AVOIDING THE NEXT ASBESTOS: CALIFORNIA’S EMERGING REGULATION FOR CARBON NANOTUBES

Sergio Cardenas, Chemistry Major, College of the Canyons
Research Mentor: Roger Eardley-Pryor  Faculty Adviser: W. Patrick McCray
Center for Nanotechnology in Society and the Department of History, University of California, Santa Barbara

Abstract
In the historical development of the nano-enterprise, scientists and lawmakers have considered the risks and benefits of nanotechnology. Enthusiasm for nanotechnology has been tempered by environmental, health, and safety concerns. Finding the right balance is crucial. A premature and outright moratorium of all nanotechnology could destroy this new industry's potential for economic prosperity. However, an unregulated industry could severely threaten workers, consumers, and the environment.

In January 2009, the state of California sent a mandatory safety information request to carbon nanotube (CNT) manufacturers in anticipation of setting state-wide regulatory guidelines. My research uses historical analysis of regulatory guidelines, government documentation, and public discourse to outline how California initiated this proactive stance and to answer why California selected CNTs instead of other nanoparticles in its first nano-specific manufacturer information request.

The California Environmental Protection Agency (CalEPA) cited two scientific studies in its rationale for choosing CNTs in its first nano-specific informational call. One study described how the biodegradation of manufacturing CNTs could be toxic, while the other stated how the fate of CNTs may threaten California’s drinking water. However, most toxicological studies of CNTs emphasized its strong affinity to asbestos, which CalEPA avoided citing. Because public perceptions could drastically alter future research and economic development of nanotechnology in California, I argue that fears of potential public backlash likely led CalEPA to ignore CNT's affinity to asbestos. Currently, no nation or state has regulatory systems in place to properly handle the unique properties of nanotechnology.

Research Questions
- Why did California take steps to regulate nanotechnology?
- How did California approach nanotechnology regulation?
- Why did California choose Carbon Nanotubes (CNTs) for its first data call-in?
- Why did California avoid citing connections between asbestos and CNTs?

Why California Concerns and Carbon Nanotubes (CNTs)

Environmental Health & Safety: As a large and populous state with beautiful beaches and incredible mountains, California has a strong interest in keeping its citizens and environment safe.

Economic Incentives: California’s 2005 Blue Ribbon Task Force of academicians, industry leaders, and policy makers considered California “extremely well positioned to be a world leader in nanotechnology.” To ensure the health of its economy, California needed clear guidelines for nanotechnology’s industrial development. A regulatory ban on nanotechnology could kill the nanotech business, forecast to be one a trillion-dollar industry by 2015. The Task Force encouraged California’s Environmental Protection Agency to negotiate an agreement with state nanotechnology manufacturers that could be the basis for information exchanges and problem solving related to responsible stewardship of nanotechnology.

How did California approach nanotechnology regulation?
Passed in September 2006, California Assembly Bill 289 (AB 289) allowed the California EPA’s Department of Toxic Substance Control (DTSC) to request information from any nanotechnology manufacturer in the state and companies importing nanotechnology into California. AB 289’s broad nature allowed DTSC to request manufacturer information about fate, transport, disposal, and detection methods of its chemicals. In January 2008, DTSC requested CNTs out of all possible nanomaterials for its first nano-specific data call to members of industry and academia.

Why did California choose CNTs for its first data call-in?
Novelty of Carbon Nanotubes
Carbon Nanotubes, newly discovered forms of carbon, only exist on the nanoscale. In 1991, Richard Smalley and colleagues discovered Buckminsterfullerenes or "bucky balls," a hexagonal form of carbon shaped into a sphere, similar to a soccer ball. This discovery led to Sumio Iijima discovering carbon nanotubes (CNTs) in 1991, a similar hexagonal structure of carbon shaped like a tube.

Toxicity of Carbon Nanotubes
The DTSC highlighted two studies from 2007 and 2008, one describing how carbon nanotubes (CNT’s) could enter drinking water and another stating that by products of the manufacturing process could be detrimental to workers health and safety.

While these studies note valid concerns, the bulk of toxicological studies between 2001 to 2010 have shown CNTs to be asbestos. The DTSC ignored this relationship in its request for nanotechnology.

Asbestos and CNTs
CNTs have a similar long and thin structure. Scientific research on CNTs indicate its toxicity is similar to asbestos. CNTs have induced mesothelioma in mice. Toxicology reports also showed inflammation from in vivo exposure of CNTs to human cells. However, many factors need consideration before CNTs could be deemed as dangerous as asbestos.

DTSC’s avoidance of this relationship spurs further questions.

Public Perception
Historical Example: The NewLeaf potato, a genetically modified organism by Monsanto, produced bacteria that killed potato beetles but not humans. The FDA approved this technology but public backlash and protests forced McDonald’s and other corporations to stop selling it, leading to millions in losses for Monsanto.

The perception that nanotechnology will cause environmental devastation or human disease could itself taint the dream of a trillion-dollar industry into a nightmare of public backlash. – Dr. Vicki Colvin, Nano Scientist, testifying before the U.S. House of Representatives’ Committee on Science (April 2003)

May 21st 2008 “Cancer risk seen in nanotek. Tiny rods turned up in some products act like asbestos, a study finds.”

Why did California avoid citing connections between asbestos and CNTs?

Conclusion
California Assembly Bill 289 allowed the DTSC to request information from any chemical manufacturer. Many factors influence the government agency’s decision to choose carbon nanotubes, including their novel aspects and potential toxicity. The DTSC is addressing key issues while making sure California’s nascent nanotechnology industry is not inhibited by unnecessary regulation or negative public perception.

I argue that concerns about public backlash explain the DTSC’s choice to avoid highlighting similarities between Carbon Nanotubes and asbestos.

Future Work
- How did California use the information collected?
- What steps will California’s agencies take to regulate nanotechnology?
- Observe the influence of non-governmental organizations on California’s information request
- Comparison of California state actions with other state, federal, and government initiatives around the world
- In the future, observe if California influences other governments to take steps to regulate nanotechnology

Literature Cited


Wang, J. “Chief Scientist, California DTSC,” August 9, Phone Interview

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