

**U.S. HOUSE OF REPRESENTATIVES  
COMMITTEE ON SCIENCE AND TECHNOLOGY**

**HEARING CHARTER**

*The National Nanotechnology Initiative Amendments Act of 2008*

**Wednesday, April 16, 2008  
10:00 a.m. – 12:00 p.m.  
2318 Rayburn House Office Building**

**1. Purpose**

On Wednesday, April 16, 2008, the Committee on Science and Technology will hold a hearing to review legislation that proposes changes to various aspects of the planning and implementation mechanisms for and to the content of the National Nanotechnology Initiative (NNI). The legislation includes changes to strengthen the planning and implementation of the environment, health, & safety (EHS) component of NNI; to increase emphasis on nanomanufacturing research, technology transfer, and commercialization of research results flowing from the program; to create a new NNI component of focused, large-scale research and development projects in areas of national importance; and to enhance support for K-16 nanotechnology-related education programs.

The legislation is based on findings and recommendations from formal reviews in 2002 and 2006 of the NNI by the National Academy of Sciences and in 2005 by the President's Council of Advisors for Science and Technology, which currently serves as the advisory committee for the NNI; witness testimony from NNI hearings from this and the past Congress; and recommendations resulting from staff discussions with various stakeholder groups.

A section-by-section summary of the bill is attached as an appendix to this memo.

**2. Witnesses**

**Mr. Floyd E. Kvamme**, Co-Chair, President's Council of Advisors on Science and Technology

**Mr. Sean Murdock**, Executive Director, NanoBusiness Alliance

**Dr. Joseph Krajcik**, Associate Dean for Research and Professor of Education, University of Michigan

**Dr. Andrew Maynard**, Chief Science Advisor, Project on Emerging Nanotechnologies, Woodrow Wilson Center

**Dr. Raymond David**, Manager of Toxicology, BASF Corporation on behalf of the American Chemistry Council

**Dr. Robert R. Doering**, Senior Fellow and Research Strategy Manager, Texas Instruments and on behalf of the Semiconductor Industry Association.

### 3. Overarching Questions

- Does the legislation address key issues for improving the way the NNI is planned and implemented and for ensuring that the program is positioned to help maintain U.S. leadership in nanotechnology?
- Are the changes proposed in the legislation to strengthen the planning, coordination, and prioritization process for research to address concerns about environmental and safety ramifications of nanotechnology likely to be effective? Is the requirement for a minimum funding level for this aspect of the program reasonable and necessary?
- Will the bill assist in overcoming the barriers to commercialization of nanotechnologies, help enhance NNI support for research in areas relevant to the needs of industry, and make user facilities supported under the NNI more welcoming to industrial users, thereby assisting with the transfer of research results to usable products that benefit the public?
- Is there a need for resources under the NNI to be readjusted to include a component for support of large-scale research and development projects focused on specific problems of national importance?
- Does the proposed legislation adequately address support for nanotechnology education under the NNI?

### 4. Background

#### Summary of Past NNI Hearings

During the 110<sup>th</sup> Congress, the Committee has held three NNI related hearings. The first, *Nanotechnology Education* [Serial No. 110-\*\*], was held October 2nd, 2007 by the Subcommittee on Research and Science Education. The witnesses, who represented the federal government, industry, and educational institutions and science educators at all levels, agreed that nanotechnology education is an important component of a strategy to capitalize on the promise of this advancing field. Several witnesses discussed the importance of early nanotechnology education, including informal education, for generating awareness, information and excitement about nanotechnology among young students and the general public. Witnesses were unanimous in expressing support for increasing formal education in nanotechnology beginning at the undergraduate level, including at 2-year colleges because of their important role in supplying much of the 21<sup>st</sup> Century skilled workforce. A representative from the National Science Foundation provided an overview of the many activities in formal and informal nanotechnology education at all levels already supported by the federal government.

A second hearing, *Research on Environmental and Safety Impacts of Nanotechnology: Current Status of Planning and Implementation under the National Nanotechnology Initiative* [Serial No. 110-69], was held on October 31, 2007. This hearing addressed the need and motivation for

research on the environmental, health and safety (EHS) aspects of nanotechnology. In addition, the hearing sought to determine the current state of planning and implementation of EHS research under the National Nanotechnology Initiative (NNI), and explore whether changes are needed to the current mechanisms for planning and implementing EHS research. Witnesses included the representatives from the organizations charged with the development of the EHS plan as well as non-governmental organizations focused on the societal implications of nanotechnology. The hearing highlighted the unanimous position by all witnesses regarding the importance of EHS research for the development of nanotechnology and the necessity of a well designed and adequately funded EHS research component of the NNI. However, there was concern that the interagency planning for and implementation of the EHS research component of NNI was not moving with the urgency it deserved. While the organizations responsible for plan development and implementation claimed that the current process is effective and that the participating agencies believe the process is working well, the non-governmental organizations were unanimous in their recommendations for changes in the planning process as well as increases in the priority of EHS in the overall NNI basic research funding.

A third hearing, *The Transfer of National Nanotechnology Initiative Research Outcomes for Commercial and Public Benefit* [Serial No. 110-\*\*] was held on March 11, 2008 by the Subcommittee on Research and Science Education. Witnesses included representatives of state and federally funded nanotechnology research and user facilities, industry, and a state-based technology transfer and funding organization. The witnesses stressed the importance of basic research in nanomanufacturing and adequate funding of geographically diverse user facilities. The witnesses were clear that basic research funding should be broad to allow for new discoveries and pioneering research; however, they indicated that it would be wise to focus some funding and planning toward commercialization. They suggested that this might be accomplished through demonstration projects or by defining areas of global competitiveness. Many of the witnesses testified that the SBIR and ATP/TIP programs are very important for the development of innovative technologies and felt that the program should emphasize the funding of nanotechnology projects.

## **NNI Organization and Funding**

The National Nanotechnology Initiative was authorized by the 21<sup>st</sup> Century Nanotechnology Research and Development Act of 2003 (P.L. 108-153). In accordance with the Act, the National Science and Technology Council (NSTC) through the Nanoscale Science, Engineering, and Technology (NSET) Subcommittee plans and coordinates the NNI. The Act authorized the National Nanotechnology Coordination Office (NNCO) to provide technical and administrative support to the NSET for this coordination. There are currently twenty-six Federal agencies that participate in the National Nanotechnology Initiative, with 13 of those agencies reporting a research and development budget. Research related to the NNI is organized into eight program component areas including: Fundamental Nanoscale Phenomena and Processes; Nanomaterials; Nanoscale Devices and Systems; Instrumentation Research, Metrology, and Standards; Nanomanufacturing; Major Research Facilities and Instrument Acquisition; Environment, Health, and Safety; and Education and Societal Dimensions. More information on the organization and structure of the NNI can be found in the Congressional Research Service Report, *The National Nanotechnology Initiative: Overview, Reauthorization, and Appropriations Issues* at <http://www.congress.gov/erp/rl/pdf/RL34401.pdf> .

The total estimated NNI budget for FY2008 was \$1.49 billion. Total planned funding for the NNI in FY2009 is \$1.53 billion. More information on the NNI program content and budget can be found at [http://www.nano.gov/NNI\\_FY09\\_budget\\_summary.pdf](http://www.nano.gov/NNI_FY09_budget_summary.pdf) and [http://www.nano.gov/NNI\\_08Budget.pdf](http://www.nano.gov/NNI_08Budget.pdf).

Planned 2009 Agency Investment by Program Component Area <sup>1</sup>									
Dollars in millions (% change from 2008 Estimates, if any)									
	Fundamental Phenomena & Processes	Nanomaterials	Nanoscale Devices & Systems	Instrument Research, Metrology & Standards	Nano-manufacturing	Major Research Facilities & Instr. Acquisition	Environment, Health, & Safety	Education & Societal Dimensions	NNI Total
DOD	227.8 (-12%)	55.2 (-20%)	107.7 (-10%)	3.6 (-55%)	12.8 (137%)	22.1 (-10%)	1.8 (-10%)		<b>431.0</b>
NSF	141.7 (2 %)	62.5 (0.6%)	51.6 (3%)	16.0	26.9	32.1 (2%)	30.6 (5%)	35.5 (5%)	<b>396.9</b>
DOE	96.9 (89%)	63.5 (-18%)	8.1 (-38%)	32.0 (167%)	6.0 (200%)	101.2 (10%)	3.0	0.5	<b>311.2</b>
DHHS (NIH)	55.5 (-0.2%)	25.4	125.8	5.9	0.8		7.7	4.6	<b>225.7</b>
DOC (NIST)	24.5 (9%)	8.5 (15%)	22.7 (5%)	20.9 (30%)	15.3 (6%)	5.7 (-2%)	12.8 (1500%)		<b>110.4</b>
NASA	1.2 (-20%)	9.8 (1%)	7.7 (24%)			0.2 (-50%)	0.1 (-50%)		<b>19.0</b>
EPA	0.2	0.2	0.2				14.3 (49%)		<b>14.9</b>
DHHS (NIOSH)							6.0		<b>6.0</b>
USDA (FS)	1.7 (31%)	1.3 (-32%)	0.7 (-42%)	1.1 (175%)	0.2				<b>5.0</b>
USDA (CREES)	0.4 (-43%)	0.8 (-50%)	1.5 (-52%)		0.1 (-80%)		0.1	0.1	<b>3.0</b>
DOJ				2.0					<b>2.0</b>
DHS			1.0						<b>1.0</b>
DOT (FHWA)	0.9								<b>0.9</b>
<b>TOTAL</b>	<b>550.8 (4%)</b>	<b>227.2 (-11%)</b>	<b>327.0 (-5%)</b>	<b>81.5 (35%)</b>	<b>62.1 (24%)</b>	<b>161.3 (5%)</b>	<b>76.4 (30%)</b>	<b>40.7 (4%)</b>	<b>1527.0 (2%)</b>

<sup>1</sup> Adapted from the *Summary of the FY2009 National Nanotechnology Initiative Budget*, February 2008. Available at <http://www.nano.gov/>.

## **Spending on EHS, Nanomanufacturing, and Education**

EHS: The President's FY2009 budget requests \$1.5 billion for the NNI. Of this amount, the budget proposes \$76.4 million (5 percent of the overall program) for research on EHS research. This is a 30% increase over the FY08 funding level. More than 40 percent of this funding would go to NSF.

Nanomanufacturing and Commercialization: The FY2008 estimated budget for nanomanufacturing research (a component that is closely tied to bridging the gap between basic research and the development of commercial products) was \$50.2 million dollars which is 3.3% of the total budget. The NNI planned investment in nanomanufacturing research for FY2009 is \$62.1 million, a 24% increase. This amount is 4% of the total FY2009 proposed budget. In addition, \$161.3 million is planned for major facilities and instrument acquisition, which can be utilized towards production of prototypes leading to commercialization.

Education: As part of its contribution to the NNI, NSF supports a number of educational activities designed to teach K-16 students, science teachers, faculty members, and the general public about nanotechnology. Major education programs include the National Center for Learning and Teaching (NCLT) in Nanoscale Science and Engineering and the Nanoscale Informal Science Education (NISE) Network. NCLT is a consortium of five universities with a mission to foster the Nation's talent in nanoscale science and engineering (NSSE) by developing methods for learning and teaching through inquiry and design of nanoscale materials and applications. They perform research and serve as a clearinghouse for information regarding NSSE curriculum, teaching methodologies, and professional development for the undergraduate and K-12 levels. NCLT is operating in the last year of a five year \$15,000,000 million grant. The NISE network received a \$12.4 million dollar grant from NSF in 2005 to develop methods of introducing the nanotechnology to the public and to draw students to careers in NSSE.

NSF also has a Nanotechnology Undergraduate Education Program funded at \$42.7 million since 2003. The grants in this program have gone to develop curriculum and purchase equipment for undergraduate students in different science and engineering disciplines. As part of the Advanced Technology Education Centers program, NSF has provided \$2.68 million since 2004 to develop nanotechnology related technician education programs at community colleges.

## **Environment, Health, & Safety Planning**

In October 2003, the NSET organized an interagency Nanotechnology Environmental and Health Implications (NEHI) Working Group to coordinate environmental and safety research carried out under the NNI. One of the NEHI Working Group's initial tasks was developing a prioritized plan for EHS research. In March 2006, the Administration informed the Science Committee that this report would be completed that spring, but the document that was finally released in September 2006 was a non-prioritized list of EHS research areas. A further iteration of the EHS research plan, which was released for public comment in August 2007, presented a rationale for the process of defining EHS research priorities and provided a reduced set of priorities based on the previous report. Finally, in February 2008, the *Strategy for Nanotechnology-Related*

*Environmental, Health, and Safety Research*<sup>2</sup> document was released. This document provided a more in depth assessment of current research needs and priorities; however, it failed to provide a schedule and timelines for meeting objectives and the proposed funding levels by topic and by agency.

## **Commercialization and Technology Transfer of Nanotechnology**

### User Facilities

The NNI funding agencies support nanotechnology user facilities to assist researchers (academic, government, and industry) in fabricating and studying nanoscale materials and devices. The facilities may also be used by companies for developing ideas into prototypes and investigating proof of concept. The National Science Foundation supports 17 facilities under its National Nanotechnology Infrastructure Network (NNIN), four of which are focused on nanomanufacturing. The Department of Energy maintains five Nanoscale Science Research Centers, each focused on and specific to a different area of nanoscale research. The National Institutes of Health has a Nanotechnology Characterization Laboratory in Frederick, MD and the National Institute of Standards and Technology maintains a user facility in Gaithersburg, MD. The application processes for each facility varies; however, all are open to academic, government, or industry users. In addition to the user facilities, the NNI is carried out in over 70 centers and institutes<sup>3</sup> throughout the country mostly on university campuses, many of which have user facilities that are open to all applicants.

### SBIR/STTR Programs

P.L. 108-153 encourages support for nanotechnology related projects through the Small Business Innovation Research (SBIR) and Small Business Technology Transfer Research (STTR) programs by requiring the National Science and Technology Council to “develop a plan to utilize Federal programs, such as the Small Business Innovation Research Program and the Small Business Technology Transfer Research Program, in support of the [NNI activities]...”. Despite the lack of a formal plan, the SBIR and STTR programs have been used as a vehicle to bring nanotechnology research developed by small business concerns closer to commercialization. The total SBIR and STTR program spending in all technology areas in FY2006 was nearly \$2.2 billion, of that budget \$79.7 million was identified as nanotechnology related research<sup>4</sup>. This was 3.7% of the total SBIR/STTR spending in FY2006 and included nine federal agencies. SBIR/STTR funding is allowable for development of technologies from concept to prototype; however, funding of scale-up to manufacturing does not fall within the SBIR/STTR scope of funding.

## **5. Witness Questions**

All witnesses were asked to give their views on the provisions of the bill, including any recommendations for ways to improve it. The list of overarching questions (item 3 above) was included in the invitation letters.

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<sup>2</sup> Available at [http://www.nano.gov/NNI\\_EHS\\_Research\\_Strategy.pdf](http://www.nano.gov/NNI_EHS_Research_Strategy.pdf)

<sup>3</sup> Information of NNI related user facilities and centers and institutes can be found at [www.nano.gov](http://www.nano.gov).

<sup>4</sup> *The National Nanotechnology Initiative Supplement to the President's FY2008 Budget*. July 2007, p. 24.