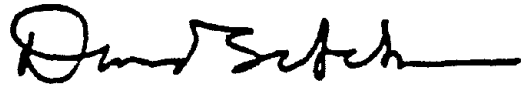
Federal Certification of Personal Protective Equipment and Clothing for Firefighters and Emergency Response Personnel



David Satcher, M.D., Ph.D
Director
Centers for Disease Control and Prevention
U.S. Department of Health and Human Services

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Executive Summary

The 1997 Senate Appropriations Report, Number 104-368, accompanying the Omnibus Consolidated Appropriations Act of 1977; P.L. 104-208, states,

> The Committee is aware of concern over the lack of standards and certification of personal protective clothing and equipment used by firefighters and emergency response personnel. The Committee encourages NIOSH to review these concerns and be prepared to report to the Committee on the feasibility and cost of implementing testing, certification of personal protective clothing, and equipment for firefighters and emergency response personnel during the fiscal year 1998 budget hearing.

This report provides a review of the literature, identifies a number of concerns with the current National Fire Protection Association (NFPA) certification process, and provides details on the feasibility and potential cost to the Federal government of undertaking a program to test and certify personal protective clothing and equipment for firefighters.

NIOSH concludes that there is little evidence to support a direct link between inadequacies in testing and certification of firefighter personal protective equipment and firefighter injuries and deaths. While there are some problems with personal protective clothing and equipment, frequently injuries result when some piece of protective gear is not used, or there is improper, or inadequate equipment maintenance. Also, existing NFPA standards for firefighter personal protective clothing and equipment (PPE) are among the most comprehensive set of standards available for protective equipment used by any occupational category.

NIOSH recommends that opportunities to strengthen existing testing and certification programs be explored before establishing a new Federal program. NIOSH estimates that it will cost approximately $1.5 million in start-up costs and an annual operating budget of approximately $6.0 million to test and certify firefighter and emergency personnel PPE. Estimated program costs include hiring staff with the expertise to conduct these tests, purchasing specialized equipment, and leasing approximately 50,000 square feet of suitable laboratory and office space to conduct the program.

NIOSH recognizes that, to date, no systematic study or evaluation of firefighter PPE standards or testing and certification has been undertaken. If desired, a needs assessment could be conducted to systematically evaluate existing standards and testing and certification programs.

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BACKGROUND

According to the 1995 Fire Department Profile from the National Fire Protection Association (NFPA), there were 1,098,850 firefighters (260,850 career and 838,000 volunteer) in the United States. Virtually all firefighters are required to use personal protective clothing and equipment during the performance of their duties, and are at risk should personal protective equipment (PPE) fail to meet minimum quality standards. There are anecdotal reports of PPE failure and mislabeling or inconsistent application of the current NFPA testing and certification process. Concerns with the NFPA certification process include labeling of products as certified without proper testing, inconsistencies between the various certification organizations, a lack of field enforcement, and nonconforming product investigations. In addition, PPE manufacturers serve on the NFPA Technical Committees that develop standards for the NFPA certification process creating a potential for conflict of interest.

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This report provides a review of the literature, identifies a number of concerns with the current NFPA certification process, and provides details on the feasibility and cost of implementing a Federal testing and certification of personal protective clothing and equipment.

LITERATURE REVIEW

Review of the literature yielded little evidence to support a direct link between inadequacies in testing and certification of firefighter personal protective equipment and firefighter injuries and deaths. The National Fire Incident Reporting System (NFIRS), maintained by the United States Fire Administration (USFA), contains information on approximately one million fire incidents per year. Data are submitted voluntarily by fire departments throughout the United States in standardized format. In 1988, the USFA conducted an analysis of the NFIRS data for 17 States, focusing on firefighter casualties associated with equipment problems. Of a total of 11,494 fire service casualties, 60 cases cited problematic protective equipment and included documentation of injury; one of these cases resulted in a fatality.

The principal conclusions from the NFIRS analysis were that equipment problems were relatively rare and that not all of the 60 cases identified reflected an equipment-related injury. It is important to note that while the NFIRS collects information on the body part injured, the type and severity of injury, and the presence of specific problems with PPE, there is no direct correlation made concerning the injury and a protective equipment failure. In addition, the report states that "Although there was a problem with protective gear, it frequently appeared to be a lack of some protective gear that allowed the injury to occur" [United States Fire Administration, 1988]. For example, one case report indicates that the firefighter's face protection melted, but the firefighter sustained severe inhalation injury because he was not wearing a self-contained breathing apparatus (SCBA). Finally, the report notes that these 60 cases do not necessarily document the failure of PPE. In another case report, although the firefighter's coat, trousers, boots, helmet, gloves, and SCBA burned, the documented injury was minor knee pain that required no medical care at the scene and was unrelated to equipment failure.

The *National Fire Protection Association (NFPA) Journal* also includes annual summaries of firefighter injuries and fatalities. According to the NFPA, an average of 106 firefighters died in the line of duty each year between 1986 and 1995 [Washburn et al., 1996]. None of the firefighter fatalities described in the annual summaries for 1990 through 1995 was directly attributed to failure of PPE. Although there were several instances in which depletion of the firefighter's air supply resulted in death, the associated circumstances generally involved loss of communication between the firefighter and the fire command, or the entrapment of the firefighter amid collapsed structural materials.

Another NFPA analysis using data from the NFIRS and the NFPA examined the relationship between fireground (fire scene) asphyxiation injury and the use of SCBA [Karter, 1996]. No breathing apparatus was used in an estimated 49 percent of minor and moderate asphyxiation injuries, and 48 percent of severe asphyxiation injuries. Nearly 52 percent of the minor and moderate asphyxiation injuries, and 41 percent of the severe injuries, occurred outside of a structure.

Similarly, when NIOSH conducted investigations of potential failures of the self-contained breathing apparatus (the one piece of firefighter equipment with a NIOSH certification), evidence suggests those equipment failures pertaining to the respiratory device were primarily due to improper or inadequate equipment maintenance, and not the inadequacy of the standard against which it was certified. (It should be noted that NFPA standards for respiratory devices [NFPA 1981] are more stringent than NIOSH respiratory certification standards under 42 CFR Part 84 because of the unique aspects of the application of these protective devices to firefighting situations.)

REVIEW OF CURRENT NATIONAL FIRE PREVENTION ASSOCIATION (NFPA) CERTIFICATION PROCESS

Firefighter PPE Product Certification Standards

Standards on personal protective equipment and clothing used by firefighters and emergency response personnel are currently established by the NFPA's Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment. The existing NFPA standards are voluntary consensus standards jointly developed by manufacturers, end users, and other interested parties. Technical Committees are responsible for the development and revision of individual standards addressing respiratory protection and personal alert safety system (PASS) alarms, as well as protective clothing and equipment used in emergency medical services, handling of hazardous materials, specialized firefighting applications, special operations, structural firefighting, and wildland firefighting. Currently, the only product from these categories certified by NIOSH is the self-contained breathing apparatus (SCBA), which is tested and certified by the National Institute for Occupational Safety and Health (NIOSH) in accordance with 42 CFR Part 84.

NFPA consensus standards are reviewed and revised at least every five years, with new standards proposed periodically. Currently, NFPA standards require independent, third party certification, governing approximately 320 products and 94 manufacturers. The majority of products are certified by Underwriters' Laboratories (UL), which does most of its testing in its own facilities, and by the Safety Equipment Institute (SEI), which performs primarily administrative functions with actual testing done by outside independent laboratories. NFPA consensus standards require that certification organizations be independent of manufacturing interests, and that they meet minimum criteria with respect to laboratory equipment, accreditation, quality assurance audits, investigation of field failures, and follow-up testing.

Problems with the Current PPE Certification Process

The existing NFPA standards for firefighter PPE are among the most comprehensive set of standards available for protective equipment used by any occupational category. However, few systematic attempts to evaluate NFPA standards have been made, and few data are available that validate the sufficiency of existing standards. In addition, PPE users, and in particular the International Association of Fire Fighters (IAFF), have identified potential concerns as to whether firefighters and emergency response personnel are, in fact, afforded the protections outlined in NFPA consensus standards. Despite the efforts of the NFPA Technical Correlating Committee to strengthen the certification process, certain inconsistencies and problems remain:

- Some certified products do not fully comply with the applicable NFPA consensus standard(s).

- Testing and certification protocols may not be consistent among the various certification organizations.

- NFPA has no authority to enforce its standards and does not investigate failure of equipment in the field.

- NFPA consensus standards stipulate that certification organizations investigate field failures of products they certify, but the business relationship between the manufacturer and certifier has the potential to influence the extent and quality of the investigation. Manufacturers pay fees to certification organizations to have their equipment certified.

- The standards development process, which includes manufacturers and certification organizations, introduces a potential conflict of interest in that new tests and requirements can increase the volume of business for certification organizations.

The potential for inconsistency and misrepresentation in the certification process is illustrated by the case of the Model 1500 firefighter helmet manufactured by Phenix Technology. This helmet was tested using manufacturer-specified guidelines that deviated from procedures outlined in the NFPA 1972 Standard for Structural Fire Fighting Helmets. Although the helmet never received the required approvals from an independent, third-party certification organization, it was marketed with the NFPA sticker, and promotional materials stated that it met NFPA standards. NFPA's response to complaints about the Phenix Model 1500 reiterates its intent to continue to act as a standards developer and publisher, rather than an enforcement agency. However, NFPA had previously acted to notify the firefighting community about reported irregularities in the testing and certification processes.

In a March 1994 press release, NFPA warned that certain protective garments and hoods might be carrying labels falsely identifying them as compliant with NFPA 1971 Standard on Protective Clothing for Structural Fire Fighting.

COSTS ASSOCIATED WITH FIREFIGHTER PPE CERTIFICATION

To determine the feasibility and costs of the complete testing and certification of firefighter PPE, an analysis was conducted by NIOSH to define the associated costs, including personnel, equipment, and space, using the current NFPA consensus standards as the basis for a new certification program. The costs associated with this analysis assume that NIOSH (or some other governmental agency) would take over the complete administration and implementation of this certification program. Under this proposal, Federal employees would conduct all laboratory testing in-house, conduct quality assurance manufacturing audits, issue product approvals, review continued compliance, conduct field problem investigations, provide technical assistance, and conduct research for standards development. Program operation and administration would be similar to the current NIOSH respirator certification activity.

Testing of New Products

In-house testing of new products and annual re-certification of previously approved products would require acquisition of appropriate laboratory space and equipment, recruitment of personnel with expertise to perform each required test, development of standard operating procedures for performance of each test, evaluation of product design and literature, and performance of appropriate laboratory tests. Investment in specialized equipment and laboratory space would be costly. For example, firefighter PPE would require: heat/flame resistance testing; liquid splash testing for hazardous chemicals; cut and puncture resistance testing; gas/water tight integrity testing; lens abrasion resistance testing; viral penetration resistance testing; etc. Laboratory space would require specialized ventilation and industrial hygiene wet lab capacity, including gas, water, and vacuum hook-ups.

Quality Assurance Audits

NFPA consensus standards currently require two random and unannounced annual audits at each manufacturing facility. Under a Federal certification program, the government would conduct all quality assurance audits.

Maintaining Personnel Expertise

Federal membership on NFPA Technical Committees would be required to remain abreast of industry developments through participation in other consensus standards groups and training courses. Additional personnel expertise would be developed and maintained through certification testing, product audit testing, nonconforming product investigations, research, and technical assistance.

Legislative Requirements

A Federal testing and certification program would require appropriate rulemaking activity to codify the present NFPA consensus standards into Federal certification standards.

Resource Requirements

As a result of the expansion of the NIOSH laboratory facilities recently opened in Morgantown, West Virginia, NIOSH is currently expanding its program of research for the development of improved respiratory and other protective equipment for firefighters and other occupations. This research effort should result in improved personal protective equipment for workers in all industries.

Additionally, in the FY 1998 President's Budget, $2.5 million is included for NIOSH to conduct detailed field investigations of all line-of-duty firefighter fatalities occurring each year. If funded by Congress, this ongoing initiative will provide the opportunity for NIOSH to expand its surveillance and field investigation capacity to collect systematic data to characterize and document the relationship of equipment failures to firefighter injuries and fatalities.

To implement this comprehensive testing and certification program, approximately 50,000 square feet of laboratory and office space would be required. Based on these estimates, the costs to implement this proposal are $1.5 million in start-up costs, with annual operating costs of $6.0 million. The table on page 10 provides a summary of estimated start-up costs and annual operating costs for a Federal program.

SUMMARY AND RECOMMENDATIONS

Review of the existing literature has yielded little evidence or data to support a direct link between inadequacies in the current NFPA testing and certification process for firefighter personal protective equipment (PPE) and firefighter deaths and injuries. Also, the existing NFPA standards for firefighter PPE are among the most comprehensive set of standards available for protective equipment used by any occupational category. NIOSH was not able to identify any data to suggest that the current NFPA standards are inadequate.

NIOSH recognizes that, to date, no systematic study or evaluation of firefighter PPE standards or testing and certification has been undertaken. If desired, a needs assessment could be conducted to systematically evaluate existing standards and testing and certification programs.

A needs assessment would include the following elements:

- A comprehensive evaluation of the adequacy of current NFPA standards related to protective clothing and equipment certification.

- The collection of detailed surveillance data to document injuries and fatalities to firefighters and emergency response personnel as a direct result of an equipment failure. These data would determine whether firefighters are at risk of injury from PPE that is either certified based on an inadequate standard, or that fails to perform at the level certified.

- The collection of data to document equipment failures, even when an injury or fatality does not occur (i.e., so called "near miss" situations).

Finally, NIOSH recommends exploring opportunities to strengthen existing testing and certification programs before establishing a new Federal program. NIOSH estimates that it will take an investment of approximately $1.5 million in start-up costs and an annual operating budget of approximately $6.0 million to test and certify firefighter and emergency personnel PPE. Projected costs include hiring staff with the expertise to conduct these tests, purchasing specialized equipment, and leasing approximately 50,000 square feet of suitable laboratory and office space to conduct the program.

REFERENCES

1. Federal Emergency Management Agency, United States Fire Administration, **Study of Firefighter Casualties and Protective Equipment Problems**, August 31, 1988 Memorandum, Emmitsburg, Maryland.

2. Washburn, A.E., et al., **1995 Firefighter Fatalities**, *National Fire Protection Association Journal*, July/August 1996.

3. Karter, M.J. and LeBlanc, P.R., U.S. Firefighting Injuries, *National Fire Protection Association Journal*, November/December 1996.

Table - Estimated Costs of Implementing a Federal Testing and Certification Program for Firefighter Protective Clothing and Equipment

Estimated Start-Up Costs

Cost Category	Estimated Cost
Equipment	$ 1,043,330
Other start-up	$ 500,000
Total	$ 1,543,330

Estimated Annual Operating Costs

Cost Category	Estimated Cost
Facility[1]	$ 3,500,000
Personnel	$ 1,797,740
Travel	$ 256,000
Other	$ 500,000
Total	$ 6,053,740

[1] Facility operating costs are based on a rental rate of $60/square foot and $10/square foot for operating costs.