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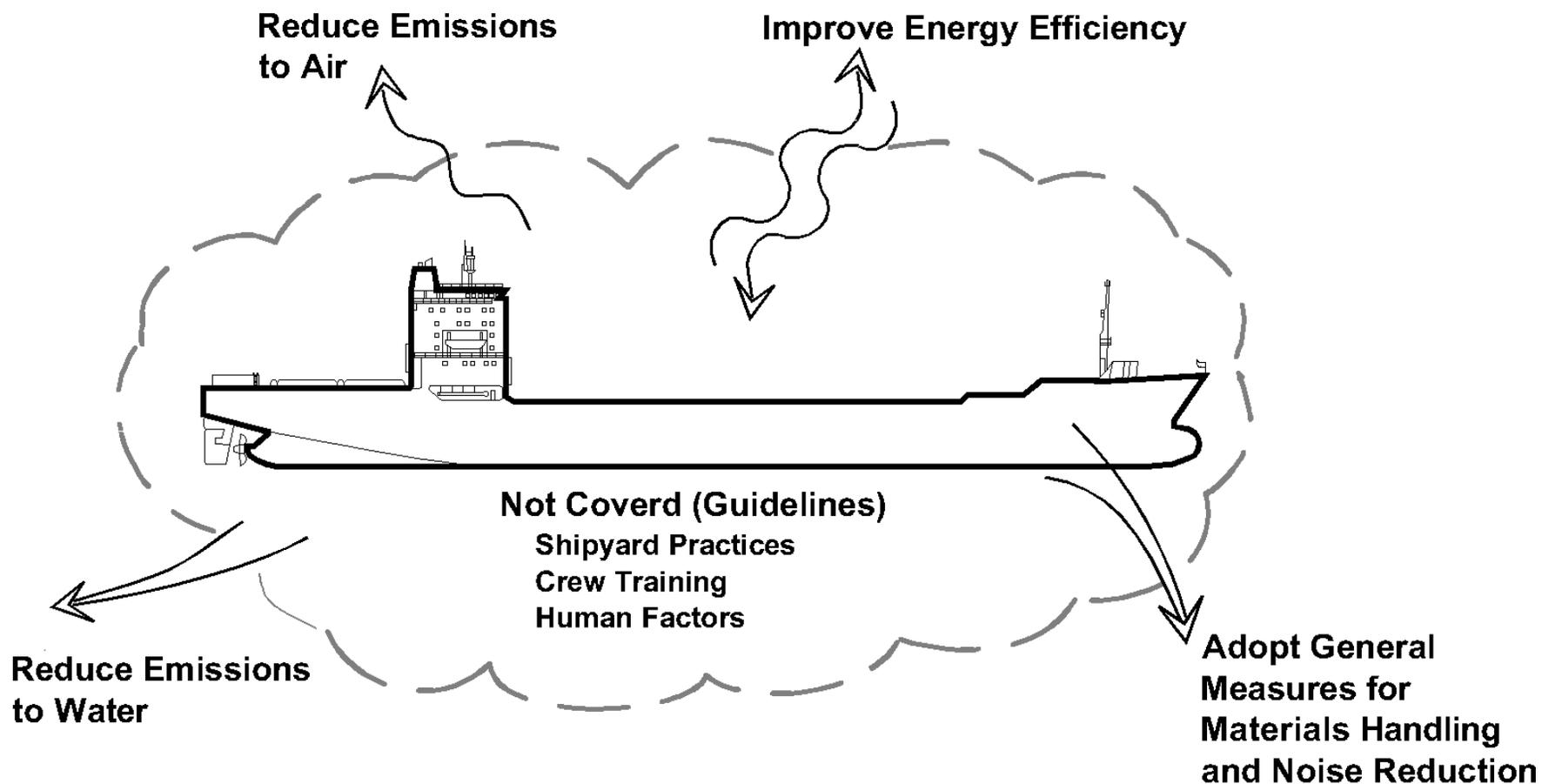
# SNAME Marine Vessel environmental Performance Assessment (MVeP)

Presentation to: UNOLS 2012, Greening the Research Fleet  
10 January 2012



# MVeP is developing guidance for marine vessels to reduce and to measure their environmental impact

**Mission Statement:** “Provide a common technical basis for assessing environmental performance, so that marine vessel designers, builders, and operators can understand relative environmental impacts of design decisions and operational practices.”





# Objective and Approach

Objective: **Minimize** Marine Vessel Environmental Impact

Approach:

- Provide a **standard assessment methodology**
  - Best Practices, **guidance** to achieve excellence
  - **Team** Industry, Academia, Environmental Groups, and Regulatory Agencies for Practical Solutions
  - **Performance driven** metric
    - Use readily available data by monitoring Or calculation
  - SNAME Technical & Research Bulletin
- Encourage **voluntary** assessment
  - Recognize leaders and exemplary performance
  - Minimal administrative burden on applicants

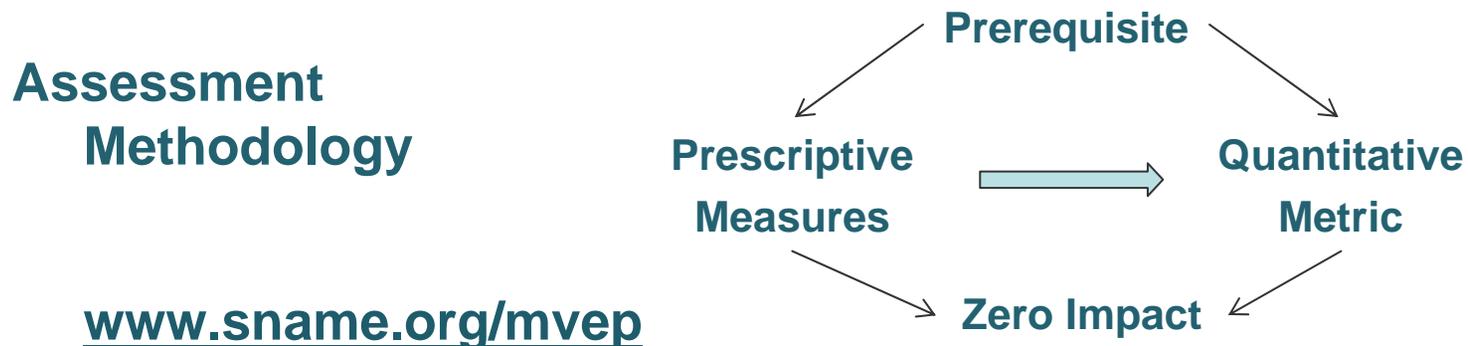




# MVeP Phase 1 Pilot Project

- Identify Need – **Whole System** Assessment, **Standard** Performance Criteria
- **Checklist** of 34 environmental impacts
- Organized impacts and developed **Assessment Methodology** to be filled in
- 3 example **Performance Assessment Guides & Template**

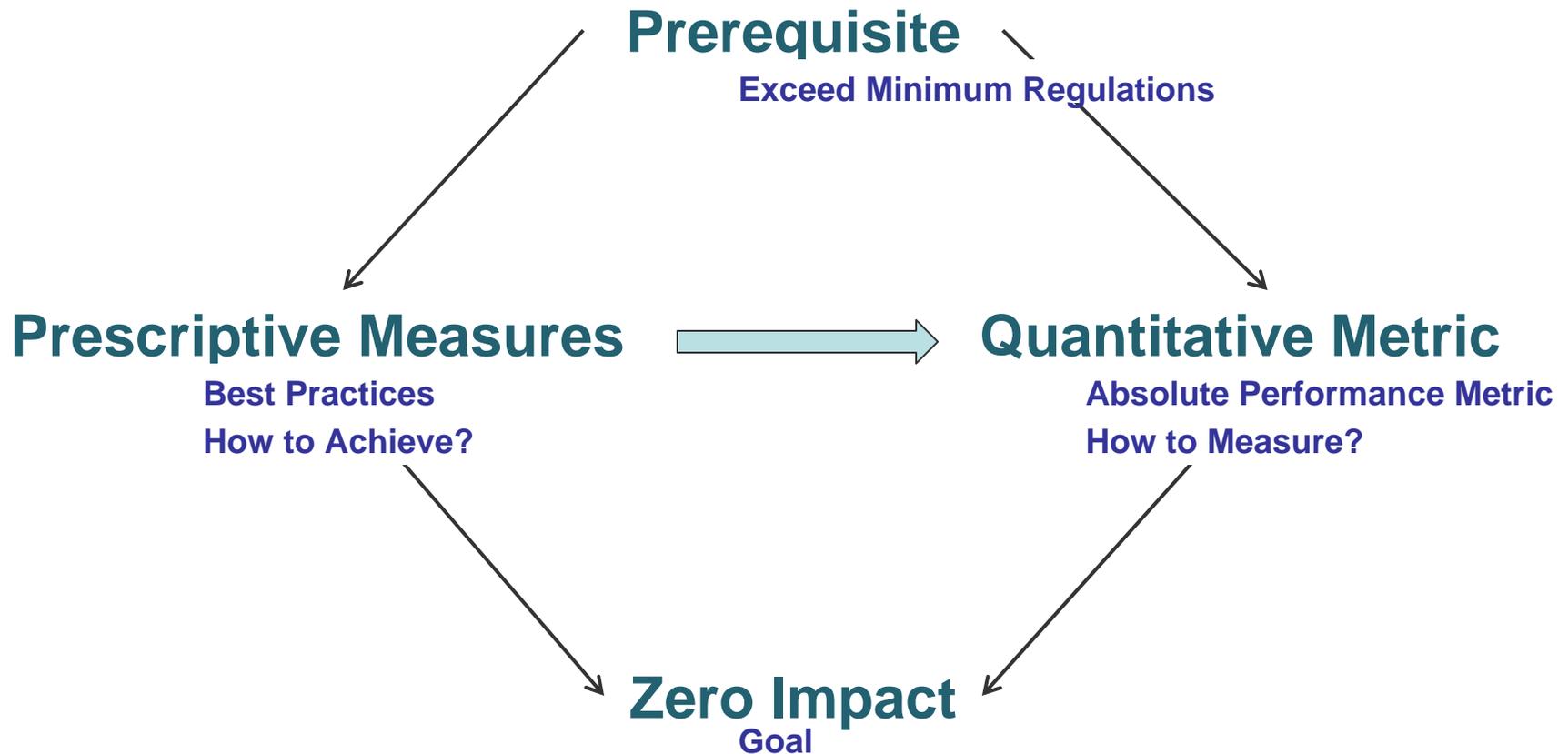
<b>Category</b>	Energy Efficiency	Air Emissions	Water Emissions	General Measures
<b>Environmental Impact</b>	1 2 ...	1 2 ...	1 2 ...	1 2 ...



[www.sname.org/mvep](http://www.sname.org/mvep)



# Assessment Methodology





# Phase 2 Performance Assessment Guides

## Performance Assessment Guide

1. Scope and Applicability
2. Statement of the Problem
3. **Assessment Methodology**
  1. Prerequisite
  2. Prescriptive Measures
  3. Quantitative Metric
  4. Zero Impact
4. Level Justifications
5. Regulatory Environment
6. Directions for Future R&D
7. Design Integration
8. Supporting Documents

### MARINE VESSEL ENVIRONMENTAL PERFORMANCE ASSESSMENT GUIDE

#### **EE1.2 Energy Optimization Measures: HVAC**

Prepared for  
SNAME Technical & Research Steering Committee

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29 January 2010  
Rev. A



# Phase 2 Impact Checklist

## Complete List

### Energy Efficiency Mike Gaffney

#### EE1 Energy Optimization Measures

- EE1.1 **Lighting**
- EE1.2 **HVAC**
- EE1.3 **Pump and Piping Systems**
- EE1.4 **Mechanical Equipment Operations & Maintenance**
- EE1.5 **Hull & Propeller Operations & Maintenance**
- EE1.6 **Route Optimization**
- EE1.7 **Vessel Speed Optimization**
- EE1.8 **Waste Heat and Energy Recovery**
- EE1.9 **Hull Optimization**
- EE1.10 **Electrical Power Generation & Distribution**

#### EE2 Innovations

- EE2.1 **LNG**
- EE2.2 **Biofuels**
- EE2.3 **Renewable Energies**

#### EE3 Carbon Foot Print Reduction

### Air Emissions Don Ricciuti

- AE1 **Nitrogen Oxides (NO<sub>x</sub>)**
- AE2 **Sulfur Oxides (SO<sub>x</sub>)**
- AE3 **Particulate Matter (PM)**
- AE4 **Volatile Organic Compounds (VOCs)**
- AE5 **Other Green House Gases (GHGs) – Postpone development.**
- AE6 **Ozone-Depleting Substances – Postpone development.**
- AE7 **Port Air Emissions**

### Emissions to Water Brian Ackerman

- WE1 **Oily Water**
- WE2 **Non-Indigenous Species Control**
  - WE2.1 **Ballast Water and Sediment**
  - WE2.2 **Hull Fouling**
- WE3 **Sanitary Systems**
- WE4 **Solid Waste**
- WE5 **Incidental Discharges**
- WE6 **Structural Protection of Oil**

### General Measures Chris McKesson

- GM1 **Materials: Reduction/Reuse/Recycle/Construction**
- GM2 **Hotel Water Use: Reduction/Reuse/Recycle**
- GM3 **Ocean Health and Aquatic Life**
  - GM3.1 **Underwater Noise**
  - GM3.2 **Wake Wash and Shore Protection**
  - GM3.3 **Lighting**
- GM4 **Hazardous Materials Control - Inventory Program**
- GM5 **Ship Recycling**



# Energy Efficiency

Category Captain: Mike Gaffney, [mike.gaffney@alariscompanies.com](mailto:mike.gaffney@alariscompanies.com)

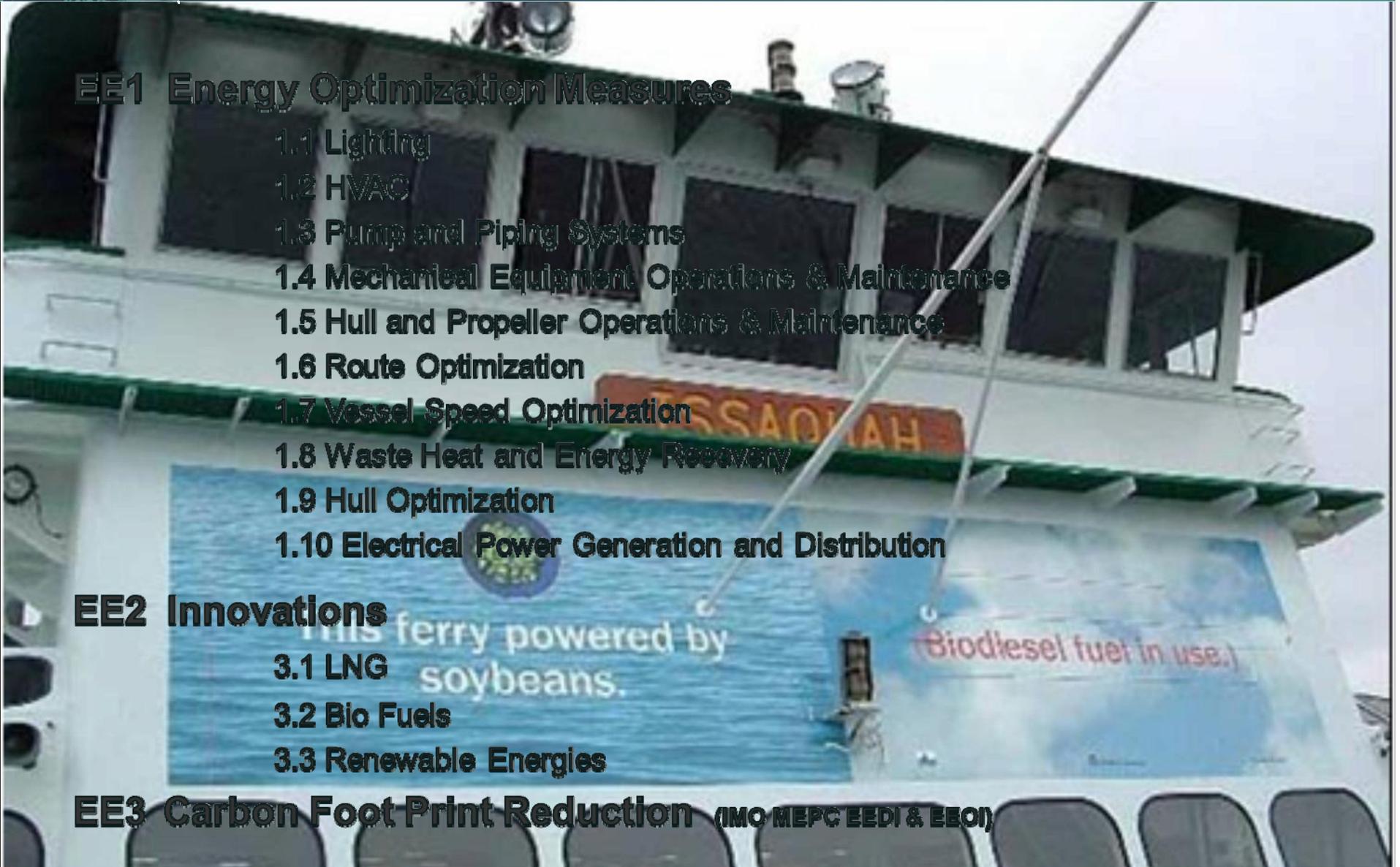
## EE1 Energy Optimization Measures

- 1.1 Lighting
- 1.2 HVAC
- 1.3 Pump and Piping Systems
- 1.4 Mechanical Equipment Operations & Maintenance
- 1.5 Hull and Propeller Operations & Maintenance
- 1.6 Route Optimization
- 1.7 Vessel Speed Optimization
- 1.8 Waste Heat and Energy Recovery
- 1.9 Hull Optimization
- 1.10 Electrical Power Generation and Distribution

## EE2 Innovations

- 3.1 LNG
- 3.2 Bio Fuels
- 3.3 Renewable Energies

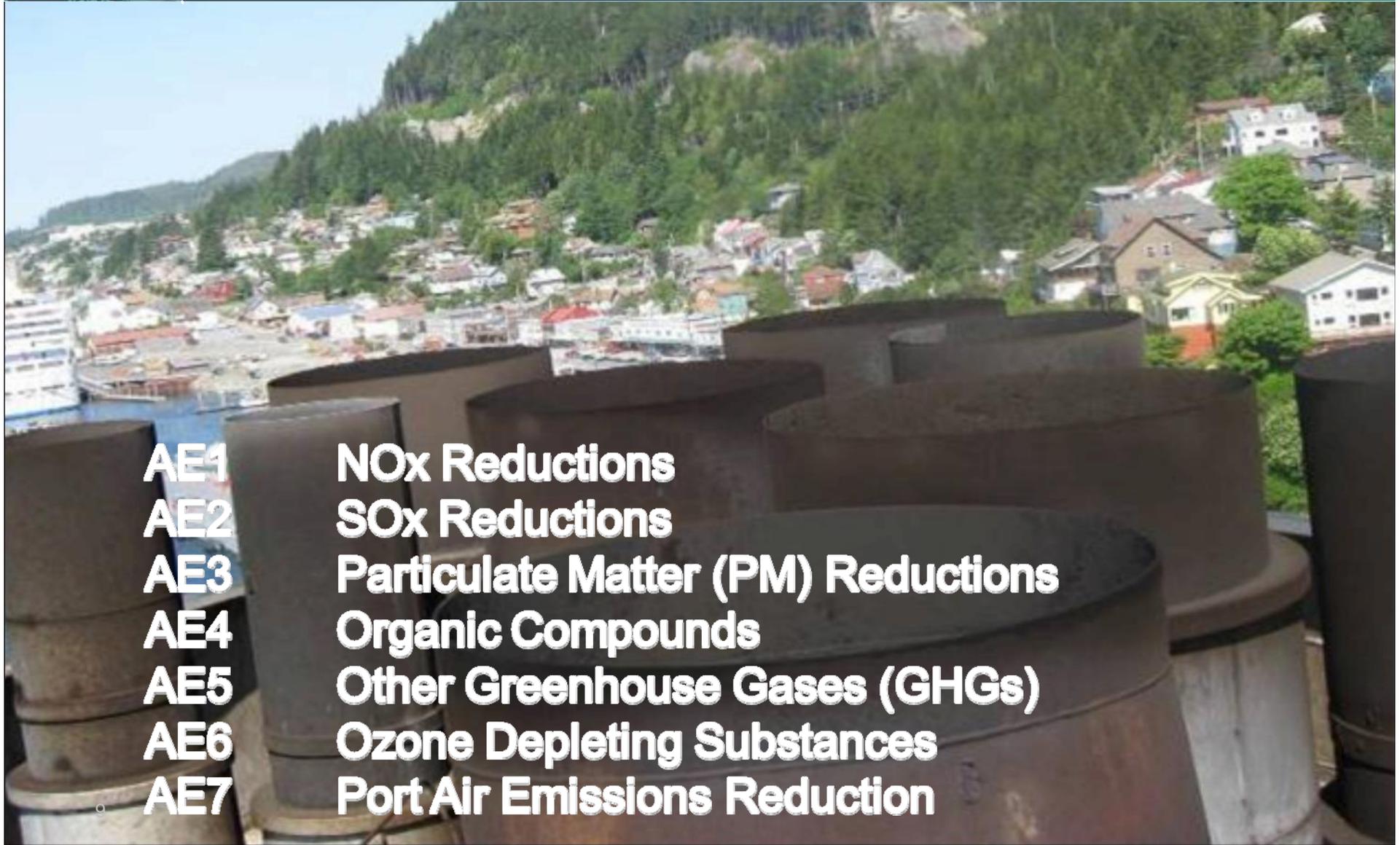
## EE3 Carbon Foot Print Reduction (IMO MEPC EEDI & EEOI)





# ***Air Emissions***

**Category Captain: Don Ricciuti, [Don.Ricciuti@rolls-royce.com](mailto:Don.Ricciuti@rolls-royce.com)**



- AE1 NOx Reductions**
- AE2 SOx Reductions**
- AE3 Particulate Matter (PM) Reductions**
- AE4 Organic Compounds**
- AE5 Other Greenhouse Gases (GHGs)**
- AE6 Ozone Depleting Substances**
- AE7 Port Air Emissions Reduction**



# ***Water Emissions***

**Category Captain: Brian Ackerman, [ackermanb@usmma.edu](mailto:ackermanb@usmma.edu)**

- 
- WE1 Oily Water**
  - WE2 Aquatic Nuisance Species**
    - WE2.1 Ballast Water and Sediment**
    - WE2.2 Hull Fouling**
  - WE3 Sanitary Systems**
  - WE4 Solid Waste**
  - WE5 Incidental Discharges**
  - WE6 Structural Protection of Oil**



# **General Measures**

**Category Captain: Chris McKesson, [chris@mckesson.us](mailto:chris@mckesson.us)**



- GM1      Materials: Reduction / Reuse / Recycle**
- GM2      Hotel Water Use: Reduction / Reuse / Recycle**
- GM3      Ocean Health & Aquatic Life**
  - GM3.1 Underwater Noise
  - GM3.2 Wake Wash and Shore Protection
  - GM3.1 Underwater Light
- GM4      Hazardous Materials Control**
- GM5      Ship Recycling**



# Phase 3 Implementation

## Who uses MVeP to reduce and to measure environmental impact?

### Who Uses Guidance?

- Ship **Designers** and **Owners** looking for guidance on developing new vessels
- **Operators** looking for guidance on improving current performance



### Who Implements Rating?

- **Port** wanting to give incentives to a green vessel
- **Regulatory body** with capacity to audit, verify, and certify
- **Private environmental initiatives** expanding their scope





# Phase 3 Implementation Next Steps

Steps from Phase II Guidance to Phase III Rating:

- **Normalize** absolute measurement by service provided
- **Weight** and **Sum** impacts
- **Peer Group**
- **Baseline** and **Performance Threshold**
- **Incentives** & Financing Models
- **Application, Verification, & Certification**

MVeP Assessments Done

- MBARI Research Vessel
- MARAD Berthing Barge



1	Category Name	Impact #	Sub Impact #	Impact Name	Quantitative Metric Score	Quantitative Metric Units	Ship Type Normalizing Factor Value	Ship Type Normalizing Factor Type	Impact Weighting Factor	Allowable Impact Weighting Factor Range	Normalized Metric Score
2	Energy Efficiency	1		Energy Optimization Measures						0	
3			1	Lighting						0	
4			2	HVAC	100	kWhr	100	passeng	??	0,1	1
5			3	Pump and Piping	100	kWhr	1E4	teu-nm	??	0,1	1
			4	Mech. Equip. Operations and						0	



# Phase 3 Score Sheet

Category Name	Impact #	Sub Impact #	Impact Name	Quantitative Metric Score	Quantitative Metric Units	Ship Type Normalizing Factor	Ship Type Normalizing Factor Name	Normalized Metric Score	Allowable Impact Weighting Factor Range	Normalized Metric Score	
Energy Efficiency	3		Carbon Footprint Reduction	1500	mT	500	scientist-days @ sea	3	0 - 20	16	Carbon output calculated from bunker receipts, scientist-days @ sea calculated from trip reports
Air Emissions	1		Nitrogen Oxides	13	mT	500	sd@s	0.03	0 - 5	3	NOx output estimated from bunker receipts, and engine information
	2		Sulfur Oxides	15	mT	500	sd@s	0.03	0 - 5	2	SOx output calculated from bunker receipts
	3		Particulate Matter	21	mT	500	sd@s	0.04	0 - 5	3	PM output estimated from bunker receipts, and engine information
Emission to Water	2		Non-Indigenous Species Control								
		1	Ballast Water and Sediment	2200	m3 equiv	500	sd@s	4.40	0 - 3	0	Equivalent output, calculated from discharge logs and treatment effectiveness
	3		Sanitary Systems	2	mT	850	person days @ sea	2.35	0-3	3	Unlikely to obtain volume/weight. Value based on prescriptive measures and treatment levels



# Phase 3 Implementation

## UNOLS

### UNOLS Gains

- Method to compare performance of different vessels...
- or to compare same vessel over different time periods
- Identify better performers to emulate
- Means to demonstrate improvements made to others

### Shared Goals

- Objective performance evaluation
- Reduce ocean research's environmental impact (ie. CO<sub>2</sub>, NO<sub>x</sub>, PM)
- Reduce operation costs (ie. ↑ fuel efficiency, ↓ port & regulatory fees)

### SNAME MVeP Gains

- Contained peer group to establish methods and baselines
- Funding partners



# Thank You to our MVeP Team Questions?



## Contributing Authors, Reviewers, and Advisors

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# Thank You to our Phase II Sponsors



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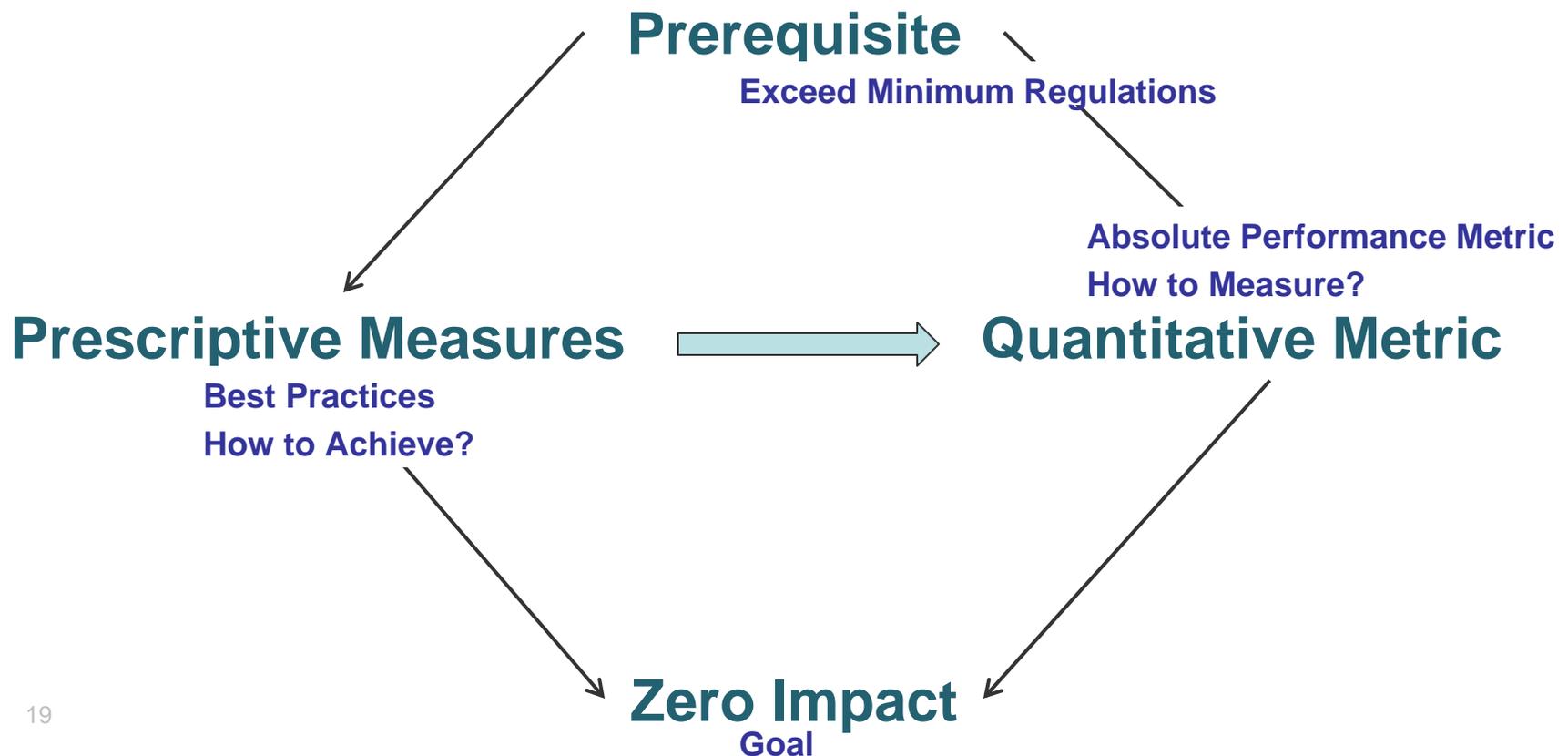


# EE1.5 Energy Optimization Measures Hull and Propeller Operations & Maintenance

Written by: **Daniel Kane** of Propulsion Dynamics

Reviewed by: **Victor Armstrong**, Teekay Shipping; **Johnny Eliasson**, ABS

Dr. **John Kelly**, International Paints; **Michael Klein-Urena**, SanSail





# EE1.5 Hull and Propeller Standard Assessment Methodology

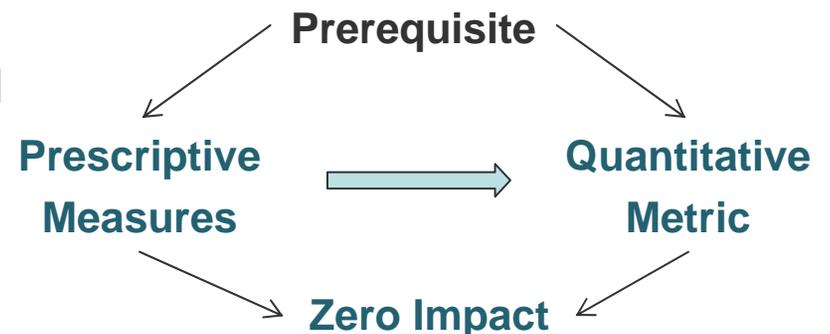
## Prerequisite

Regular visual inspections of the hull and propeller at 2.5 year intervals through vessel life

Thorough hull treatment and propeller polishing with regular dry dock intervals

Original ship sea trial data as a basis for comparing current performance of the vessel with trial trip performance when vessel likely exhibited a clean, smooth hull

MEPC.207(62) Guidelines for The Control and Management of Ships' Bio-Fouling To Minimize The Transfer Of Invasive Aquatic Species

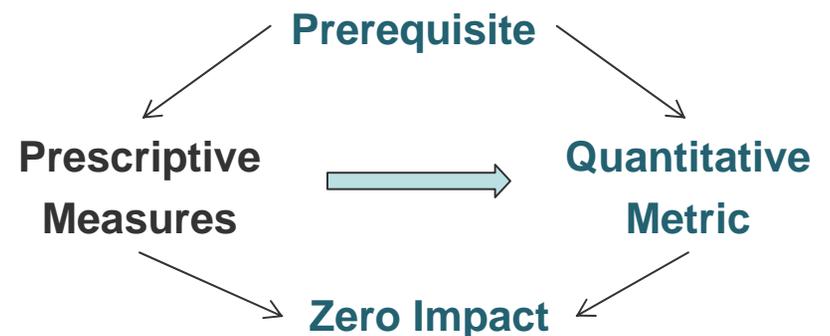
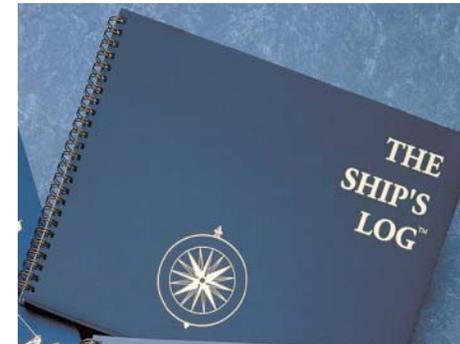




# EE1.5 Hull and Propeller Standard Assessment Methodology

## Prescriptive Measures

1. Log husbandry events
2. Select hull coating; Select propeller coating
3. Regular Inspection, Speed Tracking, Performance Monitoring
4. Pre-drydock procedures
5. Drydock procedures
6. Post docking procedures; Document performance before (and after) entering drydock





# EE1.5 Hull and Propeller Standard Assessment Methodology

## Quantitative Metric

Underwater Hull Roughness Measure (UWHR) (micron)

$i \leq 5$  in last 2.5 years

$$\frac{\sum_{\text{inspection } i} \text{Biofouling Rank}[0,5]_i}{\text{number of inspections}}$$

number of inspections

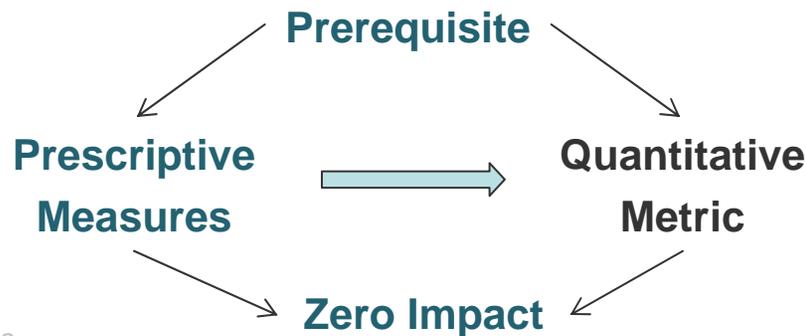


Figure 081-1-1 (SH9) FR-50, Over 40 Percent Of Area (Sheet 9 of 22).

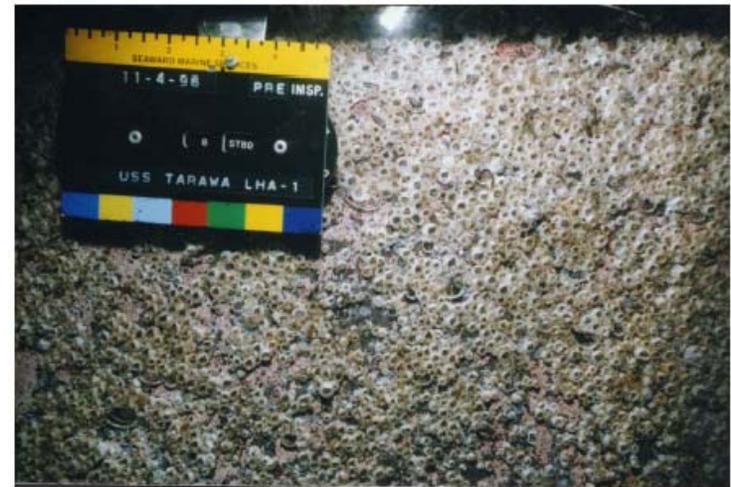


Figure 081-1-1 (SH10) FR-50, Over 100 Percent Of Area (Sheet 10 of 22).

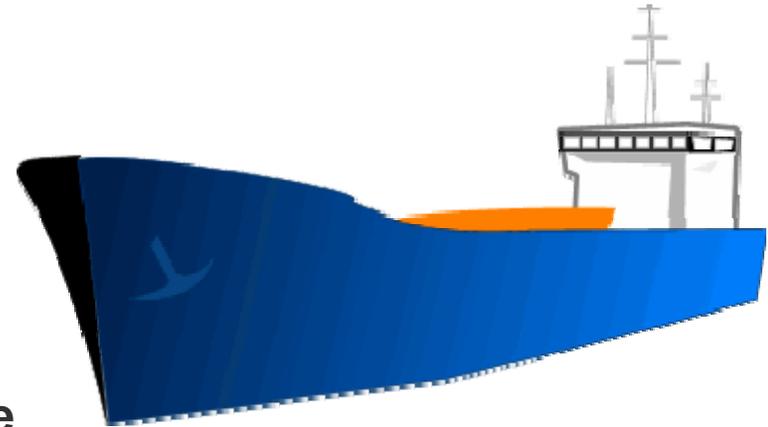
Source: S9086-CQ-STM-010, Chapter 081, Waterborne Underwater Hull Cleaning of Navy Ships



# EE1.5 Hull and Propeller Standard Assessment Methodology

## Zero Impact

A Zero Impact has not been identified. Namely, no hull coating can keep the entire hull completely free of fouling.



Hull coatings may be developed in the future which maintain hydrodynamic and niche area surfaces entirely free of slime and marine growth.

