The ART of Reading Smoke

Developed by:
Dave Dodson
Why “Read” Smoke?

To determine “HOW MUCH” fire
Why “Read” Smoke?

To help find the LOCATION of the fire
Why “Read” Smoke?

To help predict COLLAPSE potential
Why “Read” Smoke?

To help PRIORITIZE Strategies & Tactics
Why “Read” Smoke?

To PROTECT Firefighters from a “HOSTILE FIRE EVENT”
The “ADVANCED” Basics

Concept #1: Smoke is Fuel

Gases

Aerosols

Particulates
The “ADVANCED” Basics

Concept #2: Fuels have changed:
Mass and Make-up!
Concept #3: Smoke has trigger points:

- Flash Point
- Fire Point
- Ignition Temperature
The “ADVANCED” Basics

How does “flammable range” factor in?
Flammable Range & the Three Fires


Too Rich . . .

Too Lean . . .

Just Right . . .
The “ADVANCED” Basics

Need to be able to determine...

• What stage is the fire in...

• Is the “box” absorbing heat? *Laminar vs.*
  *Turbulent smoke flow*
“HOSTILE” Fire Events

- Flashover
- Backdraft
- Smoke Explosion
- Rapid Fire Spread
FLASHOVER

WARNING SIGNS:
- Turbulent Smoke
- “Rollover”
- Auto Ignition outside Smoke – Cloud Ignition is likely after flashover
Remember – Backdraft is triggered by O2 being introduced to a pressurized “box”

- Yellowish-grey smoke
- Whistling
- Bowing windows
- “Sealed” containers
Remember – A Smoke Explosion is a spark or flame applied to a mixture below its ignition temperature.

- Trapped gases in upper areas
- Growing fire
- Increasing smoke density
- Air intake overtaking smoke exiting
RAPID FIRE SPREAD

Usually “Container” Influenced
Fuel for fire spread is smoke driven vs. contents surface flaming
Look for fast-moving smoke in high pressure zones (stairs and hallways)
"Reading Smoke"

- Observations are typically made from outside - inside observations hide the "real" picture.
"Reading Smoke"

- Nothing is absolute
- Visible FIRE is easy to read - look past it for the real story
- Compare vent openings
The ART of Reading Smoke

A 4-STEP PROCESS to help predict fire behavior and hostile events
Step 1: Evaluate Key Factors

- Volume
- Velocity (Pressure)
- Density
- Color
Always relative to the “Box”
Tells “how much” fuel has off-gassed
Sets the Stage
VELOCITY (Pressure)

- How fast is the smoke leaving?
- Can indicate volume or heat
- Helps find the location of the actual fire
DENSITY

- Most Important Factor
- Quality of Burning
- Continuity of Fuel
- Likelihood of an event
- “Degree” of the Event
COLOR

- Rarely tells “material burning”
- Stage of Heating
- Location of Fire
- Amount of Flaming
- “Brown” Smoke
- “Black Fire”
“Black Fire” is the term we give to High Volume, High Velocity, Extremely Dense, Black Smoke. It is the sure sign of impending flashover – VENT & COOL are your only choices.
Step 2: Weigh Factors

- Container (most important factor)
- Thermal Balance
- Weather
- Firefighting efforts
Step 3: Judge the Rate of Change

How fast are SMOKE conditions getting better or worse?
Step 4: Predict the EVENT

Consider that:

- One hostile event can - and usually will - lead to another event.
- Communicate your observations.
- Warning Signs are not always visual – use your KNOWLEDGE and EXPERIENCE.

TRUST YOUR INSTINCTS...
Some other “Tricks”

When you open a door or window - watch what the smoke does – and what the fresh air does!
Some other “Tricks”

A 5-second change in any key factor means an event has taken place – the key is to define what event has taken place and to forecast what will likely happen next.
THE ART OF READING SMOKE

Some Examples
You Can Make a Difference!
Special THANKS to:

Mike Scott, Battalion Chief, Kent (WA) Fire
David Ross, Chief of Safety, Toronto Fire Services
Peter McBride, Shift Safety Chief, Ottawa Fire
• (303) 912-1201
Be Safe – *Make it Safe*

T**HANK YOU!**