Safety
NFPA 921, Chapter 13

References
Primary
Chapter 13

Bibliography
The Bibliography is included as Appendix A of the participants handout.

Copies of the reports included in this presentation can be obtained from the TRACE Fire Protection and Safety website
www.tracefireandsafety.com

Links to the US Government websites are provided in the Bibliography. Appendix A
I. Introduction

13.1* General. Fire scenes, by their nature, are dangerous places. Fire investigators have an obligation to themselves and perhaps to others (such as other investigators, equipment operators, laborers, property owners, attorneys) who may be endangered at fire scenes during the investigation process.

A. The Problem

A. The Problem?

How many fire investigators die or suffer injuries while investigating fires?
1. Fire Fighter Fatality Investigation and Prevention Program, NIOSH


Fire Scene

SUMMARY

On January 19, 1999, a 45-year-old career fire investigator (the victim) was killed during an investigation to determine the origin and cause of a residential fire that occurred on January 14, 1999. The victim, part of an irregular duty crew, was assigned to an on-scene advisory support fire investigator and an electrical consultant at the fire scene about 11:00 hours on the day of the incident. All fire men proceeded to the attic area of the remaining structure to conduct the investigation. About 15 minutes into the investigation, the insurance adjuster left the men and proceeded to the floors below to review the survey of the damage. The other three men, including the victim, remained in the attic and observed through the windows for clues to the origin of the fire. (Note: working for 2 hours near the front section of the attic). The victim was hit on the left side by a brick chimney. He was immediately sent to the floor about 11 feet above the floor level of the attic. After placing the victim in a neighboring house and called 911. At this time another fire investigator moved to the scene and was arrived at the scene. He used his fall radio and fire rescue company. Within a few minutes, two fire trucks arrived on the scene and the firemen were able to lift the chimney off the victim. Emergency medical personnel responded and the victim was transported to the local hospital where he died from his injuries. NIOSH investigators concluded that, to minimize the risk of similar occurrences, fire departments should...
Block Chimney

Arson Investigator Dies from Injuries Sustained from a Fall During an Arson Investigation. Illinois Report issued April 23, 2001

A. The Problem?

- How many fire investigators die or suffer injuries while investigating fires?
- How many fire investigators are affected by exposure to health risks while investigating fires?
Fire Investigator Statistics?

- Fire Investigation Community is a sub-set population and specific data is generally not known.
- Fire Investigation Community has both public and private sector members.
- Currently, only Public Sector Investigators are included in the NIOSH reports.
- Public Sector Fire Investigators are often transient and frequently move to another area of the Fire Service.

A. The Problem?

- How many fire investigators die or suffer injuries while investigating fires?
- How many fire investigators are affected by exposure to health risks while investigating fires?
- What types of diseases are fire investigators exhibiting as a result of the exposures?

Study of Cancer among US Fire Fighters

- In a NIOSH update, April 23, 2010, it was reported that NIOSH and the United States Fire Administration (USFA) were partnering to study Cancer among Firefighters.

- NIOSH Bibliography: 139 Titles and Abstracts
A. The Problem?

- How many fire investigators die or suffer injuries while investigating fires?
- How many fire investigators are affected by exposure to health risks while investigating fires?
- What types of diseases are fire investigators exhibiting as a result of the exposures?
- Where is the research to indicate that there are Safety and Health Risks on the fire scene?

B. Research and Literature


The Bureau of Alcohol, Tobacco, and Firearms (ATF) in April 1996 contacted the National Institute for Occupational Safety and Health (NIOSH) and requested a health hazard evaluation (HHE) regarding respiratory hazards associated with fire investigations.
Report Recommendations

1. The ATF should require their investigators to wear appropriate respiratory protection when performing fire scene investigations.

SCBAs would most likely not be practical during most fire scene investigations;

- Half-Face Air-Purifying Respirators combination filter cartridges (high-efficiency particulate, VOCs, acid mists, and formaldehyde)
- Powered Air-Purifying Respirators with the appropriate filter cartridges should be used.
- Non-IDLH Atmospheres

Report Recommendations

2. The ATF should establish a respiratory protection program for their fire investigators and ensure that it complies with the requirements described in 29 CFR 1910.134 (OSHA Standard).
Respiratory Protection Program

a. Written operating procedures  
b. Appropriate respirator selection  
c. Employee training  
d. Effective cleaning of respirators  
e. Proper storage  
f. Routine inspection and repair  
g. Exposure surveillance  
h. Program review  
i. Medical approval  
j. Use of approved respirators

Fit Testing?

Report Recommendations

3. The use of mechanical ventilation equipment that removes the contaminants from the areas where fire investigators are working should be utilized whenever possible.

Ventilation

Alteration of the fire scene (removing windows, doors, etc.) that promotes natural ventilation should also be considered when it would not affect the preservation of the fire scene.

- Inlet and Exhaust remote  
- Inlet and Exhaust same location
Report Recommendations

4. The use of other protective clothing should be implemented.

Protective Eye wear  Hearing Protection
Head Protection  Protective Clothing
Safety Shoes/Boots  Hazard Specific Items
Gloves

Report did not include recommendations

Report Recommendations

4. To reduce the potential for contaminants being carried home by fire investigators, the use of disposable coveralls, boots, and gloves should be considered.

- Laundering of any potentially contaminated clothing should be provided by a contractor who is aware of the contamination potential.

Report Recommendations

4. ATF should also train its fire investigators in the use of appropriate decontamination procedures utilized by emergency responders.

ATF request to NIOSH

August 19, 2004, the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) contacted the National Institute for Occupational Safety and Health (NIOSH) requesting an investigation concerning potential exposures during fire scene investigations. Concerns were raised about the presence of contamination of work uniforms upon completion of an investigation, removal of the contamination following home laundering, and contamination of home washing machines from contaminated uniforms. At the time of the request, employees had not reported health effects associated with chemical exposures during fire scene investigations.

Report Conclusions

1. Contamination of a washing machine/dryer used by an ATF fire scene investigator to launder his/her uniform is unlikely.

2. Contamination of subsequent loads of laundry is also unlikely.
Report Conclusions

3. There is a potential for contamination of other clothing being laundered with soiled uniforms.
4. Due to the number of uncontrolled variables in this study, definitive conclusions cannot be made as to whether a significant amount of PAH contamination was removed during the laundering of soiled field uniforms.

Report Conclusions

5. Additional studies are needed to provide for better comparisons of field samples and known contaminants.

Report Recommendations

1. Due to the potential for exposure to PAHs, some of which may be carcinogenic, NIOSH investigators recommend the use of protective clothing for ATF agents involved in fire scene investigation.

Polynuclear Aromatic Hydrocarbons (PAHs)
Polynuclear Aromatic Hydrocarbons, (PAHs)

<table>
<thead>
<tr>
<th>PAH Compound</th>
<th>Levels Detected (preliminary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphthalene</td>
<td>0.001-2.2 μg/sample</td>
</tr>
<tr>
<td>Acenaphthylene</td>
<td>0.005-0.04 μg/sample</td>
</tr>
<tr>
<td>Acenaphthanthrene</td>
<td>0.005-0.04 μg/sample</td>
</tr>
<tr>
<td>Fluorene</td>
<td>0.005-0.04 μg/sample</td>
</tr>
<tr>
<td>Phenanthrene Anthracene</td>
<td>0.001-0.2 μg/sample</td>
</tr>
<tr>
<td>Fluoranthene Pyrene</td>
<td>0.001-2.2 μg/sample</td>
</tr>
<tr>
<td>Chrysene Benzo(a)Pyrrene</td>
<td>0.001-2.2 μg/sample</td>
</tr>
<tr>
<td>Benzo(b)fluoranthene</td>
<td>0.001-0.2 μg/sample</td>
</tr>
<tr>
<td>Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene</td>
<td>0.001-0.2 μg/sample</td>
</tr>
</tbody>
</table>

Limit of Detection = estimated 0.011 μg/sample

Report Recommendations

2. To reduce the potential for carrying these contaminants home, disposable coveralls should be worn at the fire scene then discarded when the investigation is finished prior to entering a personal or official vehicle.

Cross Contamination

- Alternatively, a professional laundry service could be used to launder the uniforms currently worn by fire scene investigators.
Report Recommendations

3. ATF agents should wear disposable, chemical resistant gloves to further protect themselves from dermal exposures at a fire scene.

C. Additional Research

• “Characterization of Firefighter Exposures During Fire Overhaul”

• “Firefighter Exposure to Smoke Particulates”

D. Causes of Accidents and Illnesses
Causes of Accidents and Illnesses

<table>
<thead>
<tr>
<th>Accidents / Illnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous Acts</td>
</tr>
<tr>
<td>Hazardous Conditions</td>
</tr>
<tr>
<td>Unaware</td>
</tr>
<tr>
<td>Unable</td>
</tr>
<tr>
<td>Unmotivated</td>
</tr>
<tr>
<td>Unidentified</td>
</tr>
<tr>
<td>Uncorrected</td>
</tr>
</tbody>
</table>

II. Hazard Identification, Risk Assessment, and Control Procedures

Purpose:
To ensure that there is a formal process for hazard identification; risk assessment and control to assist in effectively manage hazards that may occur within the workplace.
**Key Terminology**

**Hazard:**
Anything (e.g. condition, situation, practice, behavior) that has the potential to cause harm, including injury, disease, death, environmental or property and equipment damage.

**Key Terminology**

**Hazard Identification:**
This is the process of examining each work area and work task for the purpose of identifying all the hazards which are “inherent in the job” (Task).

**Key Terminology**

**Risk:**
The likelihood or probability that a hazardous event (with a given outcome or consequence) will occur.
Key Terminology

Risk Assessment:
Can be defined as the process of assessing the risks associated with each of the hazards identified so that appropriate control measures can be implemented based on the probability, i.e., likelihood that harm, injury or ill health may occur and how severe the consequences of exposure might be.

Key Terminology

Risk Control:
This is the process of identifying and implementing the most cost effective risk control measures having regard to the Hierarchy of Control Principle.
- Engineering
- Administrative
- Personal Protective Equipment

Key Terminology

Monitoring and Review (Audit):
This involves ongoing monitoring of the hazards identified, risk assessment and risk control processes and reviewing them to make sure they are working effectively.
Hazard and Risk Assessment

1. Identify the Hazards
2. Assess the Risk
3. Control the Hazard
4. Audit

Monitor and Re-Evaluate

FIGURE A.12.4.1 Sample Hazard and Risk Assessment.

Step 1: Identify Hazards
A. Physical Hazards

- Slip, Trip, and Fall
- Sharp Surfaces
- Broken Glass
- Environmental Hazards
  - Temperature Extremes
  - Fatigue
  - Strenuous Physical Activity

Fall Hazards

Fall Protection Required?
Scaffolding?

Physical Hazard?
• Vehicle Fire Investigation
B. Structural Hazards

Structural Hazard?

Structural Hazards?
Structural Hazards?

C. Electrical Hazards

Electrical Hazards?
Electrical Hazards?

C. Electrical Hazards

- Isolate Area
- Proper Tools and Equipment
- GFCI’s
- Intrinsically Safe
D. Chemical Hazards

Chemical Hazard?

Chemical Hazard?
D. Chemical Hazards

• Isolate Area
• Safety Data Sheets (SDS)
• Remove Hazard
• Appropriate PPE

Safety Data Sheets (SDS)

What is in the container?
Global Harmonization System

https://www.osha.gov/dsg/hazcom/index.html

E. Biological Hazards

Biological Hazard?
Biological Hazards

Storage and Disposal

F. Mechanical Hazards

Lock Out/Tag Out
Zero Mechanical State

Lock Out Tag Out
Zero Mechanical State
Technical Assistance
Lock Out/Tag Out?

Key Concepts:
- Focus on the Identification and Control of the hazards present and not the proper classification.
- Modify the types of Hazards and Risks based on the actual scene.

Step 2: Determine the Risk of the Hazard
Step 2: Determine the Risk of the Hazard

<table>
<thead>
<tr>
<th>Rating</th>
<th>Impact</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Disabling injury, loss of</td>
<td>• Repetitive Event</td>
</tr>
<tr>
<td></td>
<td>body part, or fatality</td>
<td>• Greater than 50% chance of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Has happened frequently in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>similar circumstances</td>
</tr>
<tr>
<td>Medium/Moderate</td>
<td>Medical Aid Injury</td>
<td>• Infrequent Event</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 10-50% chance of occurring</td>
</tr>
<tr>
<td>Low</td>
<td>First Aid Injury</td>
<td>• Unlikely Event</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less than 10% chance of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Has never been observed but is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• felt to be possible.</td>
</tr>
</tbody>
</table>

Risk Assessment Matrix based on FM 5-19

<table>
<thead>
<tr>
<th>Severity</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic</td>
<td>I</td>
</tr>
<tr>
<td>Critical</td>
<td>II</td>
</tr>
<tr>
<td>Marginal</td>
<td>III</td>
</tr>
<tr>
<td>Negligible</td>
<td>IV</td>
</tr>
<tr>
<td>E-Extremely High</td>
<td>H-High</td>
</tr>
<tr>
<td>M-Moderate</td>
<td>L-Low</td>
</tr>
</tbody>
</table>

FM 5-19 and FM 100-14 are located in the course resources

Risk?
Risk?

Step 3: Control the hazard

A. Engineering Controls
B. Administrative Control

Time, Distance and Shielding

B. Administrative Controls

• Isolation of Area
• Signs, Cones, Barrier Tape
• Specialized Resources
• Work Practices

C. Proper Selection and Use of Personal Protective Equipment (PPE)
C. Proper Selection and Use of Personal Protective Equipment (PPE)

- Eye: Safety Glasses, UV
- Face: Face Shield
- Head: Hard Hat, Helmet
- Feet: Safety Shoes, Boots
- Hands & Arms: Gloves
- Body: Vests, Aprons, Chemical Suit
- Hearing: Earplugs, Canal Caps, Earmuffs
- Respiratory: APR, PAPR, SCBA, Air Supplied

Step 4: Monitor and Re-Evaluate the Hazards as time and conditions change
III. Conclusions

It is up to us to make a difference and cause change.

Causes of Accidents and Illnesses

- Hazardous Acts
- Hazardous Conditions
- Unaware
- Unable
- Unmotivated
- Unidentified
- Uncorrected

Document the Process!
How many of you look in the mirror in the morning and say, “Today, I could get hurt at work” or “Today, I am going to do everything possible to prevent getting hurt at work”?

Fire Investigator Safety: Uninformed, Under Informed, or Complacent

Questions?

Fire Investigator Safety: Hazard Recognition, Risk Assessment and Hazard Control

rhopkins1@earthlink.net
www.TRACEfireandsafety.com
Appendix A: Bibliography


Hopkins, Ronald L.; “Fire Investigator Safety; Uninformed, Under Informed, or Complacent”, International symposium on Fire Investigation Science and Technology, 2010; NAFI, Sarasota, FL

Donahue, Michael L., Safety and Health Guidelines for Fire and Explosion Investigators, Fire Protection Publications, Stillwater, OK


Mezzanotte, Tom; Washenitz, Frank; Baldwin, Tommy; Hales, Thomas; “Arson Investigator Dies from Injuries Sustained from a Fall During an Arson Investigation. Illinois” NIOSH Fire Fighter Fatality Investigation and Prevention Program, April 23, 2001


Bureau of Alcohol, Tobacco, and Firearms, Washington, D.C. May 1998”; Hazard Evaluations and Technical Assistance Branch, National Institute of Occupational Safety and Health, Center for Disease Control, Atlanta, GA


Bolstad-Johnson, Dawn M., Burges Jefferey L., Crutchfield, Clifton D., Storment, Steve, Gerkin, Richard; “Characterization of Firefighter Exposures During Fire Overhaul”; City of Phoenix, Arizona

Fabian,Thomas, Borgerson, Jacob L., Kerber, Stephen I., Gandhi, Pravinray D., Baxter, C. Stuart, Ross, Clara Sue, Lockey, James E. Lockey, Dalton, James M.; “Firefighter Exposure to Smoke Particulates” Executive Summary; DHS AFG Grant #EMW-2007-FP-02093 Final Report, April 2010

The Williams-Steiger Occupational Safety and Health Act of 1970, United States Congress

"Field Operations Manual” (FOM) CPL_02-00-148, Chapter 4, Occupational Safety and Health Administration, Washington DC, 2009.

Copies of the reports included in the list will be available from www.tracefireandsafety.com once there, follow the link to IAFI Fire Investigator Safety Resources. These resources will be available for 20 days after this presentation. Links to the US Government websites are provided below.
Links

US OSHA [www.osha.gov](http://www.osha.gov)
OSH Act
OSHA Field Operations Manual (FOM)
NIOSH Fire Fighter Fatality Investigation and Prevention Program
[http://www.cdc.gov/niosh/fire/](http://www.cdc.gov/niosh/fire/)

Fire Fighter Fatalities, 2012 NFPA

Fire Fighter Injuries and Fatality Reports NFPA