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AND
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INTRODUCTION

Good afternoon, Mr. Chairman and Members of the Subcommittee. I am Paul Gilman, Science Advisor to the U.S. Environmental Protection Agency (EPA) and Assistant Administrator for Research and Development. I appreciate this opportunity to discuss with you EPA's responses to the devastating events of September 11, 2001, and the Agency's ongoing assessment of the potential short- and long-term health effects from exposure to the dust and fires that resulted from the collapse of the World Trade Center towers. I will also provide information on EPA's efforts both to gather and to analyze data to assess the potential human health risks of the September 11th attack, and review our programs to study and assess the quality of both outdoor and indoor air, and our comprehensive program to clean homes and residential apartments in lower Manhattan. Finally, I will provide the status of other significant work in other federal agencies, universities and medical centers, and other public and private sector research and health organizations.

EPA responded immediately to the September 11th terrorist attack on the World Trade Center. The Agency, along with many other federal, state and local agencies, was called upon to bring its technical and scientific expertise to the national emergency. At this point, I would like to acknowledge the work and coordinated efforts, with EPA, of many other federal agencies such as the Federal Emergency Management Agency, the Agency for Toxic Substances and Disease Registry, the Occupational Safety and Health Administration, and the Centers for Disease Control and Prevention, as well as New York City and New York State public health and environmental authorities. Under unprecedented and horrific conditions, EPA, and these other federal, state, and local agencies, initiated numerous activities both to respond to the immediate emergency and to understand the ongoing human health impact of emissions from the disaster. Many EPA offices and programs quickly became involved with these activities, providing scientific, engineering, public health, and management expertise to help cope with the aftereffects of the collapse of the World Trade Center towers.

BACKGROUND

The attack on the World Trade Center immediately degraded the air in lower Manhattan, and for several months following September 11th. The airplanes that were flown into the towers contained 91,000 liters of jet fuel which ignited intense fires that burned at over 1000 C and produced enormous quantities of black smoke. When the towers collapsed, the resulting dust cloud engulfed lower Manhattan, exposing residents and workers to a complex mixture of potentially toxic contaminants. These contaminants included asbestos which was used as fire-proofing up to the fortieth floor in the North Tower. The smoke and dust from the collapse of the towers remained in the air for hours, obscuring visibility and continuing to expose people, primarily the rescue workers, to airborne particulate matter and asbestos. The collapse of the World Trade Center deposited an estimated one million tons of dust on lower Manhattan.

Further, the six-story pile of rubble that came to be known as "Ground Zero" was a continuing source of irritating and possibly harmful air contaminants in lower Manhattan for months. Underground fires resulting from the residual jet fuel and combustible materials associated with the World Trade Center - plastics and other materials from computers, carpeting, and furniture - continued until about mid-December 2001. Because these underground fires had a limited oxygen supply, the fires did not burn efficiently. Rather, the smoldering nature of the fires produced copious amounts of smoke, partially oxygenated hydrocarbons, and other products of incomplete combustion, all potentially producing adverse human health impacts.

In addition, the process of removing debris was not without consequence. For instance, each time a steel beam was cut for removal, very small particles of iron and steel which could be taken into the human lung were dispersed. Also, since some of the beams were coated with asbestos there was the potential for the release of asbestos fibers as the beams were disturbed and removed by heavy machinery. The concern was that site workers could inhale these asbestos fibers. Further, the increased number of diesel trucks, generators and heavy machinery used around Ground Zero during the cleanup also contributed to air pollution in lower Manhattan.

EPA'S RESPONSE

Within minutes of the September 11th attack, EPA activated its emergency response personnel. EPA's New York City-based Regional Office, Region 2, immediately dispatched their Emergency Response Team, headquartered in Edison, New Jersey, to the scene. As people fled lower Manhattan, EPA personnel came into the area from the New Jersey emergency operations center to monitor environmental conditions. That day, EPA on-scene coordinators collected samples of asbestos, lead and volatile organic compounds in lower Manhattan, in Brooklyn, where the smoke plume was moving, and in New Jersey, to assess the possible public health and environmental impacts of the attacks. Particulate matter and volatile organic compounds were of particular concern. In addition to the permanent particulate matter air monitoring stations - part of EPA's continuous nationwide monitoring program - that were in place in the New York metropolitan area prior to September 11th, EPA established World Trade Center outdoor air monitoring stations to sample for a variety of contaminants that were being emitted from the site. These outdoor air monitoring stations were established within days of the disaster. The purposes of this air monitoring program were: to understand what was being emitted from the rubble pile, to determine how far emitted contaminants were being transported, and to ascertain what hazards existed at Ground Zero.

Other critical aspects of EPA's early response were the safe collection and disposal of the large quantities of dust that covered lower Manhattan streets and the hazardous materials found in the debris at the World Trade Center site. The Agency pumped more than 624,000 gallons of oil or an oil/water mixture from the site; removed more than 4,000 waste containers, cylinders and batteries; and provided guidance and oversight during the transport of debris away from Ground Zero by truck and barge. In addition, EPA provided thousands of respirators and other protective gear to the state for distribution to workers at the site, and operated worker and truck wash stations, including a state-of-the-art operation where Ground Zero workers could clean up, relax and have meals.

EPA recognized immediately that workers at Ground Zero faced drastically different conditions than the general public, and made every effort to urge workers to wear respirators. Over the initial days, EPA worked with the State of New York to provide the city with thousands of respirators, respirator cartridges, and other protective gear for distribution to rescue, recovery, and cleanup workers. The respirators provided by EPA were only a small part of the thousands of respirators supplied by the Occupational Safety and Health Administration (OSHA) and other agencies. At daily on-site operations meetings, EPA consistently spoke about the need for workers at Ground Zero to protect themselves and supported the message with flyers and posters. The importance of respiratory protection was reiterated again and again at worker wash stations established at the site, in press interviews, in community meetings, and in communications with New York City Department of Health officials. In addition, EPA, working with the state and the city, took action to minimize exposures by establishing wet-down operations for trucks leaving Ground Zero, at the barge transfer areas in lower Manhattan and at the Fresh Kills Landfill.

EPA's Outdoor Air Monitoring Activities

Almost immediately, Region 2's Emergency Response Team began monitoring for airborne asbestos, recognizing the need to understand how this known human carcinogen might affect public health. Within a day of the disaster, EPA and other federal, state, and local agencies began meeting to coordinate overall response activities. The collaborating agencies included the Centers for Disease Control and Prevention, the Agency for Toxic Substances and Disease Registry, the Occupational Safety and Health Administration, the New York State Departments of Health and Environmental Conservation, and the New York City Departments of Health and Environmental Protection and the New York City Office of Emergency Management. Some of these coordination activities included determining what other contaminants should be monitored and planning for monitoring and worker safety outreach. These agencies, many of which, like EPA, had been evacuated from their lower Manhattan offices, convened at least daily by conference call to coordinate monitoring efforts, share data and discuss other findings. They quickly identified which contaminants to monitor and selected appropriate and protective benchmarks and standards against which the samples could be evaluated. The lack of existing benchmarks or standards for most World Trade Center contaminants of concern in outdoor and indoor environments also created a challenge for the responding agencies.

Airborne pollutants, including particulate matter and gases such as carbon monoxide, sulphur dioxide, and others, were measured by these cooperating agencies. One potential pollutant of considerable concern was phosgene, a gas that is extremely toxic. Phosgene can be produced by combustion of the air-conditioning product Freon, which was known to be used in the World Trade Center towers. Fortunately, no detectable levels of phosgene were found.

Other contaminants were added to the list of measured pollutants mainly due to health concerns, both short-term and long-term concerns. These contaminants include: heavy metals; volatile organic compounds such as benzene; polycyclic aromatic hydrocarbons; dioxin and furans; chlorinated hydrocarbons; polychlorinated biphenyls, known as PCBs; and silica dust.

Samples of both air and dust were taken on September 11th. Dust samples were taken near Ground Zero and air samples were taken in Brooklyn and at Liberty State Park along the New Jersey waterfront. On September 12th and September 13th, both dust and air were sampled in close proximity to Ground Zero. These dust and air samples were collected mainly to determine the presence of asbestos, but air samples were also measured for volatile organic compounds and lead. These samples were not from the fixed monitoring stations which were established beginning on September 14th. Rather, they were opportunistically taken under severe conditions, not always using standard protocols. In dust, asbestos was present in bulk samples above 1percent in about one-third of the samples. This is consistent with later dust data (that has been available) that showed about 30percent exceeding 1percent asbestos. Based on all of the dust data, EPA has treated World Trade Center dust as potentially contaminated by asbestos. These early samples were not posted on EPA's website, which focused its public reporting on the fixed monitoring station results, taken with standard protocols. These early samples are available, however, on EPA's comprehensive computer database.

Within a few weeks of September 11th, EPA had established 20 fixed air sampling stations in Manhattan and six in Brooklyn. The Agency also worked closely with the New York State Department of Environmental Conservation to draw and analyze particulate data from their existing network of air quality monitoring stations. Ultimately, the broad sampling of air, dust and water yielded almost 227,000 analytical results. In addition, thousands of real-time readings of gases, volatile organic compounds, and other potentially hazardous substances were taken at or near Ground Zero and the Fresh Kills Landfill, where the debris was transported.

EPA began posting information about its response on the Agency's Internet website within several days of the attacks. By September 26th, data on asbestos in the outdoor air were made available in a user-friendly format on the website and summaries of EPA monitoring results were posted daily. The data were also made available to the public and press in hard copy at the EPA regional offices in lower Manhattan.

At these monitoring sites, pollutants that could serve as markers of combustion, including semi-volatile organic compounds such as dioxins and PCBs, volatile organic compounds such as benzene, and elemental carbon, were measured. In addition, heavy metals including lead and chromium as well as other elements that were markers of iron and steel and other building components, were measured. The myriad of measured pollutants were useful in determining the types of pollutants originating from Ground Zero and also the magnitude of potential exposures that could be experienced by the general public -- those people who live and regularly work in lower Manhattan.

In addition, the dust itself was another critical contaminant. Both the physical dust particle as a potential respiratory irritant, as well as the contaminants that attached themselves to the dust, were of concern. Thousands of residents and workers were exposed to the dust on September 11th, and rescue workers, firefighters, debris haulers, and construction workers were potentially exposed to the dust for months as they worked on the rubble pile. Particulate matter, known as PM, derived from the dust was one of the contaminants of potential health concern for rescue workers and nearby residents.

EPA began collecting bulk dust samples on September 11th to determine whether and how much asbestos was present in the dust from the collapsed buildings. Out of approximately 170 bulk dust samples, 30 percent were found to contain more than 1 percent asbestos. One percent is an EPA regulatory definition of asbestos-containing material. Also, samples of settled dust were collected less than a week after the collapse and separated into several size ranges. The particles in the dust can be divided into two major groups by size. The small particles, smaller than 2.5 micrometers, are called $PM_{2.5}$ or "fine particles." As a comparison, the average grain of table salt is 100 micrometers across. So $PM_{2.5}$ has a diameter that is 40 times smaller than the average grain of table salt. Coarse particles are those sized 2.5 micrometers or larger, and are referred to as PM_{10}. PM_{10} is 10 times smaller than the average grain of table salt. PM_{10} accounted for 1 to 4 percent by mass of the total World Trade Center dust samples. Both PM_{10} and $PM_{2.5}$ can be inhaled deep into the lung and are associated with adverse cardiovascular and respiratory health effects. Since extremely high levels of dust of various particle sizes were produced by the collapse of the towers, even a relatively small proportion of $PM_{2.5}$ could have contributed to breathing problems in exposed Ground Zero workers who were not wearing recommended respiratory protection.

To investigate this prospect further, scientists from EPA's health and environmental effects research laboratory initiated studies on the composition of this dust and its potential pulmonary health impacts. The purpose of these studies was to evaluate the toxicity of fine particles on the respiratory tract of mice and to compare well-studied PM reference samples ranging from essentially inert to quite toxic to those collected at the World Trade Center site. EPA scientists compared the chemistry and toxicity of World Trade Center $PM_{2.5}$ samples isolated from settled dust with these reference $PM_{2.5}$ samples. The results indicate that a high dose of fine particles from World Trade Center dust would be necessary to elicit adverse effects in healthy people. High concentrations were present in the aftermath of the World Trade Center collapse, making it possible for a healthy worker not wearing respiratory protection to inhale enough $PM_{2.5}$ to cause pulmonary inflammation, airway hyper-responsiveness, and sensory irritation such as coughing. The study also found that individuals who are especially sensitive to the inhalation of dusts, such as asthmatics, may experience these effects at lower doses. It did suggest that most healthy people would not respond to a single exposure to moderately high levels of fine particles from the World Trade

Center with any adverse respiratory responses. However, the effects of chronic or repeated exposures to lower levels, or the persistence of any respiratory effects are unknown and were not components of this study. EPA advised people in sensitive groups – those with asthma or other respiratory problems – and anyone experiencing symptoms to consult with their physicians. The findings from EPA's rodent respiratory studies of World Trade Center dust are consistent with recent studies of firefighters present at the collapse of the towers, as reported in the September 2002 issue of the *New England Journal of Medicine*. Firefighters were found to have significantly increased levels of cough and sensitivity which correlated with their levels of exposure at Ground Zero. It is important to note that coarse PM (greater than 2.5 micrometers) associated with the dust could have contributed to some of the respiratory problems reported in individuals working and living around Ground Zero, but only $PM_{2.5}$ was examined in the animal studies.

By June 2002, EPA's active outdoor air monitoring program was concluded. This outdoor air monitoring program resulted in over 25,000 collected samples of over 700 contaminants. For example, EPA's exposure research laboratory, alone, collected over 2,300 samples and logged over 27,000 hours of data using continuous monitors.

While EPA's toxicology laboratory was evaluating the toxicity of World Trade Center dust, EPA's environmental assessment office was examining the large amount of data collected by outdoor air monitors, looking for trends and evaluating the potential for health impacts to the general public via the inhalation pathway. EPA's draft evaluation, "Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster," focused on monitoring results of contaminants that were judged to pose the greatest human health concerns. The contaminants evaluated were PM, metals including lead, chromium and nickel, PCBs, dioxins, volatile organic compounds, and asbestos. The air monitoring data were evaluated by comparing the measured levels at locations near Ground Zero to levels typical for New York or urban areas in general and to established regulatory benchmarks for inhalation exposure. Where available, benchmarks established to protect against acute and subchronic exposures were used. For dioxin, exposures that might have lasted up to three months after September 11th were evaluated for the potential for the long-term health consequence of cancer.

This draft exposure and health evaluation arrived at three general findings. First, people exposed to the extremely high levels of ambient particulate matter and its components during the collapse of the World Trade Center towers and for several hours afterwards were likely to be at risk for immediate acute and possibly chronic respiratory and other types of symptoms. Second, while some measurements were taken almost immediately, other contaminants were not measured for three to four days after September 11th. Further, still others were not measured for a week to two weeks after September 11th. Therefore, exposures for this early time period are not well characterized. Problems encountered by EPA and others seeking to make environmental measurements within and near Ground Zero during this time included restricted access and limited power supply. When monitoring stations became established in the first and second weeks after September 11th, it was found that the first measurements taken were among the highest found during the several month period when measurements were routinely being taken at Ground Zero and nearby. The potential for exposure during these early weeks was high, particularly for Ground Zero workers and more so for those workers who did not use protective gear while on-site. Third, except for exposures on September 11th and possibly during the next few days, people in the surrounding community were unlikely to suffer short-term or long-term adverse health effects caused by exposure to elevations in ambient air concentrations of the contaminants evaluated for this report. The elevated concentrations were measured mostly within Ground Zero, and they lasted for one to three months after September 11th. The monitoring data indicate that air concentrations decreased to background levels that are characteristic of pre-September 11th levels in the New York City metropolitan area by around December 2001.

The draft report also discusses that elevated concentrations of several contaminants were observed within and near Ground Zero, especially close to September 11th in time. Several of these early elevated measurements were higher than EPA regulatory guidance values or typical urban background levels. Concentrations of dioxins, for example, were found to be up to 1,000 times higher than is typically found in urban settings. Many of the elevated concentrations were found to have occurred in what were "restricted zones," where access was limited to emergency management and rescue personnel and other credentialed

people. The restricted zones were established by the New York City Mayor's Office of Emergency Management. From September 11th to September 14th, this restricted zone included all of lower Manhattan south of 14th Street. After September 14th, sections within about 3 blocks of Ground Zero continued to be restricted through October into November. While it is recognized that some exposure may have occurred to the general public during this early time period, certainly the lack of access to where contaminant levels were highest limited general population exposures. Also, the existence of high concentrations of critical contaminants does not in and of itself translate to an adverse health impact. In general, monitoring data indicate that ambient air levels for all of these contaminants had decreased to background concentrations that are characteristic of pre-September 11th levels in the New York City metropolitan area by about December 2001, when the underground fires were deemed extinguished by local authorities.

The draft exposure and human health evaluation has gone through both public and external peer review and will be revised to reflect those comments. When final, the report will be posted on EPA's website.

To further characterize the impacts of the disaster, with an eye toward the possibility that a similar disaster could occur in an urban setting in the future, EPA's exposure research laboratory initiated research to better understand the spatial variations and complexities - both horizontal and vertical - of pollutants in lower Manhattan that originated from Ground Zero. While it is difficult to obtain a sufficient number of real-world measurements to characterize how pollutants varied through Manhattan's street canyons, measurements using a scaled physical model of the area can allow for an appreciation of the variations. Thus, EPA scientists have constructed a scale model of lower Manhattan replicating the topography of the landscape created by the numerous buildings in the area. The scale model was produced with a very accurate likeness of the southern two kilometers of Manhattan, roughly south of Canal Street. The buildings were constructed of polyurethane foam and built to scale. Over 350 building units were included in the model. The model was placed into a wind tunnel where various wind flow regimes could be examined to determine how source emissions from the World Trade Center rubble pile were transported and dispersed through lower Manhattan. Results from the wind tunnel experiments have been computerized, so that we can attempt to duplicate the movement of contaminants away from Ground Zero. This effort is focused mainly on the hours and several days after September 11th when measurement data were not comprehensive.

For example, some of the early results from these wind tunnel experiments are shown in Figures 1 and 2. These figures show isolines - lines of equal relative concentration - overlain on a map of the Restricted Zone. The dotted line is a one mile diameter circle around Ground Zero. Let me explain further what you are looking at. First, these are not actual concentrations of any kind, but are unitless modeling results that show predicted concentrations that are relative to each other. Given that the source of emissions is centered at Ground Zero, these wind tunnels experiments will predict the relative movement of the release of gaseous phase, or small-particle phase, contaminants around the rubble pile. Without having yet quantified the actual release of specific contaminants, the model will assume a unit release, such as 1 gram of contaminant per second. For example, the innermost yellow isoline concentration is the highest predicted concentration from this unit emission, and it is given an arbitrary result of 100. The concentration predicted to occur on the yellow line is 10 times higher than on the green line, and 100 times higher than on the blue line. These two figures are results for what is typically the predominant wind direction during the Fall months in lower Manhattan and the wind direction which was occurring most of the time in the days and weeks following September 11th. Therefore, what these results illustrate is that the contaminants do move as expected in a northeast direction, and that the plume dissipates rather rapidly, with concentrations dropping by a factor of 100 even within a few blocks of Ground Zero. EPA scientists are now focused on determining what the actual emission rates were, so that these relative concentration lines can be converted to actual concentrations, and we can further understand the exposures experienced by individuals living and working near Ground Zero.

In addition, EPA scientists are currently developing computer models to simulate the collapse of the World Trade Center towers. The model estimates the levels and extent of airborne dust due to the collapse of the towers using computer generated wind fields created by the collapsing towers coupled with information about the amount of pulverized building materials (concrete, glass, insulation, etc.). The model

will also be applied to simulate the behavior of particles of different size and weight to better estimate exposures to the various components found in the dust. Also, these results of these simulations will serve as the initial source inputs to the wind tunnel simulations, so that lines of artificial concentrations (as shown in Figures 1 and 2) can be converted to real concentrations that may have been present in the morning into the afternoon of September 11th.

In summary, EPA's outdoor air monitoring program in response to the events of September 11th was activated as quickly as possible following the disaster. The outdoor air monitoring program resulted in an unprecedented amount of monitoring and measurement data collected over a very short period of time. These data have provided critical information on the types and amounts of contaminants to which workers and the public may have been exposed.

EPA's Indoor Air Monitoring and Cleaning Program

While comprehensive efforts were underway to evaluate the quality of outdoor air, it became apparent that an effort to address the quality and safety of the indoor environment was needed. Residential locations in lower Manhattan were impacted by the World Trade Center dust that settled across a broad area. Thus, in early 2002, EPA began formulating a plan to study the quality of indoor air at residential units.

In February 2002, EPA established an Indoor Air Task Force, with representatives from federal, state and city agencies, to address the health concerns of lower Manhattan residents about their homes and the need for cleanup assistance. In April, New York City Mayor Michael Bloomberg formally asked for EPA assistance in conducting an indoor testing and cleaning program. One of the first steps was to prepare a document identifying the Contaminants of Potential Concern in the World Trade Center collapse and fires. It was submitted for external peer review and was revised based on the peer review comments. The document was used in developing the Residential Cleanup Program.

The voluntary Residential Cleanup Program to test or clean and test the homes of residents who requested this assistance was announced in May 2002. The Agency subsequently mounted an aggressive outreach program to encourage area residents to participate. EPA began with a direct mailing campaign to about 38,000 addresses in lower Manhattan; attended about 80 meetings with residents, community groups, elected officials and tenants organizations; distributed 10,000 flyers promoting the program; launched a professionally-prepared public service poster campaign; advertised the program on EPA's website; and issued press releases. The deadline for requesting testing or cleaning and testing was extended twice, giving people nine months to register on-line or through a telephone hot-line open six days a week. Bilingual operators were available to assist Spanish and Chinese-language speakers, and information about the program was available in both languages.

The clean-up covers residential units south of Canal Street and from the Hudson River to the East River. Testing started in August 2002, and the free cleaning program began in September 2002. It ended this past summer. Through the program, approximately 4,100 dwelling units were tested for asbestos in the air or tested and cleaned. One hundred and forty-four buildings had common spaces cleaned and/or tested, and 110 had their heating, ventilation systems and air conditioning systems evaluated.

In addition, over 29,000 asbestos-in-air samples were taken in 4,100 apartments and in common spaces in 144 buildings. All of these air samples were taken after cleaning had been completed. The sample results were compared to a health-based benchmark of 0.0009 f/cc (fibers per cubic centimeter) for asbestos. This benchmark was developed by Region 2 specifically for evaluation of indoor air for use in their Residential Cleanup Program. If results did not exceed this benchmark, apartments were cleared. Results for only about 1percent of the 4,100 apartments, 44 apartments to be exact, exceeded the health-based benchmark. If there were exceedances of the benchmark, EPA offered to reclean the apartments, and 32 of the 44 apartment owners asked for the recleaning.

To supplement the asbestos-in-air data, a subset of 214 apartments already signed up for the clean and test program received wipe sampling. For these 214 apartments, wipe samples were taken before and after cleaning. These samples were measured for metals and for dioxin. There were about 675 samples (about 3 per apartment) taken before and 675 samples taken after cleaning in these 214 apartments. In the 675 pre-cleaning samples, 92 (13.5percent) showed exceedances of lead. In the post-cleaning sampling,

there were 20 exceedances (3percent), showing a demonstrable drop in lead levels as a result of the cleaning. For dioxins, there was very little dioxin at all as evidenced by only 3 exceedances (0.4percent) before cleaning and 4 exceedances (0.6percent) after cleaning. In this case, dioxin did not serve as an effective cleaning measure because of low occurrence frequency.

A companion study, termed the "Confirmation Cleaning Study," was carried out in a heavily-impacted lower Manhattan building to evaluate the effectiveness of the cleaning program by measuring contaminants in the air and settled dust before and after cleaning. This study showed that the combination of wet surface cleaning and High Efficiency Particulate Air (HEPA) filter vacuuming (HVAC) brought levels of contaminants to largely below health-based benchmarks established for the indoor cleaning program. This study also showed that asbestos was a good marker contaminant for the indoor program in general because it was the most sensitive marker - i.e., when apartments were clear for asbestos, they were clear for other contaminants as well.

A Background Study was also conducted in upper Manhattan above 78th Street to determine baseline, or background levels for a range of contaminants in an area not impacted by the World Trade Center attacks. Over 1,900 samples were taken as part of this study.

In summary, EPA's Indoor Air Monitoring and Cleaning Program was a significant public outreach effort to a traumatized community. EPA took every opportunity to actively contact residents in lower Manhattan and advise them of the voluntary Residential Cleanup Program. The program has resulted in approximately 4,100 dwelling units tested for asbestos in the air or cleaned and tested.

Studies Conducted by Organizations Other than EPA

To assist the Subcommittee in understanding the breadth of research that has occurred and is ongoing, we have prepared a tabular summary showing both federal (Table 1) and non-federal (Table 2) involvement in World Trade Center activities. These tables identify about 20 studies conducted by federal agencies, and about 30 studies conducted by non-federal entities, including state and local government agencies and universities. Among the federal studies are those conducted by EPA that have been previously discussed in this testimony. These studies come under general categories including: air and dust sampling; indoor environment study; toxicology and epidemiology, including health registry efforts; and exposure studies. While this table is not comprehensive, it does provide a useful overview of the scientific studies that have had, and will have, a role in understanding the environmental and human health impact from this catastrophe. I would like to highlight for you a few of these research activities.

Important studies have addressed the very significant area of potential health impacts to Ground Zero workers. OSHA began monitoring for critical contaminants for Ground Zero workers, including both personal and stationary air samplers, within a week of September 11th. Thousands of samples were taken; they monitored for asbestos, carbon monoxide, noise, total dust, respirable silica, organic compounds, dioxins, polycyclic aromatic hydrocarbons, Freon R-22, hydrogen fluoride, phosgene, and numerous other contaminants. The Centers for Disease Control and Prevention's (CDC) National Institute of Occupational Safety and Health, as well as the United States Geological Survey, were also heavily involved in sampling for exposure and environmental impact during the early weeks and months after September 11th. Available reports and websites document the findings by these federal agencies.

The National Institute of Environmental Health Sciences (NIEHS), Division of Extramural Research and Training, is funding grants to address immediate and long-term worker and community health issues arising from the World Trade Center attacks. A total of $6 million in grants have been awarded to support NIEHS Worker Education and Training Program grantees. These efforts include training new and current hazardous material teams for the New York City Fire Department, environmental remediation workers, site cleanup workers and hazardous material teams on response to weapons of mass destruction. In addition, $4.5 million in grants have been awarded to support research focused on exposure assessment, epidemiology studies, and community outreach and education by current NIEHS Superfund Basic Research Program and NIEHS Environmental Health Sciences Center grantees. These programs support the development of a framework to address current and future health and environmental concerns arising from the WTC attacks. Grantees include: Johns Hopkins University; Columbia University; University of

Medicine and Dentistry of New Jersey; New York University; Mount Sinai School of Medicine; University of North Carolina; and University of Rochester.

For example, studies conducted by the Fire Department of New York in collaboration with New York University in this NIEHS program have documented pulmonary impacts to firefighters by conducting extensive pulmonary tests on firefighters, and then comparing the results with similar routine tests conducted on the firefighters prior to September 11th. These studies showed compromised pulmonary function of the firefighters who had both pre-September 11th and post-September 11th measurements. Specifically, preliminary results showed that "World Trade Center cough" occurred most frequently in firefighters with the highest level of exposure. Specifically, cough occurred in 128 of 1,636 firefighters with a high level of exposure (8 percent), 187 of 6,958 with moderate level of exposure (3 percent), and 17 of 1,320 with a low level of exposure (1 percent). In addition, 95 percent of firefighters had symptoms of dyspnea (difficult or labored respiration), 87 percent had gastroesophageal reflux disease (disorder in which there is recurrent return of stomach contents back up into the esophagus, frequently causing heartburn and nausea), and 54 percent had nasal congestion.

Also, the Fire Department of New York, in conjunction with CDC, has conducted a biomonitoring study of blood and urine of 321 firefighters who had responded to the World Trade Center fires and collapse. These samples were analyzed for 110 potentially fire-related chemicals, including volatile organic compounds, dioxins, furans and PCBs. Most of the contaminants measured in the firefighters were similar to measurements from a control group, but significantly different concentrations were found in six contaminants - 5 were higher in the firefighters and one was higher in the control group. These contaminants and differences were: 1-hydroxypyrene (about 40percent greater in firefighters than control), 1,2,3,4,6,7,8–HpCDF (about 30percent higher in firefighters), xylenes (25percent higher in firefighters), lead (about 30percent higher in firefighters), antimony (about 20percent higher in firefighters), and uranium (about 20percent higher in controls). Also, higher rates of detection were found for four contaminants in the firefighters as compared to the control group. These four contaminants were 1,2,3,5,6,7,8-HpCDF, tetrachloroethylene, blood cadmium, and ethylbenzene.

In addition to Ground Zero workers, another population group that has been studied is pregnant women and their unborn children. Studies on this critical population group have also been funded by the NIEHS program. Other ongoing studies on this critical population group are being conducted by Columbia University.

It is expected that an accurate long-term picture of health impacts to World Trade Center workers will come from ongoing health registries established by Johns Hopkins University and Mount Sinai Hospital on the Ground Zero work force. You have already heard testimony on these efforts, so you already can appreciate their purpose and you have heard about their current findings. The largest of the health registries has recently been established by the Agency for Toxic Substances and Disease Registry (ATSDR). It is expected that this registry will contain between 100,000 and 200,000 enrollees. Interviews began for this registry just this year, and enrollees are to include both those involved in the clean-up and others who were heavily exposed based on their proximity to the site.

Another significant area of study is the indoor environment of workplaces and residences. At the request of the Ground Zero Elected Officials Task Force (a group of local elected officials), a private consulting firm was engaged to address this area. They sampled two apartments on September 18th, one of which had been heavily impacted by the collapse of the towers, and the other less severely impacted. They found very high levels of asbestos, particularly in the impacted residence, but low levels of dioxins and inorganic metals. During the early months, OSHA conducted sampling of dust and air from damaged buildings near Ground Zero, and found that levels of asbestos were non-detectable using recognized sampling methods. In addition, ATSDR and the New York City Department of Health conducted an investigation in residential buildings in lower Manhattan during November and early December 2001. The purpose of this investigation was to assess the composition of both outdoor and indoor settled surface and airborne dust within residential areas around the World Trade Center. The information was used to help determine whether additional public health actions would be needed to address any remaining World Trade Center dust inside residential units. The study found low levels of asbestos in settled surface dust samples,

primarily below Chambers Street, and a greater percentage of fiberglass and other synthetic vitreous fibers than in a comparison area above 59th Street. ATSDR and City Health recommended continued frequent cleaning with HEPA vacuums and wet wiping to reduce potential exposure.

It may be years before the health impacts from the collapse of the World Trade Center towers are fully understood. However, completed and ongoing studies are beginning to characterize the scope and nature of some of the potential human health impacts.

In closing, I want to thank the Subcommittee for the opportunity to speak today. I hope I have provided you with a useful description of the considerable work done by the EPA and others in the two years since the disaster, and about what we do know at this time and what this information suggests to us regarding potential adverse human health impacts of the horrific events of September 11, 2001. I look forward to your questions.