CHEM 489 – Spring 2020
Advanced Environmental Chemistry
Introduction to Green Chemistry
Dr. Brush

January 23: Welcome to CHEM 489!

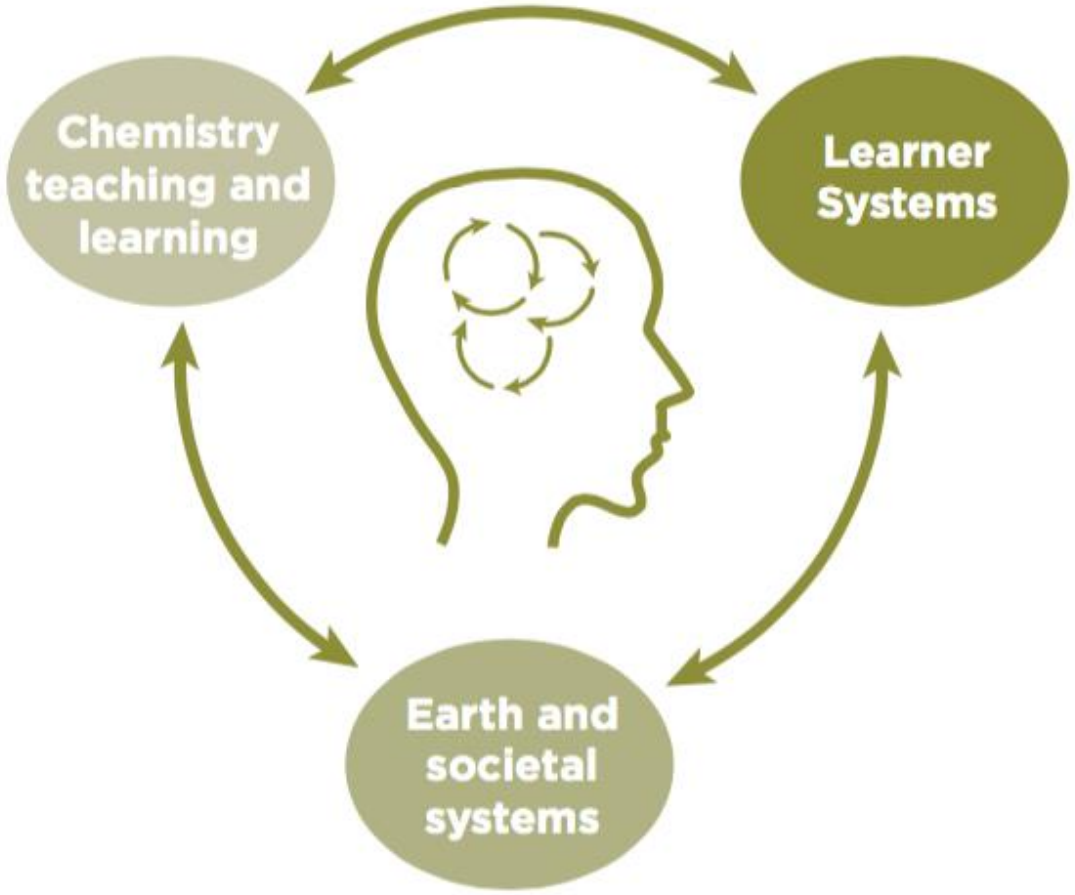
- **EJB & TDK introductions**
- **EJB Syllabus overview**

Introduction (January 23 & 28):

- **Background, Concepts, Connections**
- **Unintended Consequences**
- **12 Principles of Green Chemistry**
- **UN Sustainable Development Goals**
- **Metrics**

What is Green & Sustainable Chemistry?

To answer this question lets first consider what chemistry is all about……



Chemistry is about converting matter from one form into another to produce products for the needs of our society.

Chemistry: The Central Science!

- How the world works on the molecular level
- Great advances in technology, medicine, agriculture and more
- Chemistry is everywhere!

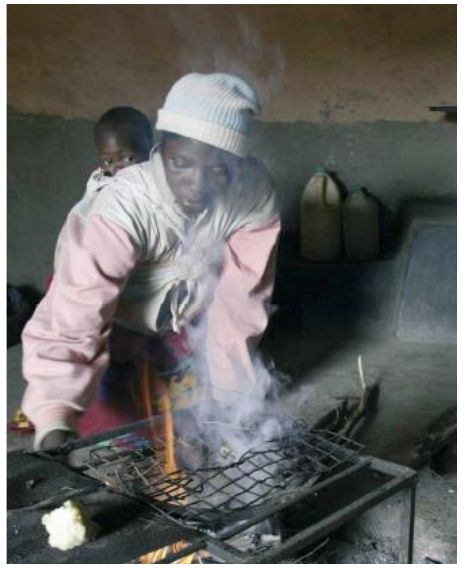
Chemistry is also central to societal challenges…..

***Unintended Consequences*.** **Poor choices in <u>some</u> of the chemicals we use are having a negative impact on human and environmental health.**

Plastics; BPA

Caffeine children's food

Endocrine disruptors



Indoor cooking

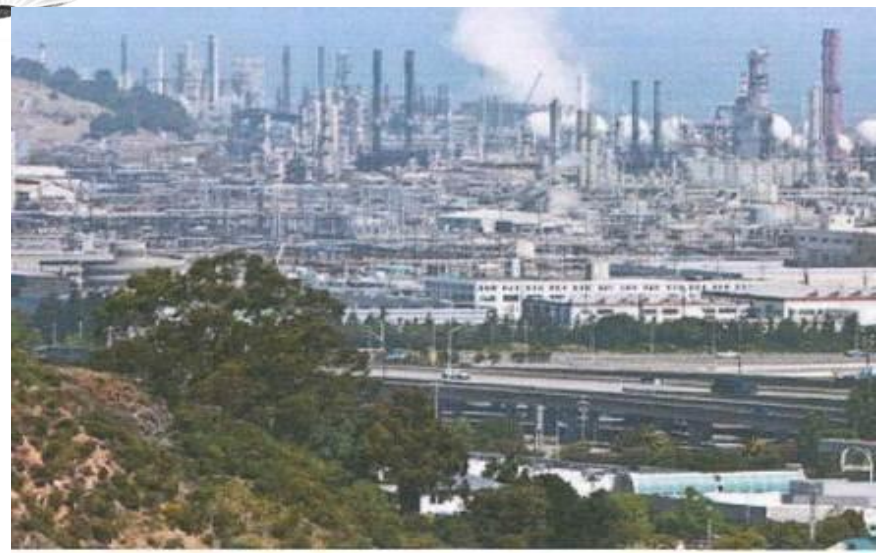
Mining critical elements in Africa

Legacy chemicals

Cosmetics & personal care products

Textiles (dyes)

Diesel particulates



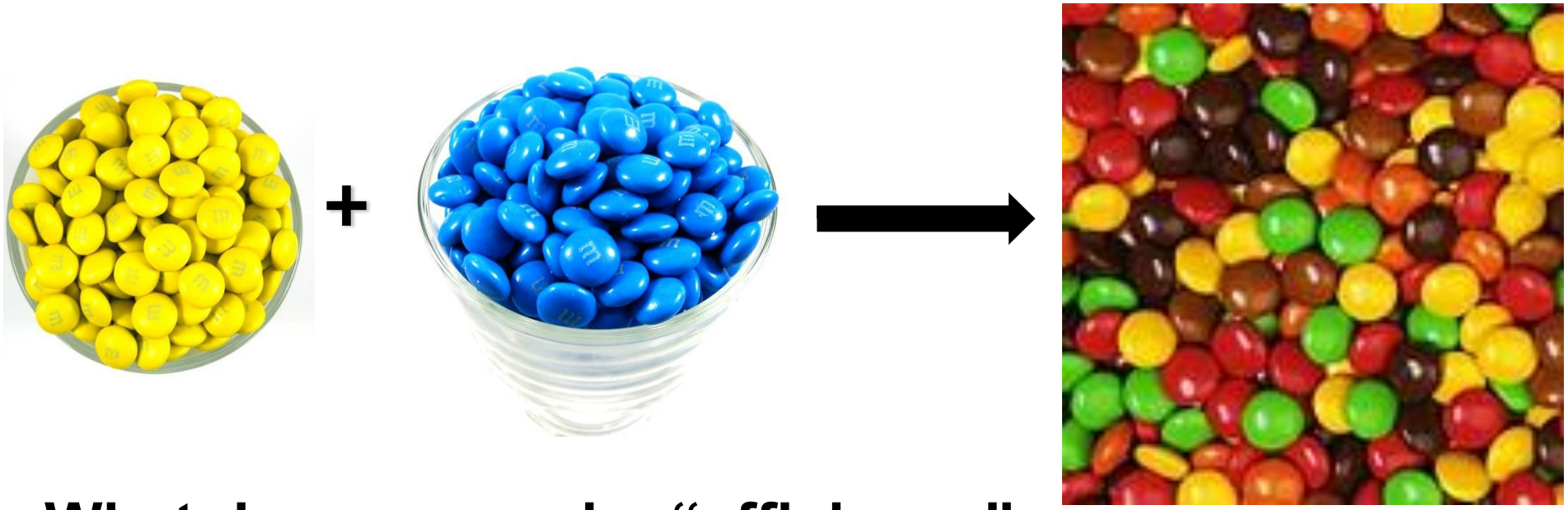
Inner city chemical exposure

Flint, MI (access to clean water

Unintended Consequences:
Social Equity & Environmental Justice

- Disproportionate exposure of children and adults to hazardous chemicals based on age, gender, race and socio-economic status.

“Traditional” chemical processes lack Efficiency!



What do we mean by “efficiency” in chemical processes?

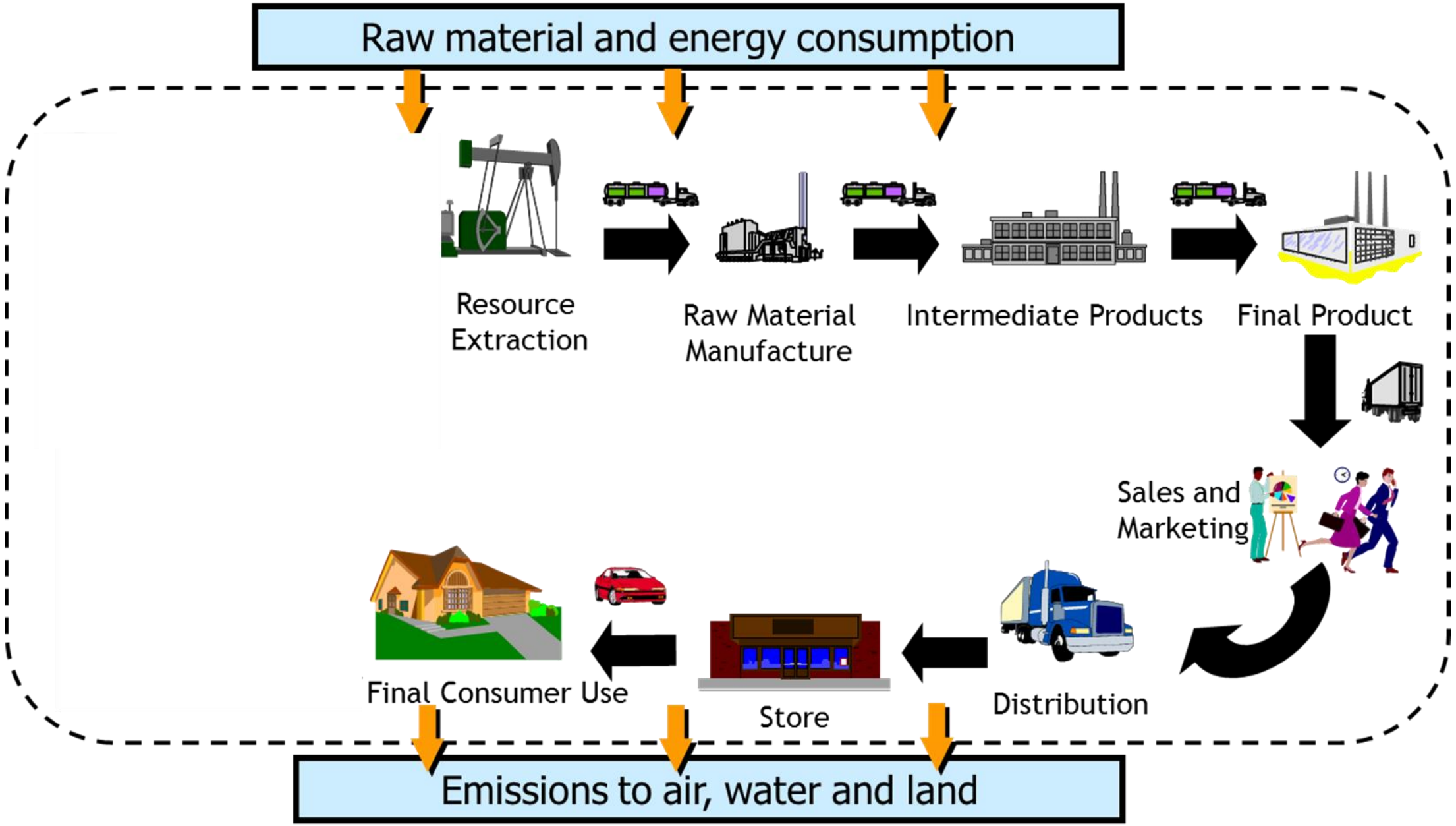
Paradigm shift in the chemistry enterprise

- **The chemistry enterprise is NOT sustainable:**
  - Create sustainability mindset in how we think about and do chemistry
  - Change the role and perception of chemistry in the world
  - Re-define modern chemistry: paradigm shift

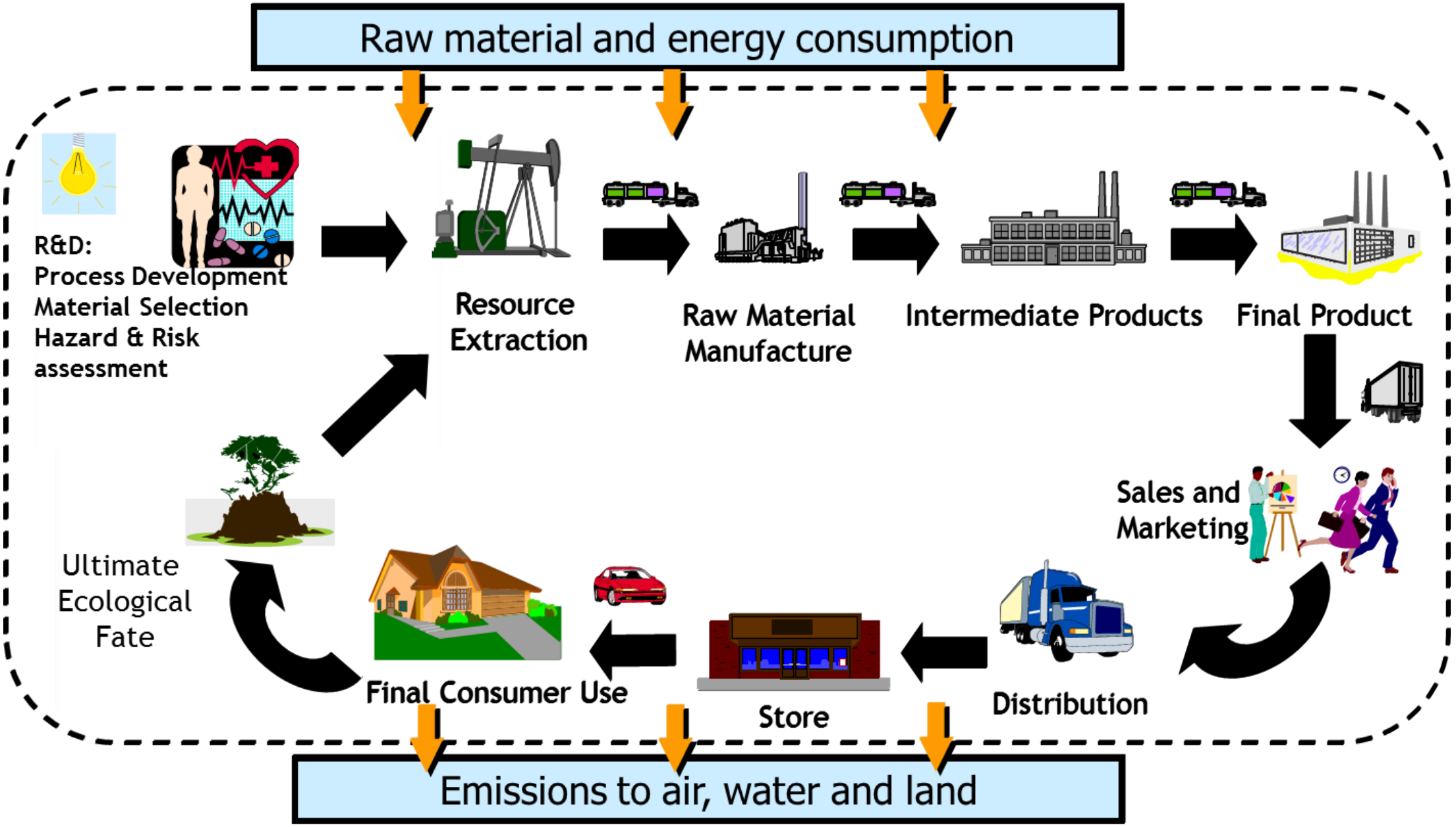
- **ACS Action Plan for the Chemistry Enterprise: :**
  - The chemical sciences are essential to solving global problems (UN SDGs)
  - Engage all chemists in all sectors to integrate and scaffold **green and sustainable chemistry, systems thinking and the UN Sustainable Development Goals** into how we think about and do chemistry.

ACS Green Chemistry Institute
Chemistry for Life®

Raw material for energy consumption: Current thinking…

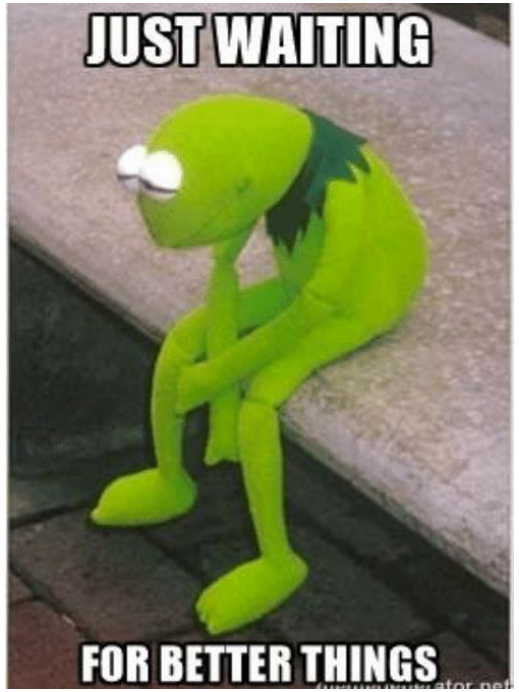


Green & Sustainable Chemistry: Paradigm shift…



Green & Sustainable Chemistry: Changing how we think about and do chemistry…

- **Systems Thinking** – Understanding the interconnectedness of elements in a system, boundaries, feedback loops
- **Life Cycle Thinking** – Understanding where things come from, how they are used, and where they end up
- **Molecular Design** – Designing inherently safer molecules that meet functional and performance needs



What are we going to do about this?

Apply the Principles of Green & Sustainable Chemistry!

What is Green & Sustainable Chemistry?

…pollution prevention starting with the design phase…

"Green Chemistry aims to reduce or eliminate the use and generation of hazardous substances associated with the design, manufacture, and use of chemicals"