

# BREATHE

## Preventing Firefighter Injuries

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One spring morning, a fire broke out at a large garden nursery. After the fire had burned for about four hours, responders realized that pesticides, herbicides, and fertilizers were on-site. As responders began reporting illness, this fire was recognized as a hazardous materials incident. After requesting the facility's inventory, the fire department learned that there were more than 200 chemicals at the scene. Eight firefighters reported symptoms that included respiratory irritation, shortness of breath, headache, central nervous system effects, and heart problems. All were treated at nearby hospitals and released. Thirty responders received on-scene decontamination. Although there were no reports of injured residents, the lack of timely recognition of this haz-mat incident meant that evacuation of nearby residences was not initiated. Later, actions were taken to protect water intakes located downstream of the contaminated fire run-off.

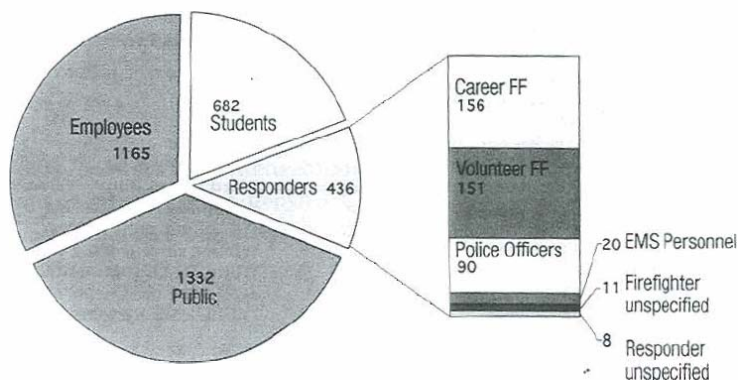
**H**azardous materials incidents happen daily. They include accidental and intentional spills, releases, and fires. Some are minor and cleaned up quickly. Others continue for longer periods and/or require more resources. What is significant about these incidents is that firefighters and other responders have been injured. Even with planning and training for hazardous materials events, injuries still occur. In some instances, like the example above, the injuries resulted from a lack of recognition that hazardous substances were involved in the incident. Immediate recognition of a haz-mat incident is crucial. It allows for protection of responders, nearby residents and resources, such as water.

In this article, we will tell you about data that we have collected about firefighter injuries at haz-mat events. We have also collected data on respirator use, haz-mat training, and medical outcome of injured firefighters. Our hope is that this information will raise your awareness and that you will act to protect your health at all times.

The New York State Department of Health, through the Hazardous Substances Emergency Events Surveillance (HSEES) program, collects information about haz-mat incidents and associated injuries. By HSEES definition, a haz-mat incident is a sudden or uncontrolled release, including an illegal release, of a non-petroleum hazardous substance. The New York HSEES data indicate that from 2000 to 2006, there were 7,735 recorded haz-mat incidents in New York state.

Of the people injured in haz-mat incidents, responders are a group who can readily take steps to protect themselves, even if the haz-

Figure 1. Categories and Numbers of People injured in Hazardous Materials Incidents



# EASY: in Haz-mat Events



ardous substance(s) is unknown. After all, responders are not being caught unaware by the incident, they are responding to it. That leads to several questions. Why are responders injured in haz-mat incidents? What are the most common injuries? What more can a responder do to protect him- or herself? Hopefully, our data will give you some answers and ideas for additional protective actions that you can take.

The data collected by the HSEES program show that of the 436 injured responders, 318 were firefighters. The majority of injured firefighters wore turnout gear (283, 89 percent of all injured firefighters and 65 percent or nearly two-thirds of injured responders). The injured included both career and volunteer firefighters in almost equal num-

bers: 156 career firefighters and 151 volunteer firefighters. The remaining 129 victims included law enforcement officers (90), EMS personnel (20), and others (19) as shown in Figure 1.

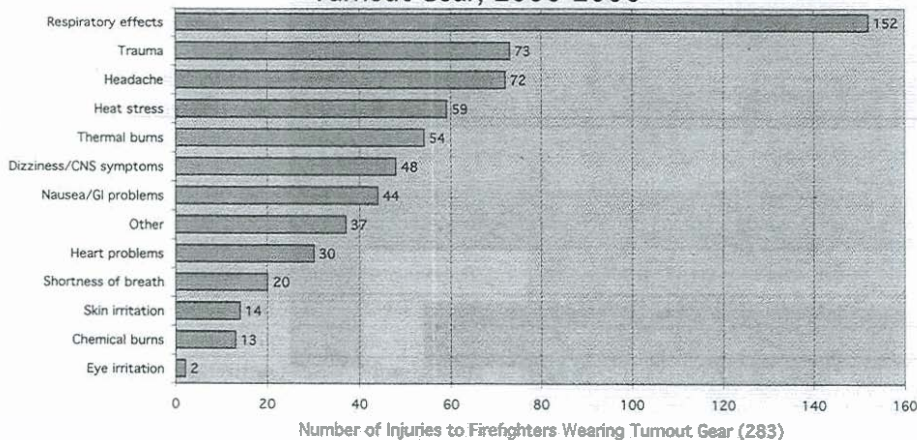
The injuries most frequently reported from 2000 to 2006 by firefighters wearing turnout gear were effects on the respiratory system (Figure 2). These included sore throat, coughing, wheezing, chest tightness (as related to breathing or asthma, not to cardiac issues), and chemical bronchitis or pneumonitis (inflammation of the lungs). Other health effects reported frequently were trauma, headache, and heat stress (effects caused by excessive heat).

Some health effects are recorded in the HSEES surveillance system because they are incident-related, but they are

difficult to connect with a cause. For example, headache can be due to exposure to a hazardous substance at the scene, but a headache can also be caused by one or more factors not related to exposure to a hazardous material. These include stress, lack of sleep, dehydration, high blood pressure, or the onset of illness. Similarly, heat stress and trauma may occur at a particular fire scene or incident, but may not be related directly to exposure to a hazardous substance. They may occur following events such as explosions or collapses that cause injury due to flying debris. The most important point to remember is that the most frequently reported symptoms among injured firefighters wearing turnout gear were effects on respiratory function, the ability to breathe. These types of injuries are primarily related to exposure to hazardous substance(s). That makes respiratory injuries preventable, or at least the occurrence of respiratory symptoms can be reduced by awareness and action.

Respiratory function matters a great deal. If your breathing is impaired, you have become one of the victims and now, you may not be able to respond. If your lungs are working with diminished capacity, other crucial organs may soon suffer from decreased oxygen, too. Most importantly, these include the heart and the brain. This decrease in oxygen can quickly affect your judgment and your decision-making ability, both critical to self-protection and response.

Figure 2. Injuries\* Sustained by Firefighters Wearing Turnout Gear, 2000-2006



\* The HSEES system allows for coding of as many as seven different injuries for each injured firefighter

**DEVELOP AWARENESS TO PREVENT EXPOSURE**

*In one haz-mat incident, a family of four, staying at a hotel in upstate New York, developed symptoms that they thought were food poisoning. One parent and two children were passed out while the second parent was barely conscious and able to call the front desk for help. All four family members had headache, nausea/vomiting, and difficulty breathing. The four patients were transported to the hospital for treatment for food poisoning. There, they were diagnosed with poisoning from carbon monoxide (CO). Following the diagnosis, the emergency room physician notified the fire department and advised them to return to the hotel and measure levels of CO. Elevated levels of CO were found in the building with the highest levels on the top floors. EMS command was established at the front entrance of the hotel and evacuation of about 86 hotel occupants began. The fire department measured CO levels of 300-1,200 parts per million and determined that the source was the pool heater. While conducting their search,*

*firefighters located two additional individuals with symptoms of carbon monoxide poisoning: one passed out, the other nearly so. Crews were sent to retrieve the ill individuals. According to newspaper accounts, the firefighters were not wearing respiratory protection. Three firefighters reported respiratory system problems, headache, and dizziness or central nervous system effects.*

To learn more about the circumstances that led to respiratory system effects among injured firefighters, we analyzed HSEES information about respirator use by injured firefighters. Unfortunately, data on respirator use was not available for every injured firefighter and was not even collected prior to 2002. Consequently, information about respirator use is unknown for nearly half the in-

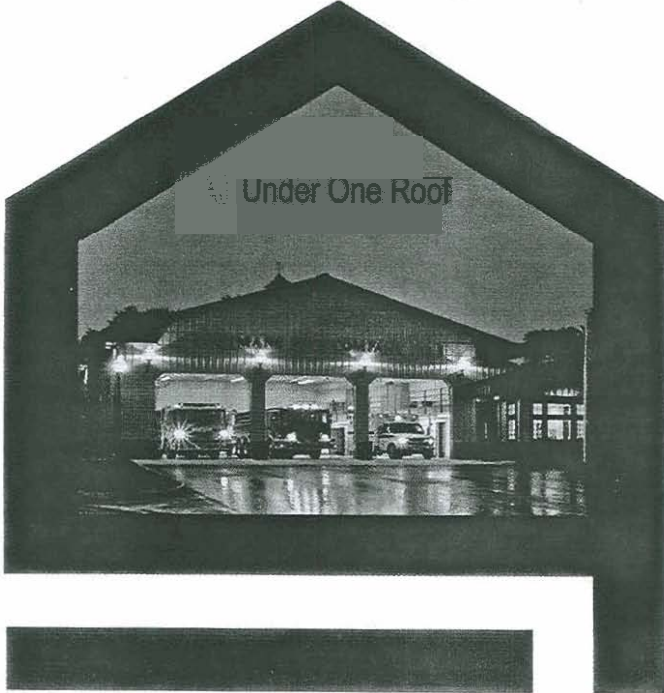
**TABLE 1. INJURIES MOST FREQUENTLY REPORTED BY FIREFIGHTERS WEARING TURNOUT GEAR, 2000-2006**

Injury	With Respirator n=94 (%)	Without Respirator n=59 (%)	Respirator use unknown n=130 (%)	Total Injuries (%)
Respiratory Irritation	32 (21)	49 (32)	71 (47)	152 (100)
Trauma	22 (30)	6 (8)	45 (62)	73 (100)
Headache	14 (19)	3 (4)	55 (76)	72 (100)
Heat Stress	23 (39)	2 (3)	34 (58)	59 (100)
Thermal Burns	19 (35)	0	35 (65)	54 (100)
Dizziness/CNS Effects	11 (23)	5 (10)	32 (67)	48 (100)

*There were 283 responders wearing firefighter turnout gear. The HSEES system allows for coding of as many as seven different injuries for each injured firefighter. These data currently contain a maximum of five injuries for any one firefighter so that the maximum of seven injuries per victim is not a limiting factor.*

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jured firefighters (47 percent). However, where respirator use was known, more respiratory irritation injuries were recorded for firefighters not wearing a respirator than for those wearing a respirator (Table 1). About one-fifth of injured firefighters who had respiratory effects wore a respirator (21 percent) and about one-third of the injured firefighters with respiratory effects did not wear a respirator (32 percent).

The HSEES data on injured firefighters indicate that respiratory tracts were not being protected or, for those firefighters who wore respirators and reported respiratory irritation, perhaps the respirators were being donned too late or removed too soon, were improperly fitted or were not working properly. Although it is not possible to determine from the HSEES data when during the response the respiratory injuries occurred, it is very important that each firefighter protect the respiratory tract until the area is clear of all irritating exposures. This is particularly important during overhaul, when the breathing hazards may be less obvious or there may be a greater temptation to remove cumbersome apparatus.

Haz-mat training, at least to the awareness level, which is eight hours, is required for every firefighter. The 8-hour haz-mat training prepares the firefighter to correctly recognize the haz-mat event. Additional haz-mat training helps firefighters to better understand the kinds of health-protective measures they can take when responding to haz-mat incidents. Within the HSEES program, a firefighter is defined as being trained in hazardous materials response after completing 40 hours of haz-mat training, which corresponds to the level of technician.

We analyzed the HSEES data to determine if the level of haz-mat training affected the incidence of injury to firefighters (Figure 3). More than one-third of injured firefighters had less than 40 hours of haz-mat training (39 percent), but 50 percent had at least 40 hours of haz-mat training. Data on haz-mat training was unavailable for about one-tenth of the injured firefighters (11 percent). The HSEES data cannot link the causes of the injuries to number of

hours of haz-mat training. However, we have learned during our data collection that, in some instances, a delay in haz-mat recognition has contributed to injuries. Every effort should be made after each incident with firefighter injuries to identify the problems that occurred and discuss solutions that will reduce future injuries.

To gauge the degree of injury sustained by each firefighter, we collected information on the level of medical treatment that was provided. The HSEES pro-

gram collects data on as many as seven possible outcomes. For example, the injured firefighter could be treated at the scene, taken to the hospital for treatment, and then released, or taken to the hospital and admitted. The information in Table 2 shows that the majority of injured firefighters (62 percent) were treated at the hospital and released. However, 38 or about 12 percent of impaired firefighters were admitted to the hospital. When comparing the data on hospital admissions between firefighters

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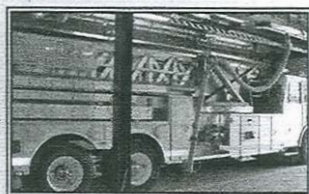
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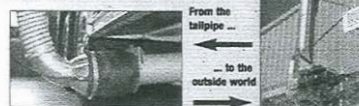
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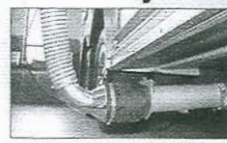


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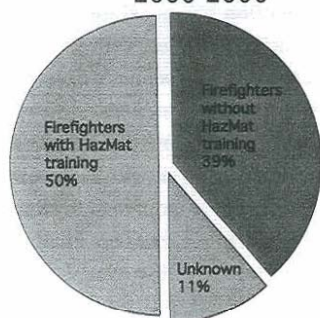
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Figure 3. HazMat Training of Injured Firefighters, 2000-2006



\*In the HSEES program, a firefighter is defined as being trained in hazardous materials response after completing 40 hours of hazmat training.

TABLE 2. MEDICAL OUTCOMES FOR INJURED VICTIMS, 2000-2006

Medical Outcome	All Victims		Firefighter Victims	
	%	Number	%	Number
Hospital, treated and released	58	2,084	62	197
Hospital, admitted	6	207	12	38
Hospital, observation only	1	28	0	0
Treated at scene	26	929	21	68
Seen by private physician	1	45	<1	1
Injuries reported by an official*	7	262	3	11
Death	2	57	1	3

\*An official at the incident reported observing symptoms in a victim who refused or did not seek medical attention at that time.

and all victims, the data shows, at a statistically significant level, that firefighters are more likely to be admitted ( $p < 0.001$ , chi-square test) indicating more severe injury and the need for more medical care. With the increased risk of serious injury, firefighters must recognize a haz-mat incident quickly and protect themselves from exposure.

As stated earlier, our goal is to offer information, the data that we have collected, to raise your awareness about haz-mat events. With that raised awareness, we hope you will act to protect your health at all times. The injuries most frequently reported by firefighters were effects on the respiratory system. The ability to breathe must always be protected so you do not become impaired. Remember:

- Know your scene. Do not rush in until you do.
- Determine as quickly as possible if hazardous materials are on scene.
- Wear appropriate PPE, particularly respiratory protection, that is fitted and working properly.

- Do not remove air packs prematurely.
- If your breathing is impaired, you cannot respond effectively.

#### ABOUT HSEES

The Hazardous Substances Emergency Events Surveillance (HSEES) is a federal program established to enable health departments in funded states to collect information on incidents involving spills or air releases of hazardous substances. The goal is to use the data to reduce morbidity (injury) and mortality (death) resulting from similar events in the future. State health departments work to meet this goal by analyzing the data, identifying factors that create a risk, and working to reduce that risk through prevention activities such as education and raised awareness. Understanding the causes and consequences of incidents and sharing the lessons learned are critical to implementing improvements that provide safety and protect health. The New York State Department of Health has been a member of the HSEES program since 1992.

If you have any questions or comments about the New York HSEES program or the data, contact THE staff at (518) 402-7810 or toll-free at 1-800-458-1158, extension 2-7810. Also, see the New York HSEES Web site at [www.health.state.ny.us/environmental/chemicals/hsees](http://www.health.state.ny.us/environmental/chemicals/hsees).

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Rebecca Wilburn, MPH, has a master's of public health degree from the State University of New York at Albany with a concentration in environmental health and toxicology. She has been working for the Hazardous Substances Emergency Events Surveillance (HSEES) program conducting investigations and analyzing hazardous materials incident data for 11 years. Prior to that Wilburn worked on a disaster mental health project and a highway traffic safety project.