

# Surveillance of Workers Responding Under the National Response Plan

**Clifford S. Mitchell, MS, MD, MPH**

**Michael Gochfeld, MD, PhD**

**Jan Shubert, MA, MSW**

**Howard Kipen, MD, MPH**

**Jacqueline Moline, MD, MSc**

**Alan Langlieb, MD, MPH, MBA**

**George S. Everly Jr, PhD**

**Iris Udasin, MD**

**Daniel Wartenberg, PhD**

**Glenn Paulson, PhD**

*The National Response Plan (NRP) establishes the framework for the nation's response to major disasters. We offer seven recommendations related to surveillance of workers who respond to events under the NRP. These recommendations address the rationale for and principles of medical surveillance in the context of large-scale disasters and the NRP; means of identifying and registering the populations that should be included in surveillance activities; the role of exposure assessment in medical surveillance; behavioral health issues; and principles regarding the communication and use of surveillance data. (J Occup Environ Med. 2007;49:922-927)*

The National Response Plan (NRP) establishes “a comprehensive, national, all-hazards approach to domestic incident management across a spectrum of activities, including prevention, preparedness, response, and recovery.”<sup>1</sup> In case of a major disaster (either natural or manmade) or threat of an event, the NRP establishes the framework for federal interaction with state, local, and tribal governments; the private sector; and nongovernmental organizations in managing the response. The NRP also provides for worker safety and health during the response, in the form of a support annex.<sup>2</sup> During an event of national significance, the US Department of Labor Occupational Safety and Health Administration (OSHA) coordinates Federal and worker safety and health activities, including a specific responsibility, not assigned to any other entity in the NRP, to “implement a system to capture and manage incident exposure data in a centralized location to enable data-sharing among agencies with a responder health and safety focus.”<sup>2</sup>

OSHA has identified a number of standards relevant to emergency preparedness, though not specifically to disasters under the NRP.<sup>3</sup> One, the hazardous waste operations and emergency response (HAZWOPER) standard, requires surveillance for certain categories of workers who may be exposed to hazardous substances or health hazards at or above the established permissible exposure limit for 30 days or more a year; wear a respirator for 30 days or more; are injured, become ill or show signs or symptoms

---

From the Department of Environmental Health Sciences (Dr Mitchell), Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland; Department of Environmental and Occupational Medicine (Drs Gochfeld, Kipen, Udasin, Wartenberg, and Paulson), UMDNJ-Robert Wood Johnson Medical School, Piscataway, New Jersey; US Environmental Protection Agency (Dr Shubert), Washington; Department of Community and Preventive Medicine (Dr Moline), Mt. Sinai School of Medicine, New York, New York; Department of Psychiatry (Dr Langlieb), Johns Hopkins University School of Medicine; and Johns Hopkins Center for Public Health Preparedness (Dr Everly), Baltimore, Maryland.

The views expressed in this article are the views of the authors and do not necessarily reflect the views of the US Centers for Disease Control and Prevention, US Environmental Protection Agency, Maryland Department of Health and Mental Hygiene, or any other federal or state agency.

Address correspondence to: Clifford S. Mitchell, MS, MD, MPH, Maryland Department of Health and Mental Hygiene, 201 West Preston Street, Room 321, Baltimore, MD 21201; E-mail: CMitchell@dhmh.state.md.us.

Copyright © 2007 by American College of Occupational and Environmental Medicine

DOI: 10.1097/JOM.0b013e318145b2b0

from possible exposures involving hazards from an emergency response or hazardous waste operation; and are members of HAZMAT teams. The standard also partially specifies the structure and content of the surveillance examinations. They must include a medical and work history “with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE (personal protective equipment) under conditions (ie, temperature extremes) that may be expected at the worksite.”<sup>4</sup>

Unlike typical workplaces, a disaster requiring activation of the NRP could involve exposures to chemical, biological, radiological, nuclear, or high explosive (CBRNE) agents, as well as more conventional hazards such as falls and fire.<sup>5</sup> The nature and extent of the hazards will evolve over time, with exposures from acute, uncontrolled, and unpredictable to more predictable and controlled (as the recovery phase proceeds). By contrast, a typical workplace involves fixed and predictable hazards that can be measured and controlled. Thus, the design and implementation of surveillance programs for a major disaster will be different from a usual workplace calamity. We discuss here the hazards involved in disaster response; the rationale for surveillance of workers who respond under the NRP; and recommendations for the structure and content of responder surveillance in disaster response under the NRP, including the incorporation of psychological surveillance within a medical surveillance program. The recommendations are a collaborative effort growing out of the September 2005 conference, “Protecting the Protectors: Medical, Psychological & Environmental Surveillance Needs for Workers Involved in Incident Response Under the National Response Plan,” sponsored by the Centers for Public Health Preparedness of the School of Public Health of the University of Medicine and Dentistry of

New Jersey, and the Johns Hopkins Bloomberg School of Public Health.

## Principles of Medical Surveillance Under the NRP

Under the NRP, OSHA establishes policies for medical surveillance and medical monitoring of response workers, and for any longer term monitoring and surveillance. The agency is also supposed to collect and manage exposure, safety, and health outcomes data; communicate with labor unions and other organizations regarding worker safety and health; coordinate incident-specific responder training; provide psychological first aid during and after response and recovery activities; and identify appropriate immunization and prophylaxis for responders and recovery workers.<sup>2</sup>

Traditionally, medical surveillance of workers was intended to identify exposures and clinical effects of exposures in populations and individuals with regular and repeated probabilities of exposure over time.<sup>6,7</sup> In the case of workers exposed to multiple hazards in a disaster, it may be very expensive to measure all of the possible exposures and health outcomes.<sup>8</sup>

*Principle 1.* The purpose of medical surveillance is to identify exposures or early symptoms or both of disease, and to link those findings to individual care and preventive interventions to 1) prevent and mitigate adverse physical and mental health outcomes and 2) assess and maintain worker functionality. By functionality, we mean the ability of the worker to attend and respond effectively to both personal and professional responsibilities. Mental health and physical health must be integrated to enhance functionality.

A primary goal of surveillance associated with response under the NRP is to maintain the physical and mental health and functionality of the responders. One potential outcome of a surveillance program is the identification of unanticipated new clinical entities (eg, World

Trade Center cough).<sup>9,10</sup> In addition, although environmental and biological monitoring are important for exposures to many chemical, physical, and biological agents, there are still clinical outcomes (including mental health outcomes and injuries) for which traditional medical and exposure monitoring are insufficient.<sup>11</sup> Therefore, it is important to establish comprehensive surveillance systems that examine a broad range of illnesses, injuries, and mental health outcomes.<sup>12</sup>

Another purpose of surveillance is to demonstrate whether protective measures are adequate to prevent detrimental exposures and health effects. Thus, in the WTC disaster, a comparison of pulmonary function in firefighters at the site with a reference group of nonexposed, off-duty firefighters showed that there were significant symptoms and pulmonary function effects in the exposed population.<sup>13</sup> A similar comparison was used to determine whether firefighters had been exposed to certain metals and organic chemicals while involved in the WTC response.<sup>14</sup> In the 2005 Gulf Coast disasters, surveillance of workers has focused on injuries, dermatologic conditions, and infectious diseases. The results have been used to develop targeted prevention messages for workers.<sup>15,16</sup>

Surveillance also plays an important role in mental health symptoms associated with disaster response.<sup>17,18</sup> There is an extensive literature on mental health sequelae of previous natural and manmade disasters for various working populations, including responders.<sup>19–22</sup> In a study of 1138 WTC rescue/recovery workers conducted between July 2002 and August 2004, 51% of the workers met criteria on at least one screening instrument indicating the need for a more in-depth clinical mental health evaluation during the first 6 months of the study. However, only 3% reported they had ever used mental health services before the study began.<sup>23</sup> Another recent report recommended the consideration of critical incident stress

management in response planning, including its application for nontraditional responder groups such as construction and trade workers and the families of responders. The report noted the importance of considering responder stress levels before, during, and after deployment, as well as the history of prior deployments.<sup>24</sup>

Integrating psychological and medical surveillance requires an understanding of the relationship between the types of disaster exposures and how they can serve as “triggers” for severe trauma responses among people who are vulnerable because of previous exposures.<sup>25–27</sup> Incorporating mental health screening into the medical component of surveillance is a challenge, however. A number of instruments have been developed to screen for PTSD and other disorders specifically associated with disasters (including some for non-English-speaking populations), but there is a need for research to validate the instruments and determine the optimal method of screening as part of a comprehensive surveillance program.<sup>28–31</sup> In addition, there is considerable literature regarding appropriate methods for ameliorating the mental health effects of disaster response experiences and the effectiveness of these methods, including critical incident stress management.<sup>32–36</sup>

**Principle 2.** Participation in surveillance should be confidential and voluntary, to the extent feasible. In the context of the NRP, surveillance should be an ongoing process, occurring all the way from predeployment, to the field, to the postdeployment period and beyond.

Surveillance programs, like other programs in occupational health, require buy-in by both the employer and worker. While surveillance under the NRP may never be completely voluntary, workers will be more likely to participate if they feel that they are not going to be penalized either for their participation or as a result of findings generated by the surveillance (although in some

cases workers could be disqualified from duty or reassigned to other duties if surveillance shows exposures or effects). In this regard, confidentiality is particularly important, since part of the data collection process may involve personal data of a sensitive nature.

The surveillance program should also be of sufficient duration to detect latent conditions caused by exposures to chemical, biological, or physical agents. Therefore, responsible agencies may need to ensure continuation of surveillance even after the NRP is no longer in effect.

Surveillance in traditional workplaces has raised several ethical issues. These include the nonvoluntary nature of many surveillance programs; the possibility that the results will be used to discipline or dismiss workers found to have had exposures or preexisting health conditions; the threat that workers who are found to have an increased risk of health effects will be terminated or otherwise discriminated against; and concerns about the confidentiality of results.<sup>37–41</sup> A further consideration is whether and under what circumstances it is ethical to use medical and psychological surveillance data obtained during disaster responses for research purposes. Although the research might not benefit the current responders; it could potentially benefit others in the future. The issue is further complicated where surveillance data is obtained from responders exposed to an infectious agent who are quarantined to protect others. Both the autonomy and privacy of these workers has to be weighed against potential public health benefits.<sup>42</sup>

**Principle 3.** On activation of the NRP, there should be a centralized mechanism to capture data related to individual and collective exposures to facilitate individual treatment, preventive interventions and future long term public health needs.

There is a specific need to share data between groups assessing exposure and those providing health care

at the disaster. This helps to ensure that health care providers are aware of the latest information on hazards detected, while exposure assessment professionals can focus measurements on areas and hazards indicated by clinical reports from health care professionals (eg, worker reports of specific types of symptoms might indicate exposures to particular types of chemical agents).

Information management is critically important in effective surveillance programs to track employees, job assignments, exposure records, health records, and in some cases insurance information. The Department of Defense has made significant progress in the design and implementation of integrated information systems to aid in surveillance.<sup>43</sup> However, the challenges of assembling such integrated systems in the civilian sector are considerable, given a multiplicity of employers, preexisting, incompatible systems, and concerns about data sharing and confidentiality.

## Identifying and Registering Affected Populations

**Principle 4.** Creation of a registry of workers at the site is critical for effective surveillance. Once a disaster site is identified and the Incident Command System (ICS) is established, access to the site should be controlled and entering workers registered. Appropriate on-site surveillance should then be initiated.

One of the most important determinants of success for any surveillance program is the ability to identify all those who need to be enrolled. In a large-scale disaster, effective surveillance absolutely requires a system to identify workers entering the site. This could be done in conjunction with training, so that workers entering a site for the first time would be required to have appropriate training and to be enrolled in a database with, if appropriate, an initial surveillance encounter to collect baseline data. This serves several purposes: 1) it ensures that untrained workers do not enter the site;

2) it controls access to the site; 3) it identifies all entrants to the site who might be at risk for purposes of a surveillance system; 4) it can be used to ensure that workers have been trained and can use appropriate PPE; and 5) it ensures that workers meet any established requirements for site entry.

Many first responders (particularly firefighters and hazardous materials response teams) are already enrolled in surveillance programs under the HAZWOPER standard and before being deployed under the NRP.<sup>44</sup> This is not true for many other responders. For those deployed early in a disaster zone, predeployment screening may be impractical. However, with adequate planning many secondary responders (security, construction workers etc.) could undergo a short but valuable predeployment screening/surveillance examination before being admitted to the disaster site. Given the need to train workers who are responding to the disaster before they start, the predeployment (baseline) surveillance examination could be coupled with training on-site-specific hazards, PPE, communications, emergency procedures, site-specific responsibilities and other required training elements.<sup>45</sup>

A particular concern in this regard is the self-employed worker. Many large employers (including the Federal government) have little difficulty carrying out surveillance or identifying their workers. Unfortunately, there are few mechanisms to effectively capture or register self-employed workers, despite the fact that they are often found in abundance once the disaster has progressed to the recovery/reconstruction phase.

Non-English-speaking workers also are difficult to reach and thus may not be included in surveillance. This can be especially important because these workers may have particularly high exposures in some cases, may have limited access to health care, and may have had little previous training in health and safety in their own language.<sup>46</sup>

## Exposure Identification and Dose Quantification

*Principle 5.* Exposure assessment strategies should be developed and implemented under the ICS as a way to protect workers on the job, and should be integrated with medical/psychological surveillance to help guide interventions.

Exposure assessment can have many different purposes. Some exposure assessment focuses on identifying risks to the general population and preventing health effects. Yet, there is a specific need for exposure information focused on workers who are responding to the disaster. The collection and analysis of these data require different assessment strategies than community exposure sampling. Although these recommendations pertain primarily to workers who are full-time professional responders responding under the NRP, there are large numbers of community members (including Red Cross volunteers, volunteer firefighters, and others) who may have responded in some capacity and have been potentially exposed within the disaster site. Exposure assessment and surveillance strategies should recognize this fact.

Anything approaching even a semiquantitative estimate of dose is not likely in the first hours or even the first few days of a disaster, with the possible exception of radionuclide exposures (unless, of course, individuals manifest acute symptoms of exposure).<sup>47</sup> Dose estimation is often imprecise for chemical and biological agents and even for airborne particulate matter. Where there is no reliably valid quantitative biological marker of exposure, exposure can sometimes be estimated using models that incorporate exposure zones, concentrations in the zones, and individual time and activity in the zone. It also may include the use of physiologically based pharmacokinetic models and is usually performed when there is no opportunity for field testing or validation.<sup>48</sup>

Biological monitoring can be used to estimate dose as well as early biological effects. For example, blood lead reflects recent exposure, whereas free erythrocyte protoporphyrin is a biomarker of lead effect in the hematopoietic system. The advantages of biological markers of exposure include their ability to integrate all sources and routes of exposure (cumulative exposure) and to account for differences in absorption, metabolism, and distribution. The use of biological markers of exposure is likely to be limited in disasters; however, because such biomarkers typically require a sophisticated understanding of the hazard and its biology, prior development of a well-validated marker, and ready access to a laboratory that is proficient in the assay. None of this is likely to be available in the case of most disasters involving the NRP. However, part of the justification for including biological monitoring as part of surveillance might be to bank specimens for future use.<sup>14,49</sup> The investigative and speculative purposes of this new form of exposure assessment may call for more detailed explanations to the participants. The evolving experience of the Department of Defense in establishing registries and exposure assessment methodologies for Gulf War veterans potentially exposed to depleted uranium may be helpful in this regard.<sup>50</sup>

## Communication

*Principle 6.* Each individual worker should receive detailed and interpreted biomedical and exposure data. All de-identified surveillance and exposure data should be publicly available, provided to all workers, and interpreted appropriately.

A primary ethical tenet of occupational health is the right of each worker to his/her own personal exposure and health information. This requirement is recognized under the law and under regulation, along with privacy rights.<sup>51</sup> The interpretation

of these exposure and health data must be done by appropriately trained health and safety professionals. Because the exposures are unique, and the health implications are potentially complicated, effective risk communication is absolutely essential and should provide workers with opportunities to ask questions and receive answers.

In the context of a large disaster under the NRP, particularly one in which the threat of unusual exposures exists, it is essential that appropriately de-identified surveillance and exposure data also be available to the general public health and health care communities. Although it is understandable in some cases to restrict data access for either security or law enforcement considerations, public health needs ordinarily should trump these justifications, except in the rarest of circumstances.

**Principle 7.** Risk communication needs to be an integral part of the entire worker protection program, including surveillance.

As noted above, the unique aspects of a large-scale disaster require that considerable thought go into the design and implementation of the communication components of the surveillance system. Workers are more likely to participate and more likely to continue participating, if they understand and support the reasons for the program.

## Conclusion

Surveillance in the context of the NRP is complicated by the nature of disasters, the workforces responding to the disaster, the unique governance of the disaster under the NRP, and the structure of occupational safety and health delivery in the United States. Surveillance, however, is essential to guarantee that workers are adequately protected under the auspices of the NRP. The elements of a surveillance program—exposure assessment, the clinical component, and program management—should be integrated

under the ICS and should not be an afterthought.

## Acknowledgment

The authors would like to acknowledge gratefully all those who participated in the September 27–28, 2005 conference, “Protecting the Protectors: Medical, Psychological and Environmental Surveillance Needs for Workers Involved in Incident Response under the National Response Plan.” The conference was sponsored by the New Jersey Center for Public Health Preparedness (CDC Cooperative Agreement U90/CCU224257) and Johns Hopkins Centers for Public Health Preparedness (CDC Cooperative Agreement U90/CCU324236.)

## References

1. Department of Homeland Security. *National Response Plan*. Washington, DC: Department of Homeland Security; 2004:2. Available at: [www.dhs.gov/xlibrary/assets/NRP\\_FullText.pdf](http://www.dhs.gov/xlibrary/assets/NRP_FullText.pdf). Accessed November 19, 2006.
2. Department of Homeland Security. *Worker Safety and Health Support Annex of the National Response Plan*. Washington, DC: US Department of Homeland Security; 2006:WSH-1-WSH-6. Available at: [www.dhs.gov/xlibrary/assets/NRP\\_FullText.pdf](http://www.dhs.gov/xlibrary/assets/NRP_FullText.pdf). Accessed November 19, 2006.
3. US Department of Labor, Occupational Safety and Health Administration. Emergency response and preparedness standards. US Department of Labor, Occupational Safety and Health Administration. 2005. Available at: [www.osha.gov/SLTC/emergencypreparedness/standards.html](http://www.osha.gov/SLTC/emergencypreparedness/standards.html). Accessed November 19, 2006.
4. US Department of Labor, Occupational Safety and Health Administration. Hazardous waste operations and emergency response. Final rule. Code of Federal Regulations 29CFR1910.120; 29CFR1926.65. 1994.
5. From the Centers for Disease Control and Prevention. Injuries and illnesses among New York city fire department rescue workers after responding to the World Trade Center attacks. *JAMA*. 2002;288:1581–1584.
6. Gochfeld M. Medical surveillance and screening in the workplace: complementary preventive strategies. *Environ Res*. 1992;59:67–80.
7. Halperin WE. The role of surveillance in the hierarchy of prevention. *Am J Ind Med*. 1996;29:321–323.
8. Melius JM. Medical surveillance for hazardous waste workers. *J Occup Med*. 1986;28:679–683.
9. Levin S, Herbert R, Skloot G, et al. Health effects of World Trade Center site workers. *Am J Ind Med*. 2002;42:545–547.
10. Prezant DJ, Weiden M, Banauch GI, et al. Cough and bronchial responsiveness in firefighters at the World Trade Center site. *N Engl J Med*. 2002;347:806–815.
11. Health hazard evaluation of police officers and firefighters after hurricane Katrina—New Orleans, Louisiana, October 17–28 and November 30–December 5, 2005. *MMWR Morb Mortal Wkly Rep*. 2006;55:456–458.
12. Lewis MD, Pavlin JA, Mansfield JL, et al. Disease outbreak detection system using syndromic data in the greater Washington DC area. *Am J Prev Med*. 2002;23:180–186.
13. Feldman DM, Baron SL, Bernard BP, et al. Symptoms, respirator use, and pulmonary function changes among New York city firefighters responding to the World Trade Center disaster. *Chest*. 2004;125:1256–1264.
14. Edelman P, Osterloh J, Pirkle J, et al. Biomonitoring of chemical exposure among New York city firefighters responding to the World Trade Center fire and collapse. *Environ Health Perspect*. 2003;111:1906–1911.
15. Surveillance for illness and injury after hurricane Katrina—New Orleans, Louisiana, September 8–25, 2005. *MMWR Morb Mortal Wkly Rep*. 2005;54:1018–1021.
16. Infectious disease and dermatologic conditions in evacuees and rescue workers after hurricane Katrina—multiple states, August–September, 2005. *MMWR Morb Mortal Wkly Rep*. 2005;54:961–964.
17. Ritchie EC, Friedman M, Watson P, Ursano R, Wessely S, Flynn B. Mass violence and early mental health intervention: a proposed application of best practice guidelines to chemical, biological, and radiological attacks. *Mil Med*. 2004;169:575–579.
18. Ruzek JI, Young BH, Cordova MJ, Flynn BW. Integration of disaster mental health services with emergency medicine. *Prehospital Disaster Med*. 2004;19:46–53.
19. North CS. The course of post-traumatic stress disorder after the Oklahoma city bombing. *Mil Med*. 2001;166:51–52.
20. Nandi A, Galea S, Tracy M, et al. Job loss, unemployment, work stress, job satisfaction, and the persistence of posttraumatic stress disorder one year after the September 11 attacks. *J Occup Environ Med*. 2004;46:1057–1064.
21. North CS, Kawasaki A, Spitznagel EL, Hong BA. The course of PTSD, major depression, substance abuse, and somati-

- zation after a natural disaster. *J Nerv Ment Dis.* 2004;192:823–829.
22. Chang CM, Connor KM, Lai TJ, Lee LC, Davidson JR. Predictors of posttraumatic outcomes following the 1999 Taiwan earthquake. *J Nerv Ment Dis.* 2005;193:40–46.
  23. Mental health status of World Trade Center rescue and recovery workers and volunteers—New York city, July 2002–August 2004. *MMWR Morb Mortal Wkly Rep.* 2004;53:812–815.
  24. Jackson BA, Baker JC, Ridgely MS, Bartis JT, Linn HI. *Protecting Emergency Responders. Vol. 3: Safety Management in Disaster and Terrorism Response.* DHHS (NIOSH) Publication No. 2004-144, 1-119. 2003. Cincinnati, OH: NIOSH. January 12, 2005.
  25. Tanskanen A, Hintikka J, Honkalampi K, Haatainen K, Koivumaa-Honkanen H, Viinamäki H. Impact of multiple traumatic experiences on the persistence of depressive symptoms—a population-based study. *Nord J Psychiatry.* 2004;58:459–464.
  26. Jayasinghe N, Spielman L, Cancellare D, Difede J, Klausner EJ, Giosan C. Predictors of treatment utilization in world trade center attack disaster workers: role of race/ethnicity and symptom severity. *Int J Emerg Ment Health.* 2005;7:91–99.
  27. North CS, Pollio DE, Pfefferbaum B, et al. Concerns of Capitol Hill staff workers after bioterrorism: focus group discussions of authorities' response. *J Nerv Ment Dis.* 2005;193:523–527.
  28. Chen CH, Lin SK, Tang HS, Shen WW, Lu ML. The Chinese version of the Davidson Trauma Scale: a practice test for validation. *Psychiatry Clin Neurosci.* 2001;55:493–499.
  29. Norris FH, Perilla JL, Murphy AD. Post-disaster stress in the United States and Mexico: a cross-cultural test of the multicriterion conceptual model of posttraumatic stress disorder. *J Abnorm Psychol.* 2001;110:553–563.
  30. Chou FH, Su TT, Ou-Yang WC, Chien IC, Lu MK, Chou P. Establishment of a disaster-related psychological screening test. *Aust NZ J Psychiatry.* 2003;37:97–103.
  31. Boscarino JA, Adams RE, Foa EB, Landrigan PJ. A propensity score analysis of brief worksite crisis interventions after the World Trade Center disaster: implications for intervention and research. *Med Care.* 2006;44:454–462.
  32. Boscarino JA, Adams RE, Figley CR. A prospective cohort study of the effectiveness of employer-sponsored crisis interventions after a major disaster. *Int J Emerg Ment Health.* 2005;7:9–22.
  33. Everly GS Jr, Boyle SH. Critical incident stress debriefing (CISD): a meta-analysis. *Int J Emerg Ment Health.* 1999;1:165–168.
  34. Deahl MP, Srinivasan M, Jones N, Neblett C, Jolly A. Evaluating psychological debriefing: are we measuring the right outcome? *J Trauma Stress.* 2001;14:527–529.
  35. Hammond J, Brooks J. The World Trade Center attack. Helping the helpers: the role of critical incident stress management. *Crit Care.* 2001;5:315–317.
  36. Everly GS Jr, Flannery RB Jr, Eyer VA. Critical Incident Stress Management (CISM): a statistical review of the literature. *Psychiatr Q.* 2002;73:171–182.
  37. Bayer R. Biological monitoring in the workplace: ethical issues. *J Occup Med.* 1986;28:935–939.
  38. Frumkin H, Kantrowitz W. Cancer clusters in the workplace: an approach to investigation. *J Occup Med.* 1987;29:949–952.
  39. Cone J. Ethical issues in occupational disease outbreak investigations. *Occup Med.* 2002;17:657–663.
  40. Fiore RN, Fleming LE. Occupational and environmental health: towards an environmentally inclusive bioethics. *Prof Ethics.* 2003;11:65–82.
  41. Schulte PA. Some implications of genetic biomarkers in occupational epidemiology and practice. *Scand J Work Environ Health.* 2004;30:71–79.
  42. Goldman LR, Anton-Culver H, Kharrazi M, Blake E. Banking of human tissue for biomonitoring and exposure assessment: utility for environmental epidemiology and surveillance. *Environ Health Perspect.* 1995;103(Suppl 3):31–34.
  43. Rubertone MV, Brundage JF. The Defense Medical Surveillance System and the Department of Defense serum repository: glimpses of the future of public health surveillance. *Am J Public Health.* 2002;92:1900–1904.
  44. Kales SN, Polyhronopoulos GN, Christiani DC. Medical surveillance of hazardous materials response fire fighters: a two-year prospective study. *J Occup Environ Med.* 1997;39:238–247.
  45. Mitchell CS, Doyle ML, Moran JB, et al. Worker training for new threats: a proposed framework. *Am J Ind Med.* 2004;46:423–431.
  46. McCauley LA. Immigrant workers in the United States: recent trends, vulnerable populations, and challenges for occupational health. *AAOHN J.* 2005;53:313–319.
  47. Stuhmiller JH, Long DW, Stuhmiller LM. An internal dose model of incapacitation and lethality risk from inhalation of fire gases. *Inhal Toxicol.* 2006;18:347–364.
  48. McMahon CK, Bush PB. Forest worker exposure to airborne herbicide residues in smoke from prescribed fires in the southern United States. *Am Ind Hyg Assoc J.* 1992;53:265–272.
  49. May LM, Weese C, Ashley DL, Trump DH, Bowling CM, Lee AP. The recommended role of exposure biomarkers for the surveillance of environmental and occupational chemical exposures in military deployments: policy considerations. *Mil Med.* 2004;169:761–767.
  50. McDiarmid MA, Engelhardt SM, Oliver M, et al. Biological monitoring and surveillance results of Gulf war I veterans exposed to depleted uranium. *Int Arch Occup Environ Health.* 2005;79:1–11.
  51. Mitchell CS. Confidentiality in occupational medicine. *Occup Med.* 2002;17:617–623.