Ten years later, what exactly residents and rescue workers were exposed to remains at least a partial mystery

By David Biello | September 7, 2011 | 0

The collapse of the Twin Towers pulverized and then scattered into the air millions of tons of cement, steel, drywall, window glass and other building materials. It also crushed and incinerated thousands of computers as well as mile after mile of items such as electrical cable and heating and cooling ducts. Finally, the dust contained the remains of the 2,753 people killed in the attack, along with the hair and skin cells shed by those who worked in the World Trade Center over the decades.

The smell cannot be forgotten. Any smoky mix of burnt plastic and other smolderings can instantly bring back memories for locals of the aftermath of the collapse of the two towers of the World Trade Center on September 11, 2001. The acrid miasma of 91,000 liters of jet fuel and the 10,000,000 tons of building materials and contents burning at temperatures above 1,000 degrees Celsius extended from lower Manhattan across the East River into Brooklyn and beyond to the sea. So what exactly was in that smoke and dust? For starters, burning plastic releases dioxins and the North Tower included hundreds of tons of asbestos as a flame retardant.

"It was such a horrific event," says environmental scientist Paul Lioy of the Environmental and Occupational Health Sciences Institute in New Jersey, who was contacted by both the federal government and the Port Authority of New York and New Jersey to collect samples of the pulverized remains of the Twin Towers in the days following the attack. "What was the contribution of the gases [from combustion]?

The real answer to that question will never be known as few direct measurements were taken of the plume that followed the disintegration of the two towers into a blizzard of dust, though air samples were collected in subsequent weeks and months. Regardless, the then administrator of the U.S. Environmental Protection Agency and former governor of New Jersey Christie Whitman said on September 13, 2001, "EPA is greatly relieved to have learned that there appears to be no significant levels of asbestos dust in the air in New York City." She added: "We will continue to monitor closely." And five days later, she announced: "I am glad to reassure the people..."
of New York and Washington, D.C., that their air is safe to breath [sic]."

Asbestos may have been the least of health concerns from the gray smoke and fluffy, pinkish-gray dust created as the two towers collapsed, pulverizing cement, glass and everything else in the buildings. As a result, the EPA’s Inspector General concluded in 2003 that the agency "did not have sufficient data and analyses to make such a blanket statement" about air safety and chided the White House Council on Environmental Quality and National Security Council for interfering with the process. And in those dust samples the EPA did collect and analyze in the first week after the attacks, 25 percent showed asbestos levels above the 1 percent threshold that indicates "significant risk," according to the EPA. "Competing considerations, such as national security concerns and the desire to reopen Wall Street, also played a role in EPA's air quality statements," the Inspector General concluded in a 2003 report [pdf].

Plus, inside the two towers were heavy metals, such as lead that helps make electric cables flexible and poisons the human brain, as well as polychlorinated biphenyls (PCBs) used in electrical transformers that are toxic on their own and become even more toxic when burned at high heat, and glass fibers that lodge in the lungs. The levels of dioxin measured in the air near the smoldering pile "were the highest ambient measurements of dioxin ever recorded anywhere in the world," levels at least 100 times higher than those found downwind of a garbage incinerator, according to an analysis published by EPA scientists [pdf] in 2007.

Ten years later, no one knows what was in the cloud of gases released by the combustion of all that jet fuel and building material but science has revealed what was in the dust—cement, steel, gypsum from drywall, building materials, cellulose from paper, synthetic molecules from rugs, glass fibers and human hair from the long decades of the two towers' use, among other items. "The [World Trade Center] dust held everything we consider near and dear to us," wrote Lioy, who carried out the first such analysis, in his book  Dust: The Inside Story of Its Role in the September 11th Aftermath  (Rowman & Littlefield Publishers, 2010).

And knowing what was in the dust suggests what may have caused the ailment dubbed "World Trade Center cough" by the New England Journal of Medicine, which doctors at Mount Sinai Medical Center in New York estimate afflicted nearly half of those who worked at the site.

The primary cause of that ubiquitous cough was the simple fact that the dust was highly basic, an enormous blast of alkalinity from the drywall and cement that fell onto Lower Manhattan. Rescue workers and those who survived the Twin Towers' collapse were bathed in the dust, which contained particles of sizes ranging from the millimeter scale down to nanometers in width, the right size to embed deep in the lungs if inhaled. Both gypsum and calcite, found in drywall and cement, irritate mucus membranes, like those in the eyes, nose and throat.

A cleansing rain on September 14 did reduce the basic nature of the dust from a pH of roughly 11 to 9 but did nothing to transform the materials in the cloud of dust. "Residual effects would be due to long glass fibers and cement particles," notes Lioy, who still uses 10-year-old dust samples to teach students how to measure toxicants. "There were a lot of irritating materials in there; everything else will be piling on top of the basic pH."

Equally important, adequate protection—specifically respirators—were often not used or used incorrectly by first responders and others at the scene, according to the National Institute of Environmental Health Sciences, even though by September 22, the EPA had supplied more than 22,000 air purifying respirators to workers at the site. "People weren't using them, probably for a variety of reasons," Lioy recalls, including an inability to communicate with the bulky face mask in place. Plus, workers at the site received conflicting messages—on the one hand, air pollution levels were announced to be safe while, on the other, the EPA urged workers to wear respirators.

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Ultimately, the EPA determined that the air around Ground Zero was harmless, despite the agency's findings concerning levels of asbestos and dioxin, at least to civilians living and working in the vicinity, if not the rescue workers. "Except for inhalation exposures that may have occurred on 9/11 and a few days afterwards, the ambient air concentration data suggest that persons in the general population were unlikely to suffer short-term or long-term adverse health effects caused by inhalation exposures," EPA scientists wrote in their analysis published in 2007 [pdf].

The reasons for that conclusion are unclear and the EPA declined multiple requests to comment on its actions in the aftermath of 9/11 or the results of its scientific investigations into air quality and the constituents of the dust.

Ground Zero smoldered until December 19, releasing fumes that researchers collected in air samples. "The debris pile acted like a
chemical factory," atmospheric scientist Thomas Cahill of the University of California-Davis explained to the American Chemical Society in 2003, after analyzing many of those air samples. "It cooked together the components of the buildings and their contents, including enormous numbers of computers, and gave off gases of toxic metals, acids and organics."

The question is: did all those toxicants—whether dust particles or air pollution—harm human health? Of course, attributing anything like cancer to being near the World Trade Center on that day or working on the pile in the months thereafter is made extremely difficult by the simple fact that roughly one in four Americans (and New Yorkers) will develop cancer in some form over the course of their lives. Teasing any extra cancers out of that number will be scientifically difficult, if not impossible. In fact, the National Institute for Occupational Health and Safety (NIOSH) has decided that "insufficient evidence exists at this time to propose a rule to add cancer" to the list of diseases that qualify for health care under the James Zadroga 9/11 Health and Compensation Act passed in 2010, though the NIOSH also adds that such an absence of evidence "does not indicate evidence of the absence of a causal association."

The EPA, for its part, deemed the increased risk of cancer from PCBs in the air during the immediate aftermath of 9/11, for example, "insignificant." The agency also concluded that exposure levels and thus cancer risk from the 29 "dioxin-like" compounds in the plume were 50 times lower than levels to which ordinary Americans are exposed to over a lifetime via their food, according to the 2007 analysis [pdf]. Other studies found that firefighters and other rescue workers had elevated levels of chemical toxicants in their blood and urine; for example, 321 firefighters tested at the end of September 2001 had elevated levels of the polycyclic aromatic hydrocarbons that result from jet fuel burning and are human carcinogens. Plus, medical monitoring over the course of the year following the disaster showed long-term loss of lung capacity in such firefighters, along with increased rates of asthma and other respiratory ailments. And a study published September 1 in British medical journal The Lancet found that the nearly 9,000 firefighters surveyed had a cancer rate 10 percent higher than that of typical American men.

And while the number of exposed firefighters is known, the total number of individuals exposed to the toxic aftermath of 9/11 remains unknown, though more than 70,000 people have signed up for the World Trade Center Health Registry, which aims to track health outcomes of the exposed population. "The key is when you arrived, whether you were wearing a respirator or not, how long you were there and how high the concentrations were there that could lead to effects," Lioy says of the rescue personnel. "I think people who wore respirators have a lower probability of health effects... People who came early to the site and were not wearing respirators have a greater probability of having more severe effects."

In future such disasters, strapping on a respirator may be among the most important safety precautions people can take. "For the future, we need to make sure people going into harm's way have respiratory protection of some degree that also allows them to move freely enough to rescue people," Lioy says. Today, more than 12,000 of the 9/11 rescue workers continue to have trouble breathing, according to a study conducted by the World Trade Center Medical Monitoring Program and published April 8, 2010, in the New England Journal of Medicine.

But it's not just the rescue workers. New York State accountant Jerry Borg, who worked in a building a few blocks from the World Trade Center on September 11, 2001, died of an inflammatory disease of the lungs in December 2010. After an autopsy, he was ruled the 2,753rd official victim of the 9/11 attacks this past June—and the third linked specifically to exposure to the toxic dust cloud. There may be more to come.

Editor's Note: Some of the infographic titles and captions have been changed for accuracy.

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