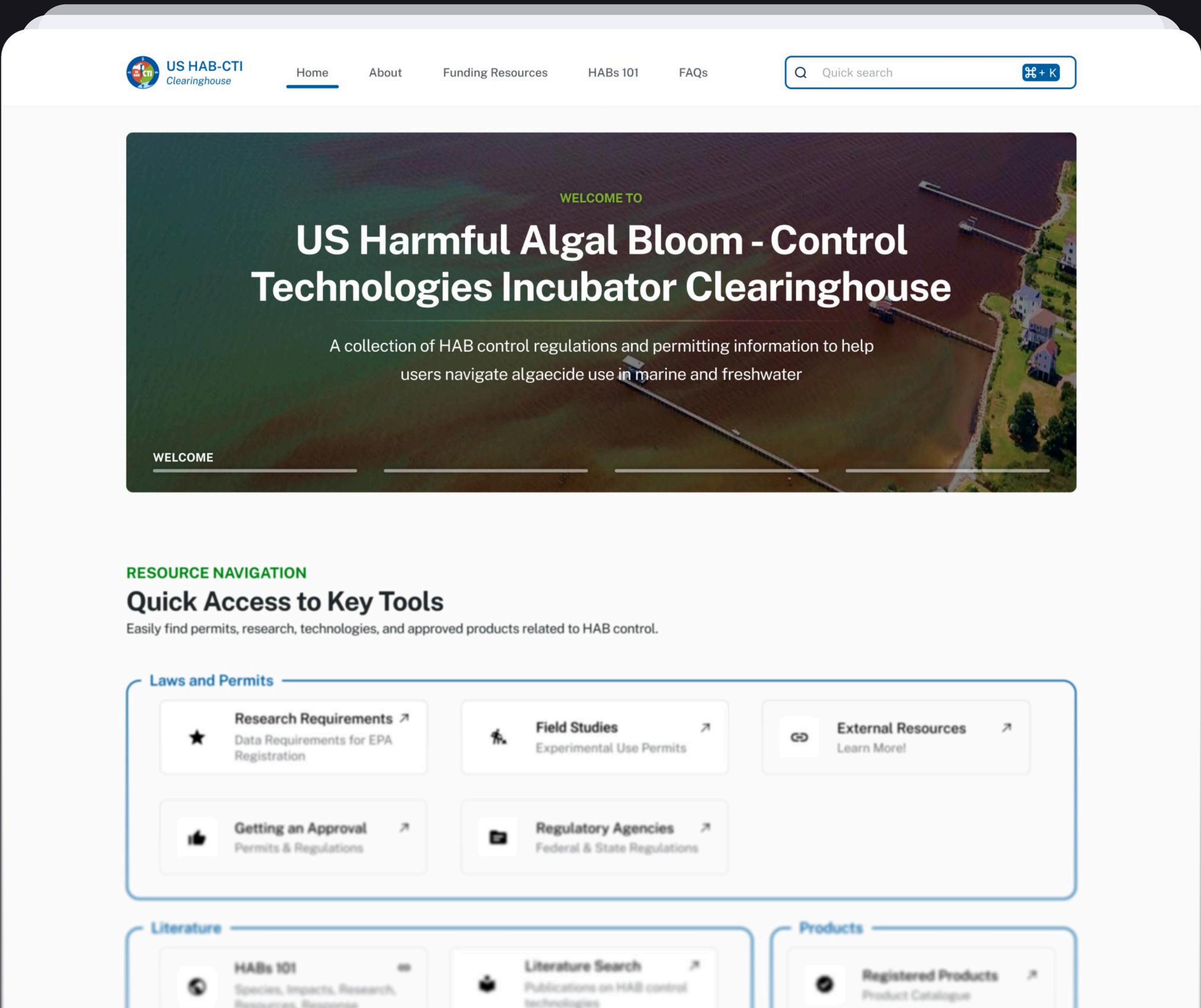
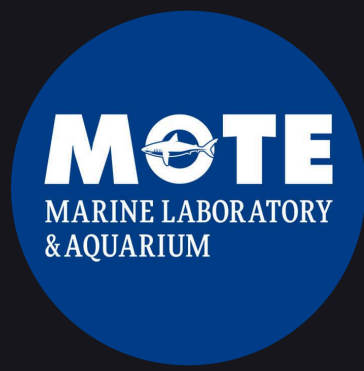


Hrushikesh Ingale & Team Presents
in collaboration with



Overview

Problem Statement

How can we improve the discoverability of scattered algal bloom mitigation guidelines to boost search success rate and reduce information access time for stakeholders?

Impact

Permits Repository	⬆️	120+
Task Success Rate	⬆️	40%
User Bounce Rate	⬆️	58%
Search Time	⬆️	30%

Strategy



Building a Regulatory Clearinghouse Website



Aggregate Searchable Records from Multiple Agencies

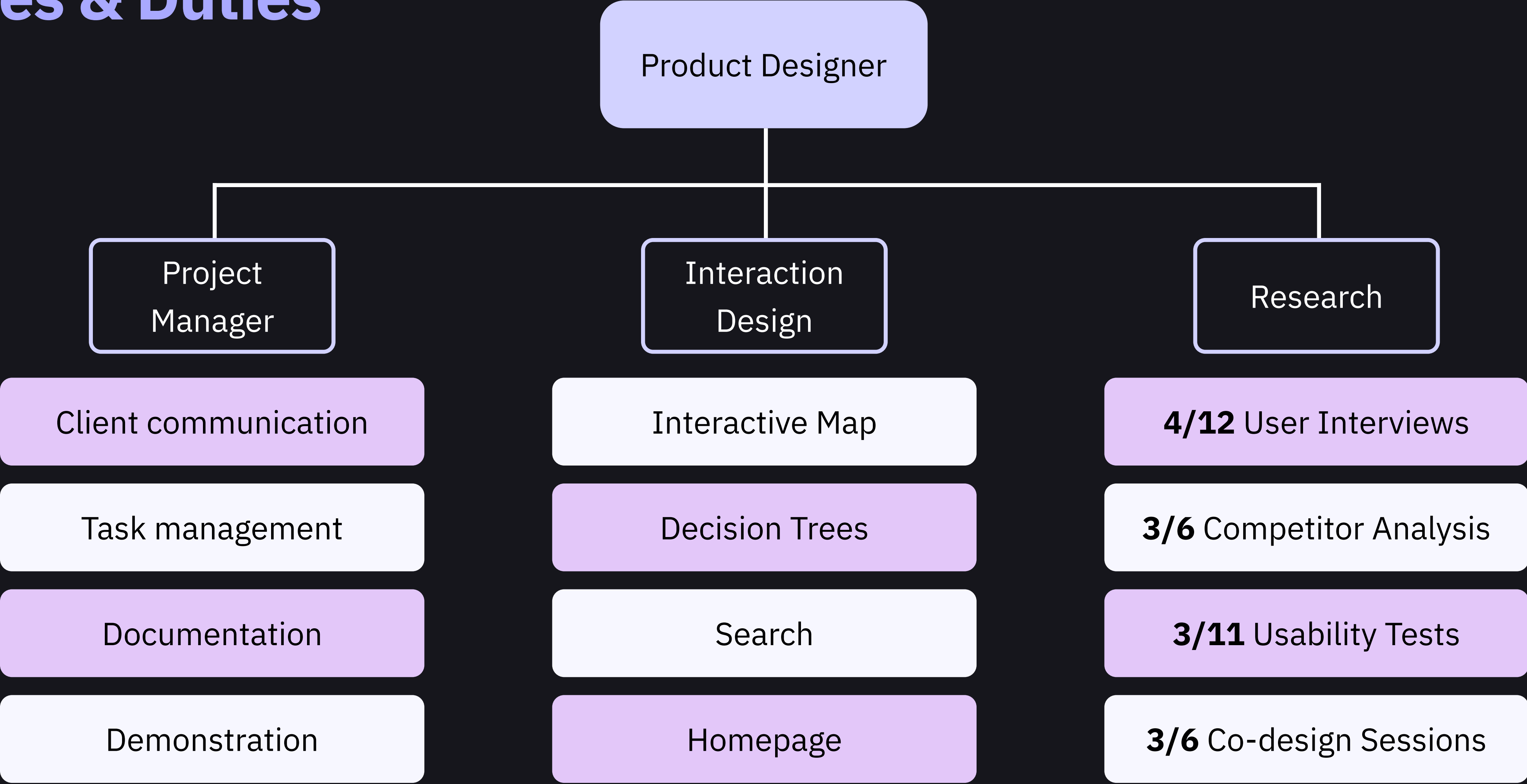


Design an Interactive Map for State-Specific Guidelines



Map Federal Permit Requirements via Decision Trees

Roles & Duties



Process



Field Study

Competitive
Analysis



Research

SME
Interviews



Ideation

Low-Fidelity
Wireframing



Design

High Fidelity
Wireframing



Testing

Supervised
Usability
Study



Deploy

Front-End
Development
Team

Research

Competitive Analysis



EPA has depth but lacks focused usability for HAB-specific technologies.



ITRC offers the best user-aligned experience for tech developers and regulators, with clear, structured guidance and tools.



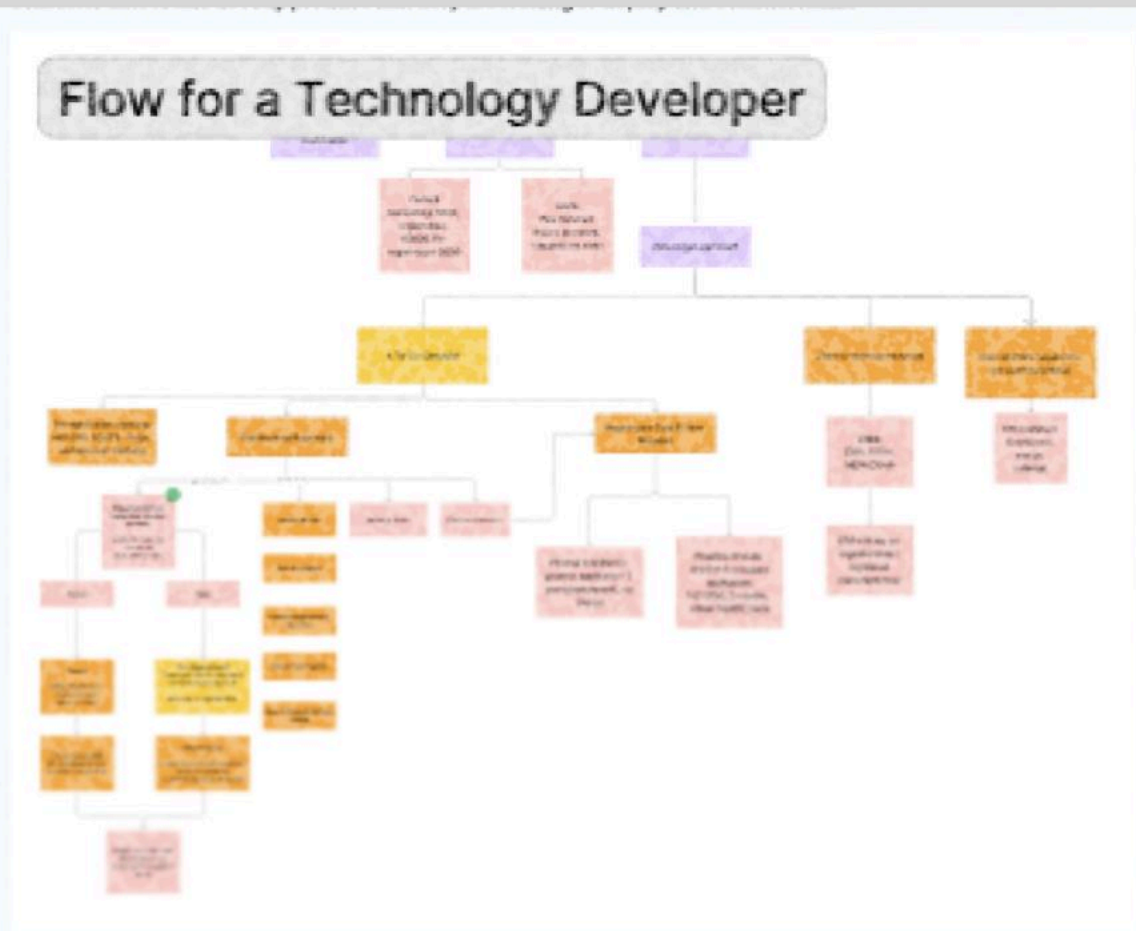
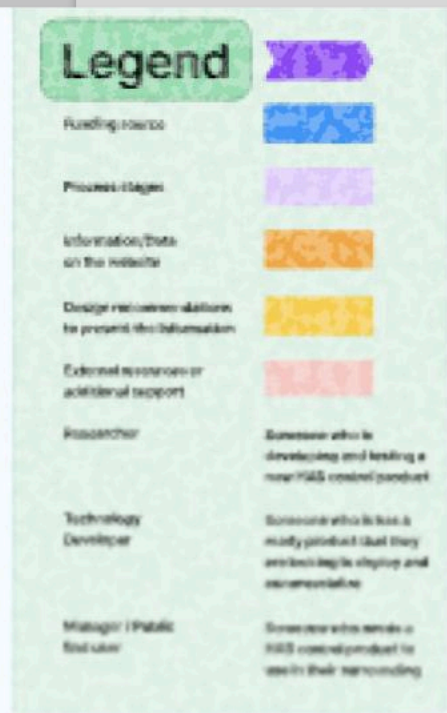
WISE is more aligned with EU policy frameworks and academic research, not practical deployment or permitting processes.

Research

User Interviews/Co-design Sessions



Interviewed 12 candidates including executives of several federal permitting agencies like NOAA, MOTE, CMU, Sudoc.



Research

Pain Points



Researchers

Scattered regulatory resources
Manual literature and data search
Unclear early compliance status



Technology Developer

Complex multi-agency approvals
High compliance costs
Unclear permit decision steps



Manager


Hard to compare products
Varying state permit processes
Limited quick decision tools

US HAB-CTI

Wireframe [Figma]

QUICK ACCESS TO RESOURCES


Guidance by Role



Researcher

Scientists conducting R&D on novel control technologies


- HABs 101
Something about HABs
- Literature Search
Something about HABs
- Regulations Directory
Something about HABs
- Research Requirements*
Something about HABs
- Field Studies
Something about HABs



Developer

Innovators bringing control technologies to market

- Patent Search
Something about HABs
- Consultants Database
Something about HABs
- Timelines and Costs
Something about HABs
- Getting an Approval
Something about HABs
- External Resources
Something about HABs



Manager

Decision-makers needing approved HAB solutions

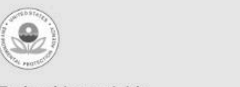
- Registered Products
Something about HABs
- Previous Literature
Something about HABs

HELP CENTER

Regulation Agencies and Acts

Grant Information lorem ipsum some more text


A second objective of the US HAB-CTI is to develop a clearinghouse that offers guidance to end users and stakeholders on navigating the relevant licensing and permitting processes, as well as environmental compliance requirements for both potential and existing control technologies.



Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Regulates the sale, distribution, and registration of pesticides and algicides.

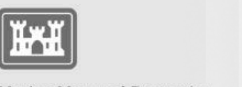
Visit the FIFRA website



Federal Food, Drug, and Cosmetic Act (FDCA)

Authorizes the FDA to set pesticide tolerances in foods, including products used in marine or freshwater sites where fish or shellfish may be exposed and consumed by humans.


Visit the FDCA website



Marine Mammal Protection Act (MMPA)

Prohibits the disturbance of a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breeding, nursing, feeding, or sheltering (Level B harassment).


Visit the MMPA website



National Environment Policy Act (NEPA)

Requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions.

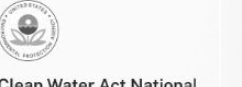
Visit the NEPA website



Section 404 of the Clean Water Act

A permit is required for the discharge of dredged or fill material into waters of the United States.


Visit the Clean Water Act website



Clean Water Act National Pollutant Discharge Elimination System (NPDES)

Prohibits anybody from discharging "pollutants" through a "point source" into a "water of the United States" unless they have an NPDES permit.

Visit the NPDES website



About Resources Resources Harmful Algal Blooms Go to Funding

Quick search 36 K Funding

Literature Search

Discover relevant studies, articles, and insights—all in one place.


What research are you looking for today? Search

Advanced Search

Your search results for “Mycelium Coxillum”

What location are you looking for today? Search

Popular Locations: Maryland, USA New York, USA California, USA Florida, USA



Active Tags: Biological Sea Alexandrium Other type Clear All

Filter Sort

Filter Clear All

Class of product

☒ Chemical

☐ Biological

Mitigation product

☐ Macroalgae

☐ Other Type

Species Tested On

☒ Alexandrium

☐ Dinoflagellate

☐ Enter name ...

Scale of Experiment

☒ Lab

☐ Mesocosm

☐ Large

Waterbody

☒ Sea

☐ Pond

☐ River

☐ Lake

1 Journal

Mitigation of *Karenia brevis* Cells and Brevetoxins Using Curcumin, a Natural Supplement

Hammond, May, Clarkson
2014; Florida : University of Florida Press

Curcumin, a natural plant product, was investigated as a mitigation tool against *Karenia brevis*, the toxic dinoflagellate responsible for Florida red tides. A series of laboratory bench-top studies were conducted with additions of 0.1, 1, 2, 3, 5, 10, 20, 30, and 40 mg/L curcumin to *K. brevis* at an average of 1.0 × 10⁶ cells/L to determine the efficacy of curcumin against *K. brevis* cells and brevetoxins and to optimize treatment dosage. Treatment with 5 mg/L of curcumin reduced *K. brevis* cell abundance by 89% and total brevetoxins by 60% within 24 h. Lower concentrations of curcumin (0.1–3 mg/L) exhibited between 2 and 45% reduction in *K. brevis* and a reduction in brevetoxins of between 2 and 44% within 24 h. At the highest curcumin doses, 30 and 40 mg/L, a 100% reduction in cell abundance was observed by 6 h, with reduction in total brevetoxins by at least 64% in 48 h. These results suggest that curcumin, used alone or potentially in combination with other technologies, is a promising *K. brevis* bloom mitigation option.

Tags: Chemical biochemical algicide
Dinoflagellate genus: Karenia Lab Marine

2 Article

Effectiveness of ozone nanobubble treatments on high biomass cyanobacterial blooms: A mesocosm experiment and field trial

Dr. Emily Waters
2021; Florida : National Oceanic Institute

Cyanobacterial harmful algae blooms (cyanobacteria) are a global threat to water resources, and lake managers need effective strategies to suppress or control them. Algaecides may have negative environmental impacts, and their use is becoming restricted. Nanobubble ozone technology (NBOT) is an emerging water treatment option with potentially fewer negative impacts. We assessed the effectiveness of NBOT in treating Planktothrix cyanobacteria from Grand Lake St. Marys (GLSM, Ohio USA) in a mesocosm (2,000 L) experiment and two 4-week trials in a GLSM embayment (Sunset Beach, SBE, ~4.7×10⁷ L). In mesocosms, the medium (1.21 ± 0.08 ozone to dissolve organic carbon ratio, O3:DOC) and high (2.04 ± 0.07 O3:DOC) doses decreased both chlorophyll *a* (chl-*a*) and phycocyanin by 98–99% and microcystins by 62% and 92%, respectively. The low dose (0.68 ± 0.05 O3:DOC) decreased chl-*a* and phycocyanin by over 70%. No effect was observed for chl-*a* or microcystins in both oxygen-only nanobubble mesocosm treatments...

Tags: Chemical biochemical algicide
Dinoflagellate genus: Karenia Lab Marine

3 Journal

Mesocosm study of PAC-modified clay effects on *Karenia brevis* cells and toxins, chemical dynamics, and benthic invertebrate physiology

Prof. Michael Reynolds
2022; Texas : Journal of Aquatic Sciences

Modified clay compounds are used globally as a method of controlling harmful algal blooms, and their use is currently under consideration to control *Karenia brevis* blooms in Florida, USA. In 1400 L mesocosm tanks, chemical dynamics and lethal and sublethal impacts of MC II, a polyaluminum chloride (PAC)-modified kaolinite clay, were evaluated over 72 h on a benthic community representative of Sarasota Bay, which included blue crab (*Callinectes sapidus*), sea urchin (*Lytechinus variegatus*), and hard clam (*Mercenaria campechiensis*). In this experiment, MC II was dosed at 0.2 g L⁻¹ to treat bloom-level densities of *K. brevis* at 1 × 10⁶ cells L⁻¹. Cell removal in MC II-treated tanks was 57% after 8 h and 95% after 48 h. In the water column, brevetoxin analogs BTx-1 and BTx-2 were found to be significantly higher in untreated tanks at 24 and 48 h, while in MC II-treated tanks, BTx-3 was found to be higher at 48 h and BTx-B5 was found to be higher at 24 and 48 h. In MC II flocc, we found no significant differences in BTx-1...

Tags: Chemical biochemical algicide
Dinoflagellate genus: Karenia Lab Marine

Regulations Directory

Something about the regulations directory

What location are you looking for today? Search

Popular Locations: Maryland, USA New York, USA California, USA Florida, USA



State Regulations

NOAA Region	States/Territories	State Agencies for HABs					
		Water/Environment	Natural Resources/Fish and Wildlife (STATE)	Department of Ag, Pesticides-Registration	Dept of Ag, Pesticides--Applicator License	Pesticides--Regulations for Applying Aquatic Pesticides	Additional Resources/Notes
		Search (State) "water permits" or "division of water" or "water resources"	Search (State) "Fish and Wildlife"	Search (State) "pesticides registration"	Search (State) "pesticides applicator license"	Search (State) "aquatic weed control pesticides"	
						Can link through dept of ag site	
Pacific Islands							
	Guam	Guam Environmental Protection Agency (GEPA), Programs	(Intentionally left blank--do not see official info on this)	Guam Environmental Protection Agency (GEPA), Pesticides	Guam Environmental Protection Agency (GEPA), Pesticides	(Intentionally left blank--do not see official info on this)	
		Visit page		Visit page	Visit page		

Tier 3 and Tier 4 Studies

Federal Regulations for Experimental Use Permits (EUPs) and Small-Scale Testing

SECTIONS

- Testing a pesticide product
- Permitting pesticide field tests
- US HAB-CTI Application
- Resources
- Other Funding Opportunities

Testing a pesticide product or new use to get it registered under FIFRA

- EPA requires that a pesticide product undergo extensive chemical, toxicological, and field-testing before being registered as a pesticide. During this testing phase, the pesticide is an unregistered product.
- In order to conduct tests with an unregistered product, the entity carrying out the testing may be required to obtain authorization to do so from the EPA. This authorization is referred to as an Experimental Use Permit (EUP).
- An EUP may also be required to conduct tests with a registered product for a new, unregistered use.
- If you're applying to get a pesticide product registered at the federal level, the state agency responsible for state registration of pesticide products may want to be informed (e.g. the Florida Department of Agriculture and Consumer Services would like to be informed).

- EUP permits require:
 - product formula
 - scientific studies
- Draft algicide label; drafted by registrants and approved by EPA
 - Use Sites
 - Use Patterns
 - Formulation Types
 - Application Methods

Permitting pesticide field tests under Section 5 of FIFRA (7 U.S.C. 136(c))

Manufacturers of conventional pesticides are generally required to obtain EUPs before conducting field tests on one acre or more of water. Biopesticides may also require EUPs when used in field test settings.

EPAs Pesticide Registration Manual: Chapter 12 - Applying for an Experimental Use Permit webpage describes when an EUP is required, EUP application requirements, including labeling requirements and fee requirements, and data reporting requirements for an EUP. (40 CFR Part 172). Some testing activities are exempt from EUP requirements.

- If you have/need an EPA Experimental Use Permit, you will need a State EUP as well
 - Many states also require:
 - Local government to be contacted before submitting permit applications for letter of approval to test in local waters
 - Pesticide Applicator License
 - Environmental Resource Permit "Impacts to surface waters of the state"
 - National Pollutant Discharge Elimination System: "Discharge to waters of the state"
 - Pesticide Generic Permit: Authorization to discharge pollutants to surface waters of the state pursuant to federally approved NPDES program
 - State wildlife government group are normally brought in to review permit applications and provide comment on recommended sites, field methodologies, measures to avoid species impacts, etc.

Steps for a researcher to determine whether an EUP may be required:

Is this product intended to be used as a pesticide?

Yes

Does this pesticide contain any chemical or combination of chemicals that have not been included in any previously registered pesticide or is this a registered pesticide for which a use is not registered with the EPA?

Yes

Other exemptions, is the testing done in

Lab Water Animals Other

Is it one acre or less?

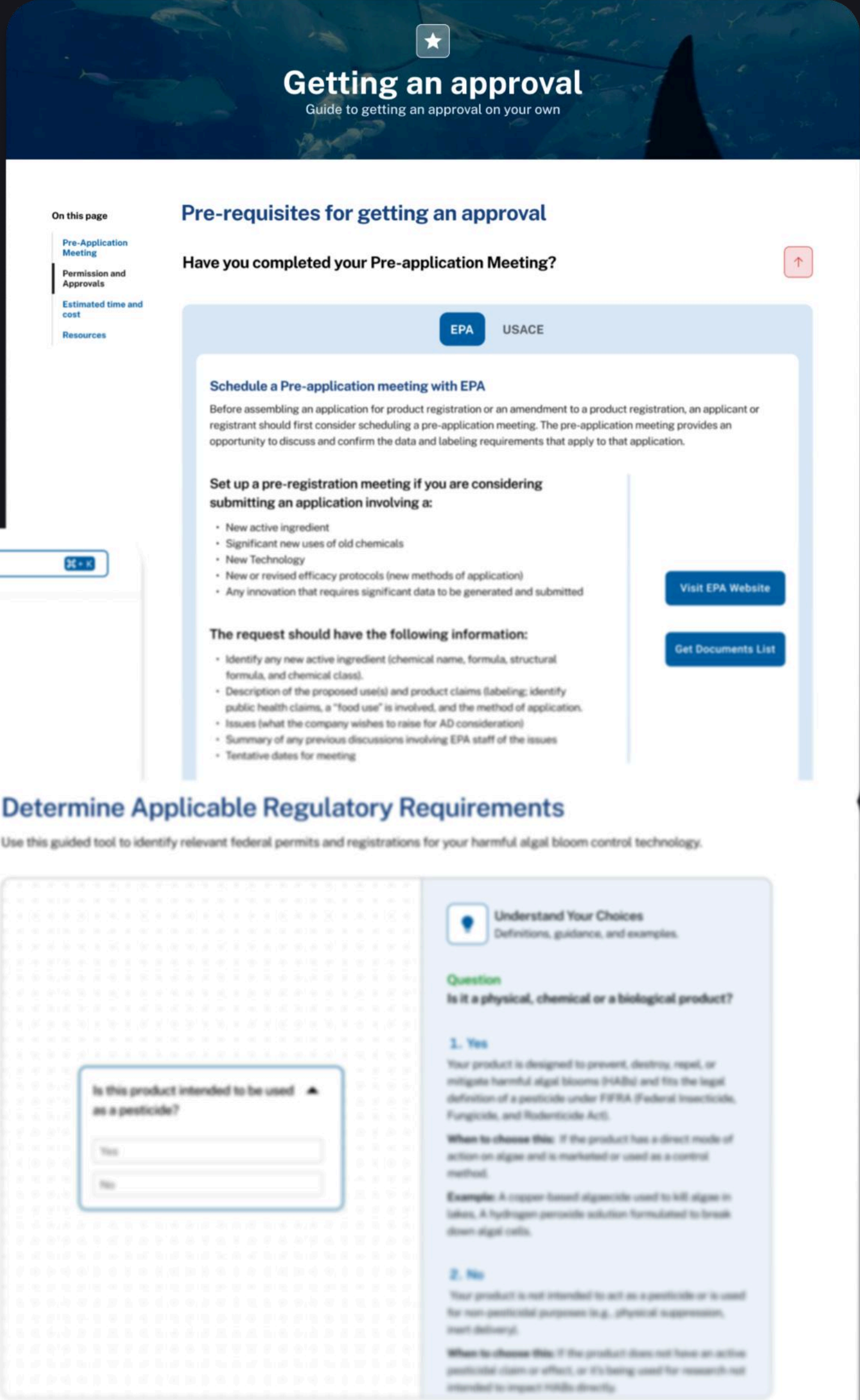
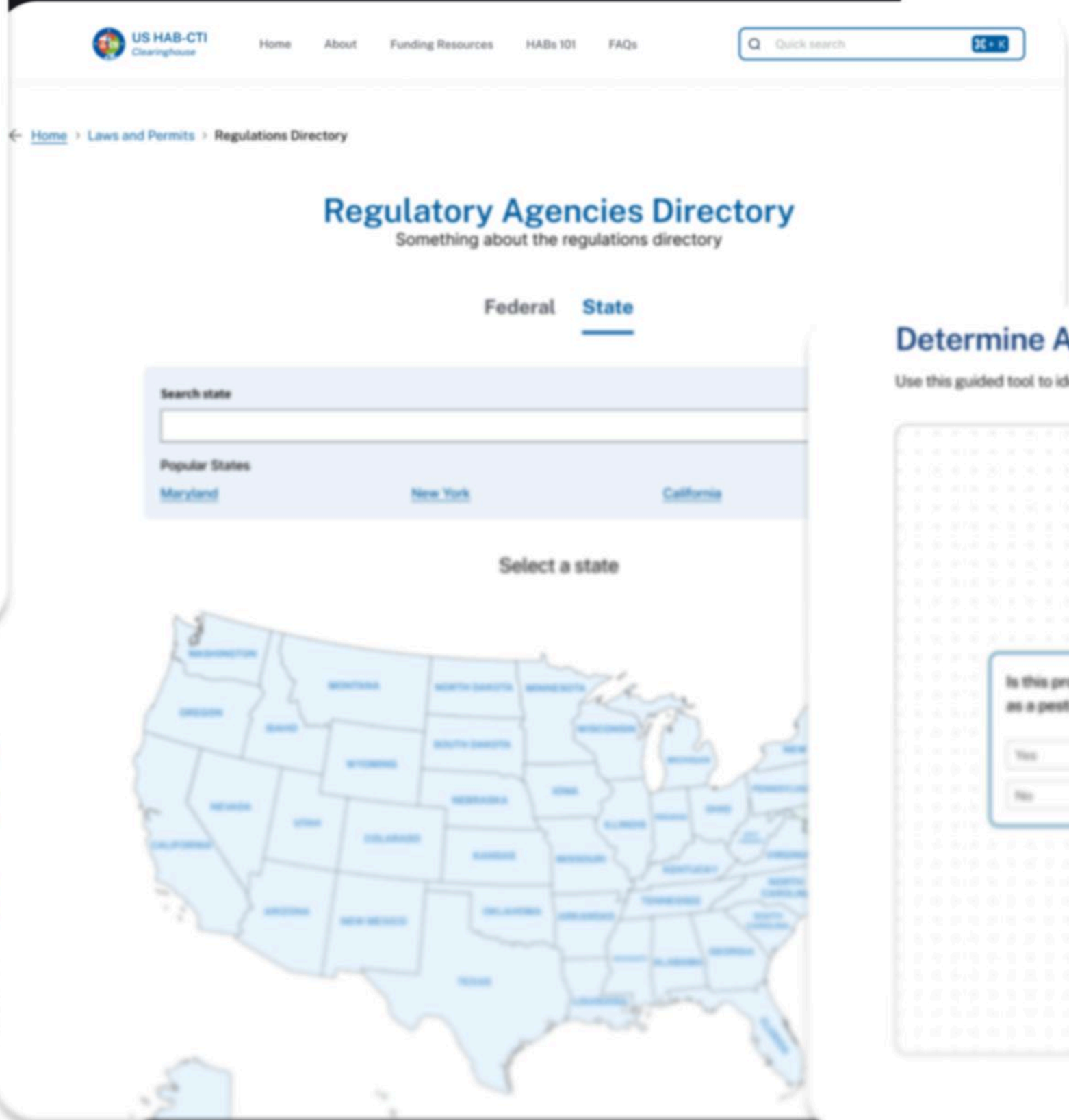
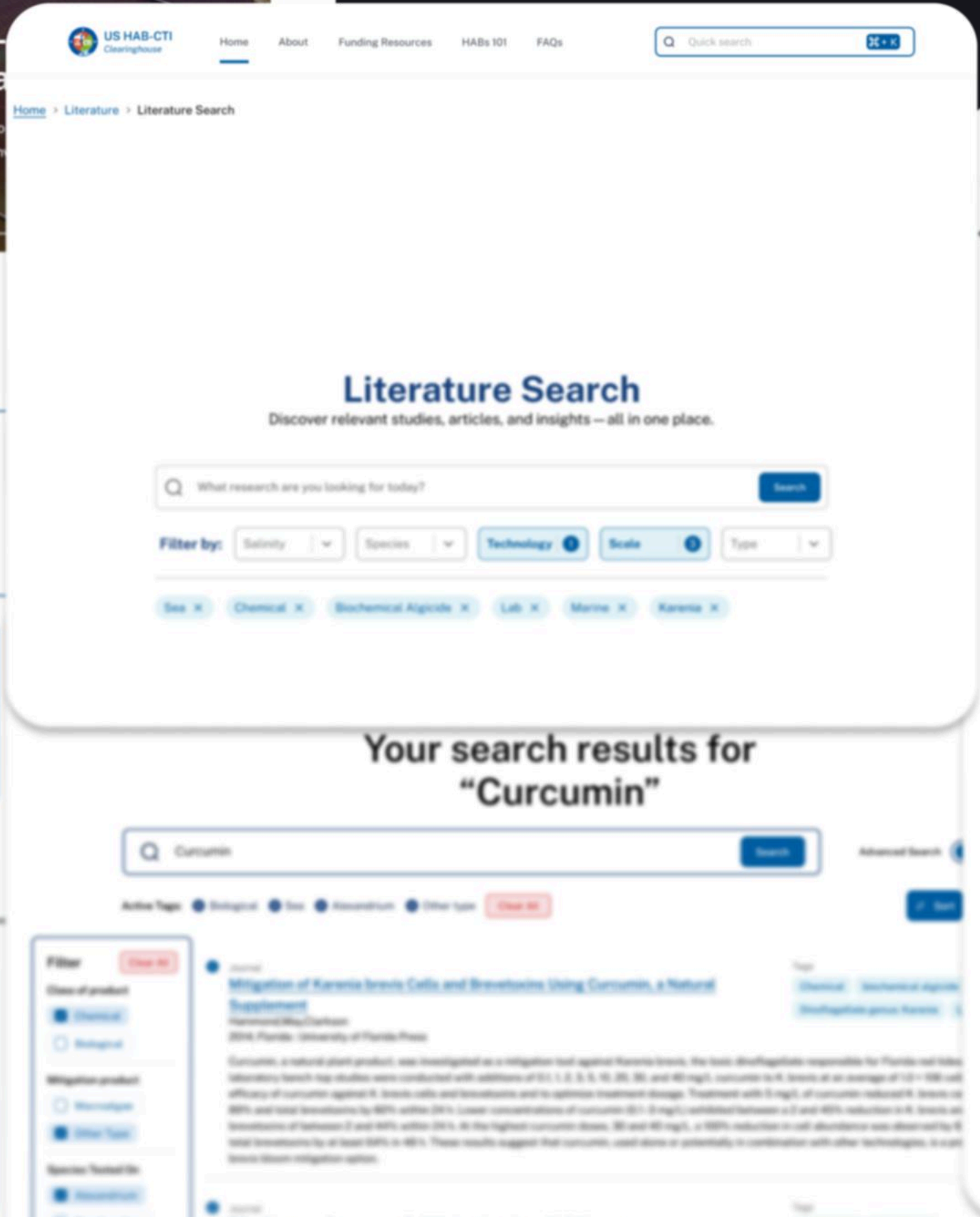
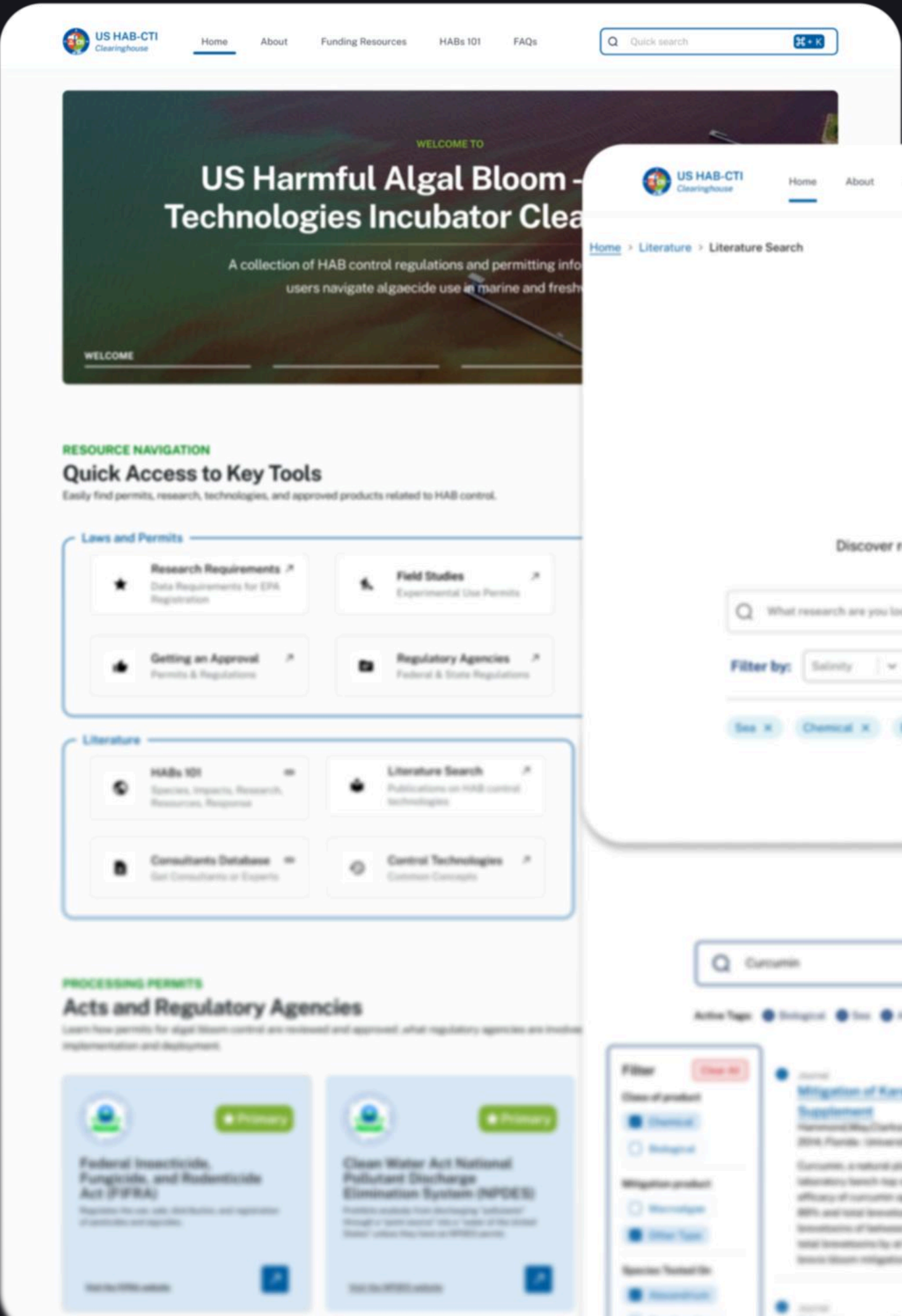
Yes

Potential Determination

Pesticide testing on water bodies one surface acre or less in size. Specifically, water bodies may be as large as one acre per pest/algae species if the effect of each pesticide on several pests is being investigated at a different time for each pest. However, if pesticide effects on more than one pest are being investigated all at the same time, the water body may not exceed one acre in size.

US HAB-CTI

Wireframe [Figma]



Usability Testing

2 Rounds!

[INST776] Content Analysis Usability Testing Round 1						
File Edit View Insert Format Data Tools Extensions Help						
75% 123 DM Sa... 11 B I A						
A1	Feature / Section					
	A	B	C	D	E	F
1	Feature / Section	Content	P1: Vijay	P2: Heather	P3: Vince Vlovko (Res)	P4: Leanne (Res)
2	Literature Search	Observations: Interviewer Notes	- tries to search first - does not know what a toggle button is. - does not notice the advance search feature	- did not notice the advance search	- had to be told to click on it for further detailed search results	- Searches "curcumin" in the search bar - Tried typing Alexandrium but fails (prototype issue) - Hits search
3		Interpretation: Interviewer thoughts	- is looking for comprehensiveness (includes ALL sources) of research papers included. So, add a feature that indicates it.	- in the advance search options, have search bars because there are too many species/products for a checklist.		PARTICIPANTS
4		Expectation: What do they think they will see here?			Usually when they are doing lit research, they care about when it was published and the scope of their(paper's) work.	- Advance search not noticable. can we put options right below? (no toggle)
5		Necessity: Is the feature necessary or important to have?	- Why are you spoon feeding? People about literature searches? It's up to them to figure it out. If I'm a researcher and I want to look at Alexandrium, I can go to web of			
6		Intutiveness/Ease of finding and understanding the section		- did not notice AS search feature. - AS options: there will be too many when the content is complete. Checklist will be too long to go through	- these are relatively standard search criteria up here	
7		Functionality: How does the website enable the user to achieve the goal?	- Will the papers behind a paywall be available on the clearinghosue website?	- Advance search features should show up on the main page (not after one click) to make it easier "I would have rather had this come up right away, like I didn't even really	- uses advanced search ONLY when needed - the publication date range is useful but might not be used as often	Advanced Search filters: The feature to select the date range is helpful if they want data from just the last 5yrs
8		Feature Highlights: What they like in what they see?			- search results page is easy to understand, makes me think of travel websites	Filters: -It's a good idea to list a few common species and also have a search option.
9		Feature Dislikes: What do they not like?			- The way the filters look is confusing i.e. Mitigation Product & Class of Product. Macro-algae is one thing but it mixes with the 'Chemical' & 'Biological' options which	
10		Aesthetic: How does it look and feel?			- Filters look confusing, 'Mitigation Product' & 'Class of Product' feel like they are grouped together because of the spacing.	
11		Sizing, Placement, Spacing: Comments on the design look and feel		- Most important ones are Class of product and salinity of water. - can choose not to show the abstract to save space		
		Changes/Suggestions: Edits	- Expects to see advance options right	- maybe having more class categories	AS Filters: They are interested in social or	

8 Interviews

+ 3 Co-working Sessions

+ ∞ Hours of Data Interpretation

Observations

Interpretation

Expectation

Necessity

Intuitiveness/Ease

Functionality

Feature Highlights

Feature Dislikes

Aesthetic

Sizing, Placement, Spacing

Changes/Suggestions

Notes/Questions for the Content Team

Focus Areas

List of Agencies/Hompage (Try it here!)

[Home](#)[About](#)[Funding Resources](#)[HABs 101](#)[FAQs](#)

WELCOME TO

US Harmful Algal Bloom - Control Technologies Incubator Clearinghouse

A collection of HAB control regulations and permitting information to help users navigate algaecide use in marine and freshwater

WELCOME

RESOURCE NAVIGATION

Quick Access to Key Tools

Easily find permits, research, technologies, and approved products related to HAB control.

Laws and Permits

★ Research Requirements

Data Requirements for EPA Registration

🔬 Field Studies

Experimental Use Permits

🔗 External Resources

Learn More!

👍 Getting an Approval

Permits & Regulations

📁 Regulatory Agencies

Federal & State Regulations

Literature

HABs 101

Species, Impacts, Research, Resources, Response

Literature Search

Publications on HAB control technologies

📖 Consultants Database

Get Consultants or Experts

🕒 Control Technologies

Common Concepts

Products

✅ Registered Products

Product Catalogue

🔍 Patent Search

IP, Inventorship Agreements & Registration Information

PROCESSING PERMITS

Acts and Regulatory Agencies

Learn how permits for algal bloom control are reviewed and approved ,what regulatory agencies are involved, and what steps are needed from application to implementation and deployment.

★ Primary

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Regulates the use, sale, distribution, and registration of pesticides and algicides.

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★ Primary

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★ Primary

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Section 404 of the Clean Water Act

A permit is required for the discharge of dredged or fill material into waters of the United States.

Visit the Clean Water Act website

Endangered Species Act

Ensures actions authorized, funded, or carried out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. EPA has an ecological risk assessment process for the evaluation of potential risk to endangered and threatened species from exposure to pesticides.

Visit Endangered Species Act website

Magnuson-Stevens Act

Protects habitat that fish need to spawn, breed, feed and grow to maturity and ensure a safe and sustainable supply of seafood.

Visit the Magnuson-Stevens Act website

Section 10 of the Rivers and Harbors Act

Prohibits unauthorized obstruction or alteration of U.S. navigable waters. A permit from the USACE is required for work or structures in, over, or under these waters, including many water bodies and wetlands regulated by the Corps.

Visit the Rivers and Harbors Act website

species. EPA has an ecological risk assessment process for the evaluation of potential risk to endangered and threatened species from exposure to pesticides.

Visit Endangered Species Act website

these waters, including many water bodies and wetlands regulated by the Corps.

Visit the Magnuson-Stevens Act website

these waters, including many water bodies and wetlands regulated by the Corps.

Visit the Rivers and Harbors Act website

CONTROL STRATEGIES

Types of HAB Control Technologies

Determining what type of product you have is key as each type has a different process for registration

🧪 Chemical

🧬 Biological

🔧 Physical

Conventional Chemical

Biochemical PesticidesAntimicrobial PesticidesMinimum Risk Pesticides

Conventional Chemical

Conventional pesticides are all active ingredients other than biological pesticides and antimicrobial pesticides. Conventional active ingredients are generally produced synthetically, i.e., are synthetic chemicals that prevent, mitigate, destroy, or repel any pest; or that act as a plant growth regulator, desiccant, defoliant or nitrogen stabilizer.

Wood preservative and anti-foulant products that do not have antimicrobial uses and agricultural fungicide and aquatic herbicide products are either classified as a conventional or a biochemical pesticide. Biochemical pesticides with a toxic mode of action are classified for the purposes of the registration process as conventional pesticides

Know More →

DISCLAIMER

Warning & Report

ⓘ Attention!

Content last updated as of: March 04, 2025, Monday

The information available through US HAB-CTI's web site is provided as a public service and is for educational purposes only. All efforts have been made to ensure the material on this site is accurate and up to date. However, US HAB-CTI and University of Maryland Center for Environmental Science cannot

⚠ Report Errors

Found broken links, missing content, or errors?

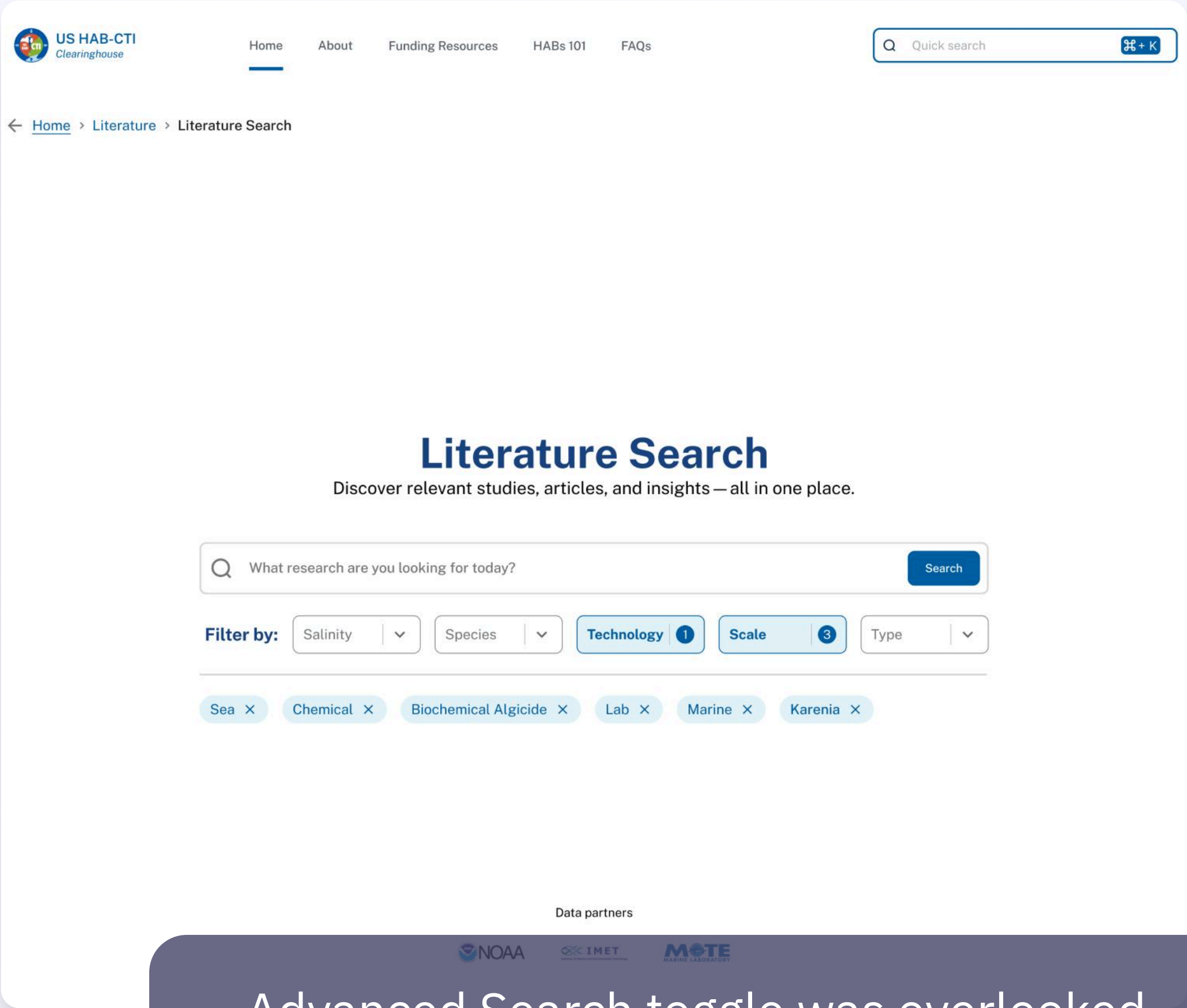
File a report below. We'll look into it and get it sorted.

Original categorized features confused users

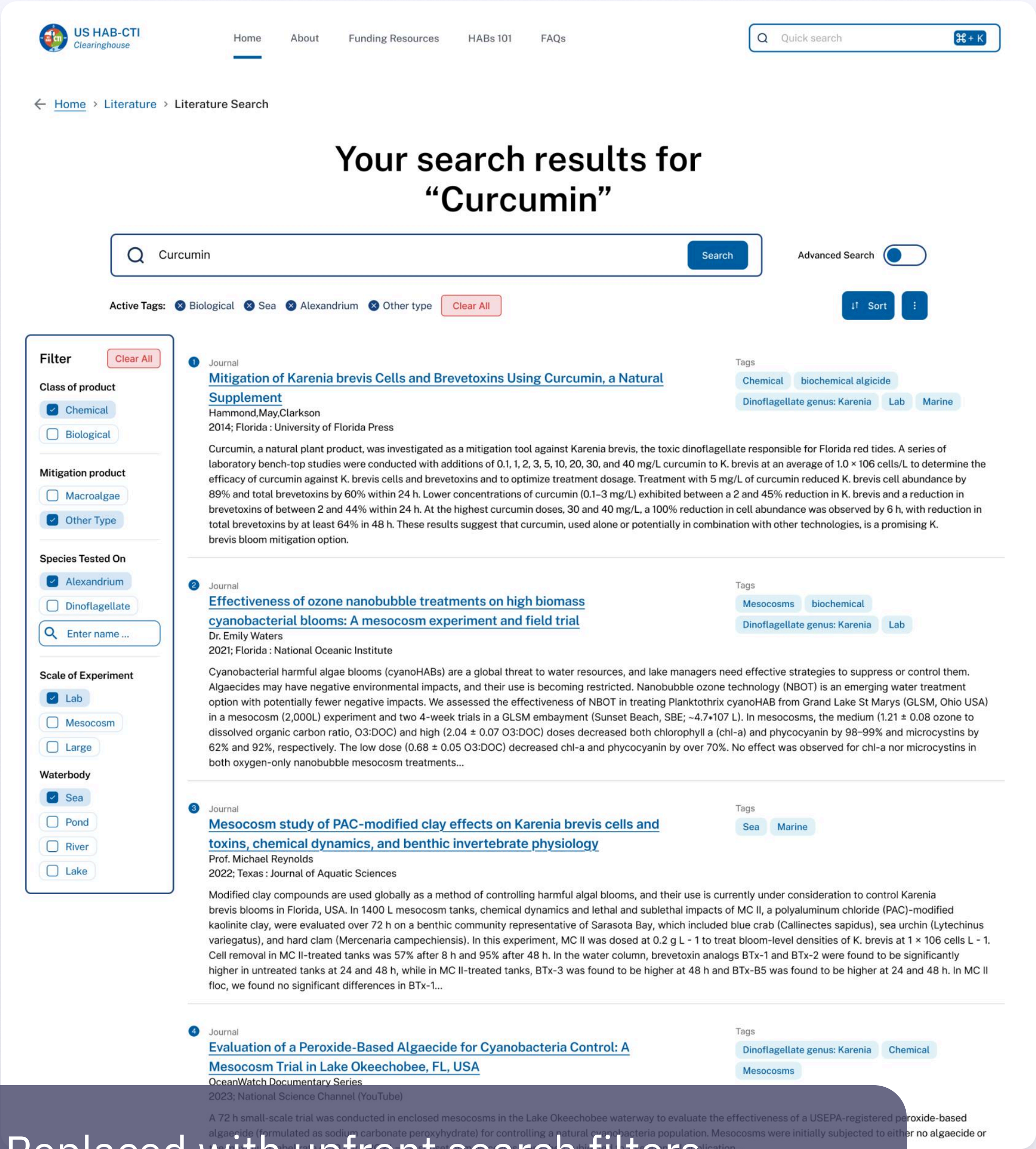
Shifted to a generalized layout so all users can easily access any feature

Focus Areas

Literature Search (Try it here!)



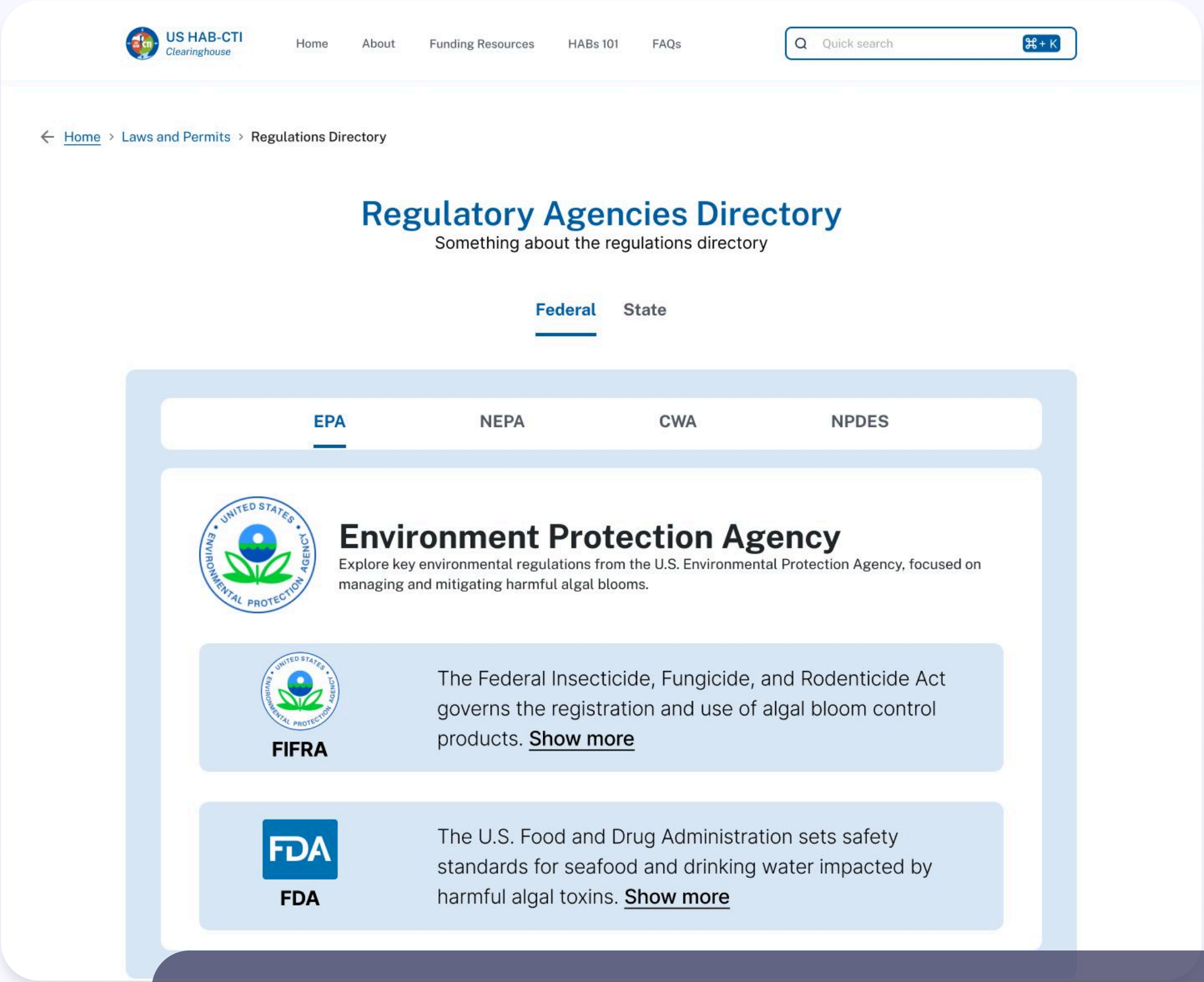
Advanced Search toggle was overlooked and unclear



Replaced with upfront search filters beside the main search bar

Focus Areas

State-wise Permit Information (Try it here!)



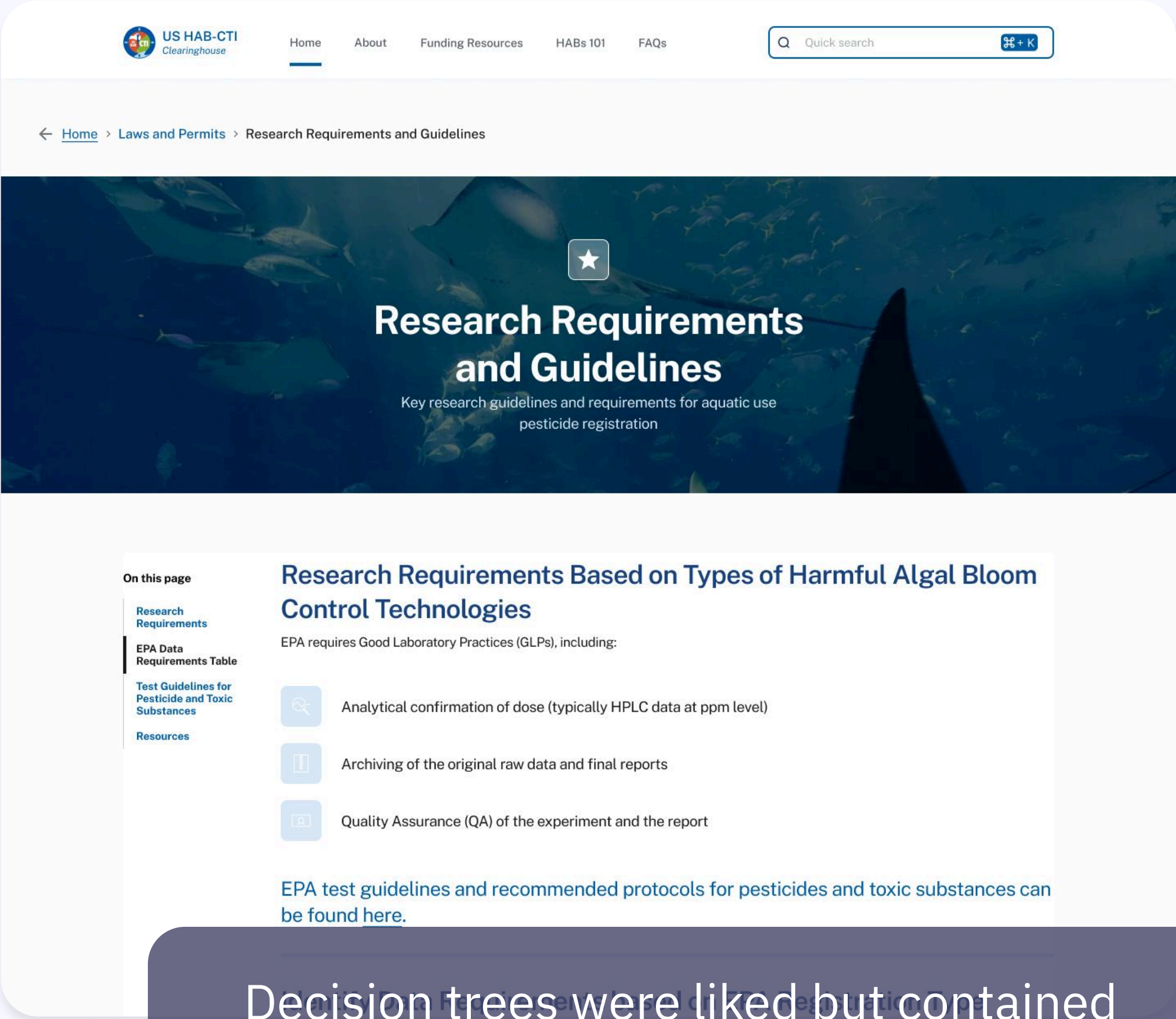
Interactive map worked, but users preferred tables



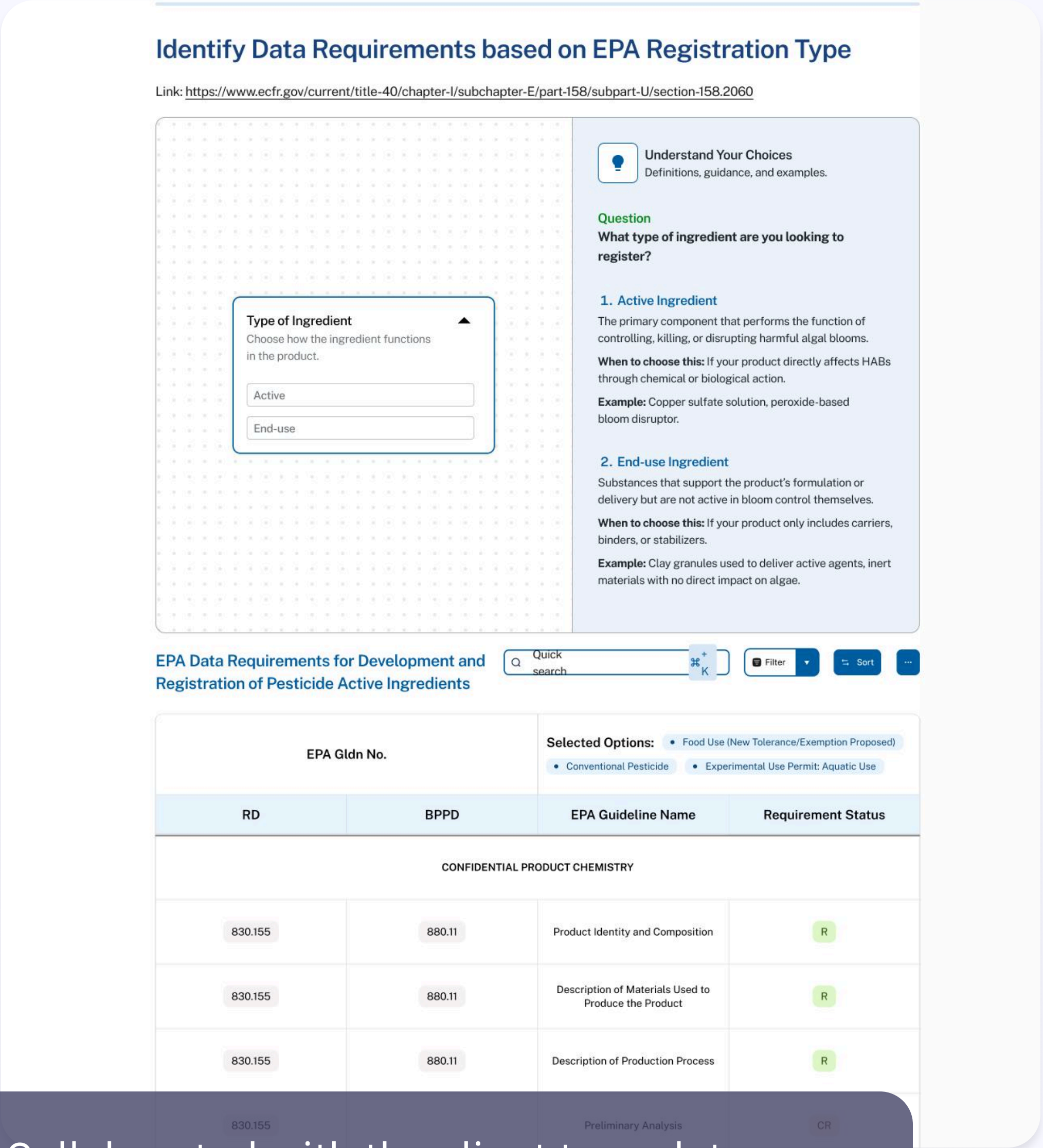
Changed from a container view to a clear, tabular format for better readability

Focus Areas

Decision Tree for Approval (Try it here!)



Decision trees were liked but contained inaccuracies



Collaborated with the client to update and validate the content

Impact

120+

Permits Repository

40% 

Task Success Rate

58% 

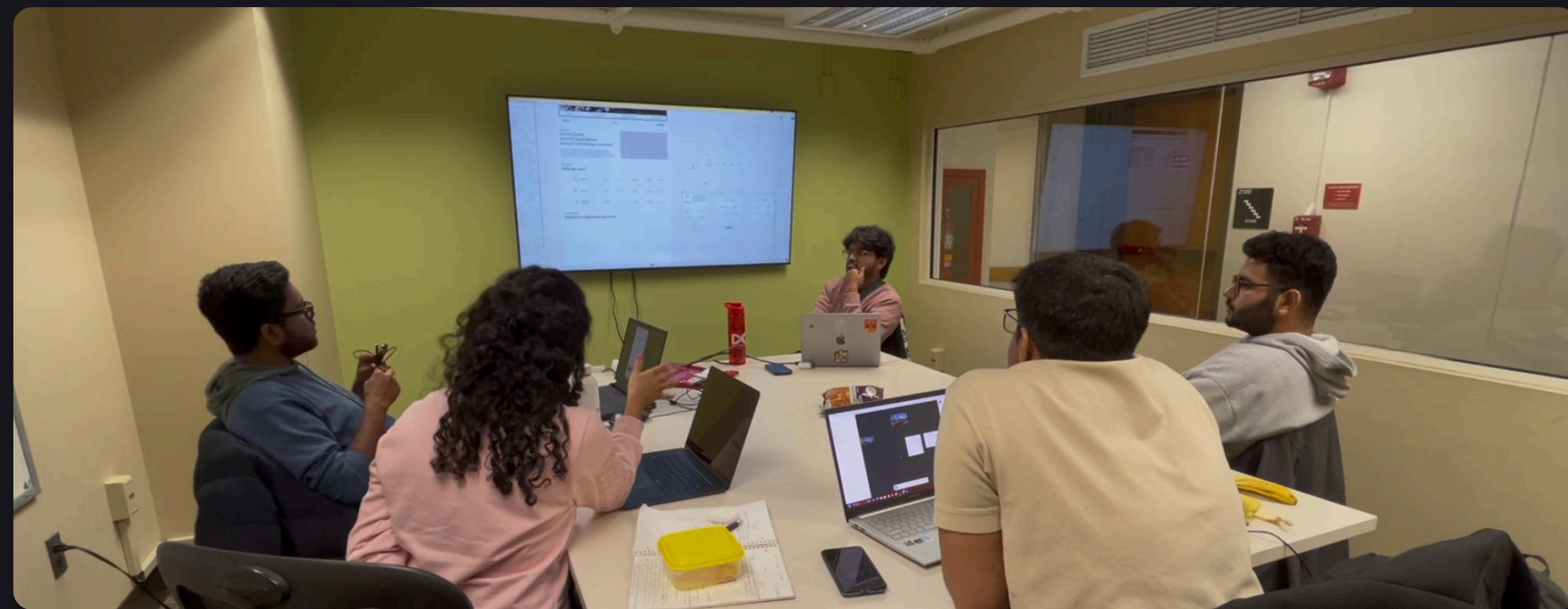
User Bounce Rate

30% 

Search Time

What worked!

Great teamwork! 🎉



- Agile-UX → **5 Sprints**
- Co-designing Sessions
- Task Management
- Rapid Prototyping
- Content is KING!