

Testimony of Jeanne Mager Stellman, PhD
Mailman School of Public Health
Columbia University
600 West 168th Street
New York, NY 10032

Before the Committee on Health, Education, Labor, and Pensions at a hearing entitled
"The Long-Term Health Impacts from September 11:A Review of Treatment,Diagnosis
and Monitoring Efforts."

March 21, 2007

My name is Jeanne Mager Stellman and I am a professor at the Mailman School of Public Health, Columbia University in New York City and director of the General Public Health program. My formal training is in physical chemistry, in which I hold a doctorate. I have spent the majority of my career in occupational and environmental health studies. I have recently been the principal investigator of a multimillion dollar contract with National Academy of Sciences to develop methodologies for evaluating exposure of veterans to herbicides in Vietnam. That work has resulted in a number of scientific publications, including an article and the cover in *Nature*, as well as an exhibit in the London Science Museum. Our methodology was strongly endorsed by the Institute of Medicine. The Institute of Medicine has recently convened a Committee for recommending ways in which to implement our methodology. Our long-term work on the health of American Legionnaires has been widely recognized and in 2005 Dr. Steven Stellman and I were awarded the Legion's Distinguished Service Medal, its highest honor.

I have been a Guggenheim Fellow and a recipient of one of the first Preventive Oncology Academic Awards given by the National Cancer Institute. I have been the principal investigator of many federally funded grants and have served on numerous peer review committees in both the United States and Canada. I am Editor-in-Chief of the 4th edition of the 4-volume Encyclopaedia of Occupational Health and Safety (ILO, Geneva 1998), an internationally recognized reference. I was Editor of the journal *Women and Health* from 1986-2004. I have written three books which have been translated into many languages, dozens of monographs, chapters and peer-reviewed articles.

With regard to the World Trade Center, I served on the EPA World Trade Center Expert Technical Review Panel, 2004 - 2006, that studied the environmental issues surrounding the destruction of the towers and the subsequent cleanup activities. Our task was to make recommendations with regard to community cleanup programs. During the past year I have been working on analysis of various aspects of the health data gathered by the clinical examinations in the WTC Medical Monitoring and Treatment Program and am the first author of a forthcoming paper on the mental health of the responders. I am thus intimately familiar with the scientific background and with the current health status of the responders.

I believe that my background and, in particular, my work with Vietnam veterans' exposures and health, and the related science policy issues, provides both expertise and

perspective for understanding the complex psychological and chemical exposures of the World Trade Center responders.

The environmental effects of the 9/11 terrorist attack on the World Trade Center were cataclysmic. When the towers collapsed and were pulverized, thousands of tons of highly toxic and corrosive dust (particulate matter) were released into the atmosphere in a toxic plume that spread contaminants over lower Manhattan and neighboring areas. The fiery crashes of two fully fueled jetliners added some 90,000 liters of jet fuel at extremely high temperatures to the conflagration, creating a toxic plume containing a mixture of volatile organic compounds, acids, soot and metals. Pulverized dust was all that remained of the Twin Towers and it created a toxic mound six stories high. The rubble continued to smolder and burn for several months. A third building in the complex, WTC 7, also collapsed, thereby adding to the toxic mess and to the intense psychological trauma of the event.

The actual chemical nature of Ground Zero and the surrounding environs is very poorly characterized. An insufficient number of representative samples were drawn so that we only have an incomplete picture of the exposures. Yet some facts are clear. The rubble was highly alkaline and contained tons of corrosive cement dust. The rubble also contained tons of man-made mineral fibers, asbestos, and other building materials. Toxic chemicals, like polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and polychlorinated furans and dioxins, were present and their composition varied from time to time and from place to place. Several excellent overviews of the devastation and conflagration exist and a few are listed in the rear of this testimony. (1-5)

The compounds and minerals that made up the WTC toxic plume were not benign. They have been the subject of much scientific inquiry and regulatory activity over the years. The toxic plume and the fumes emanating from the rubble contained a host of known and suspected carcinogens like dioxin, asbestos, the polycyclic aromatics and benzene. As the cleanup continued, diesel fuel emissions from the many construction vehicles added another toxic component and potential human carcinogen to the mix. The nature of the exposures changed with time, depending on whether or not there was rain, and the extent to which the fires were smoldering. Concentrations, of course, diminished as the cleanup progressed. Exposures were not limited to Ground Zero. Workers were involved in transporting the rubble and in adding it to the Staten Island landfill. Others were employed at the Office of the Chief Medical Examiner, and,

of course, the Fire Department of New York, FDNY, contributed enormously and selflessly to the rescue and recovery effort.

From an environmental perspective, it is important to emphasize that many of the components of the WTC rescue, recovery and cleanup operations would *individually* have been considered serious occupational health hazards. The *combination* of so many toxic substances in such large quantities, and in the presence of so much particulate matter, will very likely exacerbate any individual chemical effects, making the sum of the components far more toxic. Although most of the dust was too coarse to be inhaled deep into the lungs, given the enormous mass of rubble, even the very small percentage of dust particles that were present and small enough to enter the small airways (respirable dust) represents a serious toxic load. Such small particles not only have the potential to damage the lungs themselves, but they also serve as excellent vehicles for transporting adsorbed chemicals into the lung and bloodstream. The larger particles that were breathed into the upper airways were highly alkaline. Exposure to the alkaline dust appears to have caused serious upper airways and throat problems, as well as gastrointestinal reflux, in a significant number of rescue workers.

In addition to the dust and chemical exposures, workers were exposed to extraordinarily stressful working conditions. Among the group of workers who have been monitored by the WTC Medical Monitoring and Treatment Program (non-FDNY), more than 65% arrived at Ground Zero within the first 48 hours following the attack. By the end of the first week, about 70% of the overall workforce had arrived and by September 24, 2001, 90% of the rescue, recovery and cleanup crew was on the job. The great majority of them worked at Ground Zero operations for 3 months or more. Thus these workers were present for the extraordinarily traumatic -- and frightening -- early post-attack days and then they remained for the arduous and stressful working conditions that followed, with hours that were longer and work that was more intense than almost any other job in the United States.

The initial days at the site were fraught with danger and emotion. Workers handled nearly 20,000 human body parts. They discovered and transported bodies. They served in long bucket brigades to clear enough debris for construction vehicles to enter. Many worked around-the-clock, and then on workdays with extremely long shifts. They accomplished their tasks in a breathtakingly short period of time. Many of the rescue, recovery and cleanup workers also suffered the personal loss of friends, family or co-workers in the attack. Conditions such as these are an excellent breeding ground

for a variety of stress-related psychological problems, like post-traumatic stress disorder, depression, panic disorder, generalized anxiety and other manifestations of a substantial stress response. These disorders can affect not only the workers themselves but also their spouses, children and other loved ones.

The average age of the non-FDNY responders was about 43 years. In the group currently being monitored, about one-third were in law enforcement and about the same percentage were construction workers. Utility workers and New York City employees drawn from a variety of agencies make up the remaining rescue, recovery and cleanup team now under surveillance in the monitoring and treatment. Many of these men and women had no training in rescue/recovery operations and we know that there were serious problems in providing workers with adequate protective gear or training for using it. Many of the workers had occupations that had already subjected them to a almost two decades of exposures to toxic and dangerous conditions, thereby possibly putting them at even greater risk by exacerbating existing disease potential.

The demographic makeup of the workforce is relevant to any consideration of both long- and short-term health effects. The rescue, recovery and cleanup workers were not an army of young recruits fresh from basic training, but were more mature, with some not in optimal physical condition. It is possible that a workforce with these characteristics may be placed at even greater risk for both short- and long-term health effects.

Studies of the WTC rescue, recovery and cleanup workers and of the FDNY firefighters are already showing widespread pulmonary symptomatology. New studies on the mental health of the rescue, recovery and cleanup workers that are currently under scientific review, likewise, indicate an excess of psychological distress and an extraordinary amount of social and physical disability.

The current studies, however, cannot possibly provide us with insight into the overall burden of disease and disability because the diseases associated with WTC-like exposures are chronic and take many years to manifest themselves. Thus it is too early to know the full extent to which exposure to carcinogens and other toxic and stressful working conditions will lead to elevated rates of cancer or whether the rescue, recovery and cleanup workers will suffer from more cardiovascular disease or other chronic diseases.

Why Continue Monitoring and Treating

It is now more than five years after the terrorist attack and the question has been raised of whether or not to continue funding a monitoring and treatment program for the rescue, recovery and cleanup workers, FDNY and other governmental employees. Let us set aside moral and ethical considerations about whether our Nation has an obligation to care for those who selflessly come forward to serve us during our time of need, and instead consider some scientific and health policy issues.

- If the monitoring the rescue, recovery and cleanup worker and FDNY cohorts were to be abandoned, we might NEVER know the full extent of health effects caused by responding to the emergency and working at the site. Systematic appraisal and follow-up of the health of a sufficiently large number of responders is needed for meaningful epidemiological research. The cohort currently enrolled in the monitoring and treatment program provides us with the opportunity to understand both the short- and the long-term health consequences of exposure to the conditions caused by the attack. Environmental epidemiology studies general require a long period of follow-up both in order to have sufficient 'statistical power' to be able to observe an elevated risk and also to allow time for the chronic diseases to develop. Unfortunately, despite its many strengths, the WTC Health Registry is far from complete with respect to the worker population and no governmental or private agency has identified all the workers who participated in the operations. Thus the responders in the program provide the best study population and possibly the only feasible opportunity for identifying both long- and short-term health effects..
- If the monitoring and treatment program were to be abandoned, the rescue, recovery and cleanup workers and firefighters will probably not be adequately treated for any WTC-related maladies. Most physicians have little or no formal training in environmental and occupational medicine. They are, by and large, not equipped to take an adequate exposure history and, given the constraints on medical care today, would not have sufficient time to take such a history in any case. The exposures were complex and it is likely that the combination of psychological, physical and chemical stresses may lead to unexpected health outcomes. The symptoms that a responder presents with may be related to underlying causes not easily recognized by an untrained physician seeing isolated patients. Treatment by trained physicians and surveillance by

scientists, and in groups larger enough for patterns to be observed, is essential to our understanding the full range of health effects.

- If the monitoring and treatment program were to be abandoned, the rescue, recovery and cleanup workers and firefighters may be deprived of early treatment interventions that are much more likely to be developed in a specialized program dedicated *specifically* to this group.
- If the monitoring and treatment program were to be abandoned, the rescue, recovery and cleanup workers, and firefighters may not have the financial means to seek and pay for needed tests, examinations and treatments. Social stigma, particularly for psychological distress and disorders, may also make them reluctant to seek help. The established relationships and vigorous outreach activities of the monitoring and treatment program can help overcome those barriers.
- If the monitoring and treatment program were to be abandoned, we will have lost a great opportunity to learn from this unique and tragic event and to put into place public health policies and practices that will lessen the impact of future natural or technological disasters. Experience and knowledge will be dispersed as the scientists and physicians involved will, of necessity, turn to other activities

In conclusion, I think it is illustrative to look at another example in which men and women were called upon to serve their Nation: the Vietnam War. For more than twenty-five years I have been engaged in studying the use and effects of military herbicides in Vietnam. To date, some thirty years after the end of the Vietnam War and more than thirty-five years after the last Agent Orange was sprayed, we still cannot tell our veterans and their loved ones what the effects of exposures to the herbicides are. We base our veteran compensation and treatment policies on occupational studies of others -- forestry and farm workers -- not Vietnam veterans. Just this month an Institute of Medicine Committee met for the first time to begin formulating recommendations for implementing the exposure model I and my collaborators developed in order to carry out definitive studies on the effects of herbicides on Vietnam veterans. If and when those studies are undertaken, a major roadblock will be identifying large enough groups of veterans and reconstructing their Vietnam activities. For many veterans it will be too

little, too late. Abandoning the monitoring and treatment program will put the WTC responders into precisely the same position.

Or consider the difficulties that Vietnam veterans so often encounter in receiving appropriate diagnoses and treatment. For example, in one study we carried out on American Legionnaires we learned that Vietnam veterans seeking treatment at VA facilities were only occasionally queried about their combat exposures, a pivotal consideration for recognizing and treating PTSD. Abandoning the medical monitoring and treatment program will inevitably lead to similar results: the particular symptoms and diseases they may develop will simply be lost in the general population and few practitioners will know the right questions to ask.

And just as with Vietnam, if the Nation were to try to finally make it a priority to put together studies of the health effects of working on the World Trade Center rescue, recovery and cleanup, it is doubtful that identifying and re-assembling the group now under surveillance could be easily done at a later date.

Finally, we can wonder whether the next cohort of volunteers and responders may be less willing to put their own lives on the line if those men and women who rose to the challenge of recovering from the WTC attacks were ultimately ill-treated by their country.

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