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CORRECTION TO THIS ARTICLE
A Dec. 5 article about research on the environmental and health effects of nanotechnology contrasted the federal government's claim that it has budgeted $39 million for such research this year with a $6 million tally by the Woodrow Wilson International Center for Scholars. The story should have mentioned that the center acknowledges its estimate is incomplete because it does not include research being performed by certain government agencies that have not reported their numbers. According to federal officials, those untallied expenses add up to an additional $6.7 million. Also, because of incorrect information in a federal document, the article overstated the number of nanomaterials now being produced in the United States. New data provided by government officials after the story was published indicates that there are not 700 different nanomaterials in production. That number encompasses nanomaterials and various pieces of equipment specifically used in the manufacture of those materials.

Nanotechnology Regulation Needed, Critics Say

By Rick Weiss
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Amid growing evidence that some of the tiniest materials ever engineered pose potentially big environmental, health and safety risks, momentum is building in Congress, environmental circles and in the industry itself to beef up federal oversight of the new materials, which are already showing up in dozens of consumer products.

But large gaps in scientists' understanding of the materials are slowing the development of a regulatory scheme. Equally unresolved is who should pay for the additional safety studies that everyone agrees are needed.

At issue are "nanomaterials," made of intricately engineered particles and fibers as small as 1/80,000th the diameter of a human hair. At that scale the laws of chemistry and physics bend, giving familiar substances novel chemical, electrical and physical properties.

Nanomaterials are already being integrated into a wide range of products, including sports equipment, computers, food wrappings, stain-resistant fabrics and an array of cosmetics and sunscreens -- a market expected to exceed $1 trillion a year within a decade. Preliminary studies suggest that most of these products do not pose significant risks in their bulk form or embedded in the kinds of products that so far use them.

But the same cannot be said of the particles themselves, which can pose health risks to workers where they are made and may cause health or environmental problems as discarded products break down in landfills.

Lab animal studies have already shown that some carbon nanospheres and nanotubes behave differently than conventional ultrafine particles, causing fatal inflammation in the lungs of rodents, organ damage in fish and death in ecologically important aquatic organisms and soil-dwelling bacteria.

An estimated 700 types of nanomaterials are being manufactured at about 800 facilities in this country alone, prompting several federal agencies to focus seriously on nano safety. Yet no agency has developed safety rules specific to nanomaterials. And the approach being taken by the

Environmental Protection Agency, arguably the furthest along of any regulatory body, is already facing criticism by some as inadequate.

In documents that are now being finalized for public comment, the agency calls for a "stewardship program" that would be voluntary. Manufacturers would be asked to alert officials about nanoproducts they are making and to provide information about environmental or health risks they have uncovered. But they would not be required to make such reports or to do special studies.

Although the agency may at some point feel the need to impose stricter controls, the voluntary approach has the advantage that it can be implemented more quickly, said Charles Auer, director of the EPA's Office of Pollution Prevention and Toxics. He added that the agency is not sure it understands enough about the new materials to know how best to regulate them.

"This way we can develop something, gain experience and learn more about what we're dealing with," Auer said.

Others, including scientist Jennifer Sass of the Natural Resources Defense Council, which recently withdrew from an EPA advisory group out of frustration with the direction the agency was going, call that approach toothless.

"I think it's absolutely necessary that we have enforceable regulations and that we don't put these materials in commercial products unless we know they can be used safely over the full life cycle of the product," Sass said.

The most recent batch of published scientific studies on nanomaterials have not been reassuring. In the past few months:

Researchers at the New Jersey Institute of Technology found that nanoparticles of aluminum oxide stunt the growth of roots on several crops -- including soybeans and corn, mainstays of U.S. agriculture.

Japanese researchers found that a kind of nanosphere that some want to use to deliver drugs or vaccines into the body is a potent stimulator of immune-reaction genes, perhaps explaining fatal inflammatory responses seen in animals exposed to nanomaterials.

And a California team working with laboratory-grown cells showed that carbon nanotubes specifically activate "cell suicide genes."

"Cell growth was retarded, and there was a doubling of cell deaths," said study leader Fanqing Frank Chen of Lawrence Berkeley National Laboratory. Chen said factory exposures should be "a big concern," and added that many nanospheres are very stable and not likely to break down in the environment.

Congress has begun to take note. At a House Science Committee hearing Nov. 17, environmental and industry representatives alike said federal spending on environmental, health and safety implications of nanotechnology should be $100 million to $200 million a year, or about 10 percent to 20 percent of the government's $1.1 billion nanotech development budget for fiscal 2006.

By contrast, the government is slated to spend $39 million this year on research whose "primary purpose" is to investigate those issues, said Clayton Teague, director of the National Nanotechnology Coordination Office. He said that figure is "probably appropriate," given the overall federal investment and the modest number of products on the market.

But David Rejeski of the Woodrow Wilson International Center for Scholars, which last week released a new inventory of U.S. nano research, said federal spending on studies truly devoted to environmental and health concerns is actually only $6 million, with some topics still completely unaddressed.

Some nanospheres, for example, are extremely slippery, "like the nano version of banana peels," said Rejeski, director of the center's foresight and governance project. With slips and falls a major cause of workplace injury, he said, this is the kind of thing that deserves attention but can be easily overlooked, given the lack of an overarching national nanotechnology research strategy -- something he and others are calling for.

Also at issue is whether industry is footing a big enough share of the safety research bill. A few large companies, including DuPont, have significant programs in place. But much of the nanotechnology sector involves small businesses that are in no position to study the impacts of their products, raising concerns that answers will come too late.

"The limited data now available are flashing yellow lights that we should not ignore," said Richard Denison, a scientist at Environmental Defense, an advocacy group that is collaborating with the EPA and DuPont on nano safety issues.