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

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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 recent scientific studies, 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 information call-in. One study described how the byproducts 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 emphasize its strong affinities to asbestos, which CalEPA avoided citing. Because public perceptions could drastically derail future research and economic development of nanotechnology in California, I argue that fears of potential public backlash likely led CalEPA to ignore CNT's relationship to asbestos. Currently, no nation or state has regulatory systems in place to properly handle the unique properties of nanotechnology.

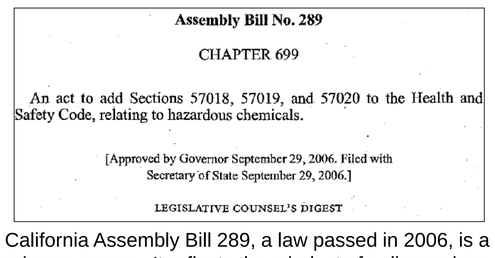
http://www.123rf.com/photo_7698100_3d-made--flag-map-og-california.html

Historical Research Methods

History is a science in a broad, qualified sense, though not an exact science. Its empirical method makes history a social science, and its critical narrative aligns history with the humanities.

Historians use and analyze both primary and secondary sources to tell a story about events in the past, and they give meaning to those events.

A primary source is evidence created during the time being examined. Primary sources include but are not limited to newspaper articles, legislation, scientific studies, and any form of original documentation.


Assembly Bill No. 289

CHAPTER 699

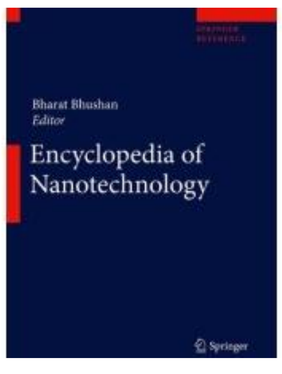
An act to add Sections 57018, 57019, and 57020 to the Health and Safety Code, relating to hazardous chemicals.

[Approved by Governor September 29, 2006. Filed with Secretary of State September 29, 2006.]

LEGISLATIVE COUNSEL'S DIGEST

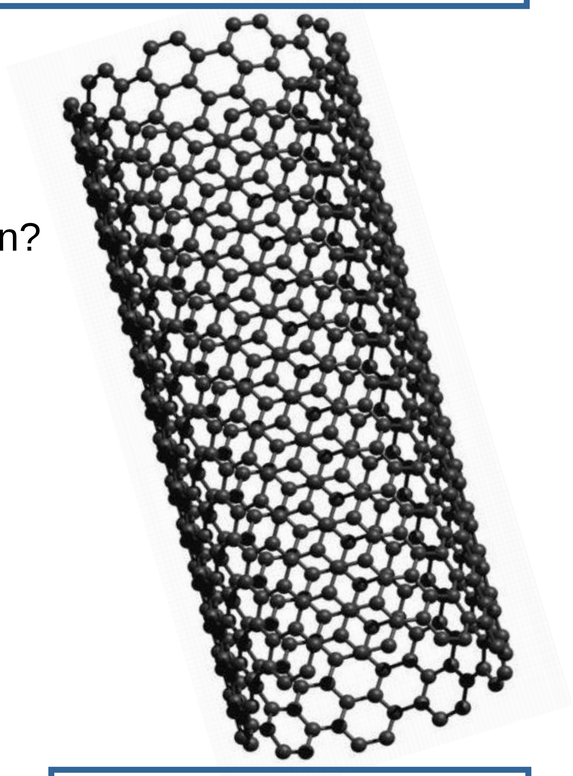
California Assembly Bill 289, a law passed in 2006, is a primary source. It reflects the mindset of policy makers in 2006, and is now embedded in Chapter 699 of California's Health and Safety Code.

A secondary source is evidence created after the time being examined. Secondary sources provide the opinions and analysis of scholars who base their views on primary source documentation. Secondary sources include but are not limited to encyclopedias, textbooks, social science and historical journal publications.



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?



California's Concerns and Carbon Nanotubes (CNTs)

Why did California take steps to regulate nanotechnology?

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. The health and safety impacts of nanotechnology are virtually unknown. Because nanotechnology has already been introduced to consumer products, California wanted to ensure protection of its workers, consumers, and its environment. California took the proactive stance of gathering information to fill knowledge gaps about nanotechnology in hope of regulating it in the future.

Economic Incentives: California's 2005 Blue Ribbon Task Force of academics, 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 a one 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 chemical manufacturers in the state and companies importing chemicals 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 2009, the DTSC selected CNTs out of all possible nanomaterials for its first nano-specific data call-in to members of industry and academia.

"We want to collect as much information as we can … and place that information back into the marketplace so those who are using those materials to make products, or those who are using those products, can make informed choices about the use of that material in making a product, or the use of that product in their daily lives."
-- Dr. Jeffery Wong, Chief Scientist of California's DTSC (Aug. 2011)

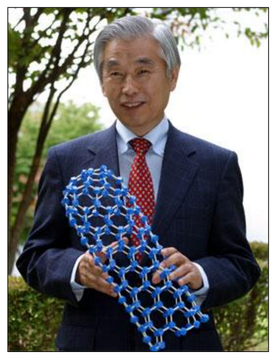
Why did California choose CNTs for its first data call-in?

Novelty of Carbon Nanotubes


Richard Smalley holding a macro size replication of a "Bucky Ball"
www.chemheritage.org

Carbon Nanotubes, newly discovered forms of carbon, only exist on the nanoscale. In 1985, 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.

Other nano-scale chemicals, like titanium dioxide and zinc oxide, have macro scale equivalents with extensive research about toxicological effects. CNTs have only been known for 20 years, so our knowledge about their properties and toxicity is limited.

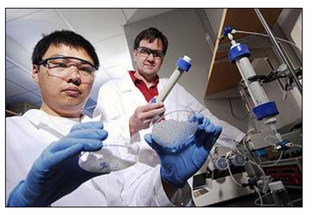

Sumio Iijima holding a macro size replication of a carbon nanotube
www.nec.co.jp

Toxicity of Carbon Nanotubes

""We needed to get more information about these materials before they started to enter the waste-stream or inadvertently enter the environment as manufacturing by-products."
-- Dr. Jeffery Wong, Chief Scientist of California's DTSC (Aug. 2011)

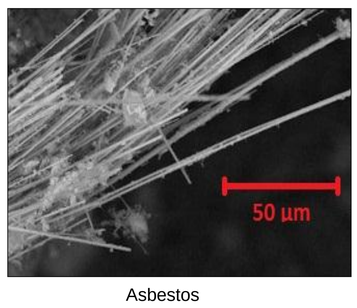
The DTSC highlighted two studies from 2007 and 2008, one describing how carbon nanotubes (CNT's) could enter drinking water and another stating that by products of the manufacturing process could be detrimental to workers health and safety.

While those studies note valid concerns, the bulk of toxicological studies between 2001 to today compare CNTs to asbestos. The DTSC ignored this relationship to asbestos.


Younggang Wang and Kurt Pennel researching the transport and retention of nano-carbon in water.
http://gtresearchnews.gatech.edu

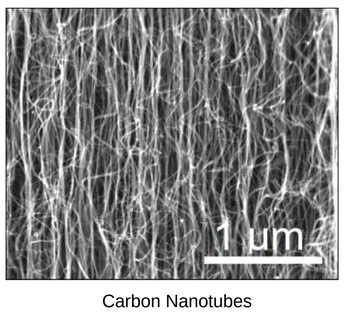
Asbestos and CNTs

Asbestos is a fibrous, microscopic substance that is toxic when inhaled by humans and animals. Chemical composition is not the source of its toxicity. Rather, asbestos fibers' long and thin structure punctures lung cells, leading to inflammation, fibrosis (lung scarring), granulomas (small nodules), and cancerous tumors leading to mesothelioma.



Asbestos

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 vitro* exposure of CNTs to human cells. However, many factors need consideration before CNTs could be deemed as dangerous as asbestos.



Carbon Nanotubes

DTSC's avoidance of this relationship spurs further questions.

Why did California avoid citing connections between asbestos and CNTs?

Public Perception

Historical Example: The NewLeaf potato, a genetically modified organism created 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 NewLeaf Potato

"The perception that nanotechnology will cause environmental devastation or human disease could itself turn 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 Representative's Committee on Science (April 2003)**

Los Angeles Times

May 21st 2008 "Cancer risk seen in nanotechnology; Tiny cylinders used in some products act like asbestos, a study finds."

Conclusions

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 perceptions.

I argue that concerns about public backlash explains 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 initiations around the world
- In the future, observe if California influences other governments to take steps to regulate nanotechnology

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Acknowledgements

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