Quiet So Far: A Muted Response to Allegations of the First Human Fatalities Linked to Nanoparticles

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Like the apocryphal dog that didn't bark, sometimes the most telling reaction is the one that doesn't happen at all.

In late August 2009, the *European Respiratory Journal* quietly circulated an embargoed study with potentially explosive news for nanotechnology: a team of doctors at Beijing Chaoyang Hospital had allegedly documented the first human fatalities linked to workplace exposure to nanoscale materials. The study reported that seven young Chinese women had suffered serious lung injuries after they inhaled fumes from polystyrene boards that were coated with a polyacrylate esther paste and then heated to 75-100 degrees Celsius. This paste contained particles that were 30 nanometers in diameter.[1] The workroom had one door and no windows, and that door remained closed to keep the room warm. The room's ventilation unit had broken down five months before the workers began to suffer symptoms, and the workers themselves wore only cotton gauze masks on an "occasional basis."

The seven women all had pleural granulomas (small nodules of inflamed immunological cells), and their lungs contained excessive amounts of discolored fluid. Two of these women later died from their injuries. The embargoed report reflected the researchers' careful efforts to confirm the presence of nanoscale parties in the polyacrylate esther paste, in the workplace equipment, and in the lung fluid and cytoplasm of the victims' lung cells. It also pointed to laboratory studies where exposure to nanoparticles had caused similar injuries in mammals.[2]

The *Journal* circulated the embargoed study because it probably felt, justifiably, that the first documented cases of human fatalities linked to nanoscale particles would spark worldwide concern. While many environmental organizations and government agencies had previously argued that nanomaterials could pose unknown risks to human health, no verified cases of serious injury had yet surfaced.[3] By circulating the report at least a full week before its press conference and online publication, the *Journal* gave mainstream journalists an opportunity to prepare balanced and thoughtful stories on a potential blockbuster story in the world of nanotechnology.

A spate of news articles followed the *Journal*'s online publication of the report on August 20, 2009, but that surge quickly faded. According to a survey by Dr. David Berube, a professor of risk communication and science communication on emerging technologies, 177 stories appeared on the Song study within the first 24 hours after the study's release, and press coverage then peaked with another 612 articles within 24 to 48 hours. The vast majority of these articles relayed or repeated information from an early article by Tan Ee Lyn of Reuters. After this initial flurry, the number of stories during the next 48 hours dropped to eight.[4] To date, the study has also not spurred any governmental efforts to add new controls for exposure to nanoscale materials in the workplace or new advocacy campaigns to restrict their use in fabrication or coating processes. This muted response led Dr. Berube to conclude that "simply put, the press doesn't seem to want to cover nanotechnology issues, even when we are talking about exposure to nanoparticles that may have resulted in two deaths and a handful of hospitalizations."[5]

Why did the Song study fail to provoke a larger call for broader or tighter scrutiny of nanomaterials used in the workplace? Several forces combined to sap the report of its impact, and these factors in turn could shape future efforts to increase the regulatory scrutiny and control of nanomaterials.

Muddled causation. The authors took pains to document the presence of nanoparticles in both the workplace,

1. A nanometer is one billionth of a meter. Materials in this size range can display unusual properties that make them commercially valuable or scientifically useful. For example, a small mass of nanoscale material may display high potency or chemical reactivity.

2. Yuguo Song et al., *Exposure to Nanoparticles Is Related to Pleural Effusion, Pulmonary Fibrosis, and Granuloma*, 34 Eur. Respir. J., 559-67 (2009).

3. Although the German government issued a recall of MagicNano (a household sealing material) on March 31, 2006, because the product injured over 110 consumers who used it, subsequent reports confirmed that MagicNano did not actually contain any nanoparticles that could have caused the injuries. Federal Institute for Risk Assessment, *Nano Particles Were Not the Cause of Health Problems Triggered by Sealing Spray* (May 26, 2006), *available at* http://www.bfr.bund.de/cd/7842.

4. David Berube, *Is Nanotechnology Newsworthy?* (Aug. 24, 2009), http://nanohype.blogspot.com/2009/08/is-nanoscience-newsworthy-why-would.html. *See also* InterNano, *Source List on Chinese Worker Exposure to Nanoparticle Study*, http://www.internano.org/index2.php?option=com_content&do_pdf=1&id=271.

5. Berube, *supra* note 4.

as well as within the lung cells of the injured workers. Using a transmission electron microscope to scan the polyacrylate esther paste, as well as biopsed lung tissue from the workers, they found nanoparticles in the paste, in dust from the broken ventilator, and in fluid and cells from the workers' lungs. The doctors also noted laboratory experiments that exposed animals to similarly sized nanoparticles had yielded similar damage to lung tissue.

Despite these careful efforts, the Song study nonetheless failed to draw a clear and unequivocal link between exposures to these nanoparticles and the workers' serious injuries and deaths. Several experts noted that the study failed to provide any data on the nature, duration, or content of the workers' exposure, and the study also did not specify the particles' primary composition, their agglomeration or aggregation, or their surface chemistry. Most importantly, the Song study did not include any chemical analysis of the particles found in the workplace or in the biological samples. It also did not assess other possible causes for the symptoms other than a quick survey to discount them (for example, the study cursorily dismisses the possible effect of other pyrolysis products).[6]

Failure to follow basic workplace safety practices. At heart, the study highlights a workplace safety tragedy that was easily avoidable. According to the study, the workers only wore cotton gauze masks occasionally and did not use any other personal protective equipment when they operated the heat-curing equipment. While the equipment had a ventilation unit and filter, that unit broke and remained unused during the five months that the workers were exposed. The sole door to the work room remained closed to keep the room warm, and the workers labored through their shifts with little exposure to fresh air. If the facility had used standard workplace safety practices to stop just one of these links in the chain of exposure, the risk of injury might have dropped dramatically.

Restricted media access. The location of the incident likely played an important role in its media impact. While the Chinese press and Internet reporting have grown increasingly sophisticated, institutional pressures and restrictions on foreign reporters can mute forceful reporting of workplace injuries involving nanoparticles. China also lacks an aggressive plaintiff's attorney bar to pursue and build press attention on injury claims. Without dramatic interviews of injured workers, striking newspaper and television coverage of the incident, or sustained advocacy to maintain public interest in the workers' plight, the spotlight soon shifted and global public media moved on to the next story.

With these factors in the background, many expert reviewers reached the same conclusion: the Song study highlighted an important incident that should steer future toxicological and epidemiological efforts to assess the risks posed by workplace use of nanoparticles. It did not, however, show indisputably that the workers suffered their injuries because of unique hazardous properties posed by the nanoscale dimension of the inhaled particles. Future studies and efforts to link nanoscale materials to human injuries in the workplace will likely face similar difficulties in making a clear and convincing case, and these challenges underline the continued importance of sponsoring additional research on safe handling practices for nanomaterials.

While the scientific inquiry proceeds at its measured pace, the Song study may still have more immediate legal repercussions. At the least, companies with extended supply chains or manufacturing operations that use nanomaterials in far-flung multiple locations might want to assess risks from similar nanomaterial usage in their environmental management assessment and monitoring. If a future injury arises from exposure to respirable nanoparticles in the workplace, companies will undoubtedly face claims that they had notice that exposure in these circumstances might cause human injury.

6. Dr. Andrew Maynard provided the most cogent and comprehensive review of the study's importance and limitations. *Is Nanotechnology Poised for the Ride of Its Life?* (Aug. 18, 2009), http://2020science.org/2009/08/18/is-nanotechnology-posed-for-the-ride-of-its-life/; *New Study Seeks to Link Seven Cases of Occupational Lung Disease With Nanoparticles and Nanotechnology* (Aug. 25, 2009), http://2020science.org/2009/08/18/new-study-seeks-to-link-seven-cases-of-occupational-lung-disease-with-nanoparticles-and-nanotechnology/; *Nanoparticle Exposure and Occupational Lung Disease—Six Expert Perspectives on a New Clinical Study* (Sept. 3, 2009), http://2020science.org/2009/08/18/nanoparticle-exposure-and-occupational-lung-disease-six-expert-perspective-on-a-new-clinical-study/. *See also* Bryony L. Ross, *Linking Nanoparticle Exposure to Pulmonary Fibrosis and Mortality: Evaluating the Key Messages of Song et al.,* http://www.safenano.org.