NIOSH Fire Fighter Fatality Investigation and Prevention Program

Stakeholder Meeting
March 22, 2006

CDC Workplace Safety and Health

NIOSH

On-duty Fire Fighter Fatalities by Year, 1977-2005

Source: USFA,

* Excluding 344 deaths at WTC

Outline

- Congressional mandate & Goals
- Investigation procedures
- Heart disease and fire fighting
- Findings & recommendations
- Dissemination & outreach efforts
- Research & evaluation
- Input for program direction

NIOSH Fire Fighter Fatality Investigation and Prevention Program

Thomas Hales, MD, MPH
Stakeholder Meeting
March 22, 2006

Outline

- Congressional mandate & Goals
- Investigation procedures
- Heart disease and fire fighting
- Findings & Recommendations

Congressional mandate to NIOSH

- Conduct fatality **investigations** to…
- **"identify causal factors** common to fire fighter fatalities,
- provide **recommendations** to prevent similar incidents,
- formulate strategies for effective **intervention**, and
- **evaluate** the effectiveness of those interventions."

Goals & Objectives

Goal

- Prevent fatalities

Objectives

- Investigations
- Identify causal factors
- Recommendations
- Interventions
- Evaluation

FF Program Organization

SCBA Investigations
Pittsburgh, PA

Illness Investigations
Cincinnati, OH

Injury Investigations
Morgantown, WV

Bob Kershner
Richard Braddee
Tom Baldwin
Kim Travel
Steve Berardinelli Jr
Virginia Lutz
Tim Merinar
Matt Bowyer
Steve Proudfoot
John Sines

Tom Hales
Lynn Bethel
Scott Jackson

Investigation Procedures

- USFA Notification
  - Definition: "any injury or illness sustained while on duty that proves fatal."
  - CVD Criteria:
    - Symptoms c/w heart attack < 24hrs
    - Fire fighting duties
  - Revised CVD Criteria:
    - Heart attack or Stroke < 24 hrs
    - Non-routine stressful or stenuous physical activity

Investigation Procedures

- Telephone contact
  - FD
  - Local Union
  - State Fire Marshal
- Prioritize

Investigation Procedures

- Site Visit
  - Interviews
  - Review records:
    - Fire Department
    - Medical
  - Family

Investigation Reports

- Circumstances
- Recommendations
- Disseminated

NIOSH

Death in the line of duty...

Fire Chief Suffers Sudden Cardiac Death While Returning to the Fire Station After a Structure Fire – Georgia

SUMMARY

Outline

- Congressional mandate & Goals
- Investigation procedures
- Heart disease and fire fighting
- Findings & Recommendations

Acute Exposures – Carbon Monoxide (CO)

- Interior-
- Exterior-suppression
- Mop-up

Acute Exposures

- Rapid ↑ HR & BP:
  - emergency calls
  - heavy physical exertion

Acute Exposures

Heavy physical exertion

↓ Trigger

Heart attacks

Sources

Willich et. al. NEJM 1993;329:1684
Tofler et. al. J Am Coll Cardiol 1992;20:1049
Mittleman et. al. NEJM 1993;329:1677

Chronic Exposures

- Shiftwork
- Overtime
- Heat
- Noise
- ETS
- Various Chemicals (including CO)

Source: Steenland & Fine. Occup Med State of the Art Reviews 2000;15:7-24

Do FF have increased RATES of heart disease?

- 25 SMR studies – mixed results
- Limitation - Healthy Worker Effect
- In 2000, Choi concludes, "there is strong evidence of an increased risk of death overall from heart disease among fire fighters."

Source: Choi. J Occup & Environ Med 2000;42:1021-34.

Do FF have increased RATES of heart disease?

- In 1995, Guidotti concluded,

"sudden death, myocardial infarction, or fatal arrhythmia occurring on or soon after near-maximal stress on the job are likely to be [work] related…."

Source: Guidotti. J Occup & Environ Med 1995;37;1348-56

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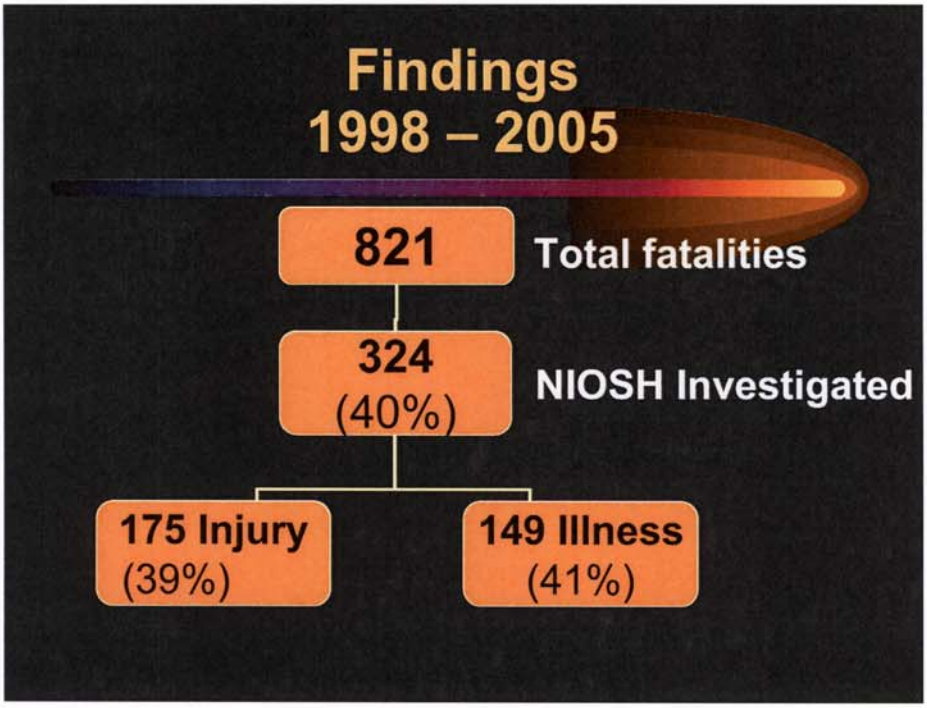
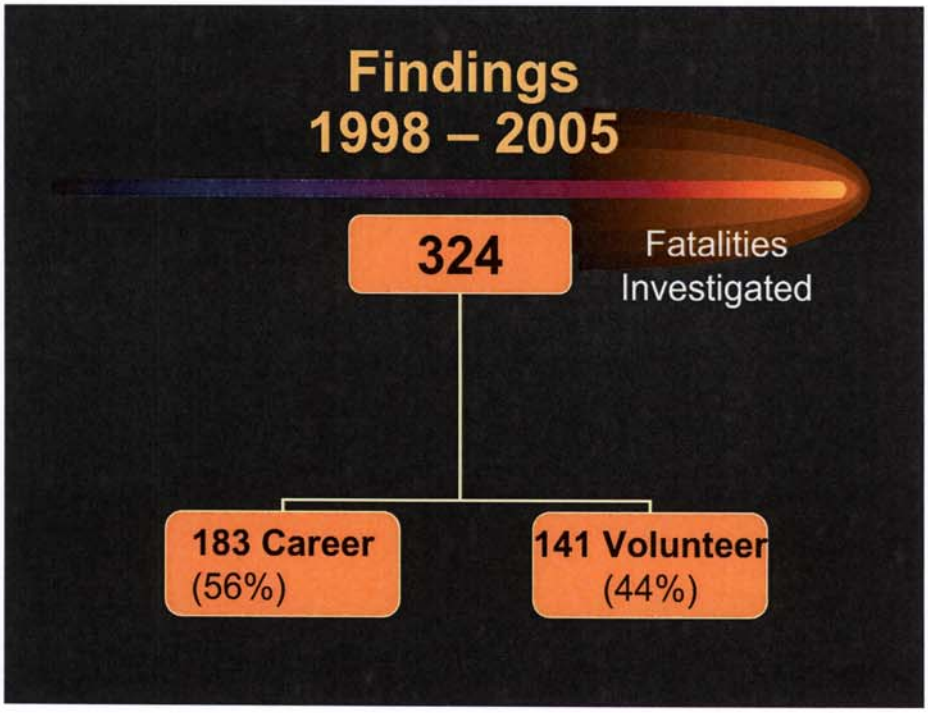
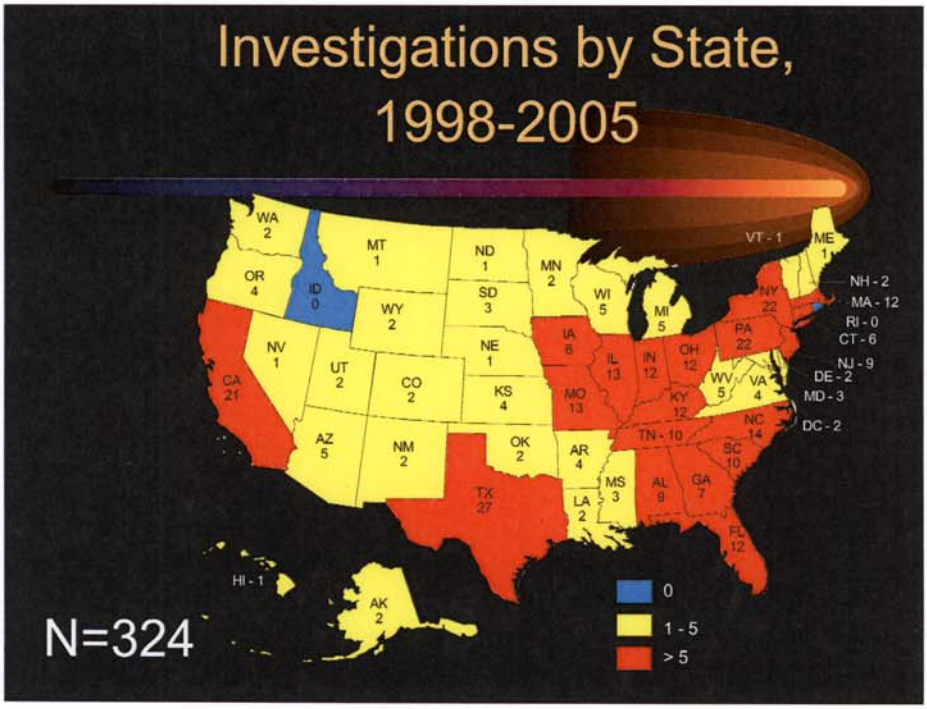
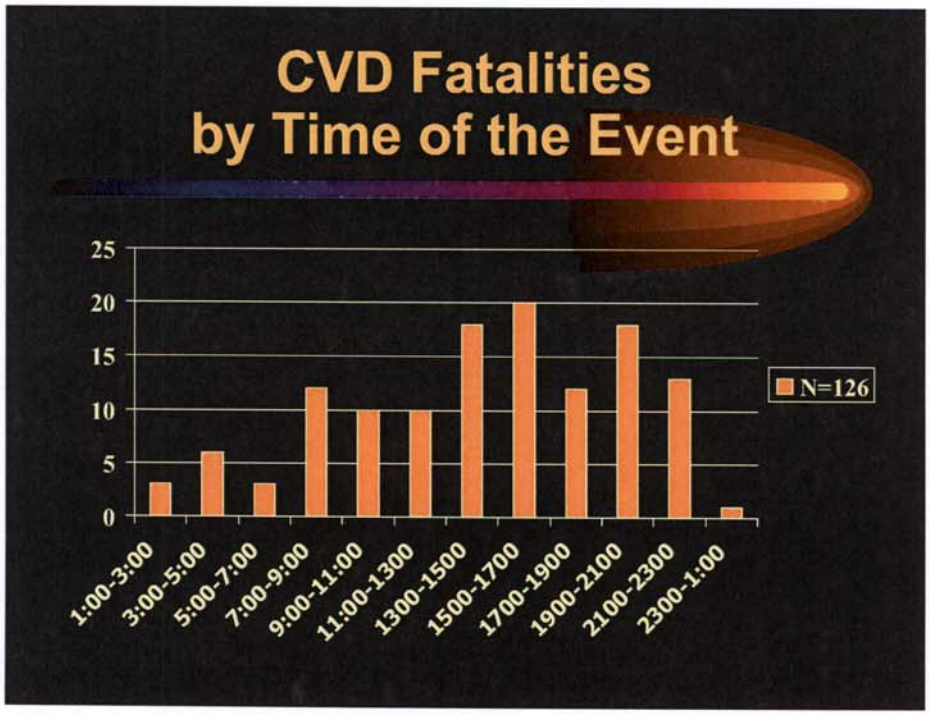

Findings
1998 – 2005
821
Total fatalities
324
(40%)
NIOSH Investigated
175 Injury
(39%)
149 Illness
(41%)

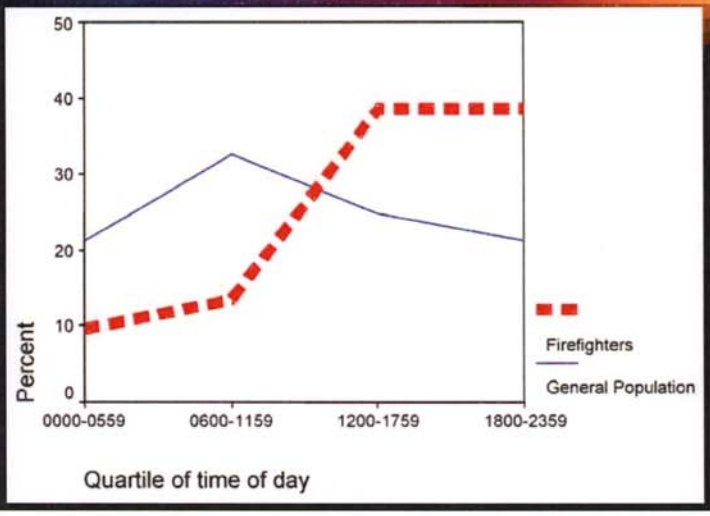

Findings
1998 – 2005
324
Fatalities
Investigated
183 Career
(56%)
141 Volunteer
(44%)


Investigations by State, 1998-2005
WA 2
OR 4
CA 21
ID 0
NV 1
MT 1
WY 2
UT 2
AZ 5
CO 2
NM 2
ND 1
SD 3
NE 1
KS 4
OK 2
TX 27
MN 2
IA 6
MO 13
AR 4
LA 2
WI 5
IL 13
MS 3
MI 5
IN 12
KY 12
TN - 10
AL 9
OH 12
WV 5
GA 7
FL 12
SC 10
NC 14
VA 4
PA 22
NY 22
VT - 1
ME 1
NH - 2
MA - 12
RI - 0
CT - 6
NJ - 9
DE - 2
MD - 3
DC - 2
HI - 1
AK 2
0
1 - 5
> 5
N=324

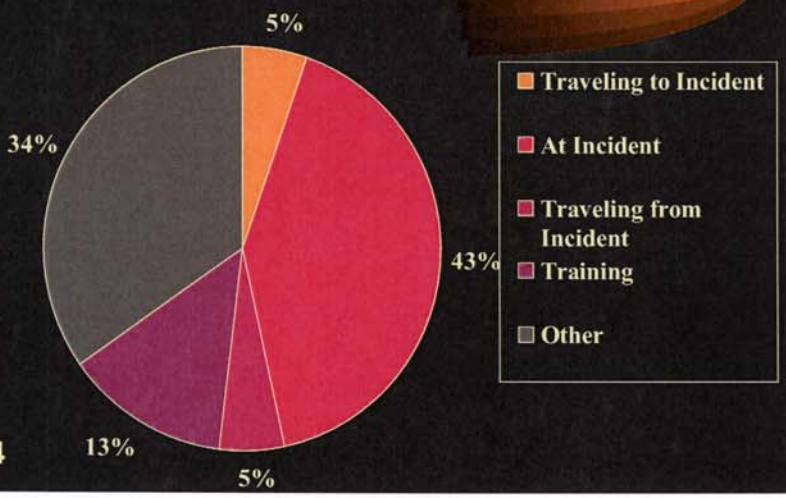

CVD Fatalities by Time of the Event
25
20
15
10
5
0
N=126
1:00-3:00
3:00-5:00
5:00-7:00
7:00-9:00
9:00-11:00
11:00-1300
1300-1500
1500-1700
1700-1900
1900-2100
2100-2300
2300-1:00

Circadian Distribution of CHD

Kales et. al. Environ Hlth: a global access science source. 2003;2:14



Illness Fatalities by Location

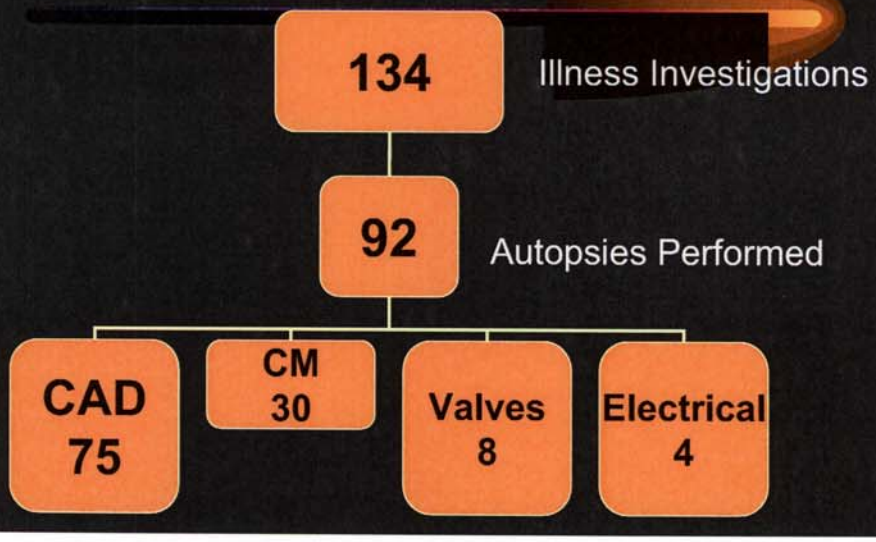


Risk Factors for On-duty FFF

Risk Factor	OR (95% CI)
Fire Suppression	64 (7.4-556)
Training	7.6 (1.8-31.3)
Alarm Response	5.6 (1.1-28.8)

Source: Kales et. al. Environ Hlth: a global access science source. 2003;2:14

Autopsies Information, 1998-2004

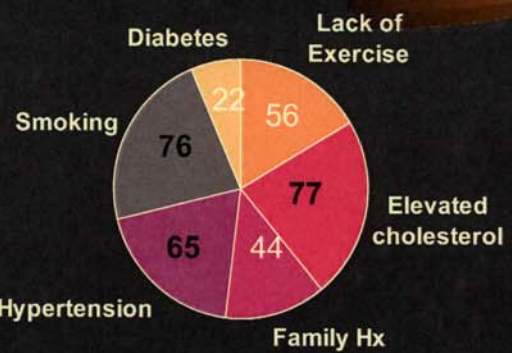


Risk Factors for Coronary Artery Disease*

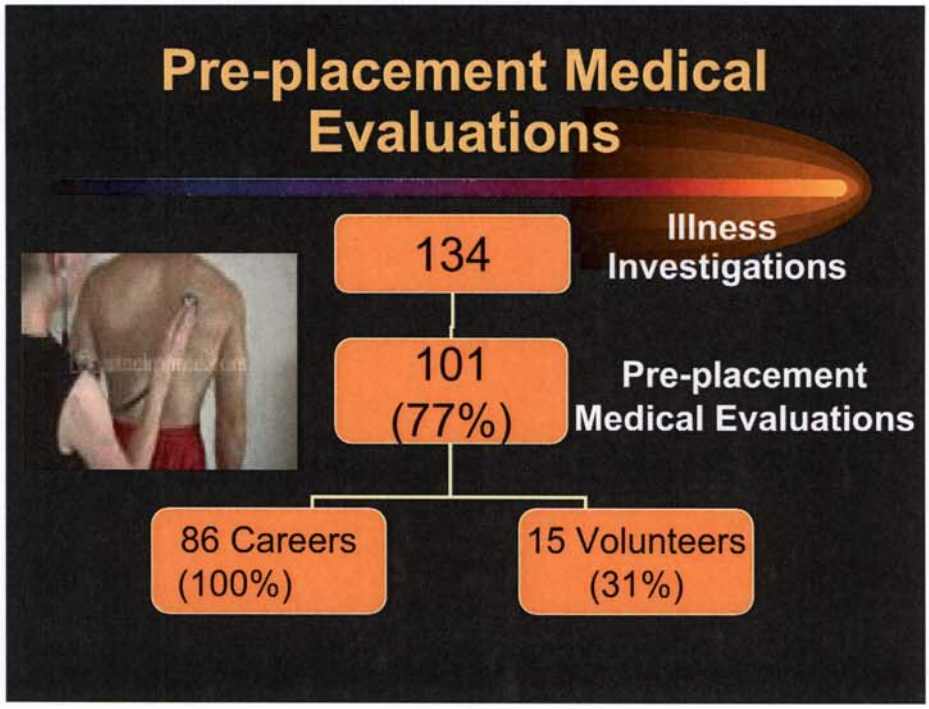
- **Non Modifiable**
  - Family History (<55years)
  - Male gender
  - Advancing age
- **Modifiable**
  - Cigarette Smoking
  - Hypertension
  - Hypercholesterolemia
  - Diabetes mellitus
  - Lack of exercise/ Obesity

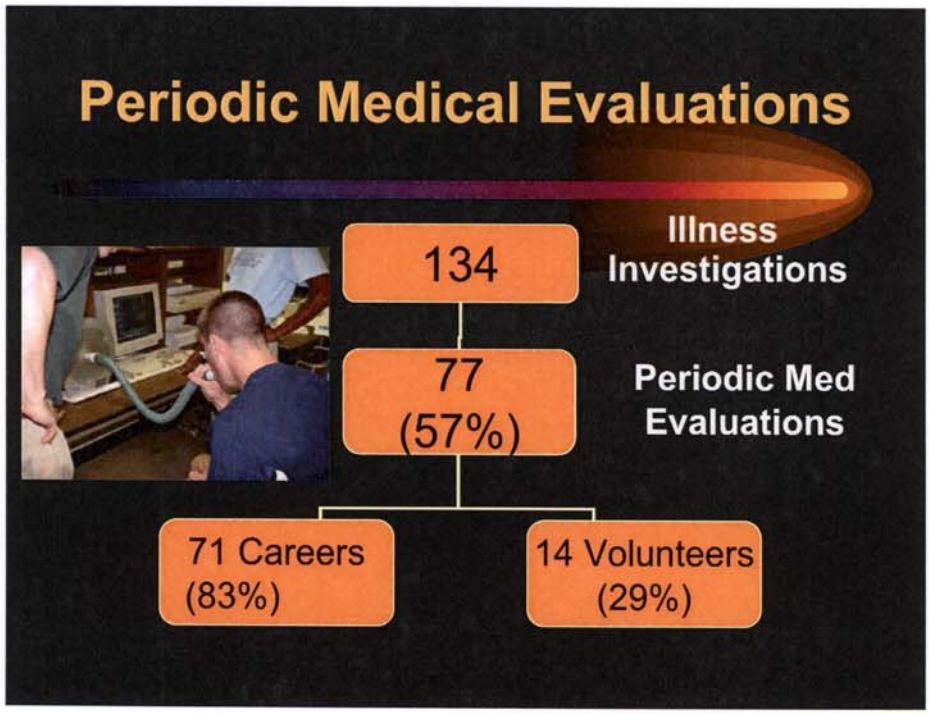
* Am Heart Assoc

CAD Risk Factors among Illness Investigation Fatalities, 1998-2004



N=134


Pre-placement Medical Evaluations
134
Illness Investigations
101 (77%)
Pre-placement Medical Evaluations
86 Careers (100%)
15 Volunteers (31%)


Periodic Medical Evaluations
134
Illness Investigations
77 (57%)
Periodic Med Evaluations
71 Careers (83%)
14 Volunteers (29%)

Pre-placement Medical Evaluations

134 — Illness Investigations

101 (77%) — Pre-placement Medical Evaluations

86 Careers (100%)

15 Volunteers (31%)

Periodic Medical Evaluations

134 — Illness Investigations

77 (57%) — Periodic Med Evaluations

71 Careers (83%)

14 Volunteers (29%)

Periodic Medical Evaluations

134 — Illness Investigations

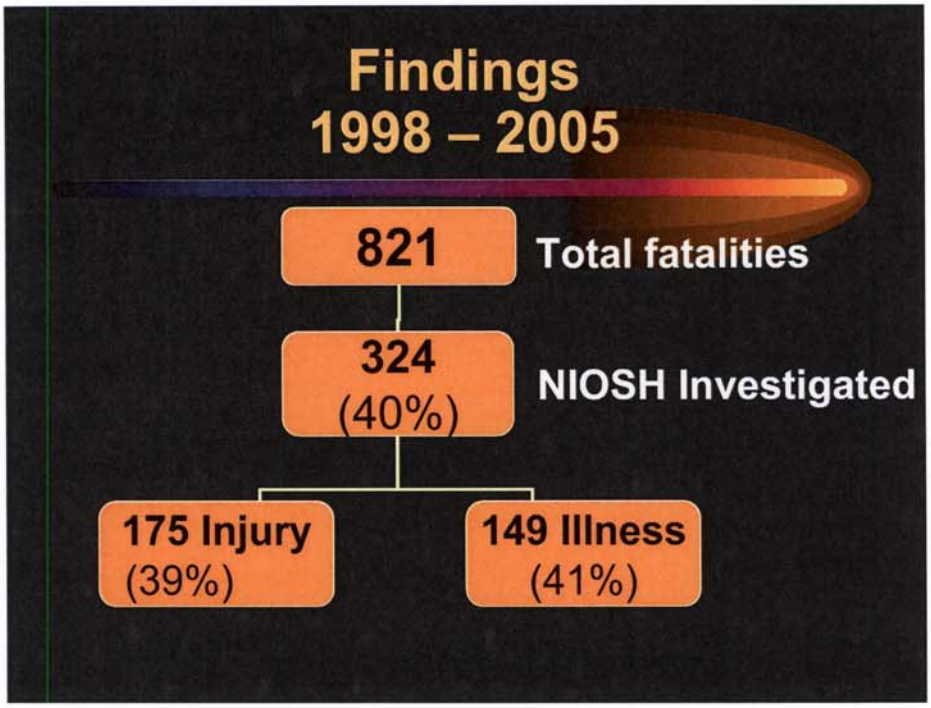
28 (21%) — Exercise Stress Tests

- 28 Careers (33%)
- 0 Volunteers (0%)

Wellness/Fitness Programs, 1998-2004

134 — Illness Investigations

- Wellness 52 (39%)
- Fitness 66 (49%)
  - Voluntary 54 (40%)
  - Mandatory 12 (9%)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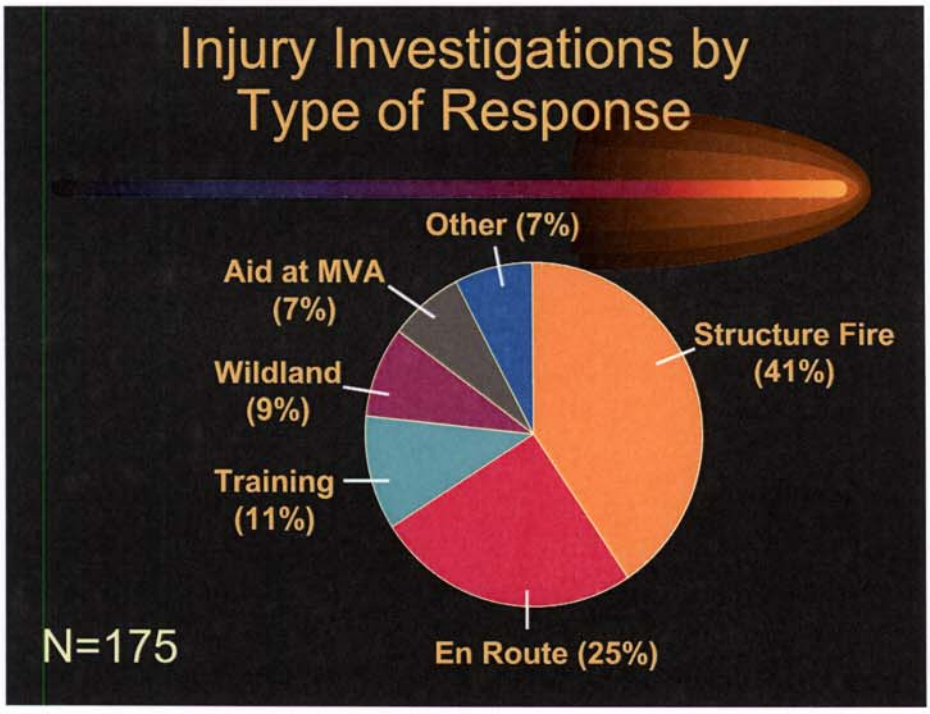
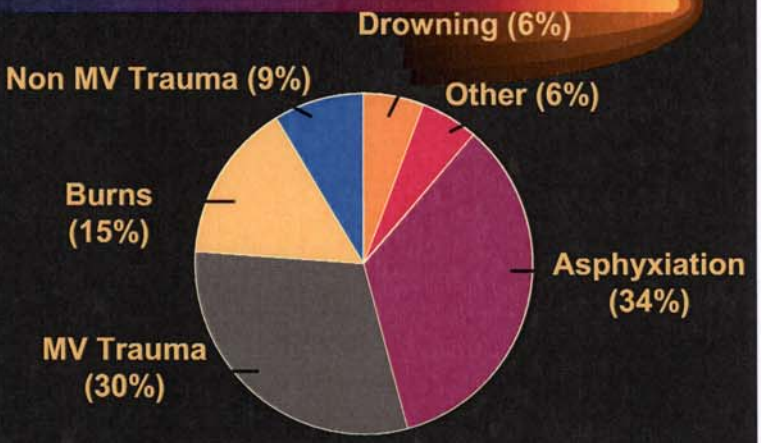

Injury Investigations by
Type of Response
Other (7%)
Aid at MVA
(7%)
Structure Fire
(41%)
Wildland
(9%)
Training
(11%)
N=175
En Route (25%)

Injury Investigations by Type of Fatality



N=175

Injury Recommendations

- SOPs
- Two-way communication between IC and FF crews

Injury Recommendations

Incident Command System (ICS)

Injury Recommendations

Injury Recommendations

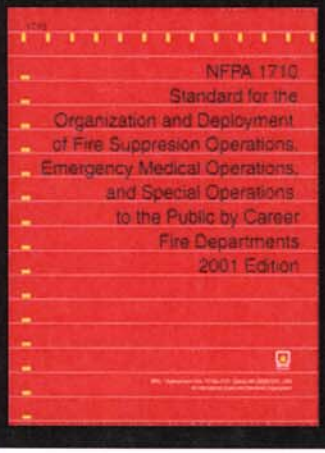
- **Rapid Intervention Team (RIT)**

Recommendations

- **SCBA**
  - **Inspected**
  - **Maintenance**
  - **Fit testing**
  - **Med Clearance**

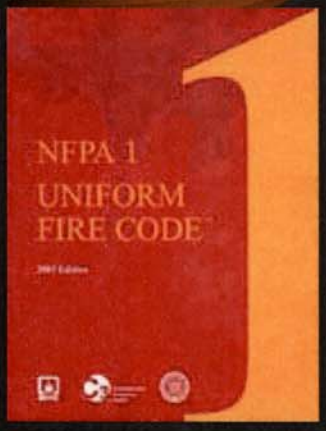
Recommendations

- **Staffing**



Injury Recommendations

- **Fire codes**
- **Research technology (e.g., downed FF locators)**

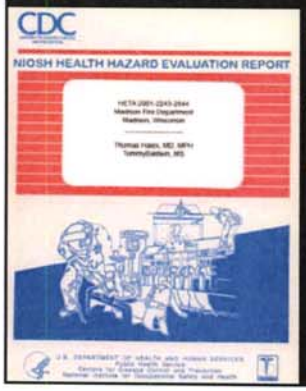


Non-fatal Investigations

- 9 non-fatal injury investigations involving 19 fire fighters.
- 10 non-fatal health investigations via the NIOSH HHE program.

HHE Requests

- Asthma
- Cancer Clusters
- Diesel Exhaust
- BBP
- Respirators



HHE Requests – Emergency Response

- FDNY post-9/11
  - Exposure monitoring
  - Medical surveillance

Emergency Response NOFD post-Katrina

Exposure Monitoring

Medical surveillance

Congressional mandate to NIOSH

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- **"identify causal factors** common to fire fighter fatalities,
- provide **recommendations** to prevent similar incidents,
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- **evaluate** the effectiveness of those interventions."

Congressional mandate to NIOSH

- **"identify causal factors** common to fire fighter fatalities,

Health Investigations

- SCD triggered by heavy physical exertion
- < 50% screened for CAD risk factors
- < 20% conducted exercise stress tests
- < 10% mandatory fitness/wellness prgm

provide recommendations to prevent similar incidents,

- Annual med eval – EST
- Fitness/wellness prgms
- SOP
- Communication
- ICS
- Seat belt use
- RIT
- Adequate personnel
- Respirator prgm
- Fire Codes
- Research

Outline

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- Heart disease and fire fighting
- Findings & recommendations
- Dissemination & outreach efforts
- Research & evaluation
- Input for program direction

NIOSH Fire Fighter Fatality Investigation and Prevention Program

Tim Pizatella
Stakeholders' Meeting
March 22, 2006

Outline

- Dissemination
- Outreach
- Research
- Impact
- Potential Future Program Directions

Dissemination

- Final report back to fire department (and union)
- All reports posted on NIOSH FF web page
- Periodic mailings to all FDs
- Distribute materials at fire service conferences, e.g., FDIC, IAFC, NFPA, NVFC, Redmond

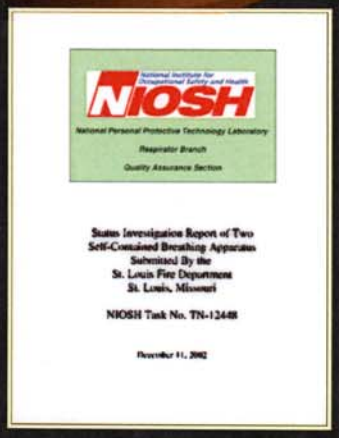
Investigation Reports

- More than 300 reports available through the NIOSH FF program web page
- Received > 60,000 visits to web page or specific investigation reports in 2005

www.cdc.gov/niosh/fire

SCBA Testing

- Report of testing results to NIOSH investigators and FD
- Results included with NIOSH investigative report
- If warranted, a field problem investigation is initiated (about 5% of samples)


NIOSH

National Personal Protective Technology Laboratory

Respirator Branch

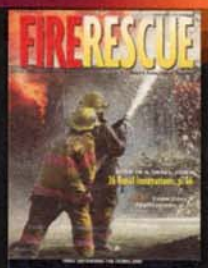
Quality Assurance Section

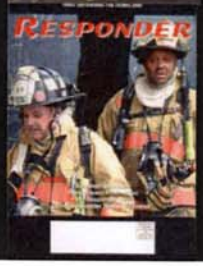
Status Investigation Report of Two Self-Contained Breathing Apparatus Submitted By the St. Louis Fire Department St. Louis, Missouri

NIOSH Task No. TN-12488

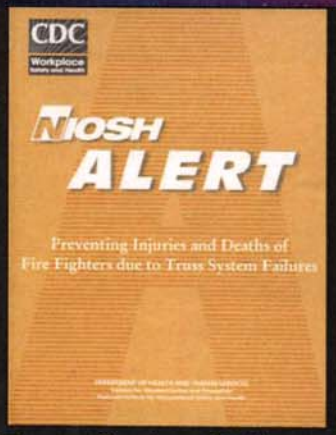
December 11, 2002

Reprinting of Investigation Summaries in Fire Service Journals

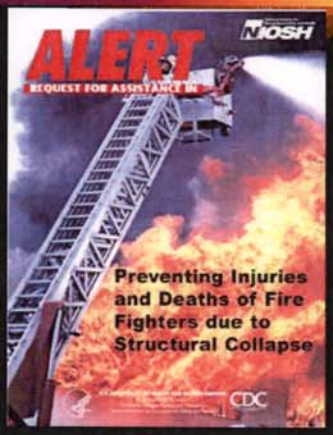




Alerts



Truss System Failures
2005



Structural Collapse
1999

Workplace Solutions

2005

- Training dives (2004)
- Electrical hazards during wildland FF (2002)
- Tanker truck rollovers (2002)
- Traffic hazards (2001)
- Propane tank fires (1999)

Documents Under Development

Alerts

- FF training
- Motor vehicle incidents
- Risk versus gain
- Heart attacks/sudden CV events

Workplace Solutions

- Use of military surplus vehicles

Joint Publications with Other Agencies


Your 1ST Safety

Death in the Line of Duty

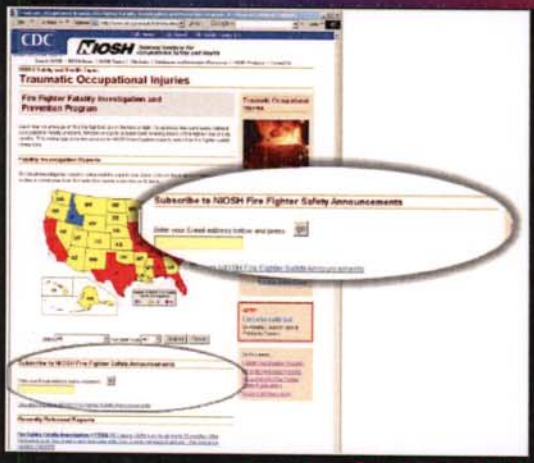
NIOSH

- DOT/Operation Lifesaver on RR crossing safety for emergency responders (2003)
- FDA Public Health Advisory on flashing of oxygen regulators (1999)
- FDA Public Health Notification on oxygen regulators and gasket seals (in development)

Products Developed by Other Agencies with FFFIPP Support

- FDA Video: Hidden Danger, Oxygen Regulator Fires
- NIST simulation of the dynamics of fires investigated by NIOSH
  - in a one-story restaurant--TX (F2000-13) www.fire.nist.gov/fds/fds03/art003.html
  - In a two-story duplex--IA (F2000-04) www.fire.nist.gov/fds/fds01/art011.html
  - Also available from NIST on CD-ROM

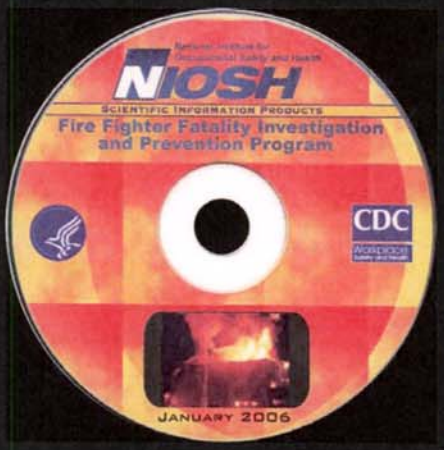
Internet



- Internet web site subscription service
- Added report search capability
- Bi-weekly "safety" quizzes
- Links to other fire service resources

www.cdc.gov/niosh/fire

Other



- CD-ROM with all reports and related publications through December 2005
- Includes links to other NIOSH resources such as the Pocket Guide to Chemical Hazards
- Hard copies

Outline

- Dissemination
- Outreach
- Research
- Impact
- Potential Future Program Directions

Outreach

- Partnered with IAFC and other fire service organizations in June 2005 "stand down" for safety initiative
- MOU with USFA to increase use of NIOSH materials in USFA FF training programs

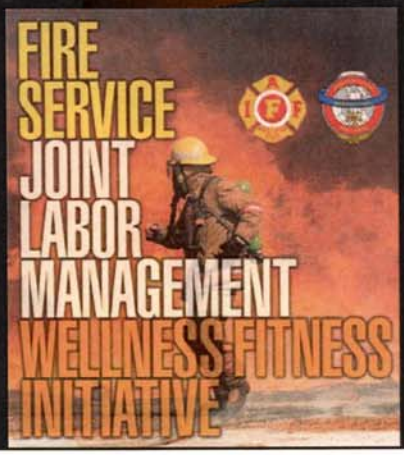
Outreach

National Fire Protection Association
The authority on fire, electrical, and building safety

- Member of a number of NFPA standards committees
  - Incident Command System (1561)
  - Medical Program (1582)
  - PASS Devices (1982)
  - SCBA (1852)

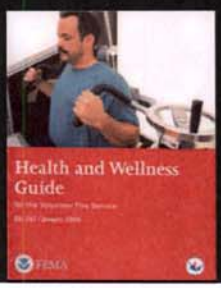
Outreach

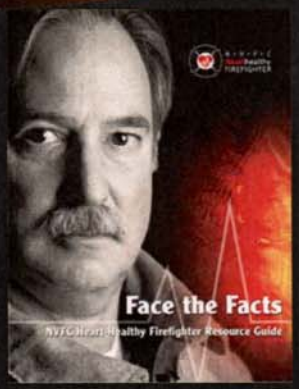
- Assisted with implementation of the IAFF/IAFC wellness/fitness Initiative



Outreach

- Work group:
  - Heart Healthy FF Program



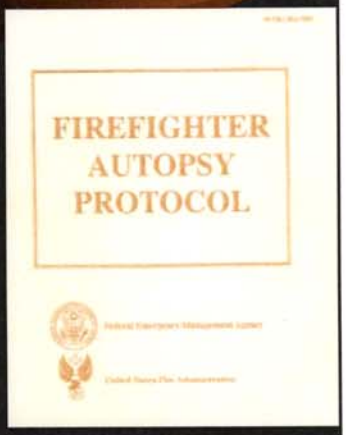


Outreach

DEPARTMENT OF HOMELAND SECURITY
PREPAREDNESS DIRECTORATE

U.S. Fire Administration
Working for a Fire-Safe America

- USFA Work Groups
  - –Update autopsy protocol
  - –Assist in determining LODD criteria



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Research

- Number of articles published in scientific literature (Appendix 1)
  - Flashing of oxygen regulators
  - Risk factors for injury in structural collapses
  - Occupational transmission of bloodborne pathogens to emergency response personnel

Research

- Effects of FF apparel on the Operation of Fire Response Vehicles
- Biomechanical and Physiological Effects of Fire Fighter Boots
- Assessing FF Glove Size and Fit
- Results will be useful to various NFPA committees

Evaluation of Emergency Vehicle Occupant Safety

- Investigations identified potential hazards to EMTs in patient compartments
- Testing demonstrated restraints could provide extra protection while allowing mobility
- Currently assessing human factors issues

Research/Training Grants

- SCBA Oximetry for FF Physiologic Monitoring
- Bioelectric Telemetry System for FF Safety
- Hazardous Substance Training for Emergency Responders

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Impact

- NIOSH findings/recommendations
  - Cited in 2003 NY legislation making it illegal to use people in the role of victims in live-fire training (Bradley's law)
  - Referenced in Hometown Heroes Survivor Benefits Act of 2003

Impact

- Communication to NFPA 1982 Committee on potential performance issues with PASS devices
- Revised standard was drafted addressing issues identified by NIOSH investigations
- Public comment period closed early March
- Goal to approve new performance criteria and certification test methods by summer 2006

Impact

- NIOSH findings/recommendations incorporated or referenced in NFPA standards
  - 1710 and 1720 recommending minimum staffing levels for career and volunteer fire departments
  - Revisions to 1500, minimum requirements for Occupational Safety and Health Programs

Impact

- NIOSH findings/recommendations
  - Used to support manufacturer recall of oxygen regulators for retrofit to replace aluminum high-pressure parts with brass parts
  - Manufacturer also offered a trade-in program with credit toward purchase of new brass regulators

Impact

- PA training academy required 1,200 local instructors to incorporate "accountability" into training based on NIOSH reports
- Fire departments using NIOSH reports in their firefighter safety training programs
  - Baltimore City MD; Portland, OR; Mentor, OH; Howell Township, NJ

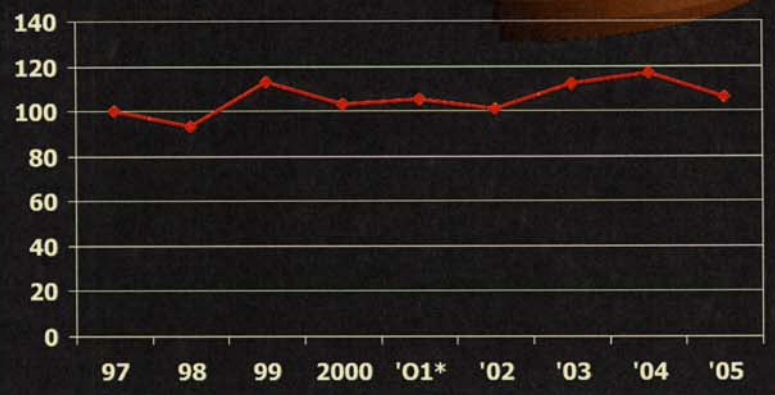
Formal Assessment of Impact of NIOSH Program

- Assess extent that FDs and FFs are aware of the NIOSH program and recommendations
- Identify ways to enhance program impact
- Data collection began February 2006
  - Survey of 3000 fire departments
  - Focus groups with frontline FFs
- Final results due September 2006

Accomplishment Summary

- Fulfilling Congressional mandate
- Widely disseminating findings to fire service
- Working with fire service organizations responsible for developing and implementing FF safety and health programs
- Addressing stakeholder expectations

On-duty Fire Fighter Fatalities by Year, 1997-2005



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- Research
- Impact
- Potential Future Program Directions

Investigations

- Continue conducting fatality investigations with priority on:
  - events accounting for larger numbers of deaths
  - investigations likely to result in new recommendations
  - investigations that impact current prevention efforts of other groups

Dissemination

- Increase efforts to develop educational materials
  - Alerts, Workplace Solutions and other documents which summarize multiple investigations
  - Seek new approaches to disseminate materials and facilitate their use by the fire service

Outreach

- Expand outreach and partnership efforts to foster increased use of NIOSH findings and products by the fire service
  - standard-setting committees
  - state training academies
  - fire service organizations

Research

- Conduct more in-depth analysis of available data on FF deaths and injuries
- Increase efforts to encourage research which builds on investigation findings
- Conduct formal evaluations of specific interventions

Research

- Cost effectiveness of wellness/fitness programs
- Investigate the barriers to implementing NFPA 1582
- Analyze NIOSH data to regarding return to work and medical clearance
- Investigate issues surrounding heat stress

The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.

Agenda & Follow-up

- Stakeholder Comments
- Discussion
- Web-based
  - –niocindocket@cdc.gov
- Summary Report