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Marine and Hydrokinetic Renewable Energy Technologies: Potential Navigational Impacts and Mitigation Measures

Final Report

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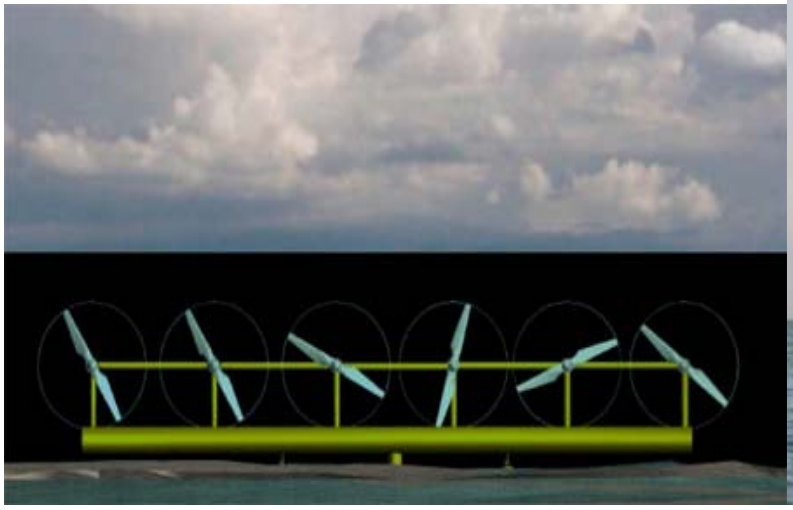

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LIST OF ABBREVIATIONS

ABS	American Bureau of Shipping
AIS	Automatic Identification System
ATBA	Area To Be Avoided
ATON	Aid to Navigation
CCTV	Closed Circuit Television
CFR	Code of Federal Regulations
COLREGS	International Regulations for the Prevention of Collisions at Sea, 1972
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DCS	Digital Selective Calling
DEC	Department of Environmental Control
DNV	Det Norske Veritas
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DSC	Digital Selective Calling
EIS	Environmental Impact Statement
EMEC	European Marine Energy Centre
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
FRF	Field Research Facility
GPS	Global Positioning System
GL	Germanisher Lloyd

IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organization
MCA	Maritime and Coastguard Agency
MEP	Marine Environmental Protection
MHHW	Mean Higher High Water
MMS	Minerals Management Service
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NTL	Notice to Lessees and Operators
NVIC	Navigation and Vessel Inspection Circular
NWP	Nationwide Permit
OCS	Outer Continental Shelf
ORM	Operational Risk Management
OTEC	Ocean Thermal Energy Conversion
PATON	Private Aid to Navigation
PCN	Pre-construction Notification
RACONS	Radar Beacons
RBDM	Risk Based Decision Making
REI	Renewable Energy Installation
RISE	Roosevelt Island Tidal Energy
SAR	Search and Rescue
TEPA	The Energy Policy Act of 2005
VHF	Very High Frequency

VTS	Vessel Traffic Service
USACE	United States Army Corps of Engineers
U.S.C.	Unites States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VCERC	Virginia Coastal Energy Research Consortium

MARINE AND HYDROKINETIC RENEWABLE ENERGY TECHNOLOGIES: POTENTIAL NAVIGATIONAL IMPACTS AND MITIGATION MEASURES

1. OVERVIEW

On April 15, 2008, the Department of Energy (DOE) issued a Funding Opportunity Announcement for Advanced Water Power Projects which included a Topic Area for Marine and Hydrokinetic Renewable Energy Market Acceleration Projects. Within this Topic Area, DOE identified potential navigational impacts of marine and hydrokinetic renewable energy technologies and measures to prevent adverse impacts on navigation as a sub-topic area.

DOE defines marine and hydrokinetic technologies as those capable of utilizing one or more of the following resource categories for energy generation: ocean waves; tides or ocean currents; free flowing water in rivers or streams; and energy generation from the differentials in ocean temperature.

PCCI was awarded Cooperative Agreement DE-FC36-08GO18177 from the DOE to identify the potential navigational impacts and mitigation measures for marine hydrokinetic technologies, as summarized herein. The contract also required cooperation with the U.S. Coast Guard (USCG) and two recipients of awards (Pacific Energy Ventures and reVision) in a sub-topic area to develop a protocol to identify streamlined, best-siting practices.

Over the period of this contract, PCCI and our sub-consultants, David Basco, Ph.D., and Neil Rondorf of Science Applications International Corp. (SAIC), met with USCG headquarters personnel, with U.S. Army Corps of Engineers (USACE) headquarters and regional personnel, with U.S. Navy regional personnel and other ocean users in order to develop an understanding of existing practices for the identification of navigational impacts that might occur during construction, operation, maintenance, and decommissioning. At these same meetings, "standard" and potential mitigation measures were discussed so that guidance could be prepared for project developers. Concurrently, PCCI reviewed navigation guidance published by the USCG and international community. This report summarizes the results of this effort, provides guidance in the form of a checklist for assessing the navigational impacts of potential marine and hydrokinetic projects, and provides guidance for improving the existing navigational guidance promulgated by the USCG in Navigation Vessel Inspection Circular (NVIC) 02-07. At the request of the USCG, our checklist and mitigation guidance was written in a generic nature so that it could be equally applied to offshore wind projects.

PCCI teleconferenced on a monthly basis with DOE, PEV and reVision in order to share information and review work products.

Although the focus of our effort was on marine and hydrokinetic technologies, as defined above, this effort drew upon earlier work by the USCG on offshore wind renewable energy installations. The guidance provided herein can be applied equally to marine and hydrokinetic technologies and to offshore wind, which are collectively referred to by the USCG as Renewable Energy Installations (REIs).

2. BACKGROUND

2.1 Technology Context

In order to identify potential navigation impacts associated with marine and hydrokinetic renewable energy technologies, it is first necessary to provide a brief overview of the important characteristics of these devices and their major subsystems, and to catalogue the common and unique attributes of existing and proposed marine and hydrokinetic devices. Appendix A, from Reference (1), contains a functional taxonomy of generic types of wave and current energy generating devices organized into logical technology classifications based on physical function, resource, platform type and major subsystems. A glossary of terms accompanies the taxonomy in Appendix A. Detailed descriptions of specific hydrokinetic energy devices are available from the U.S. Department of Energy's Marine and Hydrokinetic Technology Database (Reference 2).

In addition to the generic hydrokinetic devices listed in the functional taxonomy in Appendix A, this report also concerns itself with the navigational impacts of other marine renewable energy technologies including in-river systems and Ocean Thermal Energy Conversion (OTEC). The navigational impacts of in-river systems may be similar to those for offshore current energy devices. OTEC plants can be shore based, fixed or floating (refer to the glossary in Appendix A). The fixed and floating OTEC plants will require a large offshore platform, similar in size to those currently used for offshore oil and gas development. The navigational impacts of these OTEC platforms will be similar to the navigational impacts associated with offshore oil and gas platforms.

REIs and their navigational impacts may be significantly different from system to system. Figures 1 through 3 below provide examples of proposed marine and hydrokinetic device installations showing potential navigational hazards.

Figure 1, from Reference (3), is an artist's rendition of the South West of England Redevelopment Authority's Wave Hub, a site to test arrays of wave energy devices in the United Kingdom. Potential navigation hazards include the—

- Floating platforms containing the energy conversion devices;
- Mooring legs running from the floating platforms to multiple anchors on the seafloor;
- Power cable risers running from the floating platforms to the wave hub housing;
- Submerged floats supporting the anchor or power cables;
- Submerged wave hub housing frame; and
- Submarine cables connecting the wave hub to the substation on shore.

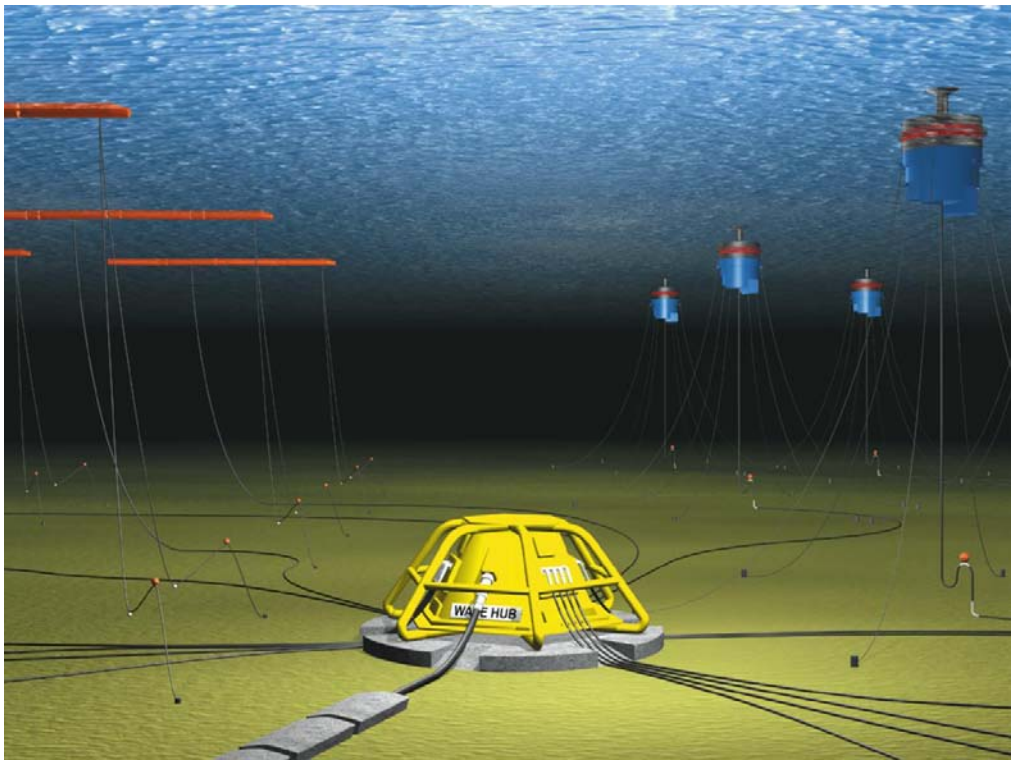

Figure 1

Figure 2, from Reference (4), is an artist's rendition of the Sea Generation Ltd. Tidal Turbine which has been proposed for deployment at locations around the world. Potential navigational impacts include the—

- Fixed, surface piercing, monopole support structure; and
- Submerged turbine rotors and associated support structures.

Figure 2

Figure 3, from Reference (5), is an artist's rendition of a proposed shelf mounted OTEC plant for Punta Tuna, Puerto Rico. Potential navigation hazards include the—

- Fixed, surface piercing, piled jacket structure;
- Submerged warm water intake pipes; and
- Submerged cold water intake pipes.

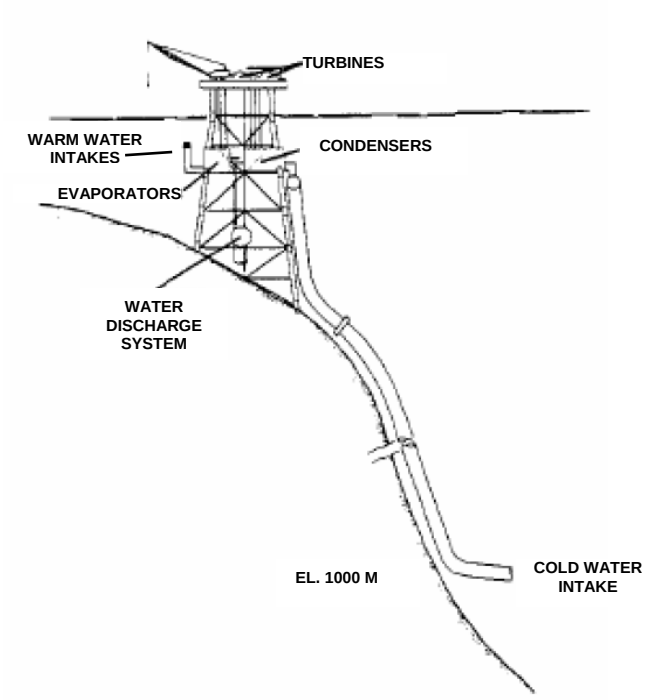

Figure 3

2.2 Overview of Regulatory Agencies

Regulatory entities that have jurisdiction over marine and hydrokinetic renewable energy technologies include—

- The Federal Energy Regulatory Commission (Federal Powers Act, 16 U.S.C. 791a);
- National Oceanic and Atmospheric Administration (42 U.S.C. § 9101, the Ocean Thermal Energy Conversion Act);
- Mineral Management Service (43 U.S.C. 1337(p) of Outer Continental Shelf Lands Act Amendments);
- U.S. Army Corps of Engineers (Clean Water Act, Section 404; Rivers and Harbors Act, Section 10);
- U.S. Coast Guard (PWSA, Pub.L. 92-340; 14 U.S.C. 83; 43 U.S.C. 1333; & NVIC 02-07 as policy guidance);
- Other Federal Agencies (e.g. Environmental Protection Agency and Departments of Commerce, Defense, Energy and Transportation) (Coastal Zone Management Act, Section 307; Endangered Species Act, Section 7; National Historic Preservation Act, Section 106); and

- State Agencies responsible for Coastal Zone Management Act (16 U.S.C. 1451), Clean Water Act (33 U.S.C. 1251-1387), and State Law provisions.

Each is summarized in the paragraphs below:

2.2.1 The Federal Energy Regulatory Commission (FERC)

FERC has exclusive jurisdiction to issue licenses and exemptions from licensing for the construction and operation of hydropower projects in accordance with the Federal Power Act (FPA)[1], including hydrokinetic devices in U.S. waters from the shoreline onto Outer Continental Shelf (OCS) and including rivers. FERC will conduct any necessary analyses, including those under the National Environmental Policy Act, related to those actions. FERC's licensing process will actively involve relevant federal land and resource agencies, including the Department of the Interior (DOI). FERC will not issue preliminary permits for hydrokinetic projects on the OCS. Additionally, FERC will not issue a license or exemption for an OCS hydrokinetic project until the applicant has first obtained a lease, easement, or right-of-way from MMS for the site.

The FERC pilot project licensing process for hydrokinetic projects is contained on their website (Reference 6). FERC encourages developers to first seek a preliminary permit which would be issued for three years and give the developer priority to study a project at the specified site for the duration of the permit. In order to allow testing of new hydrokinetic technology devices, FERC has developed expedited procedures for licensing small/low-impact hydrokinetic pilot projects 5 MW or less, which have a short (five year) licensing term. FERC anticipates that developers will then be able to transition from a pilot project license to build-out license, which will be handled as a relicensing of the pilot project and will entail a standard (30- to 50-year) licensing process, including a National Energy Policy Act (NEPA) review and full opportunity for participation by all stakeholders. A pilot project license is not a pre-requisite to applying for a standard or build-out license.

The preliminary permit process and pilot project license are elements of a larger process towards licensing. Since July 23, 2005, the Integrated Licensing Process (ILP) has been the default process and approval by FERC has been required to use the Alternative Licensing Process (ALP). Under the ILP, a federal or state agency, or Tribe with mandatory conditioning authority may request that a study dispute be referred to a dispute resolution panel. Regulations on the ILP are found at 18 CFR part 5.

For applications filed before July 23, 2005, potential license applicants were permitted to elect to use the traditional or the integrated licensing process, or to request authorization to use the ALP.

2.2.2 National Oceanic and Atmospheric Administration (NOAA)

NOAA retains jurisdiction over OTEC projects located in U.S. waters pursuant to the Ocean Thermal Energy Conversion (OTEC) Act. NOAA promulgated regulations governing license applications for commercial OTEC plants (15 CFR part 981) but

[1] Section 4(e) of the FPA, as amended (16 U.S.C. § 797(e)) states that the scope of a license would include "dams, water conduits, reservoirs, power houses, transmission lines, or other project works …"

withdrew them in 1996 due to a lack of OTEC applicants. NOAA's regulations exempted demonstration projects qualified by the Department of Energy (DOE), as well as non-permanent OTEC test platforms. In the near term, any applications for OTEC facilities are likely to be treated as demonstration projects to be qualified by DOE.

2.2.3 Mineral Management Service (MMS)

As part of the DOI, MMS was given exclusive jurisdiction under Section 388 of the Energy Policy Act of 2005 (43 U.S.C. §1337(p)), to issue leases, easements, or rights-of-way with regard to the production, transportation, or transmission of energy from non-hydrokinetic renewable energy projects on the Outer Continental Shelf (OCS), including wind and solar. MMS was also given exclusive jurisdiction to issue leases, easements, and rights-of-way on OCS lands for hydrokinetic projects. The Energy Policy Act of 2005 (EPACT 2005) gave MMS two additional authorities.[2]

MMS plan and information requirements for issuance of OCS leases and rights-of-way grants and start of construction or installation are contained in 30 CFR part 285, Renewable Energy and Alternate Uses of Existing Facilities on the OCS. MMS regulations for shallow hazards survey and archeological resource report requirements are contained in Notices to Lessees and Operators (NTLs) that supplement the regulations that govern operations on the OCS.

A Memorandum of Understanding exists between the DOI and FERC which governs how MMS and FERC will work together on hydrokinetic energy projects. In all leases, easements, and rights-of-way for hydrokinetic projects, MMS will require that construction and operation cannot begin without a license or exemption from FERC, except when FERC notifies MMS that a license or exemption is not required.

2.2.4 U.S. Army Corps of Engineers (USACE)

Regulatory Role and Responsibility

The USACE derives its primary regulatory authorities over waters of the United States from the two Federal laws that are central to the USACE regulatory program. Section 10 of the Rivers and Harbors Act of 1899 applies to all navigable waters of the United States and Section 404 of the Clean Water Act applies to all waters, including wetlands, that have sufficient nexus to interstate commerce. Waters of the United States include essentially all surface waters such as all navigable waters and their tributaries, all interstate waters and their tributaries, all wetlands adjacent to these waters, and all impoundments of these waters. The USACE has Section 10 jurisdiction from the coastline (baseline) to the outermost limits of the OCS (distance varies) for all installations except those for hydropower projects. For hydropower projects, the USACE will work as a cooperating agency to review and authorize the Section 10 permit application. If components of a hydropower project are not addressed by the

[2] Additional authorities given to MMS under EPACT 2005: 1) Authority to allow a previously-permitted offshore oil and gas structure to remain in place for use in connection with other permitted energy and marine-related activities and 2) Authority to share with nearby coastal states a portion of revenues received by the Federal government.

application to FERC, the USACE may then exert Section 10 authority. When MMS is the lead regulatory agency, the USACE will also exert Section 10 authority. (McLaughlin, 11/5/09 pers.com.)

The Section 404 jurisdiction extends from the coast out 3 nautical miles. There are some exceptions, but these are the standard interpretations of the regulations. (McLaughlin, 8/7/09 pers.com.)

The geographic jurisdiction of the Rivers and Harbors Act of 1899 includes all navigable waters of the United States which are defined (33 CFR part 329) as, "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce". This jurisdiction extends seaward to include all ocean waters within a zone 3 nautical miles from the coast line (the "territorial seas"). Limited authorities extend across the Outer Continental Shelf (OCS) for artificial islands, installations and other devices (see 43 U.S.C. 333 (e)). Activities requiring Section 10 permits include structures (e.g., piers, wharfs, breakwaters, bulkheads, jetties, weirs, transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the United States.

Navigation Role and Responsibility

USACE responsibility within navigable waters includes authorized navigation channels in Public Works projects to dredge and maintain the channels to navigable depths, as well as for potential future channel deepening projects. Care must be exercised for locating electrical cables to ensure they transit at safe depths below the authorized channel depth (plus over dredging depths) and when hydraulic dredges with spuds or spud barges put down spuds in a channel that may contain the cable.

Permit Requirements

Rivers & Harbors Act 1899 §10. Section 10 of the Rivers and Harbors Act of 1899 requires approval prior to the accomplishment of any work in or over navigable waters of the United States, or which affects the course, location, condition or capacity of such waters. Typically, Section 10 permits are required for structures and cable or pipeline crossings, as well as other activities. This authority is subsumed by the FPA, provided the activities are included in the application and the NEPA analysis. The USACE would apply the same criteria to hydrokinetic installations whether providing recommended terms and conditions to FERC or issuing a USACE Section 10 Permit.

Clean Water Act - §401 and §404. Section 401 of the Clean Water Act requires that any applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State in which the discharge originates that any such discharge will comply with the applicable provisions of the Clean Water Act.

Section 404 of the Clean Water Act requires approval prior to discharging dredged or fill material into the waters of the United States.

USACE Permits

USACE issues four types of permits: Individual Permits, Letters of Permission, Nationwide Permits and Regional General Permits. Each of these is summarized below:

An *Individual Permit* is a type of Department of the Army authorization that has undergone a full public interest review. This includes a 30-day public notice period in which a copy of the permit drawings and a description of the project are forwarded to all interested parties, adjacent property owners, and the State and Federal agencies for review and comment. The USACE has a goal for processing these types of permits within 180 days from the receipt of a complete application for non-controversial projects. Controversial or larger projects, including those that require a public hearing or an Environmental Impact Statement (EIS), will generally take longer. This type of Permit was employed for the Roosevelt Island Tidal Energy (RISE) project in the East River, NY by the New York District for Verdant Power, LLC in May 2006.

The *Letter of Permission* (LOP) is a type of individual permit used in cases where the proposed project involves a lesser degree of impact to aquatic resources. The LOP involves a 30-day comment period or a 15-day comment period in cases where the proposed impacts are minor and non-controversial. State and Federal agencies and the adjacent property owners are provided a project description and a copy of project plans. A final decision on the LOP permit application is usually reached 45 to 60 days from the date a complete application is received by the USACE office.

Nationwide permits (NWP) are general permits issued nationwide to authorize categories of minor activities. Each USACE District has developed Regional Conditions in order to provide additional protection for the aquatic environment within their region. All persons wishing to perform work under the nationwide permits must provide written notification to USACE prior to the start of work. The Regional Conditions provide a list of the information necessary to submit a complete Pre-construction Notification (PCN). After a review of the project, USACE will issue a verification letter pursuant to the applicable NWP(s). Normally, these permits are granted within 45 days after receipt of a complete application. NWP 12 deals with *Utility Line Activities*. See Appendix B for further discussion of NWP 12 as applied to electrical cable routes and one example of Regional Conditions, as specified by the New York District of the USACE.

As of this writing, USACE in Washington, DC, does not plan to develop a NWP category for hydrokinetic energy projects at the Headquarters of USACE in Washington, DC. Each USACE District Office is on its own regarding how it handles the Permit Application for a hydrokinetic energy project.

Regional General Permits are used to authorize activities that cause only minimal individual and cumulative environmental impacts. Regional general permits are developed by individual districts to streamline project review by minimizing duplication of other federal, state and local review processes, while still protecting aquatic resources. Regional general permits may be restricted for use in areas as small as a single residential development, a county, a region of the state or the entire district.

Appendix C contains two maps on a national scale. The first map shows the general locations of 41 coastal projects (28 tidal and 13 wave) and 102 inland projects (riverine) that have FERC-issued Preliminary Permits. The second map shows the general locations of 4 additional coastal projects (4 tidal and 0 wave) and 41 inland projects with pending Preliminary Permit applications at FERC. Two other sites have received pilot project licenses from FERC: the first is the Makah Bay Offshore Wave Pilot Project and the second is the City of Hastings, MN, project at USACE Mississippi River Lock and Dam No. 2. Although issued, the Makah Bay project license was surrendered, leaving one active as of this time.

As mentioned earlier in this section, the scope of a FERC license may include Section 10 of the Rivers and Harbors Act of 1899. Of the 188 projects shown in Appendix C, we are aware of two projects that elected to file separately with the USACE for a Section 10 Permit. Of those two, one project (RISE) is in the New York District of the USACE and one is in the Philadelphia District. Although the second of these was initially denied, the applicant is to reapply. See Appendix D for additional information on the RISE Project's Section 10 Permit.

Of the eight coastal USACE District Offices-with FERC-permitted projects, six districts (New England, New York, Philadelphia, Seattle, Portland, and San Francisco) have Joint Permit Application (JPA) processes with the states in their jurisdiction. This means the paper work for the permit application remains the same for the USACE District and state agencies involved, but it does NOT mean that the USACE permit governs if the state denies the permit.

The two remaining coastal USACE districts, Alaska and Honolulu, do not have a joint permit application process.

2.2.5 United States Coast Guard's (USCG) role in Renewable Energy Installations (REI)

The Navigation and Vessel Inspection Circular (NVIC 02-07) is a guidance document, not a statutory citation of primary jurisdiction. The USCG will be a cooperating agency under the NEPA with the lead permitting agency considering the issuance of a permit, lease, right of use and easement, or right of way for a REI. As such, the role of the USCG is limited to providing any such lead permitting agency with an evaluation of the potential impacts of the proposed facility on the safety of navigation, the traditional uses of the particular waterway and other USCG missions in order for the lead permitting agency to prepare their EIS. The USCG should help develop appropriate terms and conditions that provide for navigational safety and minimize potential impacts on other USCG missions in and around the proposed facility and recommend those terms and conditions to the lead permitting agency for consideration. The USCG will not approve or disapprove a REI application. The USCG's role is limited to assessing navigation impacts of a REI and forwarding such considerations to the lead permitting agency. The USCG has developed a number of MOU and Memorandum of Agreement (MOA) with MMS for OCS facilities and is in the process of negotiating an MOU with FERC addressing wave and current energy generating devices.

Coast Guard statutory authorities and guidance for navigation safety are contained in—

- Ports and Waterways Safety Act of 1972 (Public Law 92-340);

- 14 U.S.C. § 83 – Unauthorized aids to navigation; penalty;
- 43 U.S.C. § 1333 (d) - Coast Guard regulations; marking of artificial islands, installations, and other devices; failure of owner suitably to mark according to regulations; and
- Navigation and Vessel Inspection Circular (NVIC) No. 02-07.

2.2.6 Other Federal Agencies

Other Federal agencies that may be involved in the process include the Departments of Commerce, Defense, Energy, and Transportation, and the Environmental Protection Agency (EPA). In addition, appropriate state agencies and tribal governments may also be involved.

The following authorities are given broadly to federal agencies:

Coastal Zone Management Act (CZMA) - § 307. Section 307 of the CZMA of 1972, as amended (16 U.S.C. 1458(c)), requires the applicant for a required Federal license or permit to conduct an activity affecting any land or water use or natural resource of the coastal zone of a state to certify that the project is in compliance with the state's approved Coastal Zone Management Program and that the proposed activity will be consistent with the state's program. This provision also requires the applicant to furnish the state or its designated agency a copy of the certification with all necessary information and data. Within six months, the State is to advise the Federal agency that the State concurs with or objects to the applicant's certification. In general, no license or permit shall be granted by the Federal agency until the state or its designated agency has concurred with the applicant's certification.

Endangered Species Act - §7. Section 7 of the Endangered Species Act of 1973 (ESA) requires Federal agencies (not only USACE) to ensure that any action authorized, funded or carried out by them is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of their critical habitat. Section 7 outlines the process for interagency coordination by which all agencies consult with the United States Fish and Wildlife Service (USFWS) and/or National Oceanic and Atmospheric Administration (NOAA) Fisheries on a proposed project's potential to affect listed species. For the FERC licensing process, FERC will typically coordinate all ESA issues raised by federal agencies with USFWS and/or NOAA. See Reference 11.

National Historic Preservation Act - §106. Section 106 of the National Historic Preservation Act (NHPA) requires that the head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. Under Section 106 of the NHPA, the head of any Federal agency is required to consult with the Advisory Council

on Historic Preservation to determine a project's potential to impact resources of historic or cultural significance.

2.2.7 State Agencies responsible for CZMA and CWA provisions

Section 307 of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1458(c)), requires the applicant certify that the project is in compliance with an approved State Coastal Zone Management Program and that the State concur with the applicant's certification prior to the issuance of a permit or license. If the state or its designated agency fails to notify the Federal agency within six months after receipt of its copy of the applicant's certification, the state's concurrence with the certification shall be conclusively presumed.

As of this writing, three States have entered into MOUs with FERC, as follows:

Maine, 18 August 2009: The purpose of this MOU is to coordinate the procedures and schedules for review of tidal energy projects using hydrokinetic technologies in Maine state waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area, to ensure that there is a coordinated review of proposed hydrokinetic tidal energy projects that is responsive to environmental, economic, and cultural concerns while providing a timely, stable, and predictable means for developers of such projects to seek necessary regulatory and other approvals.

Washington, 4 June 2009: The purpose is to coordinate their review of renewable energy projects in Washington state waters that use emerging hydrokinetic technologies. The MOU ensures that FERC and Washington will undertake their regulatory efforts in an environmentally sensitive manner that recognizes economic and cultural factors.

Oregon, 27 March 2008: The purpose is to coordinate procedures and schedules for review of wave energy projects in state waters off the coast of Oregon. This effort will be undertaken in an environmentally sensitive manner, while taking into account economic and cultural concerns.

3. REI FACILITY AND WATERWAY NAVIGATION IMPACT RISK ASSESSMENT AND MANAGEMENT

There are safety concerns associated with the installation and operation of any man-made offshore structure in navigable waters (Reference 7). A Renewable Energy Installation's (REI) location may physically affect commercial shipping, fishing, recreational boating, homeland security operations, or other traditional uses of a particular waterway. Additionally, the REI may affect the performance of existing navigation systems used in the maritime environment. The safety concerns may vary, depending on the project phase, starting with design, through construction, transportation to the site, installation, operations and finally decommissioning. For each of these project phases the United States Coast Guard (USCG) requests developers to consider potential navigational impacts of the REI installation, including:

- Platform, Stationkeeping, Transmission Cable and other design considerations
  - Visual Navigation and Collision Avoidance
  - Effects on Communications, Radar and Positioning Systems
- REI Site and Waterway Considerations
  - Effects upon Tides, Tidal Streams, and Currents
  - Effects upon seafloor soil movement
  - Effects of varying weather and sea state
  - Effects of ice where applicable
- Maritime Traffic and Vessel Considerations
  - Traffic Survey Recommendations
  - Risk of Collision, Allision, or Grounding
  - REI Structure Clearances and Response to allision
  - Access to and Navigation Within, or Close to, the REI
- USCG Mission Considerations
  - Recommended design requirements, operational requirements, and operational procedures for installation shutdown in the event of a Search and Rescue (SAR), Pollution, or Homeland Security Operation
  - Recommendation to work with the USCG to assess likely impacts on USCG SAR, Marine Environmental Protection (MEP) and Homeland Security missions

Appendices E through H contain large format tables for each of the project phases describing potential navigational impacts applicable to that phase, and mitigation strategies to address the potential impacts.

Appendix I contains an abbreviated checklist of these potential navigational impacts and mitigation measures for use by project developers and reviewers.

4. EXAMPLE MITIGATION MEASURES AND STRATEGIES

4.1 Navigational Safety and Risk Assessment Methods

The following documents provide guidance in the assessment of navigation safety and risks:

United States Coast Guard (USCG): Commandant Instruction 3500.3 (Reference 8)

This instruction outlines the USCG's Operational Risk Management (ORM) process, a process that Coast Guard recommends applicants apply in a systematic assessment of risks to navigation safety associated with the proposed project. ORM is a systematic process to continually assess and manage risks—a risk being the chance of personal injury or property damage or loss, generally a function of severity and probability and, at times, exposure. The instruction highlights that basic decision-making principles apply: Accept no unnecessary risk, Accept necessary risk when benefits outweigh costs; Make risk decisions at the appropriate level, and ORM are just as critical in executing as in planning. Developers should expect USCG to apply this ORM process to its determinations.

American Bureau of Shipping (ABS): Appendices 4 and 5 of ABS *Guide for Risk Evaluations for the Classification of Marine-Related Facilities, June 2003* (Reference 9)

Appendix 4 provides an overview of Risk Assessment techniques with an overview of commonly used risk assessment techniques and a summary of key features of those common techniques. Following is an itemization of the techniques with the commonly used ones indicated with an asterisk (*):

Hazard Identification (HAZID) Analysis
Change Analysis *
What-if Analysis *
Checklist Analysis
Hazard and Operability (HAZOP) Analysis *
Failure Effects and Modes Analysis (FEMA) *
Event Tree Analysis *
Fault Tree Analysis *

Appendix 5 summarizes survey results of seven organizations in using risk management techniques: MMS, USCG, U.S. Nuclear Regulatory Commission, U.S. Department of Defense, U.S. Department of Energy (DOE), United Kingdom Health and Safety Executive, and the International Maritime Organization (IMO).

Inclusion in the Environmental Analysis (EA) and Environmental Impact Statement (EIS) process

Developers should be aware that navigation impacts of the REI will be addressed as part of the EA and EIS processes. Scenarios of foreseeable activity at the REI will address vessel traffic as it relates to space use conflicts, installation activities, operational and maintenance activities, decommissioning, and non-routine events such as vessel collisions and spills. The results of the previously mentioned navigation safety and risk assessments should be provided to the EA or EIS developer to assist their effort.

4.1.1 Using mooring configuration to help determine safety zones, extent and application to specific vessels, possible designation of Area to be Avoided (ATBA) or No Anchoring Areas

Floating device and REI system motions are constrained by the mooring configuration and type. Through computer analysis and model tank testing, the extent of device and system motions in various sea states can be estimated and used with an appropriate design factor as the basis for any safety zones around the REI. By mapping the anchor line(s) and electric cable(s) on charts, No Anchoring Areas and possible ATBA's can be mapped out for discussion with the local USCG office and other stakeholders.

4.1.2 Recommended minimum distance of REI structures from shipping routes

There is no fixed or prescriptive distance recommended to separate REI structures from shipping routes. A Shipping Route template found in Annex 3 of Maritime and Coastguard Agency (MCA) Marine Guidance Note 371 (See Reference 10) is one accepted methodology. See discussion in paragraph 12 of the following section (Section 5). The example given in Annex 3 is based on specific North Sea data and published ship domain theory. The boundary proposed for other locations would begin with traffic surveys and radar simulator performance at the proposed REI site and application of similar statistical study.

4.1.3 The International Maritime Organization (IMO) Accepted Routing Measures[3]

The IMO, a specialized agency of the United Nations, develops and maintains a comprehensive regulatory framework for shipping. IMO accepts as a vessel routing system, the use of one or more of the following routing measures:

- ATBA means a routing measure comprising an area within defined limits in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by all vessels, or certain classes of vessels.
- Deep-water route means a route within defined limits, which has been accurately surveyed for clearance of sea bottom and submerged obstacles as indicated on nautical charts.
- Inshore traffic zone means a routing measure comprising a designated area between the landward boundary of a traffic separation scheme and the adjacent coast, to be used in accordance with the provisions of Rule 10(d), as amended, of the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS).
- No anchoring area means a routing measure comprising an area within defined limits where anchoring is hazardous or could result in unacceptable damage to the marine environment. Anchoring in a no anchoring area should be avoided by all vessels or certain classes of vessels, except in case of immediate danger to the vessel or persons on board.
- Precautionary area means a routing measure comprising an area within defined limits where vessels must navigate with particular caution and within which the direction of traffic flow may be recommended.

[3] General Provisions on Ships' Routeing, adopted by Resolution A.572(14), as amended.

- Recommended route means a route of undefined width, for the convenience of vessels in transit, which is often marked by centerline buoys.
- Recommended track means a route which has been specially examined to ensure so far as possible that it is free of dangers and along which vessels are advised to navigate.
- Roundabout means a routing measure comprising a separation point or circular separation zone and circular traffic lane with defined limits. Traffic with the roundabout is separated by moving in counterclockwise direction around the separation point or zone.
- Separation Zone or separation line means a zone or line separating the traffic lanes in which vessels are proceeding in opposite or nearly opposite directions; or from the adjacent sea area; or separate traffic lanes designated for particular classes of vessels proceeding in the same direction.
- Traffic lane means an area within defined limits in which one-way traffic is established. Natural obstacles, including those forming separation zones, may constitute a boundary.
- Traffic Separation Scheme (TSS) means a routing measure aimed at the separation of opposing streams of traffic by appropriate means and by the establishment of traffic lanes.
- Two-way route means a route within defined limits inside which two-way traffic is established, aimed a providing safe passage of ships through waters where navigation is difficult or dangerous.

The United States may submit proposed routing measures, in particular (TSSs) to the IMO for approval, adoption, and implementation.

4.1.4 Recommendations for Marking of Renewable Energy Devices

As prescribed in the Coast Guard's NVIC 02-07, the USCG recommends marking – which includes lighting and sound signals – that either comply with USCG requirements (conformity with 33 CFR 62, 64, 66 and 67) or with recommendations by International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) (currently Recommendation O-139, Reference 7).

IALA recommends that consultation between the stakeholders such as developers, Federal authorities, the USCG, and installation contractors take place at an early stage.

In order to avoid confusion from a proliferation of Aids to Navigation (ATON) in a high-density REI, IALA recommends consideration to the use of synchronized lighting, different lighting characteristics and varied light ranges.

Marine and hydrokinetic energy extraction devices should be marked as a single unit or as a block (or field). See Appendix J, which contains a number of questions and answers about the IALA recommendations for marking offshore wave and tidal devices.

4.1.5 REI monitoring

Remote monitoring from a shore station manned on a 24-hour basis via radio and internet link is recommended. Individual devices should include GPS sensors that will

trigger an alarm at the operators console if the device is out of location. The normal position of each device should be plotted on a chart in the control room. The operator should also maintain an Emergency Action Plan and be responsible for notifications to the USCG and emergency responders in the event a device is off-station.

Remote as well as visual monitoring by the operator and third parties can be used to inspect navigation aids.

4.1.6 Information on potential impacts to U.S. Navy/Dept. of Defense facilities and programs

For a potential developer to find someone to talk to regarding potential impacts on the Department of Defense or U.S. Navy can be particularly challenging and warrants additional discussion.

The Navy, an Ocean User: The mission of the Navy is to maintain, train and equip combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas**.** The Navy's basic claim as an ocean space user is based on a Constitutional basis of the responsibility to raise and maintain a Navy for national defense. In order to do so the Navy must be trained for deployment throughout the world as necessary. To maintain that readiness the Navy uses a regular deployment and training schedule to prepare naval units for operations throughout the world's oceans. That preparation includes fundamental elements such as seamanship and navigation but also extends to weapons proficiency, emergency response, test and evaluation of shipboard systems, all weather operations, etc. The use of the nation's ocean space to train naval units in all aspects of deployment and warfare is an inherent requirement of the Navy.

The developers of marine and hydrokinetic devices may be challenged to engage the Navy's large and complex organization to discern whether their planned installations would impact naval operations. (See Appendix K for a summary of the Navy Organization.) As of this writing September 2009, there is no single point of contact at which to engage the Navy or Department of Defense. However, the best effort on engagement of the U.S. Navy to date has been the Virginia Coastal Energy Research Consortium (VCERC) effort to research and prepare for potential development of offshore wind in Virginia. By viewing this example it is possible to see the vital importance of engaging the Navy on any planned offshore development and the positive result of that early engagement. Appendix L gives a summary of the VCERC example.

FERC, whether or not it is the primary licensing agency, will coordinate a proposed electrical undersea cable from a REI to an intermediate power conditioning platform (or subsea pod), if utilized, and ashore with the Navy's Seafloor Cable Protection Office. The purpose of that Navy office is to protect the Navy's interest with respect to seafloor cables by providing internal governmental coordination and external representation of the Navy's interest.

4.1.7 Promulgation of information to mariners and other potentially impacted parties

As previously recommended, the developer should consult as early as practical with the local USCG office and other stakeholders. Prior to mobilization for installation, it will

be necessary to ensure that the USCG issues Notices to Mariners providing information on the location and timing of any planned installation activities.

4.1.8 Broader application of Permit-Specific Regional Conditions to United States Army Corps of Engineers' (USACE) Nationwide Permit (NWP) No. 12 Utility Line Activities

Recommended mitigation measures are similar to those cited in the example for NY District cited in Appendix B (USACE Permits) for electrical cable location when crossing beneath a federally maintained navigation channels and burial depth below bathymetry located outside of the dynamic beach area.

For new cable locations on eroding shorelines and beneath dynamic sandy beaches, the following applies:

Figure 4 illustrates 127 beach profiles measured at the USACE, Field Research Facility (FRF) at Duck, NC between Jan. 20, 1981, and Dec. 17, 1984. At a distance of about 100m (330 ft) from behind the dune and near the zero water elevation, the vertical shift of the shoreline was nearly 3m (10 ft). Clearly, locating the electrical cable only 4 ft below the existing beach profile would have exposed the cable. The lowest measured elevation of the sandy beach profile is also shown in Figure 4. The cable must be located below this measured (or calculated) elevation plus a safety factor.

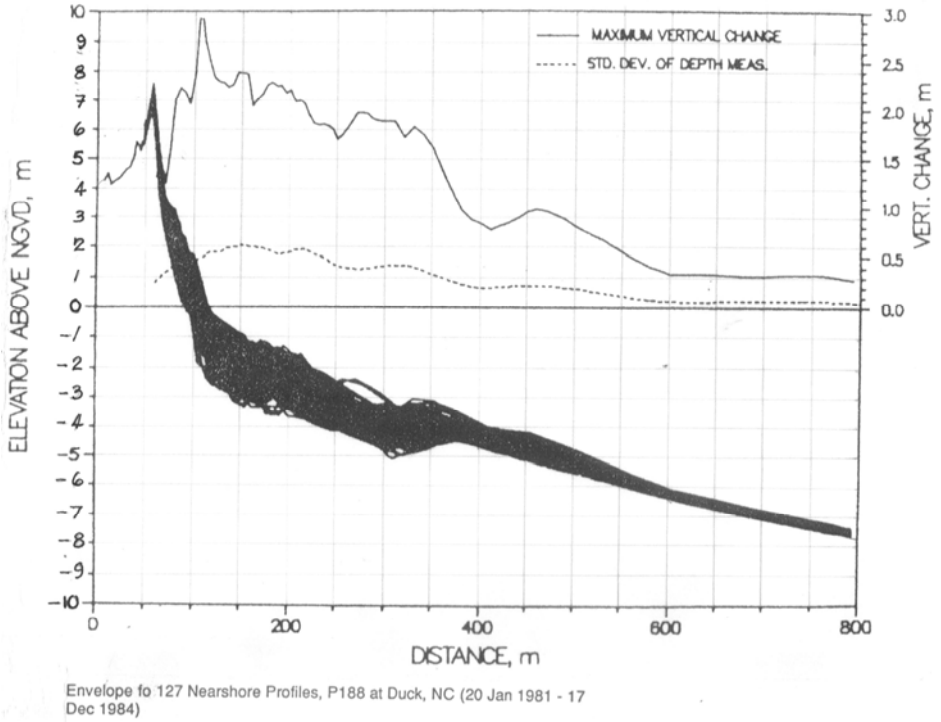

Figure 4
Vertical variation of sandy beach profiles at USACE, FRF, Duck NC from Jan 1981- Dec 1984

5. LIST OF EXISTING CODES, REGULATIONS AND STANDARDS

5.1 33 CFR Part 62 – Aids to Navigation (ATON)

The U.S. ATON, administered by the United States Coast Guard (USCG), consists of federal ATON operated by the USCG, ATON operated by the other armed services, and private aids to navigation (PATON) operated by other persons. This part describes the general characteristics of the U.S. ATON System, and the details, policies and procedures employed by the USCG in establishing, maintaining, operating, changing or discontinuing federal ATON. The U.S. System is consistent with the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Maritime Buoyage System, but it does not incorporate specifically IALA recommendations for offshore wave and tidal energy devices.

5.2 33 CFR Part 64 – Marking of Structures, Sunken Vessels and Other Obstructions

This Part sets out rules for marking structures which may interfere with or restrict marine navigation. It does not apply to artificial islands and structures that are subject to 33 CFR part 67.

5.3 33 CFR Part 66 – Private Aids to Navigation (PATON)

The term PATON includes all marine ATON operated in the navigable waters of the United States other than those operated by the Federal Government (33 CFR part 62) or those operated in State waters for PATON (33 CFR Subpart 66.05). With the exception of radar beacons (RACONS) and shore based radar stations, this part does not authorize operation of electronic ATON. Authority to regulate PATON is delegated to the USCG District Commander within their district.

Before any PATON consisting of a fixed structure is placed in the navigable waters of the United States, authorization to erect such structure shall first be obtained from the District Engineer, U.S. Army Corps of Engineers (USACE). An application (Form CG 2554) to the District Commander is required to establish and maintain, discontinue, change, or transfer ownership of a PATON. The application to establish any PATON consisting of a fixed structure shall show evidence of the required permit having been issued by the USACE.

5.4 33 CFR Part 67 – ATON on Artificial Islands and Fixed Structures

This part prescribes the obstruction lights and sound signals to be operated as privately maintained maritime ATON on the artificial islands and structures which are erected on or over the seabed and subsoil of the Outer Continental Shelf (OCS) and in the waters under the jurisdiction of the United States, for the purpose of exploring for, developing, removing and transporting resources.

There are three classifications of structures (Class A, B or C) under this part, depending primarily on the structure's distance from shore. Class A structures are generally farthest from shore and are required to have obstruction lights and sound signals that can be

detected from the farthest distance. When assigning a class, other criteria may be applied, such as (but not limited to) whether a line of demarcation has been prescribed, the dimensions of the structure, the depth of water in which it is located, the proximity of the structure to vessel routes, the nature and amount of vessel traffic, and the effect of background lighting. Based on the structure's class, minimum requirements for obstruction light arrangement, multiple lights, characteristics and operating periods are given, as are minimum requirements for sound signals, the location of the signal on the structure and operating requirements.

Lighting and sound signal requirements generally apply to individual structures, except lesser structures and piles, pile clusters, etc. will not normally be required to be lighted when they are located within 100 yards of a Class A, B or C structure. Lesser structures shall be marked with retro-reflective material.

5.5 40 CFR Part 55 – OCS Air Regulations

This part establishes the air pollution control requirements for OCS sources and the procedures for implementation and enforcement of the requirements, consistent with the objectives of section 328(a)(1) of the Clean Air Act. The requirements apply to all OCS sources except those in the Gulf of Mexico west of 87.5 longitude. OCS sources located within 25 miles of States' seaward boundaries are subject to all the requirements of this part, which include, but are not limited to, the Federal requirements in §55.13 of Part 55 and the Federal, State, and local requirements of the Corresponding Onshore Area.

5.6 American Bureau of Shipping (ABS) – Guidance Notes on Review and Approval of Novel Concepts

This guidance is intended for ABS clients who request classification of a novel design. The notes describe the process and responsibilities for ABS review proposed novel concepts from project concept stage through maintaining classification. The process draws on engineering, testing and risk assessments in order to determine if the concept provides acceptable levels of safety in line with current offshore and marine industry practice. The methodology relies heavily on risk assessment techniques as a way to better understand and anticipate structural and operational issues.

5.7 ABS Guide for Risk Evaluations for the Classification of Marine-Related Facilities

The information and process provide a risk-based perspective for ABS clients evaluating proposed designs that offer alternative means of compliance to current prescriptive classification requirements or novel designs for which classification requirements do not exist. The guide provides guidance on how to demonstrate that a proposed design meets the overall safety and strength standards of the ABS Rules. The guidance applies from concept stage through maintaining classification.

5.8 DNV-OSS-312 – Certification of Tidal and Wave Energy Converters

Det Norske Veritas (DNV) provides classification, certification and other verifications and consultancy services relating to ships, offshore units and installations and onshore industries worldwide. This specification presents principles and procedures for certification of tidal and wave energy converters by DNV. Because of a lack of operational experience in the offshore renewable energy industry, DNV refers extensively to its offshore standards and recommended practices, as well as international standards. The document covers all fixed or floating converters and construction may be steel, concrete or composite. The overall safety philosophy of the certification process applies from conceptual studies up to and including decommissioning.

5.9 EMEC – Guidelines for Health and Safety in the Marine Energy Industry

Sections 7 - 10 of the 2008 European Marine Energy Centre (EMEC) Guidelines for Health and Safety in the Marine Energy Industry describe current best practice for Health and Safety throughout the project lifecycle, from site selection through decommissioning. This guide provides comprehensive lists of issues that should be considered by a developer to adhere to the highest standards of health and safety and can be applied whether the development is in the European community or not. Those issues are broken down by site selection, initial site investigation & planning considerations (Section 7); design, specification, manufacture and testing (Section 8); installation, commissioning and decommissioning (Section 9); and operation and maintenance (Section 10).

5.10 Germanisher Lloyd (GL) IV, 14, Part 1 – Ocean Current Turbines

This guideline applies to the design, assessment and certification of ocean energy conversion systems and farms of ocean energy conversion systems, specifically ocean current turbines. Systems meeting this guideline may apply for GL Type Certification and Project Certification. Type Certification applies to assessment of the overall concept of the ocean energy current turbine. Project Certification applies assessment and certification of type-certified ocean current turbines and particular support structure designs to meet requirements governed by site-specific external conditions, local codes and other requirements relating to the site. Project Certification requires monitoring for conformity during manufacture, transport, installation and commissioning, as well as periodic monitoring at regular intervals. The service life is assumed to be at least 20 years.

5.11 IALA Recommendation O-139 (2008), The Marking of Man-Made Offshore Structures

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is a non profit, non governmental international technical association. Its aim is to harmonize ATON worldwide and to ensure that the movements of vessels are safe, expeditious, cost effective and harmless to the environment.

Recommendation O-139 recommends that wave and tidal devices be marked so as to be conspicuous by day and night, with consideration to prevailing visibility and vessel traffic. Based on the IALA Maritime Buoyage System, it is intended for the guidance of stakeholders such as National Administrations, Lighthouse Authorities, Aviation Authorities and other competent authorities, as well as ATON providers, wave and tidal energy contractors and developers. The document recommends markings during construction, operation and decommissioning (including painting and navigational lighting, as well as additional considerations, such as lighting of the structures, use of retro-reflective materials, lighting of ladders and platforms, use of yellow flashing lights of varying range and numbering of individual structures). It adopts recommendations for marking fields or arrays of devices contained in the section on offshore wind farms.

5.12 UK Maritime and Coastguard Agency (MCA) Marine Guidance Note MGN 371 – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues

This guidance highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency response caused by an offshore renewable energy installation proposed for the UK internal waters, the UK territorial sea, or the UK Renewable Energy Zone. It parallels the USCG guidance below. There are five annexes, covering 1) Considerations on site position structures and safety zones; 2) Navigation, collision avoidance and communications; 3) The MCA Shipping Template; 4) Safety and mitigation measures recommended for OREI during construction, operation and decommissioning; and 5) Standards and procedures for generator shutdown and other operational requirements. The Shipping Route template example in Annex 3 applied specifically to specific wind farms and the North Sea. As such, it is not a prescriptive tool for all OREI in the U.S., but it provides an accepted methodology for interpreting the inter-relationship of an OREI to shipping routes. The guidance is intended to cover all phases of OREI planning, construction, operation and decommissioning.

5.13 USCG Navigation and Vessel Inspection Circular (NVIC) 02-07

The USCG will be a cooperating agency under the National Environmental Policy Act (NEPA) with the lead permitting agency considering the issuance of a lease, right of use and easement, or right of way for a Renewable Energy Installation (REI). As such, the role of the USCG is limited to providing any such lead permitting agency with an evaluation of the potential impacts of the proposed facility on the safety of navigation, the traditional uses of the particular waterway and other USCG missions in order for the lead permitting agency to prepare their Environmental Impact Statement (EIS). NVIC 02-07 is the USCG's primary guidance document for REIs. Using that policy guidance, the USCG will help develop terms and conditions that provide for navigational safety and minimize potential impacts on other USCG missions in and around the proposed facility and recommend them to the lead permitting agency for consideration. The USCG will not approve or disapprove an REI application. The USCG's role is limited to assessing navigation impacts of an REI and forwarding such considerations to the lead permitting agency.

Under international treaty (Safety of Life at Sea, Chapter V) the International Maritime Organization (IMO) is responsible for ships' routing in international waters[4] and is the only international body for establishing such systems. If International Regulations for Avoiding Collisions at Sea (COLREGs) apply, USCG must propose to IMO a scheme for mitigating potential problem areas using one of IMO's accepted routing measures. Because the Maritime Safety Committee of IMO meets only every two years on a very rigid schedule, the process of getting IMO approval for the routing measure may take from 15 to 21 months.

The USCG has the authority to create a domestic scheme for mitigating potential problem areas within 12 miles (territorial seas). A traffic separation scheme or fairway takes the longest lead time due to the U.S. regulatory process.

[4] As an example, the COLREG Demarcation Line for Chesapeake Bay extends in a straight line across the entrance from Cape Charles Light on Smith Island to Cape Henry Light on Cape Henry of the Virginia mainland. The demarcation line is not 3 miles offshore.

6. REGULATORY GAP ANALYSIS

6.1 United States Coast Guard (USCG) Navigation and Vessel Inspection Circular (NVIC) 02-07

The USCG's NVIC 02-07 provides guidance on the USCG's role and responsibilities for Renewable Energy Installations (REI). Initially, the NVIC was developed specifically to address Coast Guard's involvement in the Cape Wind project off the Massachusetts coast. The scope of its title included all offshore renewable energy installations, not just wind parks, but details were provided for wind parks only. Since 2007, USCG has noted a proliferation of Federal Energy Regulatory Commission (FERC) applications for not only marine current turbines and wave devices, but also current turbine applications proposed for U.S. rivers. As summarized below, Appendix M also proposes specific additional changes to update Enclosures (4) and (5) of the USCG NVIC:

- Section 1 of Enclosure (4) was crafted with wind parks in mind and does not mention the potential problem of vessels navigating in the vicinity of subsurface devices in a current turbine or wave generator REI. We propose adding a general paragraph encouraging an applicant to assess that possibility.

- Section 2.C of Enclosure (5) is titled 'Marine Current Turbine' and was 'TO BE DEVELOPED' when the NVIC was published. We recommend changing this section name to 'Marine and Riverine Current Turbines' and propose new language on design requirements, operational requirements and operational procedures for marine and riverine current turbine installations.

- Section 2.D of Enclosure (5) is titled 'Wave Generator' and was 'TO BE DEVELOPED' when the NVIC was published. We propose new language on design requirements, operational requirements and operational procedures for wave generator installations.

- Section 2.E of Enclosure (5) is titled 'Solar' and is beyond the scope of this report.

6.2 United States Army Corps of Engineers (USACE) Nationwide Permit (NWP) No. 12, Utility Line Activities

A major concern with any marine or hydrokinetic electrical transmission system is the design of the cable crossing the land/water interface. The cable must be located well below the minimum elevation that the beach profile will take in the storm and over the long term.

USACE requirements do not specifically address the electrical cable crossing at the land/water interface. Burying the cable "…*a minimum of 4 feet below the existing level*…" of the beach does not safely address the dynamic nature of historical sediment transport, shoreline position (erosion) and the vertical variation in location of the beach profile during storms and long-term seasonal changes. The problem is defining the beach in this dynamic environment.

As indicated in section 2.2.4, the FERC licensing process typically will include review of information submitted to FERC that would be have otherwise been submitted to the USACE as part of a Section 10 Permit Application. FERC will ensure this information is provided to the USACE, which will participate in public meetings and conduct normal evaluation of the applicant's materials. Instead of the USACE's issuing a Section 10 Permit, the USACE will develop terms and conditions for FERC to incorporate into the FERC-issued license. This existing process does not address the handling of joint USACE/State permit applications, a process that exists in six of the eight USACE districts that have FERC permitted projects. How FERC will handle these joint USACE/State permit applications needs to be resolved.

USACE NWP. There currently are 50 different areas of regulatory responsibility in the USACE NWP program (33 CFR part 330: source 56 FR 59134, Nov 22, 1991). A new one could be added that addresses Hydrokinetic Energy Devices.

The policy and procedures used in USACE NWP could recognize the FERC License and simply let each District Office add Permit-Specific Regional Conditions that allow for site specific, state and local permit regulations. This would mean USACE would formally recognize the substantial amount of effort already completed by the FERC Licensee during its Permit Process.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Through the detailed identification of potential navigational impacts associated with marine and hydrokinetic renewable energy installations PCCI has provided improved guidance to developers and regulators in measures that may be taken to mitigate those impacts as part of the design and installation planning process. The mitigation measures draw upon existing United States Coast Guard (USCG) guidance and regulations where they exist, and new guidance proposed by PCCI, where existing guidance was lacking. Developers can use the information contained herein to understand how their proposed projects could impact navigation safety, and steps they can take to mitigate these potential impacts and facilitate acceptance of their marine and hydrokinetic technology projects.

A key mitigation measure involves undertaking the requisite navigational studies and evaluating the navigational risk of proposed projects. These studies will be required to provide the information necessary for environmental assessments, environmental impact statements and permit applications. They will require time and money, and often the use of experienced consultants to collect the data and prepare the reports; however, those developers willing and able to undertake these studies will accelerate the time required to penetrate the marine and hydrokinetic renewable energy market.

PCCI has completed a regulatory gap analysis and identified four key areas where changes to existing navigation guidance and permitting were suggested to allow market acceleration of marine and hydrokinetic projects.

7.2 Recommendations

Specific recommendations resulting from this study include the following:

7.2.1 For Developers

Developers should use the checklist in Appendix I and the expanded sheets in Appendices E, F, G and H in addressing potential navigational impacts of a Renewable Energy Installation (REI).

Developers should incorporate the marking schemes in International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 (2008) in their proposal, with the realization that the USCG may modify the initial marking scheme proposal, based on its review of traffic, risk and other factors.

Developers should consider the Virginia Coastal Energy Research Consortium Example and liaise with the Navy Fleet Forces Command on potential impacts to Navy operations.

Developers should schedule a series of general “education” events to invite and include all the “stakeholders” responsible or interested. These could be held over the time required to secure the FERC license. The goal is to foster a feeling of “working together” to develop the nations’ renewable energy resource, “hydrokinetic energy”.

7.2.2 For USCG

USCG should consider adopting the language in proposed CH-1 to USCG Navigation and Vessel Inspection Circular (NVIC) 02-07.

7.2.3 For the United States Corps of Engineers (USACE)

USACE, in applying local conditions to Nationwide Permit 12, should adopt a permit-specific regional condition that an electrical cable passing eroding shorelines and beneath dynamic sandy beaches be located below the lowest measured elevation plus a design factor. Additionally, visible signage at the location of the authorized crossing should be posted. This recommendation follows the conditions for new cable installations adopted by USACE NY District.

7.2.4 For Federal Energy Regulatory Commission (FERC) and USACE

FERC and USACE should address the Section 10 approval process for marine and hydrokinetic energy installations for those states where a joint Section 10 application and approval process exist.

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APPENDICES

A. Functional Taxonomy of Generic Wave and Current Devices with associated Glossary

B. United States Army Corps of Engineers Nationwide Permit 12 ─ Utility Line Activities

C. Permits for Hydrokinetic Energy Projects (Tidal or Wave)

D. Chronology and Key Aspects for the Roosevelt Island Tidal Energy Project

E. Concerns and Mitigation, Design Phase

F. Concerns and Mitigation, Construction/Transportation/Installation Phase

G. Concerns and Mitigation, Operation and Maintenance Phase

H. Concerns and Mitigation, Decommissioning Phase

I. Checklist

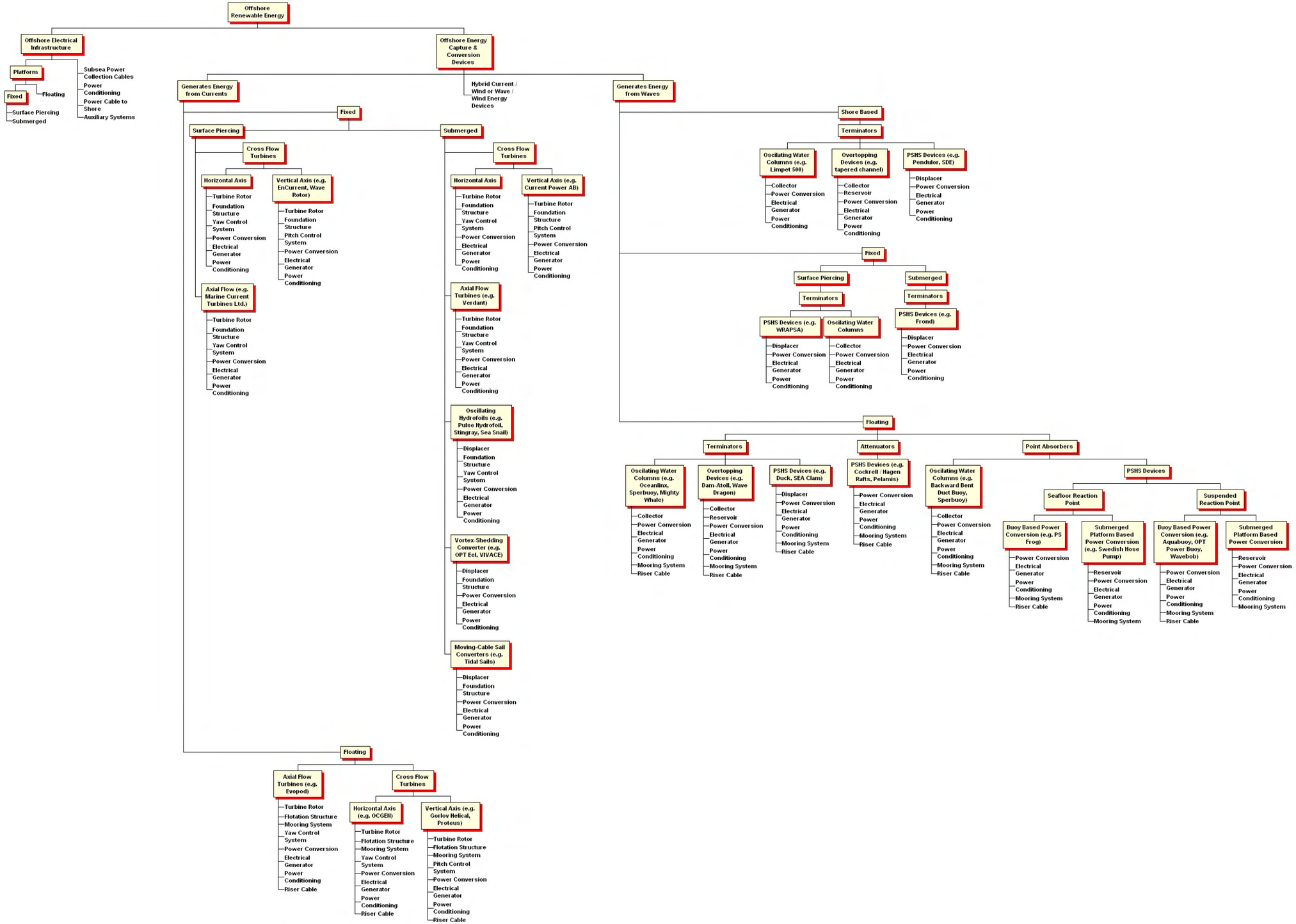
J. IALA Recommendations

K. Summary of Navy Organization

L. Summary of VCERC Example

M. Proposed CH-1 to Update Coast Guard NVIC 02-07

Appendix A


Offshore Renewable Energy
Offshore Electrical Infrastructure
Platform
Fixed
Floating
Surface Piercing
Submerged
Subsea Power Collection Cables
Power Conditioning
Power Cable to Shore
Auxiliary Systems
Offshore Energy Capture & Conversion Devices
Generates Energy from Currents
Fixed
Surface Piercing
Cross Flow Turbines
Horizontal Axis
Turbine Rotor
Foundation Structure
Yaw Control System
Power Conversion
Electrical Generator
Power Conditioning
Vertical Axis (e.g. EnCurrent, Wave Rotor)
Turbine Rotor
Foundation Structure
Pitch Control System
Power Conversion
Electrical Generator
Power Conditioning
Axial Flow (e.g. Marine Current Turbines Ltd.)
Turbine Rotor
Foundation Structure
Yaw Control System
Power Conversion
Electrical Generator
Power Conditioning
Submerged
Cross Flow Turbines
Horizontal Axis
Turbine Rotor
Foundation Structure
Yaw Control System
Power Conversion
Electrical Generator
Power Conditioning
Vertical Axis (e.g. Current Power AB)
Turbine Rotor
Foundation Structure
Pitch Control System
Power Conversion
Electrical Generator
Power Conditioning
Axial Flow Turbines (e.g. Verdant)
Turbine Rotor
Foundation Structure
Yaw Control System
Power Conversion
Electrical Generator
Power Conditioning
Oscillating Hydrofoils (e.g. Pulse Hydrofoil, Stingray, Sea Snail)
Displacer
Foundation Structure
Yaw Control System
Power Conversion
Electrical Generator
Power Conditioning
Vortex-Shedding Converter (e.g. OPT Eel, VIVACE)
Displacer
Foundation Structure
Power Conversion
Electrical Generator
Power Conditioning
Moving-Cable Sail Converters (e.g. Tidal Sails)
Displacer
Foundation Structure
Power Conversion
Electrical Generator
Power Conditioning
Floating
Axial Flow Turbines (e.g. Evopod)
Turbine Rotor
Flotation Structure
Mooring System
Yaw Control System
Power Conversion
Electrical Generator
Power Conditioning
Riser Cable
Cross Flow Turbines
Horizontal Axis (e.g. OCGEN)
Turbine Rotor
Flotation Structure
Mooring System
Yaw Control System
Power Conversion
Electrical Generator
Power Conditioning
Riser Cable
Vertical Axis (e.g. Gorlov Helical, Proteus)
Turbine Rotor
Flotation Structure
Mooring System
Pitch Control System
Power Conversion
Electrical Generator
Power Conditioning
Riser Cable
Hybrid Current / Wind or Wave / Wind Energy Devices
Generates Energy from Waves
Shore Based
Terminators
Oscilating Water Columns (e.g. Limpet 500)
Collector
Power Conversion
Electrical Generator
Power Conditioning
Overtopping Devices (e.g. tapered channel)
Collector
Reservoir
Power Conversion
Electrical Generator
Power Conditioning
PSHS Devices (e.g. Pendulor, SDE)
Displacer
Power Conversion
Electrical Generator
Power Conditioning
Fixed
Surface Piercing
Terminators
PSHS Devices (e.g. WRAPSA)
Displacer
Power Conversion
Electrical Generator
Power Conditioning
Oscillating Water Columns
Collector
Power Conversion
Electrical Generator
Power Conditioning
Submerged
Terminators
PSHS Devices (e.g. Frond)
Displacer
Power Conversion
Electrical Generator
Power Conditioning
Floating
Terminators
Oscilating Water Columns (e.g. Oceanlinx, Sperbuoy, Mighty Whale)
Collector
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Riser Cable
Overtopping Devices (e.g. Dam-Atoll, Wave Dragon)
Collector
Reservoir
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Riser Cable
PSHS Devices (e.g. Duck, SEA Clam)
Displacer
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Riser Cable
Attenuators
PSHS Devices (e.g. Cockrell / Hagen Rafts, Pelamis)
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Riser Cable
Point Absorbers
Oscilating Water Columns (e.g. Backward Bent Duct Buoy, Sperbuoy)
Collector
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Riser Cable
PSHS Devices
Seafloor Reaction Point
Buoy Based Power Conversion (e.g. PS Frog)
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Riser Cable
Submerged Platform Based Power Conversion (e.g. Swedish Hose Pump)
Reservoir
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Suspended Reaction Point
Buoy Based Power Conversion (e.g. Aquabuoy, OPT Power Buoy, Wavebob)
Power Conversion
Electrical Generator
Power Conditioning
Mooring System
Riser Cable
Submerged Platform Based Power Conversion
Reservoir
Power Conversion
Electrical Generator
Power Conditioning
Mooring System

Glossary

Attenuator - wave energy capture device with principal axis oriented parallel to the direction of the incoming wave and converts the energy due to the relative motion of the parts of the device as the wave passes along it

Axial Flow Turbine – subset of horizontal turbines used for low head and relatively high flow rate; suitable for tidal energy barrages or wave energy converters using overtopping

Buoy Based Power Conversion - power conversion system located in the actual PSHS device/buoy

Collector - structure that focuses or funnels waves into the power conversion system

Displacer – part of a wave energy device that moves in response to the waves; mechanical energy is extracted from the relative motion of the displacer relative to its fixed reference

Electrical Generator – device that takes the energy from the power conversion system and turns it into electricity

Floating - offshore energy capture and conversion device supported by buoyant members free to move on the surface of the ocean

Fixed - offshore energy capture and conversion device supported by a concrete caisson or steel platform with piles attached directly onto the seafloor

Mooring System - system of mooring cables, chain, fittings, lines and anchors that restrain a floating platform against the action of wind, wave and current forces

Oscillating Hydrofoil - similar to an aeroplane wing but in water; yaw control systems adjusts their angle relative to the water stream, creating lift and drag forces that cause device oscillation; mechanical energy from this oscillation feeds into a power conversion system

Oscillating Water Column - partially submerged structure that encloses a column of air above a column of water; a collector funnels waves into the structure below the waterline, causing the water column to rise and fall; this alternately pressurizes and depressurizes the air column, pushing or pulling it through a turbine

Overtopping Device - partially submerged structure; a collector funnels waves over the top of the structure into a reservoir; water runs back out to the sea from this reservoir through a turbine

Pitch Control System – when applied to horizontal axial flow turbines, adjusts the angle of a rotor blade relative to the rotor’s plane of rotation

Point Absorber - wave energy capture device with principal dimension relatively small compared to the wave length and able to capture energy from a wave front greater than the physical dimension of the device

Power Cable to Shore – electrical transmission cable connecting multiple subsea power collection cables to a shore-based power grid

Power Conditioning - one or more devices that adjust the voltage output of the electrical generator to whatever is appropriate to local loads; also helps to smooth out the differences in output between periods of high and low wave activity

Power Conversion – system to convert current or wave energy and transfer it through mechanical, hydraulic, pneumatic or electro-magnetic devices into a form suitable for input to the electrical generator

PSHS Device - Pitching/Surging/Heaving/Sway device; any of several devices that capture wave energy directly without a collector by using relative motion between a float/flap/membrane and a fixed reaction point

Reservoir – structure to store excess air or water not currently usable by the power conversion system; helps to smooth out the differences in output between periods of high and low wave activity; could be considered a form of mechanical power conditioning

Riser Cable – electrical transmission cable suspended between a floating platform and the seafloor where it terminates into a subsea power collection cable

Seafloor Reaction Point - using the seafloor, or rather an anchor imbedded in it, as a fixed reaction point for a PSHS device

Shore Based – an energy capture and conversion device located on, or attached to, the shore rather than on a platform located offshore

Submerged Platform Based Power Conversion - power conversion system located in a submerged platform or habitat

Subsea Power Collection Cable – electrical transmission cable connects one or more riser cables or a fixed platform to a single power cable to shore

Surface Piercing - fixed offshore platform that has all or part of its structure above the surface of the water

Suspended Reaction point - using a damper plate suspended above the seafloor as a relatively fixed reaction point for a PSHS device

Terminator - wave energy capture device with principal axis oriented perpendicular to the direction of the incoming wave and, if 100% efficient, terminates the wave; reflected and transmitted waves determine the efficiency of the device

Yaw Control System - adjusts the angle of a horizontal axis turbine or oscillating hydrofoil to keep it aligned with the principal direction of the current and achieve better efficiency

FIGURE 1

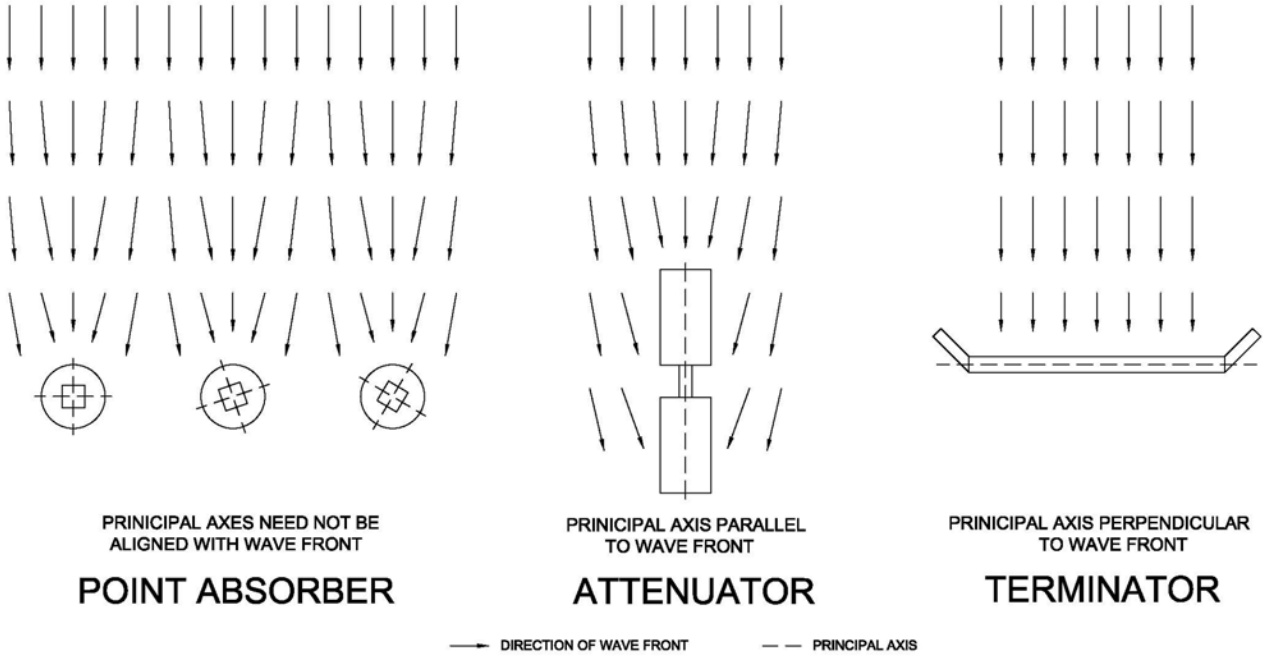
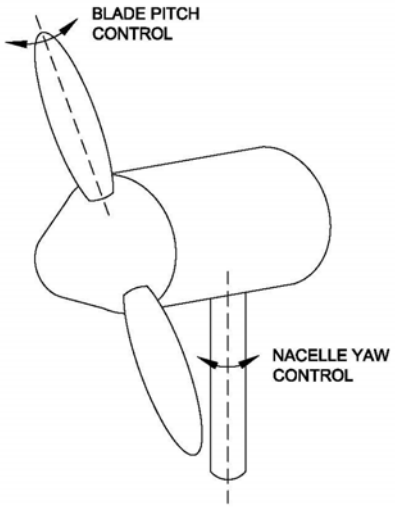
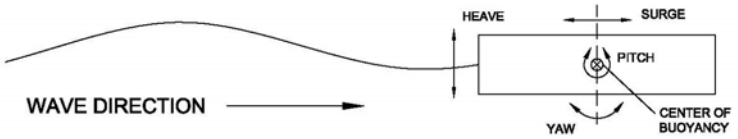

PRINICIPAL AXES NEED NOT BE ALIGNED WITH WAVE FRONT
POINT ABSORBER
PRINICIPAL AXIS PARALLEL TO WAVE FRONT
ATTENUATOR
PRINICIPAL AXIS PERPENDICULAR TO WAVE FRONT
TERMINATOR
DIRECTION OF WAVE FRONT
PRINCIPAL AXIS

FIGURE 2

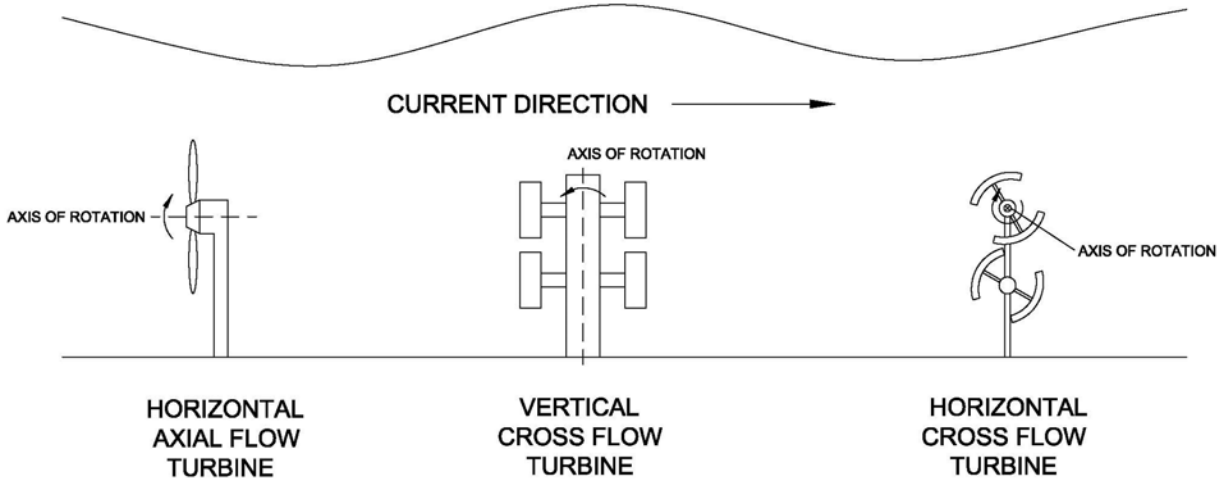


PITCH AND YAW OF
AXIAL FLOW TURBINE



PRINCIPLE ENERGY ABSORBING MOTIONS
FOR WAVE ENERGY DEVICES

FIGURE 3



AXIAL FLOW VS CROSS FLOW

Appendix B

United States Army Corps of Engineers (USACE)
Nationwide Permit (NWP) 12 ─ Utility Line Activities

The NWP for *Utility Line Activities* (#12) includes definitions for utility line activities, utility lines, utility line substations, foundations, access corridors and pre-construction notification. Activities include construction, maintenance, repair and removal of activity lines and associated facilities in US waters with no loss of greater than ½ acre of waters in the United States. A "utility line" is defined as any pipe or pipeline and any cable, line, or wire for the transmission for the purpose of electrical energy, telephone, and telegraph communication.

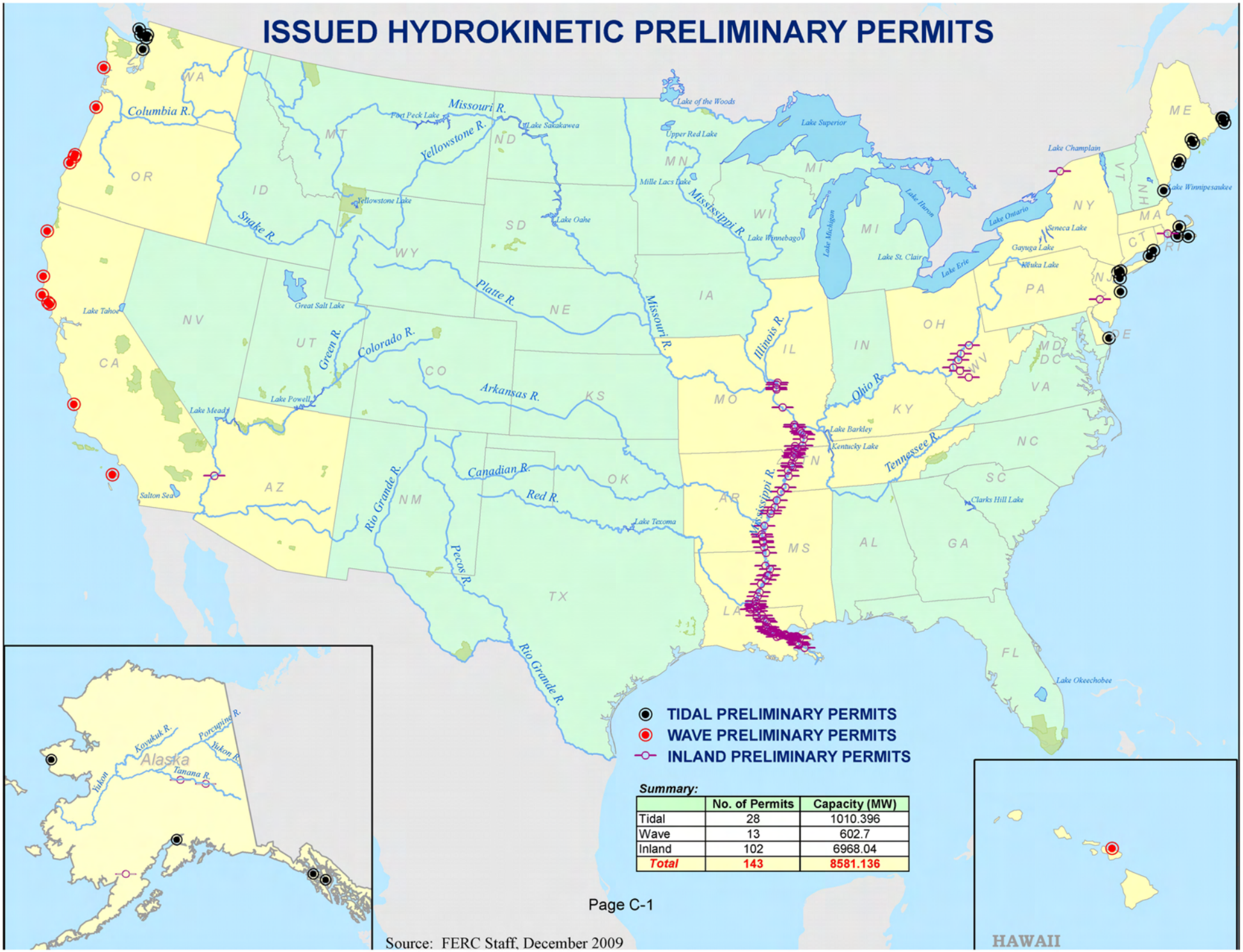
Material resulting from trench excavation may be temporarily sidecast into waters of the United States for no more than three months, provided it is not dispersed by currents. The district engineer may extend the period of temporary sidecasting up to 180 days.

USACE Division engineers are authorized to add regional conditions specific to the needs and/or requirements of a particular region or state. Regional conditions are important mechanisms to ensure that impacts to the aquatic environment authorized in the NWPs are minimal, both individually and cumulatively. As an example, the New York District has permit-specific regional conditions for "*Buried Cables and Pipelines Across Navigable Waters and Federal Navigation Channels"* as specified below.

1. "The top of the cable or pipeline crossing any Federal project channel shall be located a minimum of 15 feet below the authorized project channel depth. The District Engineer, on a case-by-case basis, may modify this depth requirement where circumstances are deemed appropriate. In areas outside of Federal project channels, the top of the cable or pipeline shall be located a minimum of 4 feet below the existing level of the waterway substrate. Where trenching and back-filling are proposed, backfill material shall consist of suitable heavy materials and shall be placed no higher or lower than the adjacent river bottom elevation."
2. "Within 15 days after completion of the authorized work, the permittee shall post visible signage on weatherproof placards no smaller than 4 feet by 4 feet on each shoreline at the location of the authorized crossing. The placard shall contain language informing waterway users of the presence of a cable or pipeline crossing (e.g., "WARNING-CABLE (or PIPELINE) CROSSING"), unless specifically authorized otherwise by the District Engineer."

The above example of permit-specific regional conditions for the New York District does not address the case of the cable coming from offshore and crossing the land/water interface, e.g. across the shoreline at a location where movable sediments (sand, silt, and clay) may be present. Dynamic shoreline conditions (erosion, accretion) may cause the vertical elevation of the near shore bottom region to vary considerably more than the "… minimum of 4 feet below the existing level of the waterway substrate" on various time scales (seasonal, storms, long-term, etc.) Further discussion of buried cable crossings at shorelines is found in Section 6 "Regulatory Gap Analysis" in this report. An "Example Mitigation Measure and Strategy" is recommended in Section 4 for design of an electrical cable crossing a shoreline with movable sediment (sandy beach).

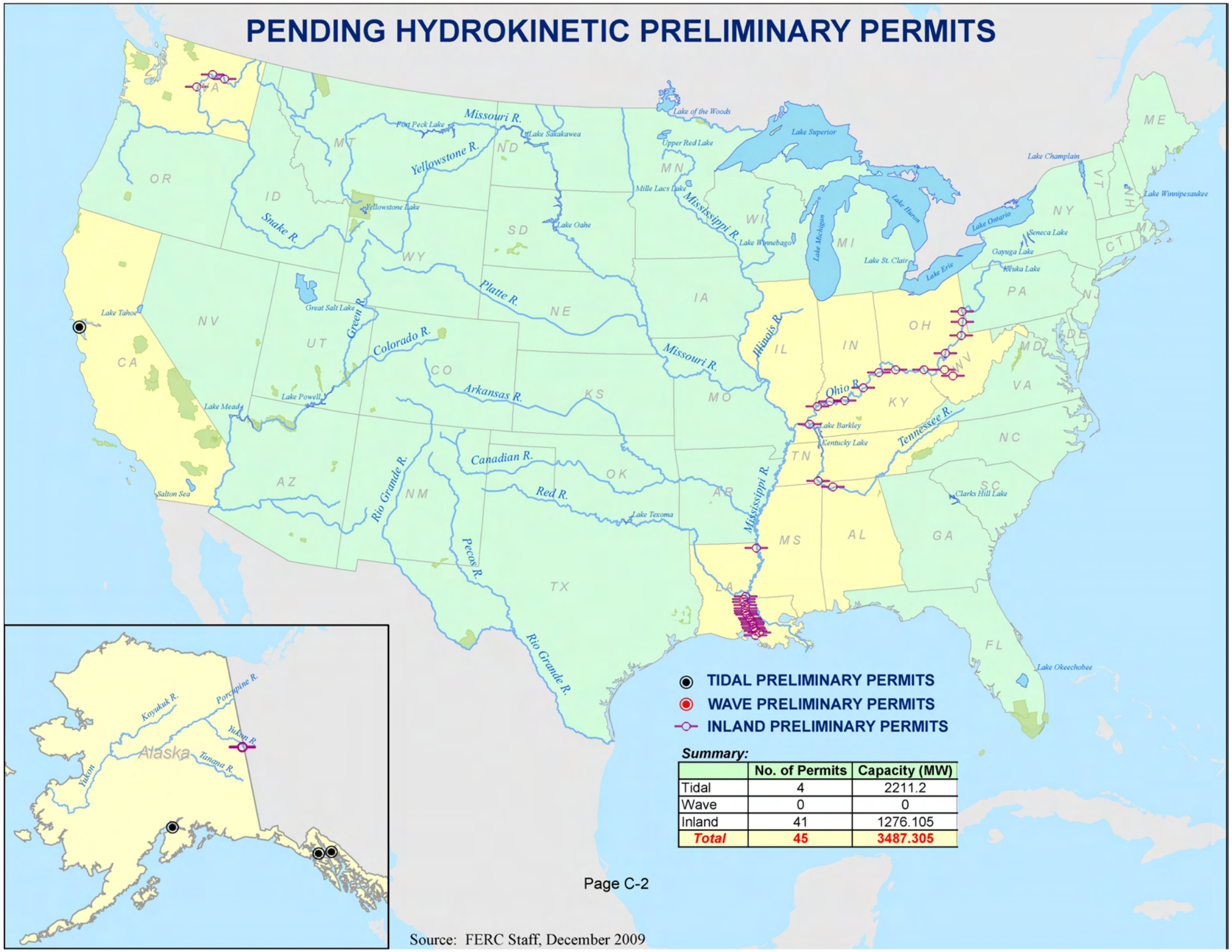
Appendix C



Source: FERC Staff, December 2009

http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/issued-hydrokinetic-permits-map.pdf

PENDING HYDROKINETIC PRELIMINARY PERMITS



Summary:

	No. of Permits	Capacity (MW)
Tidal	4	2211.2
Wave	0	0
Inland	41	1276.105
Total	**45**	**3487.305**

Source: FERC Staff, December 2009

http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/pending-hydrokinetic-permits-map.pdf

Appendix D

Roosevelt Island Tidal Energy (RISE) Project

The following summarizes the chronology and key aspects for the RISE project as obtained from a FOIA request No. FA-09-0229 from the NY District (Sep 4, 2009).

May, 2002 Verdant Power submits Preliminary Permit application to Federal Energy Regulatory Commission (FERC)

Sep, 2002 FERC issues preliminary permit, P-12178

Oct, 2005 New York state, Department of Environmental Control (DEC) issues permit

May, 2006 US Army Corps of Engineers (USACE) issues permit for three years (May 2009)

Dec, 2006 Verdant installs 2 turbines

Mar, 2007 Verdant installs 4 turbines for 6-turbine array

Sep, 2008 USACE approves Mod 1 to original permit to install new design

Dec, 2008 Verdant applies for Pilot License to FERC for 30 and 100 turbine arrays

Aug, 2009 USACE denies Mod 2 to the original permit (May 2006) for permit extension for 3 years to May 2012.

It was denied because it was "…a circumvention of the required application process for a standard three year permit". (Creamer, Aug 20, 2009). It is important to note here that in the Mod 2 request, Verdant Power included a "Proposed Monitoring Plan" that committed over $800,000 for monitoring over a 10 year period.

As seen above, although the FERC license was obtained in four months, it took about 45 months (~ 4 years) more before the USACE issued their permit. The Licensee (applicant) must recognize that it is a long process.

It is also clear that the Licensee must work with all the many "stakeholders" involved from the start. This includes the Federal government agencies, the state agencies, the local city/county agencies, universities, environmental protection groups, companies, consultants, and maritime groups. None should be omitted in the "education" process because Hydrokinetic Energy projects are very new to all the many organizations responsible and those interested in these projects.

Appendix E. Design

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
Platform, Station keeping, Transmission Cable and other design considerations			
Impairment of visual navigation.	Navigation and Vessel Inspection Circular (NVIC) 2-07 Encl (4), §1	• Installations could block or hinder the view of other vessels underway on any route. • Installations could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc. • Installations and locations could limit the ability of vessels to maneuver in order to avoid collisions	• Conduct comprehensive assessment of the risks to navigation safety associated with the proposed installation, using United States (Coast Guard) or other accepted industry standard for Risk-Based Decision Making (RBDM). • Conduct visibility study to determine whether visual navigational impairment would occur and at what distances and heights of eye. (i.e. effecting ships of what sizes and at what distances?) • Conduct maneuvering analysis to determine if the installation could reasonably prevent vessels from maneuvering to avoid collision. • Designation of the site as an area to be avoided (ATBA). • Implementation of routing measures within or near the development. • Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs. • Determine minimum distance of installation structures from shipping routes. • Other measures or procedures considered appropriate in consultation with stakeholders.
Impairment of electronic navigation and communications.	NVIC 2-07 Encl (4), §2	• Installations could produce radio interference such as shadowing, reflections, or phase changes, with respect to any frequencies used for aviation, marine positioning, navigation, or communications, including Automatic Identification Systems (AIS), whether ship borne, ashore, within aircraft, or fitted to any of the proposed structures. • Installations could produce radar reflections, blind spots, shadow areas or other adverse effects — vessel-to-vessel; vessel-to-shore; Vessel Traffic Service (VTS)-to-vessel; radio beacons to/from vessel; and between aircraft and Air Traffic Control. • Installations might produce sonar interference affecting fishing, industrial, or military systems used in the area. • Installations might produce acoustic noise or noise absorption or reflections which could mask or interfere with prescribed sound signals from other vessels or aids to navigation. • Installations, generators, and the seabed cabling within the site and onshore might produce electromagnetic fields affecting compasses and other navigation systems.	• Provide researched opinion of a generic and where appropriate, site-specific, nature concerning whether or not— ° Installations could produce radio interference, shadowing, reflections or phase changes, affecting any frequencies used for aviation, marine navigation, positioning, or communications, including AIS on ships, aircraft or proposed structures. ° Installations could produce radar reflections, blind spots, shadow areas or other adverse effects. ° Installations and generators might produce sonar interference affecting fishing, industrial, or military systems used in the area. ° The site might produce acoustic noise, absorption or reflections which could mask or interfere with prescribed sound signals from vessels or Aids to Navigation (ATON). ° Electromagnetic interference from structures, generators, and the seabed cabling within the site could produce electro-magnetic fields affecting compasses and other navigation systems. ° The power and noise generated above or below the water would create physical risks that may potentially affect the health of vessel crews.
Facility Characteristics			
Marine Navigational Markings	NVIC 2-07 Encl (5), §1	• Installation structures and buoys, on the perimeter of and within the site, both above and below the sea surface, may not be marked adequately by day and by night. • The installation site may not be marked by Radar Beacons (RACONS) and/ or, an AIS transceiver. • The installation site may not be fitted with adequate sound signal(s). • The installation site may not comply with generally accepted markings for such structures, as required by the USCG or recommended by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), respectively. • The installation's markings may impact existing Federal or private aids to navigation (PATON) in the vicinity of the installation. • The installation's navigational day and night markings may not be adequate for ongoing site marking following decommissioning.	Compliance with 33 CFR Parts 166, 167 and 162. Provide Study/Analysis showing— ° How the site would be marked by day and by night, including following decommissioning. ° How above- and below-surface structures on the perimeter of and within the site would be marked by day and by night. ° Whether RACONS and/or AIS transceivers would be used and any AIS data to be transmitted. ° Whether sound signals would be used, the characteristics of the signal(s) and location(s). ° Whether markings would comply with USCG requirements or recommendations by IALA. ° Whether the aids would be maintained to USCG availability standards and any additional District guidance would be met. ° Procedures and timeframes for responding to and correcting ATON casualties. ° How the markings will impact existing federal, state or private aids in the vicinity.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
A search and rescue (SAR), counter pollution, or salvage operation in or around an installation may necessitate that generating devices be capable of emergency shut down. (Generalized for Marine Current Turbines & Wave Generators from Wind Park recommendations)	NVIC 2-07 Encl (5), §2	• Identification at any time of day or night of a singular generating device or the buoy system associated with a singular device will be necessary. • Remote control systems may be necessary for emergency procedures. • Consultation with the USCG and other emergency support services concerning safe shut down procedures and verification may be necessary during the design process. • If orientation of electrical devices are controllable (i.e. azimuth and elevation), fixing the device(s) and maintaining its position at the request of USCG may be necessary. • If there are interior spaces of surface structures accessible to personnel (e.g. inspection, maintenance, etc.), it may be necessary for rescuers to gain access from upper surfaces of the structure if the occupants are unable to assist. • An emergency situation may result, with the potential for distressed mariners' seeking refuge on any surface of the installation or buoy, thereby affecting the optimal placement of access ladders. • At any time, a vessel in distress may allide with the installation or other emergency (SAR incident, counter pollution operation, or salvage operation) may occur in or around the installation, necessitating monitoring by the facility's owners/operators. • It will be necessary to identify by chart an individual structure, device or its buoys by GPS position or by unique identification numbers. • It will be necessary for the USCG Sector or District command center to contact the operator immediately in an emergency. • It will be necessary for the USCG Sector or District command center to have access to the same reference chart used by the operator to identify individual structures, devices, or buoys. • USCG may receive a distress call or other emergency alert from a vessel concerning a potential or actual allision with the installation. • Having received notification of a vessel in distress, other emergency alert or that a vessel is close to or within an installation, it would be necessary for the operator of an installation facility to initiate a partial or full emergency shutdown immediately. • To ensure that communications and shutdown procedures function satisfactorily, it is necessary to conduct periodical testing. • After an allision, it will be necessary for the owners/operators of the installation to submit documentation that verifies structural integrity of the installation. (46 CFR 4.05)	• Study per NVIC 5, sect2 • Designation of the site as an ATBA. • Implementation of routing measures within or near the development. • Monitoring by radar, AIS, and/or closed circuit television (CCTV). • Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs. • Determine minimum distance of installation structures from shipping routes. • Other measures or procedures considered appropriate in consultation with stakeholders.
Installation Site and Waterway Considerations			
Installation either affects tides, streams and currents or is affected by them.	NVIC 2-07 Encl (6), §1	• At various stages of the tide but not necessarily all stages, the installation could create or enhance potential maritime traffic flow issues within the installation area. • Current maritime traffic flows and operations in the general area could be affected by changes to existing currents in the area of the proposed installation. • Set and rate of the tidal stream, at any state of the tide, have the potential to affect vessels operating within or near the installation area. • Current directions/velocities might aggravate or mitigate the likelihood of allision with the installation. • Whether the tidal stream runs parallel to or perpendicular to the principle length of proposed installation; there may be an adverse effect by the installation on the existing tidal stream. • In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream or currents. • The installation's placement and design could cause changes in the set and rate of the tidal stream or direction, and flow rate of the tidal current.	• Modeling of horizontal, and possibly vertical, current flow around devices and structures.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
		• Structures in the tidal stream could cause the deposit or removal of sediments, affecting navigable water depths within the installation or in adjacent areas. • The installation could cause danger and/or severely affect the air column, water column, seabed and sub-seabed in the general vicinity of the installation.	
Weather conditions may directly affect the installation or increase likelihood of allision.	NVIC 2-07 Encl (6), §2	• Weather conditions or restricted visibility may affect vessels which pass near installations, hindering their ability to safely navigate the area. • Installation structures may affect the ability of vessels to maneuver safely. Problems may include wind masking, turbulence, or wind sheer.	• Determine minimum distance of installation structures from shipping routes. • Implementation of routing measures within or near the development. • Monitoring by radar, AIS, and/or CCTV. • Select another site.
Ice may affect the installation.	NVIC 2-07 Encl (6), §3	• Ice may impact or accumulate on or around the device or the device may make potential ice impacts worse. • Ice may impact the structural integrity of the device or the ability of its mooring system to hold the device in place, impacting shipping and shipping lanes.	• Safety zones of appropriate configuration, extent and application to specified vessels • Temporary removal of device to avoid ice impact and damage. • Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC)
Maritime Traffic and Vessel Considerations			
The installation may affect vessel traffic or other normal uses of the area.	NVIC 2-07 Encl (7), §1	• The installation may affect non-transit uses of nearby areas (e.g. aggregate dredging, fishing, fisheries, day cruising of leisure craft, racing, marine regattas or parades, and on-shore or on-water recreation, etc.) • The installation may affect shipping lane transit routes used by coastal or deep-draft vessels, ferry routes, and fishing vessel routes. • The installation alignment and proximity to adjacent shipping lanes could adversely affect vessels transiting those lanes. • The installation may affect prescribed or recommended routing measures or precautionary areas. • The installation may lie on or near a prescribed or conventionally accepted separation zone between two opposing routes or within a traffic separation scheme. • The installation may affect anchorage grounds or areas, safe havens, port approaches, and pilots boarding or landing areas. • The installation may affect the ability of vessels to anchor within the vicinity of an installation field. • The installation may be near to offshore firing/bombing ranges or other areas used for military purposes, e.g. designated firing and test ranges; undersea surveillance, detection & security systems; and training areas. • The installation may affect nearby existing or proposed offshore oil/gas platforms, marine aggregate and dredging operations, marine archaeological sites or wrecks, or other exploration/ exploitation sites. • The installation may be near designated areas for the disposal of dredging materials. • The installation may affect existing or proposed aids to navigation and/or VTS in or adjacent to the area and any impact thereon. • Existing or planned cables, pipelines, intakes, outfalls may be affected. • The installation may displace shipping lane vessel traffic and create 'choke points' in areas of high vessel traffic density.	• Conduct a traffic survey with impact assessment of the area proposed for the installation, covering at least 12 consecutive and recent months, showing, seasonal variations, numbers and sizes and types of vessels, types of cargo carried. The survey should include identification of any port or navigational authority jurisdictions. • Liaise with stakeholders, such as local fishermen, tour boat operators, tug operators and the Navy. Refer to Appendix L for recommendations on liaising with the Navy.
The installation may affect the frequency or severity of vessel casualties.	NVIC 2-07 Encl (7), §2	• The installation may increase the frequency, location or consequences of collisions between vessels; the type of collisions; or affect the types of vessels involved. • The installation may increase the frequency, location or consequences of allisions. • The installation may increase the frequency, location or consequences of groundings or affect the type of vessels involved.	• Conduct traffic study and navigational risk analysis.

Appendix E. Design

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
The installation Structure may be susceptible to being struck by vessels.	NVIC 2-07 Encl (7), §3	• Features of the installation, including auxiliary platforms and cabling to the shore, could pose difficulty or danger to vessels underway, performing normal operations, or anchoring (e.g. vertical clearances above the sea surface at MHHW, depths and clear draft below the sea surface, the burial depth of cabling, anchor fields, etc.) • Installation features could create problems for emergency rescue services, including rescue swimmers, the use of lifeboats, helicopters, and emergency towing vessels. Problems could include how rotation/movement and power transmission, etc., will be controlled by the designated services when necessary in an emergency. • Noise or vibrations from an installation above or below the water could impact navigation safety or affect other USCG missions. • Parts of an installation above or below the water surface may not be able to withstand allision or collision damage by vessels. This could topple or separate the installation from its mooring, adversely impacting vessel movement and shipping lanes.	• Conduct traffic study and navigational risk analysis. • Conduct seafloor hazard survey. • Consider including collision as a loading scenario in system design.
The installation may alter vessel access to the area.	NVIC 2-07 Encl (7), §4	• Navigation *within* the site may be safe only — for all vessels or for specified vessel types, operations and/or sizes; in all directions or in specified directions or areas; and at any time, day/night, or in specified tidal, weather, daylight or other conditions. • Navigation in and/or near the site may be — Prohibited by specified vessel types, operations and/or sizes; Prohibited in respect to specific activities; Prohibited in all areas or directions; Prohibited in specified areas or directions; Prohibited in specified tidal or weather conditions; Prohibited during certain times of the day or night; or Recommended to be avoided. • Exclusion from the site could cause navigational, safety, or transiting problems for vessels operating in the area.	• Conduct traffic study and navigational risk analysis.
Coast Guard Mission Considerations			
The installation may affect the number of SAR incidents and the ability of USCG and commercial assets to provide timely response.	NVIC 2-07 Encl (8), §1	• There could be additional SAR operations in the area due to allisions with the installation. • USCG's ability to proceed within 30 minutes of notification of distress may be impeded. • USCG'sability to being on scene at datum, or within the search area, within 90 minutes of getting underway may be impeded. • USCG'sability to effect helicopter hoist in all conditions may be impeded. • USCG'sability to effect helicopter hoist in poor visibility/low ceiling may be impeded. • USCG'sability to search by water or air in all conditions may be impeded. • USCG'sability to search by water or air at night or in poor visibility/low ceiling may be impeded. • The installation may impede response by a commercial salvor.	• Early notification and discussion with local USCG'sSector.
The installation may affect the number or severity of Marine Environmental Response (MER) incidents.	NVIC 2-07 Encl (8), §2	• Additional MER cases in the area may be expected due to allisions with the installation. • Additional response assets may be necessary due to allisions with the installation. • The installation may prevent response units from performing their mission per USCG's response standards. • The installation may prevent the response units from being on scene at datum, or within the area of pollution, within 90 minutes of getting underway.	• Based on regional data for at least a 10-year period, analyze the types of pollution cases, whether USCG'sresponses were at night or during limited visibility; by boat or helicopter; and the impact of the installation on the ability of commercial salvage assets to respond within the installation area.

Appendix F. Construction/Transportation

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
Platform, Station keeping, Transmission Cable and other design considerations			
Impairment of visual navigation.	Navigation and Vessel Inspection Circular (NVIC) 2-07 Encl (4), §1	• Installations could block or hinder the view of other vessels underway on any route. • Installations could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc. • Installations and locations could limit the ability of vessels to maneuver in order to avoid collisions	• Conduct comprehensive assessment of the risks to navigation safety associated with the proposed installation, using Coast Guard or other accepted industry standard for Risk-Based Decision Making (RBDM). • Discuss construction plans, timetables, etc. with local United States Coast Guard (USCG) and stakeholders. • Conduct visibility study to determine whether visual navigational impairment would occur and at what distances and heights of eye. (i.e. effecting ships of what sizes and at what distances?) • Conduct maneuvering analysis to determine if the installation could reasonable prevent vessels from maneuvering to avoid collision. • Designation of the site as an area to be avoided (ATBA). • Implementation of routing measures within or near the development. • Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs. • Determine minimum distance of installation structures from shipping routes. • Other measures or procedures considered appropriate in consultation with stakeholders.
Impairment of electronic navigation and communications.	NVIC 2-07 Encl (4), §2	• Installations could produce radio interference such as shadowing, reflections, or phase changes, with respect to any frequencies used for aviation, marine positioning, navigation, or communications, including Automatic Identification Systems (AIS), whether ship borne, ashore, within aircraft, or fitted to any of the proposed structures. • Installations could produce radar reflections, blind spots, shadow areas or other adverse effects — vessel-to-vessel; vessel-to-shore; Vessel Traffic Service (VTS)-to-vessel; radio beacons to/from vessel; and between aircraft and Air Traffic Control. • Installations might produce sonar interference affecting fishing, industrial, or military systems used in the area. • Installations might produce acoustic noise or noise absorption or reflections which could mask or interfere with prescribed sound signals from other vessels or aids to navigation (ATON). • Installations, generators, and the seabed cabling within the site and onshore might produce electromagnetic fields affecting compasses and other navigation systems.	• Provide researched opinion of a generic and where appropriate, site-specific, nature concerning whether or not— ° Installations could produce radio interference, shadowing, reflections or phase changes, affecting any frequencies used for aviation, marine navigation, positioning, or communications, including AIS on ships, aircraft or proposed structures. ° Installations could produce radar reflections, blind spots, shadow areas or other adverse effects. ° Installations and generators might produce sonar interference affecting fishing, industrial, or military systems used in the area. ° The site might produce acoustic noise, absorption or reflections which could mask or interfere with prescribed sound signals from vessels or ATON. ° Electromagnetic interference from structures, generators, and the seabed cabling within the site could produce electro-magnetic fields affecting compasses and other navigation systems. ° The power and noise generated above or below the water would create physical risks that may potentially affect the health of vessel crews.
Facility Characteristics			
Marine Navigational Markings	NVIC 2-07 Encl (5), §1	• Installation structures and buoys, on the perimeter of and within the site, both above and below the sea surface, may not be marked adequately by day and by night. • The installation site may not be marked by Radar Beacons (RACONS) and/ or, an Automatic Identification System (AIS) transceiver. • The installation site may not be fitted with adequate sound signal(s). • The installation site may not comply with generally accepted markings for such structures, as required by the USCG or recommended by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), respectively. • The installation's plans to maintain its aids to navigation may not meet the USCG's availability standards (i.e., "on station and watching properly") at all times. • The installation's procedures may not be adequate to respond to and correct casualties to the aids to navigation required by the USCG, within the timeframes specified by the USCG. • The installation's markings may impact existing Federal or private aids to navigation in the vicinity of the installation.	• Compliance with 33 CFR Parts 166, 167 and 162. • Provide Study/Analysis showing— ° How the site would be marked by day and by night, including following decommissioning. ° How above- and below-surface structures on the perimeter of and within the site would be marked by day and by night. ° Whether RACONS and/or AIS transceivers would be used and any AIS data to be transmitted. ° Whether sound signals would be used, the characteristics of the signal(s) and locations(s). ° Whether markings would comply with USCG requirements or recommendations by IALA, including IALA recommendations during construction. Temporary lighting may be necessary. ° Whether the aids would be maintained to USCG availability standards and any additional District guidance would be met.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
			° Discuss construction plans, timetables, etc. with local USCG and stakeholders. ° Request USCG to issue Notices to Mariners. ° Procedures and timeframes for responding to and correcting ATON casualties. ° How the markings will impact existing federal, state or private aids in the vicinity.
A search and rescue (SAR), counter pollution, or salvage operation in or around an installation may necessitate that generating devices be capable of emergency shut down. (Generalized for Marine Current Turbines & Wave Generators from Wind Park recommendations)	NVIC 2-07 Encl (5), §2	• Remote control systems may be necessary for emergency procedures. • Consultation with the Coast Guard and other emergency support services concerning safe shut down procedures and verification may be necessary during the design process. • If orientation of electrical devices are controllable (i.e. azimuth and elevation), fixing the device(s) and maintaining its position at the request of USCG may be necessary. • If there are interior spaces of surface structures accessible to personnel (e.g. inspection, maintenance, etc.), it may be necessary for rescuers to gain access from upper surfaces of the structure if the occupants are unable to assist. • An emergency situation may result, with the potential for distressed mariners' seeking refuge on any surface of the installation or buoy, thereby affecting the optimal placement of access ladders. • At any time, a vessel in distress may allide with the installation or other emergency (SAR incident, counter pollution operation, or salvage operation) may occur in or around the installation, necessitating monitoring by the facility's owners/operators. • It will be necessary to identify by chart an individual structure, device or its buoys by GPS position or by unique identification numbers. • It will be necessary for the USCG Sector or District command center to contact the operator immediately in an emergency. • It will be necessary for the USCG Sector or District command center to have access to the same reference chart used by the operator to identify individual structures, devices, or buoys. • USCG may receive a distress call or other emergency alert from a vessel concerning a potential or actual allision with the installation.	• Study per NVIC 5, sect2 • Designation of the site as an ATBA. • Implementation of routing measures within or near the development. • Monitoring by radar, AIS, and/or closed circuit television (CCTV). • Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs. • Determine minimum distance of installation structures from shipping routes. • Other measures or procedures considered appropriate in consultation with stakeholders.
installation Site and Waterway Considerations			
Installation either affects tides, streams and currents or is affected by them.	NVIC 2-07 Encl (6), §1	• At various stages of the tide but not necessarily all stages, the installation could create or enhance potential maritime traffic flow issues within the installation area. • Current maritime traffic flows and operations in the general area could be affected by changes to existing currents in the area of the proposed installation. • Set and rate of the tidal stream, at any state of the tide, have the potential to affect vessels operating within or near the installation area. • Current directions/velocities might aggravate or mitigate the likelihood of allision with the installation.	• Modeling of horizontal, and possibly vertical, current flow around devices and structures. As part of this design study, investigate temporary changes that may occur during installation.
		• Whether the tidal stream runs parallel to or perpendicular to the principle length of proposed installation; there may be an adverse effect by the installation on the existing tidal stream. • In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream or currents. • The installation's placement and design could cause changes in the set and rate of the tidal stream or direction, and flow rate of the tidal current. • Structures in the tidal stream could cause the deposit or removal of sediments, affecting navigable water depths within the installation or in adjacent areas. • The installation could cause danger and/or severely affect the air column, water column, seabed and sub-seabed in the general vicinity of the installation.	

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
Maritime Traffic and Vessel Considerations			
The installation may affect vessel traffic or other normal uses of the area.	NVIC 2-07 Encl (7), §1	• The installation may affect non-transit uses of nearby areas (e.g. aggregate dredging, fishing, fisheries, day cruising of leisure craft, racing, marine regattas or parades, and on-shore or on-water recreation, etc.) • The installation may affect shipping lane transit routes used by coastal or deep-draft vessels, ferry routes, and fishing vessel routes. • The installation alignment and proximity to adjacent shipping lanes could adversely affect vessels transiting those lanes. • The installation may affect prescribed or recommended routing measures or precautionary areas. • The installation may lie on or near a prescribed or conventionally accepted separation zone between two opposing routes or within a traffic separation scheme. • The installation may affect anchorage grounds or areas, safe havens, port approaches, and pilots boarding or landing areas. • The installation may affect the ability of vessels to anchor within the vicinity of an installation field. • The installation may be near to offshore firing/bombing ranges or other areas used for military purposes., e.g. designated firing and test ranges; undersea surveillance, detection & security systems; and training areas. • The installation may affect nearby existing or proposed offshore oil/gas platforms, marine aggregate and dredging operations, marine archaeological sites or wrecks, or other exploration/ exploitation sites. • The installation may be near designated areas for the disposal of dredging materials. • The installation may affect existing or proposed aids to navigation and/or VTS in or adjacent to the area and any impact thereon. • The installation may displace shipping lane vessel traffic and create 'choke points' in areas of high vessel traffic density. • Existing or planned cables, pipelines, intakes, outfalls may be affected.	• Conduct a traffic survey with impact assessment of the area proposed for the installation, covering at least 12 consecutive and recent months, showing, seasonal variations, numbers and sizes and types of vessels, types of cargo carried. The survey should include identification of any port or navigational authority jurisdictions. • Liaise with stakeholders, such as local fishermen, tour boat operators, tug operators and the Navy. Refer to Appendix L for recommendations on liaising with the Navy.
The installation may affect the frequency or severity of vessel casualties.	NVIC 2-07 Encl (7), §2	• The installation may increase the frequency, location or consequences of collisions between vessels; the type of collisions; or affect the types of vessels involved. • The installation may increase the frequency, location or consequences of allisions • The installation may increase the frequency, location or consequences of groundings or affect the type of vessels involved.	• Conduct traffic study and navigational risk analysis.
The installation Structure may be susceptible to being struck by vessels.	NVIC 2-07 Encl (7), §3	• Features of the installation, including auxiliary platforms and cabling to the shore, could pose difficulty or danger to vessels underway, performing normal operations, or anchoring (e.g. vertical clearances above the sea surface at MHHW, depths and clear draft below the sea surface, the burial depth of cabling, anchor fields, etc.)	• Conduct traffic study and navigational risk analysis. • Conduct seafloor hazard survey. • Consider including collision as a loading scenario in system design.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
Platform, Station keeping, Transmission Cable and other design considerations			
Impairment of visual navigation.	Navigation and Vessel Inspection Circular (NVIC) 2-07 Encl (4), §1	• Installations could block or hinder the view of other vessels underway on any route. • Installations could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc. • Installations and locations could limit the ability of vessels to maneuver in order to avoid collisions	• Conduct comprehensive assessment of the risks to navigation safety associated with the proposed installation, using United States Coast Guard (USCG) or other accepted industry standard for Risk-Based Decision Making (RBDM). • Conduct visibility study to determine whether visual navigational impairment would occur and at what distances and heights of eye. (i.e. effecting ships of what sizes and at what distances?) • Conduct maneuvering analysis to determine if the installation could reasonable prevent vessels from maneuvering to avoid collision. • Designation of the site as an area to be avoided (ATBA). • Implementation of routing measures within or near the development. • Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs. • Determine minimum distance of installation structures from shipping routes. • Other measures or procedures considered appropriate in consultation with other stakeholders.
Impairment of electronic navigation and communications.	NVIC 2-07 Encl (4), §2	• Installations could produce radio interference such as shadowing, reflections, or phase changes, with respect to any frequencies used for aviation, marine positioning, navigation, or communications, including Automatic Identification Systems (AIS), whether ship borne, ashore, within aircraft, or fitted to any of the proposed structures. • Installations could produce radar reflections, blind spots, shadow areas or other adverse effects — vessel-to-vessel; vessel-to-shore; Vessel Traffic Service (VTS)-to-vessel; radio beacons to/from vessel; and between aircraft and Air Traffic Control. Installations might produce sonar interference affecting fishing, industrial, or military systems used in the area. • Installations might produce acoustic noise or noise absorption or reflections which could mask or interfere with prescribed sound signals from other vessels or aids to navigation. • Installations, generators, and the seabed cabling within the site and onshore might produce electromagnetic fields affecting compasses and other navigation systems.	• Provide researched opinion of a generic and where appropriate, site-specific, nature concerning whether or not— ° Installations could produce radio interference, shadowing, reflections or phase changes, affecting any frequencies used for aviation, marine navigation, positioning, or communications, including AIS on ships, aircraft or proposed structures. ° Installations could produce radar reflections, blind spots, shadow areas or other adverse effects. ° Installations and generators might produce sonar interference affecting fishing, industrial, or military systems used in the area. ° The site might produce acoustic noise, absorption or reflections which could mask or interfere with prescribed sound signals from vessels or Aids to Navigation (ATON). ° Electromagnetic interference from structures, generators, and the seabed cabling within the site could produce electro-magnetic fields affecting compasses and other navigation systems. ° The power and noise generated above or below the water would create physical risks that may potentially affect the health of vessel crews.
Facility Characteristics			
Marine Navigational Markings	NVIC 2-07 Encl (5), §1	• Installation structures and buoys, on the perimeter of and within the site, both above and below the sea surface, may not be marked adequately by day and by night. • The installation site may not be marked by Radar Beacons (RACONS) and/ or, an AIS transceiver. • The installation site may not be fitted with adequate sound signal(s). • The installation site may not comply with generally accepted markings for such structures, as required by the USCG or recommended by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), respectively. • The installation's plans to maintain its aids to navigation may not meet the USCG's availability standards (i.e., "on station and watching properly") at all times. • The installation's procedures may not be adequate to respond to and correct casualties to the aids to navigation required by the USCG, within the timeframes specified by the USCG. • The installation's markings may impact existing Federal or private aids to navigation in the vicinity of the installation.	• Compliance with 33 CFR Parts 166, 167 and 162. • Provide Study/Analysis showing— ° How the site would be marked by day and by night, including following decommissioning. ° How above- and below-surface structures on the perimeter of and within the site would be marked by day and by night. ° Whether RACONS and/or AIS transceivers would be used and any AIS data to be transmitted. ° Whether sound signals would be used, the characteristics of the signal(s) and locations(s). ° Whether markings would comply with USCG requirements or recommendations by IALA. ° Whether the aids would be maintained to USCG availability standards and any additional District guidance would be met. ° Procedures and timeframes for responding to and correcting ATON casualties. ° How the markings will impact existing federal, state or private aids in the vicinity.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
A search and rescue (SAR), counter pollution, or salvage operation in or around an installation may necessitate that generating devices be capable of emergency shut down. (Generalized for Marine Current Turbines & Wave Generators from Wind Park recommendations)	NVIC 2-07 Encl (5), §2	• Identification at any time of day or night of a singular generating device or the buoy system associated with a singular device will be necessary. • Remote control systems may be necessary for emergency procedures. • Consultation with the USCG and other emergency support services concerning safe shut down procedures and verification may be necessary during the design process. • If orientation of electrical devices are controllable (i.e. azimuth and elevation), fixing the device(s) and maintaining its position at the request of USCG may be necessary. • If there are interior spaces of surface structures accessible to personnel (e.g. inspection, maintenance, etc.), it may be necessary for rescuers to gain access from upper surfaces of the structure if the occupants are unable to assist. • An emergency situation may result, with the potential for distressed mariners' seeking refuge on any surface of the installation or buoy, thereby affecting the optimal placement of access ladders. • At any time, a vessel in distress may allide with the installation or other emergency (SAR incident, counter pollution operation, or salvage operation) may occur in or around the installation, necessitating monitoring by the facility's owners/operators. • It will be necessary to identify by chart an individual structure, device or its buoys by GPS position or by unique identification numbers. • It will be necessary for the USCG Sector or District command center to contact the operator immediately in an emergency. • It will be necessary for the USCG Sector or District command center to have access to the same reference chart used by the operator to identify individual structures, devices, or buoys. • USCG may receive a distress call or other emergency alert from a vessel concerning a potential or actual allision with the installation. • Having received notification of a vessel in distress, other emergency alert or that a vessel is close to or within an installation, it would be necessary for the operator of an installation facility to initiate a partial or full emergency shutdown immediately. • To ensure that communications and shutdown procedures function satisfactorily, it is necessary to conduct periodical testing. • After an allision, it will be necessary for the owners/operators of the installation to submit documentation that verifies structural integrity of the installation. (46 CFR 4.05)	• Study per NVIC 2-07 Encl (5), section 2 • Designation of the site as an ATBA. • Implementation of routing measures within or near the development. • Monitoring by radar, AIS, and/or closed circuit television (CCTV). • Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs. • Determine minimum distance of installation structures from shipping routes. • Other measures or procedures considered appropriate in consultation with other stakeholders.
Installation Site and Waterway Considerations			
Installation either affects tides, streams and currents or is affected by them.	NVIC 2-07 Encl (6), §1	• At various stages of the tide but not necessarily all stages, the installation could create or enhance potential maritime traffic flow issues within the installation area. • Current maritime traffic flows and operations in the general area could be affected by changes to existing currents in the area of the proposed installation. • Set and rate of the tidal stream, at any state of the tide, have the potential to affect vessels operating within or near the installation area. • Current directions/velocities might aggravate or mitigate the likelihood of allision with the installation. • Whether the tidal stream runs parallel to or perpendicular to the principle length of proposed installation; there may be an adverse effect by the installation on the existing tidal stream. • In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream or currents.	• Modeling of horizontal, and possibly vertical, current flow around devices and structures.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
		• The installation's placement and design could cause changes in the set and rate of the tidal stream or direction, and flow rate of the tidal current. • Structures in the tidal stream could cause the deposit or removal of sediments, affecting navigable water depths within the installation or in adjacent areas. • The installation could cause danger and/or severely affect the air column, water column, seabed and sub-seabed in the general vicinity of the installation.	
Weather conditions may directly affect the installation or increase likelihood of allision.	NVIC 2-07 Encl (6), §2	• Weather conditions or restricted visibility may affect vessels which pass near installations, hindering their ability to safely navigate the area. • Installation structures may affect the ability of vessels to maneuver safely. Problems may include wind masking, turbulence, or wind sheer.	• Determine minimum distance of installation structures from shipping routes. • Implementation of routing measures within or near the development. • Monitoring by radar, AIS, and/or CCTV. • Select another site.
Ice may affect the installation.	NVIC 2-07 Encl (6), §3	• Ice may impact or accumulate on or around the device or the device may make potential ice impacts worse. • Ice may impact the structural integrity of the device or the ability of its mooring system to hold the device in place, impacting shipping and shipping lanes.	• Safety zones of appropriate configuration, extent and application to specified vessels • Temporary removal of device to avoid ice impact and damage. • Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC)
Maritime Traffic and Vessel Considerations			
The installation may affect vessel traffic or other normal uses of the area.	NVIC 2-07 Encl (7), §1	• The installation may affect non-transit uses of nearby areas (e.g. aggregate dredging, fishing, fisheries, day cruising of leisure craft, racing, marine regattas or parades, and on-shore or on-water recreation, etc.) • The installation may affect shipping lane transit routes used by coastal or deep-draft vessels, ferry routes, and fishing vessel routes. • The installation alignment and proximity to adjacent shipping lanes could adversely affect vessels transiting those lanes. • The installation may affect prescribed or recommended routing measures or precautionary areas. • The installation may lie on or near a prescribed or conventionally accepted separation zone between two opposing routes or within a traffic separation scheme. • The installation may affect anchorage grounds or areas, safe havens, port approaches, and pilots boarding or landing areas. • The installation may affect the ability of vessels to anchor within the vicinity of an installation field. • The installation may be near to offshore firing/bombing ranges or other areas used for military purposes, e.g. designated firing and test ranges; undersea surveillance, detection & security systems; and training areas. • The installation may affect nearby existing or proposed offshore oil/gas platforms, marine aggregate and dredging operations, marine archaeological sites or wrecks, or other exploration/ exploitation sites. • The installation may be near designated areas for the disposal of dredging materials. • The installation may affect existing or proposed aids to navigation and/or VTS in or adjacent to the area and any impact thereon. • The installation may displace shipping lane vessel traffic and create 'choke points' in areas of high vessel traffic density.	• Conduct a traffic survey with impact assessment of the area proposed for the installation, covering at least 12 consecutive and recent months, showing, seasonal variations, numbers and sizes and types of vessels, types of cargo carried. The survey should include identification of any port or navigational authority jurisdictions. • Liaise with stakeholders, such as local fishermen, tour boat operators, tug operators and the Navy. Refer to Appendix L for recommendations on liaising with the Navy.
The installation may affect the frequency or severity of vessel casualties.	NVIC 2-07 Encl (7), §2	• The installation may increase the frequency, location or consequences of collisions between vessels; the type of collisions; or affect the types of vessels involved. • The installation may increase the frequency, location or consequences of allisions. • The installation may increase the frequency, location or consequences of groundings or affect the type of vessels involved.	• Conduct traffic study and navigational risk analysis.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
The installation Structure may be susceptible to being struck by vessels.	NVIC 2-07 Encl (7), §3	• Features of the installation, including auxiliary platforms and cabling to the shore, could pose difficulty or danger to vessels underway, performing normal operations, or anchoring (e.g. vertical clearances above the sea surface at MHHW, depths and clear draft below the sea surface, the burial depth of cabling, anchor fields, etc.) • Installation features could create problems for emergency rescue services, including rescue swimmers, the use of lifeboats, helicopters, and emergency towing vessels. Problems could include how rotation/movement and power transmission, etc., will be controlled by the designated services when necessary in an emergency. • Noise or vibrations from an installation above or below the water could impact navigation safety or affect other USCG missions. • Parts of an installation above or below the water surface may not be able to withstand allision or collision damage by vessels. This could topple or separate the installation from its mooring, adversely impacting vessel movement and shipping lanes.	• Conduct traffic study and navigational risk analysis. • Conduct seafloor hazard survey. • Consider including collision as a loading scenario in system design.
The installation may alter vessel access to the area.	NVIC 2-07 Encl (7), §4	• Navigation *within* the site may be safe only — for all vessels or for specified vessel types, operations and/or sizes; in all directions or in specified directions or areas; and at any time, day/night, or in specified tidal, weather, daylight or other conditions. • Navigation in and/or near the site may be — Prohibited by specified vessel types, operations and/or sizes; Prohibited in respect to specific activities; Prohibited in all areas or directions; Prohibited in specified areas or directions; Prohibited in specified tidal or weather conditions; Prohibited during certain times of the day or night; or Recommended to be avoided. • Exclusion from the site could cause navigational, safety, or transiting problems for vessels operating in the area.	• Conduct traffic study and navigational risk analysis.
Coast Guard Mission Considerations			
The installation may affect the number of SAR incidents and the ability of USCG and commercial assets to provide timely response.	NVIC 2-07 Encl (8), §1	• There could be additional Search and Rescue operations in the area due to allisions with the installation. • USCG's ability to proceed within 30 minutes of notification of distress may be impeded. • USCG's ability to being on scene at datum, or within the search area, within 90 minutes of getting underway may be impeded. • USCG's ability to effect helicopter hoist in all conditions may be impeded. • USCG's ability to effect helicopter hoist in poor visibility/low ceiling may be impeded. • USCG's ability to search by water or air in all conditions may be impeded. • USCG's ability to search by water or air at night or in poor visibility/low ceiling may be impeded. • The installation may impede response by a commercial salvor.	• Early notification and discussion with local USCG sector.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
The installation may affect the number or severity of Marine Environmental Response (MER) incidents.	NVIC 2-07 Encl (8), §2	• Additional MER cases in the area may be expected due to allisions with the installation. • Additional response assets may be necessary due to allisions with the installation. • The installation may prevent response units from performing their mission per USCG response standards. • The installation may prevent the response units from being on scene at datum, or within the area of pollution, within 90 minutes of getting underway?	• Based on regional data for at least a 10-year period, analyze the types of pollution cases, whether USCG responses were at night or during limited visibility; by boat or helicopter; and the impact of the installation on the ability of commercial salvage assets to respond within the installation area.

Appendix H. Decommissioning

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
Platform, Station keeping, Transmission Cable and other design considerations			
Impairment of visual navigation.	Navigation and Vessel Inspection Circular (NVIC) 2-07 Encl (4), §1	• Installations could block or hinder the view of other vessels underway on any route. • Installations could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc. • Installations and locations could limit the ability of vessels to maneuver in order to avoid collisions	• All devices should be removed at the end of life. • Discuss decommissioning plans, timetables, etc. with local United States Coast Guard (USCG) and stakeholders.
Facility Characteristics			
Marine Navigational Markings	NVIC 2-07 Encl (5), §1	• The installation's navigational day and night markings may not be adequate for ongoing site marking following decommissioning. • Installation structures and buoys, on the perimeter of and within the site, both above and below the sea surface, may not be marked adequately by day and by night. • The installation site may not be marked by Radar Beacons (RACONS) and/ or, an Automatic Identification System (AIS) transceiver. • The installation site may not be fitted with adequate sound signal(s). • The installation site may not comply with generally accepted markings for such structures, as required by the USCG or recommended by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), respectively. • The installation's plans to maintain its aids to navigation may not meet the USCG's availability standards (i.e., "on station and watching properly") at all times. • The installation's procedures may not be adequate to respond to and correct casualties to the aids to navigation required by the USCG, within the timeframes specified by the USCG. • The installation's markings may impact existing Federal or private aids to navigation in the vicinity of the installation.	• Compliance with 33 CFR Parts 166, 167 and 162. • Provide Study/Analysis showing— ° How the site would be marked by day and by night, including during and following decommissioning. ° How above- and below-surface structures on the perimeter of and within the site would be marked by day and by night. ° Whether RACONS and/or AIS transceivers would be used and any AIS data to be transmitted. ° Whether sound signals would be used, the characteristics of the signal(s) and locations(s). ° Whether markings would comply with USCG requirements or recommendations by IALA, including IALA recommendations during construction. Temporary lighting may be necessary. ° Whether the aids would be maintained to USCG availability standards and any additional District guidance would be met. ° Procedures and timeframes for responding to and correcting aids to navigation (ATON) casualties. ° How the markings will impact existing federal, state or private aids in the vicinity. ° Discuss decommissioning plans, timetables, etc. with local USCG and stakeholders. ° Request USCG to issue Notices to Mariners.
A search and rescue (SAR), counter pollution, or salvage operation in or around an installation may necessitate that generating devices be capable of emergency shut down. (Generalized for Marine Current Turbines & Wave Generators from Wind Park recommendations)	NVIC 2-07 Encl (5), §2	• Identification at any time of day or night of a singular generating device or the buoy system associated with a singular device will be necessary. • Remote control systems may be necessary for emergency procedures. • Consultation with the USCG and other emergency support services concerning safe shut down procedures and verification may be necessary during the design process. • If orientation of electrical devices are controllable (i.e. azimuth and elevation), fixing the device(s) and maintaining its position at the request of USCG may be necessary. • If there are interior spaces of surface structures accessible to personnel (e.g. inspection, maintenance, etc.), it may be necessary for rescuers to gain access from upper surfaces of the structure if the occupants are unable to assist. • An emergency situation may result, with the potential for distressed mariners' seeking refuge on any surface of the installation or buoy, thereby affecting the optimal placement of access ladders. • At any time, a vessel in distress may allide with the installation or other emergency (SAR incident, counter pollution operation, or salvage operation) may occur in or around the installation, necessitating monitoring by the facility's owners/operators. • It will be necessary to identify by chart an individual structure, device or its buoys by GPS position or by unique identification numbers. • It will be necessary for the Coast Guard Sector or District command center to contact the operator immediately in an emergency.	• Study per NVIC 2-07 Encl (5), section 2 • Designation of the site as an area to be avoided (ATBA). • Implementation of routing measures within or near the development. • Monitoring by radar, AIS, and/or closed circuit television (CCTV). • Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs. • Determine minimum distance of installation structures from shipping routes. • Other measures or procedures considered appropriate in consultation with stakeholders.

Potential Navigational Impacts	Reference	Expanded Narrative of Potential Navigational Concerns	Possible Mitigation
		• It will be necessary for the USCG Sector or District command center to have access to the same reference chart used by the operator to identify individual structures, devices, or buoys. • USCG may receive a distress call or other emergency alert from a vessel concerning a potential or actual allision with the installation.	
Installation Site and Waterway Considerations			
Installation either affects tides, streams and currents or is affected by them.	NVIC 2-07 Encl (6), §1	• At various states of the tide but not necessarily all states, the installation could create or enhance potential maritime traffic flow issues within the installation area. • Current maritime traffic flows and operations in the general area could be affected by changes to existing currents in the area of the proposed installation. • Set and rate of the tidal stream, at any state of the tide, have the potential to affect vessels operating within or near the installation area. • Current directions/velocities might aggravate or mitigate the likelihood of allision with the installation. • Whether the tidal stream runs parallel to or perpendicular to the principle length of proposed installation; there may be an adverse effect by the installation on the existing tidal stream. • In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream or currents. • The installation's placement and design could cause changes in the set and rate of the tidal stream or direction, and flow rate of the tidal current. • Structures in the tidal stream could cause the deposit or removal of sediments, affecting navigable water depths within the installation or in adjacent areas. • The installation could cause danger and/or severely affect the air column, water column, seabed and sub-seabed in the general vicinity of the installation.	• Modeling of horizontal, and possibly vertical, current flow around devices and structures. As part of this design study, investigate temporary changes that may occur during decommissioning.
Maritime Traffic and Vessel Considerations			
The installation Structure may be susceptible to being struck by vessels.	NVIC 2-07 Encl (7), §3	• Parts of an installation above or below the water surface may not be able to withstand allision or collision damage by vessels. This could topple or separate the installation from its mooring, adversely impacting vessel movement and shipping lanes.	• Liaise with stakeholders, such as local fishermen, tour boat operators, tug operators and the Navy regarding decommissioning structures and additional vessels on site.
The installation may alter vessel access to the area.	NVIC 2-07 Encl (7), §4	• Navigation *within* the site may be safe only — for all vessels or for specified vessel types, operations and/or sizes; in all directions or in specified directions or areas; and at any time, day/night, or in specified tidal, weather, daylight or other conditions. • Navigation in and/or near the site may be — Prohibited by specified vessel types, operations and/or sizes; Prohibited in respect to specific activities; Prohibited in all areas or directions; Prohibited in specified areas or directions; Prohibited in specified tidal or weather conditions; Prohibited during certain times of the day or night; or Recommended to be avoided.	• Liaise with stakeholders, such as local fishermen, tour boat operators, tug operators and the Navy.

Appendix I

Navigational Impacts and Mitigation Measures for Marine and Hydrokinetic Renewable Energy Technology Projects

Checklist

Under a Cooperative Agreement with the U.S. Department of Energy, and in consultation with the U.S. Coast Guard, PCCI, Inc. developed this checklist to assist lead Federal and State permitting agencies, other cooperating agencies, and potential developers of Renewable Energy Installations (REI) to understand how broadly an REI sited in the navigable waters of the United States could impact navigation. The checklist provides a means to review navigational safety concerns and minimize potential impacts on Coast Guard missions and on other ocean users. Use of this checklist by REI developers, review agencies and permitting agencies will allow for consistency in comments submitted on development plans and permit applications and will ensure a broad range of navigation issues are addressed during the planning process. This checklist can also be used to identify potential navigational impacts and provide a screening process to improve the quality of site selection decision making.

Site Selection

☐ Has the developer consulted with other stakeholders including Federal, State and other ocean users?

☐ Has a Navigational Safety Risk Assessment been prepared for the site?

- ☐ Does the Assessment contain a recent Traffic Survey?
- ☐ Has collision risk been evaluated?
- ☐ Will the REI produce electro-magnetic fields, radio, radar, or sonar interference?
- ☐ Was navigation within, or close to, the REI site assessed?
- ☐ In areas prone to seabed scouring, will the REI result in significant deposits of material in other locations?

☐ Will the REI siting conflict with identified USCG restricted or danger zones?

☐ Will the REI siting prejudice the safe use of an existing Traffic Separation Scheme, Inshore Traffic Zone, recognized sea lanes or anchorages?

☐ Will the REI displace existing ocean users?

☐ Has an application been filed with the Army Corps of Engineers to obtain a Section 10 Permit for REI devices and cables located in navigable waters of the U.S.?

For more information, refer to:
– Local Army Corps of Engineers District
– USCG NVIC 02-07 and
– Local USCG Sector

Design Considerations

☐ Will any feature of the REI, including the energy conversion devices (including turbine blades if applicable), moorings, transformer platforms, or power cabling pose any type of difficulty to vessels

underway, performing normal operations, or anchoring?

☐ Will the REI be able to withstand collision damage by a limited range of vessel types, speeds and sizes without catastrophic failure?

☐ Have limits of buoy motions been determined for REIs that include floating structures?

For more information, refer to:
– API Recommended Practices
– DNV Offshore Specifications

Navigation Markings

☐ Has the developer complied with 33 CFR Parts 62, 64, 66 and 67?

☐ Will individual REI units be marked with clearly visible unique alpha-numeric indicators?

☐ Are individual structures, or fields of structures, marked so as to be conspicuous by day and night in accordance with IALA Recommendation O-139?

☐ Will the REI be outfitted with an Automatic Identification System?

☐ Have provisions been made to provide temporary markings during construction and decommissioning?

For more information, refer to:
– IALA Recommendation O-139
– Local USCG Sector

Construction Considerations

☐ Will a Notice to Mariners be published prior to construction?

☐ Are power cables between individual units, transformer stations, and shore sufficiently trenched to avoid exposure?

For more information, refer to:
– USCG NVIC 02-07

Operational Considerations

☐ Will REI units be continuously monitored by the facility operator?

☐ Does the developer have a plan for maintenance of the REI aids to navigation?

☐ Has the operator developed contingency plans to address the possibility of individual floating units breaking loose and becoming floating hazards?

☐ Does the operator have operational safe shutdown procedures for emergency response in the event of a search and rescue, pollution or security operation?

For more information, refer to:
– USCG NVIC 02-07

Decommissioning Considerations

☐ Will all obstructions be removed from the seabed?

Additional Resources

http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics.asp
http://www.mms.gov/offshore/RenewableEnergy/index.htm

Appendix J

IALA Recommendations

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) recommendations for marking of offshore wave and tidal energy devices (Section 2.4) and marking of offshore structures in general (Section 2.1), as contained in Recommendation O-139, are made specifically to member governments; in the U.S. represented by the Coast Guard (USCG).

A developer's alternative to following the IALA recommendations would be to follow the requirements in existing regulations (33 CFR 62, 64, 66, and 67) that apply to all private aids and to artificial islands on the outer continental shelf (OCS). In the CFRs, every device must meet the same requirements, i.e. there is no consideration of an array of many devices. The CFRs do include marking requirements for Isolated Dangers and Special Marks/Special Buoys that are consistent with those in the IALA recommendations.

At the discretion of the USCG District Commander, 33 CFR 67.01-30 provides for the use of alternate equipment, apparatus, or installation arrangements to those specified in regulation, provided the alternate proposal will result in achieving a degree of safety or compliance equivalent to the minimum requirements set forth in the CFR. The exact approval process using the IALA recommendations has not been tested, but the author believes that the same private aid to navigation permitting application will be required as is normally required for private aids that follow the specific requirements in the CFR.

Some Questions and Answers about IALA Recommendation O-139
for Wave and Tidal Device Markings

1. Q: What are the IALA marking recommendations for a single wave or tidal energy extraction device that is floating or surface piercing?

   A: *A single device is marked as an Isolated Danger —*

   - *Paint Scheme: Black with horizontal red bands*
   - *Lighting: The light is **white** – a group flash light Fl(2), with two flashes in a group. Required range is not less than 5 nautical miles.*
     Topmarks are two black spheres, one above the other.

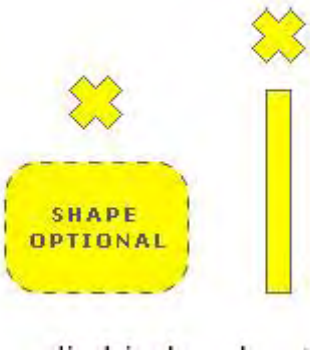
Isolated Danger Mark (black with red bands)

2. Q: What if the single device is not visible above the surface, but is considered a hazard to surface navigation?

   A: *It should be marked with a Special Mark buoy —*

   - *Paint Scheme: Solid yellow*
   - *Lighting: The light is **yellow** flashing, with a range is not less than 5 nautical miles. When a topmark is carried, it takes the form of a single yellow X.*

Special Mark (solid yellow)



3. Q: What are the IALA marking recommendations for an array or field of wave or tidal energy extraction devices that are floating or surface piercing?

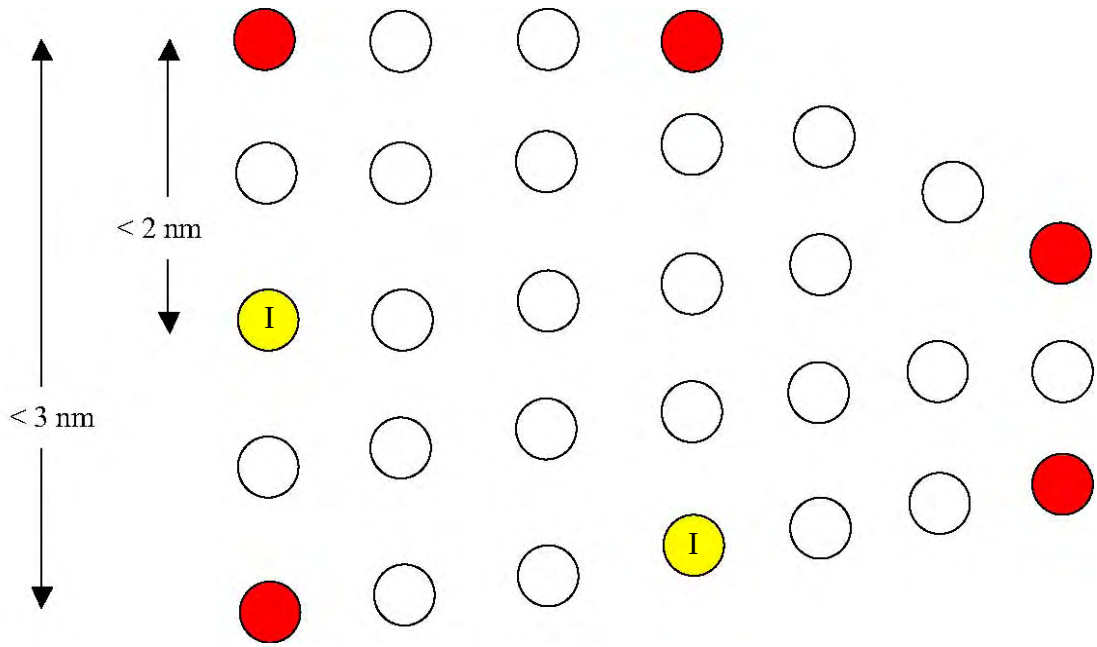
   A: *Individual devices —*

   - *Paint Scheme: Solid yellow*
   - *Lighting: Depending on boundary marking, individual devices within the array or field need not be lighted. See Significant Peripheral Structures below. If the individual devices are lighted, the light is **yellow** flashing, with a range is not less than 2 nautical miles. The flash characteristic of the individual devices should be different from those on boundary/peripheral lights.*

Significant Peripheral Structures (SPSs) — buoys or structures on the corners or other significant points on the periphery of an array or field of tidal energy extraction devices —

- *Paint Scheme: Solid yellow*
- *Lighting: IALA Special Mark characteristic, flashing **yellow** light with range of not less than 5 nautical miles, visible from all directions in the horizontal plane. Lights on an individual SPSs should be synchronize. Administrations should consider requiring synchronization of all SPS lights. For a large array or field, the distance between SPSs should not exceed 3 miles.*
- *Selected intermediate structures on the periphery of an array or field, other than SPSs, should also be marked with flashing yellow lights, visible to the mariner in all directions in the horizontal plane. The flash characteristics of these lights should be distinctly different from those on SPSs, with a range of not less than 2 nautical miles. The lateral distance between lit structures or the nearest SPS should not exceed 2 nautical miles.*

Sample marking of Wave or Tidal Energy Structures/Devices in Field



4. Q: What are the sound signal requirements for fog conditions? What about radar reflectors or Automatic Identification System (AIS) devices?

   A: *IALA Recommendation O-139 does not specify sound signals, radar reflectors or AIS devices. Rather, they recommend to administrations a number of additional considerations, including the following:*

   - *Sound signals, where appropriate, not less than 2 nautical miles;*
   - *Retro-reflective areas on individual structures that are unlighted;*
   - *Illuminating with down lights, ladders and access platforms on individual structures;*
   - *Use of flashing yellow lights with a range of not less than two (2) nautical miles on individual structures;*
   - *Identifying numbers on each individual structure, either lit or unlit;*
   - *Lighting all peripheral structures;*
   - *Lighting all structures within the field;*
   - *Racons;*
   - *Radar Reflectors and Radar Target Enhancers; and/or*
   - *AIS as an Aid to Navigation.*

   Further, Recommendation O-139 recommends that an electrical transformer station or other structure, if considered a composite part of the energy extraction field, should be included as part of the overall marking. If not considered to be within the boundaries of the field, it should be marked as a single stand-alone device.

5. Q: What is required for completely submersed tidal devices that are sufficiently deeply submerged as not to interfere with any shipping traffic?

   A: *The IALA recommendations for subsurface units apply to offshore tidal energy devices which are <u>not</u> visible above the surface but <u>are considered a hazard to surface navigation</u>. The recommendations do not specifically address the situation when the subsurface units are not considered to be hazards to navigation, in particular if the device is not offshore.*

Appendix K

Summary of Navy Organization.

The Navy Staff required to support an extensive world presence is fairly complex. Referring to Figure K-1, the following is a short summary of that staff and how it functions in support of training the fleet for world-wide operations.

The dashed line marked "Support" indicates the cooperative support of the Navy-Marine Corps team. Each of the operating forces supports the other. The operating forces commanders and fleet commanders have a dual chain of command. Administratively, they report to the Chief of Naval Operations and provide, train, and equip naval forces. Operationally, they provide naval forces and report to the appropriate Unified Combatant Commander. Commander U.S. Fleet Forces Command commands and controls fleet assets on both the Atlantic and Pacific coasts for inter-deployment training cycle purposes. As units of the Navy enter the area of responsibility for a particular Navy area commander, they are operationally assigned to the appropriate numbered fleet (e.g. 6th Fleet, 7th Fleet, etc.) All Navy units also have an administrative chain of command with the various ships reporting to the appropriate Type Commander (e.g., Commander, Naval Surface Forces; Commander, Naval Air Forces; Commander Submarine Forces).

Secretary of the Navy (SECNAV) – Deputy Assistant Secretary of the Navy, Installations & Facilities, (DASN I&F): http://www.navy.mil

- The Navy Secretariat provides the overall direction to the Department of the Navy. The Secretariat includes the offices of the Assistant Secretary of the Navy for Financial Management and Comptroller; Installations & Environment; Manpower & Reserve Affairs; Research, Development, & Acquisition; and the Office of the General Counsel. Other Secretariat staff offices include the Naval Audit Service, Naval Criminal Investigative Service, and Navy Judge Advocate General Corps.

OPNAV Staff: The Office of the Chief of Naval Operations (OPNAV) Staff is headquartered at the Pentagon near Washington, DC. (no public web site available)

- The Chief of Naval Operations (CNO) is the senior military officer in the Navy. The CNO is a four-star admiral and is responsible to the Secretary of the Navy for the command, employment of resources and operating efficiency of the operating forces of the Navy and of Navy shore activities assigned by the Secretary.
- A member of the Joint Chiefs of Staff, the CNO is the principal naval advisor to the President and to the Secretary of the Navy on the conduct of war and naval activities within the Department of the Navy (DON). Assistants are the Vice Chief of Naval Operations (VCNO), the Deputy Chiefs of Naval Operations (DCNOs) and a number of other ranking officers. These officers and their staffs are collectively known as OPNAV.

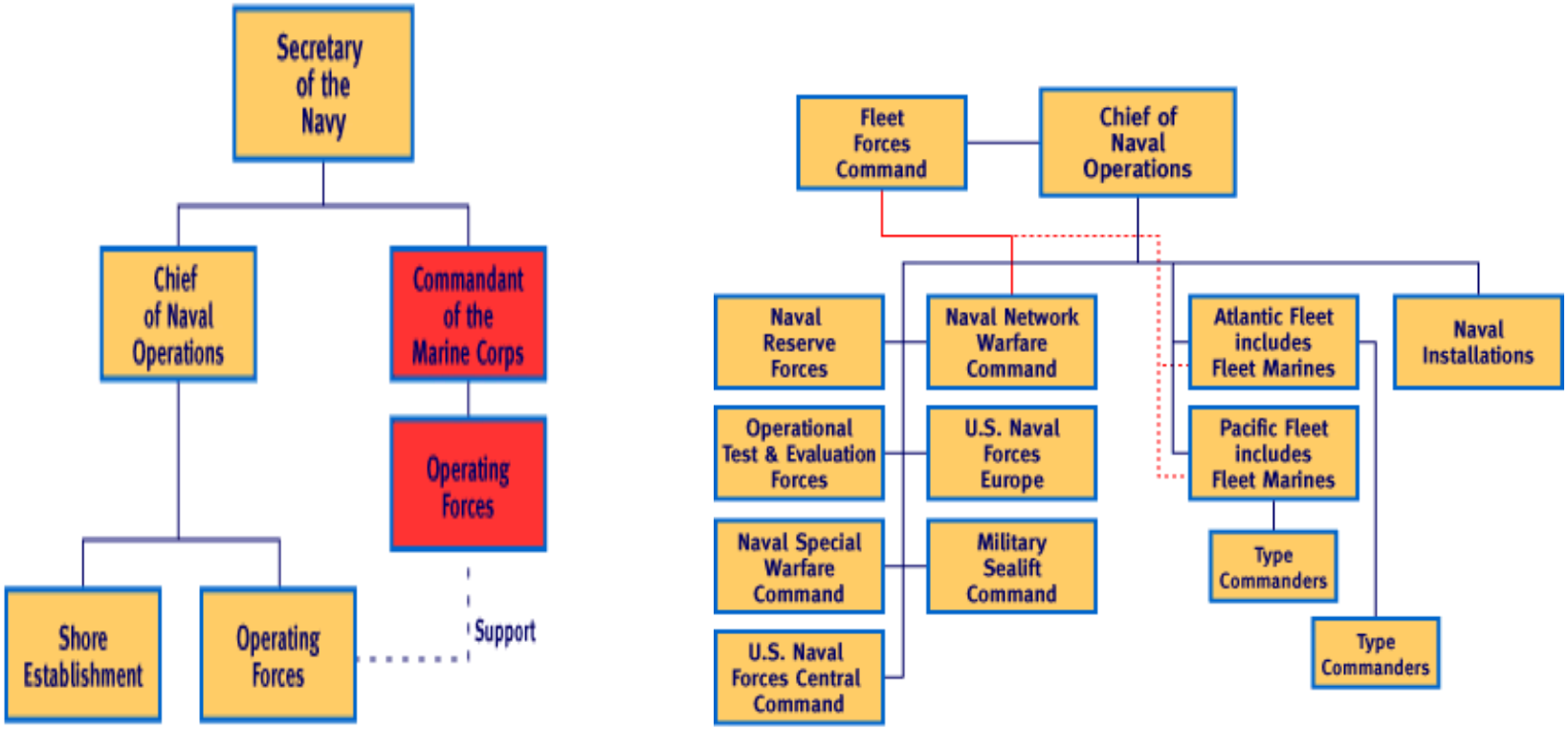


Figure K-1, Top Level Navy Organization

US Fleet Forces Command (FFC): http://www.cffc.navy.mil/ : The FFC is headquartered in Norfolk, VA, with the following general responsibilities:

- Organize, man, train, and equip U.S. Atlantic Fleet and all Navy forces along with Commander, U.S. Pacific Fleet (COMPACFLT)
- Execute Fleet Response Plan (FRP) using Fleet Training Continuum
- Navy Global Force Manager
- Integrate and consolidate matters concerning execution of operations, readiness, training in development of Navy shore requirements
- Lead the Fleet Readiness Enterprise
- Articulate to CNO the integrated Fleet war-fighting capabilities requirements as coordinated with all Navy Component Commanders and develop Fleet Concepts of Operations (CONOPS).
- Provide operational planning and support to Combatant Commanders (e.g., U.S. Northern Command (NORTHCOM) and U.S. Strategic Command (STRATCOM)).
- Perform duties as CNO Executive Agent for Anti-terrorism/Force Protection (AT/FP)
- Establish and implement AT/FP standards and policies for Navy units.
- Lead for all mission/environmental issues in the Continental United States (CONUS).

2nd Fleet http://www.secondfleet.navy.mil/ : The US Navy's 2nd Fleet is headquartered in Norfolk, VA.

- Exercise delegated Operational Control (OPCON) and Administrative Control (ADCON) of assigned ships, aircraft, and landing forces.
- Plan for and, when directed, conduct maritime, joint and combined operations in support of designated Unified and Allied Commanders.
- Train, certify, and provide maritime forces to respond effectively to global contingencies.
- Conduct maritime and joint/combined training is support Unified and Allied Commanders.

3rd Fleet: http://www.c3f.navy.mil/: The US Navy's 3rd Fleet is headquartered in San Diego, CA.

- THIRD Fleet delivers combat-ready naval forces, executes fleet operations, and defines future fleet requirements in order to deter aggression, preserve freedom of the seas, and promote peace and security.

2nd and 3rd Fleet commanders are responsible for ensuring that all naval units are trained and certified to deploy.

Appendix L

Virginia Coastal Energy Research Consortium Example.

The Virginia Coastal Energy Research Consortium (VCERC) was established in Virginia Statute in 2006 to research the potential for development of off shore wind in Virginia. The research included an assessment of the resource, other ocean users and the economic impact of the development.

Meeting with Fleet Forces Command.
As a result of that assessment, it was apparent that significant potential existed but the largest ocean user stakeholder off of the coast of Virginia was the US Navy and its training operations that occur throughout the year. The first meeting was held with the U.S. Navy Fleet Forces Command (FFC) Staff that dealt with future requirements and training. The objective was to notify the FFC Staff of the potential but also point out the benefits to the Navy in training assets and energy potential. The staff responded by suggesting several areas that would potentially be "least impacted" by a wind farm development. These areas became the focal point for the feasibility design work for the VCERC wind farm concept. At no time did the VCERC team attempt to speak for the Navy in any public comment but merely pointed out that the Navy was aware of the activity.

Meeting with Commander, Navy Region Mid-Atlantic.
https://www.cnic.navy.mil/cnrma/index.htm
The Commander, Navy Region Mid-Atlantic (CNRMA) was the next stop for the VCERC team. The Navy Region is responsible for the support facilities and bases that host all the navy combatant commands. In addition, the Navy Region handles many of the interactions with the communities which surround the naval facilities. Thus it was important to engage the Navy Region and keep them informed of the potential for wind farms development off of the coast of VA.

Meeting with Naval Facilities, Mid-Atlantic Command.
https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_navfacmidlant_pp/tab_ml_about_us:tab_ml_gen_info
The Naval Facilities Commander, Mid-Atlantic Command (NAVFAC MIDLANT) was designated as the point of contact for energy issues developing in the Mid-Atlantic Region. As a result of that decision, the VCERC team developed a close working relationship with the Commander, Naval Facilities Mid-Atlantic. Due to the emergent nature of the off shore wind farm concept in Virginia, there were two potential impacts to be considered.

1. The operational significance of the wind turbines in training areas and how that would impact the fleet was dealt with by the FFC training and readiness staff.
2. The potential impact of the energy production on the navy energy portfolio becomes important. As a result of that recognition the NAVFAC MIDLANT commander briefed his superior, Commander Naval Facilities Command.

Meeting with Naval Facilities Command.
https://portal.navfac.navy.mil/portal/page/portal/navfac/
Naval Facilities Command (NAVFAC) is responsible for all Naval Facilities world-wide and thus determines energy programs to support those facilities. The wind farm potential as a renewable resource for Navy energy programs was of interest to the command.

Meeting with Commander, Naval Installations Command.
https://www.cnic.navy.mil/CNIC_HQ_Site/index.htm
Commander, Naval Installations Command (CNIC) is responsible for policies and programs for all naval installations and facilities. The need to assess renewable energy programs required that the CNIC be briefed on the potential for wind off of VA.
As research on off shore wind progressed it became clear that the Navy's key policy decision makers needed to be engaged. This resulted in the invitation to the Deputy Assistant Secretary of the Navy, Installation and Facilities (DASN I&F) to join a workshop in Virginia Beach on the subject of off shore wind. This engagement resulted in the participation of the Deputy Director Renewable Energy, who serves as the DASN I&F.

Thus it is apparent that it required a full range of engagement on many levels of the Navy to keep all the interested staff members informed of the project and its potential. With a constant stream of meetings, briefings and workshops the VCERC team was able to establish credibility and a strong working relationship with each necessary level of the commands.

Suggested engagement strategy for marine and hydrokinetic renewable energy technologies: The FFC which is responsible for Fleet training requirements has an existing public facing engagement methodology which is flexible and responsive to public needs, questions and issues. The Public Affairs Officer (PAO): http://www.cffc.navy.mil/; (Commander, U.S. Fleet Forces Command, Fleet Public Affairs (N02P), 1562 Mitscher Ave., Suite 250, Norfolk, VA 23551-2487, (757) 836-3644), on the staff is responsible to engage the public on issues important to the community or individuals and provides an interface for these discussions. The PAO engages the public entity and then takes the details of the issue and passes it to the appropriate staff officer for action and information. When the details have been attained and the staff has had the opportunity to assess the impact that information is passed back to the PAO for dissemination to the public. This allows the PAO to maintain the relationship with the public entity and the staff officer to stay focused on the responsibilities assigned. There is an option available for these issues to be passed to local command for local community action as well but that relationship would be delegated by the FFC staff. With this in mind it would be an appropriate first engagement strategy for any project or device developer to contact the FFC Public Affairs Officer with the question of impact on Navy Operations and allow the PAO to determine the best course of action for proper information exchange.

Ongoing Recommendation: One very important consideration is that as the industry matures the impact may well change and the Navy assessment of the impact of the

industry on Navy training and preparedness may change as well. The cumulative affects on Navy training areas will change as more projects come on line due to space occupation, radar, sonar, Electro-Magnetic Interference which may begin to impact the overall operations in a specific area. Device and project developers need to keep this in mind. The flow of information will be very important to both the Navy and the industry in that there may be options on design that can be implemented that can minimize some of these impacts or even become an asset for Navy or Homeland Security concepts. For example, do opportunities exist to enhance radar tracking or signal intercept by allowing insertion of technologies into the device or project development. Can these concepts be integrated into programs of the future that allow energy programs and national security to serve the needs of the nation in multiple applications? Only by communicating early and often on technology, plans and projects can the industry and the need for national security be met simultaneously. As those aspect change and mature over the ensuing years the method of early engagement with DOD / Navy may change as well. It will take a concerted effort by all parties to make sure those communication lines are established, recognized and maintained to allow maximum opportunities for success.

Appendix M

Proposed CH-1 to Coast Guard NVIC 02-07

This document proposes changes to Enclosures (4) and (5) of existing Navigation and Vessel Inspection Circular (NVIC) 02-07. Except for the general substitution of Renewable Energy Installation (REI) for Offshore Renewable Energy Installation (OREI), additional text is shown in italics and deleted text is lined through.

Enclosure (4):

GUIDANCE ON CONDUCTING AND REVIEWING A NAVIGATIONAL SAFETY RISK ASSESSMENT

Navigation safety requires that mariners be able to determine their position, determine a safe course to steer, be aware of unseen dangers, be able to determine if risk of collision exists, and be able to take action to avoid collision.

Navigation safety would be impacted by an Renewable Energy Installation (REI) if the REI impairs the mariner's ability to do any of the above.

In order to make appropriate recommendations on the impacts to navigation safety, the Coast Guard needs to know the characteristics and number of waterway users, the routes used, the channel dimensions, bottom conditions, etc., in the area of the proposed REI.

In order to assess the impact on navigation safety, the applicant should perform a systematic assessment of the risks to navigation safety associated with the proposed project. The risk assessment should be performed in accordance with the Coast Guard's Risk-Based Decision-Making (RBDM) Guidelines or other suitable industry standards for risk assessment. As part of the assessment, the applicant should identify impacts on navigational safety and assess the increase in risk associated with the proposed REI. In addition, the risk assessment should identify and evaluate potential measures that could be implemented to mitigate the increased risks associated with the proposed project (see Enclosure (9) for examples). At a minimum, the risk assessment should consider the impact and significance of the appropriate factors (e.g., vessel, waterway, and traffic characteristics) as described in the enclosures. Early and continued involvement of the affected stakeholders in the risk assessment process is strongly recommended.

In assessing a proposed REI's impact on vessel navigation and other safety concerns, the applicant should address, at a minimum, the following:

1. Visual Navigation and Collision Avoidance

The applicant should assess the extent to which:

a. Structures could block or hinder the view of other vessels underway on any route.

b. Structures could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc.

c. Structures and locations could limit the ability of vessels to maneuver in order to avoid collisions.

d. Submerged structures could limit underkeel clearance and ability of vessels to navigate safely in or around an REI.

2. Communications, Radar, and Positioning Systems

The applicant should provide researched opinion of a generic and, where appropriate, site-specific nature concerning whether or not —

a. Structures could produce radio interference such as shadowing, reflections or phase changes, with respect to any frequencies used for aviation, marine positioning, navigation, or communications, including Automatic Identification Systems (AIS), whether ship borne, ashore, within aircraft, or fitted to any of the proposed structures.

b. Structures could produce radar reflections, blind spots, shadow areas or other adverse effects:

(1) Vessel to vessel;
(2) Vessel to shore;
(3) Vessel Traffic Service radar to vessel;
(4) Radio Beacons (RACONS) to/from vessel;
(5) Aircraft and Air Traffic Control.

c. The REI, in general, would comply with current recommendations concerning electromagnetic interference.

d. Structures and generators might produce sonar interference affecting fishing, industrial, or military systems used in the area.

e. Site might produce acoustic noise or noise absorption or reflections which could mask or interfere with prescribed sound signals from other vessels or aids to navigation.

f. Structures, generators, and the seabed cabling within tie site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems.

g. The power and noise generated by an REI above or below the water would create physical risks that would affect the health of vessel crews.

Enclosure (5):

FACILITY CHARACTERISTICS

In addition to addressing the risk factors detailed in Enclosure 4, the Navigational Safety Risk Assessment (NSA) should include a description of the following characteristics related to the proposed REI:

1. Marine Navigational Marking

The applicant should determine —

a. How the overall site would be marked by day and by night taking into account that there may be an ongoing requirement for marking on completion of decommissioning, depending on individual circumstances.

b. How individual structures on the perimeter of and within the site, both above and below the sea surface, would be marked by day and by night.

c. If the site would be marked by one or more Radar Beacons (RACONS) and/or, an Automatic Identification System (AIS) transceiver, and if so, the data it would transmit.

d. If the site would be fitted with a sound signal, the characteristics of the sound signal, and where the signal or signals would be sited.

e. Whether the proposed site and/or its individual generators would comply in general with markings for such structures, as required by the Coast Guard or recommended by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), respectively.

f. Whether its plans to maintain its aids to navigation are such that the Coast Guard's availability standards (i.e., "on station and watching properly") are met at all times. Separate detailed guidance to meet any unique characteristics of a particular REI proposal should be addressed by the respective District Aids to Navigation branch.

g. The procedures that need to be put in place to respond to and correct casualties to the aids to navigation required by the Coast Guard, within the timeframes specified by the Coast Guard.

h. How the marking of the REI will influence existing Federal aids to navigation in the vicinity of the REI.

2. Standards and Procedures for REI Shutdown in the Event of a Search and Rescue, Pollution, or Security Operation

A. Wind Park

(1) Design Requirements: The wind park should be designed and constructed to satisfy the following recommended design requirements for emergency rotor shutdown in the event of a search and rescue (SAR), counter pollution, or salvage operation in or around a wind park:

(a) All wind turbine generators (WTGs) should be marked with clearly visible unique identification characters (e.g., alpha-numeric labels such as "Al," "B2."). The identification characters should each be illuminated by a low-intensity light visible from a vessel, or be coated with a phosphorescent material, thus enabling the structure to be detected at a suitable distance to avoid a collision with it. The size of the identification characters in combination with the lighting or phosphorescence should be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer, and at a distance of at least 150 yards from the turbine. It is recommended that, if lighted, the lighting for this purpose be hooded or baffled to avoid unnecessary light pollution or confusion with navigation aids. (Precise dimensions to be determined by the height of lights and necessary range of visibility of the identification numbers).

(b) All WTGs should be equipped with control mechanisms that can be operated from an operations center of the wind park.

(c) Throughout the design process for a wind park, appropriate assessments and methods for safe shutdown should be established and agreed to through consultation with the Coast Guard and other emergency support services.

(d) The WTG control mechanisms should allow the operations center personnel to fix and maintain the position of the WTG blades as determined by the applicable Coast Guard command center.

(e) Nacelle hatches should be capable of being opened from the outside. This would allow rescuers (e.g. helicopter winch-man) to gain access to the tower if tower occupants are unable to assist or when sea-borne approach is not possible.

(f) Access ladders, although designed for entry by trained personnel using specialized equipment and procedures for turbine maintenance in calm weather, could conceivably be used in an emergency situation to provide refuge on the turbine structure for distressed mariners. This scenario should therefore be considered when identifying the optimum position of such ladders and take into account the prevailing wind, wave, and tidal conditions.

(2) Operational Requirements: Operation of all REIs should be continuously monitored by the facility's owners/operators, ostensibly in an operations center. Recommended minimum

requirements for an REI operations center are:

(a) The operations center should be manned 24 hours a day.

(b) The operations center personnel should have a chart indicating the Global Positioning System (GPS) position and unique identification numbers of each of the WTGs in the wind park.

(c) All applicable Coast Guard command centers (Sector and District) will be advised of the contact telephone number of the REI's operations center.

(d) All applicable Coast Guard command centers will have a chart indicating the GPS position and unique identification number of each of the WTGs in all wind parks.

(3). Operational Procedures:

(a) Upon receiving a distress call or other emergency alert from a vessel that is concerned about a possible allision with a WTG or is already close to or within the wind park, the Coast Guard Search and Rescue Mission Coordinator (SMC) will establish the position of the vessel and the identification numbers of any WTGs visible to the vessel. The position of the vessel and identification numbers of the WTGs will be passed immediately to the REI's operations center by the SMC.

(b) The REI's operations center should immediately initiate the shut-down procedure for those WTGs as requested by the SMC, and maintain the WTG in the appropriate shutdown position, again as requested by the SMC, until receiving notification from the SMC that it is safe to restart the WTG.

(c) Communication and shutdown procedures should be tested satisfactorily at least twice each year.

(d) After an allision, the applicant should submit documentation that verifies the structural integrity of the WTG. Reports should be made in accordance with the Marine Casualty Regulations in 46 Code of Federal Regulations, Part 4.

B. Marine *or Riverine* Current Turbine

~~This section TO BE DEVELOPED.~~

(1) Design Requirements: Marine or riverine current turbine REIs should be designed and constructed to satisfy the following recommended design requirements for emergency shut-down of the turbine blades in the event of a search and rescue (SAR), counter pollution, or salvage operation in or around the REI:

(a) The navigational buoy(s) and structures marking each marine or riverine current turbine (M/RCT) should be marked with clearly visible unique identification characters (e.g., alpha-numeric labels such as "Al," "B2."). The identification characters should each

be illuminated by a low-intensity light visible from a vessel, or be coated with a phosphorescent material, thus enabling the buoy or structure to be detected at a suitable distance to avoid a collision with it. The size of the identification characters in combination with the lighting or phosphorescence should be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer, and at a distance of at least 150 yards from the buoy or structure. It is recommended that, if lighted, the lighting for this purpose be hooded or baffled to avoid unnecessary light pollution or confusion with navigation aids. (Precise dimensions to be determined by the height of lights and necessary range of visibility of the identification numbers).

(b) All M/RCTs should be equipped with control mechanisms that can be operated from an operations center of the REI.

(c) Throughout the design process, appropriate assessments and methods for safe shutdown should be established and agreed to through consultation with the Coast Guard and other emergency support services.

(d) The M/RCT control mechanisms should allow the operations center personnel to fix and maintain the position of the M/RCT blades as determined by the applicable Coast Guard command center.

(e) Although navigational buoys or marking structures are intended to be accessed by trained personnel in calm weather for duties such as maintenance of lights and sound signal, any buoy or structure, could conceivably be used in an emergency situation to provide refuge for distressed mariners. This scenario should therefore be considered when identifying the optimum placement or position of such ladders and take into account the prevailing wind, wave, and tidal or current conditions.

(f) For moored systems, limits of mooring excursion should be calculated and plotted on charts recommended in (2)(b) and (d) below.

(2) <u>Operational Requirements:</u> Operation of all M/RCTs should be continuously monitored by the facility's owners/operators, ostensibly in a shore-based operations center. Recommended minimum requirements for an REI operations center are:

(a) The operations center should be manned 24 hours a day.

(b) The operations center personnel should have a chart indicating the Global Positioning System (GPS) position and unique identification numbers of each of the M/RCT and position of each navigational buoy or marking structure in the REI.

(c) All applicable Coast Guard command centers (Sector and District) will be advised of the contact telephone number of the REI's operations center.

(d) All applicable Coast Guard command centers will have a chart indicating the GPS

position and unique identification number of each of the M/RCT and navigational buoy or marking structure in all REIs.

(3). Operational Procedures:

(a) Upon receiving a distress call or other emergency alert from a vessel that is concerned about a possible allision with a M/RCT, its navigational buoy, or marking structure or is already close to or within the REI, the Coast Guard Search and Rescue Mission Coordinator (SMC) will establish the position and draft of the vessel and the identification numbers of any potentially impacted M/RCT navigational buoy or marking structures visible to the vessel. The draft and position of the vessel and identification numbers of the M/RCT markers will be passed immediately to the REI's operations center by the SMC.

(b) The REI's operations center should immediately initiate the shutdown procedure for those M/RCTs as requested by the SMC, and maintain the M/RCTs in the appropriate shutdown position, again as requested by the SMC, until receiving notification from the SMC that it is safe to restart.

(c) Communication and shutdown procedures should be tested satisfactorily at least twice each year.

(d) After an allision, the applicant should submit documentation that verifies the structural integrity of the M/RCTs, the structural integrity of navigational buoys/marking structures and the condition of lights and sound signals. Reports should be made in accordance with the Marine Casualty Regulations in 46 Code of Federal Regulations, Part 4.

C. Wave Generator

~~This section TO BE DEVELOPED.~~

(1) Design Requirements: Wave generator REIs should be designed and constructed to satisfy the following recommended design requirements for emergency shutdown of the devices in the event of a search and rescue (SAR), counter pollution, or salvage operation in or around the REI:

(a) The navigational buoy(s) and structures marking each wave generator device (WGD) should be marked with clearly visible unique identification characters (e.g., alpha-numeric labels such as "Al," "B2."). The identification characters should each be illuminated by a low-intensity light visible from a vessel, or be coated with a phosphorescent material, thus enabling the buoy or structure to be detected at a suitable distance to avoid a collision with it. The size of the identification characters in combination with the lighting or phosphorescence should be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer, and at a distance of at least 150 yards from the marker. It is recommended that, if lighted, the lighting for this purpose be hooded or baffled to avoid unnecessary light pollution or confusion with navigation aids. (Precise dimensions to be determined by the height of lights and necessary range of

visibility of the identification numbers).

(b) All WGDs should be equipped with control mechanisms that can be operated from an operations center of the REI.

(c) Throughout the design process, appropriate assessments and methods for safe shutdown should be established and agreed to through consultation with the Coast Guard and other emergency support services.

(d) The WGD control mechanisms should allow the operations center personnel to fix and maintain the position of the WGD as determined by the applicable Coast Guard command center.

(e) Although navigational buoys or marking structures are intended to be accessed by trained personnel by trained personnel in calm weather for duties such as maintenance of lights and sound signal, any buoy or structure, could conceivably be used in an emergency situation to provide refuge for distressed mariners. This scenario should therefore be considered when identifying the optimum placement or position of such ladders and take into account the prevailing wave, and tidal conditions.

(f) For moored systems, limits of mooring excursion should be calculated and plotted on charts recommended in (2)(b) and (d) below.

(2) <u>Operational Requirements:</u> Operation of all WGDs should be continuously monitored by the facility's owners/operators, ostensibly in a local, shore-based operations center. Recommended minimum requirements for an REI operations center are:

(a) The operations center should be manned 24 hours a day.

(b) The operations center personnel should have a chart indicating the Global Positioning System (GPS) position and unique identification numbers of each of the WGD and navigational buoys or marking structures in the REI.

(c) All applicable Coast Guard command centers (Sector and District) will be advised of the contact telephone number of the REI's operations center.

(d) All applicable Coast Guard command centers will have a chart indicating the GPS position and unique identification number of each of the WGD and navigational buoy or marking structure in all REIs.

(3) <u>Operational Procedures:</u>

(a) Upon receiving a distress call or other emergency alert from a vessel that is concerned about a possible allision with a WGD, its navigational buoy, or marking structure or is already close to or within the REI, the Coast Guard Search and Rescue Mission Coordinator (SMC) will establish the position and draft of the vessel and the identification

numbers of any potentially impacted WGD navigational buoy or marking structures visible to the vessel. The draft and position of the vessel and identification numbers of the WGD markers will be passed immediately to the REI's operations center by the SMC.

(b) The REI's operations center should immediately initiate the shutdown procedure for those WGDs as requested by the SMC, and maintain the WGDs in the appropriate shut-down position, again as requested by the SMC, until receiving notification from the SMC that it is safe to restart.

(c) Communication and shutdown procedures should be tested satisfactorily at least twice each year.

(d) After an allision, the applicant should submit documentation that verifies the structural integrity of the WGDs, the structural integrity of navigational buoys/marking structures and the condition of lights and sound signals. Reports should be made in accordance with the Marine Casualty Regulations in 46 Code of Federal Regulations, Part 4.

D. Solar

This section TO BE DEVELOPED.