WOMEN IN ENGINEERING 2021
SUSTAINABILITY ACTIVITY
Sustainable Fashion

Lifeboats

Introduction:

The RNLI uses very high specification technical clothing made by the clever clothing engineers and specialists at **Helly Hansen**. This clothing is designed to keep our Lifeboat Crews dry and warm when they are "out on a shout" and to protect our Lifeguards when they are helping people to stay safe on the beach and in the sea.

Whilst we don't all wear this type of clothing, most of us will have a cotton t-shirt in our cupboard or wardrobe. However, have you ever thought about all the steps that are involved in the production of that simple item or what impacts it has created in the environment?

Well - This challenge will give you the opportunity to learn more about it and hopefully come up with your own ideas on how to reduce any negative environmental impacts in future. You can also complete our practical challenge by upcycling an old t-shirt into something amazing, unique and new!

What is the challenge?

1. Complete the 4 Life Cycle Analysis tasks and record your findings and thoughts on the Lifecycle Analysis Template provided.
2. Complete task 5 which is to take what you have learned and using an old cotton t-shirt research, design and create a prototype of a new zero waste upcycled product, item or even a piece of art.
3. Share what you learn with family, friends, teachers, classmates and make sure you share it with us at the RNLI too.

What you will need:

Lifecycle Analysis Template provided with activity (Tasks 1-4)

Old cotton t-shirt (Task 5)

Pens, Paper

Scissors, Glue

Sewing needle and thread.

Method:

What is a Life Cycle Analysis?

Life Cycle Analysis (LCA) is a method used to evaluate the environmental impact of a product through the process steps in its lifecycle, encompassing extraction and processing of the raw materials, production, transport, use and end of life.

Tasks 1 to 4 – Research and thinking

Look at the Process Flow – Life Cycle Analysis and Resources sheet and as you complete the 4 research tasks use the Lifecycle Analysis Template provided to jot down:

1. What facts did you find during your research?
2. What are the environmental impacts?
3. What ideas and options you think there may be for eliminating or reducing any negative environmental impacts in the future?

Stages	Research facts	Environmental impacts	Ideas of ways negative environmental impacts might be eliminated or reduced
1. Raw material analysis	•	•	•
2. Production analysis	•	•	•
3. Transport analysis	•	•	•
4. Use and end of life analysis	•	•	•

Task 5 – Applying what you have learnt

Look back over your analysis and highlight or summarise what the key things you have learned are. Use what you learnt to help inform Task 5 which is your design and upcycling of your own t-shirt.

LET'S GET STARTED!

Task 1. Raw material analysis

Think about the resources that go into growing the cotton for the fabric and thread.
Cotton (the Raw Material) is grown in various countries around the world and uses resources including water which can have impacts on the environment. Your first task is to research and find out where and how cotton is grown, how much water is used and add the information you find out to your Lifecycle Analysis sheet. Then think about how any negative environmental impacts could be eliminated or reduced and add your ideas.

Growing Cotton	Activity
Growing cotton needs - land, nutrients & maybe fertilizers, pesticides, and herbicides too. Artificial fertilisers, pesticides and herbicides can have impacts on wildlife and habitats. The cotton seed may also be from a source known as Genetically Modified Organisms (GMO).	Research where and how cotton is grown and what the environmental impacts of growing cotton are.
Water	**Activity**
Water is needed to both grow the cotton and during the processing of it into a t-shirt. The use of water can impact on the availability locally and wildlife.	Research how much water it takes to grow cotton and to produce a t-shirt. Where does the water that comes out of our taps come from?

Task 2. Production analysis

Think about how is the cotton is processed and actually made into a t-shirt.
To produce a t-shirt, different substances are added and wastes produced, energy is used and different types of packaging may be used. Your second task is to research the production process and packaging and add the information you find out to your Lifecycle Analysis sheet. Then think about how any negative environmental impacts could be eliminated or reduced and add your ideas.

Production	Activity
This starts from opening the bales of cotton, opening the pulp, cleaning it, mixing, carding, combing and spinning the cotton into yarn. Dying the yarn can involve bleaching, dyes and chemicals to fix the colour, then it is moved onto drying. Energy and potentially more chemicals are also used to, cut, weave, knit and transform cotton yarn into fabric and wastes such as damaged materials and effluent will also be produced during these processes. This fabric is then cut into the pattern pieces to make a T-shirt, sewn together and possibly ironed, these processes use energy which produce carbon emissions and will produce wastes too.	Research how a t-shirt is made, what substances are added and what wastes are produced.
Energy	**Activity**
Energy is needed to operate production equipment and for heating and cooling. Using energy which is mainly electricity and gas, can create Greenhouse Gas Emissions also known as collectively as carbon emissions or CO^2e. These emissions contribute to climate change. Use of renewable energy can create lower or zero carbon emissions.	Research how the use of electricity, and gas can contribute to climate change. How do different types of renewable energy technologies work?
Packaging	**Activity**
The T-shirt is then put into packaging some of which might be single use plastics, paper, card or material and often transported to a warehouse ready to be sold, often by a Wholesaler, to a shop or online retailer.	Research different types of packaging and what their environmental impacts are.

Task 3. Transport analysis

Think about how many times transport is involved.
During its lifetime, the t-shirt materials and finished product can be transported over many hundreds or even thousands of miles using fuel. Your third task is to work out the potential impacts of different types of transport and add the information you find out to your Lifecycle Analysis sheet. Then think about how any negative environmental impacts could be eliminated or reduced and add your ideas.

Transport	Activity
Transporting materials and good by Plane, ship, train, lorry, and van create different levels of carbon emissions over the same distance and can also create air pollution via exhaust emissions.	Research how many times and how many miles the cotton might be transported from where it is grown to where it is made into a t-shirt, sent to a distribution centre, delivered to the shop/online retailer and finally the customer. What environmental impacts do different forms of transport have?

Task 4. Use and end of life analysis

Think about what happens to the t-shirt during its life and what might happen at the end of its life.
Washing clothes, use of detergent and wastewater all have an impact on the environment. Applying the principles of the Waste Hierarchy when thinking about end-of-life options for wastes, can help to reduce the amount of waste sent for disposal. Your 4th task is to find out what impacts different types of detergent have on the environment and what can be done with clothing at end of life. Add this information to your Lifecycle analysis sheet. Think about how any negative environmental impacts could be eliminated or reduced.

Use	Activity
Once you have finally got your t-shirt you will probably wear and wash it many times. Washing clothes uses energy, water and detergent. Different types of detergent can have different chemicals and/or natural ingredients in them which can create different impacts on the environment. During the washing process tiny micro fibres from your clothes come free and are washed away with the dirty water. Natural fibres will eventually breakdown but fibres from plastic based materials like fleeces, Nylon and Lycra do not, and can enter the environment causing pollution and impacts on wildlife. Wastewater is treated at a Sewerage Treatment plant before being discharged back into the environment. This process uses energy, water and bio-organisms and may use some chemicals, however it does not capture the tiny micro fibres released during washing.	Research what is in different types of detergent and how microfibres can have an impact on the environment. Research how a sewerage treatment plant works. Estimate how many times you might wear and wash your t-shirt before you get rid of it.
End of life	**Activity**
The best way to get the most from clothing is to look after it and ensure it is worn for many years. However, once your t-shirt gets to the end of its life what are your options? The Waste Hierarchy can help you consider what these might be.	Research the Waste Hierarchy and what the options for a t-shirt are. Think about what you and your friends currently do with your clothing at end of life.

Task 5. Upcycling challenge

Use the knowledge you have gained from tasks 1 to 4 to complete the practical upcycling challenge below.
Safety – Please take care if using anything that may cause injuries and ask for help if needed.

Step	Upcycling Activity
1	Find an old t-shirt and research ideas for how you could upcycle it into something new, trying to have no waste material at the end. It doesn't have be clothing it can be anything you like. Maybe you could use it to create a solution to reduce a negative environmental impact you found in your research and analysis, maybe you could cut it up into shapes or strips and reassemble it in a whole new way, you might even make a piece of art with a specific message about the environmental impacts of a t-shirt or something else that interests you.
2	Draw your design and create any templates to help you plan how you will go about creating your new item. You could create a story board or display and include your ideas, drawings and pictures to show others.
3	Create your product "prototype" from your t-shirt to help you work out the best way to do it. Jot down any issues or challenges that you overcame or that you might work on if you did it again. Think about what will happen to your new upcycled item when it gets to end of life e.g. what might its 3rd life be?
4	Write up what you did, how you did it, what you learnt and include pictures of your new Upcycled product. Show your family, teachers and classmates your upcycled item and story board/display alongside your Lifecycle 4-point analysis, to show what you have leant.

What this teaches us:

This challenge has been designed to spark curiosity and critical thinking around sustainability in our every day lives.
I hope it helps give you an insight into our world!

The next step…….

The below links may be useful during your research for the challenge and will also help to encourage a greater thought process before buying new in the future.

1. Raw material analysis

- Growing cotton - Environmental impacts of cotton production – Using less land to grow more cotton
- Fertilizers, pesticides and herbicides
- Use of water in the cotton lifecycle
- Genetically Modified Organisms (GMO) – bt GMO Cotton
- Greenhouse Gas Emissions collectively known as carbon emissions or CO^2e
- Climate Change
- Air pollution.

2. Production analysis

- How is a cotton fabric made? – Sustainable Cotton from field to fashion
- How are t-shirts made? –
- Environmental impact of a cotton t-shirt
- The Lifecycle of a T-shirt
- Packaging

3. Transport

- Compare the carbon emissions from travelling 1,000 KM by different methods –
- Which transport method has the smallest carbon footprint?

- T shirt journeys/distribution

4. Use and end of life analysis

- Detergents
- Micro fibres
- Sewerage treatment plants
- Waste Hierarchy – Changing clothing's environmental impact
- Clothing – reuse, upcycling, recycling, incineration – disposal to landfill

How this links to the RNLI:

My name is Anna Frizzell, I am the RNLI Sustainability Manager. I am part of the WinE team because I believe we need to encourage girls and women to contribute to solving our global and RNLI specific engineering and sustainability challenges.

We would love to see how you got on with the challenge so please send any photos you don't mind us sharing on our webpage to womeninengineering@rnli.org.uk (please note that we will require consent to share these photos and an automated email will be sent requesting consent).

WELL DONE FROM ALL OF US AT THE RNLI AND HELLY HANSEN!