SCIENCE POLICY

Incorporating WASHINGTON NEWS and policy news from around the world.

Massive Scare over Tiny Tech

North Americans reading the European press might think they have landed on another planet, where the laws of science are very different. In the United States, for example, the media paints nanotechnology as a great new scientific opportunity, one that will rival the IT and biology booms of the late 20th century. Newspapers in the United Kingdom, on the other hand, carry headlines proclaiming this new approach to materials science as a threat to civilization as we know it.

Nanotechnology made the transition from "Big Idea" to harbinger of doom in record time. For nuclear power and genetically modified (GM) crops, there were at least brief interludes when the headlines described commercialization and how much money would accrue to the successful innovators. Now, researchers working on nanomaterials are so concerned about image problems that they eschew, as they put it, "the N-word."

Bob Humphreys, head of the Strategic Technology Group in the materials and specialty chemicals company ICI, said "The 'nano' word is overused. I prefer to think of it as 'small technology.' The important thing is how small does it need to be to solve your problems."

Several reasons have developed for staying off the nano bandwagon. Playing down expectations is one—or as one observer said, avoiding "hype fatigue"—but more important in Europe is the attack from environmentalists. When Prince Charles this past year expressed concern over potential dangers of nanotechnology, media coverage announced his statements as an alarm over "gray goo" wreaking havoc as self-replicating "nanomachines" smothered the planet. Stung by what it saw as an ill-informed comment, the scientific community went on the offensive. This was not easy after previous debacles over mad cow disease and GM crops. No amount of reassurance would work.

Prince Charles has since clarified his views in a commentary published in the July 11, 2004, issue of the *Independent*, a respected newspaper. In his article, the Prince of Wales remains concerned that the European Union's research program for nanotechnology provides "only an estimated 5 per cent of total funding…on examining the environmental, social and ethical dimensions of these technologies."

The U.K. government commissioned a study from two leading research institutions. The Royal Society and the Royal Academy of Engineering assembled a high-powered committee to investigate nanotechnology and its implications.

After reviewing the state of the science and technology, the committee's report examined possible health effects, social and ethical issues, and regulatory aspects. The report said, "Much of nanoscience is concerned with understanding the properties of materials at the nanoscale and the effects of decreasing the size of materials or the structured components of materials…. Nanoscale particles can exhibit, for example, different electrical, optical, or magnetic properties from larger particles of the same material."

https://doi.org/10.1557/mrs2004.230 Published online by Cambridge University Press

The move into the realm where quantum mechanics becomes significant differentiates nanomaterials from bulk materials. But even here it is only some "nano stuff" that raises concerns. As Ann Dowling, professor of mechanical engineering at the University of Cambridge and chair of the working group that produced the report, said, "This report has confirmed the great potential of nanotechnologies. Most areas present no new health or safety risks, but where particles are concerned, size really does matter. Nanoparticles can behave quite differently from larger particles of the same material and this can be exploited in a number of exciting ways. But it is vital that we determine both the positive and negative effects they might have."

It is the shortage of information that concerns the working group, as the group reports, "The lack of evidence about the risk posed by manufactured nanoparticles and nanotubes is resulting in considerable uncertainty."

Concerns about nanotechnology have not escaped the notice of people who might have to pick up the bill if there are any nasty shocks: the insurance industry. Insurers do not want a rerun of their experience with asbestos, when they found themselves paying for damage inflicted decades ago, long before the ill effects caused by the material were common knowledge.

Insurance companies are already looking into the risks associated with nanomaterials. As Bruno Porro, chief risk officer at the insurance company Swiss Re, said in an introduction to a report on nanotechnology and its risks, "Since the use of nanotechnology in commercial production is set to spread rapidly, the insurance industry should waste no time in assessing the potential risks and benefits both for itself and for society in general."

Annabelle Hett, one of Swiss Re's experts on risk, advocates detailed assessment of the risks involved in handling nanotechnologically manufactured substances. "The main precondition for successful risk assessment in a technology as complex as nanotechnology," she said, "is finding a consensus among industry representatives, legislators, and research institutes concerned."

Equally important, Hett said, this activity "must extend across national borders."

The U.K. Environment Agency finds the issues serious enough to have commissioned a report on nanotechnology from Demos, an independent think tank. With the public opposition to GM food still fresh in the memory, Demos recommends a government-supported public debate on nanotechnology. Under the "Nano Nation?" banner, this would be a genuine debate that allows the public to reach reasoned conclusions about the acceptability of nanotechnology.

That debate should, the report said, "inform the U.K.'s stance in EU [the European Union] and international debates." The idea is that such a public consultation would support the United Kingdom's position in any negotiations. According to Demos, the United Kingdom would then be in a position to assert that "its position on nanotechnologies is thoroughly grounded in public views." This is an important caveat in international forums, such as the World Trade Organization, that currently place far more emphasis on scientific evidence.

https://doi.org/10.1557/mrs2004.230 Published online by Cambridge University Press

GM food has already become a cause of international trade friction, such as that between the United States and the European Union. Could it happen with nanotechnology? The fledgling industry cannot afford to run the risk.

MICHAEL KENWARD

NRC Report Recommends New Power Sources for Soldier of the Future

The U.S. Army should investigate alternative power sources, such as fuel cells and small engines, to create longer-lasting, lighter, cheaper, and more reliable sources of energy for the equipment soldiers will use in the future, according to a report released September 10 by the U.S. National Academies' National Research Council (NRC). In addition, the Army should step up its efforts to develop and acquire technologies that are more energy-efficient, said the committee that wrote the report.

"The Army should immediately conduct a comprehensive analysis of power sources for future dismounted soldiers, looking beyond today's standard military batteries," said Patrick Flynn, committee chair and retired vice president for research for Cummins Engine Company Inc. in Columbus, Ind. "Many commercial energy sources exist, but they are developed for a consumer market, not the military."

The Army will equip its future soldiers through a program called "Land Warrior," which, in addition to weaponry, includes high-tech electronics that significantly increase soldiers' awareness of the combat environment, such as helmets with visual displays, chemical and biological sensors, radios, and portable computers. But these devices are not energy-efficient and will need new power sources to operate efficiently. The development, testing, and evaluation of these new energy sources will be carried out under a program known as "Future Force Warrior."

The committee evaluated and prioritized options for supplying energy to various low- and high-power applications on the battlefield. In addition to disposable and rechargeable batteries, the committee considered fuel cells, small engines, and hybrid energy systems such as those combining a battery with a fuel cell, or a small engine with a battery. Existing military batteries can provide enough power for computer displays, radios, sensors, and electronics for a 12-hour mission, but longer missions will require other technologies to efficiently power operations lasting up to 72 hours. These include improved low-power electronics, sophisticated power management software, and "smart" hybrid energy systems that automatically adjust to the soldier's operating environment on the battlefield.

Some of the applications requiring a higher level of power—an average of 100 watts—include portable battery chargers; laser target designator devices used to guide a rocket, missile, or bomb to its target; and individual cooling systems for protective garments. For these applications, the committee said that hybrid systems operating on common military fuels would be needed.

Other devices designed to enhance soldier performance on the battlefield use even more power, requiring 1–5 kilowatts. For example, the "exoskeleton," which consists of a pair of mechanical metal leg braces and a backpack-like frame, literally

https://doi.org/10.1557/mrs2004.230 Published online by Cambridge University Press

takes the load off a soldier's back, allowing him or her to carry large or heavy packs without losing agility. To power such energy-intensive equipment, the Army should consider use of lightweight engine generators, the report said.

Among all possible energy sources, hybrid systems provide the most versatile solutions for meeting the diverse needs of the combat soldier of the future, the committee said. The key advantage of hybrid systems is their ability to provide power over varying levels of energy use by combining two power sources.

The study was sponsored by the U.S. Department of the Army. The report, "Meeting the Energy Needs of Future Warriors," is available from the National Academies Press; tel. 202-334-3313 or 1-800-624-6242; www.nap.edu.

ANSI Nanotechnology Standards Panel Holds First Meeting

The American National Standards Institute (ANSI) has formed the ANSI Nanotechnology Standards Panel (ANSI-NSP), charged with the development of nanotechnology nomenclature and terminology. The project was commissioned by the White House's Office of Science and Technology Policy (OSTP). According to John H. Marburger III, director of OSTP, "As new materials, structures, devices, and systems are developed that derive their properties and function due to their nanoscale dimensions, it will become increasingly important to the . . . stakeholders to have an agreed-upon nomenclature with which to communicate."

The panel met September 29–30 at the National Institute of Standards and Technology (NIST) in Gaithersburg, Md., with nearly 100 representatives of the academic community, legal profession, industry, government, standards developers, and expert of other subject matters.

According to ANSI, many of the stakeholders in the nanotechnology industry feel that nomenclature is seen as the fundamental building block to progress within the industry. Some definitions do exist now, but there is not always consensus on what they mean. Some of the critical issues identified during the meeting for developing a nomenclature structure and defining terminology include size, morphology, composition, process, risk management, and communications. The panel expects to issue recommendations early this fall on how to proceed. The panel welcomes ongoing participation of interested parties by way of an online survey at www.ansi.org. Questions may be e-mailed to Heather Benko at hbenko@ansi.org.

Success of China's 863 Program Upgrades Industries

China's 863 Program—a high-tech research and development (R&D) endeavor at the national level—in its 15-year implementation, has achieved key technology breakthroughs and become a powerful propeller to upgrade and transform China's traditional industries, said Ma Songde, vice minister of science and technology at an experts' hearing meeting held for the program. As reported in the July 30 newsletter of the Ministry of Science and Technology, the 863 Program has driven key technology breakthroughs in six major fields, including new materials and energy technologies. These breakthroughs have resulted in major technology projects involving integrated circuit manufactur-

https://doi.org/10.1557/mrs2004.230 Published online by Cambridge University Press

ing, high-speed telecommunication networks, coal liquidation, new-generation nuclear energy, and electric automobiles. Due to these results along with those in other scientific fields, the central government has enhanced its input in R&D.

According to the report in the newsletter, statistics show that China's R&D input in the gross domestic product (GDP) rose from 0.6% in 1995 to about 1.3% in 2003. The number of high-tech industrial parks also increased from 87 in 1991 to about 20,000 in 2003. In addition to traditional industries, including iron and steel, power generation, light industry, transportation, energy, and materials, numerous high-tech industries have emerged, including electronics, aeronautics and space, new materials, and new energy. Both traditional and high-tech industries have become a solid support for the national economy, according to the newsletter.

At the meeting, Ma said that the government would encourage high-tech R&D efforts dominated by industries. National programs such as the 863 Program will be proportioned with industrial participation. Research findings or results derived from national science and technology (S&T) programs will belong to the implementing institutions, whether they are industries, research institutions, or universities. He believes that these policy shifts will gradually change the high-tech R&D input pattern currently dominated by the government and accelerate the S&T integration process involving manufacturers, universities, and research institutions. □

https://doi.org/10.1557/mrs2004.230 Published online by Cambridge University Press