FEATURED ARTICLES & PUBLICATIONS

The following are the full abstracts of the articles featured in the May 2005 Quarterly Newsletter. These articles mark work by members of our WTCHR Scientific Advisory Committee. Their research examines health issues relating to 9/11/01 and provides health information about a variety of exposure groups. To view the complete article, please click on the web link listed at the end of the article (whenever available).

Assessing Truck Driver Exposure at the World Trade Center Disaster Site: Personal and Area Monitoring for Particulate Matter and Volatile Organic Compounds during October 2001 and April 2002. Geyh AS, Chillrud S, Williams DL, et al. J Occup Environ Hygiene. 2:179-193 (2005).
The destruction of the World Trade Center (WTC) in New York City on September 11, 2001, created a 16-acre debris field composed of pulverized and burning material significantly impacting air quality. Site cleanup began almost immediately. Cleanup workers were potentially exposed to airborne contaminants, including particulate matter, volatile organic compounds, and asbestos, at elevated concentrations. This article presents the results of the exposure assessment of one important group of WTC workers, truck drivers, as well as area monitoring that was conducted directly on site during October 2001 and April 2002. In cooperation with a local labor union, 54 drivers (October) and 15 drivers (April) were recruited on site to wear two monitors during their 12-hour work shifts. In addition, drivers were administered a questionnaire asking for information ranging from "first day at the site" to respirator use. Area monitoring was conducted at four perimeter locations during October and three perimeter locations during April. During both months, monitoring was also conducted at one location in the middle of the rubble. Contaminants monitored for included total dust (TD), PM10, PM2.5, and volatile organic compounds. Particle samples were analyzed for mass, as well as elemental and organic carbon content. During October, the median personal exposure to TD was 346µg/m3. The maximum area concentration, 1742µg/m3, was found in middle of the debris. The maximum TD concentration found at the perimeter was 392µg/m3 implying a strong concentration gradient from the middle of debris outward. PM2.5/PM10 ratios ranged from 23% to100% suggesting significant fire activity during some of the sampled shifts. During April, the median personal exposure to TD was 144µg/m3, and the highest area concentration,195µg/m3, was found at the perimeter. During both months, volatile organic compounds concentrations were low.

Respiratory Effects of Inhalation Exposure Among Workers During the Clean Up Effort at the World Trade Center Disaster Site. Herbstman JB, Frank R, Schwab M, et al. Environ Research. (in press)
During December 2001 we conducted a field study of 183 clean-up and recovery workers at the World Trade Center (WTC) disaster site to assess respiratory health effects potentially resulting from their work at the site. On site, we administered a respiratory health questionnaire designed to assess upper respiratory symptoms and lower respiratory symptoms, including cough, phlegm, and wheeze, as well as indices of exposure, including number of days worked at the site and job category. Spirometry was conducted for 175 workers. Sixty-five percent of the workers surveyed arrived at the site without lower respiratory symptoms. Of this group, 34% developed cough, 24% developed phlegm, and 19% developed wheeze. Prevalence rates of these symptoms were related to the number of days spent working at the WTC, but not job category. The mean percentage predicted FEV1 and FVC were 6% and 5% lower, respectively, for workers who developed new lower respiratory symptoms compared to those who remained symptom free. While the development of new wheeze suggested the presence of airway obstruction, the near-normal distribution of age-adjusted FEV1/FVC ratios suggested that the degree of obstruction was mild. The prevalence rates of upper airway symptoms (nasal congestion, sore throat, hoarse throat) exceeded those of lower respiratory symptoms, however, it was not determined whether symptoms pre-dated arrival at the WTC site.

Upper Respiratory Symptoms And Other Health Effects Among Residents Living Near The World Trade Center Site After September 11, 2001. Lin S, Reibman J, Bowers JA, Hwang SA, et al. Am J Epidemiol. (in press).
This study investigated changes in respiratory health after September 11, 2001 among residents of the area near the World Trade Center (WTC) site compared to a control area. Self administered questionnaires requesting information on the presence and persistence of respiratory symptoms, unplanned medical visits, and medication use, were sent to 9,200 households (22.3% responded) within 1.5 kilometers of the WTC site (affected area), and about 1,000 residences (23.3% responded) in upper Manhattan (>9 kilometers from the site, control area). Affected area residents reported higher rates of new-onset upper respiratory symptoms after 9/11 (CIR 2.21, 95% CI: 1.87, 2.61). Most of these symptoms were significantly more persistent one year after 9/11 in the affected area. Previously healthy residents of the affected area had more respiratory-related unplanned medical visits (PR1.76,95%CI: 1.15, 2.68), and new medication use (PR:2.88,95%CI:1.75,

FEATURED ARTICLES & PUBLICATIONS
(continued from page 2)

4.75) after 9/11. Greater impacts on respiratory functional limitations were also found in the affected area. Although we cannot eliminate the possibility that bias may have contributed to these increases, other analyses of WTC-related pollutants support the biological plausibility. Further analyses are needed to examine if these increases were related to environmental exposures and to monitor long-term health effects.

Bronchial Hyperactivity And Other Inhalation Lung Injuries In Rescue Recovery Workers After The World Trade Center Collapse. Banauch G, Dhala A, Alleyne D, et al. Crit Care Med. 33:S102-6 (2005). BACKGROUND: The collapse of the World Trade Center (WTC) on September 11, 2001 created a large-scale disaster site in a dense urban environment. In the days and months thereafter, thousands of rescue/recovery workers, volunteers, and residents were exposed to a complex mixture of airborne pollutants. METHODS: We review current knowledge of aerodigestive inhalation lung injuries resulting from their complex exposure and present new data on the persistence of nonspecific bronchial hyperactivity (methacholine PC20 <8 mg/mL) in a representative sample of 179 Fire Department of the City of New York (FDNY) rescue workers stratified by exposure intensity (according to arrival time) who underwent challenge testing at 1,3,6, and 12 months post-collapse. RESULTS: Aerodigestive tract inflammatory injuries, such as declines in pulmonary function, reactive airways dysfunction syndrome (RADS), asthma, reactive upper airways dysfunction syndrome (RUDS), gastroesophageal reflux disease (GERD), and rare cases of inflammatory pulmonary parenchymal diseases, have been documented in WTC rescue/recovery workers and volunteers. In FDNY rescue workers, we found persistent hyperreactivity associated with exposure intensity, independent of airflow obstruction. One year post-collapse, 23% of highly exposed subjects were hyperreactive as compared with only 11% of moderately exposed and 4% of controls. At 1 year, 16% met the criteria for RADS. CONCLUSIONS: While it is too early to ascertain all of the long term effects of WTC exposures, continued medical monitoring and treatment is needed to help those exposed and to improve our prevention, diagnosis, and treatment protocols for future disasters. http://gateway.ut.ovid.com/gw1/ovidweb.cgi

The World Trade Center Residents' Respiratory Health Study: New Onset Respiratory Symptoms and Pulmonary Function. Reibman J, Lin S, Hwang SA, et al. Environ Health Perspect. 113:406-411 (2005) The destruction of the World Trade Center (WTC) on September 11, 2001 in New York City resulted in the massive release of pulverized dust and combustion products. The dust and smoke settled in the surrounding area, which encompassed a large residential community. We hypothesized that previously normal residents in the community surrounding the former WTC would have an increased incidence of persistent respiratory symptoms and abnormalities in screening spirometry. A hybrid cross-sectional and retrospective cohort study using a symptom-based questionnaire and on-site screening spirometry in residents in an "exposed area" and in a "control area" was performed 12+4 months after the collapse. Surveys were analyzed from 2812 residents. New-onset respiratory symptoms were described by 55.8% of residents in the "exposed area" compared to 20.1% in the "control area" after the event. "Persistent new-onset symptoms" were identified in 26.4% vs. 7.5% of residents in the "exposed area" vs. "control area" respectively. No differences in screening spirometry between the groups were detected. A small pilot study suggested the possibility of an increase in bronchial hyperresponsiveness in "exposed" participants with persistent symptoms. The data demonstrated an increased rate of new onset and persistent respiratory health effects in residents near the former WTC compared to a control population. http://ehp.niehs.nih.gov/docs/2004/7375/abstract.html

Respiratory Symptoms and Physiologic Assessment of Ironworkers at the World Trade Center Disaster Site. Skloot G, Goldman M, Fischler D, et al. Chest. 125(4):1248-1255 (2004)

Study Objectives: To characterize respiratory abnormalities in a convenience sample of ironworkers exposed at the World Trade Center (WTC) disaster site for varying lengths of time between September 11, 2001, and February 8, 2002. Design: Cross-Sectional Study. Setting: The Mount Sinai Medical Center, a large tertiary hospital. Participants: Ninety-six ironworkers engaged in rescue and recovery with exposure onset between September 11, 2001, and September 15, 2001, who responded to an invitation to undergo respiratory evaluation. Measurements: Medical and exposure history, physical examination, spirometry, forced oscillation (FO), and chest radiographs. The relationships of prevalence

FEATURED ARTICLES & PUBLICATIONS
(continued from page 3)

of respiratory symptoms and presence of obstructive physiology to smoking, exposure on September 11, duration of exposure, and type of respiratory protection were examined using univariate and linear and logistic regression analyses. Results: Seventy-four of 96 workers (77%) had one or more respiratory symptoms (similar in smokers [49 of 63 subjects, 78%] and nonsmokers [25 of 33 subjects, 76%]). Cough was the most common symptom (62 of 96 subjects, 65%), and was associated with exposure on September 11. Chest examination and radiograph findings were abnormal in 10 subjects (10%) and 19 subjects (20%), respectively. FO revealed dysfunction in 34 of 64 subjects tested (53%), while spirometry suggested obstruction in only 11 subjects (17%). Lack of a respirator with canister was a risk factor for large airway dysfunction, and cigarette smoking was a risk factor for small airway dysfunction. No other relationships reached statistical significance. Conclusions: Respiratory symptoms occurred in the majority of ironworkers at the WTC disaster site and were not attributable to smoking. Exposure on September 11 was associated with a greater prevalence of cough. Objective evidence of lung disease was less common. Spirometry underestimated the prevalence of lung function abnormalities in comparison to FO. Continuing evaluation of symptoms, chest radiographs, and airway dysfunction should determine whether long-term clinical sequelae will exist.
http://www.findarticles.com/p/articles/mi_m0984/is_4_125/ai_n6120532#continue

Health and Environmental Consequences of the World Trade Center Disaster. Landrigan P, Lioy P, Thurston G, et al. Environ Health Perspect. 112:731-739 (2004).
The attack on the World Trade Center (WTC) created an acute environmental disaster of enormous magnitude. This study characterizes the environmental exposures resulting from destruction of the WTC and assesses their effects on health. Methods include ambient air sampling; analyses of outdoor and indoor settled dust; high altitude imaging and modeling of the atmospheric plume; inhalation studies of WTC dust in mice; and clinical examinations, community surveys, and prospective epidemiologic studies of exposed populations. WTC dust was found to consist predominantly (95%) of coarse particles and contained pulverized cement, glass fibers, asbestos, lead, polycyclic aromatic hydrocarbons (PAH's), polychlorinated biphenlys (PCB's), and polycholorinated furans and dioxins. Airborne particulate levels decreased sharply with distance from the WTC. Dust pH was highly alkaline (pH 9.0-11.0). Mice exposed to WTC dust showed only moderate pulmonary inflammation but marked bronchial hyperreactivity. Evaluation of 10,116 firefighters showed exposure-related increases in cough and bronchial hyperreactivity. Evaluation of 183 cleanup workers showed new-onset cough (33%), wheeze (18%), and phlegm production (24%). Increased frequency of new-onset cough, wheeze, and shortness of breath were also observed in community residents. Follow-up of 182 pregnant women who were either inside or near the WTC on 11 September showed a 2-fold increase in small-for-gestational-age (SGA) infants. In summary, environmental exposures after the WTC disaster were associated with significant adverse effects on health. The high alkalinity of WTC dust produced bronchial hyperactivity, persistent cough, and increased risk of asthma. Plausible causes of the observed increase in SGA infants include maternal exposures to PAH and particulates. Future risk of mesothelioma may be increased, particularly among workers and volunteers exposed occupationally to asbestos. Continuing follow-up of all exposed

populations is required to document the long-term consequences of the disaster. Key words: air pollution, airway hyperresponsiveness, asbestos, occupational lung disease, PM2.5, PM10, small for gestational age (SGA).
http://ehp.niehs.nih.gov/docs/2004/6702/abstract.html