FireWise CONSULTING LEARNING ACADEMY

FACTORS T... ...N BEHAVIOR

BEHAVIOR...

FIRE INCIDE...

YOUTH FIR... ...GORIES

HUMAN REA... ...EAT

CH. 11

Welcome to **Part 3 of Chapter 15, Analyzing the Incident which will cover** Fire-Related Human Behavior. If you are following us in NFPA 921 we are covering Chapter 11.
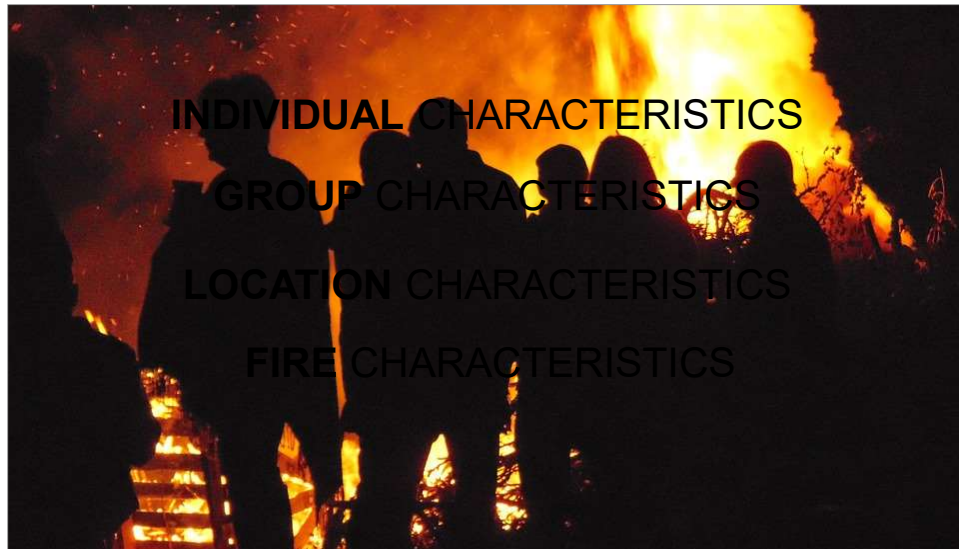
In this chapter we will:
- Discuss factors that affect human behavior,
- Identify the human behavior factors that relate to fire initiation, spread and development
- Present a fire incident case,
- Identify the recognized categories of youth firesetters, and finally,
- Describe the manner in which a person might react once they identify a threat.

HUMAN RESPONSE TO FIRE INCIDENTS

WHY THAT PARTICULAR ... ?
WHAT WERE THE CONSEQUENCES?

HOW IT STARTED	HOW IT DEVELOPS
HUMAN BEHAVIOR	RESPONSE

How a fire is started, how it develops, and the response to the fire are all affected in some way by human behavior. The study of fire-related human behavior became a distinct field for study in the 1970's. Fire Investigators today can integrate these insights into human behavior in their overall fire investigation to better understand why the witnesses or occupants behaved in a particular manner and the consequences that behavior had on the fire events.

HUMAN RESPONSE:
GENERAL CONSIDERATIONS

INDIVIDUAL CHARACTERISTICS

GROUP CHARACTERISTICS

LOCATION CHARACTERISTICS

FIRE CHARACTERISTICS

When studying the human response to fires, there are certain considerations to take into account. These considerations can be grouped within the following categories:

- The characteristics of the individual
- The characteristics of the group or population involved in the incident,
- The characteristics of the physical location as well as
- The characteristics of the fire itself.

CHARACTERISTICS OF THE INDIVIDUAL

PHYSICAL LIMITATIONS

AGE
PHYSICAL DISABILITIES
INJURIES
MEDICAL CONDITIONS
CHEMICAL IMPAIRMENT

COGNITIVE
COMPREHENSION

FAMILIARITY WITH SETTING

A person's response to a fire will be influenced by their physical limitations, their level of cognitive comprehension as well as how familiar they are with a particular setting.

When taking into account someone's physical limitations, a fire investigator must first consider the person's age as this will affect their mobility and therefore their response rate. It is important to remember that the very young and very old are the most at risk in a fire mainly due to their physical limitations.

Other questions to ask when assessing an individual's physical limitations include:
- Do they have a disability?
- Do they have an injury that limits or incapacitates them?
- Do they suffer from any medical conditions that might affect their response rate?
- Were they impaired at the time of the fire?

CHARACTERISTICS OF THE GROUP

SIZE

ZED RE

SMALLER GROUPS
RESPOND FASTER

WILL WAIT FOR LEADER
TO RESPOND FIRST

Individual characteristics are not the only aspects that influence a person's behavior in a fire. As the poet John Donne wrote, "No man is an island." An individual's response to a fire is also heavily influenced by the group of people they are with at the time of an incident.

Questions to consider are:

How big was the group? If the group was small, the response rate of individuals would likely have been quicker. People in larger groups, however, tend not to respond rapidly enough. This could be due to group dynamics; no one wants to be the first to sound the alarm or disrupt the way a group is working.

Did the group have a formalized structure? Individuals who are used to following the orders of a formal leader will delay their response until the person in that established role reacts. Schools, hospitals, nursing homes and churches are good examples of this kind of group. If you are a grade six student, you will most likely wait for your teacher to tell you to evacuate.

GROUP AND
NORMS

THE MORE FAMILIAR THE GROUP IS WITH EACH
OTHER THE QUICKER THE RESPONSE

How permanent was the group? Were they a family in their own home or a random assortment of people in a grocery store? Studies have shown that the more familiar a group is with each other, the quicker they are to respond and warn the others than when they do not know each other as well.

What were the roles and norms of the group? Socio-economic factors such as gender, social class, occupation, and education all affect response rates. For instance, studies show that women and men react to fire differently: men are more likely to try to put out the fire, while women are more likely to report it.

CHARACTERISTICS OF THE LOCATION

SUFFICIENT **# OF EXITS**

LOCATION OF EXITS

- CLEARLY MAR
- VISIBLE?

FAMILIARITY WITH B

WRONG

It is difficult to evacuate a high-rise building in case of fire.

↓

TRUTH

It takes less than 63 minutes to evacuate a high-rise building.

The characteristics of the burning structure can also have an effect on human response to fire.

A sufficient number of exits for the building size and occupancy rate, as well as the location of the exits being clearly marked and visible, can all have an impact on the people in the building at the time of the fire. In stressful situations such as a fire incident, people do not always react in predictable ways nor are they likely to be able to think straight. If a person is unfamiliar with the building, they will most likely try to exit the way they came in, even if it isn't the closest means of egress.
Making it easy for people to find the nearest exit goes a long way in ensuring an appropriate and timely response.

The height of the structure can also affect people's response to a fire. The common misconception that one is less safe in a tall building may lead to unpredictable behavior such as jumping out of windows during a fire.

FIRE ALARM SYSTEMS

VOICE MESSAGES MAY GET BETTER RESPONSE THAN **BELL ALONE**

MORE TIME TO RESPOND

FALSE SENSE OF SECURITY

OBSCURED VISIBILITY

In terms of fire alarm systems, studies have shown that voice messages or audio instructions may get a better response from occupants than just flashing lights and loud sounds alone. However, there is always the "boy who cried wolf" issue. If there are too many false alarms, people will hold off on responding in order to confirm there is an actual emergency, a delay that could be potentially lethal.

The presence of a fire suppression system may affect the behavior of occupants in a both a positive and a negative way. On one hand, they give occupants more time to respond. On the other, occupants might think the system is giving them more time than they actually have, giving them a false sense of security. The discharge of fire suppression agents can also obscure visibility when occupants are trying to escape, making it harder to find the exits.

CHARACTERISTICS OF THE FIRE

HIDDEN CHARACTERISTICS:
THREAT RESPONSE INFLUENCED BY:

TOXIC GASES
OLFACTORY

OXYGEN DEPLETION
VISUAL CUES

People's response to a threat is influenced by olfactory or visual cues such as the presence of smoke or flames. However, other existing fire characteristics may not be so evident, such as the presence of toxic gases or oxygen depletion. These can also have a severe affect on human response to a fire threat.

There are a few common misperceptions people have when it comes to fire and fire behavior:

MISPERCEPTIONS

#1 THE ASSUMPTION SMALL FLAMES DO NOT POSE A THREAT

#2 NOT UNDERSTANDING THE DANGERS OF SMOKE

**#3 NOT UNDERSTANDING HOW FIRE SUCKS UP OXYGEN**

#1: The assumption that small flames do not pose a threat. Many people don't understand how quickly a fire can grow. This means a person's response to the threat will be much slower than if they had immediately perceived the danger.

#2: Many people also don't understand the danger of smoke and the fact that it is toxic and incapacitating. They might have the misperception that light-colored smoke is less dangerous than dark-colored smoke, when really, both can be potentially lethal.

#3: Most individuals also don't always understand how a fire sucks up oxygen as it burns, which means that if you are in an enclosed space, there will be less air to breathe. They might not be aware that as a fire consumes oxygen, it then releases toxic by-products into the air. Inhaling these fumes may also result in impairment and can be lethal.

THE STATION NIGHT CLUB FIRE

Number of victims found by location (main exit at bottom-center)
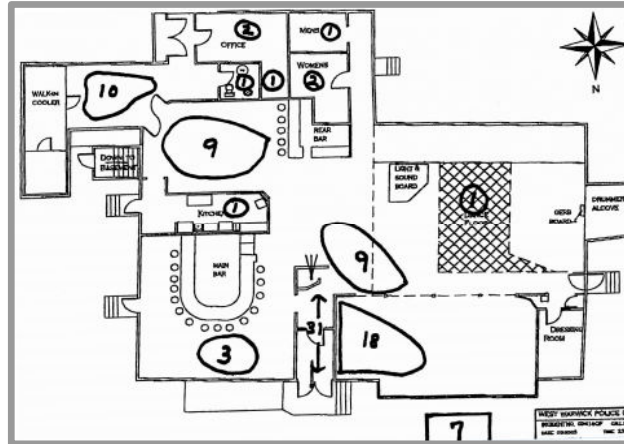
On February 20, 2003, the band *Great White* played a show to a packed audience at a nightclub in West Warwick, Rhode Island. At about 11:07 pm, the band started their set with their opening song, *Desert Moon*. The band manager set off a type of fireworks called "gerbs" which produce a controlled spray of sparks. The sparks landed on the plastic foam walls of the stage and ignited. Believing the flames to be part of the act, the crowd did not immediately react. It was only after the fireworks ended and the band, sensing the flames, stopped playing, that the crowd began to perceive the danger. At about this time the fire alarm activated. The nightclub was already filled with a toxic, thick black smoke from the burning foam which reduced visibility to almost nothing. Though there were 4 possible exits, most of the crowd tried to exit through the main entrance, creating a bottleneck and subsequent stampede. Out of the 462 people in attendance, 100 people lost their lives and half were injured either by burns, smoke inhalation, thermal trauma or trampling.

INDIVIDUAL CHARACTERISTICS
GROUP CHARACTERISTICS

LARGE GROUP – SLOW TO RESPOND

IMPAIRMENT

WAITING TO BE TOLD TO REACT

TRYING TO LEAVE THROUGH THE **MAIN ENTRANCE**

Let's take a minute to break down the Station Nightclub Fire into the 4 categories of Fire-related human behavior characteristics we discussed above.

What were the individual characteristics that came into play? Because people were not familiar with the venue and the existence of the other exits, they tried to leave the way they came in, which quickly caused a bottleneck. Panic ensued and a dangerous stampede resulted in many casualties. Impairment both by alcohol, toxic fumes and smoke inhalation as well as a group mentality, were all potential factors in slow response times.

As we have mentioned above, groups that know each other well are most likely to respond more quickly to a fire. However, in the case of a packed nightclub, this solidarity did not exist. People only began reacting after the band alerted the audience to a threat by ceasing to play.

THE STATION NIGHT CLUB FIRE - HUMAN BEHAVIOR

FIRE CHARACTERISTICS (overlapping with **EDUCATION CHARACTERISTICS**)

- **SMALL FLAMES** DID NOT SEEM ALARMING (overlapping with **OVER CAPACITY**)
- **OPAQUE SMOKE** (overlapping with **NO SPRINKLER** SYSTEM)
- **EXPOSED** URETHANE FOAM
- **BLOCKED** EXITS

Although the nightclub had a maximum capacity of 404 people, there were 462 people present during the time of the fire. The nightclub was over its capacity. Although the space should have had a sprinkler system, it did not. The exposed urethane foam used to soundproof the stage area was highly flammable and produced a very dark, aggressive smoke that emitted deadly carbon monoxide and hydrogen cyanide. A witness also reported that one exit was blocked by a table and that a bouncer would not let people through the exit reserved for the members of the band.

At first the flames did not seem alarming, but grew very quickly. It was only when the flames reached the ceiling and smoke began to accumulate that people realized the danger. The dark space, quickly became even darker with the opaque smoke from the polyurethane foam. The building was engulfed in flames within minutes.

FIRE INITIATION & HUMAN BEHAVIOR

EVALUATE THE ACTIONS OR OMISSIONS WHICH MIGHT INCLU...

(overlapping text, illegible) ...WARNINGS, ...EQUIPMENT/APPLIAN... RECALLS...


Remember that fire incidents usually occur because of something someone, or multiple people, did or did not do either before or during the fire. As a fire investigator, your job is to evaluate these actions or omissions which can include:
- Improper maintenance and operation of equipment and appliances,
- Careless housekeeping,
- Failure to follow product labels, instructions, warnings, and recalls as well as
- Violations of fire safety codes and standards

IMPROPER MAINTENANCE & OPERATION
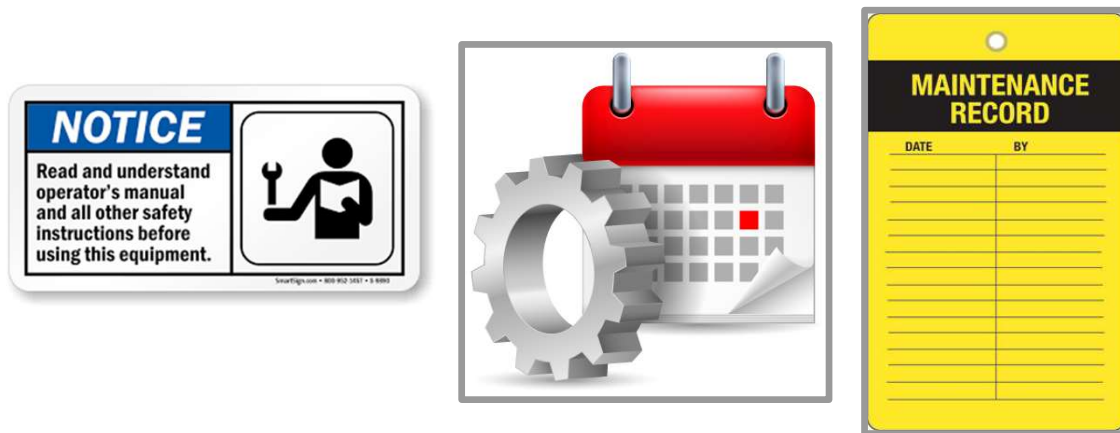
Every piece of equipment and every appliance needs to be maintained during its lifetime. Most manufacturers will provide a prescribed maintenance schedule that should be followed in order to prevent malfunctions. If the piece of equipment is capable of exploding or starting a fire, adherence to the prescribed maintenance schedule becomes even more important. As well, the official operating procedures are designed with everyone's safety in mind; if they are not followed properly it can lead to fire or explosions. For instance, the "gerbs" in the example above were not meant to be ignited indoors.

As an investigator, it is important you examine the maintenance records for all equipment and appliances involved in a fire. Remember, if these schedules and procedures have not been well-maintained, you may encounter some resistance; the individual or individuals in charge may not give them up voluntarily.

There are many potential hazards in our households and a lack of proper house keeping measures can contribute directly or indirectly to the occurrence of a fire. For example, paper products and ignitable liquids should not be stored adjacent to the pilot light of a water heater.
The discard of cigarettes or matches needs to be handled with extreme care. Combustibles should not be allowed to accumulate too close to an ignition source; many pieces of equipment or appliances will specify the clearance distance needed for close by combustibles.

Other potential housekeeping hazards include:
• grease build-up in the kitchen,
• improperly stored cleaning solutions,
• Large amounts of dust or other particulate matter becoming suspended in the air in the same environment as open flames or spark-inducing equipment,
and
• Lint build up in dryers.

4 COMPONENTS OF A PROPER WARNING

1. AN **ALERT WORD**

2. **STATEMENT OF THE DANGER**

3. HOW TO **AVOID THE DANGER**

4. **CONSEQUENCES**
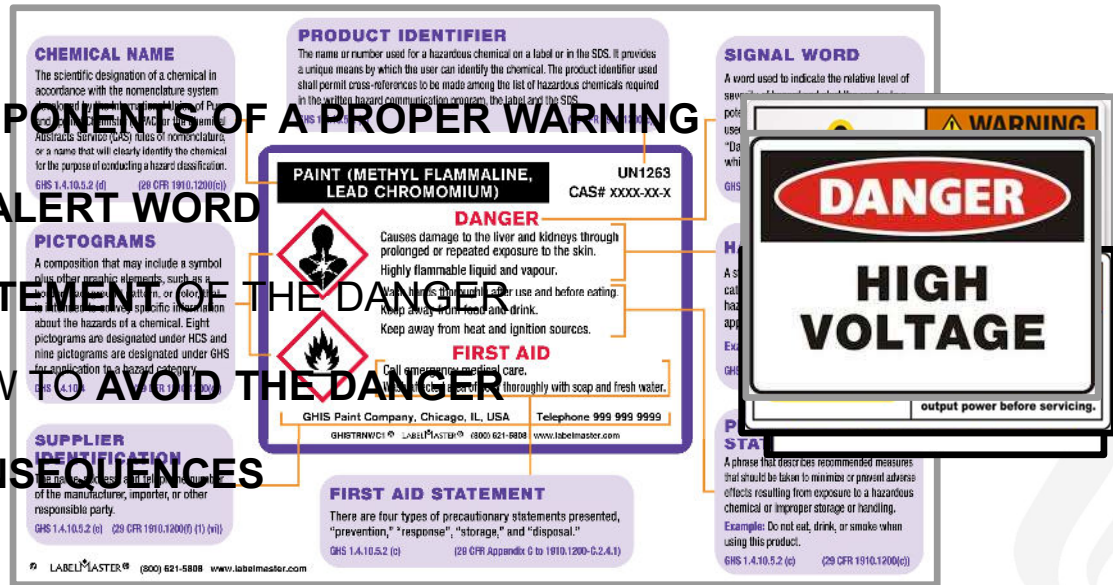
A lack of awareness of, or a disregard for product labels, instructions and warnings can also result in the accidental ignition of a fire.

A proper warning has 4 main components:
-An alert word such as "Caution", "Danger" or "Warning",
-A statement of danger,
-How to avoid the danger, and
-The consequences of the danger.

PRODUCT LABELS, INSTRUCTIONS & WARNINGS

CAUTIONS, WARNINGS & DANGER:

A caution indicates that a potentially hazardous situation may result in minor or moderate injury if not avoided,

A warning indicates a potentially hazardous situation that if not avoided could result in death or serious injury,

And danger indicates, if potentially hazardous situation if not avoided, it *will* result in death or serious injury

There are established guidelines and standards for labels, warnings and product instructions that have been developed over the years by industries and government. For instance, the American National Standard Institute differentiates between cautions, warnings and danger in the following manner:

- The word caution, indicates that a potentially hazardous situation **may** result in minor or moderate injury if not avoided,
- A warning indicates a potentially hazardous situation that if not avoided **could** result in death or serious injury,
- And danger indicates, if a potentially hazardous situation is not avoided, it **will** result in death or serious injury.

Consumer Product Update - Warns of
Fire Risk to Oxygen Therapy Patients
from Electronic Cigarettes & Other
Electrical Devices
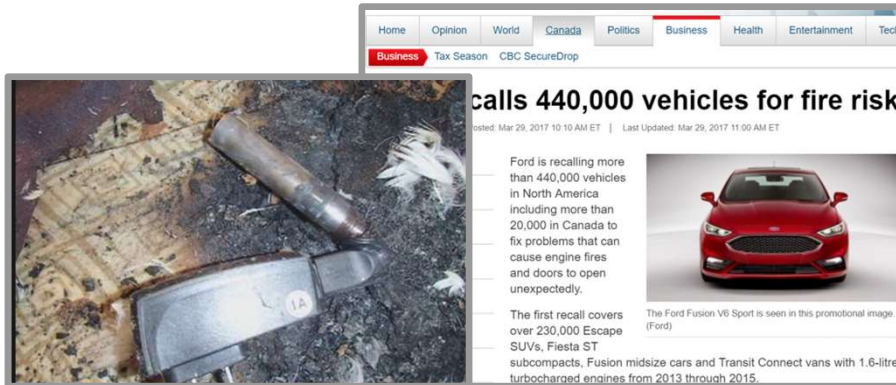
A recall notice occurs when a product that has already been released to the public is found to be defective in some way. Mostly, recalls occur because the defect can potentially cause a hazardous situation even if the product is being used correctly.

If an individual ignores a recall notice, the result could be a fire, explosion or other catastrophe.

VIOLATING FIRE CODES & STANDARDS

DELIBERATE OR **UNINTENTIONAL?**

It is important to be aware the fire incident could have resulted from violations to fire safety codes and standards, and that these violations may be deliberate or unintentional. When conducting an origin and cause determination, it can be hard to know whether the misuse or abuse of the product, or carelessness was deliberate or accidental. The fire investigator should examine training records, maintenance records, and any other relevant documentation. Check with the local fire bureau to see if any violations of codes have been issued that can provide clues to a pattern of behavior that might have resulted in the fire incident.

RECOGNIZED CATEGORIES BASED ON DEVELOPMENTAL STAGE & AGE:

PRESCHOOL — CURIOSITY

EARLY ELEMENTARY — LACK CAUSE & EFFECT

LATENCY (APPROX. AGES 8-12) — ACCIDENTAL, CRISIS/ EMOTIONAL

ADOLESCENT — BOREDOM, TEST & OVERCOME LIMITS, ACCEPTANCE OF PEERS

Youth Fire-Setting Behaviour.

Research has shown that the location of where the fire is set and the motive for it often vary according to the developmental stage and age of the child. It is important to note that a child's physical age may not be consistent with his/her development stage. There are four recognized categories of children who exhibit fire-setting behaviour.

Preschool. Preschool-aged children usually set fire out of curiosity, but are unable to comprehend how a small fire such as a match can grow into a house fire.

Early Elementary. In early elementary years children still have difficulties understanding cause and effect reasoning especially in the case of fire development.

Latency. Children approximately 8-12 years old may start a fire accidentally, but crisis/emotional fire-setting behaviour is seen most often because they are the least able to cope with any kind of change or traumatic event.

Adolescent. Adolescents have a need for independence and autonomy, but can fail to think decisions through and will start fires out of boredom, a way of testing and overcoming their limits or to be accepted by peers. These fires fall into the delinquent fire-setting category.

REHABILITATION IS MOST EFFECTIVE ON THE YOUNG

Many fire departments have community-based Youth Fire-Setting Behaviour Programs. These programs emphasize detection and initial assessment of the child and rely heavily on fire safety education as an intervention measure.

Web Object

Select this object and click
the **Web Object** button to edit

Dehaan Video # 15 Dr. DeHaan: Human Response to Fires

R & R
RECOGNITION & RESPONSE

SIGHT

SOUND

A person's ability to recognise and appropriately respond to the danger in a fire situation is critical to their survival. This ability can be affected by their physical or mental state or chemical impairment.
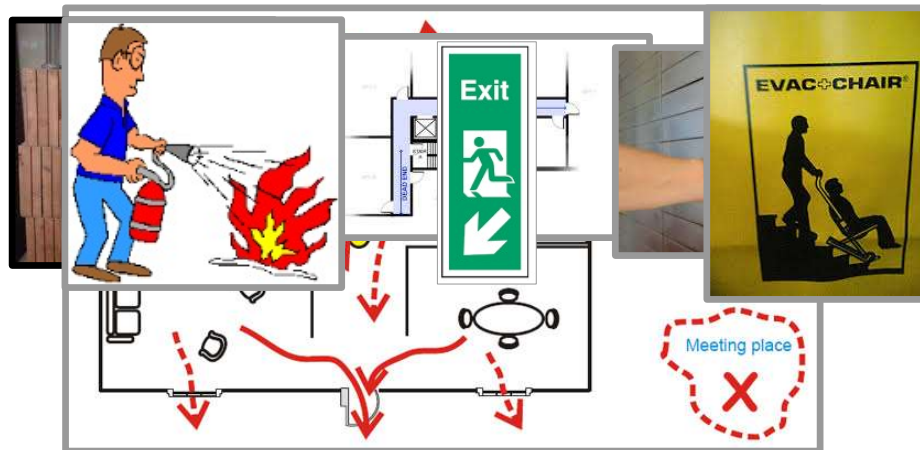
A person's reaction to a fire is based on the following:
Sight: do they have a direct view of the flames, smoke or even the flicker of a visual alarm?
Sound: Can they hear the crackling of the flames, audio alarms, windows breaking, dogs barking, children crying, or voices shouting?
Feel: Can they feel the room getting hotter and hotter? Can they feel the building shift under them?
Smell: Can they smell the smoke?

How easy was it to escape the building? Was the individual able to clearly identify escape routes? Did the fire conditions impede their means of egress? Were there any dead end corridors or obstacles blocking the escape path? Did the individual have any physical disability or impairment that slowed down their progress?

These perceptions will influence their decisions and reactions. Will they ignore the problem? Try to fight the fire? Sound the alarm? Try to rescue any people, pets or objects in the building? Will they flee or remain? All of these decisions will be affected by the individual's state of mind at the time.

PERSONAL INTERVIEWS CAN ESTABLISH:

- CONDITIONS OF THE STRUCTURE **PRE-FIRE**
- HOW FIRE/SMOKE DEVELOPED
- LOCATION OF FUEL PACKAGES

Interviewing the survivors of the fire incidents will provide valuable clues as to how and why people behaved the way they did during the fire. Personal interviews can help establish:
- What the conditions of the structure were before the fire,
- How the fire and smoke developed,
- Where the fuel packages were located and what was their orientation,
- What the victims were doing before, during and after the fire was discovered,
- What actions did individuals take in order to survive,
- What kind of decisions the survivors made and why,
- as well as

SURVIVOR INTERVIEWS

CRITICAL FIRE EVENTS SUCH AS:

- FLASHOBSERS VED SMOKE
- STRUCTURAL FEDLURAMESS
- FDIMBRWSL
- CONTACT MADE

- Details on the critical fire events such as:
  - flashovers,
  - structural failures,
  - Window breakage,
  - Alarm soundings
  - When the first smoke was observed,
  - When the first flames were observed,
  - When the fire department arrived,
  - And when contact was made with others in the building.

LOCATION CHARACTERISTICS

INDIVIDUAL CHARACTERISTICS

GROUP CHARACTERISTICS

In this chapter we discussed:

- What to consider when understanding human responses to fire incidents, including:
    - The characteristics of
        - The individual,
        - The group or population,
        - The location of the fire,
        - And of the fire itself.
- The case of the Station Nightclub fire and the various human responses that influenced the number of casualties,

RECALL THE HUMAN FACTORS   WARNINGS
PRODUCT LABELS INSTRUCTIONS
INSTALLATION

SAFETY CODE AND STANDARDS VIOLATIONS
IMPROPER MAINTENANCE AND OPERATION OF
   EQUIPMENT AND APPLIANCES
CAUTIONS
YOUTH FIRESETTERS
WARNINGS
   CARELESS HOUSEKEEPING
DANGERS
RECOGNITION AND RESPONSE

- The human factors related to fire initiation including:
    - The improper maintenance and operation of equipment and appliances, and
    - Careless housekeeping,

- The reason for product labels, instructions and warnings, including the difference between:
    - Cautions
    - Warnings and
    - Dangers
- Recalls
- Safety code and standards violations
- The different categories of youth firesetters
- And the manner in which people recognize and respond to fires

QUIZ

?

CONTACT
TRAINING@FIREWISECONSULTING.COM

That's the end of **Chapter 15, Analyzing the Incident**. You are now ready to move on to **Chapter 16 which deals with Explosions**, but please complete the quiz for **Chapter 15** first.

If you have any questions now is a good time to contact your teacher.