

01 | PROJECT OVERVIEW (Plastics Use Reduction in Medication Delivery)

GOAL

Biogen is seeking to drastically reduce plastic use as part of its **Healthy Climate, Healthy Lives™** campaign, a \$250 million, 20-year initiative that outlines its commitment to climate, health, and equity.

With growing evidence that plastics take a toll on both human and planetary health, **Biogen is seeking to identify viable plastic alternatives throughout its global operations**, from packaging to its therapy suite, to R&D and manufacturing.

SCOPE

Biogen wants our H-Lab team to do a **targeted assessment of ways the company can reduce the use of plastics** in the development and delivery of its advanced therapies.

This includes **creating a strategic sustainability framework** that it can use to assess its own products, using the **AVONEX® Pen** as a case study.



02 | EVALUATION

SUSTAINABILITY FRAMEWORK

I. SCOPE

What product lifecycle phases are we including in the scope of this project?

- Sourcing
- Design
- Packaging & Distribution
- Usage
- Disposal

II. FUNCTIONAL UNIT

What functional unit(s) should we use in our assessment?

- Dosage of AVONEX®

III. IMPACT CATEGORY

What kind of impact do we want to have?

- Reduce Plastics
- Reduce Carbon Footprint

IV. BENCHMARKING

How are we measuring our impact?

- # of Plastic Bottles "Replaced" (Baseline)

LIFE CYCLE ASSESSMENT: CRADLE-TO-GRAVE CONSIDERATIONS

← MORE CONTROL

LESS CONTROL →

1 Sourcing

What other raw materials should be considered when taking in consideration the full LCA?

3 Packaging

What primary and secondary packaging options should be considered for optimization or environmental impact minimization?

5 Usage

Which changes can be made while maintaining patients' safety and adherence?

2 Design

How should we change the design to be more sustainable using the concept of circular economy?

4 Distribution

What benefits can be obtained from changing transportation and distribution, given changes in design and packaging?

6 Disposal

What is the reduced impact that we can achieve, given global/local regulations?

BENCHMARKING EXAMPLE: PLASTICS

KEY TAKEAWAY: Choosing a common baseline/metric to compare different proposed initiatives can help Biogen more clearly communicate the impact of those initiatives to different stakeholders.

of WATER BOTTLES IN PLASTIC LANDFILLS

METRICS:

- One 16 oz water bottle weighs 0.5 oz
- 3.1 oz of CO2 released per 1 oz of ABS²
- 2.9 oz of CO2 released per 1 oz of PET (polyethylene terephthalate)³

3.2M ABS BOTTLES DISPOSED ANNUALLY

AVONEX® PEN ASSUMPTION:

- 1 AVONEX® Pen has 0.4 oz of ABS.
- Biogen has 7.1K MS patients.
- 3,602,000 AVONEX® Pens are used annually.
- ~3.2M ABS plastic bottles disposed annually.

LANDFILL ASSUMPTION (Impact of plastic released to the environment):

- % of waste that goes to landfills & ratio of landfill to incinerated waste
- US: 52.6% & 4.23 (2018)⁴
- EU: 26% & 1.19 (2018)⁵
- JP: 8.9% & 0.127 (2018)⁶

COMPETITOR BENCHMARKING: DASHBOARD

		SOURCING		DESIGN		PACKAGING & DISTRIBUTION		USAGE & DISPOSAL	
	Conduct LCA to Assess Impact	Aim for Deforestation-Free Sourcing	Adhere to Sustainable Design Guidelines	Reduce Single-Use Plastics	Find Plastic Alternatives	Audit/Screen Suppliers re: Sustainability Standards	Optimize 2nd/3rd Packaging	Improve Recycling Initiatives	Aim to Reach Zero "Waste to Landfill" Status
BIOPEN									
Pfizer									
Amgen									
GSK									
Sanoft									
Hillipore									
Sigma									
MSD									
AstraZeneca									
BMS									
Genentech									
J&J									
Novartis									
Regeneron									

CRITERIA CHECKLIST

CRITERIA	DESCRIPTION
User Experience	<ul style="list-style-type: none"> How does the proposed solution affect the patients' and/or caregivers' experience (including ease of use)? Ex: Multi-use pen introducing additional complexity of use; new design lowering adherence, etc.
User Safety	<ul style="list-style-type: none"> How might the proposed solution compromise user safety in administering the medication? Ex: Alternative materials not being durable enough to maintain product integrity; new design introducing increased risk or possibility of device misuse, etc.
Costs vs. Environmental Gains	<ul style="list-style-type: none"> How expensive is the proposed solution compared to the environmental gains defined by Biogen's goals and targets?
Impact Category Prioritization / Outcomes	<ul style="list-style-type: none"> What impact categories will the proposed solution primarily address? Does this align with Biogen's sustainability priorities? Ex: A new initiative reducing plastics but inadvertently increasing the use of conflict minerals or other materials
Brand Reputation	<ul style="list-style-type: none"> Could the proposed solution be harmful in any way to the reputation of the product or company?
Regulatory Requirements	<ul style="list-style-type: none"> Are there regulatory restrictions in place that limit the implementation of the solution? Ex: Regulations preventing recycling of any medical waste, regarding combination products and design, etc.
Stakeholder Agency / Involvement	<ul style="list-style-type: none"> What portion of the responsibility of solution implementation depends/falls upon other various stakeholders? How will Biogen's suppliers, partners, patients, etc. ultimately be affected?
Operations / Processes Management	<ul style="list-style-type: none"> How might the proposed solution affect Biogen's current supply chain management practices? How might it affect its operations, processes and relationships with its 3rd party suppliers, vendors, etc.?
Market Reception / Adoption	<ul style="list-style-type: none"> Is the market willing to adopt the proposed solution, and if so, how quickly? What new financial, social or behavioral hurdles will need to be addressed?
Adherence to Targets / Goals	<ul style="list-style-type: none"> How does the solution adhere to: 1) global or national sustainability goals, such as the UN's SDG; 2) broader pharma/healthcare industry sustainability goals, including those of Biogen's competitors; and/or 3) Biogen's own sustainability goals?

03 | FINDINGS & NEXT STEPS

POTENTIAL SOLUTIONS MATRIX

SOLUTION	DESCRIPTION	BENCHMARKING	FEASIBILITY
SOURCING Alternative Raw Materials	<ul style="list-style-type: none"> Introduce plastic substitutes for packaging and injectors that are 'bio-benign' to avoid leakage of microplastics into the environment (World Economic Forum et al. 2016, 18). Ensure material strength can guarantee product safety and integrity. Consider shelf-life and longevity of material, among other criteria. Examples: PE or PET made from sugarcane, post consumer regrind (PCR), biodegradable products (cardboard), PLA (polylactic acid), mushroom-based plastic, polyhydroxybutyrate (PHB) bioplastic, etc. 	<ul style="list-style-type: none"> # of Water Bottles Replaced / Pen # of Trees or CO2 Reduced / Pen 	Medium
DESIGN Multi-Use AVONEX® Pen	<ul style="list-style-type: none"> Develop auto-injector that can store and deliver multiple doses Involves design alterations in order to contain increased volume of medication Potentially introduce smart, electronic devices that can administer many doses with refills 	<ul style="list-style-type: none"> # of Water Bottles Replaced / Dosage 	Low
PACKAGING & DISTRIBUTION Strategy Change	<ul style="list-style-type: none"> Adjust the way AVONEX® Pen is currently packaged and distributed, either by adjusting number of injectors shipped per package, changing shipping frequency, or exploring more efficient methods Impact category mainly carbon emissions, not plastics reduction 	<ul style="list-style-type: none"> Net Amount of CO2 Reduced Amount of CO2 Reduced / Shipment 	High
USAGE Method of Dosage Delivery	<ul style="list-style-type: none"> Consider alternative, more efficient methods of home-delivery New method must still administer via intramuscular injection Regulatory approval may limit design modifications 	<ul style="list-style-type: none"> # of AVONEX® Pens or Water Bottles Replaced / Dosage 	Low
DISPOSAL Recycling Strategy	<ul style="list-style-type: none"> Handle the disposal of the AVONEX® Pen after usage directly Requires a new form of retrieval method for product Introduce separable components in autoinjector to split disposal of sharps and plastics component 	<ul style="list-style-type: none"> Net # of Water Bottles "Recycled" / Pen 	High

RECOMMENDATIONS & NEXT STEPS

01

OUTLINE A HOLISTIC PLASTICS REDUCTION STRATEGY

- Conduct Life Cycle Assessments (LCAs)** in key product lines or production plants to understand the impact of the final products and the materials used. Create a baseline, metrics and goals by product line or plant.
- Develop or Strengthen a Sustainable Design Team** to minimize the disposal of waste and plastics into the environment, introducing eco-design principles (cradle-to-grave). Secondary packaging is not regulated and can be optimized in size, weight, thickness and alternative materials.
- Target to Become "Plastic Neutral,"** which means that the company recycles as many optimized plastics as it releases to the environment.

02

CONDUCT IN-DEPTH PRODUCT & POTENTIAL SOLUTION ASSESSMENTS

4. Conduct In-Depth Assessments of the Potential Solutions presented, using the "Criteria Checklist."

Collaborate with **suppliers** to develop a road map for the implementation of **new technologies** and co-fund the development of early stage innovations and technologies to speed market availability.

Use **recycled materials**, carbon dioxide-based polypropylene carbonate (PPC) materials, or design reusable devices.

Engage and **collaborate with suppliers**, as Ypsomed did to develop autoinjectors with an environmental commitment.

03

SEEK BROADER INDUSTRY COLLABORATION

5. Consider Starting a Collaborative Effort with Other Stakeholders and Biotech/Pharma Companies to increase the reach of Biogen's initiatives and impact. Since climate change is a pressing issue, the industry should start looking to collaborate on the matter.

A united front can have more impact in the technology and innovation of new materials and in discovering the best usage of alternative materials to guarantee patient safety.

Some investments (recycle facilities, R&D for new materials, etc.) or offset possibilities (build solar panel fields, plant trees, etc.) can be much more impactful if driven by industry collaboration.

Biogen can also collaborate as a united industry with environmental agencies (i.e. EPA) to further develop and support the creation of laws that can benefit the handling of disposable materials.

PROJECT DESCRIPTION

Biogen is seeking to drastically reduce plastic use as part of its Healthy Climate, Healthy Lives™ campaign, a \$250 million, 20-year initiative that outlines its commitment to climate, health and equity. Over the course of the semester, our H-Lab team focused on **creating a strategic sustainability framework** that Biogen can use to assess the sustainability of its products against its environmental targets, using the **AVONEX® Pen** as a case study. The ultimate goal of the project was to equip Biogen with a list of tools, criteria and considerations it could use to figure out which sustainability "impact categories" it should prioritize (i.e. plastics reduction, carbon emissions reduction, etc.), what product lifecycle or system boundaries it should set, what types of assessments and proxies it should deploy, and what sustainability pharma trends it should be aware of. Final project deliverables included a competitive analysis, strategic sustainability framework, sustainability assessment and metrics examples, and further recommendations and next steps.