Contents

- Characteristics Of A Small Company
- Characteristics of EHS issues
- Precautionary Principle vs. Laissez Faire
- The Product Challenge
- The Information Challenge
- Making Your Voice Heard
- Managing For Profitable And Responsible Growth
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 cannot be sustained by a small company

**Laissez Faire**
- “just do it!”
- Liability costs cannot 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
  - 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
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 contaminates
- Repetitive motion
- Heat
- Compression
- Chemical exposures
- Optical radiation

(Courtesy Mike Yarbrough)
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....)

The American Ceramic Society

nanodynamics.
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!