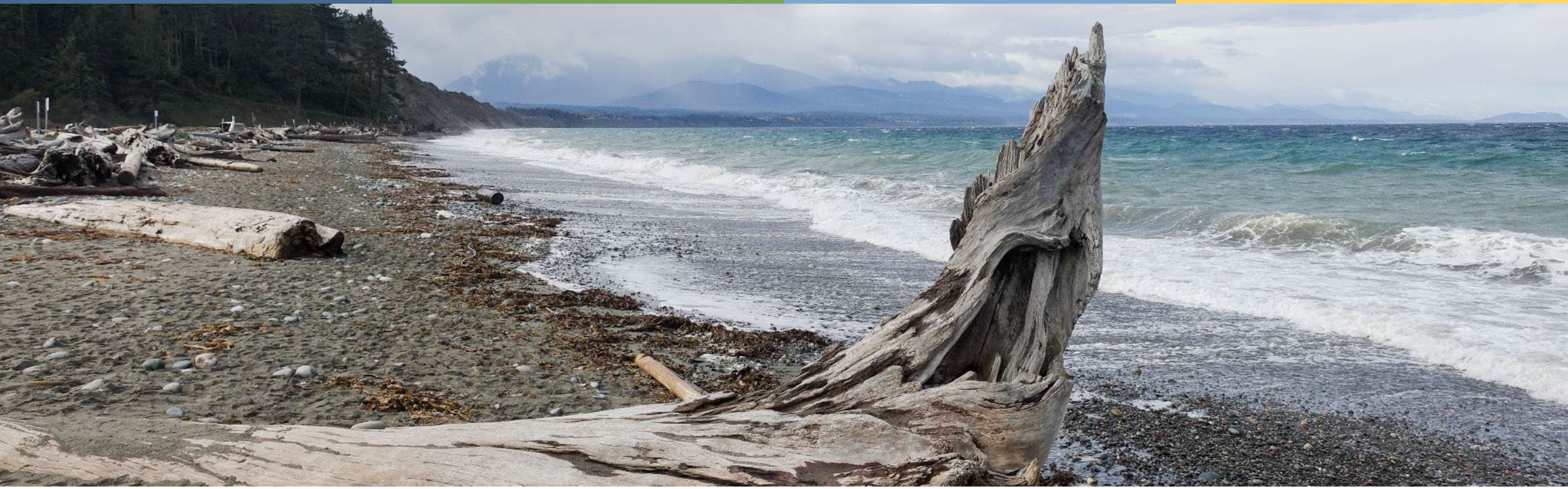


DEPARTMENT OF ECOLOGY
State of Washington

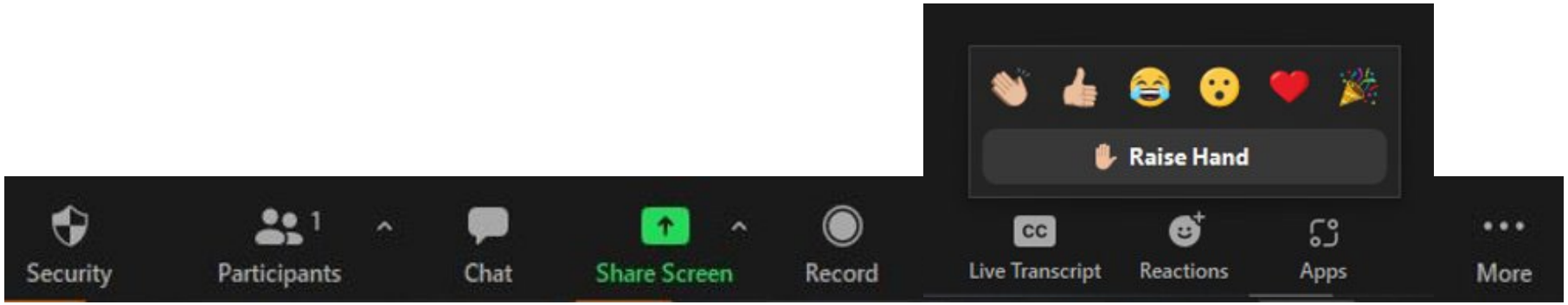
Antifouling Boat Paints in Washington State

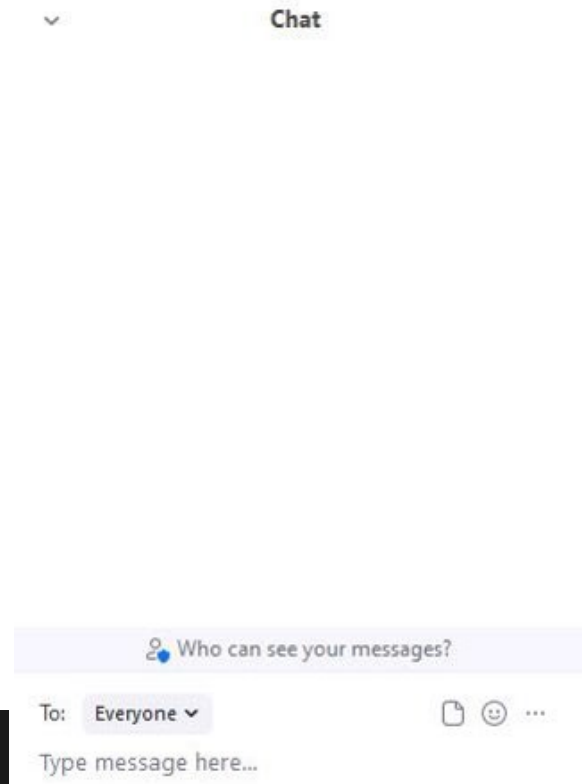
Public information session

Hazardous Waste and Toxics Reduction Program
December 6, 2023, 10:00 a.m. PST

Zoom logistics

- Send technical issues to the **host** in the chat.
- Send questions, comments, and discussion to **Everyone** in the chat.
- If you have a question, please use the **Raise Hand** button.





Agenda

1. Background on antifouling boat paint
2. Introduction to our work
3. Overview of the report
4. Performance test updates
5. Public comment information
6. Question and answer

Background on antifouling boat paints

Marine fouling

- Marine organisms can attach and grow on boat hulls
- Marine fouling can degrade surface, increase fuel consumption, and help spread invasive species.
- Antifouling boat paints prevent marine organisms from damaging boat hulls.




Photo credits to Pixabay

What is the concern?

Environmental Concerns

- Antifouling paints usually rely on biocides and other toxic chemicals to work.
- Copper has been the most popular antifouling biocide additive in the market since the 1980s.
- The direct release of copper and other toxic chemicals into water can impact water quality and cause harm to non-target aquatic species like salmon.

Types of antifouling bottom paints

Biocidal paints

1. **Copper-based paint**
   - cuprous oxide
   - cupric oxide
   - copper pyrithione
   - cuprous thiocyanate

2. **Copper-free paint**
   - Tralopyril/Econea
   - zinc pyrithione
   - DCOIT/Sea-Nine

Non-biocidal paints

1. **Foul release coatings (FRCs)**
2. **Biocide-free self-polishing coatings**
3. **Hard surface treated composite coating**

Introduction to our work on antifouling boat paint

Long history with antifouling paints

2011

- Legislature concerned about copper effects on salmon.
- Banned copper-based paints effective 2018.
- Required Ecology to study and report on antifouling paints by December 2017.

2017

- Ecology did survey of available antifouling paints.
- Report found biocidal replacements for copper might be worse.

2018

- Legislation #2
- Ecology directed to run modeling study, review new science, and report back to Legislature.
- 2018 ban put on hold.

Long history continued

Continued from previous slide

2019

- Modeling study conducted on Washington marinas.
- Report found biocidal replacements for copper might be even worse.

2020

- Legislation #3
- Delays copper ban until 2026
- Bans Irgarol effective 2023
- Gives Ecology authority to request information
- Budget allows for hiring staff lead
- New report in 2024.

Present

Directive

RCW 70A.445.020 provides:

(1)The department will conduct **a review of information** about antifouling paints and ingredients…

(2)The department must submit a report to the legislature summarizing its findings **no later than June 30, 2024.** Prior to submitting the report to the legislature, the department will conduct **a public comment process**…

Directive continued

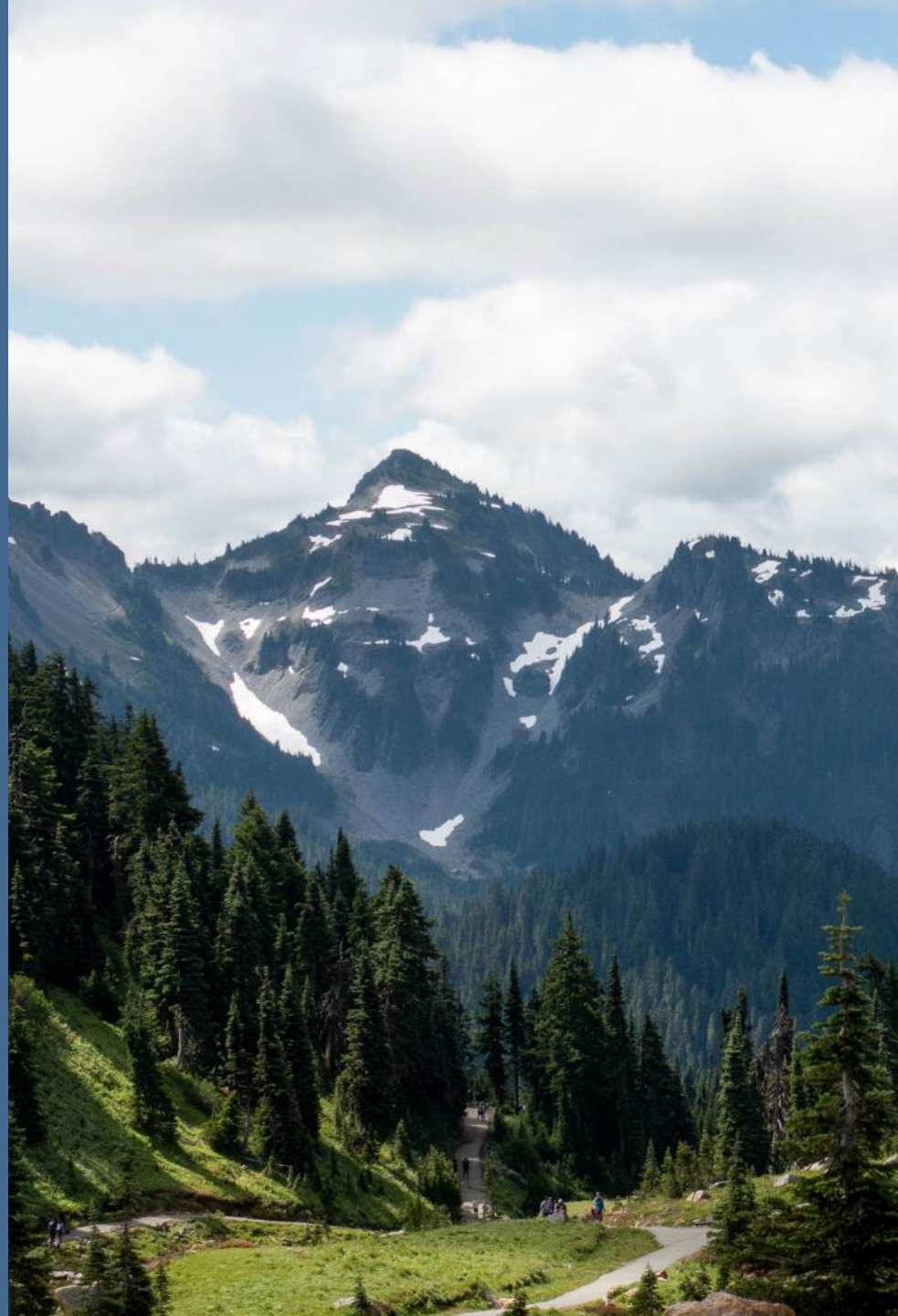
(3) If the department determines that **safer and effective** alternatives to copper-based antifouling paints are **feasible, reasonable, and readily available**, then (the copper ban will go into effect beginning January 1, 2026).

(4) If the department does not determine by June 30, 2024, that safer and effective alternatives to copper-based antifouling paints are feasible, reasonable, and readily available, then the department must conduct a second review of relevant studies and information on alternatives to copper-based antifouling paints and submit a report to the legislature summarizing its findings no later than June 30, 2029.

Definitions used in the report

- Keywords: safer and effective alternatives that are feasible, reasonable, and readily available
  - **Safer:** Hazard-based criteria for safer antifouling chemicals
  - **Effective:** Describes the performance on the product level. Effective alternatives can provide antifouling function in cold water and have a reasonable product lifetime.
  - **Feasible and readily available:** Alternatives that are already used to provide the same or similar antifouling function as copper boat paint.
  - **Reasonable:** Those that can be easily adopted by many applicators.

Overview of the report
Highlights and conclusions



Report outline

- Section 1: Criteria for safer antifouling chemicals
- Section 2: Review of information
- Section 3: Performance testing

Section 1: Criteria for safer chemicals

- **Safer antifouling chemicals**
  - Are less hazardous to non-target species.
  - Are less persistent and less bioaccumulative.
  - Release fewer toxic chemicals into the environment.

- **Target vs non-target species**
  - Target: most sessile biofouling species like barnacles, tunicates, sponges, and mussels.
  - Non-target: species that antifouling boat paint isn't meant to target, including fish like salmon, shrimp, and freshwater organisms.
  - Most standard ecotoxicity species are non-target species

- **Built upon the Safer Products for Washington safer criteria.**

Section 1: Criteria for safer chemicals (continued)

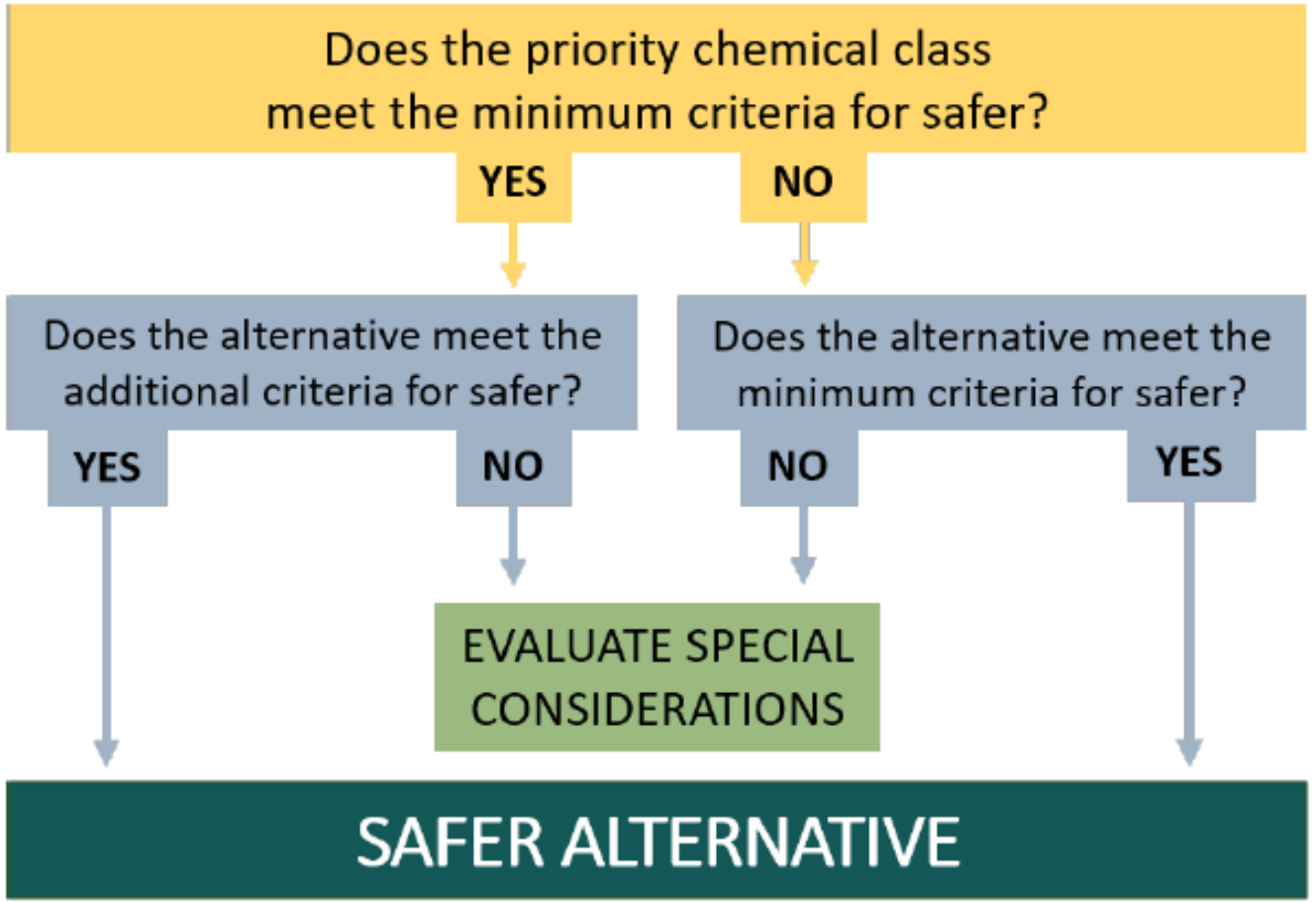


Figure 1: Overview of the general process used to determine whether alternatives are safer (Ecology, 2021). See the last slide for image description.

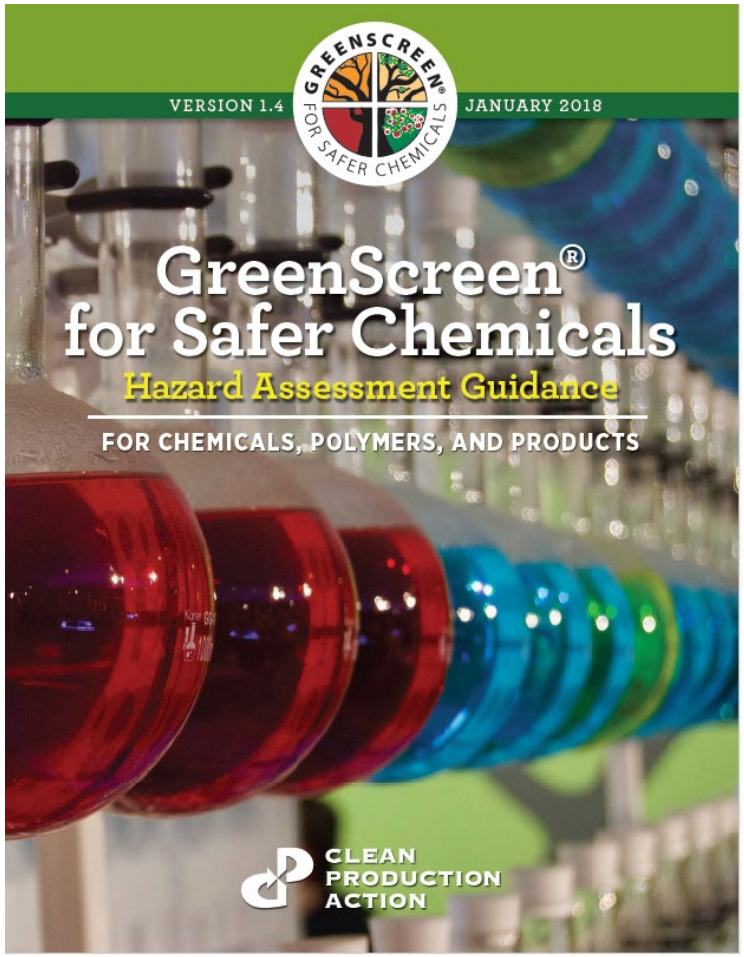
Criteria table for safer antifouling chemicals

Hazard endpoint	Requirement
Carcinogenicity	Required
Mutagenicity/Genotoxicity	Required
Reproductive or Developmental Toxicity	Required
Endocrine Disruption	Not required
Acute Toxicity	Not always required*
Single or Repeat Systemic Toxicity	Not always required*
Single or Repeat Neurotoxicity	Not always required*
Skin or Respiratory Sensitization	Required
Skin or Eye Irritation	Not required
Acute or Chronic Aquatic Toxicity	Required
Persistence	Required
Bioaccumulation	Required

*Two of three required

Additional data review: use only toxicity data from non-target species.

Criteria for safer antifouling chemicals



GreenScreen® Benchmark scores

- Benchmark-1 – Avoid: Chemical of High Concern
- Benchmark-2 – Use but search for Safer Substitutes
- Benchmark-3 – Use but still opportunity for improvement
- Benchmark-4 – Prefer: Safer Chemical

Criteria for safer antifouling chemicals (continued)

- Cuprous Oxide (Cu_2O), does not meet the minimum criteria for "safer" based on its GreenScreen® Score of Benchmark-1.

- The minimum criteria for safer is a baseline set of hazard criteria and data requirements derived from GreenScreen® Benchmark-2 criteria.

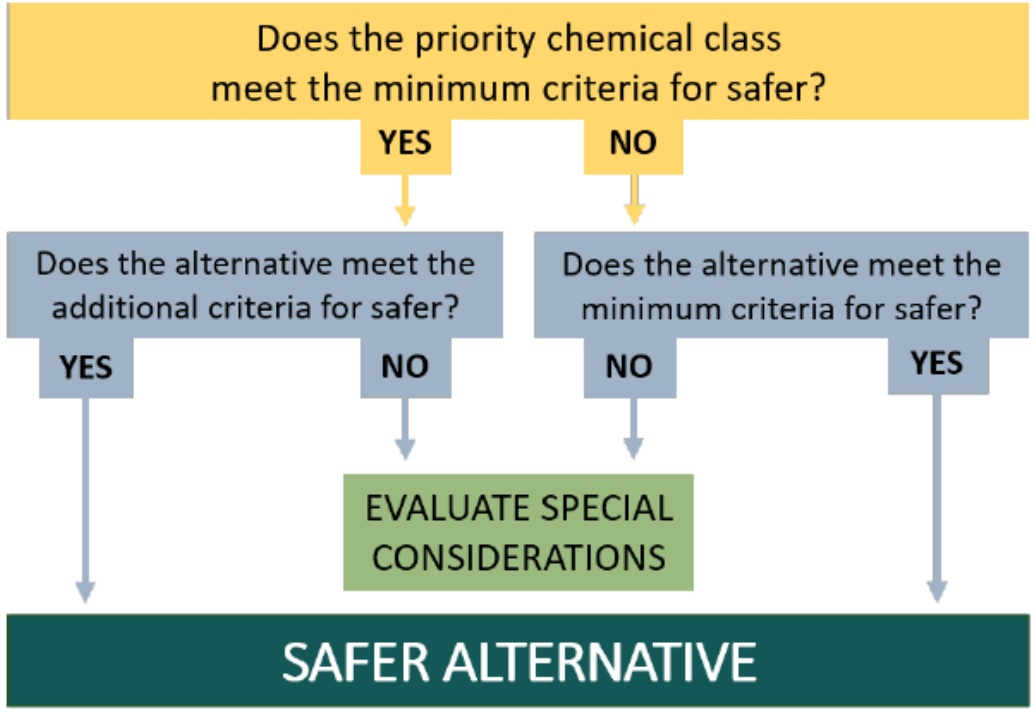


Figure 1: Overview of the general process used to determine whether alternatives are safer (Ecology, 2021). See the last slide for image description.

Section 2: Review of information

- Antifouling paints were reviewed in two categories:
  - Biocidal paints
    - Pesticides under federal and state regulations.
    - Product information available through the PICOL database.
    - Current alternatives are: Tralopyril (known as Econea), zinc pyrithione, and DCOIT (known as Sea Nine 211).
  - Non-biocidal paints
    - Not subject to pesticide regulations.
    - New emerging products.
    - Primarily developed for commercial vessels and not available for recreational vessels in Washington.

Section 2: Biocidal paints

- Tralopyril/Econea
  - Used in 11 out of 87 products.
  - New information shows high persistence after hydrolysis.
- Zinc pyrithione
  - Used in 17 out of 87 products.
  - New information shows high developmental toxicity in humans, presenting inhalation and dermal risks for painters (banned for use in anti-dandruff cosmetics by European Union in 2022).
- DCOIT/Sea-Nine 211
  - Used in 7 out of 87 products. Only one (Epaint SN-1) uses it as the single biocide.
  - Exhibits high and non-selective toxicity to marine organisms.
  - This emerging biocide has low persistence and can degrade rapidly in seawater.

Section 2: Biocidal paints graph

CAS #	Name	GreenScreen® Benchmark	Carcinogenicity	Mutagenicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity	Systemic Toxicity, Repeated dose*	Neurotoxicity	Neurotoxicity, Repeated dose*	Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability
1317-39-1	Cu_2O	1	*L*	L	L	*M*	DG	M	*H*	M	DG	DG	L	*L*	L	*H*	vH	vH	*vH*	*L*	*L*	*L*
122454-29-9	Tralopyril	1	*M*	L	*L*	*H*	DG	vH	DG	H	*vH*	H	*L*	*L*	*M*	*M*	vH	vH	*vH*	vL	L	L
13463-41-7	zinc Pyrithione	1	L	L	L	H	*M*	vH	*vH*	H	M	H	*L*	*L*	L	vH	vH	vH	*H*	vL	L	*L*
64359-81-5	DCOIT	2	L	L	L	L	*M*	vH	*vH*	L	DG	L	H	DG	vH	vH	vH	vH	*L*	*vL*	*L*	L

Table 3: GreenScreen® for Safer Chemicals summary hazard tables for biocides.

Key: vL = very low; L = low; M = moderate; H = high; vH = very high; DG = data gap; Italics = lower confidence; Bold = higher confidences.

- Tralopyril and zinc pyrithione, cannot pass the minimal criteria to be safer.
- Currently available information shows that DCOIT is a safer chemical compared to copper.
- Benchmark-2 results expire after 5 years and may change over time. DCOIT is a new biocide that started in 2015.

Section 2: Review on effectiveness

- TechLaw and Northwest Green Chemistry contracted with Washington State to conduct an Alternatives Assessment in 2017. This report evaluated paint performance based on a San Diego 2011 report and Practical Sailor panel testing.

- Information since 2019 is limited, and not relevant to Washington state waters.

- We focused on searching performance data on DCOIT-containing products. Most products use DCOIT as a booster biocide, with copper oxide.

- To fill this data gap, we collaborated with a research team at Washington State University and conducted a performance field test. The initial performance testing results are included in this report, but testing is ongoing.

Section 2: Non-biocidal paints

- Foul-release coatings
  - New emerging products.
  - Ingredients are not disclosed.
  - Usually contain silicon- or fluoropolymer-based chemicals (PFAS).
  - We lack sufficient information to conclude the toxicity and environmental impact of foul-release coatings.
  - Are non-biocidal paints safer? There are data gaps.

Performance Testing

- Dr. Xianming Shi, Professor and Chair of Civil & Environmental Engineering, Washington State University
- Mueed Jamal, project lead, Washington State University

Conclusions

- At this time, Ecology is not able to determine “that safer and effective alternatives to copper-based antifouling paints are feasible, reasonable, and readily available” pursuant to RCW 70A.445.020.

- As a result, the potential restrictions on copper-based paints in RCW 70A.445.020(3)(a)-(c) will not take effect and Ecology will conduct a second review of relevant studies and information. A follow-up report will be submitted to the Legislature by June 30, 2029.

Next Steps

Public comment process: closes January 17, 2024

Review and respond to comments: Spring 2024

Finalize report and submit to Legislature: by May 1st, 2024

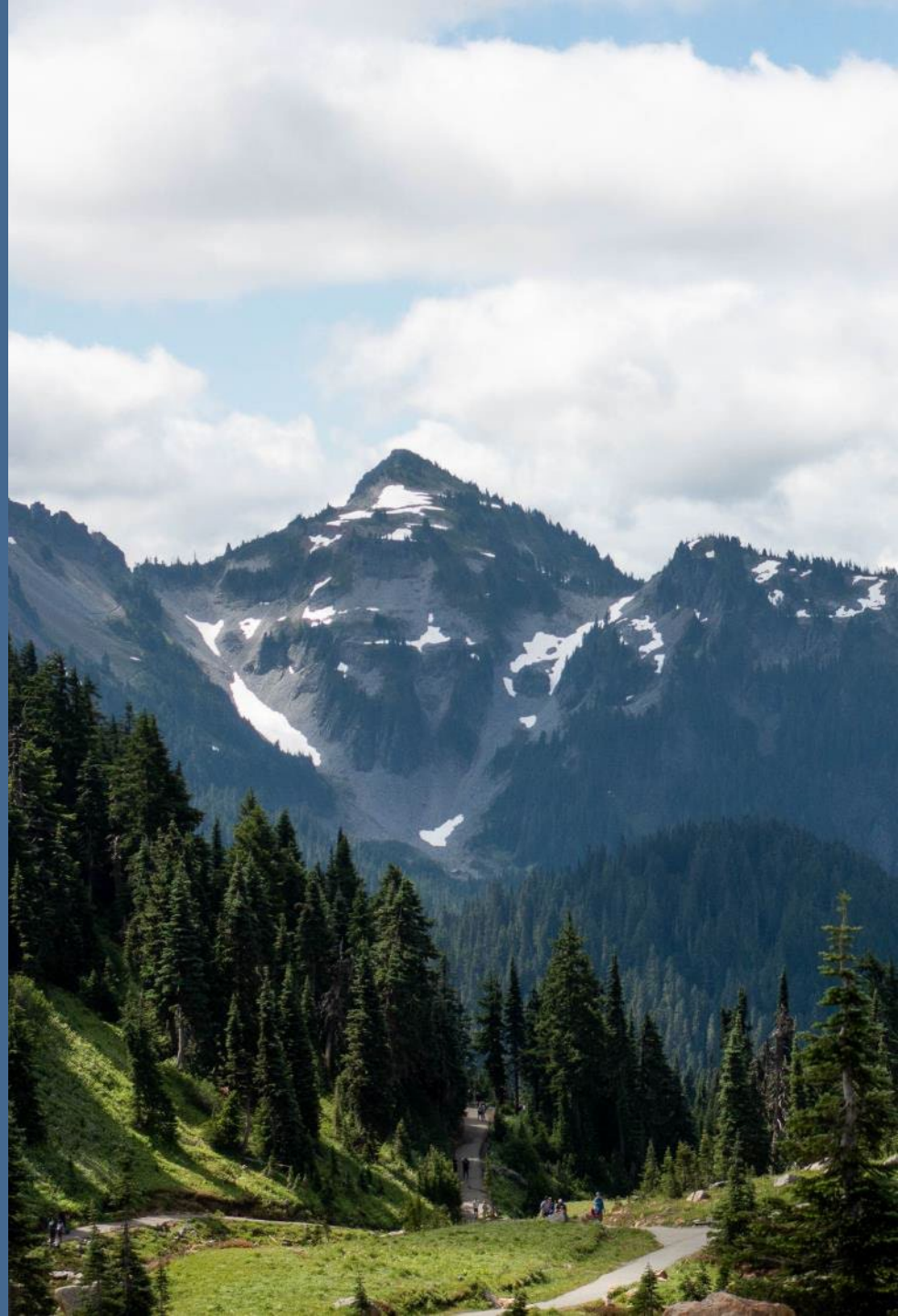
Legislative deadline: June 30, 2024

Public Comment

Draft Antifouling Paints in Washington State: Third Report to the Legislature

- We welcome all comments from December 4, 2023, to 11:59 p.m. PDT on January 17, 2024.
- Submit your comments:
  - By online public comment form.
  - By email to Iris.Deng@ecy.wa.gov.
- For tips on commenting, please visit our Commenting Tips webpage.

Questions?



Thank you!

Contact

Iris Deng
Natural Resource Scientist
360-480-6555
Iris.Deng@ecy.wa.gov

Related resources

- Chapter 70A.445 RCW (https://apps.leg.wa.gov/rcw/default.aspx?cite=70A.445)
- Pesticide Information Center OnLine (PICOL) Database (https://picol.cahnrs.wsu.edu/)
- Antifouling boat paint laws webpage (https://ecology.wa.gov/waste-toxics/reducing-toxic-chemicals/washingtons-toxics-in-products-laws/antifouling-boat-paints)
- Toxicological Effects of Antifouling Agents on Non-Target Marine Species
- Quality Assurance Project Plan: Performance Test of Green Alternatives to Copper Antifouling Paints

Criteria for safer chemicals

Figure 1:
Flowchart demonstrating how we will identify safer alternatives for antifouling boat paint. Because the priority chemical Cuprous Oxide doesn't meet the minimum criteria for safer, we are evaluating whether alternatives meet the minimum criteria.

- If yes, it meets the requirements as a safer alternative.
- If no, we will evaluate special considerations.