Green Chemistry Guide as an Effective Tool in Pollution Prevention

OLGA KREL - ASSOCIATE ENGINEER
CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SANITATION
INDUSTRIAL WASTE MANAGEMENT
DIVISION

INTRODUCTION TO GREEN CHEMISTRY

- The Pollution Prevention Act passed in 1990 in the United States.
- Pollution prevention (P2) encompasses more specialized sub-disciplines including green chemistry and green engineering.
- In 1998 Paul T. Anastas and John C. Warner published well known and widely used book “Green Chemistry: Theory and Practice” that brought to the world “The 12 Principles of Green Chemistry” that focus on reducing the volumes of chemicals used and pollution prevention”.

Pollution Prevention Hierarchy as establish by Congress in the Pollution Prevention Act of 1990

INTRODUCTION TO GREEN CHEMISTRY

Green Chemistry Definition: The design, development and implementation of chemical products and processes that reduce or eliminate the use and generation of hazardous substances.

Green chemistry is doing chemistry the way nature does chemistry-using renewable, biodegradable materials which do not persist in the environment.

Green chemistry is using catalysts and biocatalysts to improve efficiency and conduct reactions at low or ambient temperatures.

Green chemistry is a proven systems approach.

Green chemistry reduces negative human health and environmental impacts.

Green chemistry offers a strategic path way to build a sustainable future.

The 12 Principles of Green Chemistry

Provides a framework for learning about green chemistry and designing or improving materials, products, processes and systems.

1. **Prevent Waste**
2. **Atom Economy**
3. **Less Hazardous Synthesis**
4. **Design Benign Chemicals**
5. **Benign Solvents & Auxiliaries**
6. **Design for Energy Efficiency**
7. **Use of Renewable Feedstocks**
8. **Reduce Derivatives**
9. **Catalysis (vs. Stoichiometric)**
10. **Design for Degradation**
11. **Real-Time Analysis for Pollution Prevention**
12. **Inherently Benign Chemistry for Accident Prevention**

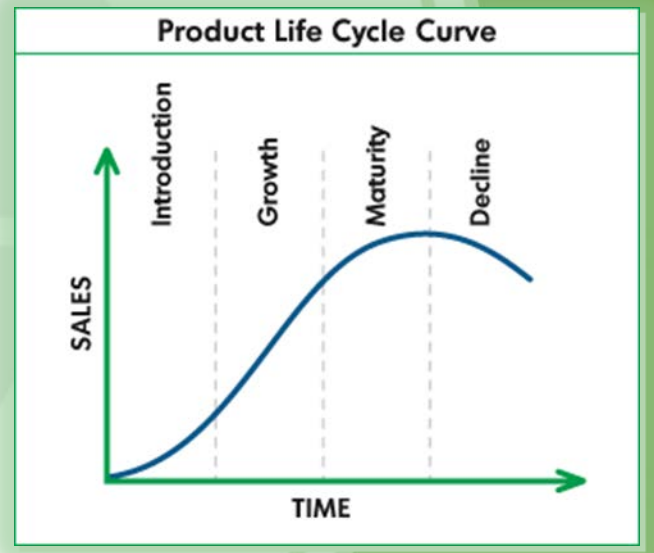
CONTENTS OF THE GREEN CHEMISTRY GUIDE

POINTS ADDRESSED IN GREEN CHEMISTRY GUIDE

- Introduces 12 principles of green chemistry.
- Presents benefits of green chemistry
- Introduces life cycle of the product
- Familiarizes reader on life cycle assessment (LCA).
- Places readers mind set forward understanding Green Chemistry.
- Presents an overview of green chemistry tools to equip agencies in providing assistance to their clients.
- Offers information on how green chemistry drives P2 strategy.
- Discusses interconnectedness of sustainability with green chemistry and pollution prevention.
- Defines green engineering
- Gives examples of case studies Builds the business case for green chemistry
- Discusses strategies for how to begin making changes
- Presents how green chemical develop and implementation team built to make those changes
- Guide provides useful Appendixes

INTRODUCTION TO GREEN CHEMISTRY

- What is Life Cycle?
- Products, services, and processes all have a **life cycle**.
- Products life cycle:
  - Raw materials are extracted or harvested.
  - Raw materials then go through manufacturing steps
  - Product is delivered to a customer
  - Product is used
  - Product disposed of or recycled



INTRODUCTION TO GREEN CHEMISTRY

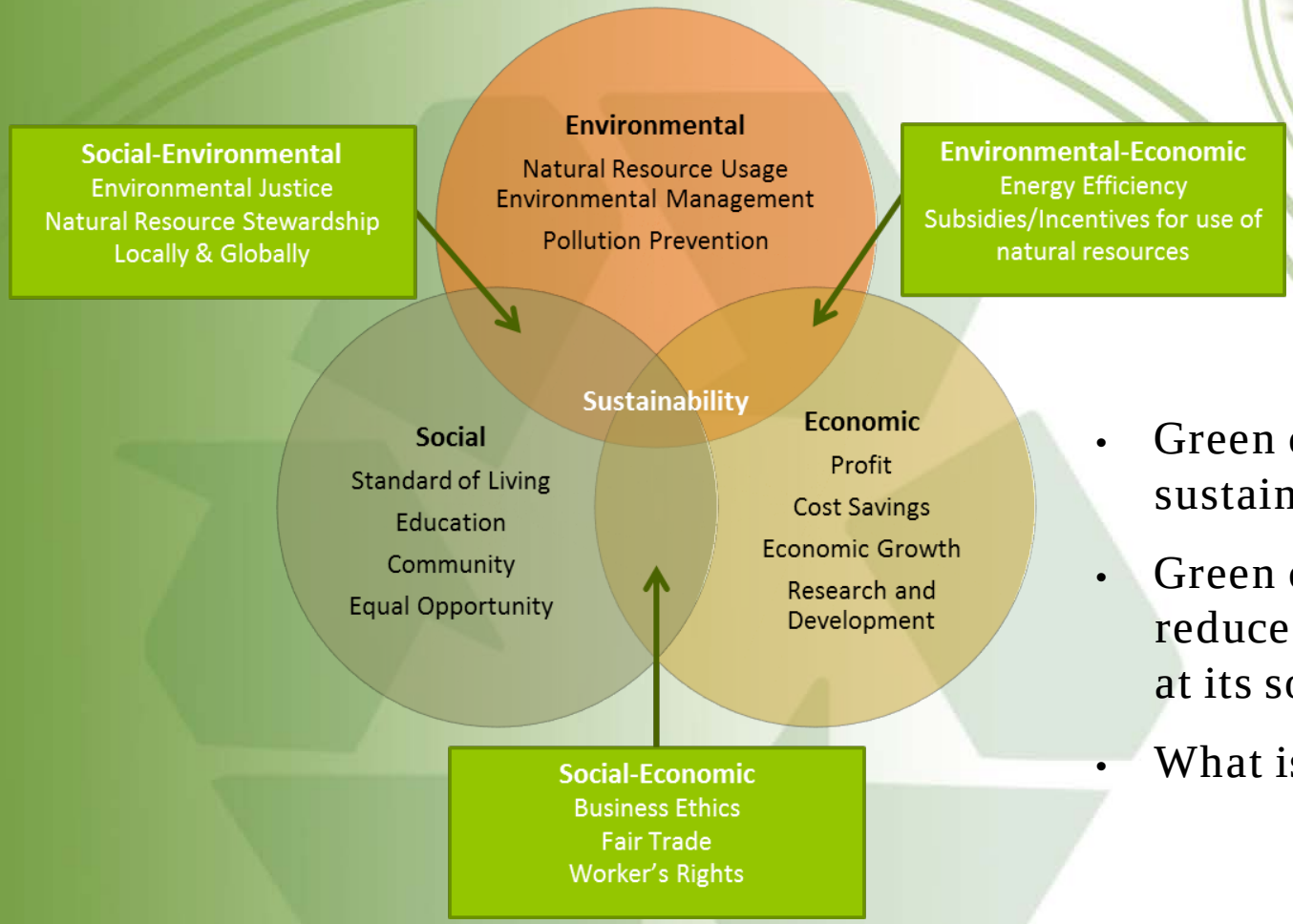


Figure 1. The Three Spheres of Sustainability

- Green chemistry, also called sustainable chemistry
- Green chemistry seeks to reduce and prevent pollution at its source.
- What is "Sustainability"?

INTRODUCTION TO GREEN CHEMISTRY

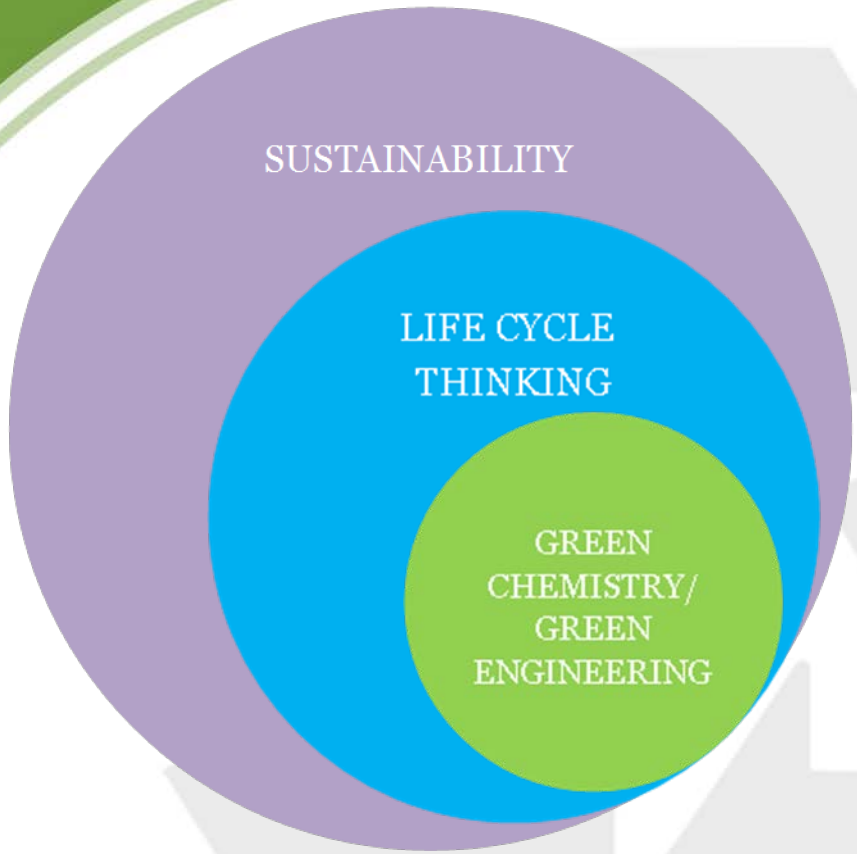


Figure 2. Green Chemistry: An Essential Component of Sustainable Production.

"Both green chemistry and green engineering rely upon lifecycle thinking to bring their concepts to fruition. All three serve to achieve the ultimate goal of a sustainable economy and society."

Source: California Green Chemistry Initiative Science Advisory Panel Report, May 2008.

The Benefits of Green Chemistry

- Economical
- Energy efficient
- Lowers cost of production and regulation
- Less wastes
- Fewer accidents
- Safer products
- Healthier workplaces and communities
- Protects human health and the environment
- Competitive advantage

BROADENING THE INFLUENCE OF GREEN CHEMISTRY

- 5 Green Chemistry Webinars
  - For list of webinars visit:

    http://wsppn.org/wpcontent/uploads/2013/07/Green-Chemistry-Manual-Individual-Webinar-Descriptions-Rev2.pdf
  - For PDFs of the webinar presentations visit: http://www.p2.org/news/
- Collaborating with the EPA on pollution prevention strategies

RELEVANCE OF GREEN CHEMISTRY IS NO LONGER THE QUESTION.

- **No industry, or company** will be able to operate without a clear mastering of the key principles of green chemistry.
- Industrial Waste Management Division (IWMD), Bureau of Sanitation of the City of Los Angeles continuously working on mastering Green Chemistry issues after overwhelming success of “Green Chemistry Guide” written and published on January 2015.
- Next very important step taken by IWMD Engineers is to tie industry processes with 12 Principles of Green Chemistry by creating Green Chemistry Checklist for every manufacturing within the spectrum of permitted trades inside the City of Los Angeles and beyond.

Please use link below to access Green Chemistry Guide at the P2 National Pollution Prevention Roundtable website:
https://drive.google.com/a/lacity.org/file/d/0B7bxC_0Zv1_yc1FaY0pZeVR6YWM/view

Department of Public Works
Bureau of Sanitation
Industrial Waste Management Division
OLGA KREL
(323) 342-6124