

ECOCHLOR CASE STUDY: Our Path to USCG Type Approval



Protecting Our
Coastal
Ecosystems



SPECIAL ANNOUNCEMENT



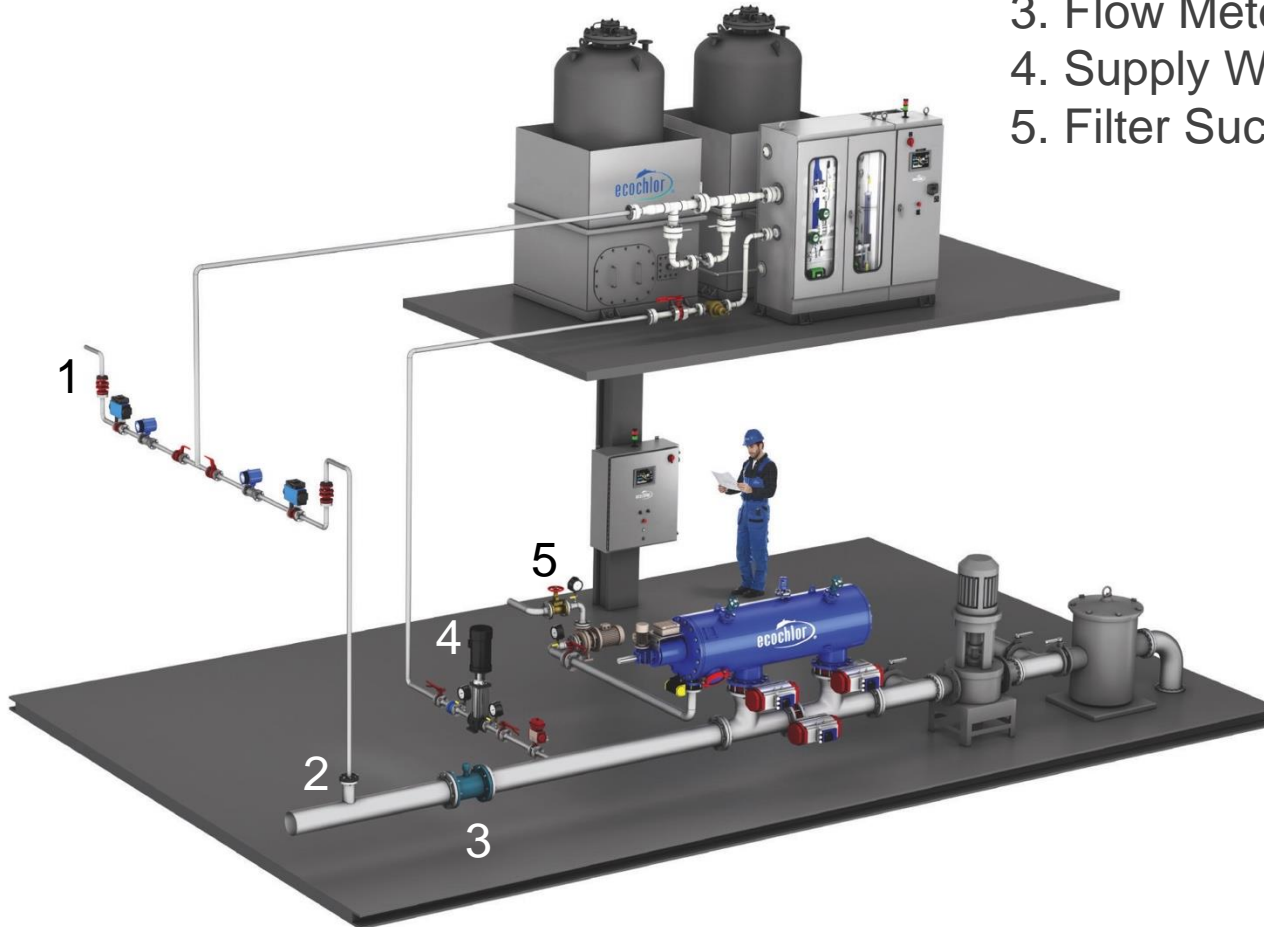
Ecochlor has successfully completed ALL land-based and shipboard testing at the Golden Bear Facility (GBF) required for USCG TA:

- ✓ **5 Shipboard Tests;**
- ✓ **5 High Salinity Land-based Tests;**
- ✓ **5 Low Salinity Land-based Tests;**
- ✓ **5 Fresh Water Land-based Tests;**
- ✓ **Successful with a Reduced Dosage vs our IMO Testing!**

Ecochlor® BWTS

Overview of Typical Installation

1. To Starboard CIO2 Injection
2. Port CIO2 Injection
3. Flow Meter
4. Supply Water Pump
5. Filter Suction Pump



Why is USCG Type Approval Important?

- **Required**

- All ships discharging ballast in US waters

- **Holds BWTS Manufacturers to Consistent Standards**

- Provides shipowners more confidence
- Either validates IMO testing results
- Disproves IMO testing results

- **Changes the Marketplace**

- High cost is a barrier to entry for some technology vendors
- High standards may eliminate some vendors/technologies or change BWTS

Ecochlor[®] BWTS – USCG Type Approval

■ Selection of IL

- Only two ILs to choose from (in 2013)
- Achieve DNV GL Type Approval simultaneously

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■ Selection of Testing Facilities

Retlif Laboratories (2014)



Golden Bear Facility (2014)



■ Letter of Intent

- Submitted to USCG in December 2014

GBF Installation February 2015



Testing Process

- **April 2015: BWTS Commissioning**
- **April – May 2015: Land-based Testing**
- **May – August 2015: Summer Cruise**
 - Shipboard tests took place in Vallejo, CA, Boston, MA, Barcelona (Spain), Naples (Italy).
- **September 2015 – April 2016: Additional Testing**
 - Last shipboard test and freshwater land-based test
 - Successful in all salinities
- **June / July 2016: Environmental Testing**
 - System components are exposed temperature extremes and vibration to simulate shipboard environments

Results



Results are consistent with Ecochlor's IMO test data from both land-based and shipboard testing.

Reduced Dosage vs IMO Testing.

4.25 ppm vs 5.0 ppm

Challenges getting USCG Type Approval

- **Time**

- Three years since AMS acceptance

- **Cost**

- Approximate \$ 3.3 million

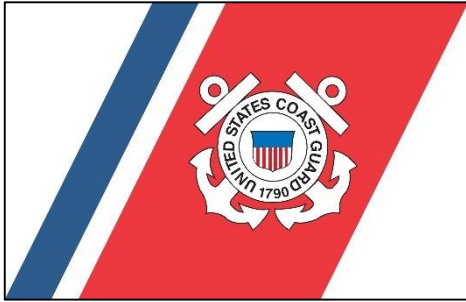
- **Uncontrollable Factors**

- Water conditions limit the timeframe in which testing can be performed

- **Future bottlenecks**

- Independent Laboratory Availability
- Sub-laboratory Availability

Path Forward



- **Environmental Test Completion (June / July 2016)**
- **Analysis and Reporting by DNV GL**
- **DNV GL Official Recommendation to USCG**
- **Ecochlor Submits Application to USCG**
- **USCG Reviews Application and Makes Recommendation for USCG Type Approval**

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