Project on Emerging Nanotechnolgies – Risk Research Inventory Update Analysis, April 19, 2008

Since its inception in 2001, the U.S. National Nanotechnology Initiative (NNI) has grown to an annual $1.5 billion federal investment in nanotechnology research. Most of this funding is focused on science and engineering that potentially will lead to incredible advances in fields such as healthcare, electronics, aeronautics and energy. By 2014, noted firm Lux Research projects that $2.6 trillion in manufactured goods will incorporate nanotechnology – about 15 percent of total global output.

If, however, nanotechnology's potential to improve life is to be realized, there needs to be a good understanding of nanotechnology's potential for harm. Comparatively little U.S. government money has been spent on ensuring that scientists know how to control or prevent possible nanotechnology environmental, health, and occupational and general safety (EHS) risks.

In fiscal year 2006 (the latest year for which actual spending figures are available), the U.S. government estimates—while offering few details—that less than 3 percent of the almost $1.4 billion federal nanotechnology budget was spent on EHS research. Analysis—based on information fully presented in this Project on Emerging Nanotechnologies (PEN) database—identifies only $13 million (or less than 1 percent of the 2006 NNI budget) spent on federal research projects primarily focused on nanotechnology risk.

That same year, European countries invested nearly $24 million in similar nanotech risk-focused projects, according to publicly available data.

NNI Reported FY 2006 Nanotechnology Risk Research Budget -- $37.7 million

The NNI supplement to the President's FY 2008 Budget reports that $37.7 million was spent on nanotechnology EHS research in FY2006, spread across eight agencies. This figure purportedly represents research primarily aimed at understanding risks associated with nanomaterials, although it is unclear whether this refers to research projects with this specific aim or research within broader initiatives that address risk.

The NNI risk research strategy released in February 2008 includes a list of 246 EHS research projects for FY 2006 that were purported to either be primarily aimed at understanding nanotechnology risks or supporting five identified strategic EHS research categories. These listed research projects are not classified by relevance, so it is not possible to differentiate which are primarily aimed at understanding risk and which are more general in nature. In addition, no project budgets are provided, preventing the aggregated research figure listed from being verified.

PEN Assessment of NNI-listed Projects Highly Relevant to Understanding Risk -- $13 million

PEN classified research projects listed in the NNI research strategy by their relevance to addressing nanotechnology risk. Four categories were used (and are explained more fully

below): ***highly relevant*** research; ***substantially relevant*** research; research with ***some relevance***; and ***marginally relevant*** research.

In brief, projects that were clearly and primarily aimed at addressing risk (such as toxicology or exposure studies) were classified as being highly relevant. Research that was primarily aimed at extending basic knowledge (or developing applications), but with a clear risk component, was categorized as having substantial relevance. On the other hand, research into areas that could possibly inform an understanding of risk but where risk research was not a main component of the studies was classified as only having some relevance or marginal relevance.

By collecting project budget data from publicly available sources, an estimate of funding levels for 2006 was calculated. The PEN assessment identified 62 projects that were ***highly relevant*** to understanding risk, with an estimated annual budget of $13 million. As many as 163 projects were identified as being either ***highly*** or ***substantially relevant***, with an estimated annual budget of $29 million.

The data used in this PEN assessment is freely available on the Internet, and the analysis presented here may be checked with full transparency.

Bottom Line

Without full transparency and a clear basis for assessing research spending, reported figures for nanotechnology EHS spending are meaningless.

Research primarily aimed at understanding nanotechnology risks is receiving significantly less funding than the NNI indicates—based on an open and transparent assessment of publicly available data.

Without classifying research by its relevance, an assessment of research investment and research directions cannot inform strategic decision-making.

There are indications that research investment reporting from the federal government is aimed at justifying the status quo, rather than enabling informed and strategic decision-making.

Effective risk research that delivers useable results will depend on marrying a robust research strategy with an accurate and verifiable assessment of current research, and sufficient funding to implement the strategy.

Definitions of Research Relevance Used by PEN:

a. ***High:*** Research that is specifically and explicitly focused on the health, environmental and/or safety implications of nanotechnology. Also included in this category are projects and programs where the majority of research undertaken is specifically and explicitly focused on the health, environmental and/or safety implications of nanotechnology. Examples of research in this category would include research to understand the toxicity of specific nanomaterials, research into exposure monitoring and characterization to further understand potential impact,

research into biological interactions and mechanisms that is focused on answering specific questions associated with potential risk. Examples of research that would not be included in this category would include exploratory research into biological mechanisms outside the context of understanding impact, general instrument development, and research into therapeutics applications which also incorporate an element of evaluating impact.

b. ***Substantial:*** Research that is focused towards nanotechnology-based applications or developing fundamental new knowledge of nanoscience, but that has substantial and explicit relevance to EHS implications. Examples of research in this category would include non-targeted research into biological mechanisms which is informative to understanding risk, instrument development for assessing nanomaterials for applications *and* characterizing nanomaterials in hazard evaluations, and major programs with a significant component focused on risk research.

c. ***Some:*** Research that is focused on the application of nanotechnology and developing fundamental new knowledge on nanoscience but that has only some relevance to EHS implications. Examples might include research into therapeutics applications which also lead to the generation of useful data on hazard.

d. ***Marginal:*** Fundamental nanoscience and/or nanotechnology applications-based research, which informs understanding on potential EHS implications in a marginal way. Examples might include the development of new analytical techniques such as analytical electron microscopy, where some attempt is made to apply the techniques to understanding potential risks unique to nanomaterials.