Nanotechnology: Governments passive, critics say TheStar.com - sciencetech - Nanotechnology: Governments passive, critics say



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Hewlett Packard technicians work on nanotechnology research in a clean room at HP headquarters in Palo Alto, Calif., Tuesday, Jan. 16, 2007.

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EDMONTON – The breakneck pace at which products with altered molecules are making their way to store shelves has scientists worried that governments around the world aren't doing enough to ensure that the new technology is safe for people and the environment.

In Canada, a blue-ribbon panel of 15 nanotechnology experts warned the federal government last summer that action is ``urgently" needed to assess the potential risks of these tiny particles, but Health Canada has yet to respond to their report.

There are no nanomaterial-specific regulations in effect in Canada. As it stands, Ottawa doesn't even have a list of nanomaterials that have been developed or are contained in more than 800 products already being hawked to consumers.

And new patents and products are being introduced each week.

"Fundamentally, we don't have enough research or resources invested in the assessment of nanomaterials from a regulatory perspective," Pekka Sinervo, chairman of the Council of Canadian Academies panel, told The Canadian Press in an interview.

"Some nanomaterials are actually quite benign and are useful. Others present an unknown, and in some cases a potentially significant risk of harm."

If developed safely, nanomaterials – made by the almost mythical practice of manipulating atomic and molecular-sized matter – could someday revolutionize the economy and vastly improve our quality of life.

The tiny particles are being used in everything from anti-bacterial ceiling paint to tooth paste that does a better job of whitening teeth. There are bandages chemically treated to help speed healing and cosmetics altered to better prevent wrinkles.

But researchers don't know much about how the particles affect humans or animals, the air we breathe, the water we drink, the food we eat or how they break down in nature over time.

At least one preliminary study has suggested that some forms of carbon nanotubes pile up in the body and can act like cancer-causing asbestos. Some nanoparticles generate oxidants, which can react with chemicals in cells and can even alter DNA.

Canada doesn't even have a standard way of measuring these materials, which can be 100,000 times smaller than the diameter of a human hair. Such standards are necessary to determine their effects on workers, consumers and the environment.

Other countries face the same knowledge gap.

In a report last month the U.S. National Research Council blasted Washington for not adequately dealing with the health and environmental impacts of nanomaterials. The report suggests that without more research the public may not accept such products. Businesses joined environmental groups in quickly calling on the U.S. government to develop clear rules for the emerging technology.

"The NRC report lends all the more urgency to our coalition's call for the independent development of a comprehensive road map to guide federal research on the environmental, health and safety implications of nanotechnology," says the statement signed by chemical giant DuPont, the NanoBusiness Alliance, the Environmental Defense Fund and others.

In Great Britain, the Royal Commission on Environmental Pollution issued a report that said, while there is no evidence that nanomaterials have harmed people or the environment, more research is needed to assess their safety. The commission noted that the development of nanomaterials has far outpaced the evaluation of the risks they may pose.

Canadian experts have recommended that the federal government toughen its existing regulatory system to deal with the unique challenges posed by nanotechnology.

They say Ottawa should create a special regulatory classification for nanomaterials and change standards to make it easier to trigger reviews of their health and environmental effects.

The Council of Canadian Academies panel said Canada should also fund more research, including bolstering the ability of Health Canada and Environment Canada scientists to put safety issues under the microscope.

"We have to take first steps toward getting our arms around the problem. And it is the government that actually needs to take these steps. Nobody else is going to do this," says Sinervo, the former dean of the arts and science faculty at the University of Toronto.

Health Canada declined interview requests on the safety challenges posed by nanotechnology.

A department spokesman forwarded an email response that states that the federal government recognizes that a balanced, stewardship approach is needed.

"Regulating products to ensure the health and safety of Canadians and the environment is a priority for Health Canada," the statement says.

"Currently, the department is using the existing legislative and regulatory frameworks to regulate applications of nanotechnology, but it is recognized that new approaches and new policies may be necessary in the future to keep pace with the advances in this area."

Canadians should take heart that experts around the world are looking into these issues and that governments and international organizations are working together to share information, says Lori Sheremeta, a lawyer who investigates the social implications of new technologies for the National Institute of Nanotechnology in Edmonton.

Sheremeta contends that there is no reason to stop or slow development of nanotechnologies as long as Canada puts more effort and money into answering the basic question: Is it safe to introduce these technologies into society?

"Government labs have been underfunded and they have been cut and cut and cut and cut" over the past 15 years, she says.

"The expertise has been eroded from the lab system and more money needs to be targeted to that particular task – ensuring public safety."

As Ottawa ponders how to regulate nanotechnology, the industry continues to expand.

Market experts predict that nanotechnology will be worth $1 trillion a year globally by 2020 and say Canada should be trying to carve out a 10 per cent slice of that pie. Canadian researchers at federal facilities, universities and private companies have been spending more than $100 million a year on projects that could lead to new or improved commercial products.

Canada's main competitors include the United States, Japan, Germany and China.

This year the Canadian National Research Council announced new projects, including research into using nanotechnology to make cheaper, efficient solar cells and a new cryptography system to better safeguard electronic financial transactions and communications.

Pierre Coulombe, president of the council, said the intent is to rapidly transfer knowledge from the research lab to industry. While the council is not a regulatory agency, safety is a key factor in their work, he said.

There are also proposals under review for research projects into nanosafety that could be funded next fiscal year, if approved by Ottawa.

"We have a responsibility, as scientists, to develop a strategy to mitigate any risks," Coloumbe said.

The real challenge for Canada is to establish a workable regulatory system for nanomaterials that won't hobble research and the development of new products.

How cautious should the government be?

"If we take radical steps to proactively regulate when we don't know if we have substantially higher risks with the materials, we really stand to damage and limit new developments in the area that could be of huge potential value," Sheremeta says.

Scientists, including the nanotechnology panel, suggest Ottawa must be open with the public about its policy-making decisions and put the safety question directly to Canadians.

If the federal government fails to be upfront and consult with consumers about safety, a backlash against nanotechnology could develop.

"I think it is important to convey to consumers the concerns," Sinervo says.

"I think it is important to expect government to respond appropriately. More needs to be done."

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# 'Space elevator' would take humans into orbit

* Story Highlights
* Japan group has more than 100 engineers trying to design a space elevator
* Carbon nanotube would be used as a wire to lift the elevator into space
* Western Australia and the Galapagos Islands are potential locations for base station
* Group sets the 2030s as a target to begin construction, although it could be later

By Mike Steere  
For CNN

**LONDON, England (CNN)** -- A new space race is officially under way, and this one should have the sci-fi geeks salivating.

The project is a "space elevator," and some experts now believe that the concept is well within the bounds of possibility -- maybe even within our lifetimes.

A conference discussing developments in space elevator concepts is being held in Japan in November, and hundreds of engineers and scientists from Asia, Europe and the Americas are working to design the only lift that will take you directly to the one hundred-thousandth floor.

Despite these developments, you could be excused for thinking it all sounds a little far-fetched.

Indeed, if successfully built, the space elevator would be an unprecedented feat of human engineering.

A cable anchored to the Earth's surface, reaching tens of thousands of kilometers into space, balanced with a counterweight attached at the other end is the basic design for the elevator.

It is thought that inertia -- the physics theory stating that matter retains its velocity along a straight line so long as it is not acted upon by an external force -- will cause the cable to stay stretched taut, allowing the elevator to sit in geostationary orbit.

The cable would extend into the sky, eventually reaching a satellite docking station orbiting in space.

Engineers hope the elevator will transport people and objects into space, and there have even been suggestions that it could be used to dispose of nuclear waste. Another proposed idea is to use the elevator to place solar panels in space to provide power for homes on Earth.

If it sounds like the stuff of fiction, maybe that's because it once was.

In 1979, Arthur C. Clarke's novel "The Fountains of Paradise" brought the idea of a space elevator to a mass audience. Charles Sheffield's "The Web Between the Worlds" also featured the building of a space elevator.

But, jump out of the storybooks and fast-forward nearly three decades, and Japanese scientists at the Japan Space Elevator Association are working seriously on the space-elevator project.

Association spokesman Akira Tsuchida said his organization was working with U.S.-based [Spaceward Foundation](http://www.spaceward.org/) and a European organization based in Luxembourg to develop an elevator design.

The [Liftport Group](http://www.liftport.com/) in the U.S. is also working on developing a design, and in total it's believed that more than 300 scientists and engineers are engaged in such work around the globe.

NASA is holding a $4 million Space Elevator Challenge to encourage designs for a successful space elevator.

Tsuchida said the technology driving the race to build the first space elevator is the quickly developing material carbon nanotube. It is lightweight and has a tensile strength 180 times stronger than that of a steel cable. Currently, it is the only material with the potential to be strong enough to use to manufacture elevator cable, according to Tsuchida.

"At present we have a tether which is made of carbon nanotube, and has one-third or one-quarter of the strength required to make a space elevator. We expect that we will have strong enough cable in the 2020s or 2030s," Tsuchida said.

He said the most likely method of powering the elevator would be through the carbon nanotube cable.

So, what are the major logistical issues keeping the space elevator from being anything more than a dream at present?

Massachusetts Institute of Technology aeronautics and astronautics Professor Jeff Hoffman said that designing the carbon nanotube appeared to be the biggest obstacle.

"We are now on the verge of having material that has the strength to span the 30,000 km ... but we don't have the ability to make long cable out of the carbon nanotubes at the moment." he said. "Although I'm confident that within a reasonable amount of time we will be able to do this."

Tsuchida said that one of the biggest challenges will be acquiring funding to move the projects forward. At present, there is no financial backing for the space elevator project, and all of the Japanese group's 100-plus members maintain other jobs to earn a living.

"Because we don't have a material which has enough strength to construct space elevator yet, it is difficult to change people's mind so they believe that it can be real," he said.

Hoffman feels that international dialogue needs to be encouaraged on the issue. He said a number of legal considerations also would have to be taken into account.

"This is not something one nation or one company can do. There needs to be a worldwide approach," he said.

Other difficulties for space-elevator projects include how to build the base for the elevator, how to design it and where to set up the operation.

Tsuchida said some possible locations for an elevator include the South China Sea, western Australia and the Galapagos Islands in the Pacific Ocean. He said all of those locations usually avoided typhoons, which could pose a threat to the safety of an elevator.

"As the base of space elevator will be located on geosynchronous orbit, [the] space elevator ground station should be located near the equator," he said.

Although the Japanese association has set a time frame of the 2030s to get a space elevator under construction -- and developments are moving quickly -- Hoffman acknowledges that it could be a little further away than that.

"I don't know if it's going to be in our lifetime or if it's 100 or 200 years away, but it's near enough that we can contemplate how it will work."

Building a space elevator is a matter of when, not if, said Hoffman, who believes that it will herald a major new period in human history.

"It will be revolutionary for human technology, and not just for space travel. That's why so many people are pursuing it," he said. "This is what it will take to turn humans into a space-bearing species."

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