USCG Ballast Water Discharge Standard

Overview of Notice of Proposed Rulemaking

U. S. Coast Guard
Public Meeting
Proposed Ballast Water Discharge Regulation

- All aspects open for comment
  - Some explicit questions posed.
- To submit your comments online
  - Go to:

  http://www.regulations.gov .
  - Click on the "submit a comment" box, which will then become highlighted in blue.
  - Insert "USCG-2001-10486" in the Keyword box.
  - Click "Search".
  - Click on the balloon shape in the Actions column.

Agenda

- Welcome
- Housekeeping
- Purpose and Procedure
- Proposed Ballast Water Discharge Regulation
  - Authorities
  - Applicability & Exemptions
  - Discharge Standard
  - Phase-in Schedule
  - Approval of Equipment
  - Recognition of Independent Laboratories
- Draft Programmatic Environmental Impact Statement
- Economic Analysis
- NOTE: This presentation will be placed on the docket and www.uscg.mil/environmental_standards .

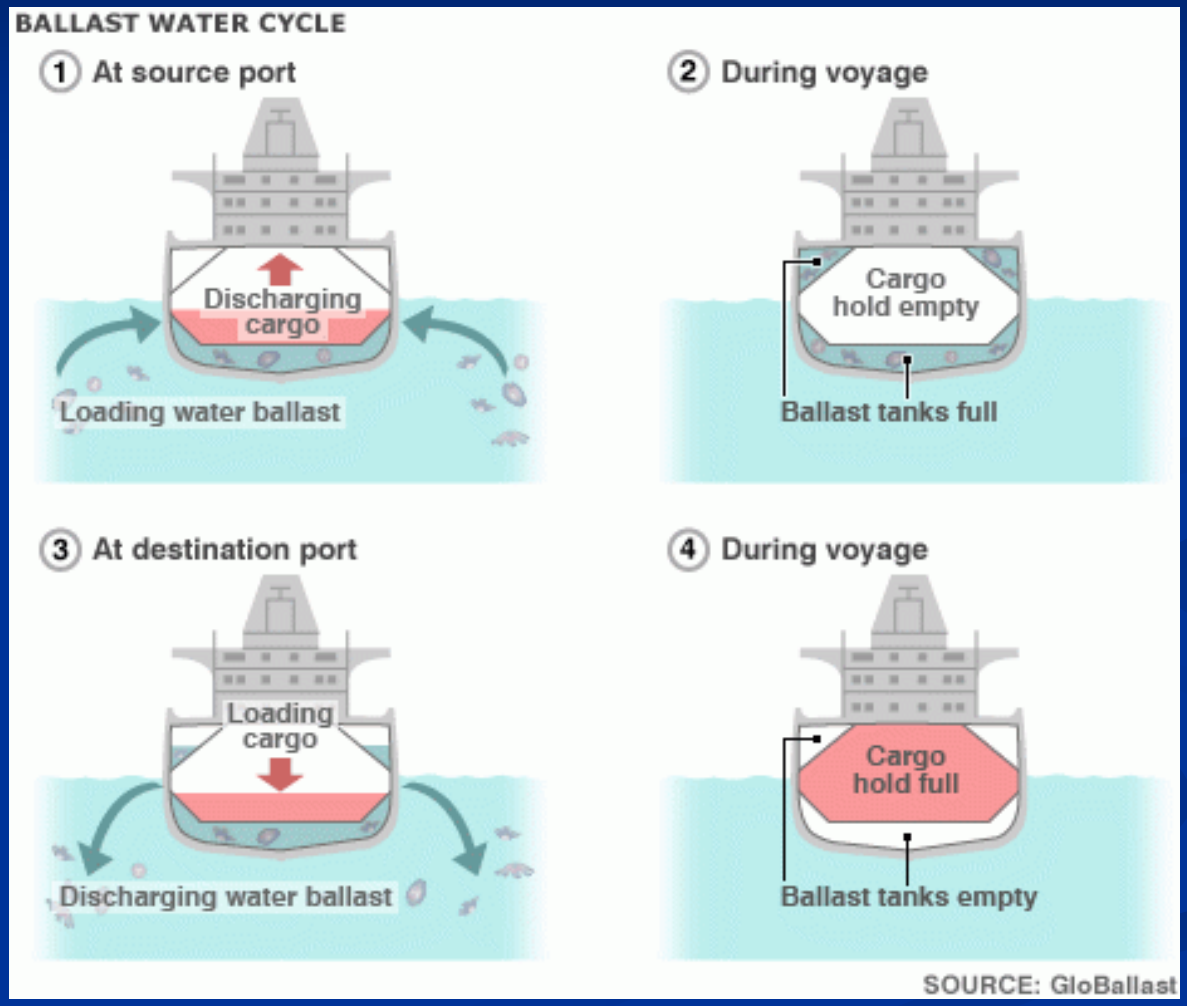
Housekeeping

- Please sign in at door.
- Exits, restrooms , etc.
- Schedule
  - Procedures for meeting
    - Lunch from 12:00 – 1:00 PM.
    - Adjourn after all signed up have spoken – will stay until 4:00 PM.
  - Presentations
    - Address questions of clarification after each section.
    - Will not discuss pros and cons of proposed rule, DPEIS, or Economic Analysis.
      - Purpose of meeting is to take your comments.
      - Response to comments will be published with Final Rule.
    - Additional information about USCG Ballast Water Management Program available:
      - Displays and / or brochures.
  - Public Comment
    - Names of all attendees and all comments, verbal and written, will be posted to the docket for this rulemaking.
    - Verbal : Sign up at door to deliver a public comment.
      - 5 minutes per speaker until all signed up have spoken.
    - Written
      - Deliver to attendant at door.

Why are we proposing a ballast water discharge standard?

- Non-native organisms introduced into U.S. waters with discharged ballast water can invade U.S. aquatic ecosystems.
- Invaders can have adverse effects:
  - Native organisms
  - Human infrastructure
  - Human health

Why is ballast water used?



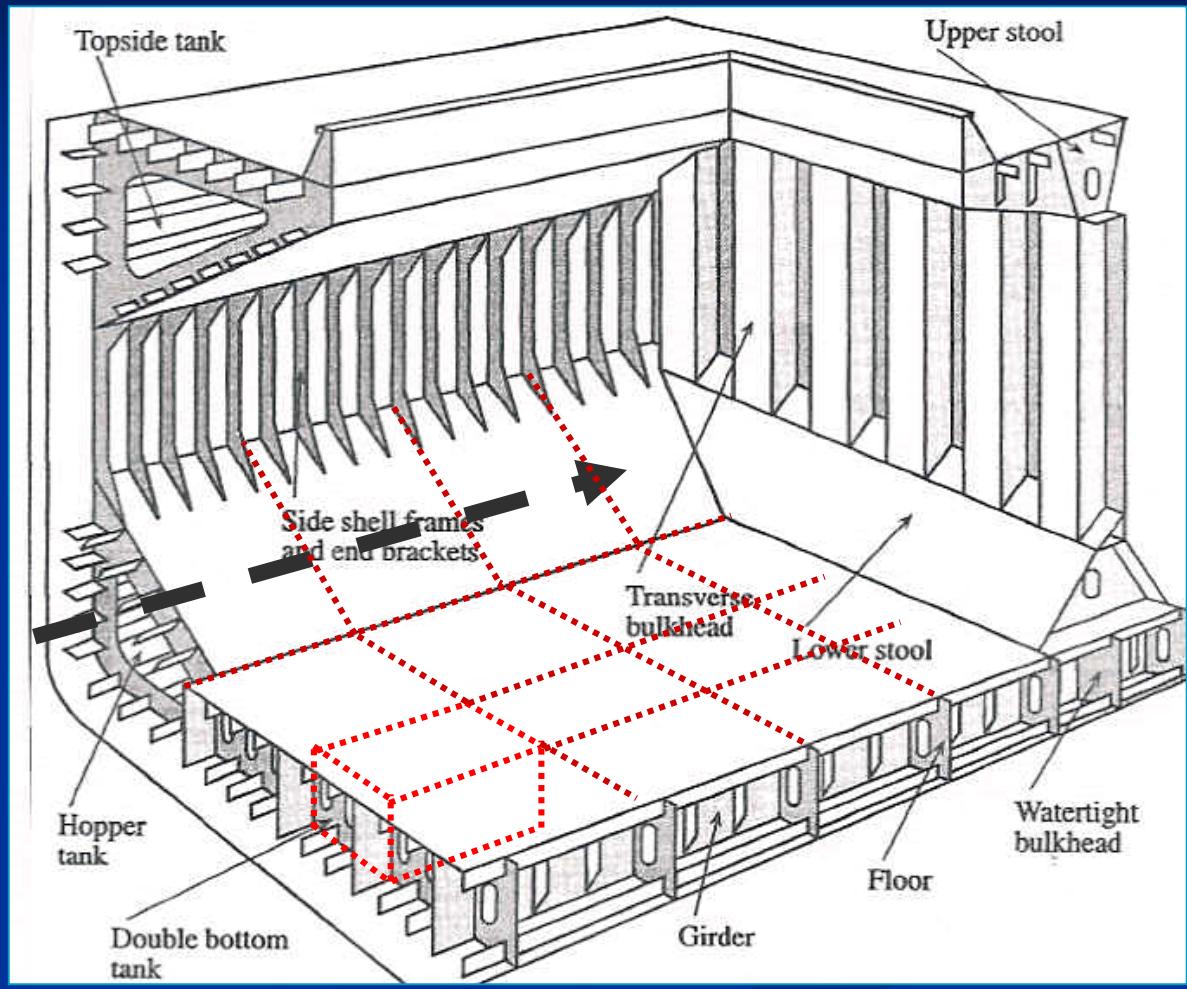
Ballast Water is Critical for Safe Operation of Ships

Ballast used to control and maintain:

Trim
Stability
Draft
Stress

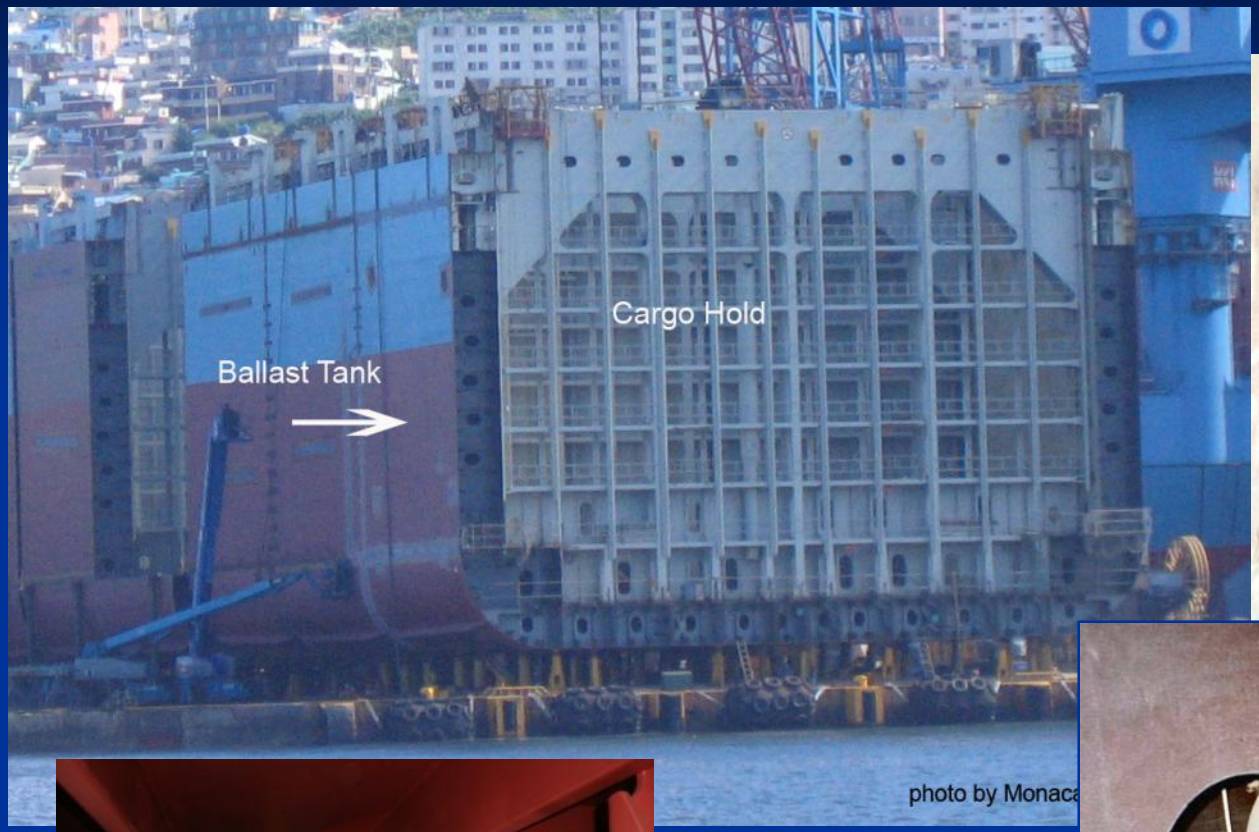
What are ballast tanks like?

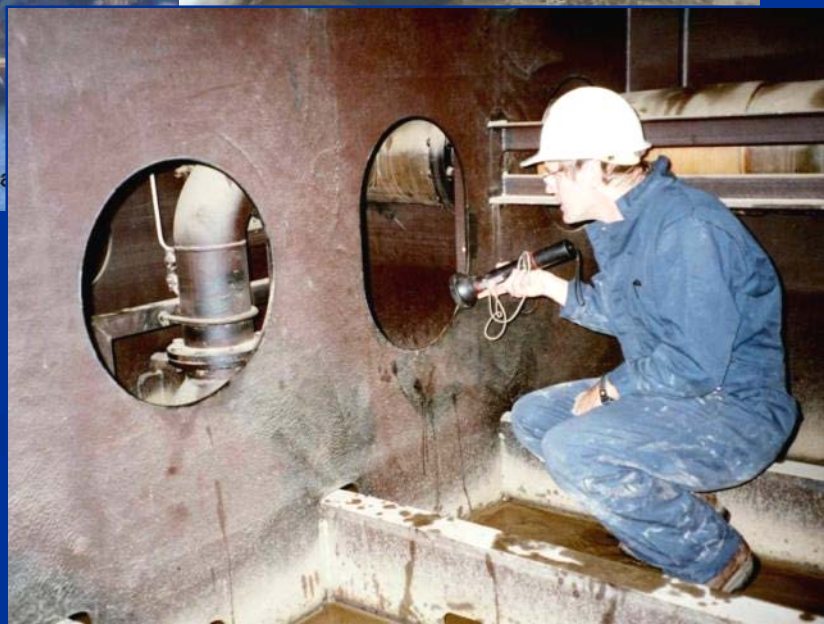
Ballast tanks are a honeycomb of individual bays or cells with lots of places to trap sediment and restrict water flow velocity



A ship can have over 20 ballast tanks

What are ballast tanks like?

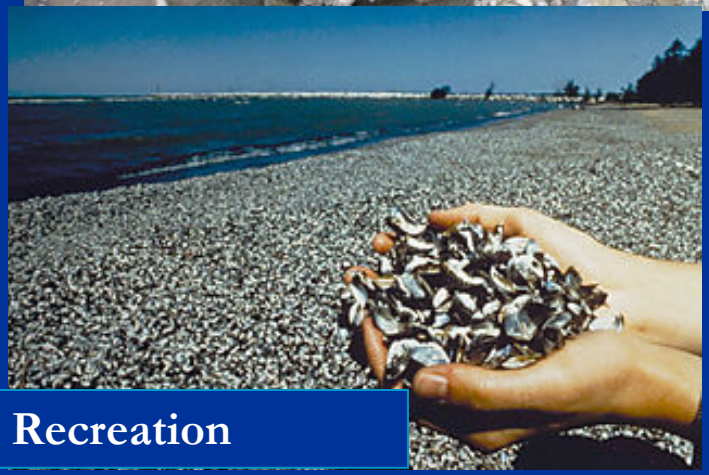




Impacts of Nonindigenous Species, Zebra Mussel, as Example

Habitat

Infrastructure



Recreation

Native species

Authority for this Rulemaking

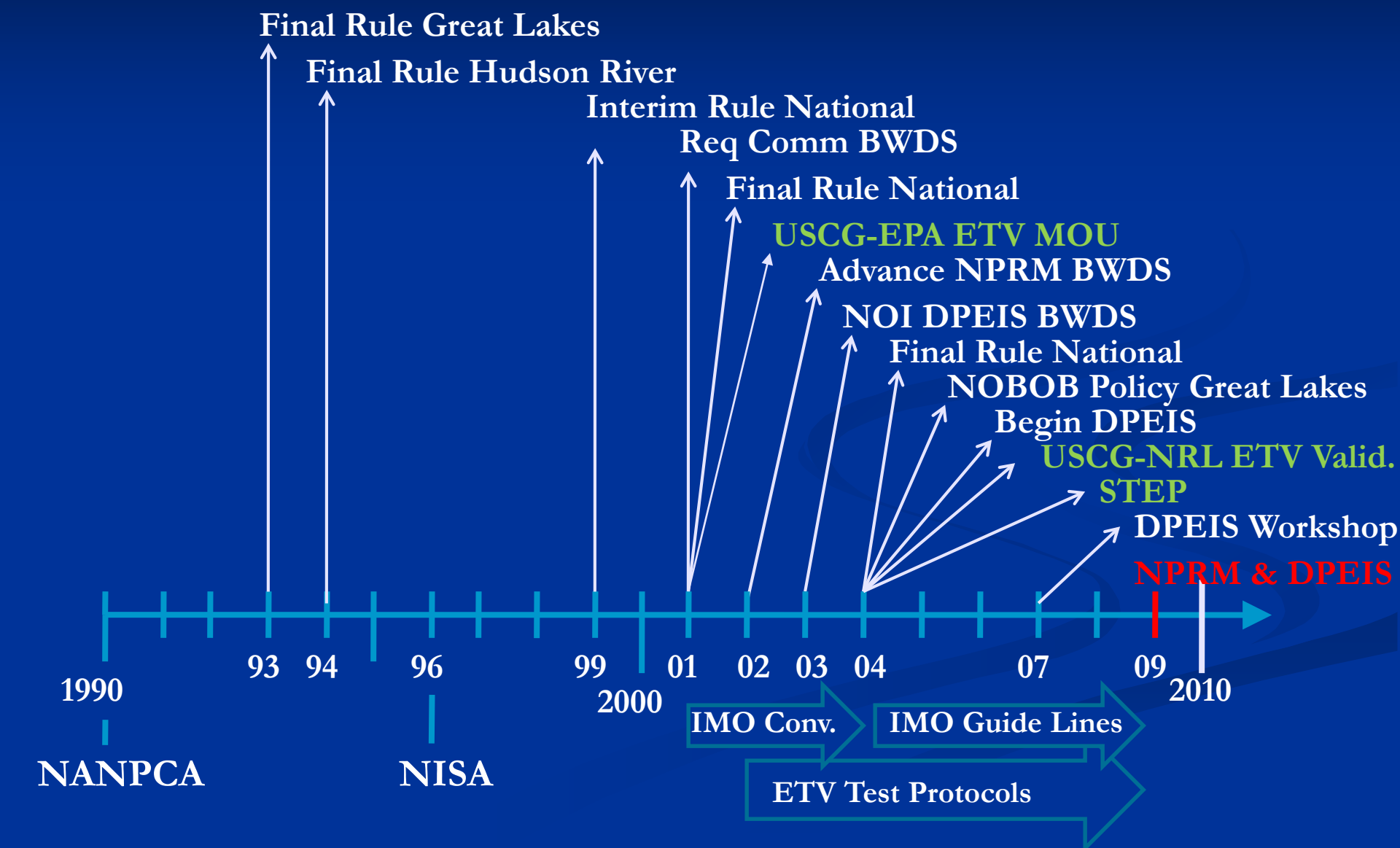
Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990

- USCG directed to develop a program of specific regulations and guidelines for the Great Lakes.
- Prevent or reduce the introduction and control the spread of NIS via the discharge of ballast water from those vessels entering U.S. waters of Great Lakes after operating outside the exclusive economic zone (EEZ).
- First voluntary, then mandatory.

National Invasive Species Act 1996

- Extend Great Lakes regime to the nation.
- First voluntary for 2 years.
- Then mandatory if voluntary compliance insufficient.
  - Specific practices directed:
    - BWE Mid-ocean.
    - Retention.
    - Alternative BWE areas.
    - USCG-approved, environmentally sound alternatives.

NANPCA and NISA USCG Implementation



Why a discharge standard?

Photo courtesy of SERC.

- In U.S. waters, over 60% of vessels can not exchange appropriately due to their routes (< 200 nm).
- Effectiveness of ballast water exchange varies.
- Provides a clearly defined benchmark for treatment technology development.
- Aids in verifying compliance with BWM requirements.

Development of a BWDS Presents a Complex Challenge

- Technologies for removing organisms from ballast water are in the early stages of development;
- Approved technologies should be compatible with existing vessels as well as future vessel designs;
- Development of the standard and approval process requires close collaboration among multiple stakeholders (gov't agencies, scientific community, water treatment experts, shipping industry, etc.).
- The standard must be:
  - Biologically protective,
  - Scientifically sound, and
  - Enforceable.

Wide Range of Organisms Found in Ballast Water

- Viruses,
- Bacteria,
- Protists & Protozoans,
- Fungi,
- Molds,
- Plants,
- Animals .

Proposed BWDS Essential Elements

- Two-phase ballast water discharge standard:
  - Phase one: IMO 2004.
  - Phase two: 1000X IMO.
- Practicability review prior to phase two implementation date:
  - Can phase two be implemented:
    - On schedule, or
    - Sooner?
  - If phase two is not practicable, but a *significant improvement* can be achieved:
    - Standard will be made more stringent to reflect this increase in capability.
    - Tightened over time as technology allows.
    - No waiting for "perfection".
    - Changes made through rulemaking under APA with notice and comment.

Applicability

- Vessels that operate in U.S. waters, are bound for ports or places in the U.S., and are equipped with ballast tanks, or are bound for offshore ports or places.
  - (Previously exempt vessels operating within 200 nautical miles (nm) of coasts would now be required to meet the BWDS).

- Statutory exemptions
  - Crude oil tankers engaged in coastwise trade.
  - Any vessel of the U.S. Armed Forces as defined in the Federal Water Pollution Control Act (33 U.S.C. 1322(a)) that is subject to the Uniformed National Discharge Standards for Vessels of the Armed Forces (33 U.S.C. 1322(n)). 16 U.S.C. 4711(c)(2)(J), (L).

- Administrative policy exemption
  - Vessels that operate exclusively in one Captain of the Port Zone (COTPZ),
  - *COTPZs defined in 33 CFR 3.*

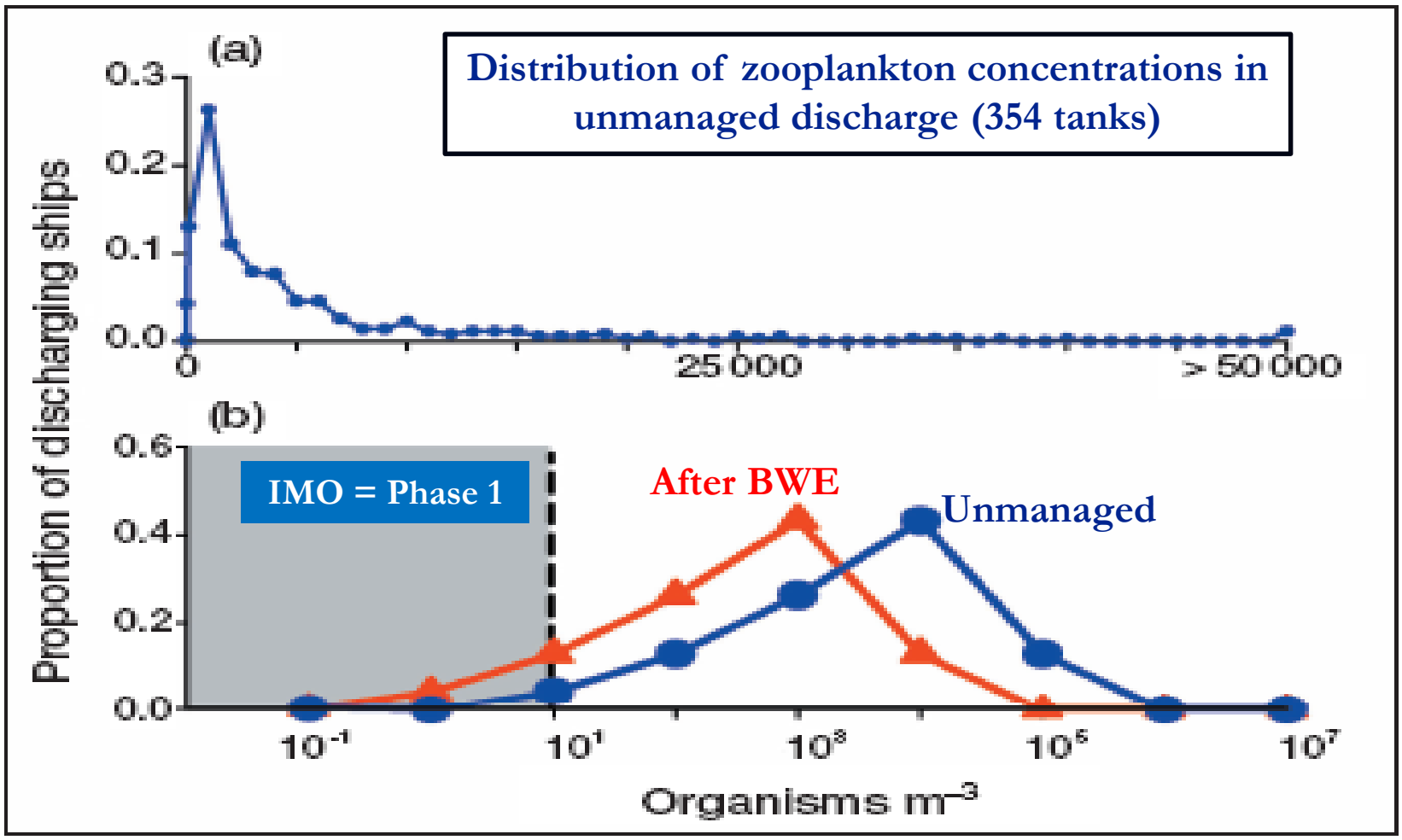
Table 1. Comparison Between Phase One and Phase Two Discharge Standards

Technical description	Large Organisms (> 50µm)	Small Organisms (>10µ and ≤50 µm)	Very Small Organisms (≤ 10µm)	Bacteria		
				Toxigenic *Vibrio cholerae* (O1 & O139)	*Eschericia coli*	Intestinal enterococci
Phase One	< 10 per m^3	< 10 per ml	N/A	<1 cfu per 100 ml	<250 cfu per 100 ml	<100 cfu per 100 ml
Phase Two	< 1 per 100 m^3	< 1 per 100 ml	< 1000 bacterial cells AND < 10,000 viruses per 100 ml	<1 cfu per 100 ml	<126 cfu per 100 ml	<33 cfu per 100 ml

Sizes and Concentrations

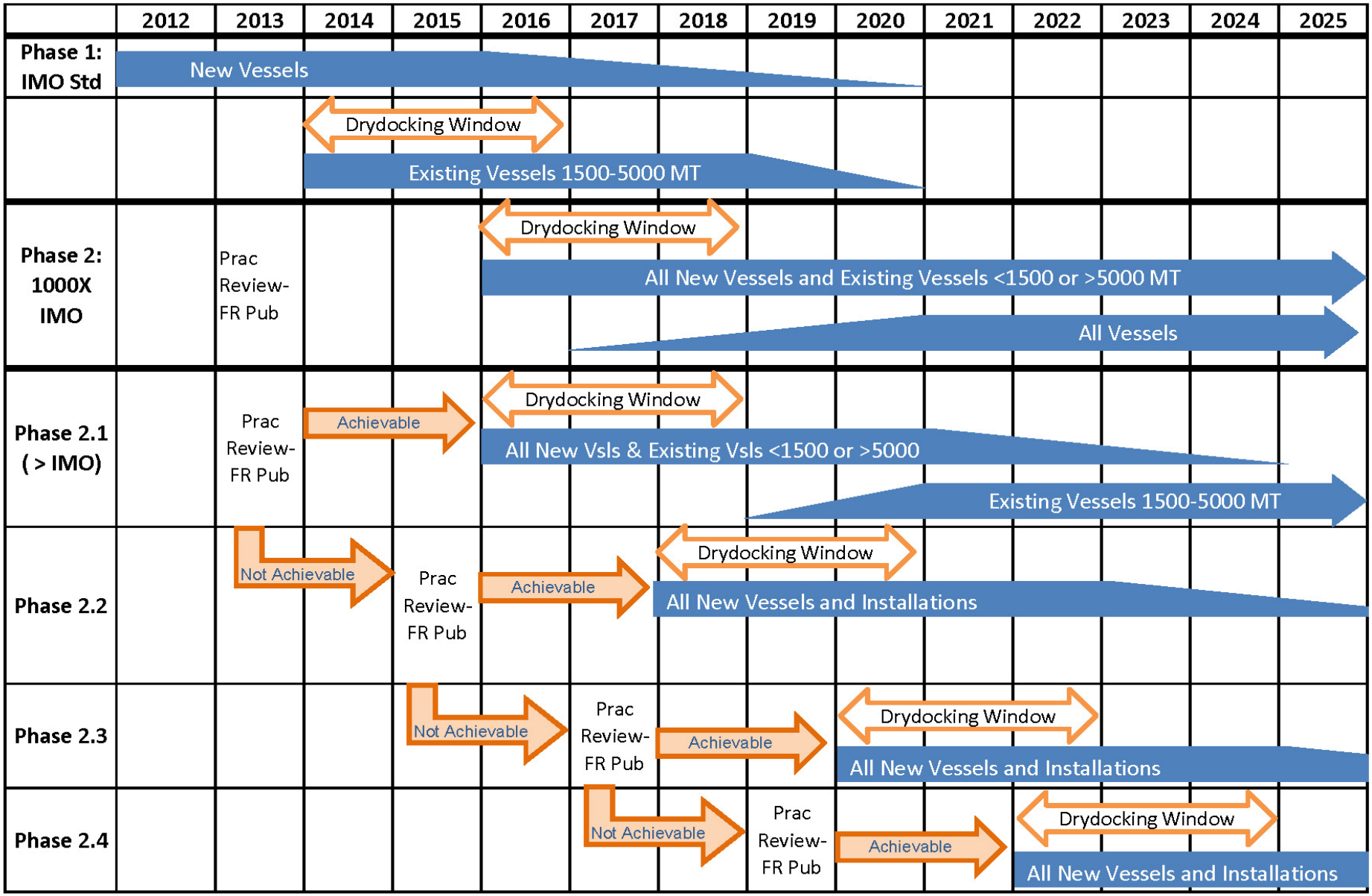
- 50um = approx 0.00197 inches, or
  2/1000 of an inch.
- Ten 50um particles equals 1.25 x 10^{-12} M^3:
  - Or, approx 1 trillionth of a M^3.
  - Equivalent to 1 second in 31,700 years.
  - One drop of water in 20 Olympic swimming pools.
- 1 cubic meter of water weighs ~ 2,200 lbs:
  - Approx the weight of a VW Bug (passenger volume: ~ 2 M^3).

The Phase One Standard will be a Significant Increase in Protection Over BWE



Minton et al., 2005

Phase 1 and Phase 2 Standards Implemention Schedule (5 year grandfathering)



If Practicability Review determines Phase 2 Standard is not achievable, but a standard which is more stringent than existing (IMO) is achievable, then that standard will be phased in 3 years following FR publication. Practicability reviews will be conducted every 2 years until full Phase 2 is achieved.

Ballast Water Treatment

Hypochlorite Generator

- $OHCl^-$ dosed into BW on uptake,
- Residual Cl^- neutralized prior to discharge.

Filters and UV

- Filter + UV on uptake,
- UV on discharge.

Venturi De-oxygenation

- De-oxygenation on uptake.

30 + unique treatment systems currently in process of coming to market

Procedures to Approve BWMS

- Biological efficacy tests:
  - Land-based tests
    - Largely based on EPA-ETV BWTS verification protocols;
  - Shipboard tests
  - "In accordance" with IMO G8 type approval guidelines.
- Engineering and operational requirements:
  - Electrical,
  - Engineering,
  - Piping,
  - Construction.
- Criteria for certification of independent laboratories:
  - Ind. labs conduct tests.
- Acceptance of BWMS approved by other countries:
  - Case-by-case basis.

No Pre-emption of States or Clean Water Act

- States retain their authority to "adopt or enforce control measures for aquatic nuisance species."
- Vessels are still required to comply with EPA's Vessel General Permit (VGP) program.
  - USCG and EPA are working to harmonize vessel owners' compliance with both regimes.

Ballast Water Discharge Standard

Draft Programmatic Environmental Impact Statement

Draft Programmatic Environmental Impact Statement

- The Draft Programmatic Environmental Impact Statement (DPEIS) addresses the effects on the human and natural environment of five alternatives for the proposed regulatory action to establish a BWDS.
  - It is a supporting document that informs the decision-maker.

Development of Standard

- USCG determined that the BWDS would be expressed as a concentration of organisms per volume that may not be exceeded in discharged ballast water.
- Based on:
  - Information collected during workshops,
  - International discussions,
  - Comments received from the Federal Register notices.
- Consensus:
  - BWDS should be expressed as a critical concentration,
  - Size categories helpful in setting criteria.

DPEIS Approach

- USCG proposed action:
  - Establish a ballast water discharge standard.
- We examine the possible impacts from setting a standard:
  - NOT from how the standard will be met.
  - Technologies to meet the standard would undergo separate environmental reviews.
- This is a national standard, so the EIS is programmatic, covering the whole program throughout all waters of the U.S.

DPEIS Development

- Notice of Intent - 2003
- Five public scoping meetings - 2003
  – 85 comments from NOI & meetings
- DPEIS begun – 2004
- Expert committee reviewed our approach
  - Invasion biologists/BW experts
- Cooperating Agency Workshop – 2007
  - EPA, FWS, NOAA, APHIS

DPEIS Structure

- Ch. 1: Purpose and Need
  - Establish BWD standard
    - Used to approve ballast water management systems.
    - Effective in preventing and/or reducing nonindigenous species (NIS) introduction via ballast water discharge.
    - Biologically protective, scientifically sound, enforceable.

DPEIS Structure

- Ch. 2: Alternatives
  - Three expert panel workshops & a study group.
    - Standard should be concentration-based.
  - Identified 5 alternatives (including No Action).
    - Concentration-based standards are increasingly stringent from Alternative 2 to Alternative 4;
    - Alternative 5 is “essentially sterilization”;
    - Alternative 2 is the Coast Guard’s preferred alternative.

DPEIS Structure

- Ch. 2: Alternatives
  - Alternative 1 – No Action: would not establish a discharge standard. Would continue the mandatory ballast water management program.

	Large Organisms >50 microns in size	Small Organisms >10 and ≤50 microns in size	Bacteria		
			Toxigenic *Vibrio cholerae* (O1 and O139)	*E. coli*	Intestinal *Enterococci*
Alternative 2	<10 per m^3	<10 per ml	<1 cfu per 100 ml	<250 cfu per 100 ml	<100 cfu per 100 ml
Alternative 3	<1 per m^3	<1 per ml	<1 cfu per 100 ml	<126 cfu per 100 ml	<33 cfu per 100 ml
Alternative 4	<0.1 per m^3	<0.1 per ml	<1 cfu per 100 ml	<126 cfu per 100 ml	<33 cfu per 100 ml

  - Alternative 5 - Elimination of all living organisms larger than 0.1 micron in ballast water.

DPEIS Structure

- Ch. 3: Affected Environment
  - Marine ecosystems,
  - Estuarine ecosystems,
  - Freshwater ecosystems,
  - Nonindigenous species,
  - Threatened & endangered species, essential fish habitat,
  - Socioeconomic resources.

DPEIS Structure

- Ch. 4: Environmental Consequences
  - Describes the invasion process.
    - Difficulties of predicting invasions.
  - Describes the analytical approach, described fully in Appendix A: Analytical Methodology.
  - Evaluates impacts of each alternative on each resource.
    - Determined by the respective reduction in the number of organisms that are introduced.
  - *Relative* effectiveness of the alternatives:
    - Due to complexities of ecological systems, the NIS invasion process, and the lack of information in the field of invasion biology.
  - Evaluates cumulative impacts.

Challenging Analysis

- Extremely difficult to predict which:
  - NIS are introduced,
  - Which may become established,
  - Which may have adverse effects on the ecosystems they invade.
- High degree of complexity of aquatic ecosystems:
  - Limited knowledge of the ecological interactions.
  - Large variability involved in the transport of aquatic organisms via ballast water.
- Need a scientifically valid approach:
  - Evidence of historical applications and validation.
  - Use the best available science and data.
    - Within reasonable resource constraints.
  - Allow for the evaluation and comparison of the potential consequences of the alternatives.

Analytical Approach

- Population Viability Analysis
  - Model that relates initial population size with extinction probability.
    - Extinction probability increases with:
      - Decreased population size,
      - Low rate of population increase,
      - High variability in population size.
  - Widely accepted in conservation biology.
    - Recognized by:
      - National Research Council,
      - Ecological Society of America,
      - Nature Conservancy.

Analytical Approach

- PVA well suited to analyze the relative probabilities of extinction due to small population size.
- In the context of conservation, the concern is usually that the population size of an endangered species be *large* enough to ensure a high probability of *persistence*.
- In the context of preventing biological invasions, the concern is that the initial size of an introduced population be *small* enough to ensure a high probability of *extinction*.

DPEIS Conclusions

- Impacts on resources
  - Alternative 1 – No Action: Current environmental impacts would continue.
  - Alternatives 2, 3, and 4 – No adverse impacts, NIS introductions could be reduced.
    - Increasing stringency of alternative → decreased chance of successful introduction.
  - Alternative 5 – No adverse impacts, no introductions of organisms over 0.1 micron in size.

DPEIS Summary

- As expected, PVA indicates that decreasing the number of organisms introduced decreases the probability of invasion.
- Alternative 2 would provide a significant increase in protection compared to BWE.
- There are no adverse impacts from setting a standard.
- Selection of Alternative 2 by USCG as preferred alternative is based on both protectiveness and practicability.

Regulatory Impact Analysis

Technology Costs

- USCG BWTS costs
  - Installation: $258K - $2,525K
    - Low cost range: $258K - $650K
  - Operational: $0.02/$m^3$ - $0.08/$m^3$
- Lloyd's Register BWTS costs (2008)
  - Installation (mean): $379K - $875K
  - Operational: $0.047/$m^3$ (mean)
- CBO BWTS costs (2007)
  - Installation: $300K - $1,000K

Phase-One Costs

- Approximately 7,575 existing vessels, of which 2,616 are U.S. vessels, would be required to meet the BWDS.
- Since phase one is consistent with the IMO convention, we estimate the phase-one costs of this rulemaking to involve U.S. vessels only.
- During a 10-year period of analysis, the total phase -one cost is about $1.18 billion.
  - Annualized costs for phase one are approximately $167 million.
- The phase-one implementation costs over the first five years is about $1.02 billion.
  - Implementation for the existing U.S. fleet to install BWMS
  - Represents more than 85% of the 10-year cost
  - Estimate includes new vessels coming online during the implementation period.

Estimated Annual Costs Associated to Aquatic Nonindigenous Species Introduction in the U.S ($2007)

Species	Costs
Fish	$5.7 billion
Zebra and Quagga Mussels	$1.06 billion
Asiatic Clam	$1.06 billion
Aquatic Weeds	$117 million
Green Crab	$47 million

Source: Pimentel, D. et al, 2005. “Update on the environmental and economic costs associated with alien-invasive species in the United States,” Ecological Economics. 52:273-288

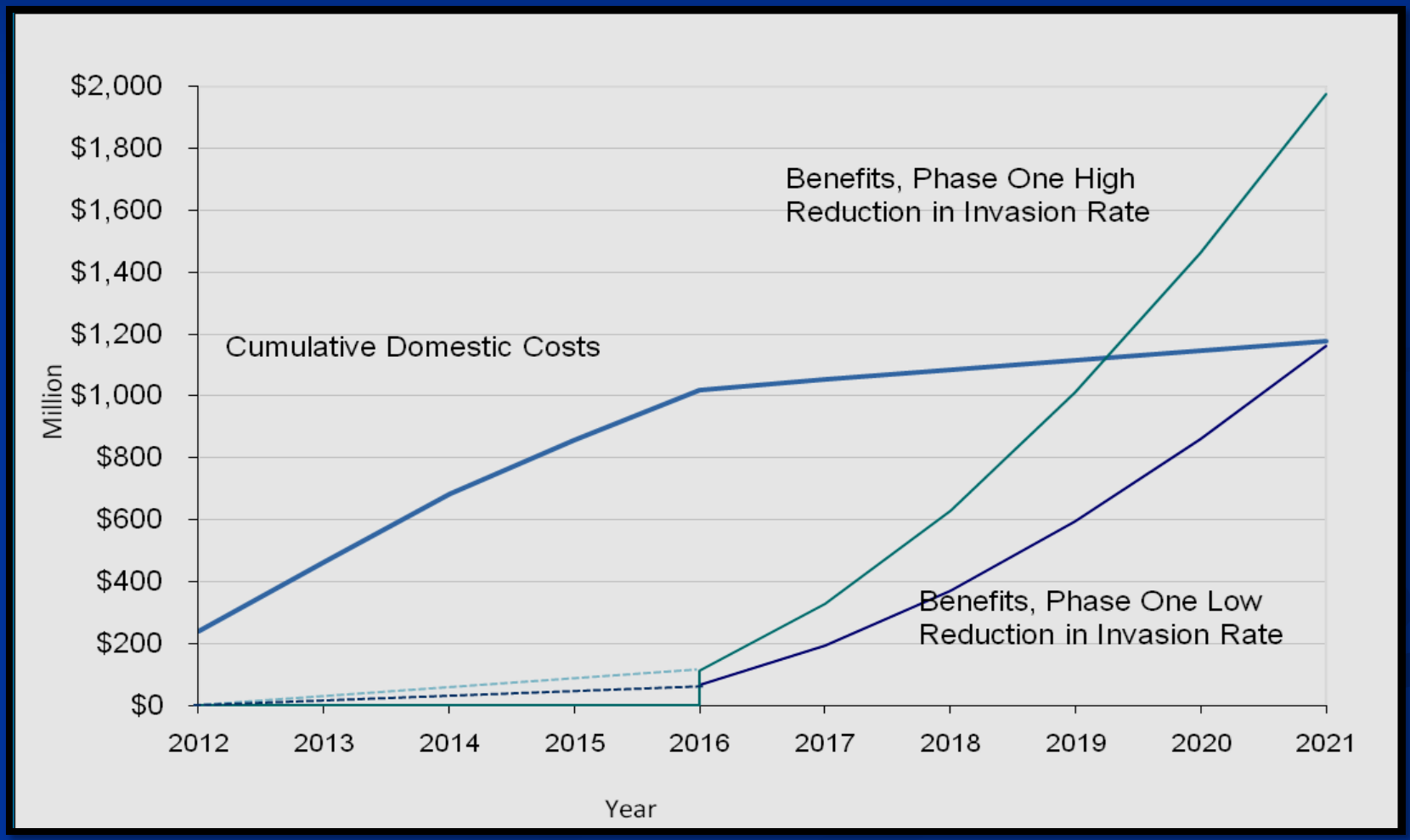
Phase-One Benefits

- The primary benefit of this proposed rule would be the economic and environmental damages avoided from the reduction in the number of new invasions attributed to ballast water discharge.
- Annualized benefits (damages avoided) for phase one are $165 million to $282 million per year at a mid-range estimate, but could be potentially as high as $553 million.
- We estimate total phase-one benefits over the 10-year period of analysis are $1.16 billion to $1.98 billion at a mid-range estimate, but could be potentially as high as $3.88 billion.

Summary of Phase-One Benefits & Costs

- Annualized costs for phase one are approximately $167 million.
- Annualized benefits (damages avoided) for phase one are $165 million to $282 million per year at a mid-range estimate, but could be potentially as high as $553 million.
- There is strong evidence that this rulemaking is cost-beneficial at phase one.

Comparison of Phase-one Cumulative Benefits & Costs



Phase-Two Standards

- Cost estimates for treatment systems that would potentially meet phase-two standards are uncertain.
- The Coast Guard will know more about costs for those treatment systems as the technology is developed and tested.
- We anticipate phase two would have greater beneficial impacts if technology is available to deliver higher stringencies.

U. S. Coast Guard
Notice of Proposed Rulemaking

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  - Insert "USCG-2001-10486" in the Keyword box.
  - Click "Search".
  - Click on the balloon shape in the Actions column.
- Public meetings
  - West Coast, Gulf Coast, Great Lakes, East Coast.
  - Dates and locations TBA later.

Appendix: Specific Questions from the NPRM

Specific Questions Standards

- What is the appropriateness of the proposed rule for control of invasive species from ballast waters discharged into the Great Lakes or other areas?
- More specifically, are there characteristics of the Great Lakes ecosystem or other ecosystems that would justify more stringent standards or earlier compliance dates for ships operating in the Lakes or other areas than for ships in other U.S. waters, keeping in mind that NISA also requires that such regulations should be practicable?

Specific Questions Standards

- Are there practices or technologies not addressed in then proposed rule that might be practicably applied specifically to protection of the Great Lakes or other ecosystems (e.g.: on-shore treatment or prior to entering freshwater or limitations on access to the Lakes or other areas for vessels that pose a special risk of discharge of new invasive species, and if so, how would those special risks be assessed in a practicable manner)?

Specific Questions Standards

- Would it be possible for vessel owners to comply with a phase-one BWDS implementation schedule that called for all existing vessels to install an approved BWMS on their vessel by 2014.
- Are there any facilities ready to meet the requirements of becoming an Independent Lab (IL), and any technology vendors ready to submit their system(s) to the propose protocols as soon as a facility is recognized as an IL, such that the initial practicability review now scheduled for January 2013, could be moved to January 2012.

Specific Questions Grandfathering

- Is a grandfather clause necessary, and if so, is the proposed five year period enough time, more than enough time, or not long enough?
- We specifically request information pertaining to the impacts, cost, and otherwise, of the grandfather clause as it is proposed, as well as not having a grandfather clause (i.e. requiring all vessels to install a phase-two technology at their first dry dock after January 1, 2016). Assuming a grandfather period is necessary, what is the appropriate period, and why?

Specific Questions Costs

- We wish to solicit comments with respect to the following questions (when providing comments, please explain the reasoning underlying your comment and provide quantitative data specifying the technologies, necessary modifications (to go to a more stringent standard), costs, and sources of the information, as well as citations to and copies of any relevant studies, reports and other sources of information on which you rely):

Specific Questions
Costs

1. What are the acquisition, installation, operation/maintenance and replacement costs of technological systems that are able to meet more stringent standards? Please provide quantitative cost data specifying complete data sources, type of technology and testing status, and the stringency (at 10x, 100x, and 1000x the IMO standard and for sterilization).
2. Are there technology systems that can be scalable or modified to meet multiple stringency standards after being installed?

Specific Questions
Costs

3. What are the additional costs for vessels compliant with the phase-one standard to go to the phase-two standard?

4. What are the technology alternatives and costs for smaller coastwise vessel types?

Specific Questions Phasing

5. Would an approach that bypassed phase-one and went directly to the phase-two standards be practicable and provide greater protection of the aquatic environment?

6. In light of the potentially severe nature of such damages, does the proposed rule ensure to the maximum extent practicable that aquatic nuisance species are not discharged into waters of the United States from vessels, as required by NISA?

Specific Questions Ultimate Standard

1. What BWDS is sufficient to adequately safeguard against the introduction of species into U.S. waters via ships' ballast water? Should the standard provide for zero risk of spreading invasive species via ballast water (e.g. zero living organisms), or should the standard be one that substantially mitigates any risk, but may not eliminate the possibility of species being introduced?

Specific Questions Ultimate Standard

2. For any BWDS identified in response to (1), what is the evidence that the systems can meet either of the BWDS proposed in this NPRM, and what are the timeframes by which such BWDS can be achieved and what technologies are, or will be, available to meet such BWDS?

Specific Questions Ultimate Standard

3. For any BWDS identified in response to (1), what are the costs of such systems for various classes of ships and under differing operating conditions?

Additionally, what are power requirements (for treatment) on board those vessels and what additional chemical storage requirements and other space requirements are needed on board those vessels?

Additional Questions

4. Any studies that exist on the effects of propagule pressure on successful establishment of a NIS in aquatic ecosystems.