



EHS – The Smaller Company Perspective

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Characteristics of a small company

- May or may not have a full time EHS person
 - Rely heavily on outsiders for counsel and data
- May be populated by researchers with little experience of / regard for regulations
 - Personal protection
 - Environmental protection
 - Training
- Need to understand the transition between production by skilled process engineers to production by regular workforce

Characteristics of EHS issues in a small company

- Cardinal rule #1
 - Nobody must be harmed
- Errors and omissions will close your company even if nobody gets hurt
- Regulations come from a large number of agencies (Federal and State) and ignorance is not a defense
- Interpretation of regulations is best left to professionals
- Don't forget international regulations – RoHS, REACH, EUP....if you or your customers are selling internationally

Precautionary Principle vs. Laissez Faire?

➤ Precautionary principle

- Do not release a product until its lifecycle effects are fully known
- Upfront costs can not be sustained by a small company

➤ Laissez Faire

- “just do it!”
- Liability costs can not be sustained by **any** company!

Middle Ground

- Gather all the relevant information
- Make well-communicated and informed decisions
- Always remember Cardinal Rule #1
 - Nobody gets harmed.

The Product Challenge

- New businesses are custom product businesses
- Single-walled nanotubes (SWNT) as characterized by Vicki Colvin, Rice U CBEN
 - 20 major types of SWNT
 - 4 manufacturing types (trace impurities)
 - Lengths ranging from 5-300nm
 - 10 possible surface coatings
- >50,000 SWNT samples alone

The Product Challenge

- We don't know at this time which products will become commodities like AISI 1070 carbon steel
- The path to commercialization is not very easy or fast (carbon nanotubes discovered 1991), 2007~ \$80M (BCC)
- Small and large companies can't afford case by case risk assessment

The Information Challenge

- “Drinking from a Firehose” of information of variable quality (over 2M Google hits on nanotechnology + environment!)
- Condensed sources of information include
 - Industry Associations, local and national (http://ewh.ieee.org/r6/san_francisco/nntc/ , <http://www.chemicalvision2020.org/nanomaterialsroadmap.html>)
 - NNI (www.nano.gov)
 - Government agencies (www.cdc.gov/niosh/topics/nanotech)
 - NGOs such as the Woodrow Wilson Institute, Clean Production Action (<http://www.nanotechproject.org/> , www.cleanproduction.org)
 - Legal advice (not usually free!) (www.nanolabweb.com)

Making Your Voice Heard

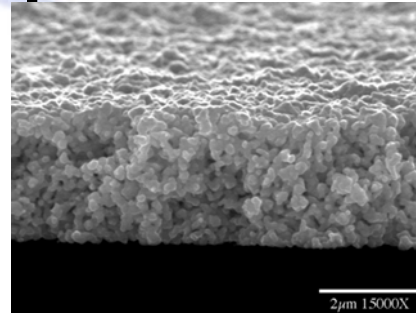
- Get involved!
- Participate in national standards and other organizations - small businesses can be underrepresented and there are real tensions
 - ISO TC 229, ASTM... (overall)
 - IEC TC113, IEEE, iNEMI, JIC...(industry-specific to electronics)
- Talk to the Government agencies!
- Nano Business Alliance
 - <http://www.nanobusiness.org/aboutus.php>

Managing for profitable and responsible growth

- The NanoDynamics experience
 - Formed 2002
 - ~125 associates
 - Basic nanotechnology platforms metal, oxide, coating, nanotubes
 - IP from universities, inventors, other companies or internally generated
 - Joint venture with Shell Technology Venture Fund 1, Epik Energy Solutions LLC

Types of Products

➤ Powders



➤ Dispersions



➤ Assemblies



➤ Systems



Safeguarding Employees and Customers

- Mandatory safety training for all employees
 - (may be grants available for this, use local resources such as Community College with OSHA and State Hazard Abatement grants)
- Certified Industrial Hygienists do this for a living
- Job Hazard Analysis procedure before a process starts
- Planned exposure reduction by using dispersed or contained products wherever possible
 - For any material risk = toxicity x exposure x bioavailability
- MSDS verification
 - Flammability, explosive limits in particular
- PPE availability

Job Hazard Analysis

(extract from NanoDynamics safety training)

Hazards to focus on

- Impact potential
- Penetration
- Harmful airborne contaminants
- Repetitive motion
- Heat
- Compression
- Chemical exposures
- Optical radiation

Job Hazard Analysis

NanoDynamics Pre-Operational Checklist

- 1 – General
- 2 – Procedures
- 3 – Equipment
- 4 – Ergonomics
- 5 – Environmental
- 6 – WHAT IF ANALYSIS
- 7 - Action Required (**ACTION ITEMS**)
- **Final Signoff**

Job Hazard Analysis

When is a JHA Revised / Revisited ?

- When an accident/injury occurs
- When the equipment/process is modified
- After a close call (***Near Miss***)
- Following an employee complaint
- If equipment suffers damage for any reason
- Per a scheduled review (***at least every 3 years minimum***)

Safeguarding The Environment

- Waste minimization / segregation, approved disposal
- Dialog with State and Federal agencies
- Participation in national bodies (e.g. ANSI-ISO) to understand changing understanding of environmental guidelines and regulations

Experience

- “Nano” can be an advantage, neutral or a disadvantage depending on which industry you are talking to
- Research on nano products can lead to non-nano (micron) products if the economies are right
- Nano products can be transient (disappear during the process because they grow or are consumed) or remanent (stay in the product)
- Nano products are critical for efficient clean tech (catalysts, solar cells, printed electronics, batteries, fuel cells, thermoelectrics, low carbon footprint cement, antimicrobial surfaces, water purification.....)

Summary

- Consider EHS upfront as a priority
- There are lots of resources you can turn to for specialized help (e.g. companies specializing in MSDS preparation, FIFRA or TSCA registration)
- Involvement in industry associations and standards bodies allows you to network with other companies, NGOs and government agencies in a constructive way.
- Don't try and do this alone!