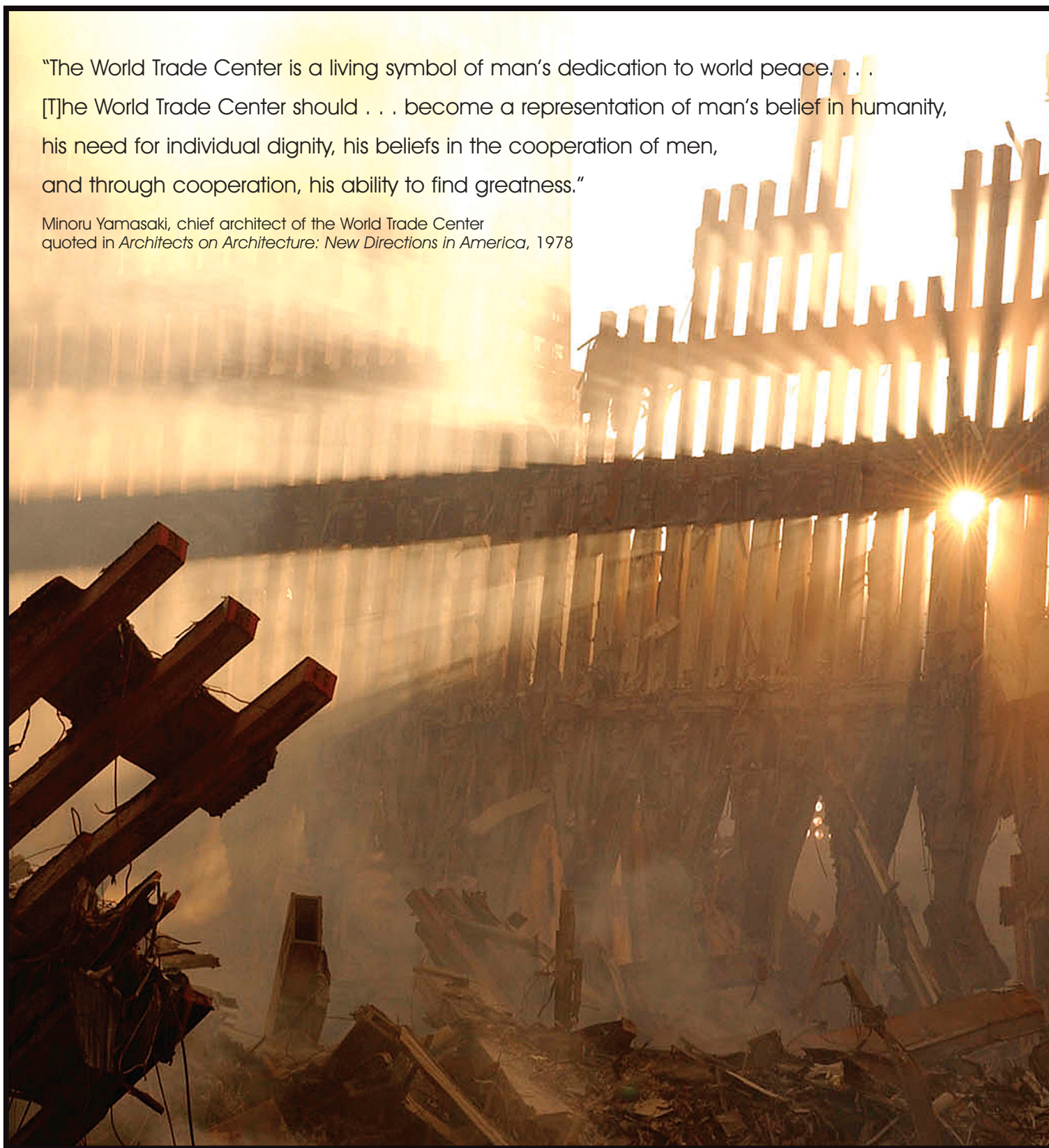


“The World Trade Center is a living symbol of man’s dedication to world peace. . . .
[T]he World Trade Center should . . . become a representation of man’s belief in humanity,
his need for individual dignity, his beliefs in the cooperation of men,
and through cooperation, his ability to find greatness.”

Minoru Yamasaki, chief architect of the World Trade Center
quoted in *Architects on Architecture: New Directions in America*, 1978



Environmental Aftermath



FEMA

On 11 September 2001, over a million tons of steel, dust, and debris fell to earth on the island of Manhattan. Where once the two giant towers of the World Trade Center had stood, now ruins lay in clouds of smoke. The buildings, symbols of America's international economic influence, had been destroyed by terrorist attacks, and over 4,000 lives had been lost. When two hijacked airplanes fully loaded with 91,000 liters of jet fuel flew into the twin towers of the World Trade Center, the resulting explosions and fires burning at over 1,800°F caused the buildings to collapse into themselves. The enormous heat, combined with the burning of a vast number of materials such as asbestos, concrete, computers, carpeting, and furniture, created a gaseous cloud of potentially toxic dust and smoke that took weeks to dissipate.

Following the initial shock of the largest death toll ever from terrorism on U.S. soil, federal, state, and local officials along with scientists across the nation began the enormous process of recovering human remains, removing and disposing of debris, and evaluating the potential continued health threat to emergency responders and the surrounding community from environmental exposures related to the attacks.

A Storied History

The idea for a central site dedicated to world trade had been considered for New York City since the end of World War II, but the right conditions of finance, political will, and appropriate location didn't come together until the early 1960s. The Port Authority of New York and New Jersey, the city agency in charge of transportation matters, was responsible for commissioning the monumental venture.

The goal was to build 10 million square feet of new commercial office space on a 16-acre site, while also accommodating future and existing subterranean railways. Inevitably, this meant building upward to unprecedented heights. The project would put to the test construction and design technologies that were new at the time and that represented real challenges to builders, architects, and construction engineers.

With this challenge in mind, chief architect Minoru Yamasaki studied over 100 different building configurations before choosing the concept of two twin towers rising from an open plaza flanked by three other low-rise structures. Faced with the complexities of building

to new heights, Yamasaki and engineers John Skilling and Les Robertson worked to seamlessly merge design and structure.

They employed an innovative structural model consisting of a hollow tube made of steel columns set only 22 inches apart. This exoskeleton of steel lattices acted as wind bracing to resist outside forces and made it unnecessary to have indoor columns in the office spaces. In the upper floors there was as much as 40,000 square feet of open office space per floor. The steel lattice was connected to floor supports radiating from a steel central core containing elevators and stairs.

The enormous weight of the structure was anchored to the bedrock located 75 feet below ground that makes possible downtown Manhattan's high-rise skyline. Given the proximity of the site to the Hudson River, the whole complex had to be contained in a "bathtub," an impermeable wall more than 3,000 feet long encircling the excavation site. The below-ground foundation was used to house seven levels of stores, subway lines, commuter rails, and garages.



Excavation to build the foundation removed over a million cubic yards of earth and rock. Instead of being trucked away for disposal, excavated soil was used to create 23 acres of fill in the Hudson River adjacent to the World Trade Center site. The new grounds claimed from the river were developed into a housing complex known as Battery Park City, where more than 9,000 people live in 25 buildings.

After seven years of construction, the World Trade Center ribbon-cutting ceremony was held on 4 April 1973. The Twin Towers were a blend of structure and function that provided a centralized space from which world business was conducted. Its proximity to Wall Street and to the New York Stock Exchange was also part of the attraction for many of the tenants who later filled the work spaces. The World Trade Center housed 9 million square feet of rentable office space in two 110-story towers, each nearly 1,400 feet tall. The towers provided working space for 292 companies with over 50,000 employees. With a panoramic view 45 miles in every direction, the towers also provided a major tourist attraction in New

York City. Over 90,000 people visited the towers on any given day.

Ground Zero

The six story-high pile of compacted rubble that resulted from the fires and collapse of the towers became known as Ground Zero or simply “The Pile.” In the first days after September 11, immediate physical dangers were everywhere. Buildings adjacent to the towers collapsed or suffered major damage. Intense fires continued to burn, and a massive cloud of dust and smoke spread with the prevailing winds for miles out from the site.

All this occurred in the middle of an intensely populated urban center. New York City’s financial district encompasses not only a vibrant working community but also a significant residential neighborhood. Nearly 20,000 people live within a half-mile of Ground Zero, close to 3,000 of them children.

Following the disaster, people who worked in the financial district fled and were barred from returning to work immediately, and more than 20,000 neighborhood

residents were displaced. “No one could have conceived of a disaster like this,” says Mary-Helen Cervantes-Gross, chief of public outreach for the U.S. Environmental Protection Agency (EPA) Region 2 Office in New York City, whose office was only a few blocks from the disaster.

In response to the attacks, thousands of firefighters, police officers, medical personnel, and other types of rescue and relief workers poured in to the Ground Zero site to help with the rescue and recovery efforts. In the days soon after September 11, many worked around the clock in thick smoke and dust—sometimes with respirators and other personal protective equipment, sometimes not. Many continue to work amid the rubble and unknown environmental exposures.

Among the immediate exposure concerns are agents such as asbestos from concrete, polychlorinated biphenyls (PCBs) from electrical wiring, dioxins from jet fuel combustion, particulate matter from pulverized concrete and other building materials, and lead and other metals from computers and monitors [see table below]. Noise pollution from the heavy machinery used in the

Contaminants Potentially Present * at the World Trade Center Site

Contaminant	Health Effects	Source
Asbestos	Carcinogenic. Causes tissue scarring in the lungs when inhaled over long periods and can lead to asbestosis, mesothelioma, and lung cancer.	Used as an insulator and fire retardant, applied to steel beams.
Benzene	Flammable and carcinogenic. Short-term effects include dizziness, headaches, and tremors. Long-term exposure can lead to leukemia.	Combustion of plastics.
Biohazards	Exposure to blood and body parts can transmit infectious diseases such as hepatitis and AIDS. After long periods, they may pose little hazard to health, although finding human remains can cause psychological trauma.	Human remains of the victims trapped in the rubble (less than 15% of the bodies have been recovered).
Chromium	Carcinogenic when inhaled at high concentrations. Dermal contact can cause skin ulcers.	Video and computer monitors.
Copper	In large amounts can cause dizziness, headaches, vomiting, and damage to the kidneys and liver.	Electrical wiring and cables.
Diesel fumes	Asthma trigger. Can aggravate symptoms in asthmatics.	Truck traffic and heavy machinery from the cleanup effort.
Dioxins	Chloracne is a short-term effect of exposure. Strong evidence for carcinogenic, teratogenic, reproductive, and immunosuppressive effects. Persist and bioaccumulate in the environment and food chain.	Combustion of polyvinyl chloride found in electrical cables and other insulating materials and some plastics.
Freon	Damages the ozone layer. When burned, can produce phosgene, a potent cause of severe and life-threatening pulmonary edema.	Refrigeration and air-conditioning equipment.
Lead	Neurotoxic. Damages the central nervous system, especially in children. Can also cause kidney and reproductive damage in adults.	Video and computer monitors, rust proofing paint used on steel beams.
Mercury	Neurotoxic. Damages the peripheral nervous system, especially in children.	Thermometers and other precision instruments.
Particulate matter	Asthma trigger. Can aggravate symptoms in asthmatics. Can also aggravate cardiovascular disease. Smaller particles (PM _{2.5}) may be more potent than larger particles (PM ₁₀).	Pulverized concrete and other materials (large particles); smoke, dust, and soot from combustion (small particles).
Polychlorinated biphenyls	Carcinogenic. May also cause hormonal problems and reproductive and developmental abnormalities. Persist in the human body and the environment.	Transformers and other electrical equipment.
Sulfur dioxide	Pulmonary toxicant. Can cause severe airway obstructions when inhaled at high concentrations. Can burn the nose and throat.	Combustion of many materials.

* Not all of the pollutants listed are currently being tested for at the World Trade Center site, and final data are not yet available for pollutants that are being tested for.

rescue and cleanup efforts is also a concern. The EPA immediately began monitoring the air around the site for some pollutants, but the long-term effects of the potential exposures is yet to be known.

A Community Comes to Grips

Catherine McVay Hughes's home is one block from Ground Zero. Hughes is the mother of two small children and the president of an online resource center helping families manage asthma called AsthmaMoms.com. Looking out the window at the smoke still rising from the rubble one month after the attacks, she says, "Our home is now next door to an uncontrolled incinerator burning who-knows-what twenty-four hours a day."

Hughes and 8,000 other neighborhood residents remain displaced from their homes. In an attempt to remove air hazards from her family's home, Hughes has bought four air purifiers, which she keeps running constantly in her apartment, and she has arranged to have all upholstered furniture and beds removed. The Hughes family will remain living in a Brooklyn hotel at least through the end of the year. As she says, "We don't know what is coming out of that smoke and what the effects may be on our children."

She is not alone in this concern. According to Joel Forman, an assistant professor of pediatrics at the Mount Sinai School of Medicine in New York, special attention must be placed on the possible effects on small children of any pollutants being released from the site. "Since small children breathe air that is closer to the ground, it is possible that they may breathe in higher doses of the dust as it settles," he says. Because children's organs and systems are still developing, they may also be more vulnerable to chemical insult. These are things that need to be considered before children are returned to that environment, he says.

There are 36 schools located within the four ZIP codes closest to Ground Zero, serving over 19,000 students from kindergarten through high school. Dust and debris entered the schools following the attacks through windows and ventilation systems.



A changed landscape. Following the attacks, an enormous cloud of dust and smoke blanketed the neighborhood surrounding the World Trade Center, obliterating normal life and raising concerns that health consequences, as well as the emotional aftershocks, may endure for a long time to come.



In order to protect children, these schools are being tested for environmental toxicants and cleaned especially carefully by government agencies in charge of responding to the emergency. Strict regulations for contaminants in schools are being applied. For example, the Asbestos Hazard Emergency Response Act (AHERA) of 1986 requires that a standard for asbestos 10 times stricter than the Occupational Safety and Health Administration (OSHA) standard for workplaces be applied in schools. This is necessary because "no one knows what the risk may be for small children since they have a longer time to develop any cancer that may be caused by asbestos exposure," says Philip Landrigan, chairman of the Department of Community and

Preventive Medicine at the Mount Sinai School of Medicine.

Along with applying existing measures, there are new government initiatives that will aid in limiting the impact of the disaster on children's environmental health. In a speech at the EPA Region 2 Asthma Summit held at the Mount Sinai School of Medicine on October 12, EPA administrator Christie Whitman stated, "In many ways, there's no better time to describe what is happening with our new efforts on asthma in the city."

Asthma is a special concern in this community. Asthmatics, especially children, are more susceptible to many air pollutants that can trigger symptoms of the disease. Some types of air pollutants such as fine particulates that were liberated into the



A helping hand. FEMA community relations worker Jean Fequiere helps Manhattan resident Carmen Rivera through the federal assistance registration process following the World Trade Center attacks.

environment during the collapse of the World Trade Center buildings are known to be potent asthma triggers. However, the asthma-related effects of other pollutants that may have been released is largely unknown.

At an October 11 community forum to discuss health impacts of the World Trade Center attacks, the auditorium at Pace University, located about four blocks from the World Trade Center site, was filled to capacity with residents asking questions about what toxicants may be in the air, when it will be safe to return home, and what the long-term health effects may be from exposure to the dust and smoke. These are important and practical questions, but they are difficult to answer because of the unprecedented nature of the disaster. Scientists and public health officials are working to identify and quantify the toxicants that may have been released, and to determine the hazards that these agents may pose to the surrounding community, as well as to emergency workers at the site.

Hazards to Heroes

During the first few days after September 11, the main goal of operations at Ground Zero was to find and rescue survivors that may have been trapped in the rubble. Thousands of volunteers from as far north as Montreal and as far south as Texas converged in New York City to offer their help. The most serious immediate hazards to these workers were related to traffic safety, falls, cuts, and crush injuries.

As the site was stabilized, other occupational hazards

became more apparent. Port Authority officials, who were concerned about the safety of rescue workers digging through the rubble without appropriate personal protective gear such as respirators, requested recommendations from academic researchers in occupational health and safety programs from around the area.

Mark Robson, an associate professor and director of the Environmental and Occupational Health Division at the University of Medicine and Dentistry of New Jersey (UMDNJ) School of Public Health, headed the team. He says, “During the search and rescue phase, good industrial hygiene was put on hold”—the priority at that time was to find survivors quickly. However, says Michael Gochfeld, a professor of environmental and occupational health at the Robert Wood Johnson Medical School and a member of OSHA’s occupational safety advisory team, “As the operation moves from rescue to recovery, an appropriate respirator program will need to be put into place.”

Such a program is being implemented by OSHA. Nancy Clark, an industrial hygienist at the Irving J. Selikoff Clinical Center for Occupational and Environmental Health at the Mount Sinai School of Medicine, is collaborating with OSHA in establishing this program. “The program must medically screen, fit test, and train

workers in the proper use of respirators for the program to be effective,” she says. But these steps couldn’t be taken during the immediate emergency, so many workers may have been affected by toxicants in smoke and dust. According to Stephen Levin, co-director of the Selikoff Center, several workers have been stricken with new-onset asthma, and at least one worker had to be treated for carbon monoxide poisoning. To assess the possible long-term effects of exposures, Selikoff Clinic staff plan to conduct clinical assessments on workers who will be contacted through their labor unions over time.

Federal regulatory and research agencies will continue to evaluate the levels of contamination, the potential short-term health effects to workers, and long-term health impacts on both workers and the surrounding community through a number of studies. Several of these will be conducted under grants from the NIEHS to its Environmental Health Sciences Centers and one Children’s Environmental Health and Disease Prevention Research Center in the Manhattan area. The NIEHS has also awarded grants to five organizations to provide much-needed equipment, resources, sampling, and training to the workers engaged in the World Trade Center cleanup [see “NIEHS Responds to World Trade Center Attacks,” p. A526].

Asbestos. The release of asbestos fibers from the World Trade Center site into the neighboring community has become one of the major environmental concerns. Asbestos is a known human carcinogen. It can cause



Dangerous days. Ironworkers balance precariously as they cut through the rubble of the World Trade Center.

American Red Cross

lung cancer and mesothelioma, a lung condition specific to asbestos. Workers who are exposed to high doses over long periods of time are particularly at risk.

There is currently no clinical examination that can detect whether a person has been exposed to asbestos. The damage to the lungs caused by asbestos only appears after many years, and can then be seen on a chest X ray. According to David Prezant, chief pulmonary physician of the New York City Fire Department, chest X rays have been taken for 350 of about 4,000 firefighters who worked at the site. Some researchers have criticized this effort, maintaining that any damage wouldn't show up at this early stage. However, the data can serve as a baseline for workers who may be followed over time.

Ironically, concerns about asbestos are not new to the World Trade Center. During the construction of the towers, asbestos-laden slurry was sprayed on steel beams as a fire retardant. The late professor Irving J. Selikoff of the Mount Sinai School of Medicine, considered by many to be the father of modern occupational medicine, observed that during construction "snowfalls of asbestos-containing material" fell from the construction site over widespread areas of downtown Manhattan. Based on data gathered by Selikoff and colleague William Nicholson, the New York City Department of Air Resources issued a ban on the spraying of asbestos fibers in New York on 13 May 1970 (a year before the federal government made a similar nationwide ruling).

By that time, 5,000 tons of asbestos-containing fireproofing material had been sprayed up to the fortieth floor of one of the towers. Mineral wool and fiberglass were used as replacements for the asbestos from then onward in the construction process, but some asbestos may also have been applied by hand in the central core of the buildings after the ban was issued.

The collapse of the Twin Towers caused the asbestos fibers that had been safely tucked into the walls of the buildings to disperse in the resulting dust cloud. "Asbestos contamination was one of the very first environmental health concerns that we had," says Cervantes-Gross. Since September 11, the EPA has taken samples of the local air, dust, water, river sediments, and drinking water and analyzed them for the presence of pollutants, including asbestos, that might pose a health risk to response workers and the public. All 99 samples taken in and around Ground Zero between October 12 and October 15 showed asbestos levels of less than 70 structures [particles of asbestos] per square millimeter, which is the AHERA standard for allowing children to reenter school buildings after asbestos removal activities.



A mountain of loss. Two days after the attacks, urban search and rescue teams continued the search for survivors below the towering wreckage of the World Trade Center.

However, at least 27 earlier readings had shown levels that were above this standard.

Since the attacks, controversy has swirled around the EPA response to the threat of environmental contaminants in the dust. Results obtained by independent contractors who tested the asbestos content in dust samples suggest that the force of the explosions may have pulverized the asbestos fibers into short particles that are too small to be seen by conventional testing methods used by the EPA and other agencies.

One such contractor, HP Environmental of Herndon, Virginia, submitted its results to

the American Industrial Hygiene Association for review (that report is not yet available). "It is hard to comment on this without seeing [the report]," says Landrigan. However, he states that although it is known that smaller particles can enter deeper into the lungs, long fibers, which ordinarily don't penetrate as easily into lungs, can cause more cellular damage, and thus are considered more toxic. Landrigan also notes that a mixture of fibers of many lengths was released at the site.

Although air levels of asbestos may be below the range that would require regulatory

action, dust that has accumulated on windowsills and sidewalks and inside homes throughout the area should be treated as if it contains asbestos, suggests Levin. He believes that due to unequal release of the asbestos, only some samples may contain the substance, but that all dust exposures should be considered potentially hazardous.

The New York City Department of Health has issued guidelines for residents returning to and attempting to clean their homes. To reduce dust recirculation, the department recommends using high-efficiency particulate air filtration vacuums when cleaning up apartments, if possible. Wetting down the dust before removing it is also recommended in order to reduce the dispersion of the asbestos particles.

Unfortunately, recommendations for proper cleanup did not reach all residents before they returned to their homes. “The city was under pressure to let people into their homes as soon as possible,” says Gochfeld, so many residents may not have followed these procedures. Even so, “the chances of getting mesothelioma or other asbestos-related disease is vanishingly small for residents,” says Levin, as exposures would have to occur for much longer periods to have a detectable effect.

Other researchers believe, however, that even single exposures can be hazardous, with long-term effects. And it is possible that certain susceptible populations such as smokers may be at higher risk. According to

Landrigan, smokers run about 55 times the normal risk of developing lung cancer after exposure to asbestos.

For this reason, many community residents are contracting with professional cleaning services to assist them. The Federal Emergency Management Agency (FEMA) has provided some relief to assist families with this expense. Over 3,400 requests for assistance have been filed with the agency to date. (Area businesses and stores are also receiving help from FEMA and the city in cleaning up the dust.)

However, the widespread use of cleanup companies that are not well certified—for instance, by the New York Committee for Occupational Safety and Health—can create other problems. At a community forum held on October 18 at New York University, residents raised concerns about the risk involved in the dust cleanup. Trina Semorile, a community resident, said, “I am afraid that we are transferring our risk to the poor workers who come to clean our homes.” This concern arises because many cleanup crews have been put together that do not have the proper training and equipment to handle these kinds of materials. As Joel Shufro, executive director of the New York Committee for Occupational Safety and Health, says, “Cleanup workers are at higher risk. Some are being given respirators but no training.”

Particulate matter. The force of the explosions and collapse of the World Trade Center buildings shattered the cement

structures, sending plumes of dust and smoke far into the air. The resulting particles are of various sizes and composition. They can aggravate illnesses such as asthma, bronchitis, and some cardiovascular conditions in people who breathe the air around Ground Zero.

The EPA regulates particulate matter according to size. The larger particles, those measuring 10 microns or less (PM_{10}), are also called inhalable particulates because they can penetrate the human respiratory system beyond the larynx into the airways. Smaller particles of 2.5 microns or less ($PM_{2.5}$) are considered in the respirable range because they can penetrate even deeper into the lungs, to the unciliated regions. This difference in lung penetration explains why several studies have found that the $PM_{2.5}$ fraction of PM_{10} may be more toxic.

The level of concern to protect sensitive populations, including children, the elderly, and people with heart or lung disease, is 40 micrograms per cubic meter measured over a 24-hour period for fine particulates. Above this level, the EPA recommends that sensitive groups reduce their exposure. Air monitoring being conducted by the EPA at sites near the World Trade Center wreckage shows that daily average measurements for $PM_{2.5}$ fall below the standard.

However, when hourly measurements are considered, occasional peaks of fine particulates have been recorded that surpass the level of concern. This occurs often at night, when winds are calm and thermal inversions occur that reduce the dispersion of particles, explains George Thurston, an associate professor of environmental sciences at New York University. “Some peaks, especially at night, may have health implications for sensitive populations,” he says, including onset of asthma attacks in asthmatics. To alleviate this problem, Thurston proposes to reduce the amount of recovery work being done during those critical hours when the air pollution burden appears to increase.

Lead. Although many uses of lead were banned in the United States in the 1970s, lead continues to be a threat to public health. There are several sources of lead that may have been released during the destruction of the World Trade Center. Computers contain



Standing on the brink. Despite losing many of their own, firefighters continue to brave unknown threats.

small quantities of lead in the solder used for circuit boards. Computer monitors may contain as much as four pounds of lead each, according to the Silicon Valley Toxics Coalition. Because there were possibly tens of thousands of computers in the offices of the World Trade Center, the amount of lead from this source may be significant.

In addition, it was common practice at the time of the construction of the buildings to use lead-based paint to rustproof steel beams. Investigations being conducted by Paul Lioy, associate director of the Environmental and Occupational Health Sciences Institute at Rutgers and UMDNJ, show that lead particles from paint chips and paint dust can be found in the dust originating from the site. He has obtained measurements of lead in dust ranging from 38 to 635 micrograms per gram. "These levels are not high, but are moderately high and cannot be ignored," says Lioy.

Lead can persist in the body for very long periods and can accumulate in bone, from which it can be mobilized and transferred to fetuses during pregnancy and infants during breast-feeding. Although the EPA action level for lead poisoning is 10 micrograms per deciliter in blood, it has been argued in the scientific literature that much lower levels can cause detrimental neurologic effects in children.

Some investigators who have been involved in the work related to the World Trade Center disaster suggest that dust samples in homes and parks should be carefully monitored for lead content. This is important as cleanup proceeds and residents start returning to their homes. Many residents may not be able to properly decontaminate their homes of lead. For example, says Lioy, "You would not be able to see one gram of lead dust spread over a one-square-foot surface."

PCBs. PCBs were present in different types of electrical equipment present at the Twin Towers at the time of the attacks. They have been used as lubricants and coolants in capacitors, transformers, and other equipment because they are good insulators. The manufacture of PCBs was halted in the United States in 1977, but equipment in the buildings made before that year may have contained PCBs.

Exposure to this class of compounds has been associated with toxicity to the developing brain in humans and animals. PCBs may also affect the hormonal system in fetuses. Another major concern about PCBs is that they are lipophilic, and thus tend to accumulate in the food chain and persist in the environment and the body.

So far, all samples of air analyzed by the EPA for PCBs at locations surrounding Ground Zero have been below the EPA's



The work of recovery. The rumble of machinery continues 24 hours a day as vast amounts of debris are removed from "The Pile" at Ground Zero and trucked and ferried to "The Hill" at the Fresh Kills Landfill. Investigators there comb through it carefully for evidence of the crime and personal effects of the victims.

screening level. PCBs were not detected in the vast majority of samples. However, they were detected in some instances within the area where the recovery efforts are taking place. It appears that the release of certain contaminants such as PCBs may be episodic, occurring when work at the site disrupts pockets of toxic materials buried in the rubble. As Landrigan puts it, "Exposure is intermittent, but the threat of exposure is constant."

A Mountain of Waste

The destruction of the Twin Towers generated over 1.2 million tons of tangled waste of innumerable materials, according to a study commissioned by the city that used computer modeling to estimate the amount of debris. Most of the debris is made up of construction materials such as huge steel beams and mountains of concrete, dotted with the remains of the businesses that operated there and the equipment they relied on. All of this waste is potentially laced with traces of some or all of the contaminants discussed in this article, as well as the remains of the victims of the disaster. Only

549 bodies have been recovered from the site so far.

To date, close to 500,000 tons of debris have been removed from Ground Zero. It is estimated that it will take about a year for cleanup to be completed, partly because of the complexity of the recovery effort at the site, which is at once a crime scene, a cemetery, a hazardous waste site, and a source of valuable recyclable materials.

The city is making efforts to identify recyclable materials that can be sorted on site for recovery. For example, the Port Authority has estimated that each of the towers contained 78,000 tons of recyclable steel, which can be sold for up to \$100 per ton. Other materials such as aluminum and copper can fetch much more in the scrap metal business. It has not yet been decided how any monies collected in this way will be distributed.

Most of the rest of the debris is being taken by truck or barge to the Fresh Kills Landfill on Staten Island. The landfill collected New York City garbage for five decades and had been closed to additional disposal six months before September 11. It

was immediately reopened to accept the debris from the World Trade Center.

At the top of the 180-foot-high mountain of garbage rising from the landfill, the New York Police Department has set up an evidence recovery operation known simply as “The Hill.” There, as many as 30 investigators at a time, wearing full hazardous materials suits, perform the grim task of sifting through the debris looking for the flight recorders of the two hijacked airplanes, human remains, and any belongings that can help identify the victims. Such finds are catalogued for identification, and the rest is landfilled.

One of the consequences of the cleanup effort is the constant flow of dump trucks, which adds to the already heavy traffic of downtown Manhattan and to the levels of diesel exhaust fumes in the neighborhood. “We already had a traffic problem here, and now you can see these trucks with their uncovered loads going down our streets,” said neighborhood resident Alicia Aguilar during a recent community forum. To alleviate the truck traffic associated with the cleanup effort and to allow easier access to remove debris to the Staten Island landfill, the U.S. Army Corps of Engineers has ordered the dredging of an area of the Hudson River that is near the World Trade Center site.

Some of the debris is being removed by barge, but high truck traffic and use of diesel-powered machinery at the site continues.

Thurston, who has been monitoring concentrations of air pollutants, has seen that carbon levels have been elevated in some instances, “and these may come from

community residents who can still smell the fumes emanating from the disaster site is a major challenge to regulatory agencies charged with the enormous task of protecting the public and allaying its fears.

Although multiple layers of local, state, and federal agencies have converged upon the World Trade Center site to conduct environmental assessments, monitor for occupational hazards, and sample the environment for further study, the result for community members often may be confusion and further questions. “There have been many lessons learned during this process,” says William Muszynski, acting regional administrator for EPA Region 2. “We need to be prepared to give people relevant information in a simpler and [more] usable way.”

This sentiment is shared by many in the affected community who still ask whether it is safe to go home. No one person or agency is fully prepared to answer that question. But as the nation’s political leaders work to protect American citizens and prevent future attacks, the environmental health community of scientists and officials continues working diligently to assess and minimize the environmental health risks to both recovery workers and the public from the events of September 11.

Luz Claudio



Hope survives. A firefighter makes his way through the headstones at Trinity Church Cemetery in lower Manhattan on his way back to work on the city’s recovery.

increased diesel combustion,” he says. Diesel combustion and the soot that it produces can be a trigger for asthma attacks in those who have the disease.

Continuing Questions

The state of the science cannot possibly predict all the possible long-term environmental health effects of this unprecedented disaster. The science of risk assessment is still limited, and it does not permit the full recognition of all potential hazards. Communicating this uncertainty to

In Memoriam: Kristin White

In the tragic events of 11 September 2001, we at *EHP* lost one of our own. Kristin White, a freelance science writer from New York City, was killed in the crash of United Airlines Flight 93 near Pittsburgh. Kristin began writing for *EHP* in our first year of publication as a monthly journal. Over the years, she illuminated a range of topics for our readership with clarity and conciseness. Of particular note are her investigations into the environmental health effects of the Midwestern floods of 1993, the revamping of the Clean Water and Safe Drinking Water Acts, and the health consequences to soldiers who served in the Persian Gulf War. Kristin was a consummate professional with a passion for environmental issues. We will miss our collaborations with her and her contribution to the environmental health sciences.

Lt. Bill McGinn Memorial Lecture Fund

The Mount Sinai Department of Community and Preventive Medicine in New York City has established the Lt. Bill McGinn Memorial Lecture Fund. McGinn was a leader of Rescue Squad 18 of the New York City Fire Department. He had collaborated with his wife, Anne Golden, an assistant professor of epidemiology in the Mount Sinai Department of Community and Preventive Medicine, in conducting epidemiologic studies to assess how exposure to toxic chemicals produced in fires can affect the health of firefighters. Together, they sought to develop methods by which firefighters could protect their health and also improve the safety of their work environment.

McGinn is described by colleagues as “the man who would climb stairs two steps at a time when responding to a fire in a building.” He died while responding to the September 11 attacks on the World Trade Center.

The fund will support an annual lecture series devoted to health and safety topics of concern to emergency responders, including firefighters. The fund will also support other educational efforts related to firefighter safety, as well as to fire safety in general.

Donations to the Lt. Bill McGinn Memorial Lecture Fund can be sent to the Lt. Bill McGinn Memorial Lecture Fund, Box 1049, 1 Gustave Levy Place, New York, NY 10029 USA; phone: 212-373-4940