

### Green Chemistry Principle # 10

Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.

### Project Design

To teach about the importance that green chemistry can have for our environment. Simple use of green practices saves money, the environment and creates more efficient and safer chemicals for cleaning and many other industrial and

### Background

Household products include cleaners, fresheners, laundry products, drain cleaners, dishwashing detergents, carpet shampoos, polishes and pesticides. Exposure to toxic household hazardous chemicals from ingestion, inhalation or skin contact can produce acute (immediate) or chronic (long term) health effects such as:

Headaches	Burning Eyes
Fatigue	Skin Rashes
Allergic Reactions	Runny Nose
Chemical Sensitivity	Cancer
Cardiac Damage	Respiratory Tract Irritant
Nervous System Damage	Liver and Kidney Damage

We can not assume the conventional household products we buy at the local department store is a healthy and environmentally responsible product because of its availability. Product label information addresses acute (immediate) effects only and no warnings or discussion of long term health impacts of the products, such as cancer, is required. These common household products are also not required to disclose "inert" ingredients which can very hazardous and toxic.

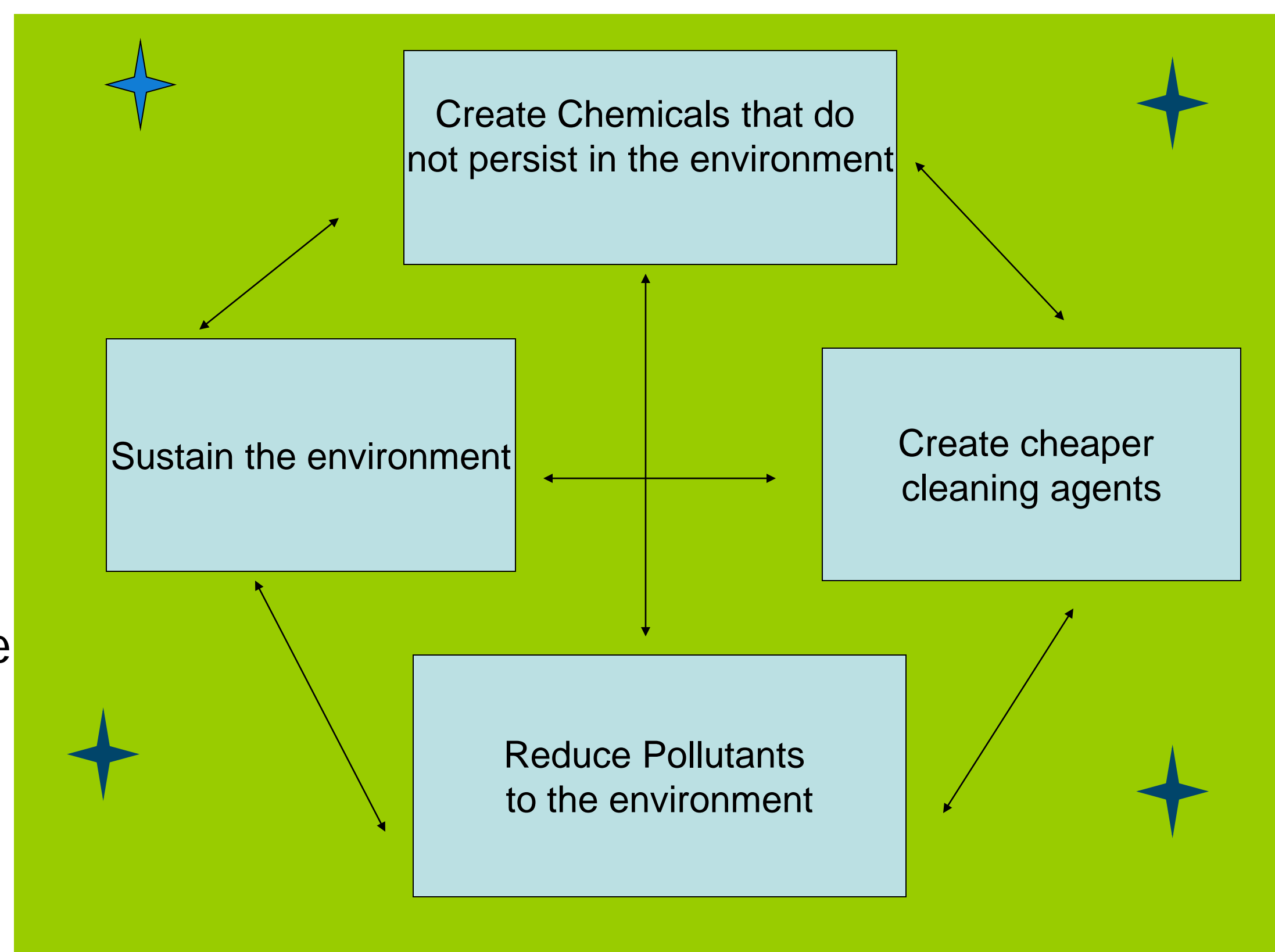
When considering the purchase of household products, select products that have less toxic, renewable and natural ingredients and are packaged responsibly. The purchase of these products supports companies that help minimize the impact of using these products on your health and the environment.

### Implications of the GC Principle

- Safer Chemicals allow for a more environmental friendly way to live. Achieves a balance between science and nature

### References

Information Retrieved from:  
<http://www.chemistry.org/portal/resources?id=fc396792f29b11d6fbc16ed9fe800100>  
[http://www.healthgoods.com/Shopping/Household\\_Products/Household\\_Hazardous\\_Products.htm](http://www.healthgoods.com/Shopping/Household_Products/Household_Hazardous_Products.htm)  
<http://www.chemistry.org/portal/resources/?id=58b9233a112911d7f48b6ed9fe800100>



### Greener Cleaning Products

#### Crystal Simple Green®

- Water based industrial cleaner
- Non-toxic, biodegradable surfactants
- Replaces traditional organic solvents
- Eliminates hazardous waste sludge production and VOC pollution

#### Sodium Iminodisuccinate

- Biodegradable, environmentally friendly chelating agent
- Synthesized in a waste-free process
- Eliminates use of hydrogen cyanide

#### Rhamnolipid Biosurfactant - A Natural Low Toxicity Alternative to Synthetic Surfactants

The Jeneil Biosurfactant Company has successfully produced a series of rhamnolipid biosurfactant products that provide good emulsification, wetting, detergency, and foaming properties, along with very low toxicity. Rhamnolipid biosurfactants are much more environmentally friendly alternatives to traditional petroleum-based surfactants. This technology was awarded the Presidential Green Chemistry Challenge Award in the U.S. in 2004

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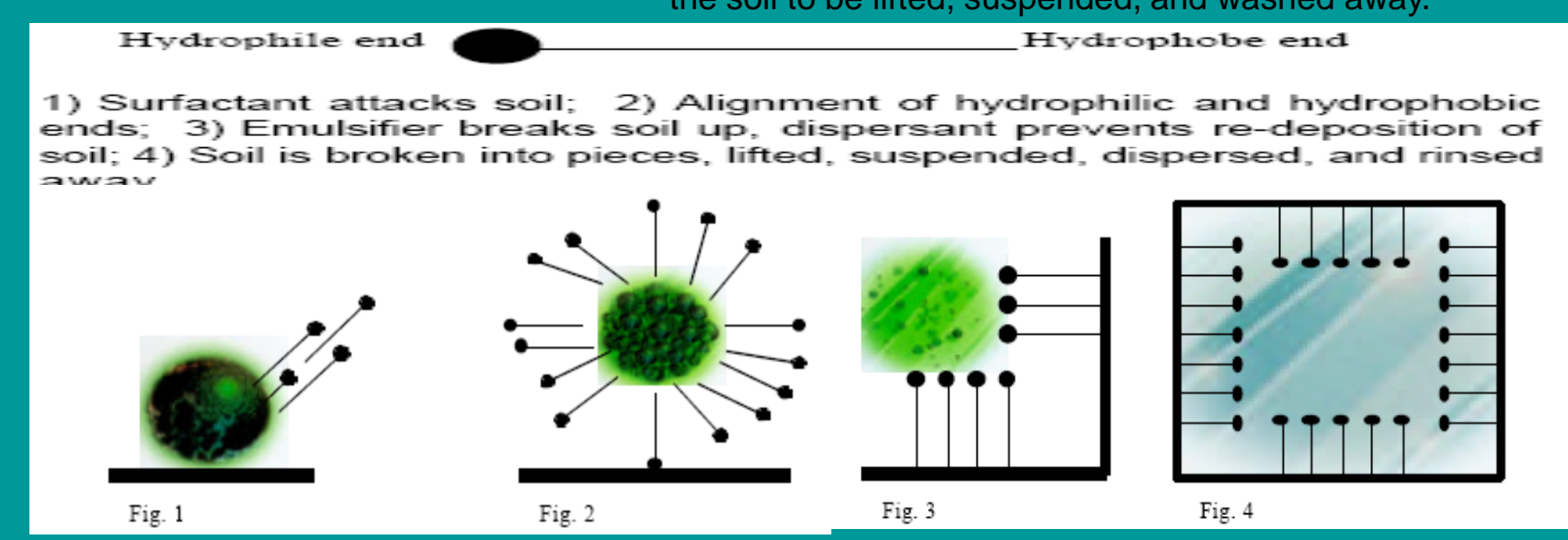
# Household Friendly Products

Here are some key benefits of using natural and less toxic household products:

- **Super Concentrated** - Products provide more uses per size than conventional products. This allows economical use, reduces packaging and reduces the impact on the environment of manufacturing and transportation of the product.
- **Environmentally Safe** - Products are readily biodegradable, contain no known carcinogens, mutagens, teratogens or pollutants. Will not harm beneficial bacteria in septic systems..
- **Non-Toxic** - Products contain no hazardous ingredients or fumes. Use of the products are safe for workers, aquatic life, animals and families. More compatible with people that have chemical sensitivities and allergies.
- **Natural Ingredients** - Products use the highest quality, naturally derived ingredients that do not deplete our non-renewable resources.
- **No Animal Testing** - Products contain no animal ingredients and have not been tested on animals.
- **Performance Tested** - Products work as well or better than conventional hazardous products.

Cleaning agents typically are a combination of ingredients to make them effective in removing soils. Cleaners are formulated to handle a specific soil, or tackle a variety of soils.

Term	Definition
<b>SOLVENT</b>	The medium in which soil is suspended and carried away from the surface. The customer adds most of the solvent to Simple Green Products- I.E. water
<b>SURFACTANTS</b>	Abbreviation for "Surface Active Agent", surfactants work at the boundary layer (the interface) between the soil and the solvent. Each molecule of surfactant has a hydrophilic end which is attracted to water, and a hydrophobic end which is attracted to soil. In an effective cleaner/degreaser such as Simple Green, many surfactant molecules attack the soil with their hydrophobic ends, breaking it up into small bits and surrounding it. Their hydrophilic ends then allow the soil to be lifted, suspended, and washed away.
<b>PENETRATING &amp; WETTING AGENTS</b>	By changing the chemical composition of the hydrophilic and hydrophobic ends of the surfactant molecule, different surfactants with varying degrees of effectiveness can be created. By "punching up" the penetration and wetting ability of the surfactant, more water is able to surround soil particles that would otherwise repel water.
<b>EMULSIFIERS</b>	Enable surfactants to break up soils (particularly petroleum soils) into smaller droplets that are more easily dispersed throughout the solvent.
<b>SOLUBILIZERS</b>	Enable soils to be dissolved so that they are no longer solid particles, thereby making them easier to break apart.
<b>DISPERSANTS</b>	Enable the spreading of particles throughout the solvent and prevent them from re-adhering to the cleaned surface.
<b>CHELATING AGENTS</b>	Chelators [ "key-laters" ] "bind up" hardness minerals found in water, enabling the other active ingredients to more effectively attack the soils. Chelators can also pull minerals and metals into solution and, in some extreme precision applications, this is not always desirable.
<b>SAPONIFIERS</b>	Are strong alkaline chemicals that make animal fats soluble in water and more easily washed away.
<b>BUILDERS</b>	Give the overall solution additional strength to hold heavy soil loads. The most common builder is phosphate –but, due to environmental concerns, phosphate is not used as much in modern solvents.



# Household Hazardous Products

## Household Product Information:

- Household products can contain hazardous ingredients such as organic solvents which may persist in the indoor environment long after the period the product use is completed.

### Household hazardous products have a negative impact on our health and the environment in at least 3 ways:

- Usage** - Their use may release toxic and hazardous vapors into the indoor air which may be unhealthy for our families.
- Manufacture** - The purchase of potentially hazardous products creates a demand for toxic chemicals which contributes to environmental pollution due to the development, manufacture and transportation of these chemicals.
- Disposal** - When hazardous products are used, they are releasing chemicals into the ground and wastewater stream which may contaminate our groundwater and present a problem to wastewater treatment facilities. Most often hazardous products are not disposed of properly and are land filled or incinerated where they release their toxins to the environment.

Product type	Possible Ingredients	Potential Hazards
Air Freshener and Deodorizer	Formaldehyde	Toxic; carcinogen; irritant to eyes, nose, throat, and skin; may cause nausea, headaches, nosebleeds, dizziness, memory loss, and shortness of breath.
Bleach	Sodium hypochlorite	Corrosive; irritates or burns skin, eyes, respiratory tract; may cause pulmonary edema or vomiting and coma if ingested; contact with other chemicals may cause chlorine fumes.
Disinfectant	Sodium hypochlorite	Corrosive; irritates or burns skin, eyes; may cause pulmonary edema or vomiting and coma if ingested.
	Phenols	Flammable; very toxic; respiratory, circulatory, or cardiac damage.
	Ammonia	Vapor irritating to eyes, respiratory tract, and skin; possible chronic irritation.
Floor Cleaner Wax	Diethylene glycol	Toxic; causes central nervous system depression and kidney, liver lesions.
	Petroleum solvents	Highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs.
	Ammonia	Vapor irritation to eyes, respiratory tract, and skin; possible chronic irritation.
Furniture Polish	Petroleum distillates or mineral spirits	Highly flammable; moderately toxic; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; entry into lungs may cause pulmonary edema.
Oven Cleaner	Sodium or potassium hydroxide (lye)	Caustic; irritant; inhibits reflexes; burns to skin, eyes; poisonous if swallowed due to severe tissue damage.
Spot Remover	Perchloroethylene or trichloroethane	Slow decomposition; liver and kidney damage; perchloroethylene is suspected carcinogen.
	Ammonium hydroxide	Corrosive; vapor extremely irritable to skin, eyes, and respiratory passages; ingestion causes tissue burns.
	Sodium hypochlorite	Corrosive; irritates skin, eyes, respiratory tract; may cause pulmonary edema and skin burns.
Toilet Bowl Cleaner	Sodium acid sulfate or oxalate or hypochloric acid	Corrosive; burns from skin contact or inhalation; ingestion may be fatal.
	Chlorinated phenols	Flammable; very toxic; respiratory, circulatory, or cardiac damage.
Window Cleaner	Diethylene glycol	Toxic; causes central nervous system depression and degenerative lesions in liver and kidneys.
	Ammonia	Vapor irritating to eyes, respiratory tract, and skin; possible chronic irritation.