The Green Warriors of Norway (NMF)
Norges Miljøvernforbund (NMF)
Postboks 593
5806 BERGEN
NORWAY
www.nmf.no

BAUA
Bundesanstalt für Arbeitsschutz und Arbeitzmedizin

Bergen, Norway 22.12.2021

2nd Stakeholder Consultation on a Restriction for Bisphenol A and Bisphenols of similar concern

Summary of concerns regarding Restriction for Bisphenol A ECHA/Reach

Green Warriors of Norway/Norges Miljøvernforbund will add our previous "REACH-Comments and documentation for 4,4'-isopropylidenediphenol (Bisphenol A) (BPA) and structurally related bisphenols of similar concern for the environment" of 15.02.2021.[1]

Subsequent to that report/hearing, several new and strengthened concerns regarding BPA and its environmental and health related impacts has been raised. These concerns are also increasingly reflected in the general population through several concerned inquiries to our organization and also on the internet and in social media. People are not only concerned about the negative hormone disturbance and other health related impacts on the human body and propagation, but also how these problematic substances impact our common environment.

BPA and Bisphenols of similar concern as an environmental and human health issue is closely related to the issue of micro plastics, and therefore cannot be reviewed separately from it. We will address both issues.[2]

Germany is also conducting their "Second call for evidence: restriction of BPA and structurally related bisphenols / 2nd Stakeholder Consultation on a Restriction for Bisphenol A and Bisphenols of similar concern (BPAF, BPB, BPF, BPS)".[3]

One of our main concerns regarding BPA, as an environmentally potent toxin and hormone disruptor is that it poses a significantly bigger hazard for, not only, the human body, but also for the ecosystems than has previously been known. Not only the substance itself in its pure form, but also as a "protected"

[1] https://www.nmf.no/wp-content/uploads/2021/02/Green-Warriors-of-Norway-ECHA_REACH-Bisphenol-comments-and-evidence.pdf

[2] https://echa.europa.eu/hot-topics/bisphenol-a

[3] https://web.archive.org/web/20211221175701/https://link.webropolsurveys.com/Participation/Public/285b96ad-500b-4629-b6a7-908043b3e9e2?displayId=Ger2377521

compound inside particles released to the environment. Such particles (micro- and nano sized) may consist of fragments of epoxy composites, various materials of rubber and other plastics, i.e., PVC and polycarbonates. BPA, when bound inside such particles, are in the environment in a large extent protected from the same degradation mechanisms the substance in its free form is exposed to. This is what's called the Trojan Horse effect. The particles protect the substance from degradation but may be released in a different temperature level or more acidic environments like we find in the digestive system of various organisms.

Humans, which is positioned on top of the food chain may be exposed to BPA through several primary and secondary sources. Every source is in addition to other sources in an accumulative effect.

Further notes of concern are a study that show the Bisphenol A in eggs causes development-specific liver molecular reprogramming in two generations of rainbow trout. Future research may also show similar generational effects on other species as well, including on us humans.

The European Food Safety Authority (EFSA) has newly re-evaluated the risks of bisphenol A (BPA) in food and proposes to considerably lower the tolerable daily intake (TDI) to 0,04 nanograms per body weight per day compared to its previous assessment TDI of 4 micrograms in 2015. The new proposed TDI limit is therefore a significant 100,000x lower than the previous set limit.[4]

While EFSA is mainly concerned with food safety, environmental sources may also pose a significant additional risk. This is also our focus of this comments and concerns briefing.

We have several calls for restriction regarding limiting sources for BPA pollution, as presented further down in this document.

[4] https://www.efsa.europa.eu/en/news/bisphenol-efsa-draft-opinion-proposes-lowering-tolerable-daily-intake

Contents

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

Background
The 15 January 2021 Call for evidence: restriction of BPA and structurally related bisphenols is part of the process to collect information for preparation in ECHA in relations to restrictions, into developing Annex XV restriction dossiers or other documents. This current call for comments and documentation from the Norwegian Environment Agency is parallell to Germany's "Second call for evidence: restriction of BPA and structurally related bisphenols / 2nd Stakeholder Consultation on a Restriction for Bisphenol A and Bisphenols of similar concern (BPAF, BPB, BPF, BPS)".

> "Germany intends to submit an Annex XV restriction dossier on 08 April 2022. A previous call for evidence was open from 14/10/2020 to 15/02/2021. Germany is now hosting a second call for evidence on their national helpdesk from 22 Oct 2021 to 22 Dec 2021. The second call for evidence is intended to offer an opportunity for stakeholders to provide updated information on uses, including tonnages, emissions, alternatives and transition costs, and limit values."[5]

Scope

The elements that need to be considered during the preparation of a restriction proposal are set out in Annex XV of REACH and further elaboration in ECHA Guidance documents. These can be summarised, as follows:

1. A characterisation of exposure and resulting risks to human health from a use of a substance, including via food and water;
2. A characterisation of exposure and resulting risks to the environment and wildlife from a use of a substance;
3. A justification that risks are not adequately controlled and occur on a Union-wide basis;
4. An analysis of the availability, technical and economic feasibility of alternatives to the substance to be restricted;
5. A socio-economic analysis (e.g. costs and benefits to society) that would arise from a restriction.

We will mainly address 1 to 3.

The concerns for BPA leading to the restriction proposal are based on its endocrine disrupting properties for the environment. A restriction proposal is, therefore, intended to minimise emissions of BPA to the environment. Via limiting the release rate of BPA from articles throughout the life cycle.

We must therefore:

a) Restrict the use of BPA as an additive.
b) Restrict content of residues (unreacted monomer) in articles.
c) Restrict the use of mixtures with content of BPA for both industrial and professional uses.

[5] https://web.archive.org/web/20211221175701/https://link.webropolsurveys.com/Participation/Public/285b96ad-500b-4629-b6a7-908043b3e9e2?displayId=Ger2377521

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

d) Introduce restrictions for BPA from articles (products and subassemblies) during service life (weathering, leaching due to cleaning action) preventing release into the environment and/or (direct) migration to organisms.

BPA – One problematic chemical, many sources

As mentioned in our summary, there are several sources of BPA pollution to the environment and to human consumption and health. In addition to the direct sources of the substance in its original form, most sources of the release of BPA are, when it is contained in various materials of all sizes. Most of those, ranging from various epoxy composites, rubber, and plastic products is degraded and eroded into smaller particles when exposed to the environment. Micro- and nano sized particles pose a significant environmental and health related risk where each source is accumulated and added to every other source and the accumulation from previous years. This is due to most of these types of particles being non degradable in the environment, before being subjected to hydrolysis in the gastrointestinal tract of organisms in the food chain. BPA and other chemicals bound inside such particles is also as an effect protected from the same environmental impacts of degradation the substance in it's free form is subject to. This is what's called the "Trojan Horse effect". The amounts of pollution we release today, will in large extents remain as a severe hazard in the environment for hundreds, if not thousands, of years to come.

> **Human exposure to endocrine disrupting compounds: Their role in reproductive systems, metabolic syndrome and breast cancer. A review**
>
> *«Bisphenols are not covalently bound to the polymeric structure, from which with time, or due to physical and/or chemical factors such as heat and acidity, can be gradually released into the external environment, contaminating water, soil and sediments, and later the rest of the agro-food chain».*
>
> *«Unfortunately, changes in temperature and pH cause hydrolysis of ester bonds in the compound itself resulting in leaching of bisphenols into foods and beverages» M. Giulivo et al. / Environmental Research 151 (2016) 251–264.*[6]

There are several sources for BPA to reach into the environment, and into the human body. Human exposure may result in several disturbing and negative health effects, and its ability to disrupt propagation functions and cause generational damage in various species may also disrupt entire populations and ecosystems.

[6] https://doi.org/10.1016/j.envres.2016.07.011

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

A recent study **"Plastic Products Leach Chemicals That Induce In Vitro Toxicity under Realistic Use Conditions"** (2021), from Lisa Zimmermann, Zdenka Bartosova, Katharina Braun, Jörg Oehlmann, Carolin Völker, and Martin Wagner, show that;

> **Plastic Products Leach Chemicals That Induce In Vitro Toxicity under Realistic Use Conditions (2021)**
> Lisa Zimmermann, Zdenka Bartosova, Katharina Braun, Jörg Oehlmann, Carolin Völker, and Martin Wagner
>
> ***Abstract***
> *Plastic products contain complex mixtures of extractable chemicals that can be toxic. However, humans and wildlife will only be exposed to plastic chemicals that are released under realistic conditions. Thus, we investigated the toxicological and chemical profiles leaching into water from 24 everyday plastic products covering eight polymer types. We performed migration experiments over 10 days at 40 °C and analyzed the migrates using four in vitro bioassays and nontarget high-resolution mass spectrometry (UPLC-QTOF-MSE). All migrates induced baseline toxicity, 22 an oxidative stress response, 13 antiandrogenicity, and one estrogenicity.*
>
> *Overall, between 17 and 8681 relevant chemical features were present in the migrates. In other words, between 1 and 88% of the plastic chemicals associated with one product were migrating. Further, we tentatively identified ∼8% of all detected features implying that most plastic chemicals remain unknown. While low-density polyethylene, polyvinyl chloride, and polyurethane induced most toxicological endpoints, a generalization for other materials is not possible.*
>
> ***Our results demonstrate that plastic products readily leach many more chemicals than previously known, some of which are toxic in vitro. This highlights that humans are exposed to many more plastic chemicals than currently considered in public health science and policies.***[7]

We must therefore put significant restrictions on all existing sources and stop new sources from occurring or being implemented.

Examples of current significant sources of BPA in microplastics to the environment:

- Rubber tires.
- Micro plastics in cosmetics.
- Plastic products that are exposed to physical forces on land, in our waterways or in the ocean.
- Epoxy composites used in boats and in wind turbine wings.
- Epoxy paint on ships and offshore installations.
- Microplastics released from the feeding systems in offshore open fish farms.
- Degrading of ropes, nets and various fishing equipment.

[7] https://pubs.acs.org/doi/10.1021/acs.est.1c01103

Calls for restrictions

Call for restrictions on rubber tires

Car tire manufacturers must deliver a list of total chemical components in the product. As of now, the ingredients are in large extent withheld from the public due to competing producers, but the amount of problematic chemicals in the products must be shown. This is important for consumers to make informed decisions, and for the governing authorities to put forth proper regulations.

Testing car tires at the border.
Countries must take test samples of imported car tires and analyze for content of BPA and other bisphenols. If a tire contains BPA or any bisphenols, it must be stopped/not imported to the country.

Car tire producers must be fined for producing tires with BPA-components after the regulations are put into action. This will motivate the tire industry to change the mix not to contain any hormone altering components.

Fact 1:
Car tire manufacturers are not informing the customers about the chemical components in the tires.

> Continental:
> - *Plasticizers (oils and resins)*
> - *Anti-ageing agents and other chemicals*
>
> *What's in your tires? | Continental tires*
> *It's easy to take your tires for granted, but that black ring on the wheel of your car contains so much more than just plain rubber. In actual fact, it's a complex blend of different rubbers – natural and synthetic – plus a whole host of other chemicals and construction materials.*[8]

Fact 2:
Tires for private cars are hardly re-treaded.
There are about 1 billion private cars on the roads globally. 1 set of car tyres equals 40 billion kilos of rubber. Re-treading of car tires can be done up to 20 times according to Michelin.
As long as the stem is not damaged, the part that touches the road can be changed when it's weared down.

10% of the weight of a car tire is the treading, and 90% is the stem/base of the tyre.

With re-treading, the waste from car tires can be reduced significantly, up to 80%.
Today, the turf industry cuts up the one-time used car tires for playgrounds, road fillings and rubber asphalt. This causes an enormous potential of spreading microplastics containing BPA and other hazardeous chemicals.

Authorities must demand that all new produced car tires are designed for re-treading.

[8] https://www.continental-tires.com/car/tire-knowledge/tire-basics/tire-mixture

The threading part of the tires are the source of microplastics during the driving, and regulations should demand a higher part natural rubber and no hazardeous chemicals that are harming the environment.

BPA-free alert on labeling
Plastics for domestic use, baking, bottles and sports equipment etc. with other versions of Bisphenoles must not be labeled BPA-free solely, the products must also have information about the content of all Bisphenoles.

Call for restrictions on micro plastics in cosmetics

There's no excuse for micro plastics in cosmetics. Good replacements should be readily available. Only a total ban in this area is acceptable.

Call for restrictions on the use of plastics in products and wrapping

Too much of the plastics in products and in wrapping finds its ways into the environment despite good waste management and recycling schemes. This may be the cause of recklessness, accidents and unintended transportation by wind and weather. In the environment it is eroded up and broken up into micro sized particles which in large extent are non-degradable. Either way, a transition to more ecologically friendly and sustainable materials should be promoted through tighter restrictions and consumer encouragement and information.

Call for restrictions on the use of epoxy composites in boats and wind turbine wings

Materials of epoxy composites are a main source of BPA and micro plastic pollution into the environment. Therefore, stricter restriction must be placed on production and use of such materials. The problematic parts are that the problematic nature of both micro plastic particles and its combination with BPA and other highly toxic chemicals pose on the environment, the food chain, and onto human health. Each point of pollution is added to every previous and other source, non-degradable and is accumulated in the environment.

Tight restrictions have to be put on existing sources and an industry wide transition onto better and more ecologically friendly materials must be forced.
At the same time, as long as the industry insists on existing materials and standards, it's imperative that tight restrictions must be implemented to avoid new sources of this kind of pollution to be constructed or built.

The governing authorities must also put immediate and strict restrictions on all in situ maintenance operations and ban all open-air procedures.

The governing authorities must also put immediate ban on all demolition at end of life for wing turbine blades. These results of large areas covered with epoxy glass fiber pieces that in many cases are not collected properly. They pose a direct hazard to all grass eating creatures and may remain in the environment for decades. These kinds of fragments are in most part only to be fragmented further into micro sized particles and contained BPA, further adding to this severe pollution problem.

More on this further on in this paper.

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

Call for restrictions in open fish farms and transition to closed systems

Only from the plastic pipes in the feeding systems in Norwegian open system fish farms is estimated, by the Norwegian organization Norges Naturvernforbund, to 300 tonnes of micro plastics a year. This is based on the loss by erosion of approx.. 0.5 kg material per meter per year in the feeding system piping multiplied by the average length for each open water fish farm. A Norwegian research report estimates the amount micro plastics released to the marine environment to between 10-100 tonnes of BPA containing plastic micro particles, where a general average is estimated to 30 tons yearly due to a 2019 report. The report also states that these numbers may be underestimated. It's important to note that much of the available data is sourced from the industry and as two recent scientific reports from Sweden and from the Republic of Korea show, the derived knowledge may therefore still be influenced and biased. More on the findings from these reports further below. In addition to the microplastics released from the feeding systems, there is also a significant amount of microplastics released from the net that separate the farmed fish from the environment. All pollution from open fish farms is released directly into the marine environment. As an existing source of pollution, this is totally unacceptable. The number of this type fish farms in Norway is increasing each year, both in numbers and in volume.[9] [10]

Open fish farming is a significant and increasing source of BPA and microplastics pollution not only in Norway, but also in EU, Europa and the world. **Immediate restrictions on open fish farming and a forced transition into closed systems with purification is a must. A forced transition to closed systems will eliminate most of the microplastic pollution from this production sector.**

Call for restrictions on the use of epoxy paint on ships and offshore installations

Epoxy paint is widely used to protect metals and various materials from corrosion in harsh and demanding environments. Restrictions should force limitations on use and transition into better and more environmentally friendly products and methods. Further, all removal, by chemical, mechanic sanding or sandblasting should be conducted in closed systems where the residue is collected and deposed in proper facilities. Many in situ maintenance operations by the above-mentioned methods are released unfiltered into the environment, but there are several different systems for closed system sandblasting available. With proper restrictions on open polluting procedures, good closed systems may be preferred for in situ maintenance and repair jobs in the future.

Call for restrictions on the use of ropes, nets and various fishing equipment

The fishing industry and commercial fish farming is a significant source of microplastics and chemicals like BPA to the environment due to their heavy reliance of ropes and nets from various plastic materials. They are often exposed to heavy mechanical forces and environments and are easily broken up in smaller fragments and particles.
Restrictions must be put on the production and use of such non degradable materials and plastics to promote a transition to more ecologically friendly materials.

---

[9] https://www.nrk.no/tromsogfinnmark/naturvernforbundet_-mer-enn-300-tonn-mikroplast-fra-foringsror-gar-rett-i-havet-1.13826213?fbclid=IwAR2agrcEs_qQPyHi_x6OQSiIoQ88ad-hiUJ10gPOx28p-pde9jjGrj_kpeU

[10] https://www.researchgate.net/publication/336937871_Sluttrapport_HAVPLAST_-_Marin_plast_fra_norsk_sjomatnaering_-_kartlegging_kvantifisering_og_handling

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

Strict restrictions do work

We have often seen a significant hesitancy towards the replacement of production and use of problematic materials. Large economic interests have in a large extent dictated the policy to stay at status quo. Environmental concerns have been put aside for pure economic interests, but regarding such problematic pollutants as BPA and micro plastics, each by its own, or in combination is so problematic that we do not have a choice. Strict restriction on production, trade, and usage must be used to force a transition into better solutions and more ecofriendly materials and procedures of handling and maintenance/repair. The problem is increasing each year and every source and volume of pollution is added on top of what has been released previous years and is accumulated into the environment.

We are now at a point of no return. We can't remove the pollution that already been released into the environment, but we can restrict existing sources and prevent new sources from appearing. This is just as important as the prevention of climate change and the loss of biodiversity, if not more. The pollution, of this type, we release today will in large extent remain in and disrupt the environment for hundreds, if not thousands of years to come.

There are several examples from our past that show that strict restrictions work. Not only do they force innovation and transition into better materials and solutions, but also more sustainable products, methods and informed consumer decisions. One good example is the ban on CFCs.

The widely use of CFCs (chlorofluorcarbons) led to the large and growing hole in the ozone layer. If a strict ban hadn't been placed on the CFCs, the world had faced one of its worst, and possibly non recoverable disasters. Entire ecosystems were in danger of vanishing if we lost our protecting ozone layer. It was in widely use in everything from spray cans to refrigerators and heat exchange systems. The industry opposed a ban and stated that a ban would be impossible to implement. However, as the ban became a fact, the industry quickly managed a transition into alternative gases and production methods. Without a strict ban/restrictions, we would still be using the same products and probable be without any protection from the diminishing ozone layer.

This is an example that show that proper restrictions force innovations and transition into more ecofriendly solutions. When the industry is faced with stricter restrictions on materials and products that contain BPA and other problematic chemicals, and products and materials that is the very source of micro plastics released into the environment, we are sure that the industry can manage that just as well as the transition away from CFCs.

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

More data on BPA and microplastics as sources of hazardous pollution of the highest concern

As stated above, the problem of BPA and other similar substances of concern are deeply linked to various epoxy-, rubber- and plastic materials, which in nature are broken into smaller pieces and in large extent is non degradable. More on this below.

The environmental problems might be even bigger that the current scientific knowledge reflects due to data biased by the industry

Recent studies from Sweden and from the Republic of Korea suggest that the scientific papers on the toxicological properties of chemical pollutants, of which environmental policymakers rely for knowledge, is heavily related on publications associated with the industry. This raises several additional concerns. Especially what regards to the precautionary principle, where the numbers and conclusions from the industry may not in a significantly way reflect the actual problem. Proposed restrictions may not be as far reaching as they need to be to address the severity of the problem at hand.

> **Does the scientific knowledge reflect the chemical diversity of environmental pollution? – A twenty-year perspective**
> Kristiansson, E., Coria, J., Gunnarsson, L. et al (2021)
> Environmental Science and Policy, 126: 90-98 [11]
>
> ***Environmental policymaking relies heavily on the knowledge of the toxicological properties of chemical pollutants. We also show that university- and corporate-based research exhibit distinct publication patterns and that for some chemicals the scientific knowledge is dominated by publications associated with the industry.***
>
> *In this study, we investigated the scientific knowledge on environ- mental chemical pollution generated by the research community over the last two decades.*
> *Our results show significant changes in the research agenda with decreasing publication frequency of chemicals used as plant protection products while the publication frequency of pharmaceuticals increased.*
>
> ***We could, furthermore, conclude that the ecotoxicological research community is highly focused on a few well-studied chemicals, especially heavy metals, and this raises concerns about our ability to sufficiently cover the large chemical diversity of environmental pollutants.***
>
> ***There is, indeed, a large number of chemicals for which no, or very little, knowledge is available or where the knowledge is, to a large extent, generated through corporate-associated research.***
>
> ***We conclude that a continued expansion and/or a reprioritization of the ecotoxicology research is necessary to meet the challenges associated with the increasing chemical diversity***

[11] http://dx.doi.org/10.1016/j.envsci.2021.09.007

of the expanding chemosphere and to ensure that the need for independent and objective scientific knowledge *– as requested by the society – are properly met.*

Highlights
Environmental Science & Policy
Volume 126, December 2021, Pages 90-98

1. *The ecotoxicological research has been highly focused and as few as 65 chemicals dominates the scientific literature.*
2. *Over the last twenty years, the research interest has increased for pharmaceuticals and decreased for biocides.*
3. *Corporate-associated research has distinct publication patterns and compose large parts of the knowledge for some chemicals.*
4. *A large number of chemicals have little to no scientific knowledge about their toxicity.*
5. *Expansion of the ecotoxicological research field is necessary to catch up with the increasing diversity of the chemosphere.*
6. *"The scientific ecotoxicological knowledge is growing but it is not clear to what extent the research community manages to cover the large chemical diversity of environmental pollution." and*

"We also show that university-and corporate-based research exhibit distinct publication patterns and that for some chemicals the scientific knowledge is dominated by publications associated with the industry.

We conclude that there is a large number of chemicals with little, or no, scientific knowledge and that a continued expansion of the field of ecotoxicology will be necessary to catch up with the constantly increasing diversity of chemicals used within the society."

Environmental Science & Policy
Volume 126, December 2021, Pages 90-98 [12]

[12] https://www.sciencedirect.com/science/article/pii/S1462901121002537?via%3Dihub

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

The report on BPA from the Republic of Korea highlights the problem with industry driven research and manipulation even further:

Journal of Hazardous Materials 417 (2021) 126076

Drivers of owning more BPA

Md Saidur Rahman , Elikanah Olusayo Adegoke , Myung-Geol Pang *
Department of Animal Science & Technology and BET Research Institute, Chung-Ang University, Anseong, Gyeonggi-do 17546, Republic of Korea

4. Suspicious reference doses: do we need more evidence?
(page 5)

Despite the variety of human health effects following exposure to low doses of BPA, in a provisional CLARITY–BPA report, the US FDA stated that the currently approved doses (both TDI and NOAEL) are still safe (FDA, 2018). This statement is factually inaccurate and has been forcefully refuting by many experts (Vandenberg et al., 2019; Vom Saal, 2019).

Indeed, industrial lobbyists might have been responsible for driving such a decision. ***It has been noticed that industrial lobbyists use different strategies, such as sponsoring industry-friendly researches, limiting access to the information on risks of endocrine-disrupting chemicals (EDCs), launching misleading websites, influencing international trade negotiations, and using financial agreement to defeat BPA banning bills (Janssen, 2010; Erler and Novak, 2010).*** *For example, the NTP panel's review in 2001 indicated credible evidence that low doses of BPA produce harmful effects on specific endpoints' (Gross, 2007). To refute these findings, the American Plastics Council, consisting of all the major BPA producers and their trade groups, commissioned a review from the Harvard Center for Risk Analysis (HCRA). Surprisingly, the HCRA released a report showing that "the weight of the evidence for low-dose effects of BPA is very weak" (Gross, 2007).* ***Besides, the chemical industries have adopted fear tactics claiming that all canned food would disappear from store shelves if BPA bans were passed and have tried to manipulate the legislative process (Janssen, 2010; Erler and Novak, 2010). Moreover, their financial resources and a vast network with legislators made industrial lobbyists an unformidable force opposing the effort to pass more stringent regulations.*** *As such, the regulatory agencies, industrial researchers, and lobbyists' conscious efforts to sustain BPA uses might eventually follow the similar path of sugar overused in everyday food despite its harmful impact on healthy living. Therefore, it is vital to public health that the levels of BPA exposure be redefined according to the prevailing scientific consensus.*[13]

These findings are also in accordance with our experience. One example is Leading edge erosion (LEE) data, where microplastic particles from wind turbine wings are eroded and released into the environment, where a significant amount contains BPA. Media and the industry, in unison, rely unfiltered on undocumented data from the industry and their lobby groups. Any questions, even when documented by scientific findings, are automatically "debunked" by the same undocumented claims. In Norway, there are mainly two references, that supposedly document this industry view. One is from the Norwegian based Fred Olsen Renewables with a significant interest and investment in the wind power

[13] https://www.sciencedirect.com/science/article/abs/pii/S0304389421010402?via%3Dihub

industry, both domestically and abroad. The Norwegian premiere technical magazine Teknisk Ukeblad (TU) take their undocumented claimed data at face value to "debunk" and "fact check" all questions and claims from the public, concerned organizations and others with knowledge contradicting the industry claims. At the same time, the energy companies, and other groups with significant financial interests in the wind power industry remain among the main contributors to that magazine's yearly ad revenue.[14]

The other main source for these undocumented claims is from the Norwegian interest and industry organization for renewable energy, NORWEA. They claim that, quoted:

> *«Microplastic is also a small problem for the modern wind power plants we have in Norway, and a wind turbine emits less microplastic than, for example, a car tire or a garment. (7) Emissions from a wind turbine are on average 150 grams per turbine per year, and it is mainly paint that is eroded away."* [our translation][15]

NORWEA's claim of 150 grams microplastic per turbine per year remain undocumented. Still these undocumented claims and industry opinions are much sited by the media, and more concerningly also find their way into the Norwegian government agencies as true facts. The Norwegian Ministry of Petroleum and Energy give this statement on their wind power Q&A page, quote:

> **How much microplastic does the wind turbine emit during its lifetime?**
> *Today, there is no comprehensive overview of the amount of microplastic emissions from wind power. It is important that plastic pollution is not trivialized, but even if emissions from turbine blades occur, it is still of limited importance. In the Norwegian Environment Agency's survey of Norwegian sources for the spread of microplastics, wind power is not mentioned in the overview. In feedback that NVE* ***has received from a wind power producer****, annual wear on modern turbine blades is in the order of up to 50 grams of microplastic per year per turbine blade. In order to increase the knowledge base on wear and wind power, NVE will work together with the Norwegian Environment Agency, as proposed in Meld. St. 28 (2019-2020).*
> [Our translation – this page is only available in norwegian][16]

Here, the Norwegian government at its highest level rely solely on undocumented claims from an unnamed wind power producer as their only source of truth. Please reread the two above reports from Sweden and the Republic of Korea. They are quite revealing.

It provides no confidence that undocumented claims from financial beneficiaries form the basis of governmental policy making and legislation. Serious claims and questions of significant environmental and health related concerns need a better approach from the governing authorities than being a dedicated lap dog and gate keeper for the industry. Our organization, Green Warriors og Norway/Norges Miljøvernforbund (NMF) has raised these questions and concerns several times with our governing authorities. A serious approach would be to conduct independent research into the matters at question,

---

[14] https://www.tu.no/artikler/ni-pastander-om-vindkraft-vi-har-faktasjekket-dem/509409

[15] https://norwea.no/norwea-mener/2021/5/28/klare-faktafeil-fra-motvind-om-vindkraftforurensning

[16] https://www.regjeringen.no/no/tema/energi/landingssider/vindkraft-pa-land/sporsmal-og-svar----vindkraft-pa-land/id2770374/?expand=factbox2774088

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

but who remains independent?

From the Swedish study, by Kristiansson, E., Coria, J., Gunnarsson, L. et al (2021), as quoted above:

> ***Environmental policymaking relies heavily on the knowledge of the toxicological properties of chemical pollutants. We also show that university- and corporate-based research exhibit distinct publication patterns and that for some chemicals the scientific knowledge is dominated by publications associated with the industry.***

What they don't tell you..

Most of the information on LEE (Leading edge erosion) is based on natural occurring erosion, as rain, hail, airborne particles from salt and sand and other causes. What the industry never mentions is the other source of microplastic particles to the environment where much also contain BPA, which is the common procedure of in situ reparations. When mechanical open-air sanding is the main part of the operation, the amounts of microplastic particles released into the environment may even exceed the amounts caused by natural erosion. In most cases, where in situ maintenance repair procedures appear, you can easily at least double the industry pollution volume claims. It's not likely, however, that the financial beneficiaries have any interests than to keep their pollution data as low as possible.

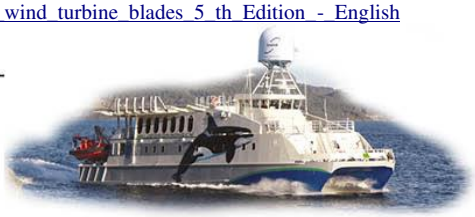
No microplastics pollution here..? Image show the commonly used practice of open air mechanical sanding at an in situ repair job. The industry won't tell you this, but this is common practice. Image from: YouTube.

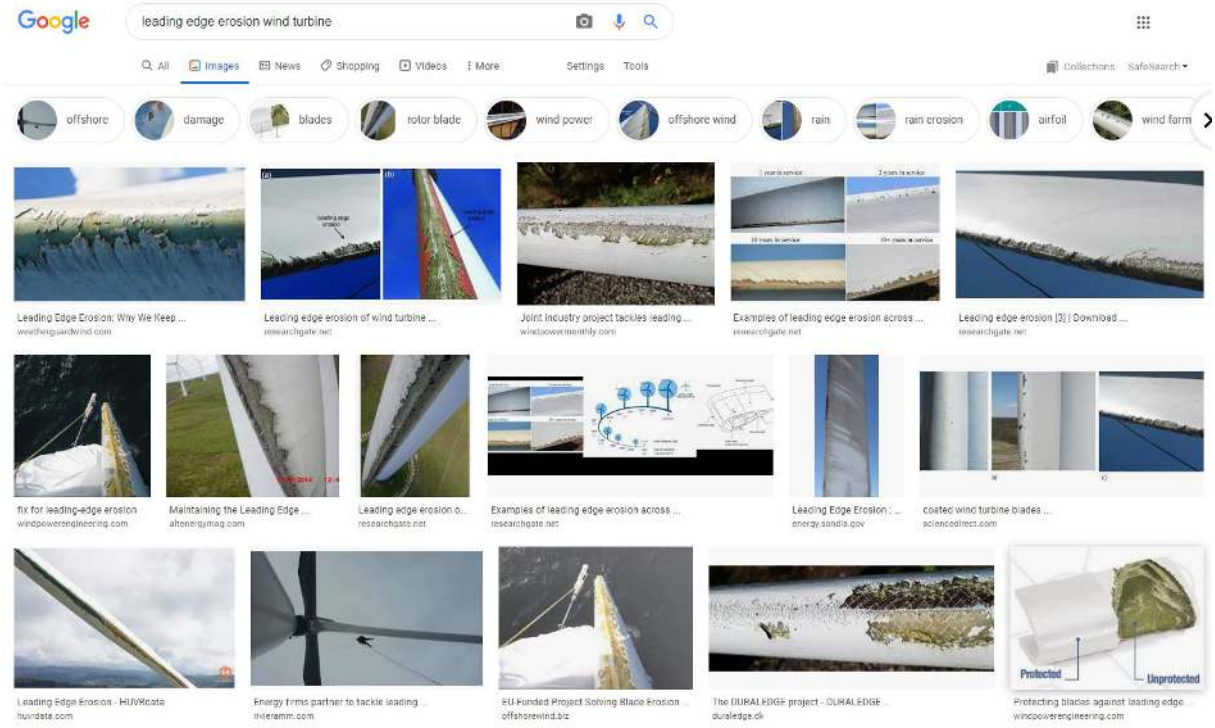
The report by Asbjørn Solberg, Bård-Einar Rimereit og Jan Erik Weinbach "THE TURBINE GROUP" JULY 2021, "Leading Edge erosion and pollution from wind turbine blades - 5 th. Edition", which has stirred much controversy among the wind power industry and its lobby, has still not been disproven. It has only, as far as we understand, been met with the same undocumented claims and opinions as we have documented above. The concerns and principles raised in that report therefore still remain true to

this day. Also, important to note is that the report doesn't consider in situ repair procedures as an additional source, as they only address natural occurring microplastics and BPA pollution. This show that vital information is clearly withheld by the industry groups and their lobby. Without the full data in public open and reviewable sources available, how can we trust that governmental policy makers make the right decisions or legislation? [17]

More on LEE (Leading edge erosion) and the common industry practice of in situ maintenance and repair on wind turbine wings further down below.

[17] https://www.researchgate.net/publication/353395665_Leading_Edge_erosion_and_pollution_from_wind_turbine_blades_5_th_Edition_-_English





New and updated information on LEE (leading edge erosion) from wind turbine blades, and the dangers of micro plastics and BPA pollution in the environment

The report by Asbjørn Solberg, Bård-Einar Rimereit og Jan Erik Weinbach "THE TURBINE GROUP" JULY 2021, "Leading Edge erosion and pollution from wind turbine blades - 5 th. Edition" highlight the vast and increased problem with erosion of micro particles from epoxy composites and other plastic materials in environments with much rain and aerial particles present. The report bases its findings on research conducted at the University of Stratdclyde in Scotland. [18] [19]

As the boundaries where the wind farms are pushed into more harsh and challenging environments, more and increased erosion must be taken into account. It's also problematic that colder environments as we find along the coast in arctic and sub arctic environments may also lead to slower bio degradation processes, and as such, a increased environmental problem than is experienced in more warmer and less harsh environments further south in Europe and the world.

[18] https://www.researchgate.net/publication/353395665_Leading_Edge_erosion_and_pollution_from_wind_turbine_blades_5_th_Edition_-_English

[19] https://drive.google.com/file/d/1z8YFP0JFmR-0ywpijtClfDEy2gT-6wFB/view

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

A recent study, "Microplastics and bisphenol A in mussels along Italian and Croatian coast of the Adriatic Sea", May 2021, by Tanja Bogdanović, Ludovica Di Renzo, et al, show how severe this problem is even in warmer coastal climatic conditions.

Microplastics and bisphenol A in mussels along Italian and Croatian coast of the Adriatic Sea

The Mediterranean basin is one of the most impacted area by marine litter and within it the Adriatic Sea even more. Recent studies detected floating and sinking microplastics (MPs) in the aquatic environment, as well as in biota (Di Renzo et al, 2021). From ancient times, Adriatic coasts are particularly devoted to the mussel farming. Mytilus galloprovincialis is one of the most commercial interest species, it is widely consumed by humans. ***Mussels could be considered as particularly good trusted candidates for the assessment of human exposure to MPs, as they are filter-feeders directly exposed to MPs present in the environment*** *(Mercogliano et al, 2021).*

Nowadays, a broad range of complementary analytical methodologies has been applied regarding the detection and identification of MPs and their additives such as Bisphenol A (BPA), without any harmonized monitoring protocols by making difficult the comparison of disposable data on their occurrence in marine biota and the risk assessment for human health (Barboza et al, 2020).

Results:

- *The average number of MPs in Adriatic mussel is 1 item/g.*
- *Polyester and High Density Polyethylene were detected in 10 sampling sites, out of 17.*
- *Free PTA, PC and PET were revealed in all samples, free BPA in 76,5%.*

Risk assessment and conclusion

- This study provides evidences of microplastics contamination of mussels farmed along the Italian and Croatian coastline of the Adriatic Sea with Polyester (PE) and Polypropylene (PP) as the main polymer types.
- The median of bisphenols detected in Italian mussel resulted with considerably higher EDI values (3-fold higher) compared to Croatian results and the THQ values above 1.
- The THQ values of BPA based on the percentiles, representing a higher scenario of exposure, were above one suggesting that there is risk of exposure higher than the safety limits recommended by the EFSA.
- The obtained results also revealed a potential risk of exposure to microplastics and associated contaminants in mussels as a food source.
- PCA analysis showed the existence of the differences in the polymer abundance inside the mussel's tissue along the Adriatic coast despite the growth of mussels in the clear seawater and at distance from urban settlements. Probably, factors such as marine currents and sea depth affect the microplastics content in sessile organisms like mussels.
- Identification data should be combined with quantification data in order to estimate the mass of MP present in bivalves what is of great value for both environmental and human health risk assessment. [20]

[20] https://www.researchgate.net/publication/351330440_Microplastics_and_bisphenol_A_in_mussels_along_Italian_and_Croatian_coast_of_the_Adriatic_Sea?fbclid=IwAR1UTebMJ4BCixw4CX6WnPa-d8zKzpEA-rGfWYrbERSUFenRLgV9JzsNCF0

It's also of great concern that BPA seems to cause generational damage in organisms.

> "Bisphenol A in eggs causes development-specifc liver molecular reprogramming in two generations of rainbow trout"[21]

LEE (leading edge erosion) from wind turbine wings is a significant source of micro plastics

In addition to the report from by Asbjørn Solberg, Bård-Einar Rimereit og Jan Erik Weinbach "THE TURBINE GROUP" APRIL 2021, «Forurensning fra vindturbinvinger» (wind turbine wings pollution), we also have corroborating evidence from other reports.

A probabilistic long-term framework for site-specific erosionanalysis of wind turbine blades: A case study of 31 Dutch sites [22]

Received: 28 August 2020 Revised: 20 February 2021 Accepted: 22 **February 2021**

Rain-induced leading-edge erosion (LEE) of wind turbine blades (WTBs) is associated with high repair and maintenance costs.

The effects of LEE can be triggered in less than 1 to 2 years for some wind turbine sites, whereas it may take several years for others. In addition, the growth of erosion may also differ for different blades and turbines operating at the same site.
Hence, **LEE is a site- and turbine-specific problem.**

[21] https://www.researchgate.net/publication/320630432_Bisphenol_A_in_eggs_causes_development-specific_liver_molecular_reprogramming_in_two_generations_of_rainbow_trout/fulltext/59f37f8ca6fdcc075ec349ab/Bisphenol-A-in-eggs-causes-development-specific-liver-molecular-reprogramming-in-two-generations-of-rainbow-trout.pdf?origin=publication_detail

[22] https://onlinelibrary.wiley.com/doi/epdf/10.1002/we.2634

In this paper, we propose a probabilistic long-term framework for assessing site-specific lifetime of a WTB coating system.

Case studies are presented for 1.5 and10 MW wind turbines, where geographic bubble charts for the leading-edge lifetime and number of repairs expected over the blade's service life are established for 31 sites in the Netherlands.

The proposed framework efficiently captures the effects of spatial and orographic features of the sites and wind turbine specifications on LEE calculations. For instance, **the erosion is highest at the coastal sites and for sites located at higher altitudes**. In addition, **erosion is faster for turbines associated with higher tip speeds**, and the effects are critical for such sites where the exceedance probability for rated wind conditions are high. The study will aid in the developmentof efficient operation and maintenance strategies for wind farms.[23]

These results compare very well to our own findings, that the harsher climatic impacts in coastal regions result in increased erosion and release of micro plastic particles than we find further inland. Also, the northernmost parts of Europe is also a vector that show increased climatic impact, and also a slower biodegradation rate vs. more tempered environments.

Another recent report **"Minimum Leading Edge Protection Application Length to Combat Rain-Induced Erosion of Wind Turbine Blades"** (2021), also collaborates the problems of LEE erosion.

Minimum Leading Edge Protection Application Length to Combat Rain-Induced Erosion of Wind Turbine Blades

Faculty of Aerospace Engineering, Delft University of Technology, Kluyverweg 3, 2629 HS Delft, The Netherlands
SINTEF Ocean AS, Otto Nielsens veg 10, 7052 Trondheim, Norway
SE Blades Technology, B.V. Jan Tinbergenstraat 290, 7559 ST Hengelo (Overijssel), The Netherlands
Department of Marine Technology, Norwegian University of Science and Technology (NTNU), 7052 Trondheim, Norway
Department of Engineering Sciences, University of Agder, 4879 Grimstad, Norway
Energies **2021**, *14*(6), 1629;

Published: 15 March 2021

Leading edge erosion (LEE) repairs of wind turbine blades (WTBs) involve infield application of leading edge protection (LEP) solutions. The industry is currently aiming to use factory based LEP coatings that can applied to the WTBs before they are shipped out for installation.

However, one of the main challenges related to these solutions is the choice of a minimum LEP application length to be applied in the spanwise direction of the WTBs. Generally, coating suppliers apply 10–20 m of LEP onto the blades starting from the tip of the blade

[23] https://onlinelibrary.wiley.com/doi/epdf/10.1002/we.2634

using the "rule of thumb", and no studies in the literature exist that stipulate how these LEP lengths can be calculated.

In this study, we extend the scope of a recently developed long-term probabilistic framework to determine the minimum LEP application length required for WTBs to combat rain-induced erosion.
A parametric study is performed where different wind turbines with varying power ratings of 2.1 MW to 15 MW at different Dutch sites ranging from inland to coastal are considered.
The results of the study show that the **LEP application length is sensitive to the choice of the site, as well as the turbine attributes. Further, LEP lengths for WTBs are found to be the highest for turbines installed at coastal sites and turbines with higher power ratings.**

A detailed investigation is further performed to check the sensitivity of the LEP application length with the wind turbine parameters.
The results of the study are expected to provide guidelines to the industry for efficient repair strategies for WTBs.[24]

The report show that the the Leading Edge Lifetime (LEL) vary very much for each section of the turbine blade for the three different turbine models investigated (2.1 MW, 10 MW, and 15 MW). Coastal climatic has increased erosion than inland climate, and larger wind turbine blades has also shorter LEL due to higher wing tip speeds.

The reports show also that maintenance and repair must be conducted in shorter intervals, even as short as 1.25 times a year (9-10 months). However, as the wind industry doesn't take any environmental aspects into account, we may expect that they will stretch the interval between maintenance cycles to a maximum, simply due to economic considerations. This is especially a factor in coastal and offshore locations where maintenance operations are expected to be both very costly, weather dependent, and difficult to conduct, compared with smaller inland plants. Coastal plants may also experience a 3-4x increased LEL shortened lifetime over inland based plants.

We see that most of the research on this field are in large extent only focused on the economic side of the effect loss caused by LEE. It is also of concern that there's no industry standard defining Wing Tip Speeds as a parameter.

Most of the offshore wind plants in central and southern parts of Europe are in shallow waters where maintenance operations might be considered relatively easy to conduct. Still, they are conducted on a purely cost based cycle, rather than environmental concerns. When a wind turbine wing starts to erode, the process is rapidly increasing. Too long intervals in a maintenance cycle may therefore pose an unnecessary extra pollution factor, compared to an environmental focused maintenance cycle.

In Norway, most of the proposed offshore wind farms will, due to the added depths mostly be floating constructions far from shore. This is expected to increase the difficulty and costs of maintenance operations significantly, which is no good sign for the environment in regard to the pollution of micro plastic particles and BPA. Also worth noting is that deep sea offshore wind still has to be constructed

[24] https://doi.org/10.3390/en14061629

and built, and therefore must be considered as potential new sources of this problematic and non-biodegradable pollution.

These findings are also collaborated by another recent report, “A probabilistic rainfall model to estimate the leading-edge lifetime of wind turbine blade coating system” (2021), by Amrit Shankar Verma, Zhiyu Jiangb, Marco Cabonic, Hans Verhoef, et al., that states that:

A probabilistic rainfall model to estimate the leading-edge lifetime of wind turbine blade coating system /2021)
Amrit Shankar Verm, Zhiyu Jiang, Marco Cabonic, Hans Verhoef, Haraldvan der Mijle Meijer, Saullo G.P.Castroa, Julie J.E.Teuwen

Abstract
Rain-induced leading-edge erosion of wind turbine blades is associated with high repair and maintenance costs. *For efficient operation and maintenance, erosion models are required that provide estimates of blade coating lifetime at a real scale. In this study, a statistical rainfall model is established that describes probabilistic distributions of rain parameters that are critical for site-specific leading-edge erosion assessment. A new droplet size distribution (DSD) is determined based on two years’ onshore rainfall data of an inland site in the Netherlands and the obtained DSD is compared with those from the literature. Joint probability distribution functions of rain intensities and droplet sizes are also established for this site as well as for a coastal site in the Netherlands. Then, the application of the proposed model is presented for a 5 MW wind turbine, where the model is combined with wind statistics along with an analytical surface fatigue model that describes lab-scale coating degradation.*

The expected lifetime of the blade coating is found three to four times less for the wind turbine operating at the coastal site than for the inland site - primarily due to rainfall at higher wind speeds. *Further, the robustness of the proposed model is found consistent with varying data periods used for the analyses.*

1.1. Background

The continuous demand in the growth of renewable sources of power production has led to rapid growth in the wind energy sector. Wind turbines, both at onshore and offshore locations, are in high demand and it is expected that by 2050, half of the EU's1 electricity demand will be met by wind energy alone.

In order to achieve this goal, the current market trend involves deploying turbines with higher power ratings, along with turbines deployed at locations with larger wind speeds such as near coastal and offshore locations. ***Such classes of turbines are profitable to the industry, however, this also presents enough challenges to the wind turbine owners and operators, especially from a maintenance perspective. For instance, large size blades rotating at high tip speeds are exposed to harsh environmental conditions such as frequent exposure to rainfall, thereby causing material degradation at the blade's leading-edge - commonly referred to as rain-induced leading-edge erosion (LEE) of WTBs.***

The impact between rain droplets and the rotating blade at high tip speeds, typically in the range of 70–110 m/s, develops large impact pressure, subsequently leading to a combination of complex damage modes such as pitting, roughening of the leading-edge surface, fatigue failure of the blade coating, and eventually structural damage. In Ref., it has been found that LEE

increases the drag coefficient of the aerofoil section by more than 314% and decreases the lift coefficient by around 53%, thereby reducing the overall aerodynamic efficiency of the WTB. ***The damage modes associated with LEE and their effects on the turbine's performance can appear in less than two years of the blade's service life,*** *while the blade is expected to last for atleast 15 years continuously.*

As a result, costly repair and maintenance work is imperative to be performed in order to maintain the design power curve of the wind turbine, thereby contributing to the overall increase in the cost of energy. *It has been reported in Refs. that LEE repair and maintenance expenses cost the European offshore wind turbine sector over £56 million annually, and hence LEE of WTBs requires urgent attention.*[25]

The many challenges this report lists as severe obstacles before the wind power industry reaches an acceptable cost/benefit level on maintenance and lifetime of the turbine blades, doesn't seem to be reached anytime soon. Offshore wind will therefore remain a costly and expensive alternative, purely based on economic criteria. Deep sea offshore wind farms will also contribute to even higher costs due to the complexity of the installations itself, and the increased difficulties and costs associated with maintenance and repair operations. The effects of LEE can be triggered in less than 1 to 2 years for some wind turbine sites, whereas it may take several years for others.

[25] https://doi.org/10.1016/j.renene.2021.06.122

Current practice of in situ repair and maintenance adds significant amounts of microplastics erosion to the environment

While production of wing turbine blades is conducted in closed environments with strict procedures for work environment and filtering, most of the repair jobs are conducted in situ. Whether the operation is conducted by personnel hanging in ropes or by robots, most of the examples we have found are open air solutions where all microplastics and dust is released directly into the environment.

We must also assume that the volume removed mechanically by sanding machines are no less than what has been eroded naturally by LEE (Leading Edge Erosion). The governing authorities must put immediate and strict restrictions on all maintenance operations and ban all open air procedures.

Green Warriors of Norway - (Norges Miljøvernforbund)

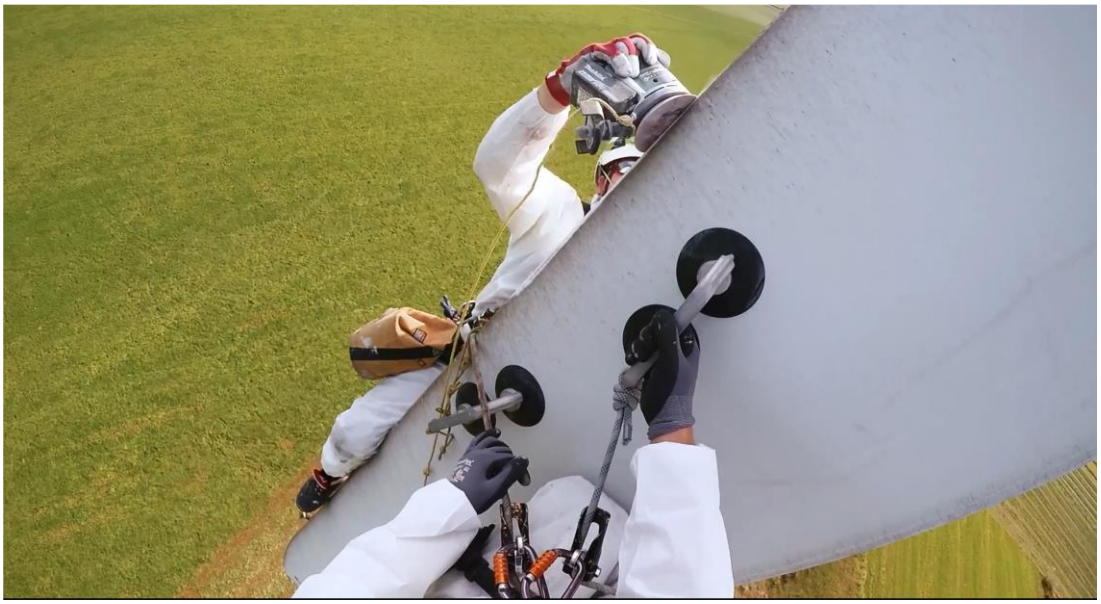
Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00



Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

Accidents do and will happen

One thing never change, and that is the fact that accidents do and will happen.

Here is a compilation of some of the many accidents regarding wind turbines around the world.[26]

[26] http://www.caithnesswindfarms.co.uk/fullaccidents.pdf

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

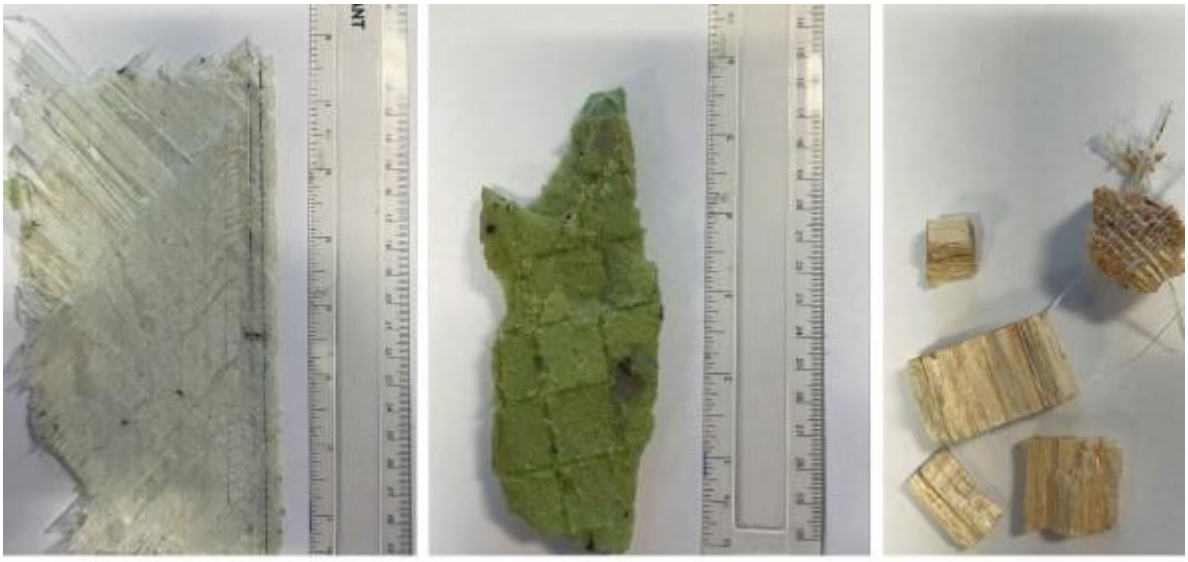
Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00

Offshore wind power plants also pose a heightened risk of collision with ships and other sea born vessels. Operations on the offshore turbines is also a posed risk factor that must be considered.

Just as recently as late October this year 21.10.2021, three 61-metre blades fell into the sea during a major component exchange at Ormonde offshore wind farm in the UK.

> *A hub, three 61-metre blades, and blade clamping tool have fallen into the sea during major component exchange at the Ormonde offshore wind farm in the UK, with majority of the parts and tools now resting on the seabed and debris from one broken blade reported to be on the sea surface.*
>
> *The MPI Adventure jack-up vessel was positioned alongside the wind turbine B01 when the parts fell into the water, adjacent to the vessel and in proximity to the B01 turbine.*
>
> *Along with the three turbine blades weighing 126 tonnes and blade clamping tool weighing around 3 tonnes, a hub containing three pitch motors, batteries, four electrical cabinets, grease pumps and other components was also dropped.*



Debris has fractured off from one of the blades and will likely reach the shore.[27] [28]

Video:
https://www.youtube.com/watch?v=HF5w2eWcKjI

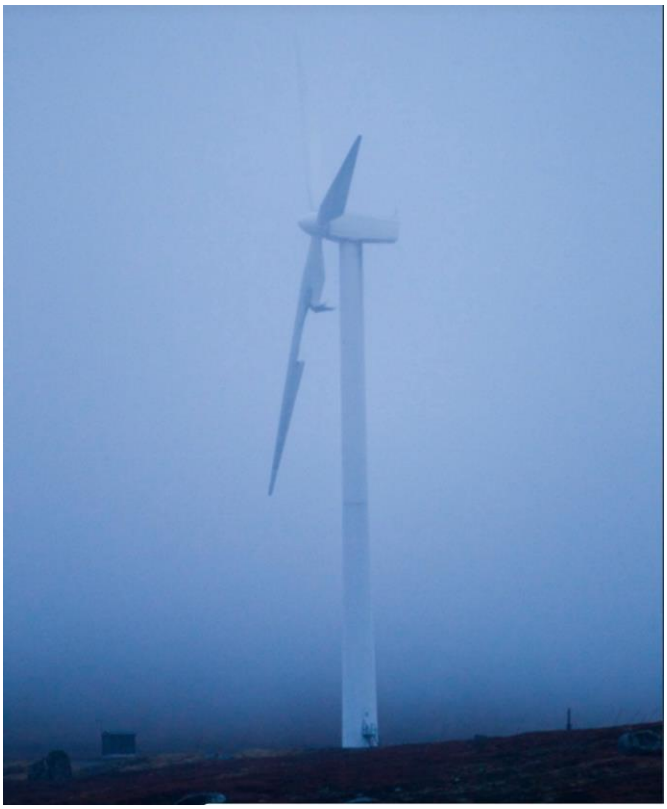
[27] https://www.offshorewind.biz/2021/10/21/turbine-parts-dropped-into-sea-at-ormonde-offshore-wind-farm/?fbclid=IwAR3zF9FM6IUWtYdNy_bJDHJ7UUpoYsx9FIR9X91gOv38bBql12MVI0Q-iLE

[28] https://www.offshorewind.biz/2021/10/25/update-video-rotor-hub-and-blades-fall-into-sea-at-ormonde-owf-coastal-debris-could-be-widespread/

We must also note that the falling wind turbine blades are completely broken into pieces by the impact on the water surface. Many accidents, both onshore and offshore are similar situations where a wing turbine blade is falling off and impacting on the below surface. When these types of accidents happen fare from shore it's not likely any, or most of the debris can be retrieved at nearby beaches.

Estimated BPA content of the three turbine blades weighing 126 tonnes is estimated to 15%, at a significant 20 tonnes of BPA. Just from this one accident alone.

The next image is from the Mehuken wind power plant in Norway 2011, after the hurricane "Dagmar" with measured wind speeds upwards at 80 m/s. Large parts of the accompanied wetland environment was littered with fragments afterwards.



Mehuken wind power plant 2011 - Image: Thomas Bikchardt/ Bickfoto

Wind turbine wings don't always fall off the nacelle in strong winds. Sometimes they have no explanations for the accident, as here recently this year on Frøya Vindpark, Norway.[29]

There are also several accidents where the whole turbine tower is collapsed, as here in Sweden earlier this year.[30]

[29] https://www.nrk.no/trondelag/vingeblad-pa-froya-har-falt-av-vindturbin---tronderenergi-stanser-anlegg-1.15727620

[30] https://www.tu.no/artikler/svensk-vindmolletarn-kollapset-vindturbiner-i-valer-midlertidig-stanset/505557?key=Jgk2ZovJ

The environmental pollution associated with BPA and micro plastics are of significant and rising concern.

In many ways, this type of pollution is non-biodegradable and is accumulated and may remain in the environment for several hundreds of years. Each year's pollution may in such regard be considered as a new point of no return.

We expect that our proposed restrictions in this document is taken into the further work with the ECHA/Reach Annex protocols.

With green regards,
Green Warriors of Norway
Norges Miljøvernforbund

Caseworkers and main contributors:

- Arnfinn Nilsen

- Jan-Erik Weinbach

- Asbjørn Solberg

Ruben Oddekalv - Leader
ruben@nmf.no

Green Warriors of Norway - (Norges Miljøvernforbund)

Postal address:
Box 593
5806 BERGEN
Norway

Main office:
Skutevikboder 24
5035 BERGEN
Norway

Website:
nmf.no

Contact:
nmf@nmf.no

Phone:
+47 55 30 67 00