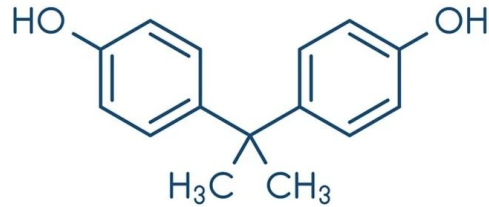




Bisphenol A Pollution from Wind Turbines

Tim Smith 13/07/2023

What is Bisphenol A?



bisphenol A

Bisphenol A (BPA) is a chemical produced in large quantities for use primarily in the production of polycarbonate plastics and epoxy resins.

“Bisphenol A is the most toxic substance we know”

- Swedish Environmental Protection Agency

New Regulations

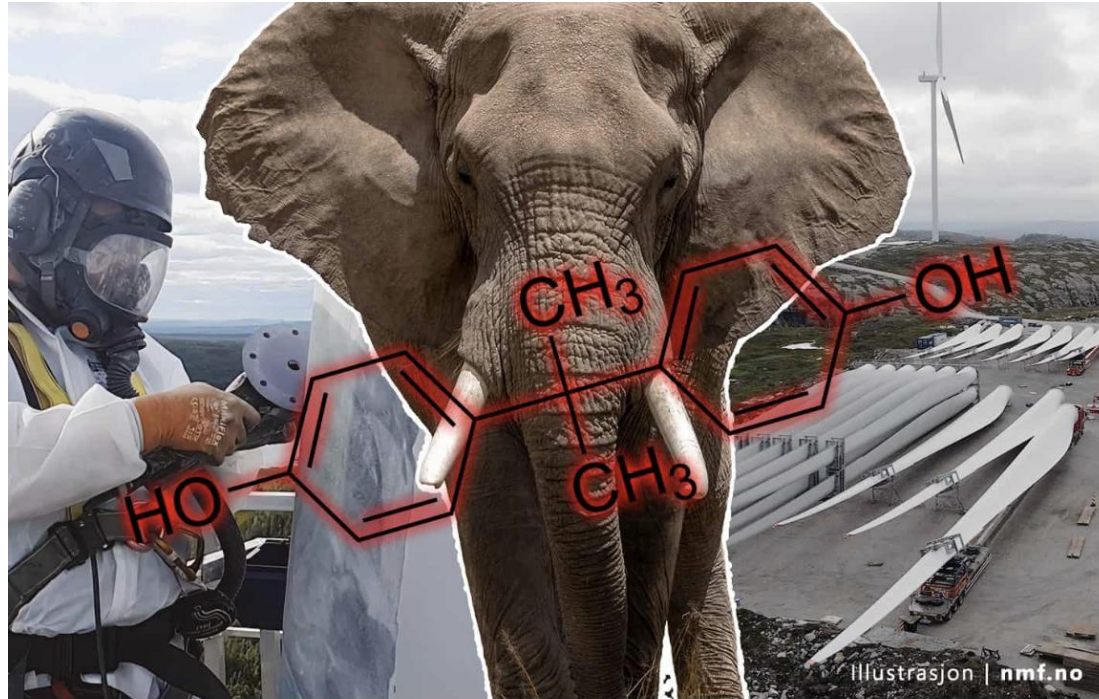
The infographic features a central red diamond with the text "NEW EU HAZARD CLASSES 2023!!". The background includes the European Union flag and four laboratory flasks containing liquids of different colors (blue, yellow, green, red), each with a skull and crossbones hazard symbol. Four callout boxes are connected to the diamond by thin lines, listing hazard classes: "Endocrine Disruption for Human Health" (top-left), "Endocrine Disruption for the Environment" (bottom-left), "Very Persistent, Very Bioaccumulative" (top-right), and "Very Persistent, Very Mobile" (bottom-right).

NEW EU HAZARD CLASSES 2023!!

- Endocrine Disruption for Human Health
- Endocrine Disruption for the Environment
- Very Persistent, Very Bioaccumulative
- Very Persistent, Very Mobile

Avoid release to the environment!

The Elephant In The Room



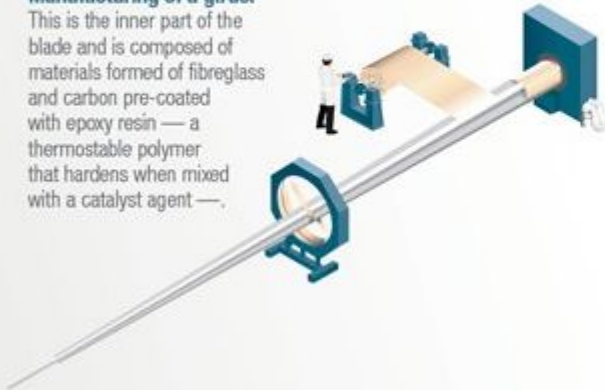
Wind Turbine Blade Construction

MANUFACTURING

1

Manufacturing of a girder

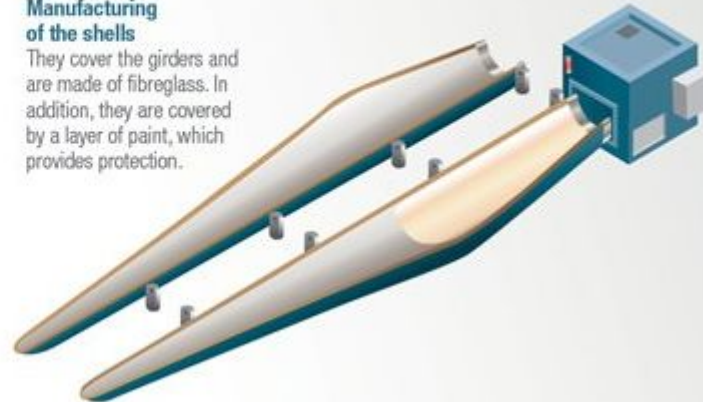
This is the inner part of the blade and is composed of materials formed of fibreglass and carbon pre-coated with epoxy resin — a thermostable polymer that hardens when mixed with a catalyst agent —.



2

Manufacturing of the shells

They cover the girders and are made of fibreglass. In addition, they are covered by a layer of paint, which provides protection.

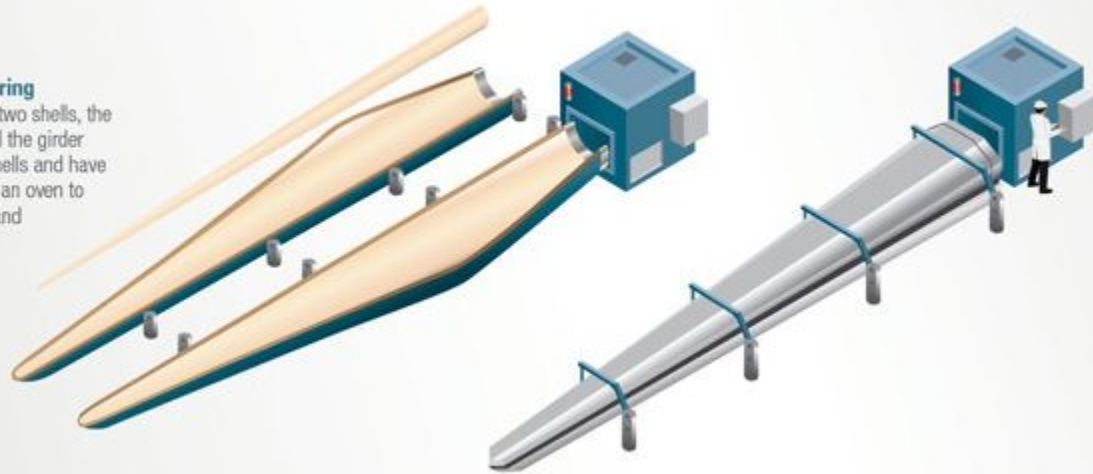


Wind Turbine Blade Construction - cont

3

Assembly and curing

After obtaining the two shells, the next step is to bond the girder between the two shells and have them pass through an oven to form a single firm and strong structure.



Wind Turbine Blade Construction - cont

4

Finishing

Once the leading and trailing edges of the blade are finished, the structure undergoes a new inspection prior to the blade being moved to its destination wind farm.



TRANSPORTATION AND INSTALLATION

The blades of a wind turbine are very heavy, massive structures. The blades of the **Wiking** offshore wind farm, for example, have a length of 67.5 m. They require **specialised forms of transport** that are capable of loading these structures and carrying them to their destination. At the destination, **an experienced team of people** assembles the blades and the rotor on the nacelle.

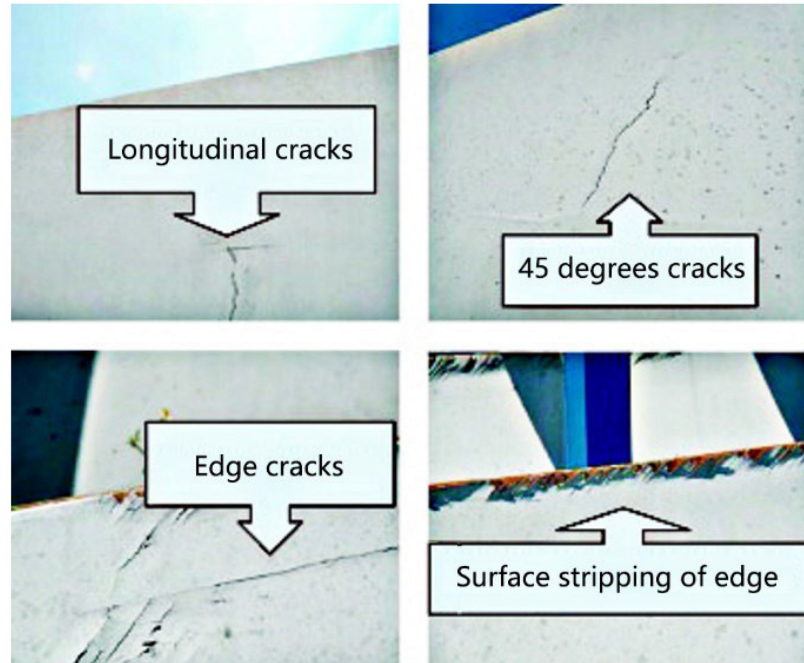


Process: Leading Edge Erosion



A different process takes place on the trailing edge leading to cracks running a significant part of the blade length.

Process: Vibration / Cracks



Blade tip speed in excess of 200 mph on larger turbines which suffer worse vibration!



Blade Maintenance

What materials are used?

Most blades are made with fibreglass-reinforced **polyester or epoxy**. **Carbon fibre or aramid (Kevlar)** is also used as reinforcement material. Nowadays, the possible use of wood compounds, such as wood-epoxy or wood-fibre-epoxy, is being investigated.

How is maintenance carried out?

There are two types of maintenance: **preventative** and corrective. The former consists of periodic inspections to determine the condition of the blades and identify any damage. These checks are made using different techniques: from the ground, with high-precision telephoto lenses, climbing the blades with ropes, cranes or lifting platforms and remotely, by using drones. **Corrective** maintenance meanwhile consists of the repair or reconstruction of the blades and *nacelles* to correct any damage that appears, both on the surface and within the structure.

How are the blades repaired?

Wind turbine blades can suffer cracks, damage caused by the impact of lightning and birds or openings in the leading or trailing edge, among other damage. The repair tasks are performed by workers at height, who hang from the blades with **ropes** or are lifted up to them on **suspended platforms**. At present, alternative repair and cleaning systems, such as drones, are being looked into to prevent operators from having to climb up to the turbines.



Process: Sanding



Repair Epoxy Datasheet

VPVB = Very Persistent and Very bioaccumulative

[Procedure used to derive the classification according to Regulation \(EC\) No. 1272/2008 \[CLP/GHS\]](#)

Classification	Justification
Acute Tox. 4, H302 Skin Corr. 1B, H314 Eye Dam. 1, H318 Skin Sens. 1, H317 STOT RE 2, H373 Aquatic Chronic 1, H410	Calculation method Calculation method Calculation method Calculation method Calculation method Calculation method

[Full text of abbreviated H statements](#)

H302 H312 H314 H315 H317 H318 H319 H351 H373 H400 H410 H412	Harmful if swallowed. Harmful in contact with skin. Causes severe skin burns and eye damage. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye damage. Causes serious eye irritation. Suspected of causing cancer. May cause damage to organs through prolonged or repeated exposure. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects. Harmful to aquatic life with long lasting effects.
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[Full text of classifications \[CLP/GHS\]](#)

Acute Tox. 4 Aquatic Acute 1 Aquatic Chronic 1 Aquatic Chronic 3 Carc. 2 Eye Dam. 1 Eye Irrit. 2 Skin Corr. 1B Skin Irrit. 2 Skin Sens. 1 STOT RE 2	ACUTE TOXICITY - Category 4 SHORT-TERM (ACUTE) AQUATIC HAZARD - Category 1 LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 1 LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3 CARCINOGENICITY - Category 2 SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1 SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2 SKIN CORROSION/IRRITATION - Category 1B SKIN CORROSION/IRRITATION - Category 2 SKIN SENSITISATION - Category 1 SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2
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Date of issue/ Date of revision : 21/03/2022

EKNOBLADE REPAIR 9000-20 - WHITE

Label No : **85140**

Date of issue/Date of revision : 21/03/2022 Date of previous issue : 08/01/2021

Version : 1.02 12/13

Process: Disposal



While manufacturers are frantically seeking the 're-cycleable' turbine blade, today the majority end up in landfill where Bisphenol A is leached out into groundwater.

Process: Fire



Nearly 120 wind turbines catch fire each year, according to research in 2014 - ten times the number reported by the industry. The figures, compiled by engineers at Imperial College London and the University of Edinburgh, make fire the second-largest cause of accidents after blade failure. 4 Aug 2022



How Much Bisphenol A?

Method A: (German EPA Report - updated for 2023)

The EU produces some 347,000 tons of Bisphenol A,

15% of this goes into wind turbine blade production as epoxy resin so 52,050 tons pa, of which 12.39 tons pa is calculated as emissions.

23% of the EU fleet of turbines is in the UK (WindEurope)

2.85 tons pa Bisphenol A emissions for the UK wind turbine fleet

Method B: (Danish EPA Report based on manufacturer's figures)

4,400 wind turbines in Denmark produce .66 tons of microplastics, so 11,000 in UK produce 1.650 tons pa of which 30 to 40 % is Bisphenol A

0.577 tons pa Bisphenol A emissions for UK wind turbine fleet



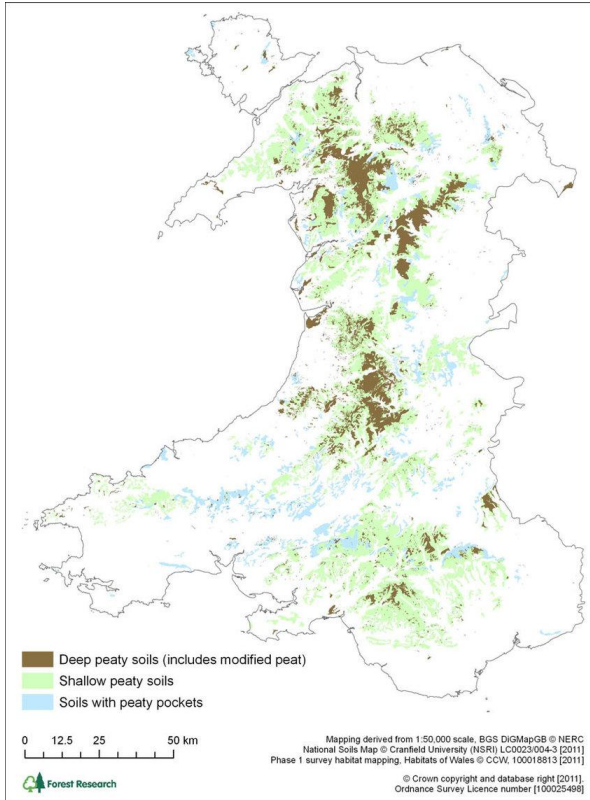
How Much Bisphenol A?

It really does not matter which method you believe:

1 kg of Bisphenol A makes 10 billion litres of water unusable!!

7 kg of Bisphenol A would make LLyn Celyn unusable!!

Environment?



CAA suggests the turbulent zone from wind turbines is 5 x the diameter of the base. That can therefore be considered the direct fall out zone into which microplastics are carried.

The leaching of Bisphenol A from microplastics is a well known process that is dependent on pH and temperature.

Leaching is known to be accelerated in acidic conditions. This is one of the reasons it is so dangerous by ingestion.

Peat is an acidic environment!



Health & Bisphenol A

- **In April 2023, EFSA published a re-evaluation of BPA's safety, significantly reducing the tolerable daily intake (TDI) set in its previous assessment in 2015.**
- **At the time, the TDI was made temporary as EFSA's scientists identified a number of data gaps and uncertainties, which they committed to reassess when new data became available, in particular a two-year chronic study from the US National Toxicology Program research programme.**
- **Based on all the new scientific evidence assessed, EFSA's experts established a TDI of 0.2 nanograms (0.2 billionths of a gram) per kilogram of body weight per day, replacing the previous temporary level of 4 micrograms (4 millionths of a gram) per kilogram of body weight per day.**



Conclusion

While there are many other sources Bisphenol A, there is no more potent unregulated delivery system to spread toxins into the environment.

Consequences:

For farmers - Routine blood testing, quarantine, and slaughter of livestock, if recovery is not possible. (West Coast of Jutland, Denmark, confirmed by Danish EPA).

“Endocrine disruptors are chemicals that can interfere with the endocrine system, which is responsible for regulating hormones in the body. This disruption can lead to a wide range of adverse health effects, including developmental and reproductive issues, metabolic disorders, and even cancer” - EC Regulation 2023/707

Far from saving future generations, wind turbines could prevent them!