



Planning and Development Department
Toxics Management Division

ACTION CALENDAR
December 6, 2005

To: Honorable Mayor and
Members of the City Council

From: Community Environmental Advisory Commission

Submitted by: Michael Toffel, Chair of Community Environmental Advisory Commission

Subject: Nanotechnology Safety Procedures at Lawrence Berkeley Lab

RECOMMENDATION

That City Council direct the City Manager to request that the Lawrence Berkeley National Laboratory (LBNL) provide updated information to the community regarding future nanotechnology activities that will take place at LBNL's Molecular Foundry on the following questions:

- What are the potential impacts to the environment and community health associated with the LBNL's nanotechnology activities?
- Which credentialed independent sources (individuals or organizations unaffiliated with Department of Energy [DOE] or LBNL objectives) have endorsed this list of potential impacts to the environment and community health as being comprehensive?
- For each of the items on this list, how strong is the evidence of potential impacts to the environment and community health?
- What steps is LBNL taking to identify and manage each of these potential impacts to the environment and community health?
- Since the science is just emerging on many of the potential health and environmental impacts associated with nanomaterials, how often will the LBNL revisit its nanotechnology environmental, health, and safety policies?
- How will the LBNL publicize changes to these policies to the City and the community?

FISCAL IMPACTS OF RECOMMENDATION

None.

CURRENT SITUATION AND ITS EFFECTS

There are no standards or local, state, federal or international regulations that govern the safe handling of nanoparticles.

Nanoparticles do not act as macro-particles of the same chemistry. Instead, nanoparticles behave in a much more energetic manner and the particles themselves can move through living tissue with more

freedom than macro-particles. According to a recent joint research solicitation from the US Environmental Protection Agency (EPA), National Science Foundation (NSF), and the National Institute for Occupational Safety & Health (NIOSH), “Little is known about the fate, transport, and transformation of nanosized materials after they enter the environment.” (Additional quotes are included in Attachment A.)

Staff and community comments for the Tiered Initial Study and Final Mitigated Negative Declaration of April 2003 for LBNL’s Molecular Foundry included inquiries about what health and safety policies and procedures the Lab would establish for this new technology. LBNL felt that they had adequately responded to health and safety questions and concerns of the Berkeley community and staff in the Negative Declaration. LBNL will open its new Molecular Foundry by the spring of 2006 according to the Negative Declaration.

The DOE Policy for nanotechnology states that the “DOE will adopt and implement, as appropriate, both existing and future environment, safety and health best practices, ‘National Consensus Standards,’ and guidance relating to nanotechnology developed by recognized standard-setting organizations” (see Attachment B). Essentially, this Policy proposes that a safety policy will be adopted in the future.

No policy has been adopted on our last query with LBNL. Given the Molecular Foundry will open within a few months, it is a real possibility that it may open without any health and safety policy in place – and extremely likely that any eventual health and safety policy will not be shared with the public.

Opening the facility without rigorous policies and procedures to protect Berkeley’s environment and community health poses unnecessary risks. While CEAC recognizes there are potential benefits of nanotechnology research, CEAC recommends the City Council insist that LBNL take more seriously its obligation to have policies and procedures in place to protect Berkeley’s environment and community health before the LBNL opens its nanotechnology research facility – and that the Lab be significantly more transparent regarding these policies and procedures.

CEAC has formulated a series of basic questions that the City Council could direct the City Manager to ask of LBNL. These questions essentially call on LBNL to do the following: (a) publicly articulate the risks to the environment and community health posed by its new nanotechnology activities, (b) bolster the credibility of their list by noting which independent scientists or organizations agree their list is comprehensive, (c) describe the policies and procedures that LBNL is implementing to address these risks, and (d) state the steps LBNL will take to ensure these policies and procedures are continuously updated to represent cutting-edge knowledge about community health and environmental protection for this new scientific area. It is hoped that LBNL shares its knowledge and deliberations with the public so that we can all benefit from an open process.

CEAC believes these questions are reasonable and appropriate. They are aligned with a typical approach to industrial environmental management, as embodied in the ISO 14001 Environmental Management System Standard, which has been adopted by over 50,000 organizations around the world.

BACKGROUND

Knowledge of nanoparticle toxicity is at an infancy stage. We do know that the very high surface area-to-mass ratio of nanoparticles has bequeathed a very reactive character to the materials. Free radicals are generated by the interaction of such particles with living organisms. These free radicals play an important role in nanoparticle toxicity. Experimental evidence has led some to believe that all nanoparticles are toxic. Clearly, additional studies are needed to understand nanoparticle behavior, and this will take time and money. Unfortunately, governments and private institutions have not yet begun funding health and safety studies in nanotechnology at substantial levels.

The Royal Society and Royal Academy of Engineering in Britain provided clear set of recommendations that nanomaterials should undergo full safety assessments before they are allowed in products and that manufacturers should publish details of the methodologies they have used in assessing the safety of their products containing nanoparticles (see <http://www.royalsoc.ac.uk/landing.asp?id=1210>). The British Government failed to adopt their recommendations. The European Union has also advised a precautionary approach to nanoscience. Unfortunately, most producers and researchers have ignored the findings of these institutions.

The CEAC and TMD staffs have commented on nanoparticle health and safety issues since LBNL provided information on building a foundry for research in this field. The TMD staff contacted California Department of Health Services, California Department of Occupational Safety and Health, Office of Health Hazard Assessment and National Institute for Occupational Safety and Health for safety input. None had any policies or rules on nanoparticles handling. A review of European Community and individual European nations safety publications found a similar lack of policies or lack of regulations. During the last year, the CEAC Chair made several requests for information from LBNL and the focus was turned towards the Lab for input on health and safety guidance. LBNL has since hired professionals in this field and are in a better position to respond to City concerns.

On October 6, 2005, the CEAC considered the motion from the Chair to ask LBNL to research and make public questions of safe handling of nanoparticles, hopefully prior to the opening of the Molecular Foundry in the spring of 2006. This action was supported by Toffel, Hale, Wood, Moret, Harris. MacKusick and Issel were absent. Clear voted against the motion. Clear noted that LBNL claims that they will only be experimenting on nanoparticles that are either bound, in solution, or in a closed system so that there will be no release and no hazard, therefore LBNL's responses are likely to provide no additional useful information. However, he further noted that LBNL has not provided any information on nanoparticle waste disposal. It would be of benefit to pose the following questions:

- 1) What procedures are in place to insure that liquid suspensions or substrates carrying nanoparticles are not disposed of in a manner that allows them to escape to the environment after synthesis and experimentation is complete?
- 2) If there is disposal of experimental materials, what assurances are there that the bound or suspended nanoparticles are destroyed first, or are otherwise incapable of entering the environment?
- 3) If synthesis is in a closed system, what procedures are there to insure that the system remains closed, or that the particles are destroyed before the system is opened?

Dr. Clear discloses that he conducts part-time research on windows and lighting at LBNL.

RATIONALE FOR RECOMMENDATION

CEAC is applying the City's precautionary principle toward a novel activity whose impacts on the natural environment and community health are largely unknown. It seems unacceptable for the Berkeley City Council and for Berkeley residents to have virtually no information about the environmental and community health risks associated with the new nanotechnology activities that will soon be conducted in our midst, or about the measures LBNL will implement to control these risks.

ALTERNATIVE ACTIONS CONSIDERED

A failure to obtain this information will put the Berkeley City Council and Berkeley residents in the uncomfortable position of merely having to "trust" that the LBNL will implement all necessary measures to protect our natural environment and community health. Unfortunately, the LBNL's failure over the past several months to provide substantive replies to CEAC regarding these basic questions could be interpreted as an indication that either no protective measures are being planned, or that the measures being planned might be deemed inadequate if they were publicly disclosed. Thus, it is in the mutual interest of the City and LBNL to increase transparency about this issue.

CITY MANAGER

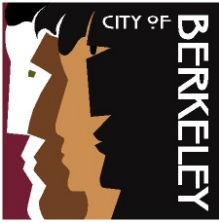
The City Manager takes no position on the content and recommendations of the Commission's Report.

CONTACT PERSON

Michael Toffel, Commission Chair, CEAC 510 642 9949

Attachments:

1. CM letter to Steve Chu, Director of LBNL
2. Quotes excerpted from Nanotechnology Research Grants
3. Department of Energy Nanotechnology Safety Policy



Office of the City Manager

Attachment 1

December 7, 2005

Steve Chu, Director
Lawrence Berkeley National Laboratory
1, Cyclotron Road
Berkeley, CA 94720

Dear Mr. Chu:

On December 6, 2005, the Berkeley City Council approved a recommendation from the Community Environmental Advisory Commission that requests LBNL health and safety personnel to make public any policies adopted at the Molecular Foundry for safe handling of new materials, known as nanoparticles. Specifically, the request is for the following items:

- What are the potential impacts to the environment and community health associated with the LBNL's nanotechnology activities?
- Which credentialed independent sources (individuals or organizations unaffiliated with Department of Energy [DOE] or LBNL objectives) have endorsed this list of potential impacts to the environment and community health as being comprehensive?
- For each of the items on this list, how strong is the evidence of potential impacts to the environment and community health?
- State the steps LBNL is taking to identify and manage each of these potential impacts to the environment and community health.
- Since the science is just emerging on many of the potential health and environmental impacts associated with nanomaterials, how often will the LBNL revisit its nanotechnology environmental, health, and safety policies?
- How will the LBNL publicize changes to these policies to the City and the community?

You will also find attached the full text of the CEAC proposal. Please direct any questions or responses to Nabil Al-Hadithy, Toxics Management Division.

Sincerely,

Phil Kamlarz
City Manager

cc: Nabil Al-Hadithy, Secretary CEAC
Sara Cox, City Clerk
Dan Marks, Director of Planning and Development
Terri Powell, Public Relations, LBNL
Michael Toffel, Chair, CEAC

Attachment 2

The following are quotes excerpted from "Nanotechnology Research Grants Investigating Environmental and Human Health Effects of Manufactured Nanomaterials: A Joint Research Solicitation - EPA, NSF, NIOSH http://es.epa.gov/ncer/rfa/2004/2004_manufactured_nano.html

- "There is a serious lack of information about the human health and environmental implications of manufactured nanomaterials, e.g., nanoparticles, nanotubes, nanowires, fullerene derivatives, and other nanoscale materials."
- "Potentially harmful effects of nanotechnology might arise as a result of the nature of the nanoparticles themselves, the characteristics of the products made from them or aspects of the manufacturing process involved. The large surface area, crystalline structure, and reactivity of some nanoparticles may facilitate transport in the environment or lead to harm because of their interactions with cellular material. In the case of nanomaterials, size matters and could facilitate and exacerbate any harmful effects caused by the composition of the material."
- "Some research has been done on inhalation and dermal exposure to nanoparticles. However, the current research on ultrafine particles may not be applicable to manufactured nanoparticles because the ultrafine materials studied are neither a consistent size nor pure in chemical or structural composition. Exposure may occur via the dermal and ingestion, as well as inhalation routes."
- "It is unknown whether nanomaterials bioaccumulate and, thereby, pose human health and environmental risks because of this potential property."
- "Little is known about the fate, transport, and transformation of nanosized materials after they enter the environment. As the production of manufactured nanomaterials increases and as products containing manufactured nanomaterials are disposed of, these materials could have harmful effects as they move through the environment."

Attachment 3

Department of Energy Nanotechnology Safety Policy

September 15, 2005

The Department of Energy (DOE) requires that all work with nanomaterials be conducted in a safe and responsible manner that protects workers, the public, and the environment. Thus, the Department must be prudent and follow a cautious approach in the production, use, and disposition of nanomaterials.

It is imperative that the Department's work with nanomaterials be conducted in a manner that encompasses the following attributes:

- DOE will adopt and implement, as appropriate, both existing and future environment, safety and health best practices, "National Consensus Standards," and guidance relating to nanotechnology developed by recognized standard-setting organizations. Further, any existing DOE Directives and Standards which contain provisions that are relevant to nanotechnology work must be appropriately applied.
- DOE and its contractors will identify and manage potential health and safety hazards and potential environmental impacts at sites through the use of existing Integrated Safety Management Systems, including Environmental Management Systems.
- DOE organizations working with nanomaterials will stay abreast of current research and guidance relating to the potential hazards and impacts of nanomaterials, and will ensure that this best current knowledge is reflected in the identification and control of these potential hazards and impacts at their facilities.
- DOE will continue to both support research on the environmental and safety and health impacts of nanomaterials, and participate in government-wide activities aimed at identifying and resolving potential environmental, safety, and health issues.

SAMUEL W. BODMAN
Secretary of Energy