

The Role of NIOSH In Protecting On-The-Job Health of Fire Fighters

Les Boord, Director

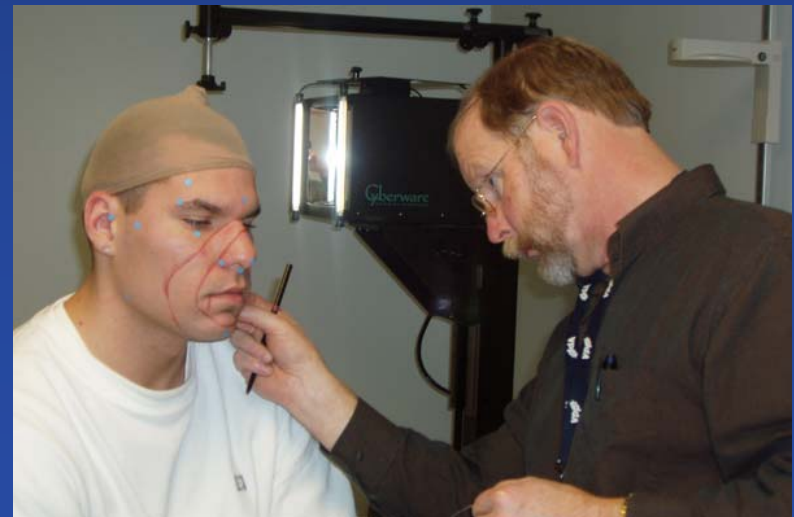
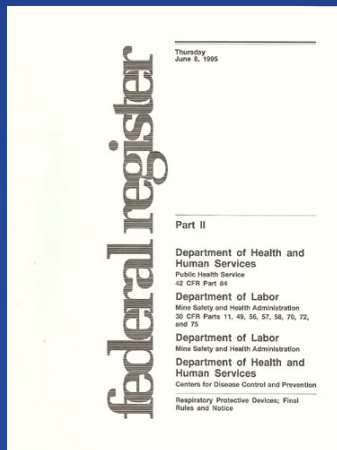
**National Institute for Occupational Safety and Health (NIOSH)
National Personal Protective Technology Laboratory (NPPTL)**

September 30, 2009



Presentation Overview

- NIOSH Overview
- Fire Fighter Fatality Investigations
- Respirator Certification
- Research
- Policy & Standards Development



Occupational Safety and Health

Regulation/Enforcement

**Research, Training, and
Prevention Recommendations**

**Department of Labor
(DOL)**

**Department of
Health and Human Services
(HHS)**

**Mine Safety
and Health
Administration
(MSHA)**

**Occupational
Safety and Health
Administration
(OSHA)**

**Centers for Disease
Control and Prevention
(CDC)**

**National Institute for
Occupational Safety
and Health (NIOSH)**

NIOSH Divisions & Laboratories



- Office of the Director, NIOSH
- Office of Extramural Programs
- Pittsburgh Research Laboratory (PRL)
- **National Personal Protective Technology Laboratory (NPPTL)**

- Division of Respiratory Disease Studies (DRDS)
- Division of Safety Research (DSR)
- Health Effects Laboratory Division (HELD)
- Education and Information Division (EID)
- Division of Applied Research and Technology (DART)
- Division of Surveillance Hazard Evaluation and Field Studies (DSHEFS)
- Office of Compensation Analysis and Support (OCAS)
- Research to Practice (r2p)
- Spokane Research Laboratory

NIOSH Mission

The mission of the NIOSH is to generate new knowledge in the field of occupational safety and health and to transfer that knowledge into practice for the betterment of workers. To accomplish this mission, NIOSH conducts scientific research, develops guidance and authoritative recommendations, disseminates information, and responds to requests for workplace health hazard evaluations.

NIOSH provides national and world leadership to prevent work-related illness, injury, disability, and death by gathering information, conducting scientific research, and translating the knowledge gained into products and services, including scientific information products, training videos, and recommendations for improving safety and health in the workplace.



Fire Fighter Fatality Investigation Program (FFFIP)



Background

- 1.1M US fire fighters
- 75% are volunteers
- > 50 traumatic injury LODDs each year
- 95,000 non-fatal injuries



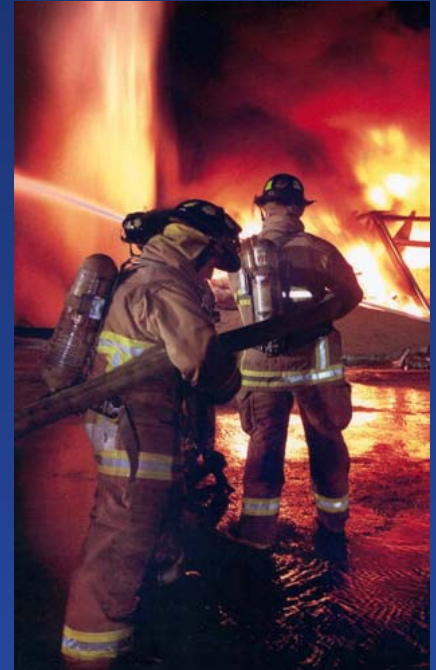
NIOSH FFFIPP

- Congressional appropriation in FY98
 - funded NIOSH to implement a fire fighter safety initiative
- Investigation of FF LODDs
 - identify contributory factors
 - disseminate prevention recommendations
- Program shaped with input from the fire service
 - stakeholder meetings to date (1998, 2006, 2008)



FFFIP Objectives

- Better define the characteristics of line-of-duty deaths among fire fighters
- Develop recommendations for the prevention of deaths and injuries
- Disseminate prevention strategies to the fire service



FFFIP Investigations

- NIOSH FFFIP conducts investigations of fire fighter line-of-duty deaths
- Investigation purpose is to learn from events in order to prevent future events
- Formulates recommendations for preventing future deaths and injuries

FF Program Outputs

- Summary report for each investigation
- NIOSH-numbered documents focused on specific hazards
- Topic page for fire fighter products and information
- Articles in technical journals and fire service publications
- Presentations at fire service conferences
- Participation on NFPA technical committees

Fire Service Feedback

- “NIOSH has recently released the following [three] excellent Fire Fighter Fatality Investigation Reports. These reports, like so many of the more recent ones, are loaded with everything that is needed including photos, graphs and charts to TRAIN all Firefighters on what went wrong, so history doesn't get repeated.”

Quote from Chief Billy Goldfeder in his
6/17/2009 listserv mailing (>100,000 subscribers)

NIOSH Respirator Certifications

- Approximately 300 NIOSH respirator certifications are issued each year
- 90 manufacturers
- 102 manufacturing sites
- 18 countries



NIOSH Respirator Certification

42 Code of Federal Regulations, Part 84



- **Respirator Certification**
 - Engineering Evaluation
 - Respirator Testing
 - QA Plan Evaluation
- **Post Certification**



- Manufacturing Site Audits
- Respirator Product Audits
- Respirator Evaluations



Engineering Evaluation

- **General Construction**

- Sound engineering and scientific principles
- Evidence of good workmanship
- Components contacting wearer's skin are made from non irritating materials
- Replaceable components not damaged by normal handling

- **Component Parts**

- Designed, constructed and fitted to ensure against creation of any hazard
- Assembled to permit easy inspection, repair and cleaning

- **Pre Approval Data**

- Applicant Test data equal to or exceeding requirements of 42 CFR, Part 84

Respirator Testing

Typical Performance Test Requirements

Air Purifying Respirators

- Resistance Test (pressure drop @ specified flow)
- Valve Leakage Test (exhalation valve)
- Facepiece Test Isoamyl Acetate (except particulate only)
- Facepiece Visor Impact Resistance Test
- Particle / Aerosol Penetration Test
- Gas Life Bench Test (organic vapor, acid gas, ...)

Respirator Testing

Typical Performance Test Requirements

Air Supplied Respirators

- Breathing Resistance Test (breathing machine and constant flow)
- Minimum Gas Flow Test (constant flow)
- Exhalation Valve Leakage Test
- Facepiece Visor Impact Resistance Test
- Cold Temperature Test (self-contained breathing apparatus)
- Carbon Dioxide Test (closed circuit self-contained breathing apparatus)
- Pressure Gauge Accuracy Test (compressed gas self-contained breathing apparatus)
- Gasoline Permeation Test (airline hose & breathing bags)
- Strength of Couplings Test (airline hose)
- Gas Tightness Test (isoamyl acetate with complete apparatus)
- Man Tests 1-6 (self-contained breathing apparatus)

Quality Assurance Plan Evaluation

Quality Control Plan Addresses:

- Organizational structure to implement quality requirements
- Requirements for production of quality data and records
- Control of engineering drawings
- Control and calibration of measuring and test equipment
- Control of purchased material (incoming inspection)
- Lot identification, control of processes
- Audit of final inspection of completed product
- Classification of characteristics

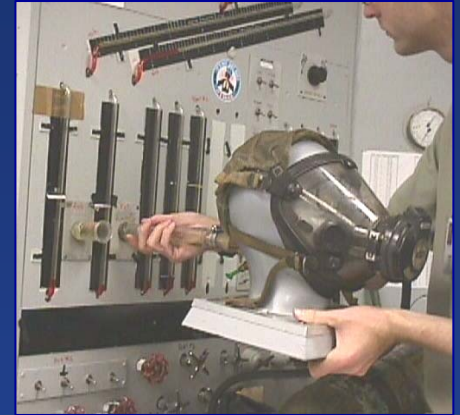
Quality Assurance Plan Evaluation

Classification of Characteristics

- **Critical Characteristics** – A defect that judgment and experience indicate is likely to **result in a condition immediately hazardous to life or health** for individuals using or depending on the respirator.
- **Major A Characteristic** – A defect, other than critical, that is likely to result in failure to the degree that the **respirator does not provide any respiratory protection**, or a defect that **reduces protection and is not detectable by the user**.
- **Major B Characteristic** – A defect, other than Major A or Critical, that is likely to result in **reduced respiratory protection, and is detectable by the user**.
- **Minor Characteristic** – A defect that is not likely to materially reduce the usability of the respirator for its intended purpose, or a defect that is a departure from established standards and has **little bearing on the effective use or operation of the respirator**.

Post Certification Programs

- Respirator Manufacturing Site Audits
- Certified Product Audits
- Certified Product Investigation
- Firefighter SCBA Evaluation
- SCSR Long Term Field Evaluation



NPPTL Technology Research Branch



• Technical Areas

- Respiratory Protection
- Sensors & Electronics Integration with PPT
- Protective Clothing & Ensembles
- Human Performance



Respiratory Protection Research

- **Aerosol/Filtration Studies**

- Nanoparticles / Bioaerosols

- **Respirator Fit Research**

- Facial anthropometrics
- Frequency of fit testing
- Novel respirator designs
- User seal check



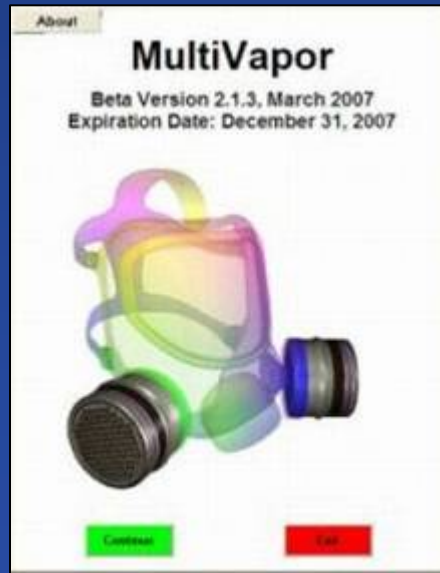
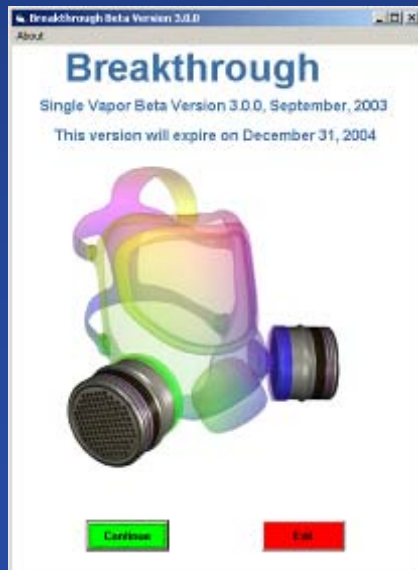
- **Influenza Pandemic / HCW**

- Reusability of filtering facepiece respirators
- Risks of handling a contaminated respirator
- Antimicrobial respirators
- Evaluate respirator performance against cough generated aerosols
- Respirator clinical effectiveness study



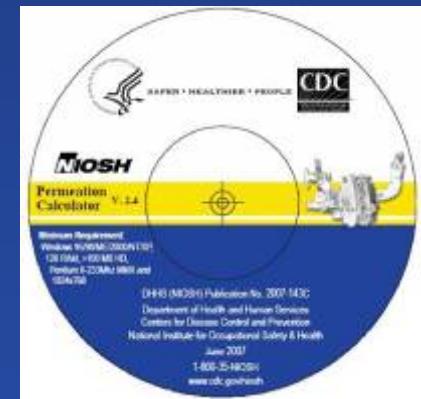
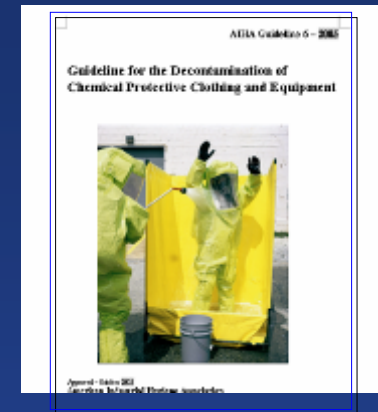
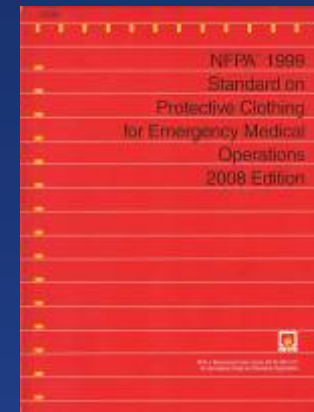
Sensors & Electronics Research

- Develop/Integrate Chemical Sensors for Real-Time Determination of Respirator Cartridge Service Life
- Respirator Cartridge End-of-Service Life Modeling



Protective Clothing & Ensembles Research

- * EMS Protective Clothing
- * Chemical Protective Clothing Decontamination Efficacy
- * Particulate Penetration Measurements on Protective Clothing and Ensembles
- * Stored Thermal Energy Test Method
- * Risk-Based Material Permeation Criteria
- * Fire Fighter – Whole Body Anthropometrics
- Mine Rescue Ensemble
- Comparison of Ensemble Total Inward Leakage (TIL) Tests



Human Performance Research



- * **Project HEROES – Physiological/Ergonomic Evaluation of Firefighter PPE Prototype with Advanced CB Protection**

- * **Physiological Models and Countermeasures**

- Test methods to assess physiological “burden” of PPE

- Portable physiological monitoring equipment

- * **Validation of the Total Heat Loss test**

- * **Biomechanical and Physiological Study of Firefighter Boots**

- **Impact of Respirator Use on CO₂ and O₂ levels (with and without a surgical mask overlay)**

- **Variability in Attainable Travel for SCSRs**

- **Mine Refuge Chamber**

- **Physiological Evaluation of Air Fed Ensembles**



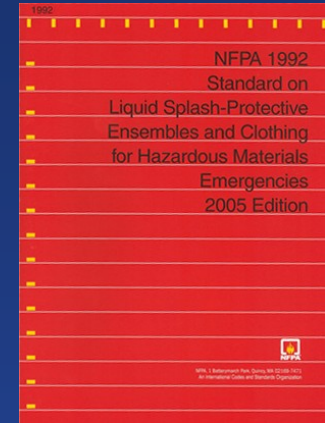
Federal Regulations (42 CFR, Part 84) Respiratory Equipment

- **Notices for Proposed Rulemaking (NPRM) in Agency Review**
 - **Quality Assurance Module**
 - **Closed Circuit Escape Respirator**
 - **Total Inward Leakage for filtering facepiece (FFR) and half masks respirators**
- **Concepts Completing Development**
 - **Closed Circuit SCBA**
 - **Powered Air-Purifying Respirators**
- **Concepts in Development**
 - **Supplied Air Respirators**
 - **Air Fed Ensembles (where the ensemble acts as the respirator)**



NPPTL Participation with Standards Setting Organizations

- **National Fire Protection Association (NFPA)**
- **American Standard for Testing (ASTM)**
- **American National Standards Institute (ANSI)**
- **International Standards Organization (ISO)**
- **42 Code of Federal Regulations (42 CFR)**



NIOSH Personal Protective Technology Program



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Disclaimer: 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.

Thank you!!!