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BOEM 2022-012

Supporting National Environmental Policy Act Documentation for Offshore Wind Energy Development Related to Munitions and Explosives of Concern and Unexploded Ordnances

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Authors:
Pamela Middleton
Jennifer Salerno
Bethany Barnhart

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By
Booz Allen Hamilton
8283 Greensboro Ave
McLean, Virginia

DISCLAIMER

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List of Abbreviations and Acronyms

ALARP	As Low As Reasonably Practical
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
EIS	Environmental Impact Statement
MEC	Munitions and Explosives of Concern
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
T&E	Threatened and Endangered
UXO	Unexploded Ordnances
WEA	Wind Energy Area

Executive Summary

Munitions and explosives of concern (MEC) and unexploded ordnances (UXO) are a concern in offshore wind development. The risk can be greatly reduced or eliminated through procedures in place such as research, surveys, and risk analysis. Mapped UXO disposal areas have already been excluded from potential offshore wind development, thereby reducing the likelihood of a leaseholder encountering UXO within their lease area. Applying the "As Low As Reasonably Practical (ALARP)" risk mitigation process is the method of investigation BOEM recommends to identify UXO. Overall, UXO are not a major risk for an offshore wind developer, but still one to take seriously due to the number of military activities that have taken place in U.S. waters.

The purpose of this white paper is to provide a brief overview of the typical steps to taken by a lessee in consideration of UXO when preparing a Construction and Operations Plan (COP) and potential mitigation measures for incorporation by reference in BOEM's environmental impact statements (EIS) for proposed offshore wind projects.

1 Introduction

Munitions and explosives of concern (MEC) and unexploded ordnances (UXO) are project hazards to be identified by leaseholders and analyzed for occurrence in offshore wind projects. MEC are defined in 32 Code of Federal Regulations (CFR) §179.3 as "specific categories of military munitions that may pose unique explosives safety risks." UXO are a subset under MEC defined as "military munition that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and remain unexploded whether by malfunction, design, or any other cause (32 CFR §179.3)." The term 'UXO' will primarily be used for the remainder of this document. While UXO may not be present within every offshore wind energy project area, the subject must be included in a leaseholder's Construction and Operations Plan (COP) and in the National Environmental Policy Act (NEPA) analysis prepared by the Bureau of Ocean Energy Management (BOEM) prior to its decision whether to approve the project.

This white paper provides a brief overview of the typical steps taken by a lessee in consideration of UXO when preparing a COP and the mitigation options, if UXO are found within a project area. The potential impacts of those mitigation measures are summarized and can be incorporated by reference in BOEM's environmental impact statements (EIS) for proposed offshore wind projects.

1.1 Background

Wind energy development in Europe and the United Kingdom (UK) has been in production since the 1990s. The prevalence of UXO found in the offshore environment in Europe is exponential compared to those found along the outer continental shelf in the United States (U.S.). As with much of the offshore wind industry in the U.S., many leaseholders have experience in Europe or UK, or they reference industry practices across the Atlantic for insight into offshore wind development. Because of the war time activities related to WWI and WWII, UXO are far more common in Europe and the UK, the issue may receive more attention in the U.S. than is warranted.

Most UXO identified along the U.S. Atlantic coast are small, about a meter or less in size. Locations of UXO disposal areas have already been excluded from potential offshore wind development, thereby reducing the likelihood of a leaseholder encountering a UXO within their lease area. Overall, UXO are not a major risk for an offshore wind developer, but still one to take seriously due to the number of military activities that have taken place in U.S. waters. A desktop study to identify UXO risks within a lease area is part of the COP development. Surveys to investigate and identify UXO may be warranted to reduce risks to levels as low as reasonably practical, are also considered part of the permitting process, and must be complete prior to equipment installation.

2 Study and Investigation for COPs

UXO are found offshore in most U.S. coastal waters and can present danger to humans or animals from injury or death and can damage or destroy boats or equipment, if detonated. Understanding where the proposed project is located relative to historic or present military exercise areas and known UXO locations helps to determine the safest positions for turbines, substations, and cable routes.

Applying the "As Low As Reasonably Practical (ALARP)" risk mitigation process helps direct the investigation to identify UXO. Briefly, the ALARP is comprised of the following five steps:

- A desktop study,
- Investigation surveys to determine the presence of objects,

- Identification surveys to determine the nature of identified objects,
- Removal of identified UXO and/or construction relocation/rerouting, and
- Project installation (de Lange, 2015).

Further detail of ALARP can be found in this article from Hydro International (de Lange, 2015). ALARP aims to consider mitigation while being cost effective and efficient. Additionally, BOEM contracted a study in 2017 to further describe in detail how a lessee should incorporate risk management into MEC/UXO studies and mitigation (Carton, et al., 2017).

There are resources available to prepare a cursory desktop overview of UXO for a project area. The following are a few examples of maps, data, and information to help with wind energy area (WEA) project siting:

- Unexploded Ordnance Dataset, National Oceanic and Atmospheric Administration (NOAA): https://catalog.data.gov/dataset/unexploded-ordnance-areas (Data.gov, 2021 a)
- MarineReports (BOEM/NOAA) at: https://marinecadastre.gov/oceanreports (Marine Cadastre, 2021)
- Formerly Used Defense Sites (Unexploded Ordnances), NOAA from Data.gov: https://catalog.data.gov/dataset/formerly-used-defense-sites-unexploded-ordnances (Data.gov, 2021 b)
- Munitions and Explosives of Concern Survey Methodology and In-field Testing for Wind Energy Areas on the Atlantic Outer Continental Shelf, available at this link (Carton, et al., 2017).

Research of a preliminary project site followed by additional intrusive and non-intrusive geophysical surveys are combined to support that unknown UXO are not present. Investigation surveys and associated finding reports are generally required following the desktop study unless waived by BOEM. BOEM has made recommendations to include a risk assessment when evaluating and assessing sites for UXO to protect human health and the environment using the ALARP process.

A preliminary risk assessment framework for MEC/UXO is described in Chapter 5 of BOEM's *MEC Survey Methodology and in-field Testing for Wind Energy Areas on the Atlantic OCS* (Carton, et al., 2017). Figure 1 is a graphic example of the risk management framework for MEC/UXO.

What to do if an UXO is Encountered

Developer—stop work, note location, and move away from UXO.

Leaseholder—re-assess project plan. Can operations be moved a safe distance? Does it make sense to have the UXO removed by a contractor?

BOEM should be contacted and apprised of the situation.

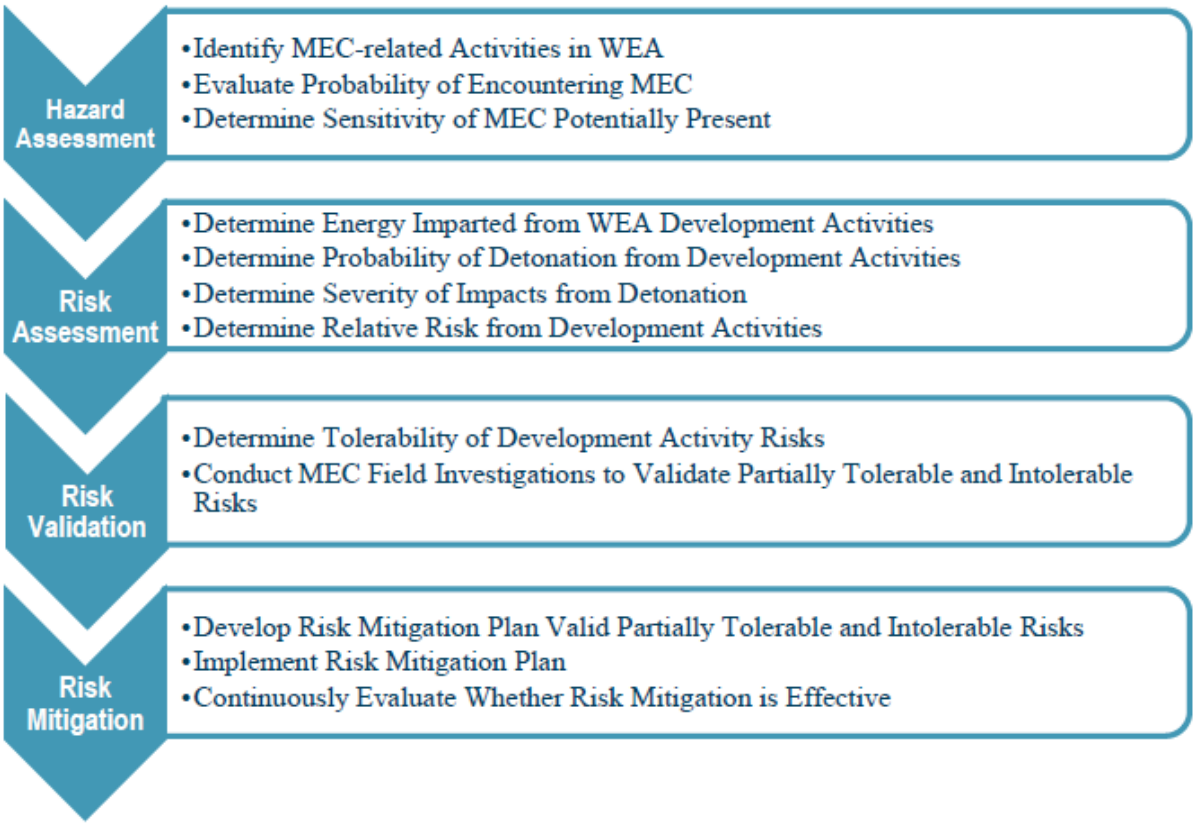

Figure 1. MEC Risk Management Framework
(Carton, et al., 2017)

Risk management and ALARP, combined with the unique aspects of the project and location, inform mitigation options for analysis in the EIS.

3 Options for Mitigation

Mitigation measures are applied and analyzed by the lessee when one or many UXO have been identified in a project area. These mitigation measures include risk-based assessments for identified UXO. Mitigation options are determined based on object location, size, and condition of the UXO, in addition to risk management and ALARP. Several mitigation approaches applied in the management alternatives for analysis in the EIS support the decisions for how the UXO is ultimately managed. Items considered to develop mitigation measures include the following:

- Flexibility of project design and lease location.
- Density of UXO.
- Types of UXO.
- Presence of sensitive species such as marine mammals, sea turtles, fish, or avian species listed as threatened and endangered (T&E), or critical habitat for listed species.
- Presence of historic or cultural resources.

The full range of information should be used to determine possible mitigation measures for analysis in the EIS. The analysis and final project decisions (preferred alternative/proposed plan) are built on the unique characteristics of the project, the affected environment surrounding the project, the degree of known hazard, and the financial/logistical feasibility of the mitigation actions. Mitigation measures for UXO are briefly described below.

Re-route or re-position. This is the most common approach for UXO mitigation. Alternatives include moving a proposed export cable to use an existing cable corridor as an alternate route, if the option is available. Making location adjustments to inter-array cable, export cable, and turbines within the lease area to avoid UXOs is the first and often least expensive mitigation option. Location adjustments are usually limited to 15 to 30 meters, not a major modification to plans. Using re-routing or re-positioning, most UXO can be avoided and lease development can proceed as planned.

Relocate or removal. Relocating or removing UXO is not a common mitigation measure due to the high risk and cost associated with this option. Most UXO are avoidable and lease development can continue with just a slight adjustment to plans. If this is not possible, this measure may include moving the item a short distance within the marine environment from a planned cable route or turbine location, which would be high risk and moderate cost. Relocation by moving an item out of the marine environment to a secure location on shore is a very high-risk, high-cost option that could also affect the project schedule. Securing and removing UXO for detonation elsewhere may also be considered. If relocation or removal is deemed by developers as the only option, a thorough plan would be required, including how the UXO is to be moved, where the UXO is proposed to be relocated, if/how the UXO will be monitored though the life of the project, and a description of safety protocols including how the Safety Management system would include UXO relocation/removal activities.

Detonate/incinerate in place. These measures are high-risk and high-cost mitigation options, generally considered a least desirable option. In-situ underwater detonation or incineration may be a viable measure if the UXO cannot be avoided using re-routing and re-location is not desirable.

Certain locations and conditions may prove that this option is the best mitigation measure for the project. If this measure was deemed the only option, a thorough plan would be required, including protective measures for marine life, cultural resources, and human health and safety. (Geneva International Centre for Humanitarian Demining, 2016)

Table 1 contains information regarding each of the three mitigation measures presented and includes overarching benefits, disadvantages, and common impacts. These three mitigation measures may be applied as appropriate to projects and expanded upon, considering the cultural, socioeconomic, and natural resources present in the project area.

Table 1. Examples of Pros, Cons, and Impacts from Mitigation

Mitigation Type	Benefits	Disadvantages	Common Impacts
Re-route/ re-position	• Lower cost • Low hazard • Takes less time to complete changes to plans	• UXO can drift/migrate[1] • Additional study for UXO drift/ movement[1] • Project delays	More seafloor disturbance if export cable relocation is not the shortest route; similar disturbance issues if inter-array cable is lengthened or distances are increased.
Re-locate	• Reduction of hazard • Removal of hazard item	• Additional surveys for re-siting UXO, marine mammals, T&E species, etc. • Possible danger of detonation • Project delays	Socioeconomic due to project delays. Cost to developer is moderate to high.

Mitigation Type	Benefits	Disadvantages	Common Impacts
Detonate/ incinerate	• Removal of hazard item • Removal of future items of concern	• High danger • High cost • May cause schedule delays while surveying for and clearing protected species and marine mammals for detonation[2]	Shock waves can cause damage to the seafloor, marine habitat, nearby boats or structures, and injury (or death) to humans and aquatic species, including causing hearing damage.[2] Detonation procedures can be dangerous to divers. Possible release of chemicals or waste. Socioeconomic due to project delays.

[1] (REASeuro, 2019)
[2] (Geneva International Centre for Humanitarian Demining, 2016)

4 Summary/Conclusion

UXO are a concern for offshore wind development; however, with research, surveys, and risk analysis, the danger can be greatly reduced or eliminated. Procedures are in place during and following COP development to ensure turbines and infrastructure within offshore wind farms are not affected by the presence of UXO. As offshore wind development continues, more resources, survey tools, and databases will improve and become more robust. Similarly, new mitigation options may arise, adding more opportunities to address UXO in offshore wind development.

5 References

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