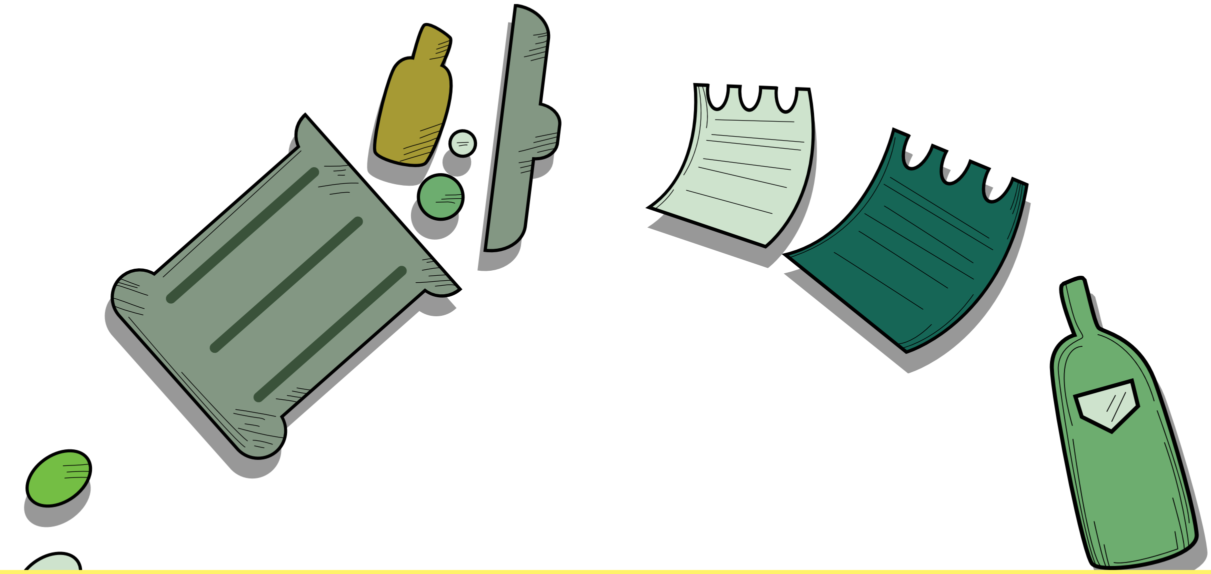
HOW WILL WE CREATE A FUTURE WITHOUT WASTE?



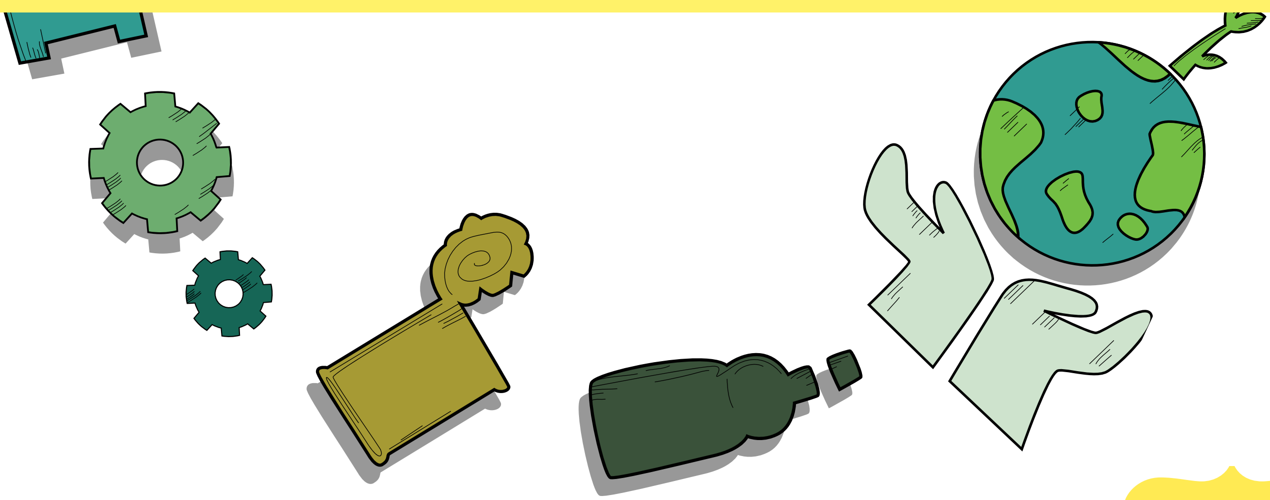
TERRACYCLE

Teacher's Guide

Grade: 6-8

Lesson: How will we create a future without waste?

Number of Class Periods: 5 45-minute periods



The Cloud Institute for Sustainability Education

HOW WILL WE CREATE A FUTURE WITHOUT WASTE?

Standards

<u>Common Core State Standards</u>

www.corestandards.org/the-standards/english-language-arts-standards

ELA

Grade 6

Reading: Informational Text – 1, 2, 3
Writing – 1, 2a, b, d, e, f, 4
Speaking and Listening – 1
Language – 1-6

Grade 7

Reading: Informational Text – 1, 2, 3
Writing – 1a, b, d, 2a, b, d, e, f, 4
Speaking and Listening – 1
Language – 1-6

Grade 8

Reading: Informational Text – 1, 2, 3
Writing – 1 b, e, 2a, b, d, e, f, 4
Speaking and Listening – 1
Language – 1-6

EfS Standards performance Indicators
Dynamics of Systems & Change

C. 18 Take responsibility for the effect (s) of their actions on future generations.

C. 28 Define how their own (or other peoples) actions affect the systems they are in.

C. 31 Reasonably predict intended consequences, and reasonably predict and prepare for unintended consequences.

C. 43 Recognize mental models and paradigms as guiding constructs that change over time with new knowledge and applied insight.

C. 47 Recognize/identify how mental models and paradigms affect current reality and create our futures.

Natural Laws and Ecological Principles

F. 7e Make a case for why global citizens should understand the basic natural laws and principles including: materials cycle.

Inventing and Affecting the Future

G. 2 Set goals; develop indicators (rubrics, checklists, quantitative measures) to measure the extent to which they are moving toward or away from their goals.

G. 6 Demonstrate the habit of turning problems into opportunities to make positive change.

G. 7 Make a contribution that solves more than one problem at a time and minimizes the creation of new problems. (Create value.)

G. 10 Demonstrate the use of different learning strategies to increase their ability to understand information and ideas.

G. 23 Embrace making change, improving, innovating, and experimenting.

G. 29 Be good at calculating and minimizing the risks they are taking.

EfS Enduring Understandings

1. A healthy and sustainable future is possible. We can learn how to live well within the means of nature.

2. We are all in this together. We are interdependent on each other and on the natural systems.

3. Healthy Systems have Limits. Tap the power of limits.

9. Read the feedback. We need to pay attention to the results of our behavior on the systems upon which we depend.

10. It all begins with a change in thinking. Thinking drives behavior and behavior causes results.

LESSON SUMMARY

Students learn about the Habits of a Systems Thinker and apply them to articles that explain how places and companies have already achieved "zero waste." They explore the Material Cycles hierarchy and apply this to their idea for eliminating "waste." In the end, students create a proposal that enacts either cradle-to-cradle design thinking or upcycling as its core principle, and results in the reduction or elimination of "waste."

OVERARCHING QUESTION

How will we create a future without waste?

GUIDING QUESTIONS

- What is waste?
- Can we live without waste? Can we continue to live with it?
- What are the Habits of a Systems Thinker?
- How have others successfully eliminated waste?
- Which of these habits most support the kind of changes and thinking necessary to adopt a zero waste mentality?
- What is cradle-to-cradle design?
- How do we deal with the stuff that's already in the system?
- Can I become a zero waste producer?

Resources/materials for this lesson:

Handouts: Habits of a Systems Thinker "One Pager"

Zero Waste stories (youth and corporate)

Cradle-to-Cradle explanation (teacher resource)

Cradle-to-cradle design template

Material Cycle Hierarchy (teacher and student resource)

LEARNING OPPORTUNITIES, ACTIVITIES, AND PROCEDURES

DAY 1

Day 1 Diagnostic:

1. Students respond to the following questions:
   - How will we create a future without waste?
   - Can we live without it?
   - Can we live with it? How do you know?
   - How can using the habits of a systems thinker help us to eliminate waste?

Note to teachers: The diagnostic should be reviewed to ascertain both students' thinking and needs, but not graded or marked in any way. Select readings and create working pairs or groups based on what is learned from reviewing the diagnostic.

2. Students examine articles about places that have successfully eliminated "waste." They track the Habits of a Systems Thinker that they notice in the story.
   a. Introduce Habits of a Systems Thinker Sets
   b. Engage students in matching Habits of a Systems Thinker to the article, using the two articles about student citizenship that follow. For each article, ask:
      - Which Habits of a Systems Thinker was/were practiced?
      - Which other Habits, if used throughout the experience, would have contributed to improved results?

Example 1:

Quincy High School, Quincy, Washington Students
Excerpted from: Miller, Elise, and Jon Sharpe. "When Youth Lead." Yes!, Spring 2003.
www.yesmagazine.org/25environmentandhealth/millersharpe.htm. Permission Pending.

Quincy is a small town in the heart of Washington state's wheat and potato country. . .
A string of chemical and food-processing companies lines the railroad tracks through town. When Quincy's mayor began uncovering a shocking story about fertilizer companies adulterating their products with toxic waste as a way of cheaply disposing of it, few believed her. When she began claiming that some land in Quincy was contaminated with waste, and then recruited an investigative reporter from the Seattle Times to substantiate her claims, many in the town were enraged at the mayor for stirring up trouble. The reporter, Duff Wilson, eventually discovered. . . companies throughout the US were exploiting legal loopholes to turn industrial waste into fertilizer. . . But the story began with a chemical waste pond near Quincy High School. No one knew exactly what was in it — perhaps not even the company responsible for it knew. . . .Eventually, U.S. Environmental Protection Agency scientists showed up in full chemical protection suits and began taking samples from the capped-over pond. . . .

When a group of Quincy students were looking for a local issue to research for a science class, their teacher suggested they study the waste pond. Although high school runners on the track had sometimes complained of fumes from the pond, the student researchers had never heard of the issue. When they learned of the investigation, they were skeptical and angry at the controversy stirred up. They wanted to check for themselves the validity of the scientific methods investigators had used, and their conclusions.

It is just this kind of project that Washington state's Youth Network for Healthy Communities (YNHC) encourages. Through this program, the Quincy students were connected via videoconferencing with university scientists. They prepared a presentation of their research for a panel of experts assembled at the University of Washington by the Center for Ecogenetics and Environmental Health. The panelists queried the students about their work, pushing the students to engage in critical thinking.

. . . They researched the chemicals involved in the leak, gathered documents from state and federal agencies, and scrutinized air sample analysis. Their research showed that the plume of contamination from the waste pond did not make a right-angle turn as scientists had predicted, but instead flowed straight under their high school.

One student, Camille Grigg, went to city hall to check correspondence between agencies and learn about the public process that led to the scheduled clean-up. Another student, Chelsea Dannen, checked what the government knew about the health effects. Her analysis of documents found that little was known.

At first the students refused to believe that school could be in session if the contamination were so bad. Rob Stagg, the science teacher who worked with the students, said, "They used to think that environmental issues were just dreamed up by people with an agenda and that if there were a real problem we would all know about it. Now they know that these issues involve real data and that most people will never know about the issues unless they look and listen for them."

The students concluded that much more research needed to be done about the health effects of the leak, and they learned something more: "They learned that it is within our power to become aware of these conditions, share their understanding with others, and influence actions taken to alter the conditions," said Stagg. He plans to continue working with YNHC in years to come, helping class after class of students to study the health effects of the chemical leak over the years, building a deep community understanding of the issue. Already, one of his students, Rose Gonzales, has analyzed the methods used to evaluate air quality samples collected by previous Quincy High School students working with Washington State University scientists.

For more information on environmental health efforts with young people, see the Center for Ecogenetics & Environmental Health (CEEH), http://depts.washington.edu/ceeh; Institute for Children's Environmental Health (ICEH), http://www.iceh.org; Project WILD, http://www.apialliance.org/wild.htm; and YMCA Earthservice Corps, http://www.yesc.org. The National Institute of Environmental Health Sciences funds the CEEH and the YNHC program.

Jon Sharpe is curriculum manager for the CEEH. Elise Miller is executive director of ICEH.

© By Rob Stagg
Camille Grigg and Chelsea Dannen analyze data.

Example 2

Board OKs CCA Students' Wetlands Plan
By Deidre Bello

Excerpted from: Bello, Deidre. "Board OKs CCA Students' Wetlands Plan." *http://www.press-citizen.com/news/030603cca.htm.* Permission Pending.

TIFFIN — A persuasive student presentation on the benefits of using wetlands to treat wastewater convinced the Clear Creek Amana School Board not to cut the design option from a new alternative learning center.

"It was a real experience for the students to participate in civic government," teacher Ellen Hartz said about the student's one-hour presentation. "I was so impressed."

The School Board's unanimous decision came after a February 20 presentation by eight students at ECHO Alternative High School. The students spent several months researching the septic system through consultations with local experts, said Hartz, an environmental and science specialist.

The wetland system uses plants to consume and remove solids from wastewater. It will have an estimated 10-year cost of $13,500, not including maintenance. Connecting to the city sewer system, by comparison, would cost $24,690 for the same period, students and school officials said.

In addition to cost savings for the school district, the wetland system could act as an educational tool. The school district is planning to use a $1 million grant from the state's Vision Iowa program and a matching bond issue to build a 4,800-square-foot learning center on 59 acres adjacent to the high school. The building will accommodate a maximum of 45 students and four teachers for ECHO, as well as before and after-school programs and continuing-educational programs offered by Kirkwood Community College.

DAY 2

HOW HAVE OTHERS SUCCESSFULLY ELIMINATED WASTE?

WHAT HABITS OF A SYSTEMS THINKER MOST SUPPORT A ZERO WASTE APPROACH?

1. Arrange students in pairs or triads, and assign one zero waste story, found at the end of the lesson, to each group (ensure that at least two groups use the same story).

   Note to teachers: Use the information from the diagnostic to help you determine best groupings and how to assign the stories.

2. Students use Post-Its to identify the Habits of a Systems Thinker at the points in the article where they are most evident.

   Note to teachers: Since students are working independently, a formative assessment moment may be well timed here. Review process, comprehension and application of the Habits of a Systems Thinker by sitting in on groups that need more focused attention, and scheduling 5-minute conferences with those who can be left more on their own.

3. Pairs and triads that read the same story now meet to compare and discuss the Habits that they connected. Though they do not have to change their responses, give them an opportunity to discuss any discrepancies so that their thinking is clarified and then allow revisions to be made, if desired.
4. Individually, students respond to the following questions on a worksheet:
   a. How would you describe the mindset of the company and/or the people in the article that you read?
   b. If they had continued without making any changes, what do you predict their story would have been?
5. Students post the articles they read placed around the classroom, now annotated to show Habits of a Systems Thinker. They do a "Gallery Walk," reviewing each other's work, noting similarities in the Habits that are evidenced by each story.
6. After they finish reviewing one another's work, use the following questions to spark discussion:
   a. Which of the Habits of a Systems Thinker seem to most support the kind of changes and thinking necessary to adopt a zero waste mentality?
   b. What do you predict the future will be like if the story that you read becomes common?
   c. What Habits of a Systems Thinker will be most necessary to the continued success of the zero waste approach that you read about?
7. Reflection – students respond to the following questions, individually:
   a. Which of the Habits of a Systems Thinker do you practice the most? What makes you say this?
   b. Which Habits do you think you may have to develop more? Why do they seem important to you?

DAY 3

WHAT IS "CRADLE TO CRADLE" DESIGN?

1. Use the Cradle-to-Cradle teacher's resource to help you explain the concept. Using the zero waste articles as a context, help students craft their own definition of "cradle-to-cradle design."

DAY 4

WHAT IS "UPCYCLING"?

1. Refer to the "Material Cycle Hierarchy" mini-lesson.
Remind students about the concept and practice of "cradle-to-cradle" design, which involves designing things well to be cycled again and again over time. Then, ask, "But, what do we do with the stuff that is already in here and wasn't designed to be continuously cycled?"
Record the student responses and share them with students by creating a piece of chart paper for each one, with the word and its description in the center. Post these around the classroom.

2. Chalk Talk activity (30 minutes):
   a. Divide the class into 4 groups, and give each student a marker.
   b. Assign each group to a poster.
   c. Using "chalk talk" strategy, without speaking, students add specifics to flesh out each concept – including words, phrases, questions, images, examples, etc. to each piece of chart paper. Encourage them to act as a team, building on things that others have written, but remind them not to talk. The purpose is to capture all of their ideas and examples about each term, connecting their own thinking to the ideas of others on their team, without discussing them.
   d. Have each group move to a different chart all together
   e. Once groups have had an opportunity to work with two charts, review each chart paper with the class. Note patterns, trends, connections, powerful images or ideas, etc.

3. Processing – Individually, students respond to the following question in writing:
   a. What do the articles we've read, the Habits of a Systems Thinker, and the terms from the Material Cycle Hierarchy make you think about in terms of your own life and the waste that you are responsible for?
   b. What kinds of "waste" do you, yourself, contribute to the system?
   c. Which of the actions – reduce, reuse, recycle, upcycle – would be the best strategy for you to use to eliminate waste from your own life?

DAY 5

CAN I BECOME A ZERO WASTE PRODUCER?

1. Consider the waste that results from the things you use every day. How might you use the concept of cradle-to-cradle or upcycling to bring you closer to being a "zero waste producer"? How would this help create a healthier future for you and others?

2. Develop a proposal for your idea.
   a. Include a rationale that explains in a very clear and persuasive way, why your idea is necessary (include important facts about the issue it addresses), what it will accomplish, what will be lost if it is not implemented.
   b. Explain the Habits of a Systems Thinker that will be required and supported by your plan.
   c. Define the costs of implementing your plan (consider time, materials, personnel, etc.).
   d. Explain the benefits associated with your plan.
   e. List others who could be involved.
   f. Describe your measures of success (How will you know that your plan is working? What evidence will you collect?).

3. End of experience reflection –
   a. Students revisit and revise their diagnostic, using a different color pen (How will we create a future without waste? Can we live without waste? Can we continue to live with it? How do you know?).
   b. They respond to the questions:
   c. How has your response changed?
   d. What do you think is responsible for the change(s)?
   e. What Habits of a Systems Thinker have you practiced during this activity?

Authenticity extension

- Create a community service campaign for your classroom, school or community that promotes the changes that you propose. Include before and after scenarios to persuade your intended audience to make zero waste their goal. If funding is needed, include a pitch to potential funders.
- Actually implement one or more of the campaigns and track the progress, using behavior over time graphs, photos, models and documentation of stories of change that you share publically with the intended audience. Celebrate the progress made.

EfS Assessment/Scoring Criteria

What do I need to collect or administer to prove that students have grown towards and/or achieved desired outcomes/standards?

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
C. System Dynamics and Change	C. 18	Processing reflections from Chalk Talk activity	Take responsibility for the effect (s) of their actions on future generations.
	C. 28	Proposal, Extension Campaign	Define how their own (or other peoples) actions affect the systems they are in.
	C. 31	Predictions	Reasonably predict intended consequences, and reasonably predict and prepare for unintended consequences.
	C. 43	Reflections on Systems Thinking Habits	Recognize mental models and paradigms as guiding constructs that change over time with new knowledge and applied insight.
	C. 47	Pre/post questions reflections	Recognize/identify how mental models and paradigms affect current reality and create our futures.
F. Natural Laws and Ecological Principles	F. 7e	Proposal rationale	Make a case for why global citizens should understand the basic natural laws and principles including: materials cycle.
G. Inventing and Affecting the Future	G. 2	Proposal indicators of success	Set goals; develop indicators (rubrics, checklists, quantitative measures) to measure the extent to which they are moving toward or away from their goals.
	G. 6		Demonstrate the habit of turning problems into opportunities to make positive change.
	G. 7	Extension Campaign plan and/ or implementation	Make a contribution that solves more than one problem at a time and minimizes the creation of new problems. (Create value.)
	G. 10	Pre/post questions reflections	Demonstrate the use of different learning strategies to increase their ability to understand information and ideas.
	G. 23	Final reflections	Embrace making change, improving, innovating, and experimenting.
	G. 29	Proposal costs and benefits	Be good at calculating and minimizing the risks they are taking.

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Common Core ELA Reading: Informational Text	Key Ideas and Details	Habits of a Systems Thinker activity, Chalk Talk activity	Grade 6 Students will: 1. Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text. 2. Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments. 3. Analyze in detail how a key individual, event, or idea is introduced, illustrated, and elaborated in a text (e.g., through examples or anecdotes). Grade 7 Students will: 1. Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text. 2. Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. 3. Analyze the interactions between individuals, events, and ideas in a text (e.g., how ideas influence individuals or events, or how individuals influence ideas or events). Grade 8 Students will: 1. Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text. 2. Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text. 3. Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories). Note to Teachers: Student attainment of enduring understandings can be monitored through the questions identified with (EU).

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Common Core ELA Writing	Text Types and Purposes	lesson reflections, written processing of Chalk Talk activity, Zero Waste proposal	Grade 6 Students will: 1. Write arguments to support claims with clear reasons and relevant evidence. a. Introduce claim(s) and organize the reasons and evidence clearly. b. Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text. c. Use words, phrases, and clauses to clarify the relationships among claim(s) and reasons. d. Provide a concluding statement or section that follows from the argument presented. 2. Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. a. Introduce a topic; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/ contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Establish and maintain a formal style. f. Provide a concluding statement or section that follows from the information or explanation presented. Grade 7 Students will: 1. Write arguments to support claims with clear reasons and relevant evidence. a. Introduce claim(s), acknowledge alternate or opposing claims, and organize the reasons and evidence logically. b. Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text. c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), reasons, and evidence. d. Provide a concluding statement or section that follows from and supports the argument presented. 2. Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/ contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Establish and maintain a formal style. f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Common Core ELA Writing	Text Types and Purposes	lesson reflections, written processing of Chalk Talk activity, Zero Waste proposal	Grade 8 Students will: 1. Write arguments to support claims with clear reasons and relevant evidence a. Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text. b. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence. c. Provide a concluding statement or section that follows from and supports the argument presented. 2. Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Establish and maintain a formal style. f. Provide a concluding statement or section that follows from and supports the information or explanation presented.
	Production and Distribution of Writing	lesson reflections, Zero Waste proposal	Grade 6, 7 and 8 Students will: 1. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Common Core ELA Speaking/ Listening	Comprehension and Collaboration	whole class and small group discussions	Grade 6 Students will: 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. b. Follow rules for collegial discussions, set specific goals and deadlines and define individual roles as needed. c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion. d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Common Core ELA Speaking/ Listening	Comprehension and Collaboration	whole class and small group discussions	Grade 7 Students will: 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly. a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. b. Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed. c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed. d. Acknowledge new information expressed by others and, when warranted, modify their own views. Grade 8 Students will: 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. a. Come to discussions having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.
Common Core ELA Language	Conventions of Standard English	lesson reflections Zero Waste proposal	Grade 6, 7,and 8 Students will: 1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. 2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. 3. Use knowledge of language and its conventions when writing, speaking, reading, or listening. 4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 6 (7 or 8) reading and content, choosing flexibly from a range of strategies. 5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings. 6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

HABITS OF A SYSTEMS THINKER

[2] Habits of a Systems Thinker cards ©2010 Waters Foundation, Systems Thinking in Schools.
To purchase a complete set of the Habits cards go to http://www.watersfoundation.org/webed/main/prod-desc/product-description.html

STUDENT RESOURCE
ZERO WASTE STORIES

Story 1

InterfaceFLOR, laying the foundations for better industrial practices
www.ellenmacarthurfoundation.org/business/articles/laying-the-foundations-for-better-industrial-practices
By Joss Breriot
August 20, 2010

A worldwide leader in modular commercial flooring manufacture, InterfaceFLOR now has a 15-year history in sustainable practice and expertise in Closed Loop model industrial application. InterfaceFLOR started considering sustainability as a pivotal element of its business model during the mid-nineties, when chairman Ray Anderson set his company a precise and bold target – to become the world's first sustainable business by 2020. Code-named Mission Zero, the set of guidelines designed to achieve that goal would impact on every business, manufacturing and design decision made. At the same time, InterfaceFLOR embarked on a journey to influence and inspire other businesses to adopt better practices. As the official company literature points out:

"InterfaceFLOR addresses sustainability on seven fronts. These involve eliminating waste and harmful emissions; maximizing use of renewable energy; recycling waste materials and reusing products; developing resource efficient transportation methods; creating a culture that integrates the principles of sustainability into working lives; and creating new models for businesses."

Facts

The progress made since 1996 is quite impressive in terms of impact reduction, as figures released in May 2010 show:

- Waste – 80% reduction in waste sent to landfill since 1996 per unit of production
- Water – intake in manufacturing is down 80% since 1996 per unit of production
- Total energy usage – down by 43% since 1996 per unit of production
- Non-renewable energy – down by 60% since 1996 per unit of production
- Greenhouse gas emissions – an actual reduction of 44% from a 1996 baseline

© InterfaceFLOR

Interestingly, and rather than simply sticking to a virtuous reduction effort, InterfaceFLOR has pioneered the Closed Loop model, designing products to be fed back into the production cycle at the end of their life. The Cool Green system feeds on manufacturing and carpet waste, thus dramatically reducing material flow and products that are sent to landfill. InterfaceFLOR's innovative approach has been examined by Ken Webster and Craig Johnson in 'Sense and Sustainability':

Ray Anderson, founder and Chairman of the billion dollar a year carpet company Interface, tells the story of the creation of his carpet tile product Entropy. David Oakey, head of product design at Interface, sent his design team into the forest with the instruction to find out how nature would design floor covering! 'And don't come back', he instructed, 'with leaf designs – that's not what I mean. Come back with nature's design principles.' So the team spent a day in the forest, studying the forest floor and streambeds until they finally realized that it is total chaos there: no two things are like, no two sticks, no two stones, no two anything… yet there is a pleasant orderliness in this chaos. They returned to the studio and designed a carpet tile such that no two tiles have the same face design. All are similar but all are different. Interface introduced the product into the marketplace as Entropy, and in 18 months the design was top of their bestseller list.

The Entropy tile, designed using a biomimetic approach, mimicking the way nature designs.

The advantages of Entropy were astonishing: almost no waste and off quality in production. The designers could not find defects in the deliberate imperfection of having no two tiles alike. Installers can put the carpet in quickly without having to take time to get all the pile net running uniformly. They could take tiles from the box as they came and lay them randomly, the more random the better – like a floor of leaves. Moreover, dye lots now merged indistinguishably which means sellers do not have to maintain an inventory of individual dye lots waiting to be used. Entropy is made with recycled content in a climate neutral factory; 82 of Interface's products are now designed on the principle of no two alike. These represent 52% of Interface's sales. Using principles like waste minimization and biomimicry has enabled Interface to bring the company's carbon dioxide emissions to roughly 10% of their 1996 levels.

Facts

The sun-trackers installed at the InterfaceFLOR Scherpenzeel production plant use motorized mirrors to direct natural light into the building throughout the day by moving with the sun. This reduces the need for electric lighting by 75% throughout the year.

Sources

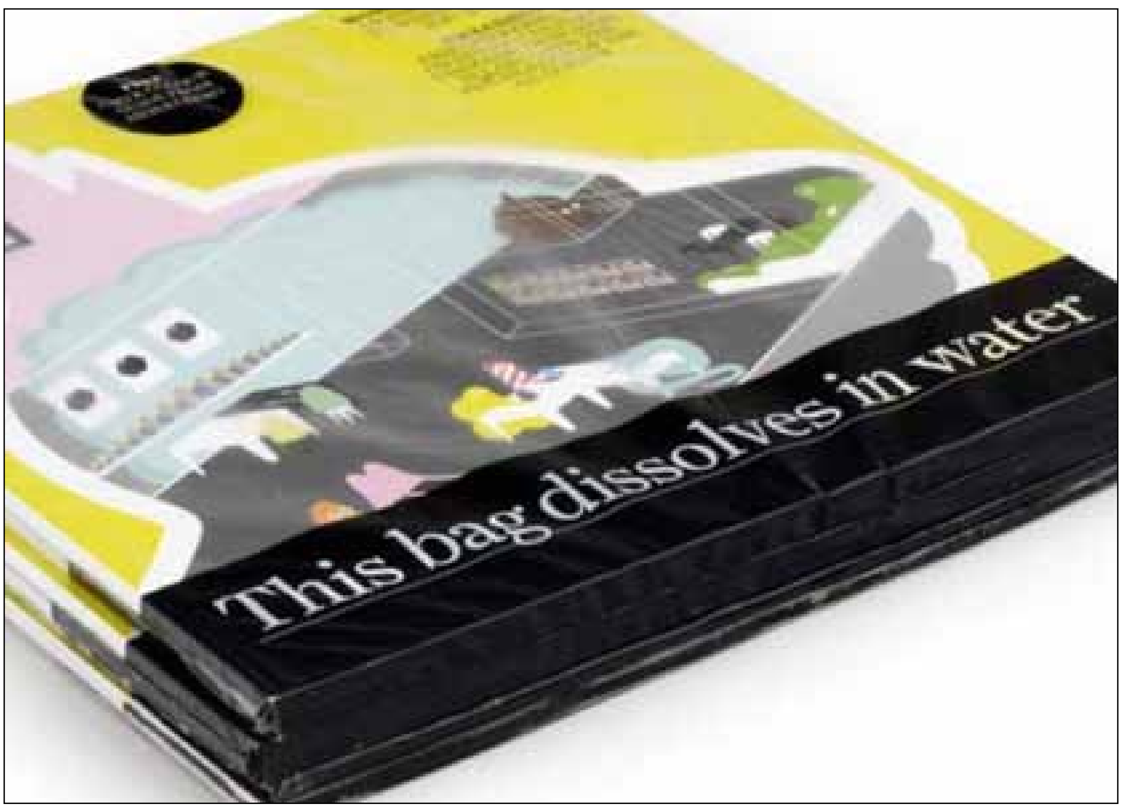
- InterfaceFLOR EcoMetrics
- Sense And Sustainability, Ken Webster and Craig Johnson
- State of the World 2008, Worldwatch Institute

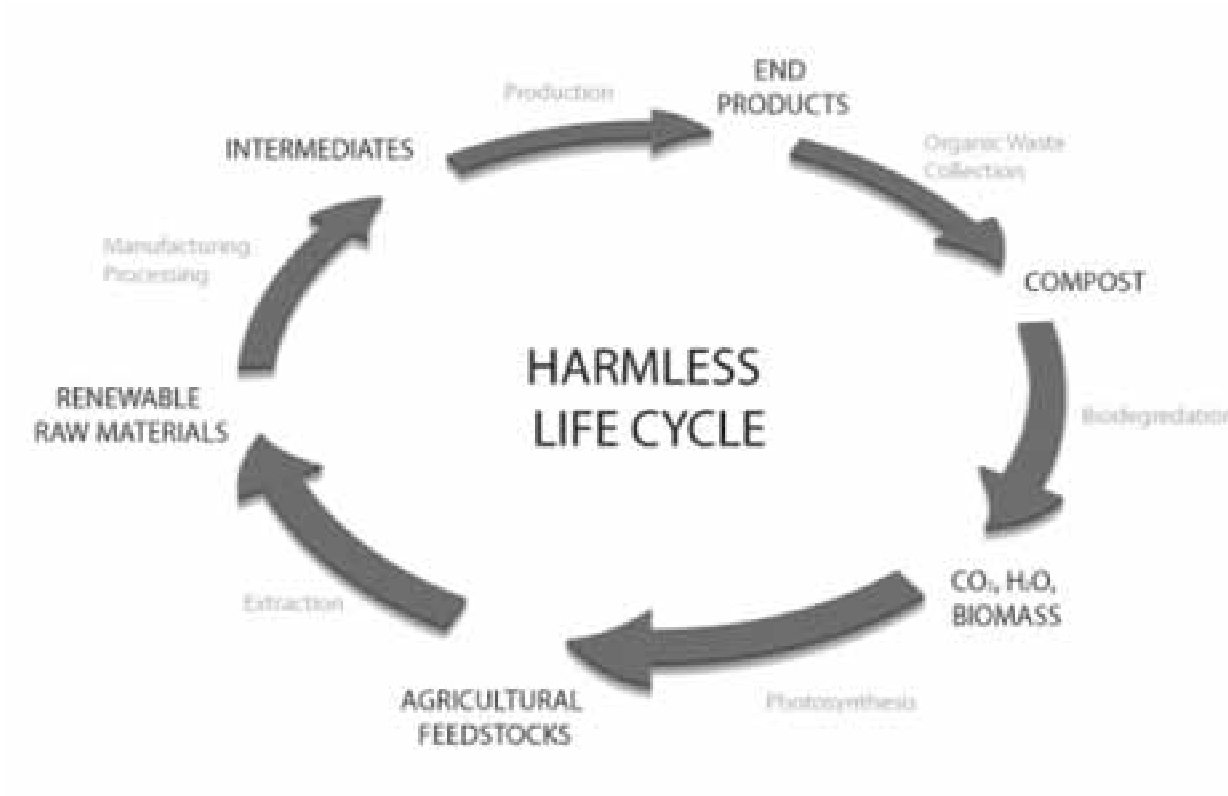
Story 2

Harmless packaging: wrap it up!
By Joss Breriot
August 20, 2010

Packaging…Who hasn't at some point been appalled by the quantity of materials that most of the "stuff" we buy comes wrapped in? From plastic-clad half cucumbers to plastic bag-sealed magazines, packaging amounts to more than 50% of all household waste. A UK company has decided to tackle the issue, not by going down the "less" route, but by making packaging better by design.

The name says it all – Harmless packaging is on a mission to change the current state of affairs, in a country where roughly 80% of the plastics we dispose of end up in landfill. By creating a range of dissolvable and compostable products, the company developed a closed-loop approach in order to meet its objective of creating products that *"start in the earth harmless and end in the earth harmless"*.





© Harmless Packaging

"To be classed 'compostable', a material must meet the stringent EN 13432 standard. The testing process involves mixing the material with organic waste and leaving it for 12 weeks under commercial composting conditions. After this time, the material must show evidence of being biodegraded due to microbial action. This means breaking down into water, carbon dioxide and biomass, rather than just breaking up into pieces, as degradable oil-based plastics do. To meet the standard, less than 10% of the remaining fragments are allowed to be larger than two millimeters.

The composted material is then tested for toxicity, to make sure it's suitable to grow food crops. Finally, it's sown with summer barley to check that it will support plant life."

The company has created a protective 'plastic' bag that dissolves in water, which was notably adopted by the surf gear brand 2Thirds, and developed compostable mailing envelopes for Nokia. Harmless's range includes corn-derived bubble bag and even fully degradable void-filling air pillows…"cheaper than LDPE (low-density polyethylene) equivalents", claims the company!

Go further…

Watch Harmless's bag dissolve here

Story 3

From Inspiration to Innovation/ Nike's Giant Steps Toward Sustainability

By William McDonough & Michael Braungart

This article originally appeared in the July-August 2002 issue of green@work.

Ever since Nike co-founder Bill Bowerman used a waffle iron to cook up a new sole for a pair of running shoes more than 25 years ago, innovation has been Nike's bread, butter, and glory, the not-very-well-kept secret of the company's enduring success.

Bowerman's waffle sole revolutionized the athletic shoe, bringing energy, creativity and new technology to a field that had been running in place for years. Suddenly, runners everywhere were trading in their worn out flats for fast, light-as-air Nikes. First out of the blocks, Nike never looked back. Several years after the premier of the waffle sole came the famed "Air" cushioning system. First introduced in running shoes, it stormed the basketball shoe market on the wings of Michael Jordan and became a standard of both high performance and street fashion.

Now Nike is applying its innovative spirit to a new standard of performance. In the early 1990s, when Air Jordans were all the rage, a small group of Nike's designers and managers were quietly exploring the idea of sustainable development. Centered in the Nike Environmental Action Team (NEAT), this cadre of pioneers began to study Nike's operations through the emerging lens of sustainability, asking questions that would ultimately transform the company's understanding of itself and its mission. What, they wondered, are the long-term environmental and social impacts of the athletic footwear industry? How does a company with annual revenues in the billions (over $9 billion in 2001) and more than 700 contract factories worldwide profitably integrate ecology and social equity into the way it does business, every day at every level of operation?

Inspiration and Ecological Intelligence

Sarah Severn, Nike's Director of Corporate Sustainable Development, led NEAT in its early years. Working closely with Heidi McCloskey, currently Global Sustainability Director for Apparel, and Anne Peirson-Hills, Senior Manager of Environmental Affairs, based at Nike's European headquarters, Severn sifted through emerging theories of sustainability and was drawn to the concepts that we have come to call cradle-to-cradle thinking.

Rather than trying to limit the impact of industry through the management of harmful emissions, cradle-to-cradle thinking posits that intelligent design can eliminate the concept of waste, resolving the conflict between nature and commerce. By modeling industrial systems on nature's nutrient flows, designers can create highly productive facilities that have positive effects on their surroundings, and completely healthful products that are either returned to the soil or flow back to industry forever. It's a life-affirming strategy that celebrates human creativity and the abundance of nature-a perfect fit with Nike's positive, innovative culture.

This was key for Severn. "So much of the environmental debate had addressed end-of-pipe problems and end-of-pipe solutions," she said. "And here was a strategy that was turning that on its head. It was not about restriction or reaction. It created positive solutions at the front of the design process. That meshes very well with the culture here. And it's an exciting message. If you talk about environmental management systems and eco-efficiency, people just roll their eyes. But if you talk about innovation and abundance, it's inspirational. People get very, very excited."

And get excited they did. Severn, McCloskey, and Peirson-Hills all began to feel that design for sustainability offered a compelling path to a new level of performance for Nike. Their enthusiasm was contagious. In 1996, just three years after the formation of NEAT, Nike contracted William McDonough + Partners to design a new, state-of-the-art campus for its European headquarters in The Netherlands. A complex of five new buildings, the campus was designed to integrate the indoors with the surrounding environment, tapping into local energy flows to create healthy, beneficial relationships between nature and human culture.

The buildings are organized around a central green and form four smaller courtyards around the perimeter, each landscaped with native plants. The orientation of the buildings and the window design maximize daylight while minimizing heat gain. Ground-source heat pumps use the constant temperature of the Earth for heating and cooling. On the roofs, cisterns collect 3.9 million liters of storm water annually for landscape irrigation and other greywater uses. Outdoors there are volleyball, basketball and tennis courts; indoors, a bistro and restaurant, sunlight and copious fresh air. In short, it's an exceptionally pleasant place to work, to connect with colleagues and friends, to come to know the surrounding natural world-to find inspiration.

Yet, as inspiring as Nike's European headquarters can be, the company soon understood that even the best facilities in the world would not change the design of their products. Could Nike integrate cradle-to-cradle thinking into product design, manufacturing, and customer connections, too?

Change and Integration

In the Nike culture, people tend not to flinch at the prospect of change. Like the elite athletes they serve, Nike's leaders are more likely to embrace a challenge and set new standards than look for easy excuses or piecemeal improvements. Sparks of inspiration flying up from new ideas about sustainable business had to be translated into action and innovation across the board, into long-term strategies, new common goals and novel ways of measuring success. Nike was changing yet again.

"We had come to see that our customers' health and our own ability to compete are inseparable from the health of the environment," said Darcy Winslow, one of the early leaders of the sustainability movement within the company. Product innovation and performance remained Nike's first priority, she said, "but our sense of design excellence had expanded to include a commitment to ecological intelligence, to fully understanding the impacts of our products on the natural world."

Nike's first steps toward ecologically intelligent product design began with materials assessments undertaken with McDonough Braungart Design Chemistry (MBDC). Together they sought to determine the chemical composition and environmental effects of the materials and manufacturing processes used to produce Nike's line of athletic shoes. Focusing primarily on Nike's global footwear operations, the process began with factory visits in China, where teams collected samples of rubber, leather, nylon, polyester, and foams to begin assessing their chemistry.

In this ongoing partnership, when Nike and MBDC identify materials that meet or exceed the company's emerging criteria for sustainable design, those components are added to a growing palette of materials that Nike will increasingly use in its products. These 'Positive List' ingredients are those designed to either be metabolized by nature's biological systems at the end of a product's useful life or be perpetually recovered and reutilized for new products. We call the former biological nutrients and the latter technical nutrients. Using natural flows of energy and nutrients as models, these product materials are designed to flow in closed loop cycles, eliminating the concept of waste while enhancing and replenishing both nature and commerce. Biological and technical nutrients, and the systems in which they flow, are the foundation of our concept of Cradle to Cradle Design SM.

Ultimately, Nike is working toward a cradle-to-cradle manufacturing and product life cycle system. Already, a two-phase collaborative effort between MBDC and Nike, launched in 2000, is setting new design guidelines and auditing all of the company's major material suppliers. Since 2001, research has focused on the chemicals used in the manufacturing process and the development of a list of materials that will comprise a positively defined materials palette.

"Our goal," said Winslow, "is to take responsibility for our product through its entire life cycle." To do so, Nike has begun to "align the life cycles of all its footwear, apparel, equipment, and accessories as closely as possible with natural cycles." When that goal is reached, Nike and MBDC will have identified a palette of chemicals and materials with wholly positive effects and designed systems for their perpetual retrieval and re-use. Products will then flow in discrete biological and technical cycles, nourishing the soil or circulating as high quality technical nutrients from producer to customer and back again.

Sound ambitious? It is. But, as we have seen, innovation is what Nike is all about. And the company's publicly stated corporate goals strongly suggest it means business. By 2020 Nike aims to:

"Eliminate the concept of waste in product design, using materials, energy, and resources that can be readily recycled, renewed or reabsorbed back into nature.

"Eliminate all substances that are known or suspected to be harmful to human health or the health of natural systems.

"Close the loop and take full responsibility for its products at all stages of product and process lifecycle, including the end of a product's useful life when consumers are likely to dispose of it.

"Develop financial structures that promote greater product stewardship in design, engineering, and manufacturing, as well as create new financial models to reflect the full cost of doing business.

New Directions

Many Nike leaders are energetically pursuing this new direction. As Ed Thomas, Director of Advanced Materials Research, said with typical Nike exuberance, "You've got to take the stake and you've got to plant it somewhere big and you've got to say that's what we're driving for. It's not just going more slowly. It's not just going to zero. It's actually turning around and picking a new direction."

Nike has responded to this self-imposed challenge with a series of far-reaching initiatives aimed at integrating principles of sustaining design into all its day-to-day operations. While ongoing learning programs usher sustainability into Nike culture, the company is also reaching out to its partners-from suppliers to factories to distributors-to develop "a driver of continual improvement" and "a common understanding of the goals of sustainability."

With its Management of Environmental Safety and Health program, for example, Nike has merged health and safety metrics with a Nike management model to create a framework for sustainability suitable for its Asian contract factories. Through a series of training workshops, Nike is helping factory managers and employees in four countries learn how to employ sustainable work practices and eliminate the problematic impacts of manufacturing athletic shoes and apparel.

What has all this training added up to? It is difficult to measure the impact of a cultural shift within a company, and harder still to measure the impact of such a shift on a company's supply chain. But Nike's systematic effort to develop a positive materials palette has begun to produce tangible results, such as the phasing out of polyvinyl chloride (PVC).

PVC, commonly known as vinyl, is a cheap, durable material widely used in building construction and a variety of consumer products, including toys, apparel and sporting goods. As Nike's web site explains, the vinyl chloride monomer used to make PVC is a suspected carcinogen, while incineration of PVC can result in dioxin emissions. MBDC is also very concerned about the many problematic additives commonly used in PVC.

After two years of scientific review, Nike set its sights on the elimination of PVC from footwear and non-screenprint apparel by the end of 2002. In Spring 2002 Nike highlighted two of the company's PVC-free products, Keystone Cleats and Swoosh Slides, as a way to begin a dialogue with consumers about its PVC-free commitment.

Another example of positive materials development at Nike is its increasing use of organic cotton in its apparel products. By 2010 Nike plans to use a minimum of 5% organically grown cotton in all cotton apparel and will introduce its first collection to incorporate 100% organically grown cotton this Fall. A key element of the cotton program is the positive perspective that drives it. "When we looked at what type of beneficial impact we could have on the environment," said Heidi McCloskey, "organic cotton was a key area."

Unlike many apparel manufacturers, Nike is aware that nine of the most toxic pesticides are used on cotton, producing a huge amount of groundwater contamination and community pollution. From a responsible business perspective, those are costs no company would want to bear.

As McCloskey says: "By taking responsibility for the chemicals and materials that make up Nike's products and designing out the things that have long-term cost to people's health and the environment, we're in a much better business position." In the case of agricultural products like cotton, designing in positively defined cotton fiber is, in effect, designing out toxic characteristics and larger negative impacts. For example, by 2000, Nike was purchasing nearly 1 million pounds of cotton annually from organic farmers. This positive alternative to managing the use of toxic pesticides helps build a safe, new industry, provides a quality product to customers, and creates a new niche market for Nike.

Ongoing Challenges

As promising as all these changes are there is still much work to do. While the integration of sustainable design principles continues at a remarkable pace, sustainability has yet to truly find a home in the minds of all of Nike's designers. "The task of taking design concepts that are new and complex and putting them into the repertoire of all the decisions a designer has to make in a hectic environment is extremely challenging," said Bill Malloch, General Manager of Footwear Sustainability.

"Nike's in-line designers understand the concepts of sustainability but they don't necessarily know how to apply them today," he explained. "We hope, in the next couple of years, that we will be able to simplify sustainability into core ideas that allow designers to consistently make the right decisions."

There are also the challenges surrounding the management of more than 700 contract factories worldwide. No one is quite certain how to guarantee that every producer is using materials selected from Nike's preferred palette. The story of Keystone Cleats and Swoosh Slides, however, suggests that successfully monitoring product materials is certainly within reach, and could well lead to a deep and profitable understanding of Nike's vast supply and manufacturing network.

Managing materials presents some of the same logistical challenges Nike is facing in its management of labor practices in the factories of its suppliers. These efforts can go hand in hand; as Nike implements its palette of positively defined, healthful materials it creates healthier workplaces and communities.

Though questions abound, we have no doubt that Nike can reach its ambitious goals. It has already shown, time and time again, its ability to turn inspiration into fruitful action. It will do the same as it takes on each new challenge on the path to sustainability. As Nike VP Tinker Hatfield said, the company's discovery of the concepts of sustainable design "woke up this sleeping giant."

"It is a wonderful thing," he said, "for us to take this aggressive, ambitious, powerful group of people…and just change that basic level of expectation to a better place."

We agree. And whether the once-sleeping giant is now striding along in Swoosh Slides, Air Jordans, or organic cotton socks, we've been delighted to see it rise to its feet.

Story 4

Climatex Lifecycle, a Cradle to Cradle certified fabric, available to consumers
By Joss Breriot
August 20, 2010
www.ellenmacarthurfoundation.org/business/articles/case-study-climatex-lifecycle-a-cradle-to-cradle-certified-fabric-available-to-consumers

Swiss firm Rohner produces the Climatex Lifecycle biodegradable fabric, used extensively in the office furniture manufacturing business. The material is compostable, and true to the C2C founding principle of "waste = food". "The team decided to design a fabric that would be safe enough to eat", stressed William McDonough.

A new product, a new business model integrating social responsibility.

The Climatex Lifecycle fabric, a good product whose formula is now freely accessible – when environmental and social values meet. © Climatex

When carrying out the initial research to create the first 100% biodegradable synthetic fabric ever produced, the team asked suppliers for the composition of their ingredients in order to assess their degree of healthiness. Not surprisingly, they came up against the "secret recipe" argument but eventually Ciba-Geigy agreed to play the game. Out of the 8000 or so elements analysed, only 16 were selected, but that was enough to base a complete fabric line upon. Resulting commercial success proved huge and by 2002 Climatex Lifecycle accounted for a third of Rohner's approximately $8 million in revenues.

As surprising as it may seem, the company eventually decided to share this valuable asset, allowing the entire fabric industry to use the Climatex Lifecycle production process free of charge.

The key facts and figures resulting from this C2C approach are as follows:

- By 2002, Climatex Lifecycle accounted for a third of Rohner's approximately $8 million in revenues (source: Investor Environmental Health Network).
- Drastically reduced waste disposal costs, Rohner no longer have to pay to send trimmings to be burned at a Swiss-regulated incinerator or to Spain.
- Scraps of the all-natural product were made into a feltlike material and sold to local farmers and gardeners for use as mulch or groundcover.
- Overall production costs were lowered, by eliminating the need for filtering of dyes and chemicals in the production process.
- Regulators inspecting the factory were "astounded to realize that the water coming out of the factory was as clean or cleaner than the water coming in from the town's drinking water supply" (source: Investor Environmental Health Network).

"It had been seven years since we developed Climatex Lifecycle, and in that time, to our knowledge, no one else has developed a 100% safely biodegradable fabric, although there was a big interest in it. It's not really green thinking if we just hold that information secret. It's a good product that everyone should use."

Bonnie Sonnenschein, corporate marketing manager for DesignTex

Story 5
Victor Innovatex: Transforming the Textile Industry

The North American textile industry is taking a beating. In 2001 alone, nearly 67,000 textile workers in the United States lost their jobs. Industry giants such as Burlington and Guilford Mills filed for bankruptcy, while more than 100 U.S. and Canadian plants shut down. As the value of Asian currency continued its freefall, U.S. textile exports dropped for the sixth straight year and industry leaders pleaded with Congress to help slow the wave of cheap apparel flooding the market.

Worldwide, textile producers face other challenges. The industry that launched the Industrial Revolution has long illustrated some of its most notorious design failures. About one half of the world's wastewater problems are linked to the production of textile goods, and many of the chemicals used to dye and finish fabrics are known to harm human health. Often, the clippings from carpet or fabric mills are so loaded with dangerous chemicals they are handled like toxic waste, while the products made from these materials are considered safe for use in the home.

The crisis in the textile industry reverberates widely. More than 32 million people worldwide work in clothing manufacturing plants. Millions more work in mills producing the fabrics that surround us, such as seating, drapes, and carpeting. In short, the industry's material flows affect nearly everyone: From the vast appetite of its supply chain-including one third of the production of the chemical industry-to a distribution network that spans the world, textiles are quite literally woven into the fabric of life. It's an industry crucial to the human prospect and in dire need of innovation.

This is not news to Alain Duval, president of Victor Innovatex, a family-owned and run contract fabric producer headquartered in Saint-Georges, Quebec. Duval has been working in the textile industry since he was a boy, when he sorted wool for recycling in his grandfather's mill. Upon assuming leadership of the company from his father in the early 1980s, Duval saw that Victor would not survive if it continued to produce woolen goods for the commodities market-a market in which it would always be undersold by manufacturers in countries with a steady supply of low cost labor. Instead, Duval focused the company on manufacturing high-quality fabrics for the contract furniture market. Melding Victor's heritage as a lean manufacturer to an increasingly strong interest in new technologies and environmental responsibility, Duval staked the company's future on an ethic of innovation within a well-defined market niche.

His bet paid off. Victor has not only survived the economic crisis in the textile industry, it has flourished, continuing to prosper while becoming a recognized industry leader in ecologically sound design. In 2001, Victor introduced Eco-Intelligent™ Polyester, the first polyester produced and dyed with all environmentally safe ingredients, including a new catalyst that replaces the heavy metal antimony, a known carcinogen. Developed in partnership with MBDC (www.mbdc.com) and its German sister company EPEA (http://epea-hamburg.org/index.php, Eco-Intelligent Polyester is designed to be safely recycled into new fabric at the end of its life, with none of the hazardous by-products of traditional polyester recycling. It is a truly revolutionary fabric-a healthy alternative for the textile trade and a signal of hope for human industry.

Polyester and the Future of Recycling

This breakthrough in polymer design could have an enormous impact on the textile industry. Polyester is a key synthetic fiber. Its high performance and durability make it the world's most popular polymer. Roughly 11 million tons of polyester are produced each year, one half of the total annual production of all synthetic fibers. Polyester is also recyclable. In fact, polyester recycling is so common, and so widely perceived as environmentally sound, it is now de rigeur for fabric manufacturers to carry a recycled polyester product. Industry also uses reclaimed polyester for fuel, as do the poor in many Third World countries.

Unfortunately, traditionally produced and recycled polyester is far from optimal. Most polyester is manufactured using antimony as a catalyst. Along with being a carcinogen, antimony is toxic to the heart, lungs, liver and skin. Long-term inhalation of antimony trioxide, a by-product of polymer production, can cause chronic bronchitis and emphysema. Other by-products include mill wastewater tainted with antimony trioxide, which leaches from polyester fibers during the high-temperature dye process. Recycling polyester, another high-temperature process, creates the same wastewater problems; burning it releases antimony trioxide into the air. Indeed, the conventional manufacture of polyester is so riddled with harmful chemicals a recycling strategy that does not redesign the whole process could not hope to do anything but recapitulate toxic events.

Current recycling practices for nearly all materials tend to be high-tech waste management strategies for low quality products. Rather than regaining valuable materials for perpetual reuse in high quality goods, much recycling is actually downcycling, a reduction in the value of material over time. The recycling of plastics, for example, often mixes different polymers to produce a hybrid of lower quality, which is then used to produce something amorphous and cheap, such as speed bumps-a spiraling loss of value that ultimately ends in the landfill. And, as we have seen, recycling of this kind is often a toxic process.

Eco-Intelligent Polyester changes the story. By starting the design process at the molecular level, MBDC and EPEA were able to analyze every ingredient in polyester and choose dyestuffs, auxiliary chemicals, and a catalyst that are safe and environmentally sound. This creates the opportunity to transform recycling from a costly waste management strategy into a system that eliminates the concept of waste.

Here's how. When product design begins with the selection of healthful ingredients, materials such as Eco-Intelligent Polyester can be safely and perpetually used, reclaimed, and reused in high quality products. In fact, closing the loop on material flows in this way only makes sense if the material is designed to be ecologically safe. Otherwise, the closed loop cycles become contaminated with toxic chemicals, triggering health concerns and a downward spiral in value. But when design begins at the molecular level, synthetic products can be conceived as technical nutrients, which are materials specifically designed to "feed," or be returned to, industrial systems without any harmful effects. Materials made from natural ingredients can be designed as biological nutrients, which can be safely returned to the earth. From this perspective, industrial waste is no longer problematic. Instead, waste equals food. Products designed as food, or nutrients, for technical and biological systems are the future of effective recycling.

An Energetic Industry Leader

Eco-Intelligent Polyester is the first textile designed as a technical nutrient. It's no surprise it emerged from Victor Innovatex. Victor is a small company with a tradition of quality manufacturing, sound environmental management, and strong, collaborative relationships with its customers. During the 1990s it incorporated new spinning and high speed weaving technologies, a responsive product development process, and customer service goals all targeted toward becoming a leaner, faster, more efficient company. These innovations, paired with Victor's energetic cultivation of the contract furniture market, led to extraordinary growth for the company.

Victor's goal, however, was "not to grow big" but to work closely with its clients to "do big things." The opportunity to do a truly extraordinary thing came in 1999, when one of Victor's customers, Susan Lyons of DesignTex, approached the company about developing with MBDC and EPEA an ecologically intelligent synthetic textile, a technical nutrient. Here was an opportunity to further differentiate the company within its market niche while developing a stronger partnership with one of its key clients. It was also a chance, said Victor's Marketing Manager, Janelle Henderson, "to do the next great thing."

"We are very good at being lean," she said. "We raised the bar on lean manufacturing. We raised the bar on quality and consistency. But the time had come to take the next step."

For Henderson, and for Victor's leadership, developing an innovative polyester designed to maintain high value through many product life-cycles-a source of food for industrial systems-felt like a sensible leap. "When you eliminate the concept of waste you eliminate all the problems associated with conventional industrial production," she said. "For us, the idea that 'waste equals food' just makes sense."

So Victor took the next step, engaging MBDC and EPEA in the design of its new polyester. The firms began by identifying an environmentally sound catalyst to replace antimony. They had been seeking a new polymer catalyst since discovering during the design process of a new shower gel that antimony was leaching from the gel's plastic packaging into the product itself. By the time their work with Victor began, they knew of effective alternatives and specified for Eco-Intelligent Polyester a titanium- and silica-based catalyst with no toxic effects.

Next, MBDC and EPEA analyzed all the dyes and auxiliaries Victor used in the manufacture of polyester, trimming a list of 57 chemicals to 15. Of those, several were replaced with more environmentally sound chemicals, polishing off a new, totally safe palette. The chemical assessment and material evaluation guidelines of the MBDC Protocol are now being used by Victor's designers and engineers and have become part of an ongoing design process geared to producing fabrics with wholly positive impacts on human and environmental health.

From Performance to Partnerships

We sometimes call Eco-Intelligent Polyester "the polyester environmentalists can love." But it's also a polyester Victor's designers, engineers, sales people and executives can appreciate. Along with being optimized for environmental safety, Eco-Intelligent Polyester offers all the performance benefits of conventional polyester. There are no limitations on color choice and it can be woven in any jacquard pattern in a great variety of styles.

While designers love the aesthetic values, Victor's executives think Eco-Intelligent Polyester simply makes good business sense. Developing the new fabric, said Alain Duval "was perfectly in line with our 'lean thinking' philosophy, yet it was even more advanced." The new protocol, he said, extended thoughtful consideration of materials throughout the design process, from sources in the supply chain to the impact on the earth of "every aspect of the product and the manufacturing process." As a result, Victor has been able to satisfy the needs of its customers-furniture manufacturers such as Steelcase, as well as textile distributors DesignTex, Carnegie and C.F. Stinson-for cutting edge solutions to environmental problems.

Eco-Intelligent Polyester might be of only passing interest if it were Victor's lone environmentally safe product. But the company's leadership has taken bold steps to fulfill the promise of their new fabric, launching a series of initiatives to integrate ecologically intelligent design at every level of the business. Engineers are applying the MBDC Protocol to product design; Victor's facilities are increasingly using energy from renewable sources; marketing efforts are built on communicating the benefits of products that go beyond waste reduction to benefit the environment at all phases of their life cycle; and strategic efforts throughout the company are building partnerships with other businesses that share Victor's vision.

Together, these efforts add up to a product development process Victor calls its Eco-Intelligence Initiatives (EII). As Sales and Marketing Director Jean Francois Gagnon said, product development is "not just about the product."

"Yes, Eco-Intelligent Polyester is a wonderful fabric," he said. "But in designing and producing new fabrics we also want our manufacturing process to meet the highest environmental standards, we want to tap into the knowledge and passion of our designers and engineers, and we want to develop partnerships with like-minded companies. The environmental agenda has to be shared."

Thus far the partnerships that support the expanding EII product line have yielded Eco-Intelligent Polyester and Climatex® LifeguardFR TM, a fabric woven of organically grown, compostable fibers. While the new polyester is a technical nutrient, Climatex LifeguardFR, produced in collaboration with the Swiss textile mill, Rohner, is a biological nutrient designed to be safely returned to the earth after use. This pair of new fabrics makes Victor the first company ever to produce and market both a biological and technical nutrient, a landmark in ecologically intelligent design.

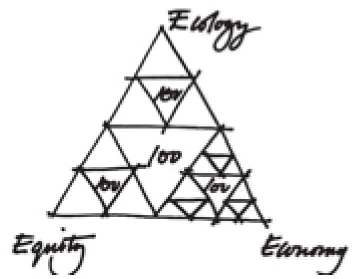
As Gagnon makes clear, Victor could not have achieved this pioneering role alone. Victor cannot sustain it alone either. By developing environmentally sound fabrics it has taken the first, crucial step toward safely closing the loop on the flow of industrial materials. Building a system for the reclamation of those materials is a challenge for the entire industry.

It's a challenge some are accepting. Textile makers, fabric distributors, and furniture manufacturers have already begun to come together to explore the design of a take-back program for textile recycling. Though some in the U.S. textile industry dismiss the idea, we see hopeful precedents. The automotive industry, for example, has begun to appreciate the economic benefits of reusing valuable materials and is already moving toward implementing take-back programs. In Europe, the reclamation of automotive materials is the law. As other industries follow suit, companies such as Victor will be perfectly positioned to offer value-added materials designed for safe reclamation and re-use. A further step could include making polyester from renewable resources, transforming it into a fully biodegradable material that flows in biological cycles.

What we're talking about here is nothing less than The Next Industrial Revolution. Can textile manufacturers, with their enormous influence on the world economy, recover from their current woes to lead this transformation of human industry? We think Victor Innovatex is showing how they might. Clearly, North American apparel makers are in for an uphill battle as they compete with inexpensive imports in the commodities market. But if restructuring is the order of the day, why not reshape the textile industry following the lead of successful companies, such as Victor and Rohner, that are creating economic value with innovation, intelligence and good design? Wouldn't it be fitting and delightful if the constructive, 25-year discussion of environmental issues birthed by Rachel Carson's Silent Spring were directed by business leaders toward product quality? Imagine the textile industry renewed by the insights of ecology. Imagine industrialized nations projecting their strength through the export of life-affirming products that bring economic, social, and ecological value to the entire world. Instead of a legacy of toxic materials, low wages and ecological destruction, let's build on today's innovations and create a legacy of nutritious materials, prosperity and health for all species.

TEACHER RESOURCE

Cradle to Cradle Implementation
By Bill McDonough, www.mbdc.com



Starting at the Bottom

In action, the Cradle to Cradle® framework can be applied to assessing the human and environmental health characteristics of materials throughout their life cycles, product recyclability/biodegradability, effectiveness of product recovery and recycling, renewable energy use, water stewardship, and social responsibility, as well as optimizing any current weaknesses.

The primary application of Cradle to Cradle by MBDC, to date, has been under the principle of "Eliminate the concept of waste" or "Waste equals food." In order to understand whether materials can be safely cycled as 'biological nutrients' and 'technical nutrients,' they should be evaluated for their human and environmental health characteristics, from production through use and post-use disposition, and recyclability/compostability:

First, each material must be broken down into its individual ingredient chemicals (e.g., a printing ink can contain a pigment, defoamer, surfactant, resin/polymer, wax, solubilizer, antioxidant and other additives). Simply knowing the type of material usually is insufficient for a full evaluation of material health. For example, knowing something is "high-density polyethylene" or a "printing ink with non-chlorinated pigments" does not identify the various additives that may be combined with the base material and typically are the most critical in determining the human and environmental health attributes of the finished material. Collaboration with and education of the supply chain is critical to this inventory effort, in order to fill in the proprietary gaps not covered by Material Safety Data Sheets (MSDS). The ingredient data collection effort quickly can mushroom into numerous vendors and months of calendar time.

Second, each ingredient must be evaluated for its known or suspected human and environmental health hazards throughout its life cycle, by analyzing peer-reviewed research studies of the pure chemical's attributes against Material Evaluation Criteria.

Third, the chemical 'profile' as a pure chemical then is placed into the context of the chemical's use within a material application. This 'in-situation' (or 'in-situ') assessment may alleviate some of the ecotoxicity concerns associated only with the pure chemical.

Finally, the 'in-situ' chemical assessments are combined together to develop an assessment of human and environmental health characteristics for a complete material and/or finished product, across their entire life cycles. In addition, the material's recyclability/compostability is evaluated, based on its own physical properties, irrespective of the relative availability of infrastructure for closing the loop or the Federal Trade Commission definition of 'recyclable.'

Ingredient Optimization and Beyond

Using completed material assessments, product developers can select ingredients that are safe for human and environmental health and fully recyclable/biodegradable. In cases where materials fall short, alternative formulations should be researched collaboratively with vendors. A manufacturer also should explore various strategies for fully recycling or biodegrading its product, which often requires connections with external partners, such as customers, retailers, recyclers, public agencies, and nonprofit organizations. Fully closing the loop on materials requires their safe recovery and reformulation into new products or biodegradation into the soil.

In order to "Power with renewable energy" or "Use current solar income," the final manufacturing process and vendors' manufacturing should be powered by 100 percent renewable energy (e.g., solar, wind, low-impact hydroelectric, biomass) produced on-site, purchased directly from a utility, or offset with Green-e Certified Renewable Energy Certificates (REC).

In an effort to "Respect human & natural systems" or "Celebrate diversity," manufacturers and their vendors should ensure they are using as little water as possible and ideally keeping that water within closed loops. In addition, water released to the environment should be of at least the same quality as before it was removed from a water source, to promote ecosystem and watershed health. Social responsibility should guide relationships with workers, local residents, customers, vendors, the larger business community, the government and other stakeholders.

Cradle to Cradle optimization may not be achieved easily or quickly, and may require continuous improvement over time. For example, performance and cost considerations also may prevent preferred solutions from coming into use in the short term, but at least manufacturers are prepared with an eco-effective solution once other market conditions are met. The Cradle to Cradle goal may take a long time to completely realize for a particular product or industry, but designers, material fabricators and manufacturers should accept the challenge, establish a trajectory toward this ideal, and begin to implement strategies to help them achieve it. Leveraging this expanded notion of 'good' design will help create materials and products that benefit the company, its stakeholders and the environment.

Value of the Approach

Optimized sustainability requires an organization to reorient its goals and strategies, employ innovation and creativity, prevent problems and waste from being created in the first place, utilize more comprehensive metrics, and engage all stakeholders in both the vision and implementation of a positive future.

Characteristics of Cradle-to-Cradle Design or Redesign

From GreenBlue / McDonough-Braungart Design

We have read several case studies of companies that are revolutionizing the design of materials so that we can eliminate the notion of waste completely. **Cradle to Cradle Design** is a form of "biomimicry" (Biomimicry is the science and art of emulating Nature's best biological ideas to solve human problems www.biomimicry.net or www.asknature.org In this case, Cradle to Cradle Design mimics the materials cycles on Earth (rock cycles, water cycles, nitrogen cycles, etc.)

Materials that come from nature can cycle through the biological or "bio" cycle. Materials that people have made that nature can't cycle through the bio-cycle, can cycle through the "techno" cycle in which people create recovery systems to continually cycle those materials so that they are never wasted and contribute to our well being over time.

Design or Redesign of: ____

Market/Economic:

Social Benefit:

Human/Ecological Safety:

Renewable Materials:

Renewable Energy:

Design for Resource Recovery:

Actual Resource Recovery:

Teacher and Student Resource

Glossary of Terms and Mini Lesson

One day soon, all materials will be designed to continuously cycle, contributing to our well being every time they cycle around. We will have eliminated the concept of waste all together. Until then, we are surrounded by "stuff" that we have to figure out what to do with. Here are our choices:

REDUCE: Tap the power of limits! Limit the number of purchases that you make, and the amount of stuff you use in the first place. Be conscious of your consumption of materials and choose wisely. The more we reduce our over-all consumption of stuff, the less materials we have to cycle. This saves the most energy, time, money and biological capacity.

REUSE: Use materials again and again for the same or different purposes, and avoid having to send them through the materials cycle. Examples include reusing or repurposing items like glass bottles or yogurt containers and turning them into vases or planters.

RECYCLE: Extract the materials that make a product to make a new product using those materials. http://terracycle.net/recycling

Typically a piece of waste can be seen as two things: the material it's made from and the shape it is in. For example a chip bag is made from plastic and is in the form of a bag. If one were to melt a chip bag into a plastic product it would be considered recycling.

UPCYCLE: Use every aspect of waste as value.
http://terracycle.net/upcycling

Typically a piece of waste can be seen as two things: the material it's made from and the shape it is in. For example a chip bag is made from plastic and is in the form of a bag. If one were to upcycle a chip bag one would be leveraging both aspects and not destroying any part of it.

TERRACYCLE'S MATERIAL CYCLE HIERARCHY

1. FLEXIBLE PACKAGING: Bags, envelopes, pouches, sachets, wraps, etc., made of easily yielding materials such as film, foil, or paper sheeting which, when filled and sealed, acquires pliable shape. These packages are typically sent to a landfill. These are options for the waste stream (1 is most desirable, 5 is least):

1. Upcycle add value by using the material as (e.g. using candy wrappers to make a tote bag)
2. Reuse (for instance using a yogurt cup and making into a planter)
3. Dissemble/recycle – creating plastic pellets –to use as plastics
4. Incinerate
5. Send to landfill

2. RIGID MATERIALS. These materials are made by one polymer and are very sturdy, such as a plastic soda bottle or a yogurt container. These are options for the waste stream (1 is most desirable, 5 is least):

1. Reuse the material for the same use, such as using a soda bottle to hold vermicompost or reusing a glass milk jar to hold water.
2. Dissemble/Recycle it (melt the polymers and recycle them, like we do with our soda bottles today)
3. Incinerate
4. Send to landfill

3. COMPLEX HYBRID MATERIALS. These materials are made by more than one polymer, causing multiple waste streams. These are options for the waste stream (1 is most desirable, 5 is least):

1. Upcycle/reuse: Re-purpose the product into a value added product (such as turning old eye glasses into a chandelier).
2. Incineration
3. Send to landfill