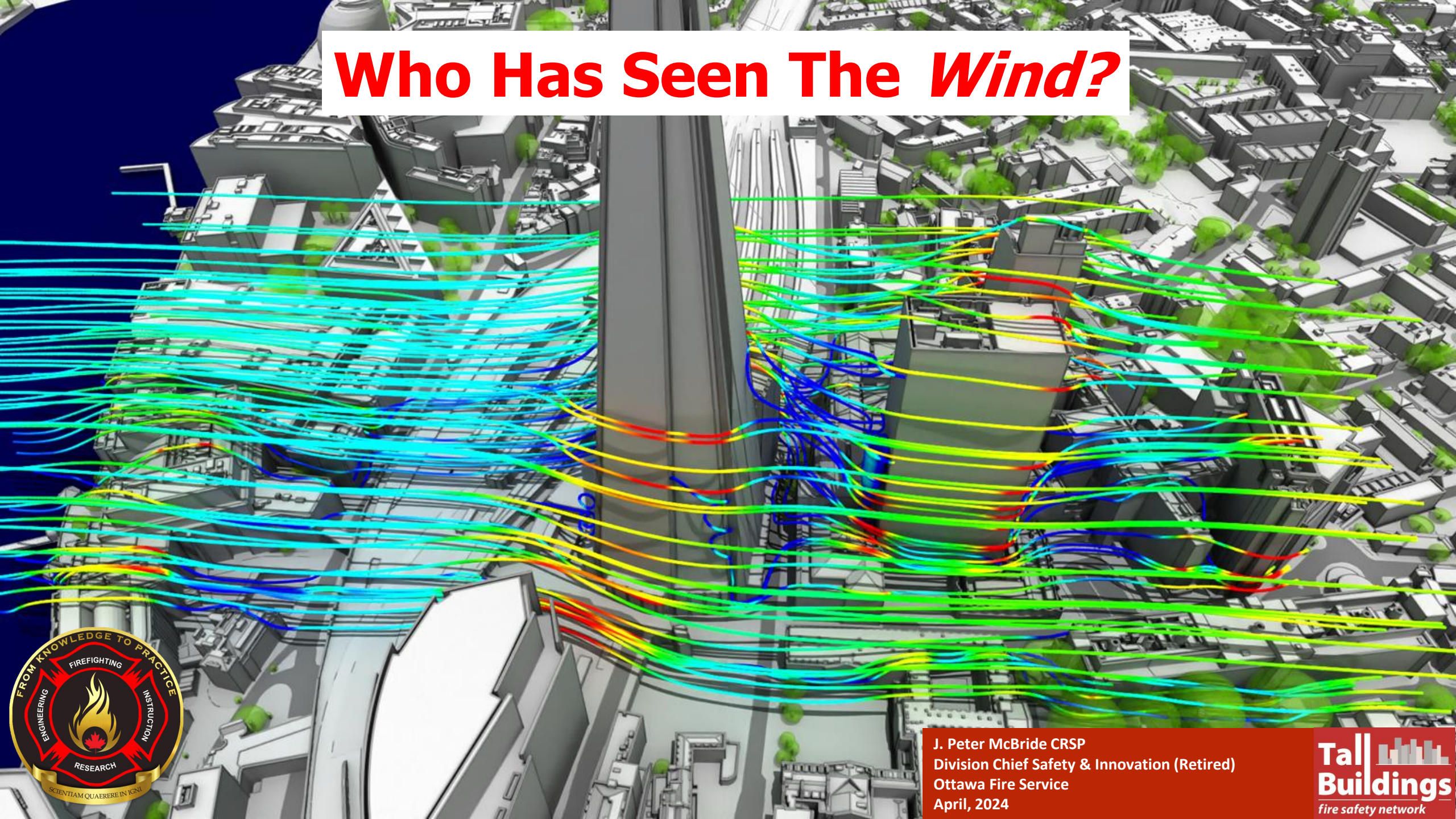
Who Has Seen The *Wind?*



J. Peter McBride CRSP
Division Chief Safety & Innovation (Retired)
Ottawa Fire Service
April, 2024

Built Design and Climate Change

- Climate Change… …Climate Changed!
- Shifts in weather patterns
    - Temperature, Winds, Snowfall, Rainfall, Waves, Wildfires
- Emerging risks for the public, developers, engineers, architects and the fire service
- Codes have dated assumptions and only represent **minimum** requirements!

Building Codes & Design

Codes predicated on:

- Ensuring Life Safety, Health, Accessibility, Environment, Occupancy, Time for egress
  - Tenability – Obscuration, Toxicity, Temperature
- Achieved by compartmentation & protective features
- Fire performance of assemblies does not include wind or pressure differences

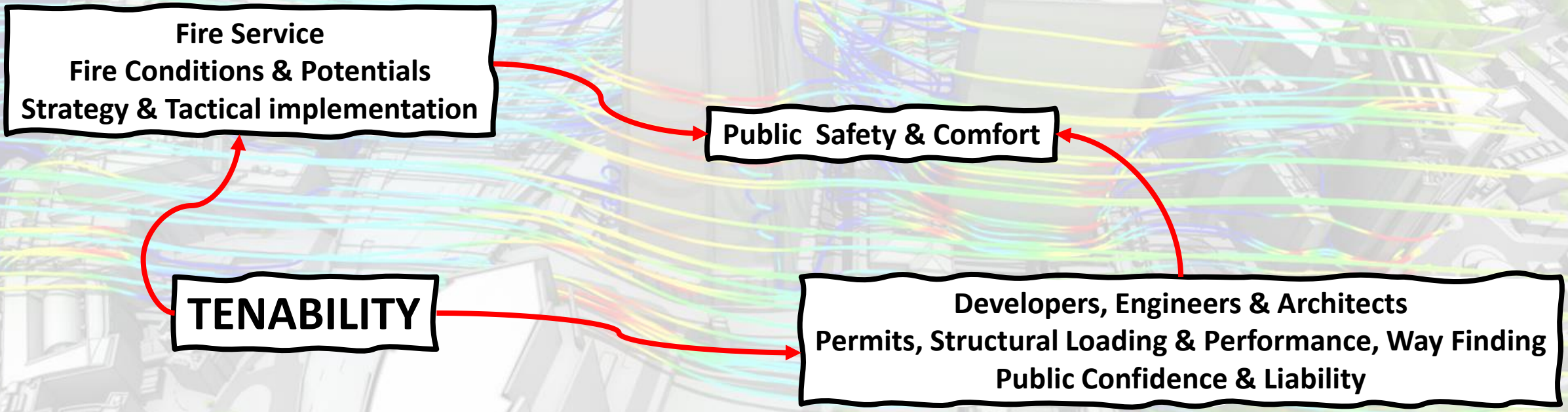
- **Assumptions baked into codes…**
  - Firefighting outside the compartment
  - The fire building is the compartment in some cases

∴ Fire Fighter life safety objectives not included in Codes!

- **WIND DRIVEN FIRE IS NOT CONSIDER IN CODES or DESIGN!**

Who Has Seen The *Wind?*

Depends on Who is Looking and Why



National Research Council Canada | Conseil national de recherches Canada

NRC · CNRC

Positive Pressure Ventilation for High-Rise Buildings

Research report 102

Date of Issue: August 2002

Authors: G.D. Lougheed
P.J. McBride and D.W. Carpenter

Published by
Institute for Research in Construction
National Research Council Canada
Ottawa, Canada
K1A 0R6

January 1999

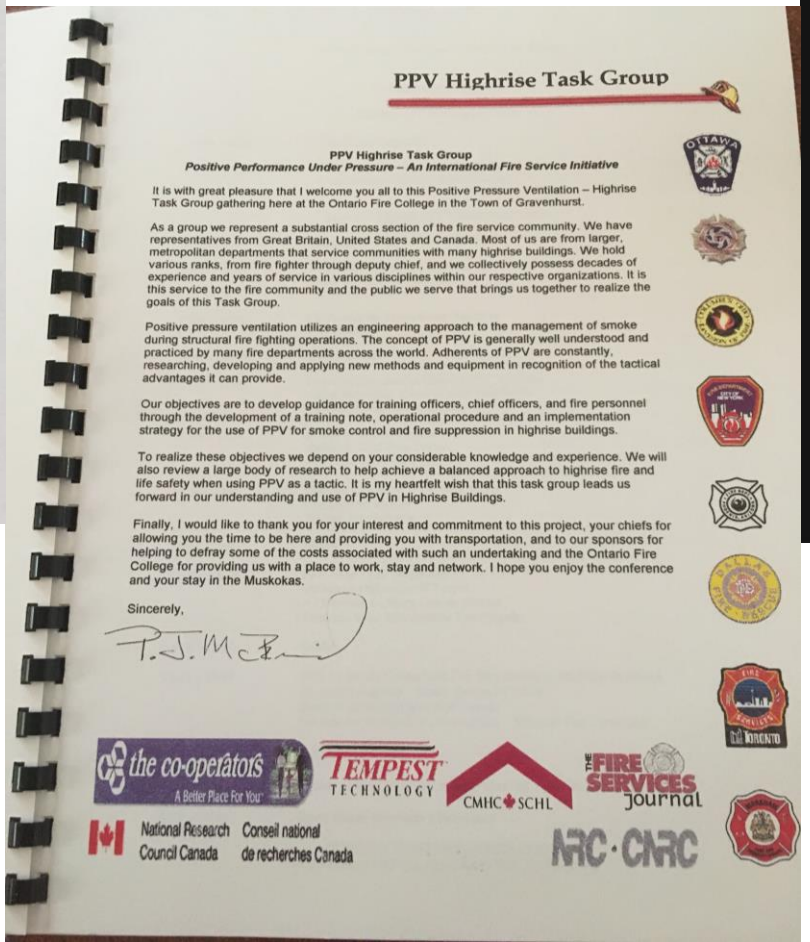
Promoting productive workplaces through safety and health research | NIOSH

Three Fire Fighters Die in a 10-Story High-Rise Apartment Building - New York

Death in the Line of Duty…A summary of a NIOSH fire fighter fatality investigation

F99-01 Date Released: August 2, 1999

November 2001



PPV Highrise Task Group

PPV Highrise Task Group
Positive Performance Under Pressure – An International Fire Service Initiative

It is with great pleasure that I welcome you all to this Positive Pressure Ventilation – Highrise Task Group gathering here at the Ontario Fire College in the Town of Gravenhurst.

As a group we represent a substantial cross section of the fire service community. We have representatives from Great Britain, United States and Canada. Most of us are from larger, metropolitan departments that service communities with many highrise buildings. We hold various ranks, from fire fighter through deputy chief, and we collectively possess decades of experience and years of service in various disciplines within our respective organizations. It is this service to the fire community and the public we serve that brings us together to realize the goals of this Task Group.

Positive pressure ventilation utilizes an engineering approach to the management of smoke during structural fire fighting operations. The concept of PPV is generally well understood and practiced by many fire departments across the world. Adherents of PPV are constantly, researching, developing and applying new methods and equipment in recognition of the tactical advantages it can provide.

Our objectives are to develop guidance for training officers, chief officers, and fire personnel through the development of a training note, operational procedure and an implementation strategy for the use of PPV for smoke control and fire suppression in highrise buildings.

To realize these objectives we depend on your considerable knowledge and experience. We will also review a large body of research to help achieve a balanced approach to highrise fire and life safety when using PPV as a tactic. It is my heartfelt wish that this task group leads us forward in our understanding and use of PPV in Highrise Buildings.

Finally, I would like to thank you for your interest and commitment to this project, your chiefs for allowing you the time to be here and providing you with transportation, and to our sponsors for helping to defray some of the costs associated with such an undertaking and the Ontario Fire College for providing us with a place to work, stay and network. I hope you enjoy the conference and your stay in the Muskokas.

Sincerely,

P.J. McBride

the co-operators A Better Place For You | TEMPEST TECHNOLOGY | CMHC SCHL | THE FIRE SERVICES Journal

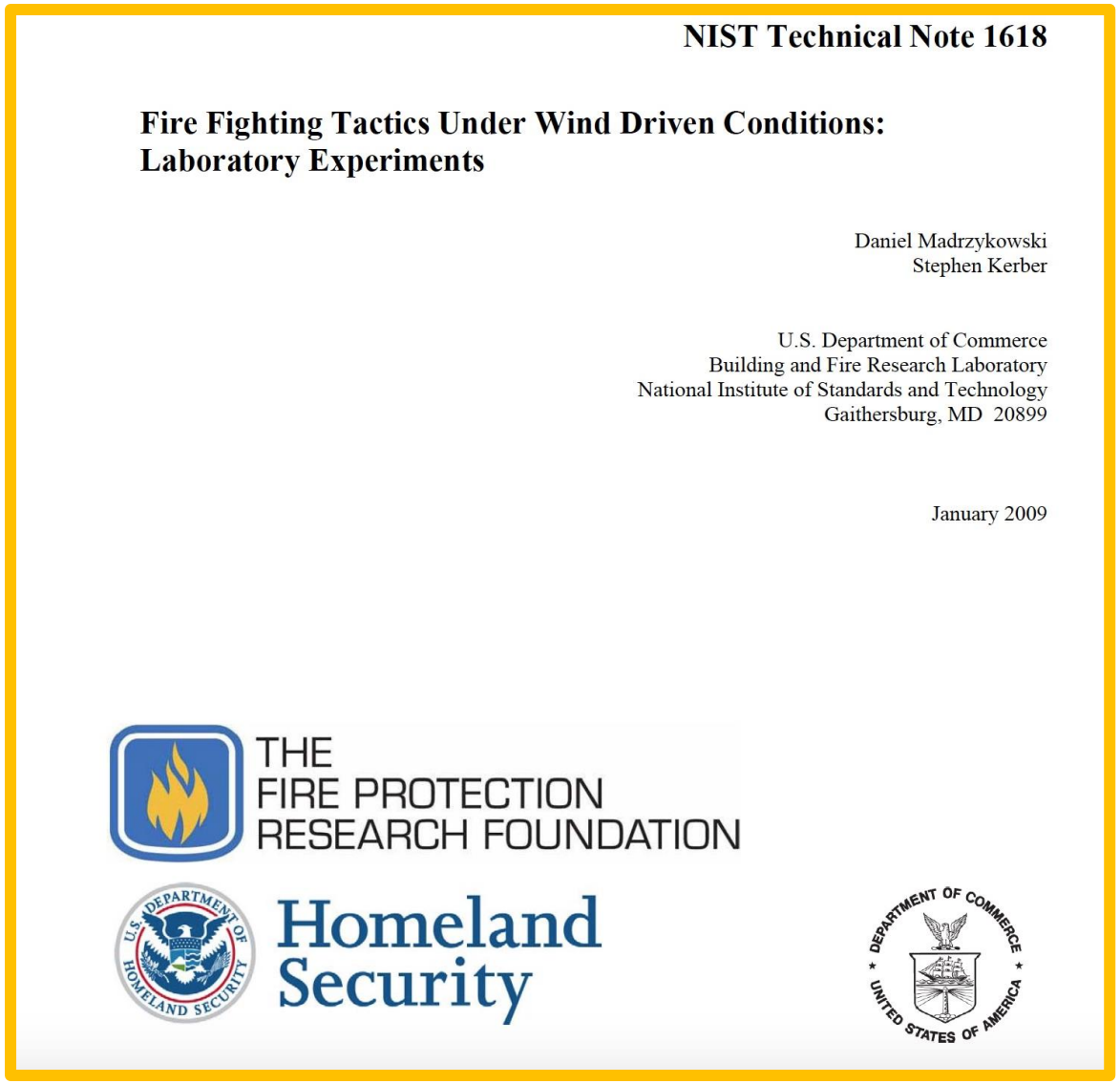
National Research Council Canada | Conseil national de recherches Canada | NRC · CNRC

Workers' Report
Critical Injuries:
Forward Avenue Fire

February 2007

DATA 2007

- Wildland training manuals dedicate almost half of their fire behavior chapter to weather with significant sections on wind.
- Structural firefighter training manuals, which are approximately 1000 pages in length, dedicate a page or less to the interaction of wind and structural fire behavior.
- NFPA Analysis - 565 Fires – Rated 1 (no wind) to 5 (wind)
- FDNY Experiences – Chiefs Tracy & Norman



NIST Technical Note 1618

Fire Fighting Tactics Under Wind Driven Conditions: Laboratory Experiments

Daniel Madrzykowski
Stephen Kerber

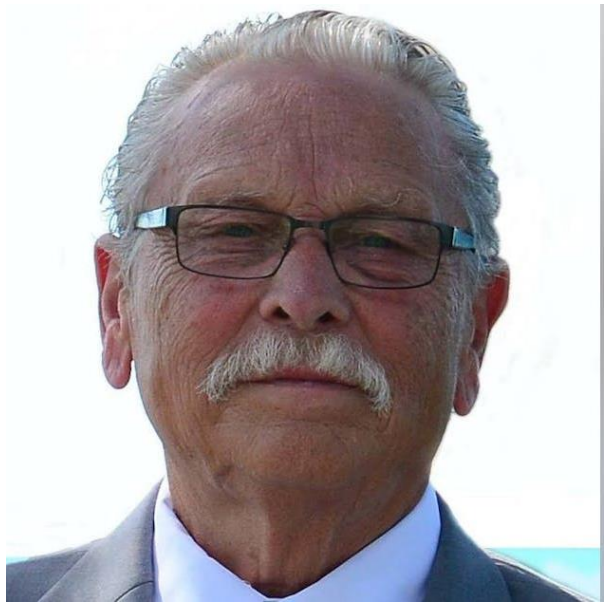
U.S. Department of Commerce
Building and Fire Research Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899

January 2009

THE FIRE PROTECTION RESEARCH FOUNDATION

Homeland Security

- Toledo PPV - 2007
- Govenors Island – 2008
- Chicago – 2009
- Tracy - Timeless



Two Career Fire Fighters Die in a Rapid Fire Progressio
Searching for Tenants—Ohio

Death in the Line of Duty...A summary of a NIOSH fire
fatality investigation

Career Probationary Fire Fighter and Captain Die as a Result of Rapid Fire Progression in a Wind-Driven Residential Structure Fire - Texas

Death in the Line of Duty...A summary of a NIOSH fire fighter fatality investigation

F2009-11 Date Released: April 8, 2010
Revised on January 4, 2011 to add NPPTL SCBA Evaluation report.
Revised on December 8, 2014 to correct the building construction type.

Two Career Fire Fighters Die in a Rapid Fire Progression While Searching for Tenants—Ohio

Death in the Line of Duty...A summary of a NIOSH fire fighter fatality investigation

F2014-02 Date Released: April 14, 2015

4 Career Fire Fighters Killed and 16 Fire Fighters Injured at Commercial Structure Fire - Texas

Death in the Line of Duty...A summary of a NIOSH fire fighter fatality investigation

F2013-16 Date Released: July 15, 2015

Revised June 10, 2008 to clarify Recommendation #2

Career Fire Fighter Dies in Wind Driven Residential Structure Fire - Virginia

Death in the Line of Duty...A summary of a NIOSH fire fighter fatality investigation

F2007-12 Date Released: May 16, 2008

2014 09

Death in the line of duty... NIOSH

A summary of a NIOSH fire fighter fatality investigation *March 2, 2016*

Lieutenant and Fire Fighter Die and 13 Fire Fighters injured in a Wind-driven Fire in a Brownstone—Massachusetts

SJ INTERNATIONAL
FIRE & SAFETY JOURNAL
Issue 34
...ction, Analysis and Insights for Manufacturers, Fire Fighters and Senior Fire and Safety Professionals

ELECTRIC VEHICLES
Understanding the intricacies of EV fires

EXPERT INSIGHT

15TH - 20TH APRIL 2024
FDIC

...nto
...ding

...on 22 February
...ed two 14-story
..., has raised serious
...the materials used
... cladding. Initial
...sted the presence of
...e insulation, but recent
... from authoritative bodies
...ested this claim.
...odern Building Alliance
...sed regret over the incident and
...ded sympathies to those affected.
... noted early media reports citing
...yurethane insulation but highlighted
...at the Vice-President of the College
...of Industrial Technical Engineers of
Valencia and the Technical Architecture
School of Valencia have dismissed this
hypothesis.
The Alliance stated: "We hope that

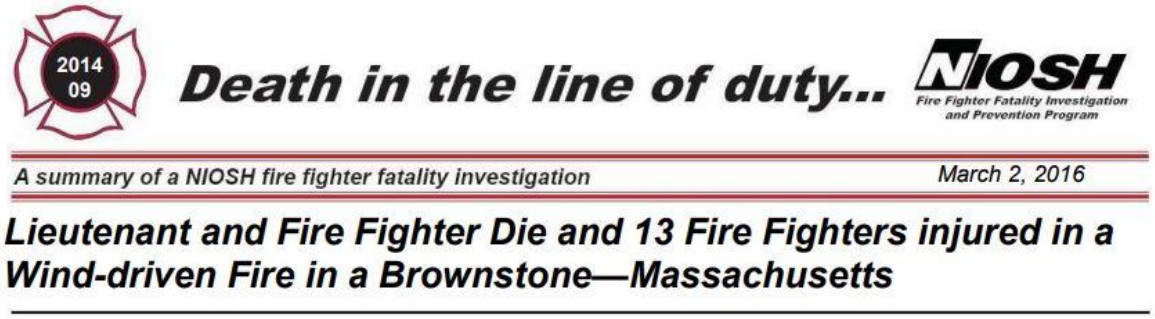
the fire and why it spread through the façade so quickly."
The Rigid Polyurethane Industry Association (IPUR) also addressed the issue, offering condolences and support to those affected. They confirmed that there is no evidence of polyurethane in the building's ventilated façade, neither as a filler for exterior cladding nor as insulation in the air chamber.
The property manager corroborated this, stating that the insulating product was not polyurethane. IPUR said it is ready to assist authorities

FASNY raises concerns over fire service standard update

The Firefighters Association of the State of New York (FASNY) has raised objections to the Occupational Safety and Health Administration's (OSHA) proposed updates to the Fire Brigades Standard. Edward Tase Jr., President of FASNY, noted the potential drastic effects these changes could have on the fire service sector.
OSHA's initiative to revise the Fire Brigades Standard (29 CFR 1910.156), which originated in 1980, involves the introduction of the "Emergency Response Standard." This new standard is designed to bolster safety and health protections for emergency responders, including firefighters, EMS providers, and technical search

Why is this still happening?

March 2021



"SIZE UP" TOOLS – FIRE/WIND?

Ongoing observation and evaluation of factors that are used for strategic goals and tactical objectives

- COAL WAS WEALTH
  - Construction, Occupancy, Area, Life hazard
  - Water, Auxillary systems, Street conditions
  - Weather, Exposures, Apparatus & personnel, Location, Time, Hazards

- SLICE-RS
  - Size Up
  - Locate the fire
  - Identify & control flow path
  - Cool the space from safetest location
  - Extinguish the fire
  - Rescue
  - Salvage

- RECEO-VS
  - Rescue
  - Exposures
  - Containment
  - Extinguish
  - Overhaul
  - Rescue
  - Salvage

- DICERS-VO
  - Detect
  - Isolate
  - Confine
  - Extinguish
  - Rescue
  - Salvage
  - Ventilation
  - Overhaul

Basic Fire Models

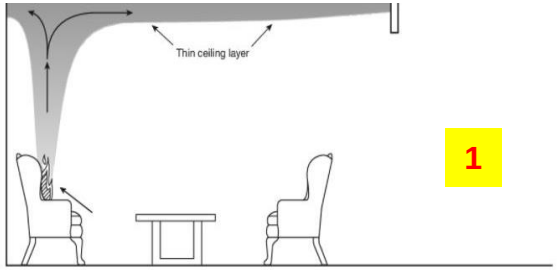


FIGURE 6.4.2.1.1.4 Early Compartment Fire Development.

1

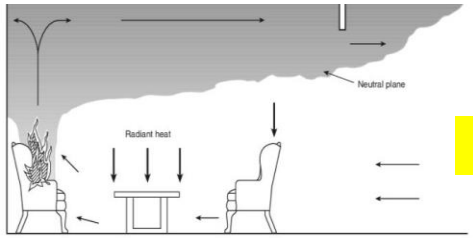


FIGURE 6.4.2.1.1.6(c) Neutral Plane — Upper Layer Development and Airflow.

2

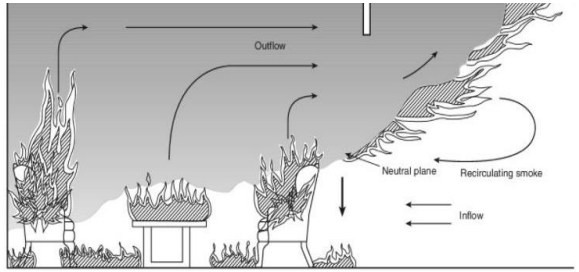
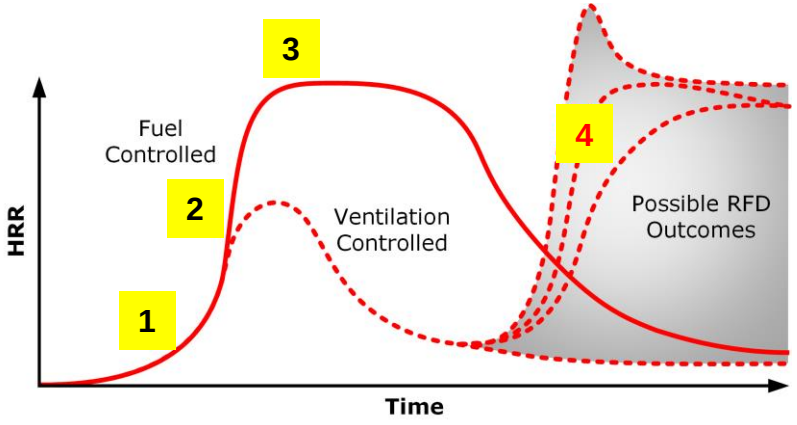


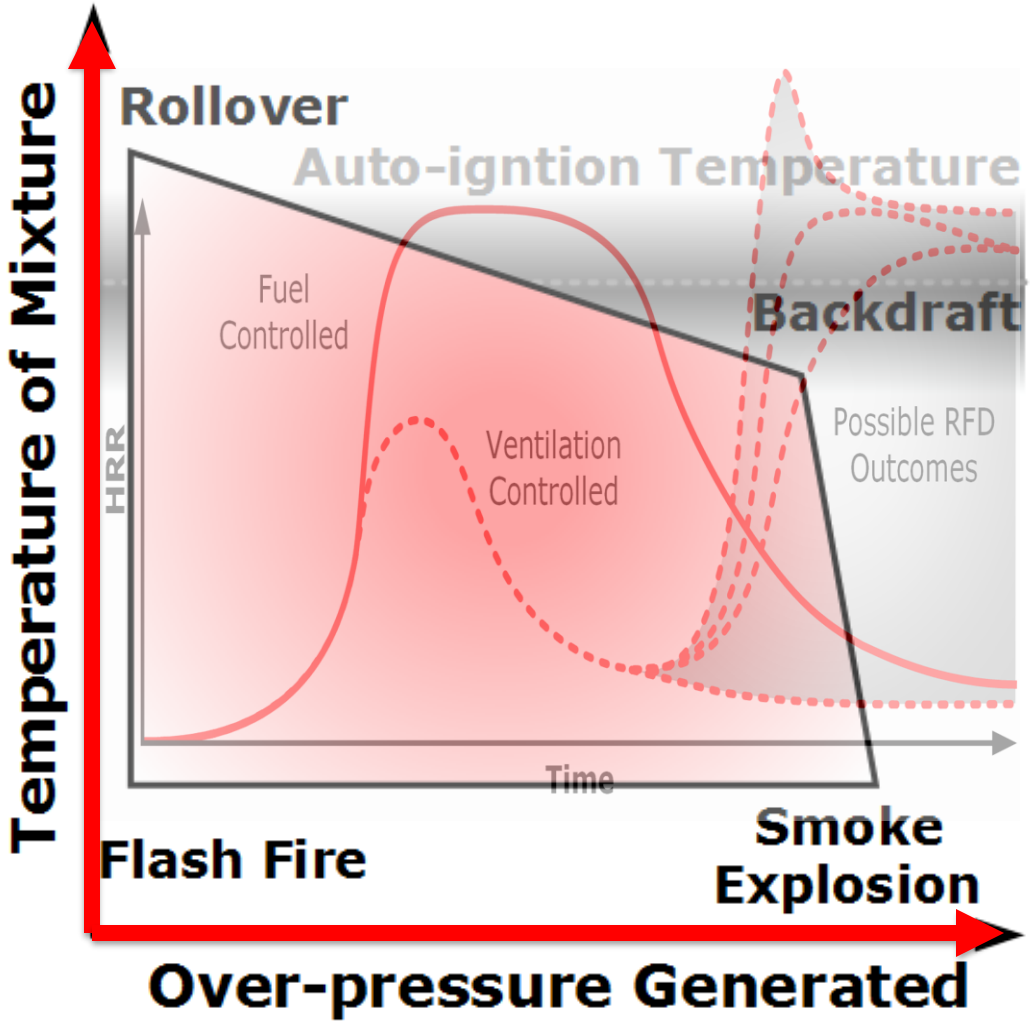
FIGURE 6.4.2.1.2 Flashover Conditions in Compartment Fire.

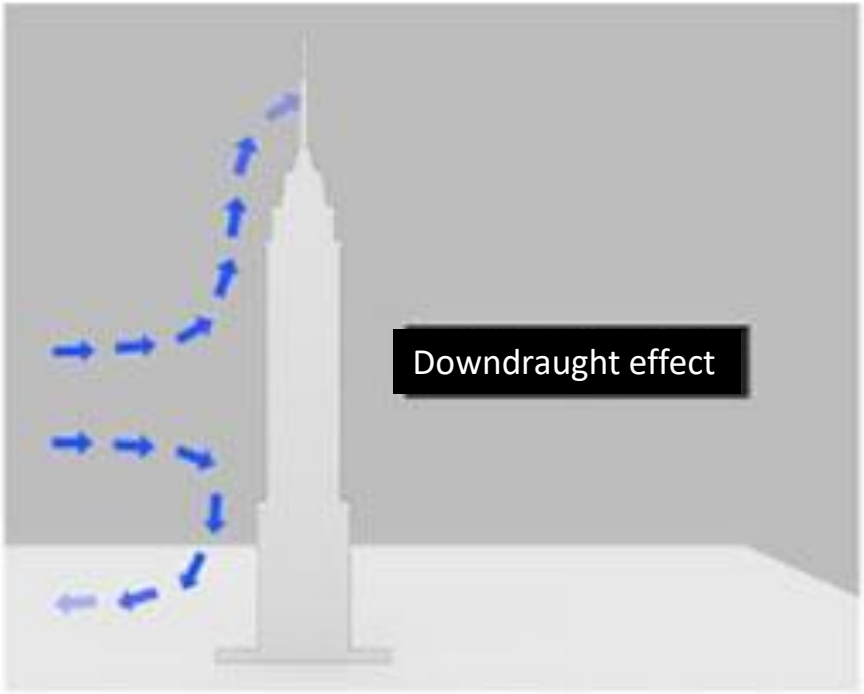
3

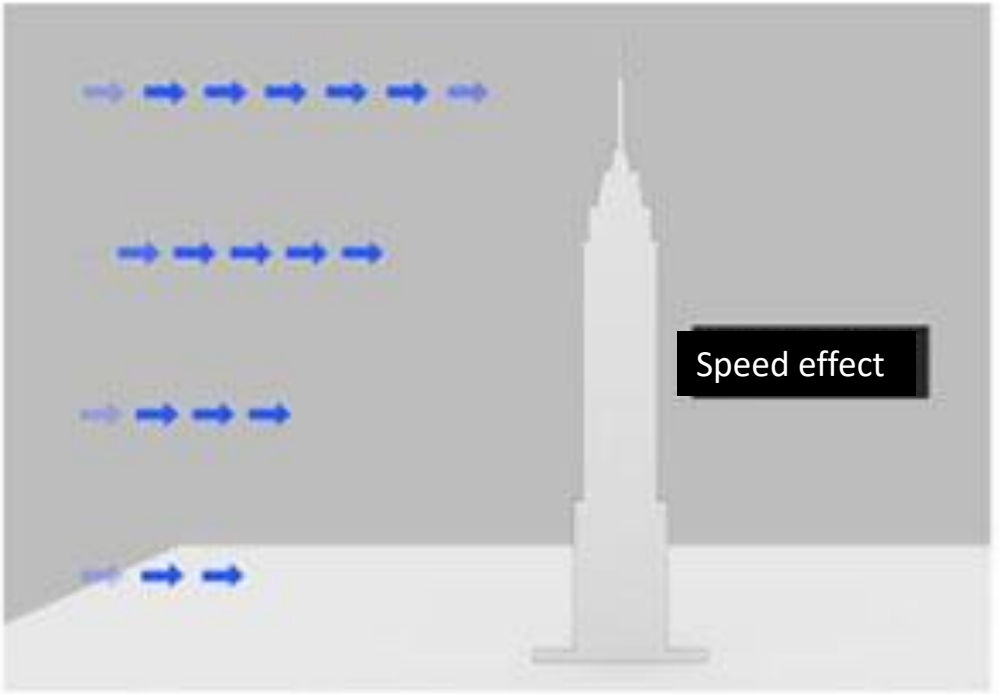


4

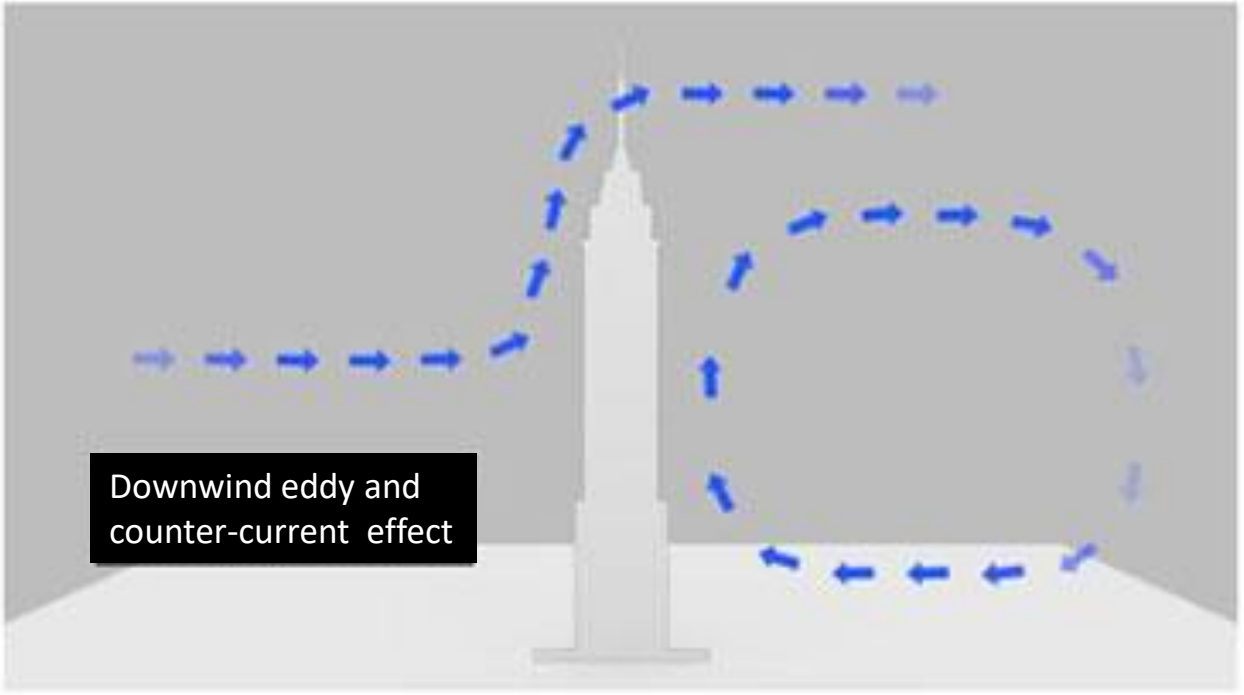
Rapid Fire Development

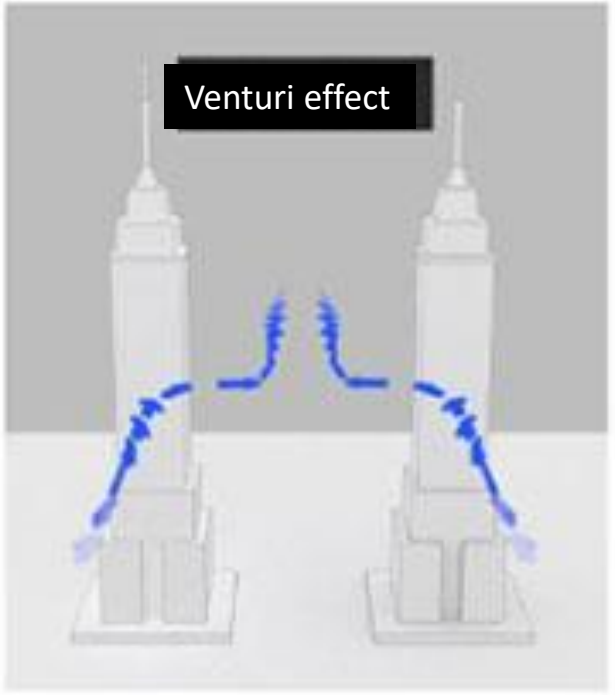






Basic Urban Wind Effects Are Not Taught





Building and Environmental Factors

"Topography Spawned Effects"

- Effects caused by variations in elevation of land and/or buildings and building geometry.
- Can generate significant aerodynamic effects even in low to moderate wind conditions such as:
  - Pressure zones
  - Buffeting
  - Rip currents
  - Vortices

HOLDING UP WATER

EXTERIOR

CONTROL

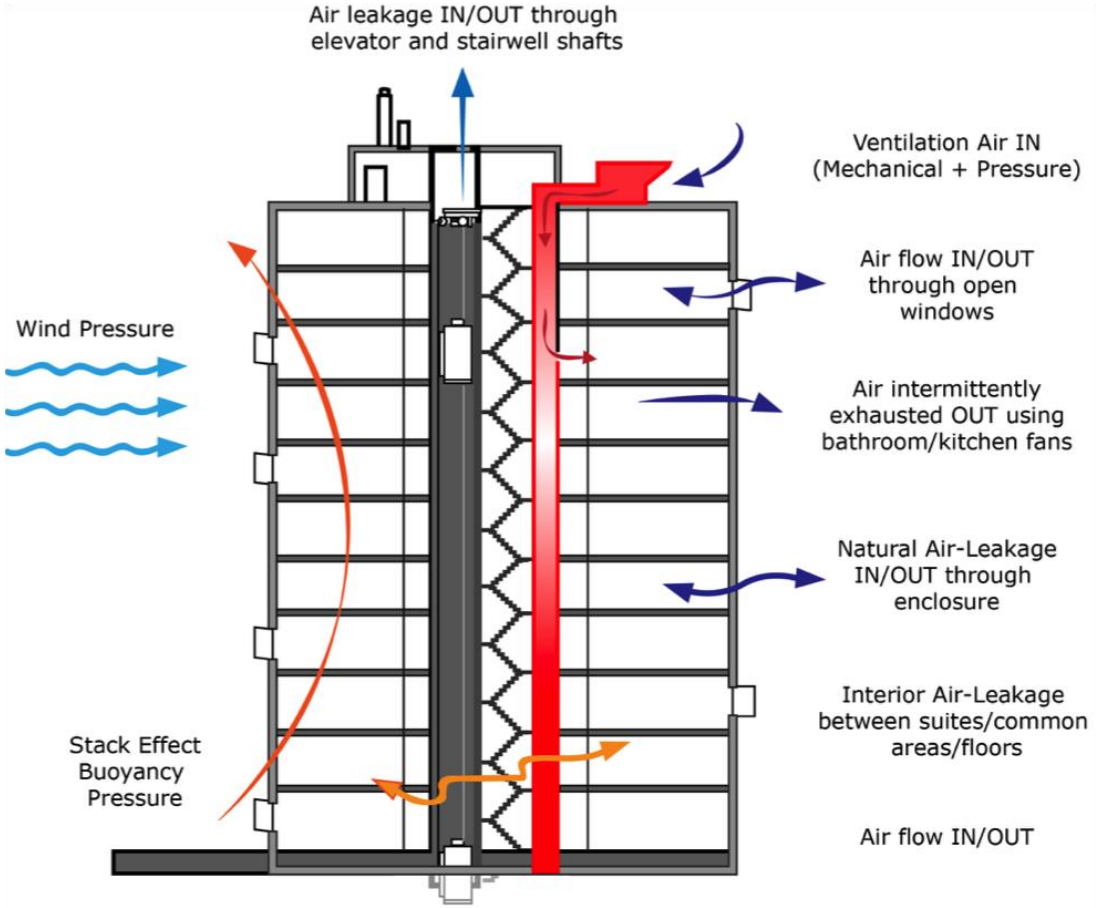

Most
Error
Likely
Tactic
Deploying
Opposite
Wind
Needlessly

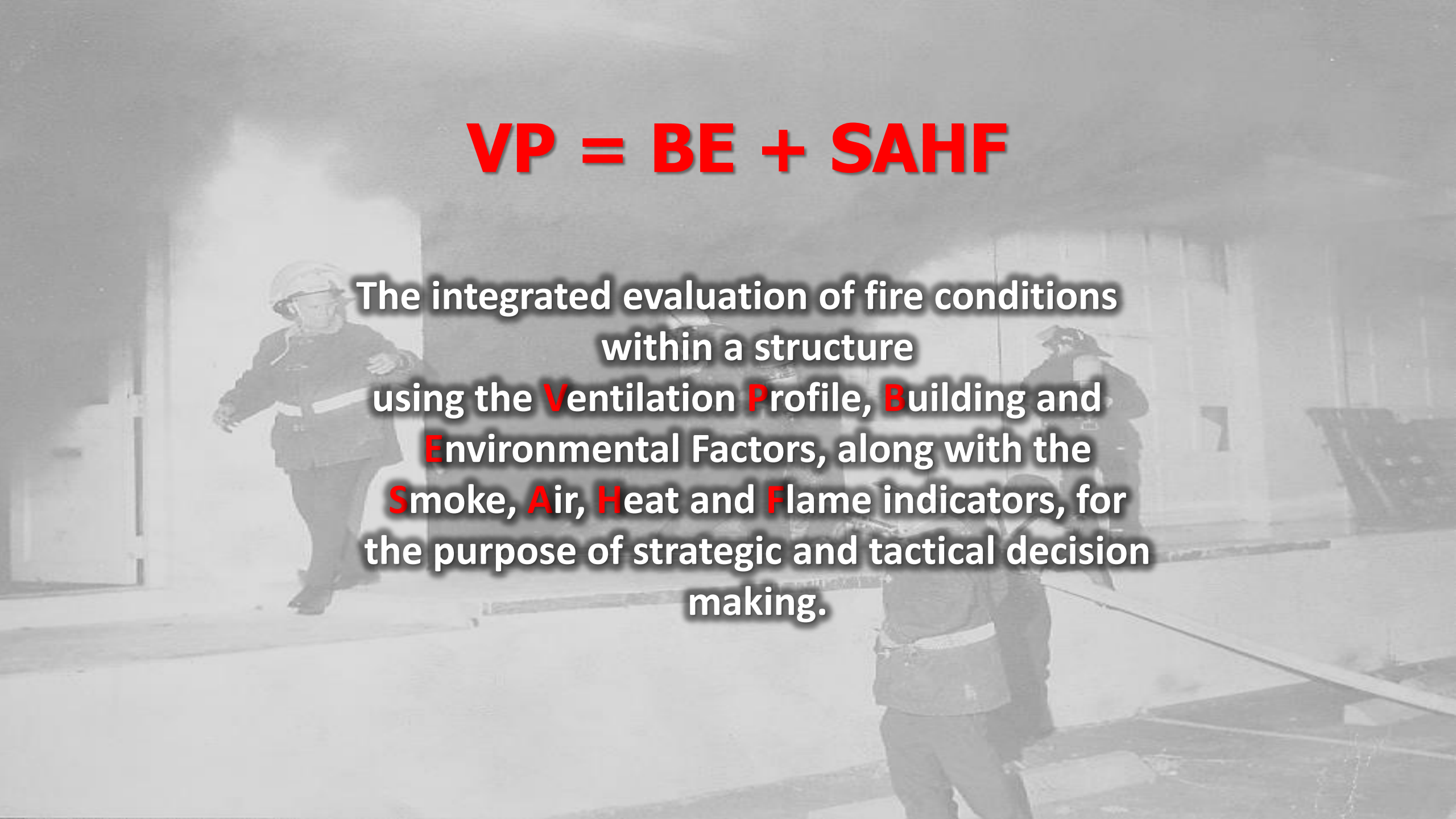
Situ-Wind-ational Awareness

- Weather reports
- Vegetation movement – grasses, plants & trees
- Flags & wind socks
- Wave action – ripples vs. waves
- Smoke movement
- Door opening forces
- Sound – whistling at lobby door or elevator shafts
- Signage
- **VENTILATION PROFILE !**

Ventilation Profile

The appearance of the <u>entire</u> fire building's ventilation openings, showing the flow paths of any air movement into the structure as well as smoke, heat or flame out of the structure. *(FKTP ➢ NFPA 1700)*





VP = BE + SAHF

The integrated evaluation of fire conditions within a structure using the Ventilation Profile, Building and Environmental Factors, along with the Smoke, Air, Heat and Flame indicators, for the purpose of strategic and tactical decision making.

VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators

- At openings, or within rooms, the smoke/air flow flow(s) may be classified as:

  - ❖Unidirectional flow
  - ❖Bidirectional flow
  - ❖Dynamic flow

Vent Profiles Dynamic Flow

- **Eccentric** - showing from corners of a window, but not from the centre of the window.
- **Projected** - exiting horizontally from the vent opening.
- **Inverted** - exiting the vent over the bottom of the window-sill.
- **Hollowed** - flames and smoke in an open window, but the opening is not venting flames or smoke.
- **Pulsations**
  - **Puffing -** pushing and puffing from an open vent in a pulsating pattern.
  - **Star Fire** - issuing from the building and being flattened against the building's surface.

VP = BE + SAHF

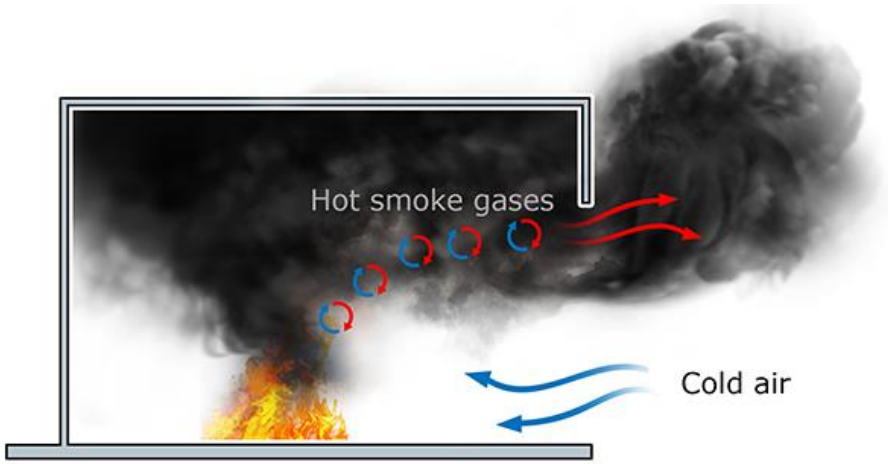
Smoke/Air Flow, Heat and Flame Indicators

- **Unidirectional Flow:**
  A flow of smoke/air moving in a single direction.

VP = BE + SAHF

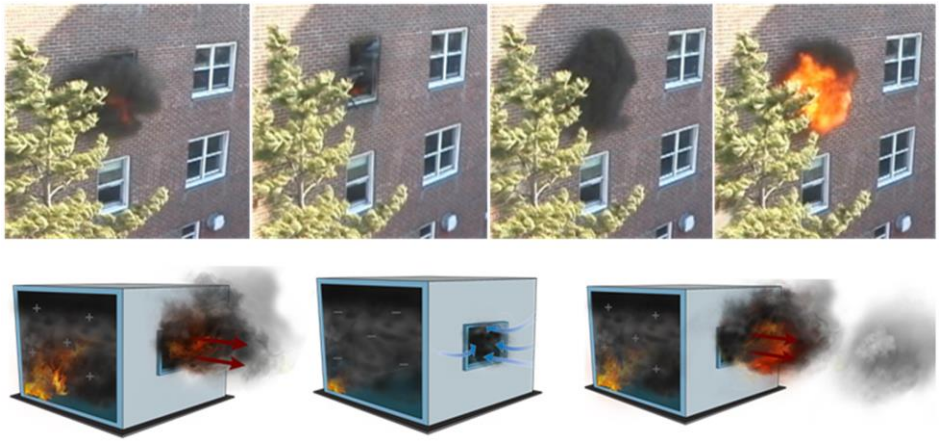
Smoke/Air Flow, Heat and Flame Indicators

- **Bidirectional Flow:**
  A smoke/air flow moving in opposing directions.



VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators



- **Dynamic Flow:**

  A unidirectional or bidirectional flow of smoke/air that presents irregular stratification and shape or alternates in direction (pulsations). *(NFPA 1700)*

VP = BE + SAHF

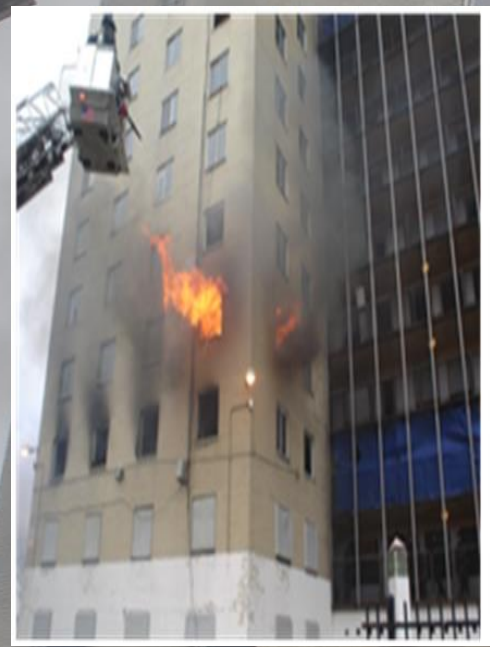
Smoke/Air Flow, Heat and Flame Indicators

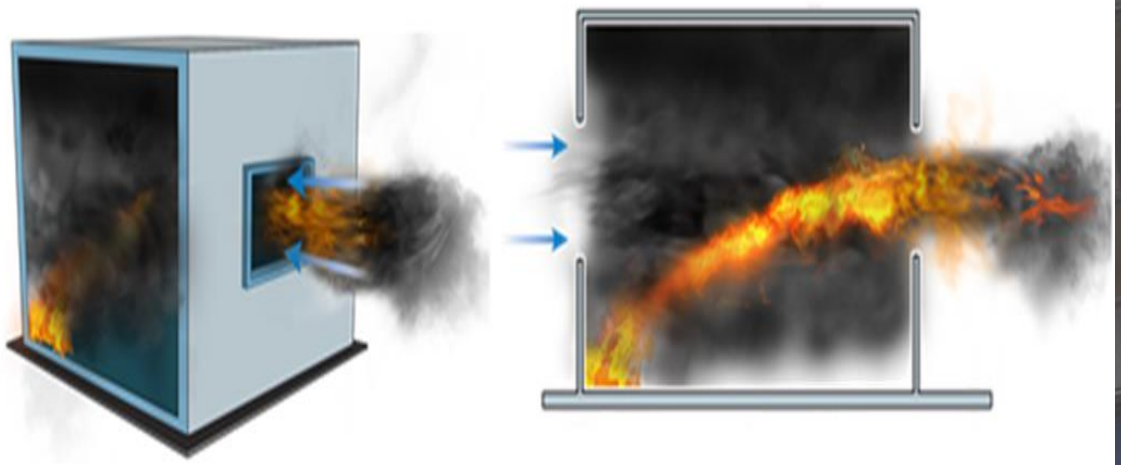
Dynamic Flow

- Eccentric

VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators



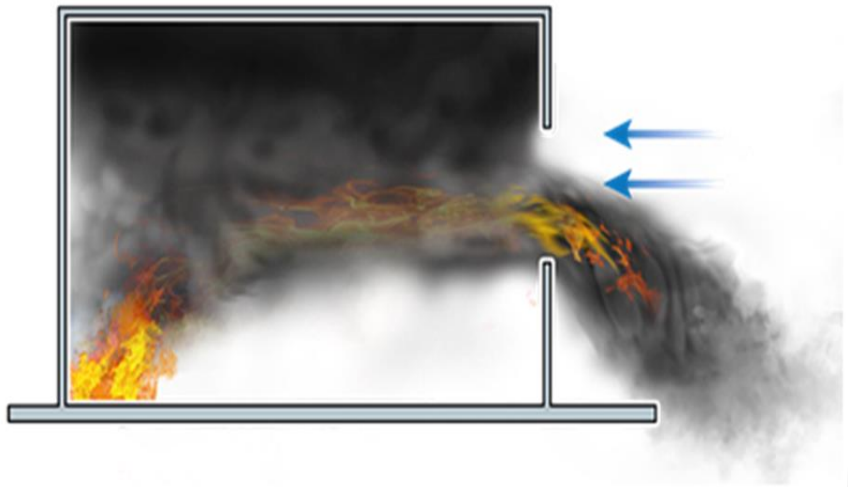


Dynamic Flow

– Projected

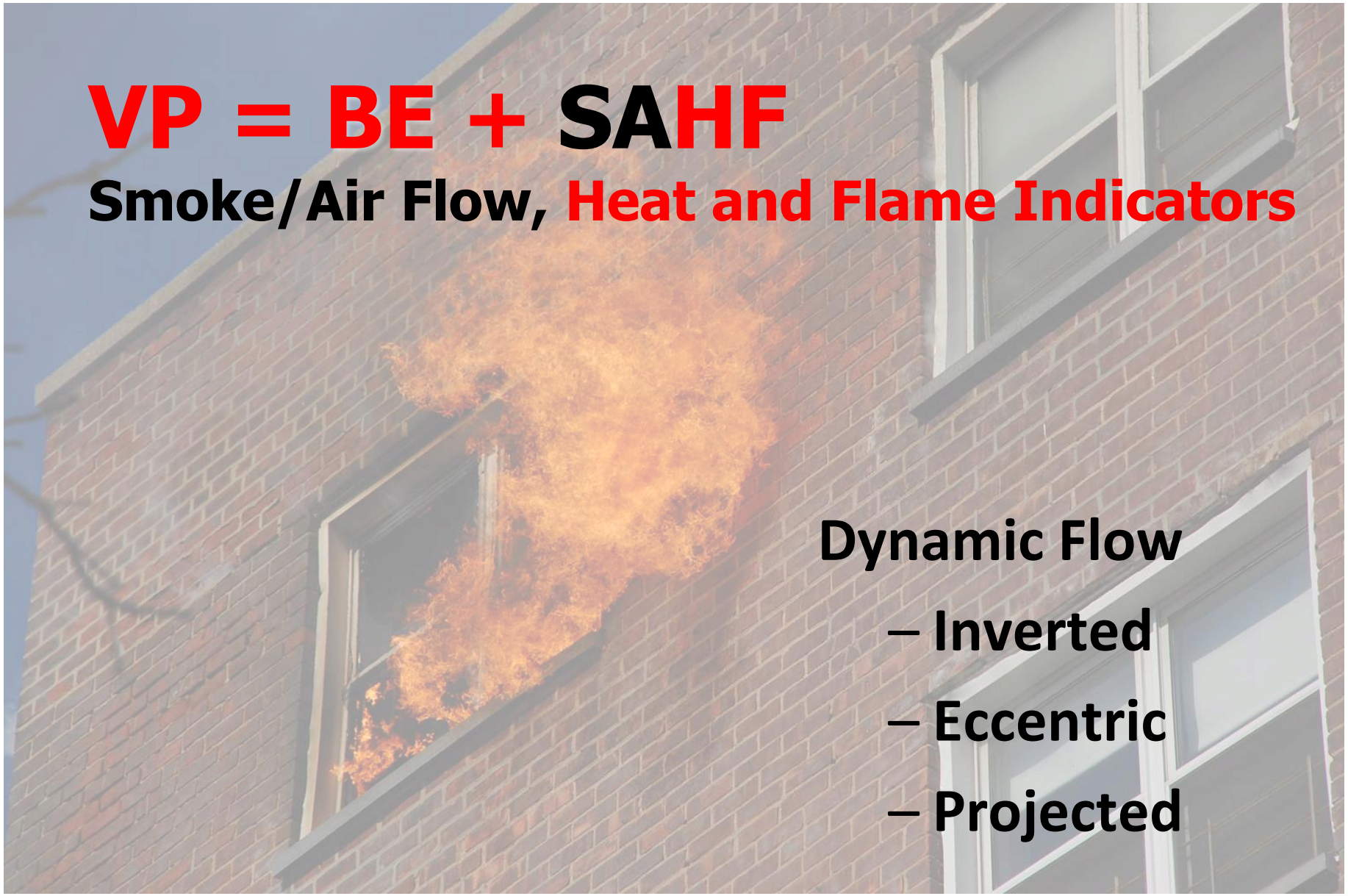
VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators



Dynamic Flow

- Inverted
- Projected



VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators

Dynamic Flow

- Inverted
- Eccentric
- Projected

VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators

Dynamic Flow

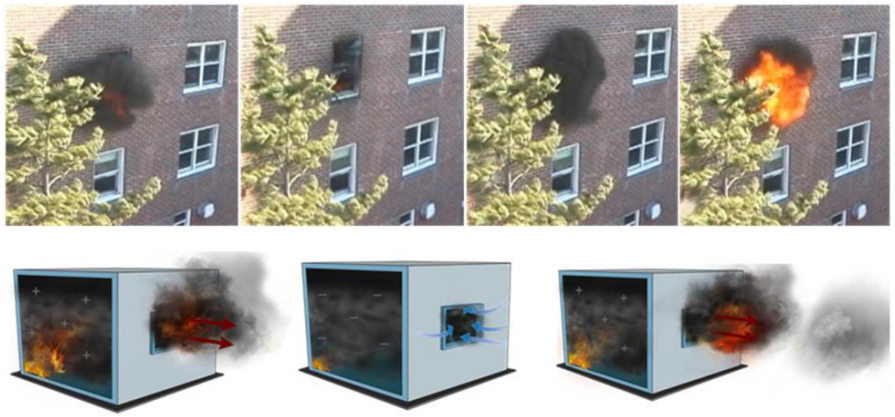
- **Hollowed**

VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators

Dynamic Flow

– Pulsations - Puffing



VP = BE + SAHF

Smoke/Air Flow, Heat and Flame Indicators

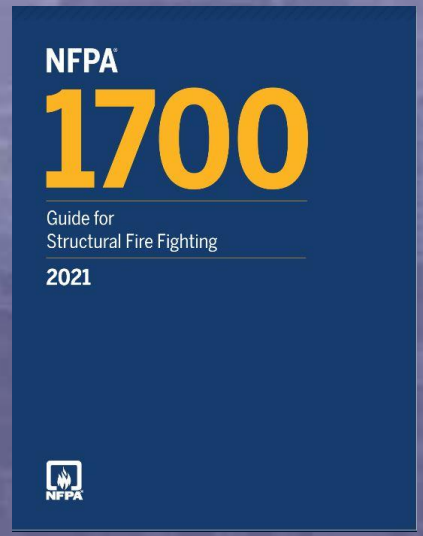
Dynamic Flow

– Pulsations - Starfire

Key To Understanding - Air Geometry

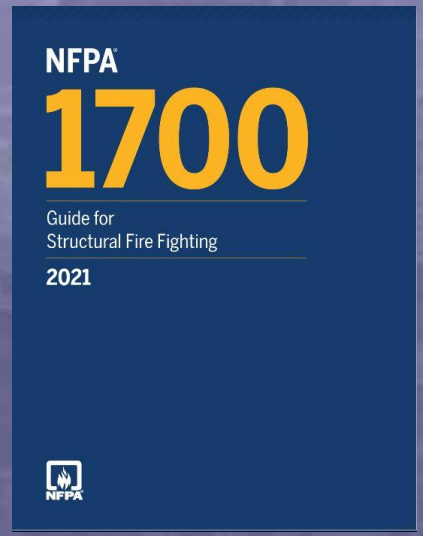
Recommendations

- Hazard Recognition, Assessment & Control
  - Education to Stakeholders
    - Curriculum revisions addressing wind & fire
    - NFPA 1700
    - Public
  - Individual study
    - **Vent Profile** - typical vs. atypical
  - Pre-plan
    - Alternative tactics/tools/techniques



Recommendations

- Professional advocacy
  - Code intervention
    - Expand wind assessment requirements
  - Engage wind engineering professionals
    - To enhance understanding
    - To develop visualization & assessment models for firefighters
  - Legislation lobby
    - Fire Fighter Life Safety Objectives in Codes



Who Has Seen The *Wind*?

dynamicfire.mcbride@gmail.com

https://www.firedynamicstraining.ca

THANK YOU!