

**A HYPOTHETICAL SCENARIO FOR THIS WORKSHOP  
TO SPUR DISCUSSION**

**A SUCCESSFUL NANOCOMPANY EMERGES,  
UNTIL...**

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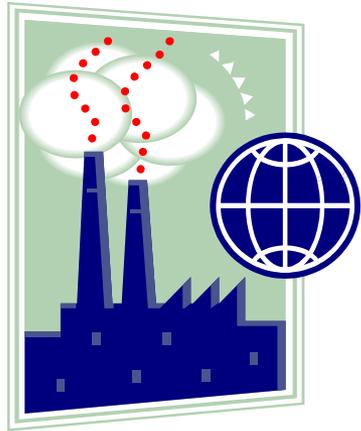
**Tempe, AZ**

# Another Nanomaterial Manufacturer Becomes Successful

- Two entrepreneurs start a manufacturing firm producing a wide variety of nanomaterials that come in all shapes, sizes and compositions (inorganic and organic)
- They make millions of dollars & employ thousands
- They save the country's economy, and are philanthropic heroes
- They only use “green” chemicals and gases for synthesis of the nanomaterials
- Their nanomaterials are used in everything from medicines to cure cancer, popular soda drinks, solar-collecting electronic devices and pesticides that double agricultural yields
- Life is very, very good as they are about to celebrate their 10 year anniversary



# NANOCOMPANY THRIVES



## THEN IT STARTS TO HAPPEN

- Over the course of the next year, at and around the manufacturing site,
  - Local birds start to die
  - Grasses grow, but shrubs die off in the surrounding countryside
  - 10 miles downstream, deformed frogs and dead fish start to show up
- Concerns mount, but the causative agent(s) – nanomaterial or otherwise --have not been identified:
  - Immediate site-specific eco-system concerns
  - Need to clean up the environment
  - Concern over the now global usage of the dozens of nanomaterials produced at this site in products that are revolutionizing society



A COMPREHENSIVE TEAM  
IS ASSEMBLED ON OCT 6-7, 2009 IN  
WASHINGTON,  
TO SOLVE THE IMMEDIATE CHALLENGE  
AND  
TO REASSESS WHAT COULD HAVE BEEN  
DONE TO PREVENT THESE ECOLOGICAL  
EFFECTS IF THE NANOMATERIALS WERE  
RESPONSIBLE



# THE IMMEDIATE CHALLENGE = FIND THE MANUFACTURED NANOPARTICLES

- Assume the culprits could be nanomaterials from this manufacturing facility
- Why is there an ecological disaster?
  - Did nanoparticles directly cause the problem?
  - Was it a by-product of nanoparticles ?
  - Did nanoparticles bioaccumulate in the food chain?
  - Were nanoparticles selectively affecting critical organisms in the food chain?
- Why were fish and birds dying, but deformed frogs living? Why was it occurring many miles downstream? Did the growth of grasses and dieoff in shrubs have anything to do with it?
- How would you go about identifying the one of potentially many nanomaterials in the air, soil or water that could have caused this ecological catastrophe?
- How would you find nanoparticles, or their by-products, in the suite of natural and synthetic nanomaterials?
- Your Mission: find the culprit nanoparticles and remove them from manufacturing if they were responsible, but continue manufacturing of all the other great beneficial nanomaterials at this facility



# WHAT COULD HAVE BEEN DONE TO PREVENT THIS CATASTROPHE?

- What biological and instrument methods could have been used to test all the nanomaterials produced by this company?
- What biological effects could they have looked for?
- Are current paradigms for inorganic or organic chemicals suitable for use with nanomaterials?
- How could the transformations in the nanoparticle properties in the air, water or soil have been predicted?
- If nanoparticles were responsible, what were their associated critical physiochemical properties (size, shape, coating, composition) that lead to the observed biological effects?



## REMEMBER THIS CASE STUDY

- As a participant of this Team Workshop – try to keep in mind this Scenario
- Your questions, ideas and input will helpfully help prevent potential catastrophes such as this one from occurring
- This is the BIG fear of many companies, and this may be hindering revolutionary breakthroughs
- What is the sequence of responsible research needed to reduce the uncertainty that such Nanoparticles may one day exist?

