



## PROJECT ON EMERGING NANOTECHNOLOGIES **RESEARCH BRIEF**



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- Focus on the bottom line.
- Become or develop a champion within your firm.
- Incorporate life cycle thinking into operations and product development.
- Seek information and assistance on EHS implementation.
- Follow best practices for worker health and safety precautions.
- Prepare for potential nano-specific regulations.
- Increase educational efforts.
- Seek continued improvement.

### **How to Reduce Your Firm's Risk and Increase Revenues Related to Nanotechnology**

#### **An 8-Step Program for Small Firms**

**Deanna Lekas, ICF International**

*With limited time and resources, how can your firm start to think about or expand on its environmental, health, and safety (EHS) practices related to the use of nanomaterials?*

*This pamphlet presents eight suggestions to assist nano firms in addressing EHS issues associated with the production and use of nanomaterials.*



#### **STEP 1: FOCUS ON THE BOTTOM LINE.**

The first step in dealing with the nano EHS landscape is to recognize that nanomaterial safety is sufficiently important to warrant consideration. Here are a few key reasons why your firm should take action to minimize potential nano EHS risks in order to increase revenue streams and reduce costs.

#### **Why take this step?**

To reduce financial risks: By reducing environmental and human health risks, firms can insulate themselves from future liabilities. It will save time and money in the long run by doing things right the first time—designing risks out of processes and products in the early stages of development instead of paying for remediation or retrofitting later. In addition, insurers and investors want to minimize their own risks.<sup>1</sup> If they see that your firm is being proac-

tive on these issues, investors may be more inclined to help fund your venture and insurers may offer lower premiums.

**To protect human and environmental health:** Studies show that exposure to certain nanomaterials can present toxicity through inhalation or ingestion.<sup>2</sup> At the same time, ecological systems are affected by the release of certain nanomaterial effluents.<sup>3</sup> Given such concerns, many firms have decided to act to protect workers and the environment from harmful exposure potentially reducing healthcare and future liability costs.

**To improve or maintain a positive corporate image:** Addressing EHS issues offer reputation benefits to nano firms. Consumers and other firms prefer to buy a tested and safe product rather than one with unknown risk. This is especially important given increased concerns about potential risks, including calls for a moratorium on nanotechnology coming from some non-governmental organizations (NGOs).<sup>4</sup> Although the public still knows little about nanotechnology,<sup>5</sup> consumers are beginning to voice concerns.<sup>6</sup> Firms have an opportunity to prevent this type of fear from escalating and halting nanotechnology's development and promise. In addition, implementing proactive EHS strategies makes smaller firms more favorable to other companies that are scrutinizing the EHS performance of their suppliers.

**To improve recruitment and retention of employees.** Creating a safe work environment will encourage employee retention and productivity, and help in recruiting highly-qualified employees.

The interconnected nature of these various decision factors is shown in Figure 1.



## STEP 2: BECOME OR DEVELOP A CHAMPION WITHIN YOUR FIRM.

If you do not already have an environmental manager, designate someone as the “environmental champion” that has been defined as an “individual within an organization, who champions environmental progress within that organization”<sup>7</sup>, who focuses—even just one day a week—on nanomaterial EHS issues. Make it a priority, management needs to be seen as setting this as a priority and part of the overall strategic plan of the company. The “champion” needs authority in order to implement appropriate changes and safety measures. A successful EHS champion will integrate the concerns and needs of management and employees into the firm’s EHS strategies.<sup>8</sup> Having at least one person focus on EHS issues as part of their responsibilities is a good step forward. Many of the steps that follow could be led by your firm’s assigned EHS staff person.

### Why take this step?

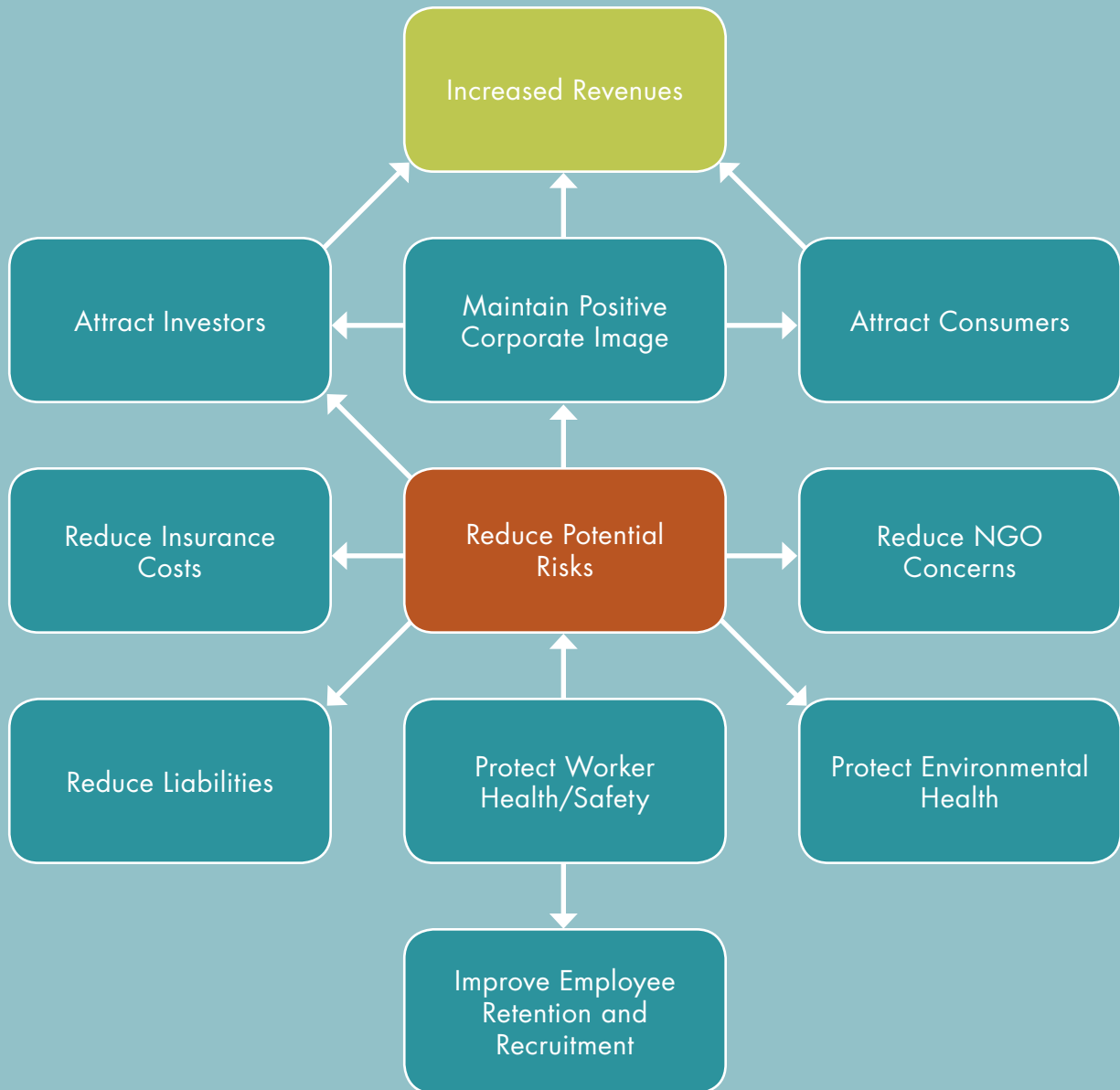
The companies that have been most successful and innovative at reducing their impacts on the environment have had a visible environmental champion within their organizations.<sup>9</sup> Such a person can position your firm on a safer and greener course.



## STEP 3: INCORPORATE LIFE-CYCLE THINKING INTO OPERATIONS AND PRODUCT DEVELOPMENT.

Even if your firm does not conduct a formal life cycle assessment, it should consider the life cycle implications of your nano material or product. To do so, evaluate key points of potential human exposure or release to the environment of the nano material or product handled or produced by your company across that material or product’s life cycle—from extraction of input materials, to production, transport, use, and end-of-life disposal.

**Figure 1.** The Interconnectedness and Benefits of Firm Action on Nano EHS



Then, identify ways to reduce those potential points of exposure. Firms could work with suppliers of equipment and material inputs to find ways to minimize costs to the environment and to prevent worker health risks in handling and transporting materials. During production, efforts could be taken to control emissions and the release of nanoparticles into the air, water, or waste stream. Product testing according to set criteria, such as the European Commission's Good Laboratory Practice (GLP) Directives,<sup>10</sup> could help to identify and prevent health or safety implications for users of your products.

For more specific information on how your firm could evaluate the life cycle impacts of your nano materials or products, refer to the following resources:

- NANO Risk Framework (established through a partnership between Environmental Defense and DuPont), which provides guidance on profiling your nanomaterial's properties, inherent hazards, and exposures across the material's life cycle. Available at: [www.nanoriskframework.com](http://www.nanoriskframework.com).
- Taking Action on Nanotech Environmental, Health, and Safety Risks (developed by Lux Research), which recommends that firms create a risk inventory for nanomaterials. See [www.luxresearchinc.com](http://www.luxresearchinc.com).<sup>11</sup>

### Why take this step?

Considering impacts across the material or product life cycle allows firms to identify points of risk that may not be immediately apparent. Armed with that knowledge, firms then have the opportunity to reduce those impacts, streamline manufacturing and waste streams, lower disposal and clean up costs, lower insurance costs and reduce litigation risks. The investment community also is paying attention to those firms that are considering life cycle implications (e.g., by working with suppliers to minimize risks).<sup>12</sup>

## ✓ STEP 4: SEEK INFORMATION AND ASSISTANCE ON EHS IMPLEMENTATION.

To the extent that your firm is able, try to seek and review risk information that is relevant to your nanomaterials. A few useful resources for the latest research findings on nanomaterial EHS include:

- International Council on Nanotechnology (ICON) EHS Database: [icon.rice.edu/research.cfm](http://icon.rice.edu/research.cfm)
- National Institute for Occupational Safety and Health (NIOSH) Nanoparticle Information Library (NIL): <http://www2a.cdc.gov/niosh-nil/index.asp>
- SAFENANO Database: [www.safenano.org/AdvancedSearch.aspx](http://www.safenano.org/AdvancedSearch.aspx)

If your firm wishes to seek outside assistance, NIOSH also has a field team of nanotechnology researchers that will work with firms “to observe and assess occupational health and safety practices in facilities where nanotechnology processes and applications are used.” More information is available at: [www.cdc.gov/niosh/updates/upd-12-28-05.html](http://www.cdc.gov/niosh/updates/upd-12-28-05.html). Your firm may also wish to get involved in nano-business groups and listservs that provide updated information on research and policy activities.

### Why take this step?

Information in the public domain can assist your firm in efforts to better understand and manage risks while keeping abreast of the current research findings.



## STEP 5: FOLLOW BEST PRACTICES FOR WORKER HEALTH AND SAFETY PRECAUTIONS.

To protect workers from nanomaterial toxicity, handling of these materials requires an extra level of caution. During manufacture of nanoparticles in laboratories and production facilities, it is important to ensure that adequate exhaust ventilation controls are in place. Firms should also equip their researchers and workers with personal protective equipment, including the least permeable masks on the market. This is especially important given that studies show that existing respiratory masks do not adequately protect against nanoparticle exposure.<sup>13</sup> In addition, Material Safety Data Sheets (MSDS) used for larger counterpart materials are not adequate for nanosized materials; MSDSs designed to deal with changed properties at the nanoscale would include lower exposure limits for nanoparticles.

A few key resources providing useful information on worker safety best practices include the following:

- NIOSH, *Approaches to Safe Nanotechnology: An Information Exchange with NIOSH*, Available at: [www.cdc.gov/niosh/topics/nanotech/safenano/](http://www.cdc.gov/niosh/topics/nanotech/safenano/)
- ASTM International, *ASTM E2535-07 Standard Guide for Handling Unbound Engineered Nanoscale Particles in Occupational Settings*, Available for purchase at: [www.astm.org](http://www.astm.org)
- International Standards Organization, *ISO/TR 27628:2007 Workplace atmospheres—Ultrafine, nanoparticle and nano-structured aerosols—Inhalation exposure characterization and assessment*, Available for purchase at: [www.iso.org](http://www.iso.org)

To reinforce best practices, firms should better inform their employees about the potential risks through training. It is unlikely that employees are fully aware of potential hazards in the work environment through nanoparticle exposure. They should be informed about what is known (and not yet known) so that they take proper care of themselves when handling these materials (e.g., wear their mask and protective gear, wash hands thoroughly, etc.). Providing training on proper safety precautions and environmental management practices during employee orientation and/or through periodic training sessions will encourage employees to embrace these practices more quickly. Such trainings can also serve as opportunities to get feedback from staff on how to improve safety and environmental practices. The strength of your environmental manager/champion and the priority set forth by upper management on the importance of environmental health and safety will determine the effectiveness of any educational campaign.

### Why take this step?

It is important for firms to recognize that workplace safety practices for handling nanomaterials should be more rigorous than those for handling conventional

**“Firms should also equip their researchers and workers with personal protective equipment, including the least permeable masks on the market... studies show that existing respiratory masks do not adequately protect against nanoparticle exposure.”**

materials. Although many unknowns on nanomaterial health risks remain, firms should make use of existing resources. Employee EHS training is an opportunity to educate employees on a continual basis about evolving knowledge on nano risks. It serves as a lower cost step with significant potential to maintain and improve EHS performance.

### ✓ **STEP 6: PREPARE FOR POTENTIAL NANO-SPECIFIC REGULATIONS.**

In addition to complying with existing environmental regulations and health and safety regulations, firms should prepare themselves for changes in regulations that address nanomaterials. New laws could place the burden on manufacturers of nano-based products, requiring them to demonstrate that their products meet adequate safety levels.<sup>14</sup> To help prepare for potential nano-specific regulations or the potential of future liabilities, Cientifica poses three questions that businesses using or producing nanomaterials should be able to answer: (1) *“Are there intrinsic risks associated with any of my current or future products and over what timescale?”* (2) *“What regulation is likely, and how will this apply to my products?”* (3) *“How will the above affect my business model?”*<sup>15</sup>

To keep up with the latest policy developments, firms may wish to subscribe to various listservs, including those available through the following Web sites:

- NanoReg News: [www.nanoregnews.com](http://www.nanoregnews.com)
- U.S. National Nanotechnology Initiative: [www.nano.gov](http://www.nano.gov)
- Small Times: [www.smalltimes.com](http://www.smalltimes.com)
- Project on Emerging Nanotechnologies: [www.nanotechproject.org](http://www.nanotechproject.org)

#### Why take this step?

The nano policy landscape is evolving with increased knowledge on nanotechnology and potential risks.

Firms need to anticipate that regulatory changes may affect your business practices. Firms that better manage the EHS impacts of their nano products and processes will have a competitive advantage in a new regulatory environment.

### ✓ **STEP 7: INCREASE EDUCATIONAL EFFORTS.**

Nano firms that are producing end products to consumers should better inform the public about their products. This would improve public perception and increase acceptance of nanotechnology. It is in companies’ best interests to explain what is in their products, especially those for use on skin and in food.

#### Why take this step?

Focus groups have shown that people want to know if nanotechnology was used to create or is contained in the products they buy and use. They want transparency. Fear of the unknown can be minimized through education. Educational efforts can protect firms against consumer backlash.

### ✓ **STEP 8: SEEK CONTINUED IMPROVEMENT.**

Steps one through seven are intended to assist your firm in moving forward on nano EHS management and improvement. As you make progress in each of those seven areas, continue to re-evaluate, monitor, and improve the rigor of your efforts over time. . . While these steps are focused primarily on nanomaterials, following the steps set forth in your current EHS model would suffice if you designate the nanomaterials as a hazardous material.

Following these steps will move your firm closer towards reaping the business rewards of a safe workplace and cleaner environment—lowered insurance and liability costs, competitive advantage and increased revenues, happy employees, and reassured consumers.

## NOTES

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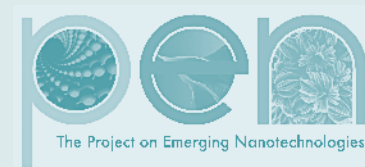
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