

Hempaguard X7 antifouling coating

Comparative LCA against Hempel's Mille NCT 71880 antifouling (BAU) on a superyacht steel hull

1 INTRODUCTION

Hempaguard X7 is an antifouling topcoat based on Hempel's ActiGuard® technology: hydrogel silicone plus a fouling-preventing biocide (under 10% copper). Hempel states that its smooth, low-friction surface improves fuel consumption. At $2 \times 100 \mu\text{m}$ it lasts up to 5 years.

2 METHODOLOGY

Functional unit. 1 m^2 of coated yacht steel surface, over 20 years of yacht use.

System boundaries. Cradle to grave, same for both scenarios.

Upstream: paint components and their transport to the factory in Portugal. *Core:* manufacturing (electricity, water, packaging, waste).

Downstream: first application (airless spray), use (yacht diesel), maintenance (water blasting and repainting), end of life (hull steel recycled with its paint).

Standards. ISO 14040; ISO 14044 (incl. Amd 2, 2020).

Impact methods. CML-IA baseline v3.07 (tables: CML 2001 baseline, Jan. 2016) for GWP, ODP, POCP, AP, EP and NOx, SOx, PM; AWARE v1.04 (water); ReCiPe 2016 endpoint (H), Ecopoint (Pt).

This study compares a superyacht steel hull coated with Hempaguard X7 (Scenario 1) and with Hempel's conventional Mille NCT 71880 (Scenario 2, BAU); here Scenario 1 is the solution. Goal: verify its environmental performance for WRF's Hub of Verified Solutions.

Data sources. Mainly primary data from Hempel. Ecoinvent v3.8, plus proxies where data were missing; SimaPro 9.3. End-of-life recycling: loads split 50/50 between recycling and secondary steel.

Use phase. Yacht diesel over 20 years: 729 t (BAU) vs 586.8 t (Hempaguard X7); CO₂ 1,881 vs 1,425 t and NOx 21.2 vs 16 t (IMO factors).

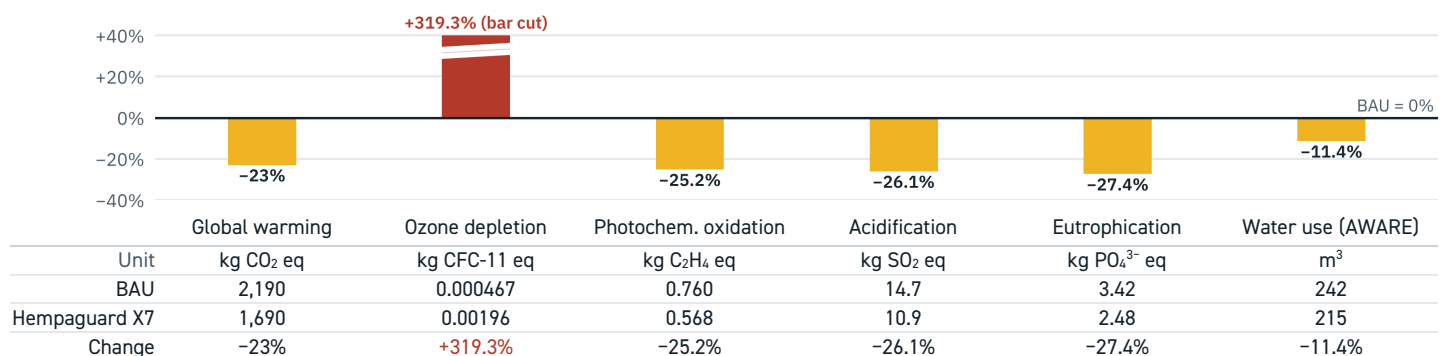
Coating data. X7: $2 \times 100 \mu\text{m}$, 2 l per 7 m^2 , repaint every 5 years, 520 g VOC per application. BAU: $2 \times 80 \mu\text{m}$, 2 l per 6.4 m^2 , every 3 years, 850 g VOC. Released to water per t of paint: 77.86 kg copper omadine (X7); 357 kg cuprous oxide and 30 kg copper omadine (BAU).

BAU reference. Hempel's Mille NCT 71880. Its manufacturing data were set equal to X7's (no primary data).

Not reported: Primer and tie-coat layers do not appear in the inventory.

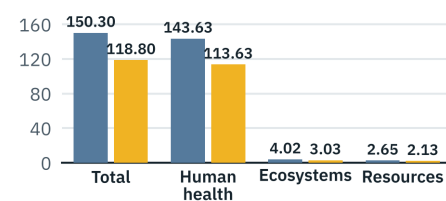
3 RESULTS per functional unit (1 m^2 of coated steel)

Hempaguard X7 change vs BAU (%), as reported in Tables 16 and 18 of the LCA report



The ODP bar is cut; it is not to scale.

Ecopoint (Pt), report Figure 1



Bar values: Figure 1 chart data in the report file.

Ecopoint (Table 19)

Ecopoint (Pt)	BAU	X7	Change
Total	150	119	-31.5%†
Human health	144	114	-30%†
Ecosystems	4.02	3.03	-24.6%
Resources	2.65	2.13	-19.6%

† As printed; does not match the values.

Ecopoint by stage (Tables 20–21)

Stage (Pt)	BAU	X7
1st application	0.647	0.179
Maintenance	5.87	0.894
Use phase	111	85.3
End of life	32.4	32.4
Total	150	119

NOx, SOx and particulates (Table 17)

Flow (kg)	BAU	X7	Change
Nitrogen oxides	1.50	1.19	-20.7%
Nitrogen monoxide	2.11E-06	1.51E-06	-28.4%
Nitrogen dioxide	20.32	15.39	-24.3%
Sulfur oxides	2.31E-03	1.88E-03	-18.6%
Sulfur dioxide	3.12	2.13	-31.7%
Sulfur trioxide	2.22E-04	6.65E-05	-70.0%
PM < 2.5 μm	0.198	0.157	-20.7%
PM 2.5–10 μm	0.118	0.0812	-31.2%
PM < 10 μm	1.18E-06	5.93E-07	-49.7%
PM > 10 μm	0.346	0.271	-21.7%

4 KEY FINDINGS

Lower in most indicators. Global warming is 23% lower ($2,190 \rightarrow 1,690 \text{ kg CO}_2 \text{ eq per m}^2$). POCP, acidification and eutrophication are 25–27% lower, water use 11.4% lower, and all NOx, SOx and particulate flows 18.6–70.0% lower.

Use phase drives the result. It is 71.82% (X7) and 74.14% (BAU) of the Ecopoint score; diesel over 20 years is 586.8 vs 729 t. Maintenance falls from 5.87 to 0.894 Pt (repaint every 5, not 3 years). End of life: 32.4 Pt in both.

Keep in mind: the report says results depend on proxies; BAU manufacturing data were copied from X7

Trade-off: ozone depletion is 319.3% higher. The report links this to dimethyldichlorosilane in the proxy used for the silicone oil (566.41 kg per t of paint), so it depends on secondary data.

Ecopoint headline needs checking. Values fall from 150 to 119 Pt, but the report states 31.5% (Table 19, conclusions) and 26.52% (summary). These do not agree.