Green Chemistry and Sustainable Innovation

Bill Greggs
Procter & Gamble
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Statement of Purpose

“Provide products of superior quality and value that improve the lives of the world’s consumers, now and for generations to come”
The Consumer is Boss

For the Boss, safety is a vital “ingredient” in product performance and value.
Product Safety — A Business Must

Company Policy

“Ensure that our products, packaging and operations are safe for our employees, consumers and the environment and comply with all applicable regulations.”

Designing Safety In—*Right from the Start*

**Product Development**

Idea → Lab evaluations → Small scale Consumer Testing → Large scale Consumer Testing → Market Testing → Broadscale Market entry

**Exploration**

**Experimentation**

**Production**

**Safety Evaluation**

Info/Data → Hazard → Exposure Risk → Refine Assessment → Final Clearance → In-Market Monitoring

> 500 Human, Environmental, Regulatory Scientists

*Every Ingredient, Every Package, Every Product*
Risk Assessment

Principle

- A chemical is not safe or unsafe
- It’s the use and exposure of a chemical that can be judged as safe or unsafe

Safety Evaluation

1. Info/Data
2. Hazard
3. Exposure Risk
4. Refine Assessment
5. Final Clearance
6. In Market Monitoring

Risk Assessment
Risk Management

- reduce uncertainty (e.g. generate more data)
- reduce exposure
  - lower product concentration
  - special packaging
  - use instructions/precautionary labeling
- substitute for substance
- abandon substance company-wide
- re-evaluate and take action based on new information

Safety Evaluation

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Info/Data → Hazard → Exposure Risk → Refine Assessment → Final Clearance → In Market Monitoring
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Risk Assessment

Risk Management
Avoidance and Vigilance—Reducing Risks

Examples: Avoiding, eliminating or reducing uses of:

- Nonylphenol ethoxylates
- Nitromusks
- Cyclotetrasiloxane
- Geranyl nitrile
- Diethanolamine
- Dibutyl, Diethylhexyl phthalate
- DTDMAC / non-biodegradable quaternary amines
- ......
Importance of “Informed Substitution”

Informed substitution – considered transition from a chemical of particular concern to safer chemicals or non-chemical alternatives when it:

• Is technically feasible
• Improves health and environmental safety profile
• Maintains or improves cost, performance, economic/social considerations, and
• Has the potential for lasting change.
Increasing Transparency—Sharing P&G Science and Safety Information

• Our Commitment - Product Safety
  – Corporate Portal
    www.pg.com/product_safety

• Science in the Box
  – Laundry and cleaning products
  – 20,000 visitors/month
  – Working to add North American brands
    www.scienceinthebox.com

• Science of Beauty
  – Pilot launched 12/04
  – Pantene, Olay; 5,000 visitors/month
  – Working to add additional brands
    www.pgbeautyscience.com

• P&G Perspectives
  – Editorial views on policy & emerging issues
  – Target audiences: authorities, activist groups, scientists, other influencers
    www.pgperspectives.com
Collaboration

Work with suppliers, competitors and retailers via trade associations
- Share best safety practices
- Develop/share risk assessments
- Work with stakeholders
- Engage in local, regional and global chemical policy discussions
Key Elements—P&G Product Safety and Sustainability

- Company-wide policies on product safety and sustainability
- Pre-market, science-based assessment of product safety
- **Innovation: product performance, value, environmental quality**
- Rigorous control of production from raw material specifications, to formulation management, to process and quality control.
- Safe operations that protect the health and environment of employees and the surrounding community
- Compliance with all applicable product safety, labeling regulatory requirements, including transportation, waste mgt., product disposal.
- Transparency in communicating safety and sustainability information
- Constant vigilance: post market surveillance and rapid response
- Industry involvement and leadership in safety and sustainability
- Ongoing assessment and improvement of systems performance
Sustainable Innovation

Green Chemistry Innovation for Sustainability
Sustainability

Ensuring a better quality of life for everyone, now and for generations to come
Sustainability

Environmental Protection
  - Investing in the environment

Social Responsibility
  - Investing in people

Economic Development
  - Investing in communities
Sustainable Innovation

= Green Chemistry

• Improve safety profile
• Perform better
• Conserve resources
• Lower cost to consumers
## Sustainable Innovation: Inventing Technologies that Improve Environmental Quality

<table>
<thead>
<tr>
<th>Old Technology</th>
<th>Replacement Technology</th>
<th>Why change?</th>
</tr>
</thead>
</table>
| ABS            | LAS                    | Anionic surfactant  
Foaming in rivers/improved biodeg profile |
| DTDMAC         | DEEDMAC                | Fabric softener active  
Non-biodegradable to biodegradable |
| APE            | AE                     | Nonionic surfactant  
Marginal to complete biodeg/tox/ED issues |
| Anionic surfactants | HSAS                 | Anionic surfactants with superb environmental pedigree replaced; cold water wash need |
| EDTA           | EDDDS                  | Non biodegradable to biodegradable chelator |
### Sustainable Innovation: Inventing Technologies that Improve Environmental Quality

<table>
<thead>
<tr>
<th>Old Technology</th>
<th>Replacement Technology</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>LAS</td>
<td>Improved environmental profiles based on fate and effects properties led to commercialization or enlightened technology guidance (use/don’t use)</td>
</tr>
<tr>
<td>DTDMAC</td>
<td>DEEDMAC</td>
<td>In all cases, environmental risk assessment processes were key to the decision</td>
</tr>
<tr>
<td>APE</td>
<td>AE</td>
<td>All these technologies were P&amp;G developed or directed by us thru suppliers</td>
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<tr>
<td>Anionic surfactants</td>
<td>HSAS</td>
<td></td>
</tr>
<tr>
<td>EDTA</td>
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<td></td>
</tr>
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Sustainable Innovation…

Green Chemistry

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is more than

Toxicity Reduction
Life Cycle Assessment (LCA)

Tool to assess env. impact of technologies and products through their entire life cycle

Covers a variety of environmental indicators

- Energy consumption
- Water consumption
- Use of resources
- Solid waste
- Global warming
- Emissions into air
- Ozone depletion
- Emissions into water
- Human toxicity
- Summer smog
- Acidification
- Eutrophication
- Aquatic ecotoxicity
Comparative LCA Footprint of Laundry Detergents
Energy Use across Life Cycle Phases

Overview of Energy Footprint For Selected Products

Life Cycle Phase

Energy (gigajoules)

Product Category
Results

• Invented Tide Coldwater formula, reducing consumer energy use to heat wash water.

• Same great performance as regular Tide

• Up to $63 / year energy savings for the consumer

• 6% of US Kyoto protocol target if everyone washed in cold water
Sustainable Innovation

Pampers

Diaper Weight

<table>
<thead>
<tr>
<th>Year</th>
<th>Weight (g/diaper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>67</td>
</tr>
<tr>
<td>1990</td>
<td>59</td>
</tr>
<tr>
<td>1993</td>
<td>51</td>
</tr>
<tr>
<td>1997</td>
<td>47</td>
</tr>
<tr>
<td>2004</td>
<td>42</td>
</tr>
<tr>
<td>Tgt</td>
<td>38</td>
</tr>
</tbody>
</table>

More from Less

35% reduction in diaper weight since 1987 due to design and technology improvements

Packaging Weights

<table>
<thead>
<tr>
<th>Year</th>
<th>Weight (g/diaper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>7</td>
</tr>
<tr>
<td>90-94</td>
<td>5</td>
</tr>
<tr>
<td>95-96</td>
<td>4</td>
</tr>
<tr>
<td>97-99</td>
<td>3</td>
</tr>
<tr>
<td>2000</td>
<td>2</td>
</tr>
</tbody>
</table>

80% reduction in packaging weight
- Raw Materials - down 33,000 tons
- Energy - down 354,000 GJ
- Water - down 300,000 m³
Sustainable Innovation

2X Ultra: Laundry Compaction

Benefits

• 35% less packaging
• 44% less water in product
• 15% less energy to make, pack & ship

Annual savings

• Up to 33,000 tonnes of solid waste
• > 800 million kWh
• > 170,000 tonnes of CO₂
• > 150 million gallons of water
Sustainable Innovation
Charmin Mega Roll

- 144 million fewer cores
- 85,000 fewer gallons of diesel fuel
- 501,000 lbs. less film in landfills
The Consumer
Would you purchase green products?

Yes!
Consumers Do Not Expect to:

• Pay more for environmentally friendly products
• Give up any performance benefits
• Experience any added inconveniences
Consumers

- Their expectation is our Sustainable Innovation challenge
Sustainable Innovation
Social Responsibility

Improve quality of life,
especially for those
who need it most

Children’s Safe Drinking Water

PLC: Live, Learn and Thrive Initiative.
Reverse engineers municipal treatment using same ingredients

Robust removal of turbidity, parasites (>99.9%), viruses (>99.99%), and bacteria (>99.99999%)

Each sachet treats 10 liters

Production cost of $0.035 per sachet
Kenyan Drinking Water Samples

<table>
<thead>
<tr>
<th></th>
<th>Dam</th>
<th>Spring</th>
<th>Lake</th>
<th>Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity (NTU)</td>
<td>1850</td>
<td>55</td>
<td>37</td>
<td>1</td>
</tr>
</tbody>
</table>

The image shows a comparison of water samples from a dam, spring, lake, and treated water, with corresponding turbidity levels in NTU (Nephelometric Turbidity Units).
Results so far:

• >500 million liters of safe water
• Programs in 13 countries
• > 20 partnerships
• Clinton Global Initiative
Touching lives, improving life. P&G™