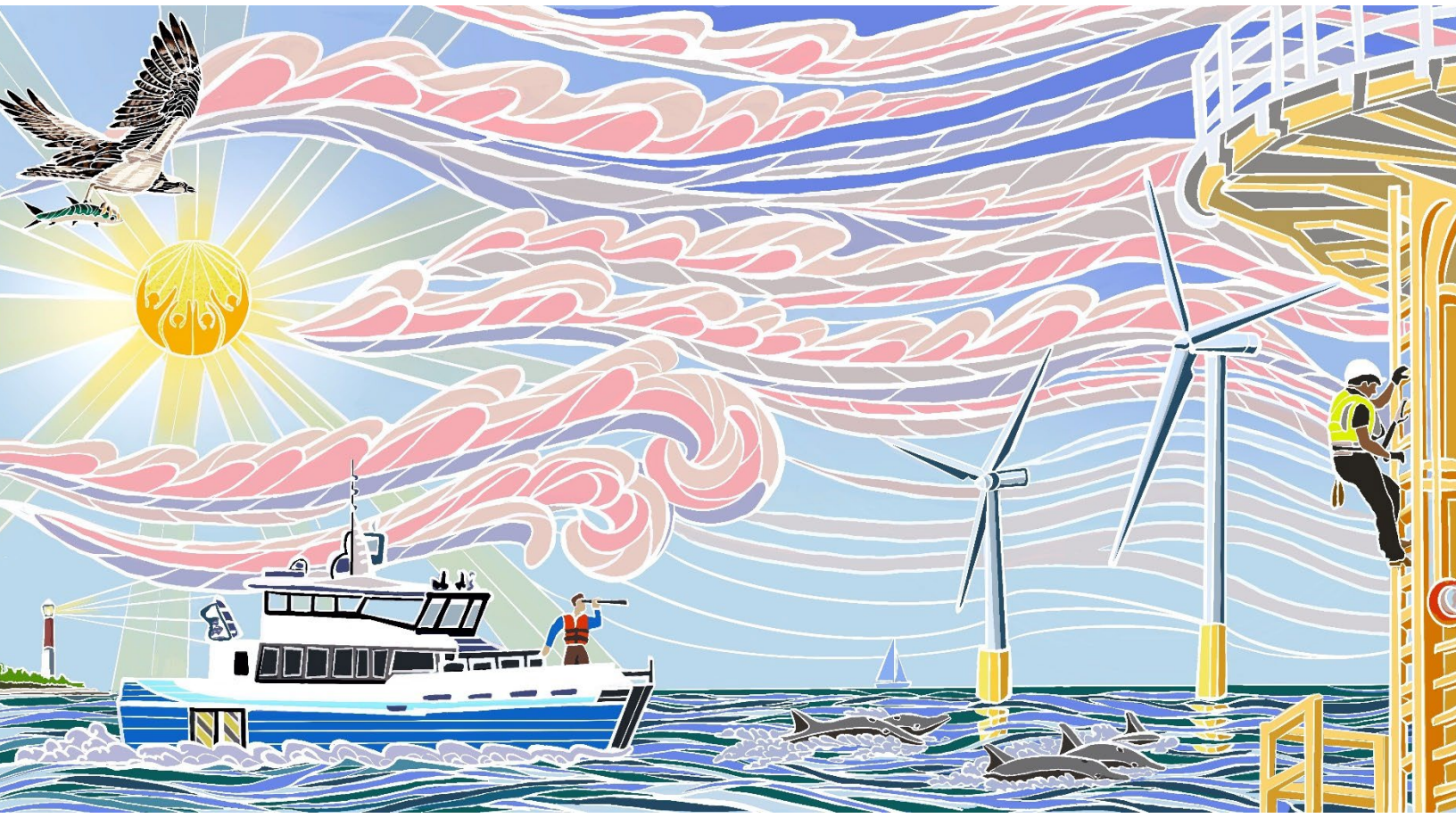

Appendix II-U4

Search and Rescue Risk (SAR) Assessment Workshop Summary Report

March 2024

Atlantic Shores SAR Risk Assessment Workshop Summary Report

Document Identity: Atlantic Shores SAR Risk Assessment Workshop Summary Report– Rev0

Release: October 2021

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List of Abbreviations

Abbreviation	Definition
ADLS	Aviation detection lighting system
AGL	Above Ground Level
AOR	Area of responsibility
BOEM	Bureau of Ocean Energy Management
EMT	Emergency Medical Technician
ERP	Emergency Response plan
FAA	Federal Aviation Administration
HAZID	Hazard Identification
IFR	Instrument Flight Rules
NOAA	National Oceanic and Atmospheric
NTMs	Notice to Mariners
NVIC	Navigation and Vessel Inspection Circular
OSS	Offshore Substations
PIW	Person in water
SAR	Search and Rescue
USCG	United Stated Coast Guard
VFR	Visual Flight Rules
VHF	Very High Frequency
WTA	Wind Turbine Area
WTG	Wind Turbine Generator

Introduction

This document summarizes the outcome of the Search and Rescue (SAR) Risk Assessment Workshop (the workshop) conducted in July 2021. The objective of the workshop was to methodically review the potential impacts of the proposed offshore wind projects (the projects) within the Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0499 (the Lease Area) on the United States Coast Guard (USCG)'s SAR operations and identify existing safeguards and additional recommended measures to mitigate these impacts. The results from this workshop will inform the development of Atlantic Shores Offshore Wind, LLC (Atlantic Shores)'s Emergency Response Plan (ERP) as well as Atlantic Shores' ongoing efforts to implement practical measures that mitigate any potential impacts of the projects to other ocean users.

Workshop Overview and Scope

The SAR Risk Assessment Workshop was held on July 20, 2021 from 12:30PM – 5:00PM ET and on July 21 from 1:30PM – 5:00PM ET via Microsoft Teams. The workshop included attendees from Atlantic Shores, the USCG, and BOEM along with other relevant stakeholders. A complete list of attendees can be found in Appendix A: Workshop Attendees.

The scenarios that were developed and assessed during the workshop focused specifically on foreseeable interactions between the proposed projects within the Lease area and helicopter-based SAR operations conducted by the USCG in and around the Lease area. The workshop took into consideration the proposed Wind Turbine Generator (WTG) dimensions and layout as proposed in the Project Design Envelope (PDE), including a 1,047 ft maximum tip height, a 919 ft rotor diameter, and a 1.0 x 0.6 nm turbine spacing. Build out of the full Lease Area was considered, including the area covered by the Construction and Operation Plan (COP) currently under review for the southern portion of the Lease Area as well and the northern portion of the Lease Area which will be covered in a future COP. Figure 1 shows these areas outlined in red and grey respectively.

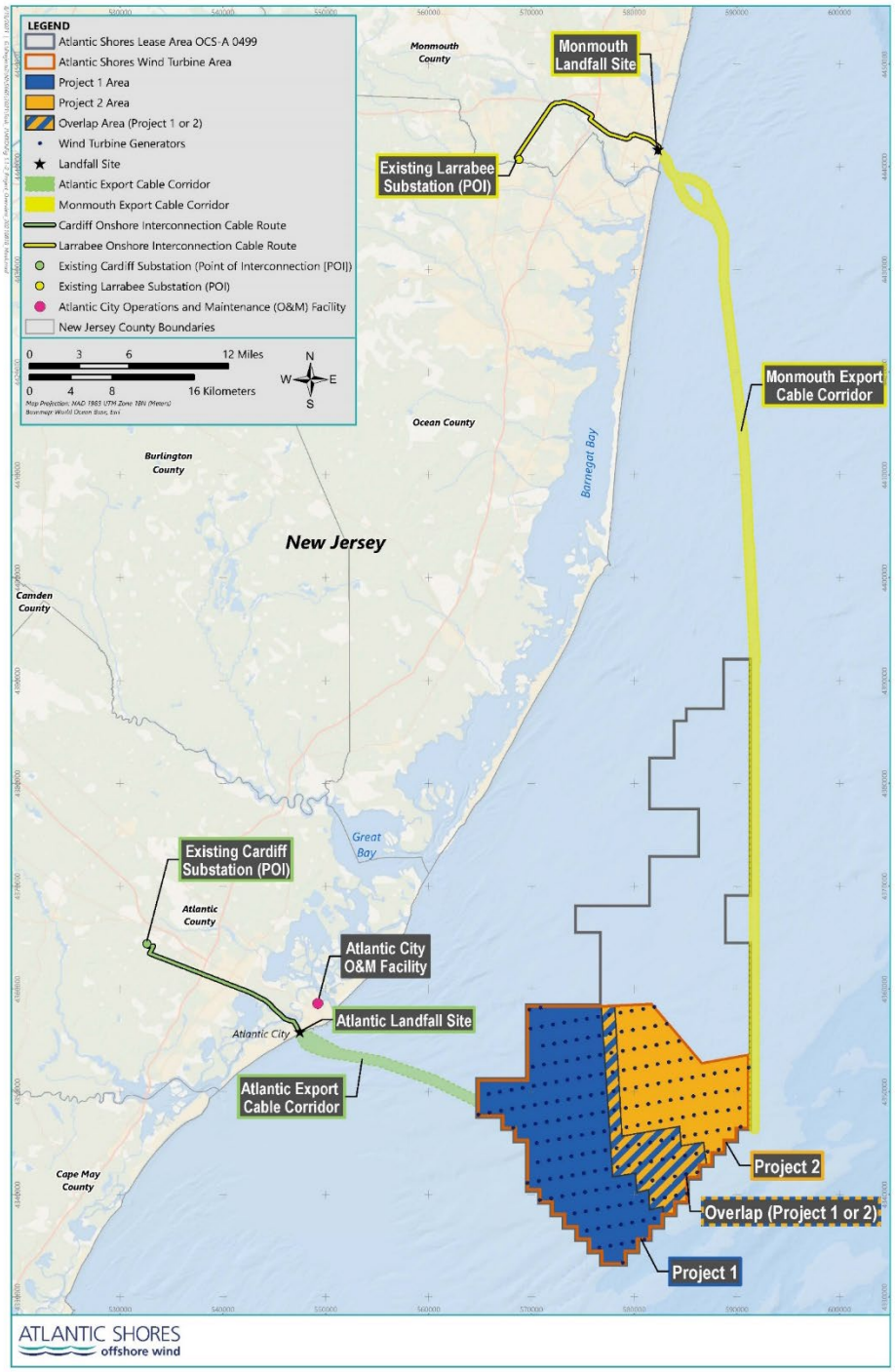

Figure 1: Lease OCS-A 0499

Atlantic Shores has already committed to mitigation measures or safeguards that meaningfully reduce the risk associated with conducting SAR operations in and around the proposed projects. These safeguards were reviewed during the workshop and considered when performing the risk assessments. These safeguards are summarized in Table 1.

Table 1: Existing Safeguards

Existing Safeguards
1) A Marine Coordination Center is to be established, led by a Marine Coordinator. Activities of this Center will include monitoring daily vessel movements, implementing of communication protocols with external vessels, and monitoring safety buffers. The Marine Coordinator will be Atlantic Shore's primary point of contact with USCG, port authorities, and state and local law enforcement.
2) Real-time meteorological/oceanographic measurements (waves, wind, currents) will be monitored across the Lease Area.
3) Atlantic Shores will regularly coordinate with the USCG and NOAA on chart updates as project components (e.g., foundations, WTGs, OSSs) are constructed, and regarding the issuance of Notices to Mariners (NTMs).
4) A Fisheries Liaison Officer has been hired as part of an overall Fisheries Communication Plan and will communicate and coordinate with the local commercial and recreational fishing community during the construction phase.
5) Coordination will be carried out with local port authorities on development of vessel traffic management plans for the various staging ports.
6) All construction and decommissioning vessels will display appropriate navigation lights and day shapes as per regulatory requirements.
7) Once constructed WTGs and OSSs will be marked and lit in accordance with USCG and BOEM requirements.
8) Aviation obstruction lighting will be provided on constructed WTGs and OSSs in accordance with FAA and BOEM requirements.
9) The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures will be provided.
10) Implementation of rotor emergency braking system to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts.
11) Possible provision of access ladders as a possible refuge for distressed mariners and a signaling device (to indicate presence on the structure).
12) Bi-annual testing of the communication and rotor braking systems.
13) Blades can be oriented to allow for nearly 1 nm access corridor in east-west direction

Methodology

The workshop was facilitated by ABS Group and conducted using a hazard identified (HAZID) approach. Identified scenarios were assessed qualitatively to identify potentially hazardous conditions, assess potential consequences, identify existing mitigations, and document additional recommendations for consideration to further mitigate the consequences of the hazardous scenario. Only hazardous scenarios that were materially impacted by the development of the proposed projects were evaluated. This process is summarized in Figure 2.

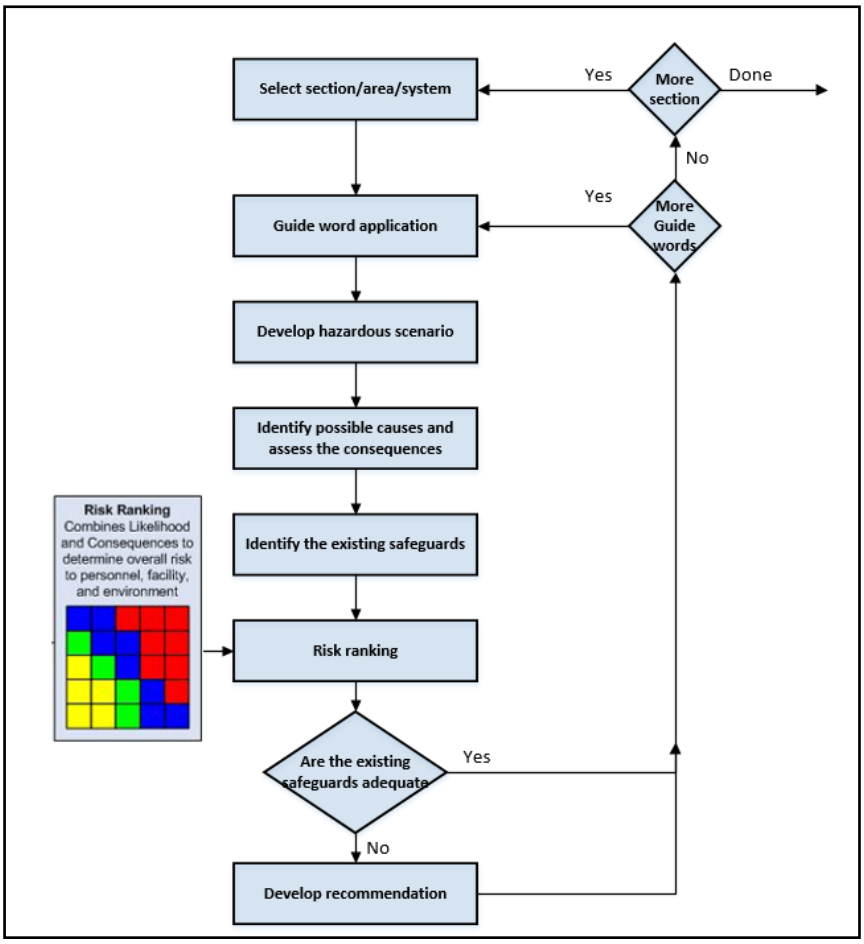

Figure 2: The HAZID Study Process

A Risk Assessment Worksheet was used to capture the discussion during the workshop and contains the following elements:

Hazard describes a broad category of factors that could lead to a hazardous scenario.
Hazardous Scenario describes a specific occurrence that could lead to consequences.
Causes describes a specific event that could occur in a hazardous scenario and result in a consequence.
Consequences refer to specific adverse impacts that result from a given hazardous scenario.
Safeguards are existing or planned measures that reduces the likelihood or severity of a given consequence.
Risk Ranking describes the risk associated with a particular consequence given the existing safeguards.

Recommendations are additional measures that could be considered to further reduce the risk associated with a given consequence.
Mitigated Risk is the risk ranking of a particular consequence after both the safeguards and recommendations are taken into consideration.
Remarks is used to capture any additional discussion that is not captured elsewhere in the worksheet related to a particular hazardous scenario.

A risk assessment was performed for each potential consequence to assign an existing risk level considering only existing safeguards. A summary of these existing safeguards can be found in Table 1. After additional recommended mitigations were identified, a second risk assessment was performed to find the risk level after implementing the identified recommendations. The risk rankings were assessed using the Risk Matrix shown in Figure 3 based on the "severity" and "likelihood" of the worst credible consequence. The worst credible consequence represents the most severe consequence that could reasonably be foreseen to occur as a result of the identified hazardous scenario. The likelihood is based on the probability of the selected worst credible consequence occuring.

Likelihood is ranked from A to E in increasing event frequency, and consequence is ranked from 0 to 5 in increasing severity. Figure 3 provides additional detail on the definition of likelihood and consequence severity levels. Once a likelihood and consequence severity are assigned, the risk matrix can be used to determine a risk ranking – a number/letter combination and corresponding color. Each color indicates a comparable overall level of risk regardless of the specific number/letter designation.

Light Blue – Very Low Risk
Dark Blue – Low Risk
Yellow – Moderate Risk
Red – High Risk

Mitigations and recommendations were considered that addressed moderate and high risk consequences. A mitigation that reduces the overall level of risk (for example, moving from a Red to a Yellow) is more impactful than a mitigation that changes the risk designation but does not change the overall risk level (for example, moving from a Yellow to a Yellow). Comparing the severity of the Risk Ranking and the Mitigated Risk provides an indication of the effectiveness of the recommendations for a given scenario at reducing the overall risk.

Event Frequency			Consequence Severity					
			0	1	2	3	4	5
	E	Has happened more than once per year at the Location	0E	1E	2E	3E	4E	5E
	D	Has happened at the Location or more than once per year in the Organization	0D	1D	2D	3D	4D	5D
	C	Has happened in the Organization or more than once per year in the industry	0C	1C	2C	3C	4C	5C
	B	Heard of in industry	0B	1B	2B	3B	4B	5B
	A	Never heard of in industry	0A	1A	2A	3C	4C	5A

Severity	People	Asset	Environment	Reputation
0	No injury or health effect	No Damage	No Effect	No Impact
1	Slight injury or health effect	Slight Damage < $10K USD	Slight Effect Contained within the facility	Slight Impact Local public awareness, but no media coverage
2	Minor injury or health effect	Minor Damage $10K to $100K USD	Minor Effect Minor environmental damage, but no lasting effect	Minor Impact Local public concern, local media coverage
3	Major injury or health effect	Moderate Damage $100K to $1M USD	Moderate Effect Limited environmental damage that will persist or require cleaning up	Moderate Impact Regional public concern, local stakeholders, e.g., community, NGO, industry, and government are aware, extensive local media attention, some regional and national media coverage
4	PTD or up to 3 fatalities	Major Damage $1M to $10M USD	Major Effect Severe environmental damage that will require extensive measures to restore beneficial uses of the environment	Major Impact National public concern, impact on local and national stakeholders, extensive attention in national media, some international media coverage, potential for regulatory action leading to restricted operations or impact on operating licenses
5	More than 3 fatalities	Massive Damage > $10M USD	Massive Effect Persistent, severe environmental damage that will lead to a loss of commercial, recreational use	Massive Impact International public concern, high level of concern amongst governments and action by international NGOs, international media attention, significant potential for effect on

Figure 3: Risk Matrix

Results and Recommendations

During the 2-day workshop, the team identified and evaluated 13 hazardous scenarios in 4 hazard categories, including Marine Hazards, Wind Farm Infrastructure, Helicopter Operations, and SAR Operations. Throughout the workshop, 16 reccomendations were made to support the reduction of overall risk to USCG missions resulting from the full build-out of the offshore wind facility in Atlantic Shores Lease OCS-A 0499. These risk mitigation recommendations and assessed potential for reducing risk are summarized in Table 2. The full outcome of the workshop is captured in Appendix B: Risk Assessment Worksheet.

Atlantic Shores will review these recommendations in coordination with the USCG and key stakeholders and may elect to implement recommendations that are found to meaningfully reduce risk and meet other project criteria.

Table 2: Recommendations

Hazard Category	Recommendation	Existing Risk					Mitigated Risk				
		S	E	Sev.	L	RR	S	E	Sev.	L	RR
Marine Hazard	1. Evaluate need for VHF direction finding equipment to aid helicopter search and rescue operation. Presence of windfarm may lead to scenario where helicopter pilots might have difficulty in navigating through windfarm. Presence of VHF direction finding equipment will support helicopter pilots during search and rescue operation.	5	2	5	C	Red	5	2	5	B	Yellow
Marine Hazard	2. Develop an Emergency Response Plan (ERP) to specify coordination, shutdown, and rescue procedures associated with wind farm. The ERP will need to reviewed and updated regularly based on feedback received from Atlantic Shores and the USCG as windfarm operations evolve.	5	2	5	C	Red	5	2	5	B	Yellow
Marine Hazard Wind Farm Infrastructure	3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.	5	2	5	C	Red	5	2	5	B	Yellow
Marine Hazard	4. Review needs for development of training covering the following areas: • Search planning efforts • Pilot training • Hoist training • Pilot familiarization training • Lessons learned from international rescue training	5	2	5	C	Red	5	2	5	B	Yellow
Marine Hazard Wind Farm Infrastructure	5. Ensure WTG lights are compatible with night vision technologies to ensure they do not obstruct pilot visibility when night vision technologies are being used.	5		5	C	Red	5		5	B	Yellow
Marine Hazard Wind Farm Infrastructure	6. Review impact on aircraft radar readings due to WTG presence and if it can lead to any consequence of interest provide adequate safeguards accordingly. (Not ranked)										

Hazard Category	Recommendation	Existing Risk					Mitigated Risk				
		S	E	Sev.	L	RR	S	E	Sev.	L	RR
Wind Farm Infrastructure	7. Consider implementing passive monitoring in wind farm area to aid in locating of personnel during search operation in wind farm during emergency situations.	4		4	D	Red	4		4	B	Yellow
Wind Farm Infrastructure	8. Consider limiting access (e.g., safety zones) to wind farm during adverse weather conditions.	4		4	D	Red	4		4	B	Yellow
Wind Farm Infrastructure	9. Review communication protocol to inform concerned authority on emergency situations within windfarm area.	3		3	C	Yellow	3		3	B	Blue
Wind Farm Infrastructure	10. Review developing operating limitation of aircraft within wind farm to ensure aircraft can operate safely within wind farm area.	5		5	D	Red	5		5	B	Yellow
Wind Farm Infrastructure	11. Review means to limit the time helicopter spends in wind farm area during SAR operation.	5		5	D	Red	5		5	B	Yellow
Wind Farm Infrastructure	12. Review minimum spacing between WTGs to ensure to help mitigated risk of helicopters operations within wind farm area specifically during adverse weather conditions and icing conditions.	5		5	D	Red	5		5	B	Yellow
Wind Farm Infrastructure	13. Review needs for a single dedicated access corridor (>=1 nm) for helicopter through wind farm in a north-south direction.	3		3	D	Yellow	3		3	C	Yellow
Marine Hazard	14. Develop pilot training specific to operation within windfarm to ensure pilots are aware of hazards associated with the flying within and around wind farm area.	5	2	5	C	Red	5	2	5	B	Yellow
Wind Farm Infrastructure	15. Review if substation helipad (if implemented) can act as a safe haven for CG helicopters during emergency scenarios.	5	2	5	A	Yellow	5	2	5	A	Yellow
Wind Farm Infrastructure	16. Consider means measuring meteorological/oceanographic conditions outside of windfarm area to aid in Coast guard SAR operations outside of wind farm area.	3		3	C	Yellow	3		3	B	Blue

Appendix A: Workshop Attendees

Name	Organization
Alexis Billet	Atlantic Shores
Amanda Ingram	Epsilon Associates, Inc.
Baker, Arianna C	BOEM
Benjamin Aaronson	USCG
Brian Mottel	USCG
Colleen Brust	NJ DEP
Tim Eason	USCG
Jesse Diaz	USCG
Robert Webb	USCG
Stephen West	USCG
Chris Sparkman	USCG
Christopher Rein	EDR
Joseph Cimino	NJ DEP
Cristina Forbes	USCG
Dan Butierries	USCG
Darshankumar Lakhani	ABSG
Dwight Dunk	Epsilon Associates, Inc.
Francis Genco	ABSG
George Detweiler	USCG
Jack Frost	USCG
Jennifer Daniels	Atlantic Shores
Jerry Barnes	USCG
Jody Lima	EDR
Joris Veldhoven	Atlantic Shores

Name	Organization
Joseph Plunkett	USCG
Kyle Hilberg	Atlantic Shores
Andrew Cooke	USCG
Ashley Dufresne	USCG
Chris Pulliam	USCG
Chris Rosen	USCG
Mike Feltovic	USCG
Warren Wright	USCG
Louis Steinbrecher	ABSG
Lowell Dickerson	Atlantic Shores
Amanda Faulkner	USCG
Shawn Antonelli	USCG
Matt Creelman	USCG
Matthew Brooks	USCG
Monica Cisternelli	USCG
Paul Phifer	Atlantic Shores
Rain Byars	Atlantic Shores
Ryan Tookes	Atlantic Shores
Brandi Sangunett	BOEM
Dan Verda	Atlantic Shores
Will Waskes	BOEM

Appendix B: Risk Assessment Worksheet

Node: 1. SAR operations within/around the windfarm																
Hazard	**Hazardous Scenario**	**Causes**	**Consequences**	**Safeguards**	**Risk Ranking**					**Recommendations**	**Mitigated Risks**					**Remarks**
					P	**E**	**SR**	**LR**	**RR**		**P**	**E**	**SR**	**LR**	**RR**	
1. Marine Hazard	1. SAR operation in adverse weather condition during daytime	Adverse wind condition or sea state	1. Potential inability to physically control aircraft in adverse wind condition within wind farm area. Potential for aircraft damage if collision with WTG. Personnel injury/fatality. Potential effect on fuel load requirement and search pattern during search planning; delay in performing SAR operation. Inability or difficulty in performing the rescue operation. Potential exists for helicopter collision risk with wind turbine during flyout or emergency situations. Potential ineffective search operational efficiency/reduced probability to detect within wind farm area. Potential reduction in number of searches (helicopter and surface based) conducted because of wind farm presence and due to potential increased risk of collision with WTGs.	1. Real-time meteorological/oceanographic measurements (waves, wind, currents) will be monitored across the Lease Area and this information can be shared with USCG/NOAA.	5	2	5	C	Red	1. Evaluate need for VHF direction finding equipment to aid helicopter search and rescue operation. Presence of windfarm may lead to scenario where helicopter pilots might have difficulty in navigating through windfarm. Presence of VHF direction finding equipment will support helicopter pilots during search and rescue operation.	5	2	5	B	Yellow	1. Surface SAR operation is not part of this study scope and will be reviewed separately, as applicable
				2. Ability to shutdown wind turbines on request (shutdown time) Implementation of rotor emergency braking system to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts. Bi-annual testing of the communication and rotor braking systems						2. Develop an Emergency Response Plan (ERP) to specify coordination, shutdown, and rescue procedures associated with wind farm. The ERP will need to reviewed and updated regularly based on feedback received from Atlantic Shores and the USCG as windfarm operations evolve.						
				3. A Marine Coordination Center is to be established, led by a Marine Coordinator. Activities of this Center will include monitoring daily vessel movements, implementing of communication protocols with external vessels, and monitoring safety buffers. The Marine Coordinator will be Atlantic Shore's primary point of contact with USCG, port authorities, state and local law enforcement, marine patrol, port operators, and commercial operators (e.g., ferry, tourist, and fishing boat operators).						3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.						
				4. Atlantic Shores will regularly coordinate with the USCG and NOAA on chart updates as Project components (e.g., foundations, WTGs, OSSs) are constructed and regarding the issuance of Notices to Mariners (NTMs).						4. Review needs for development of training covering the following areas: • Search planning efforts • pilot training • Hoist training • Pilot familiarization training • Lessons learned from international rescue training						
				5.The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner						14. Develop pilot training specific to operation within windfarm to ensure pilots are aware of hazards associated with the flying within and around wind farm area.						

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
				towers/SPSs and perimeter structures will be provided. WTG foundation will also be marked with temporary lighting during construction phase												
				6. Aviation obstruction lighting will be provided on constructed WTGs and OSSs in accordance with FAA and BOEM requirements.												
		Adverse wind condition or sea state	1. Inability to perform SAR; potential personnel injury /fatality event	1. Aviation obstruction lighting will be provided on constructed WTGs and OSSs in accordance with FAA and BOEM requirements.	4		4	D	Red	1. Evaluate need for VHF direction finding equipment to aid helicopter search and rescue operation. Presence of windfarm may lead to scenario where helicopter pilots might have difficulty in navigating through windfarm. Presence of VHF direction finding equipment will support helicopter pilots during search and rescue operation.	4		4	C	Yellow	
				2. The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures will be provided. WTG foundation will also be marked with temporary lighting during construction phase						2. Develop an Emergency Response Plan (ERP) to specify coordination, shutdown, and rescue procedures associated with wind farm. The ERP will need to reviewed and updated regularly based on feedback received from Atlantic Shores and the USCG as windfarm operations evolve.						
				3. Atlantic Shores will regularly coordinate with the USCG and NOAA on chart updates as Project components (e.g., foundations, WTGs, OSSs) are constructed and regarding the issuance of Notices to Mariners (NTMs).						3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.						
				4. A Marine Coordination Center is to be established, led by a Marine Coordinator. Activities of this Center will include monitoring daily vessel movements, implementing of communication protocols with external vessels, and monitoring safety buffers. The Marine Coordinator will be Atlantic Shore's primary point of contact with USCG, port authorities, state and local law enforcement, marine patrol, port operators, and commercial operators (e.g., ferry, tourist, and fishing boat operators).						4. Review needs for development of training covering the following areas: • Search planning efforts • pilot training • Hoist training • Pilot familiarization training • Lessons learned from international rescue training						
				5. Ability to shutdown wind turbines on request (shutdown time)						14. Develop pilot training specific to operation within windfarm to ensure						

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
				Implementation of rotor emergency braking system to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts. Bi-annual testing of the communication and rotor braking systems.						pilots are aware of hazards associated with the flying within and around wind farm area.						
				6. Real-time meteorological/oceanographic measurements (waves, wind, currents) will be monitored across the Lease Area and this information can be shared with USCG/NOAA.												
	2. SAR operation in adverse weather condition during nighttime	Adverse wind condition or sea state	1. Potential inability to physically control aircraft in adverse wind condition within wind farm area. Potential for aircraft damage if collision with WTG. Personnel injury/fatality. Potential effect on fuel load requirement and search pattern during search planning; delay in performing SAR operation. Inability or difficulty in performing the rescue operation. Potential exists for helicopter collision risk with wind turbine during flyout or emergency situations. Potential ineffective search operational efficiency/reduced probability to detect within wind farm area. Potential reduction in number of searches (helicopter and surface based) conducted because of wind farm presence and due to potential increased risk of collision with WTGs. Potential impact on night vision equipment from WTGs lights.	1. Pilot training specific to operation within windfarm	5		5	C	Red	1. Evaluate need for VHF direction finding equipment to aid helicopter search and rescue operation. Presence of windfarm may lead to scenario where helicopter pilots might have difficulty in navigating through windfarm. Presence of VHF direction finding equipment will support helicopter pilots during search and rescue operation.	5		5	B	Yellow	1. Surface SAR operation is not part of this study scope and will be reviewed separately, as applicable
				2. Real-time meteorological/oceanographic measurements (waves, wind, currents) will be monitored across the Lease Area and this information can be shared with USCG/NOAA.						2. Develop an Emergency Response Plan (ERP) to specify coordination, shutdown, and rescue procedures associated with wind farm. The ERP will need to reviewed and updated regularly based on feedback received from Atlantic Shores and the USCG as windfarm operations evolve.						
				3. Ability to shutdown wind turbines on request (shutdown time) Implementation of rotor emergency braking system to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts.						3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.						
				4. A Marine Coordination Center is to be established, led by a Marine Coordinator. Activities of this Center will include monitoring daily vessel movements, implementing of communication protocols with external vessels, and monitoring safety buffers. The Marine Coordinator will be Atlantic Shore's primary point of contact with USCG, port authorities, state and local law enforcement, marine patrol, port operators, and commercial operators (e.g., ferry, tourist, and fishing boat operators).						4. Review needs for development of training covering the following areas: • Search planning efforts • pilot training • Hoist training • Pilot familiarization training • Lessons learned from international rescue training						
				5. Atlantic Shores will regularly coordinate with the USCG and NOAA on chart updates as Project components (e.g., foundations, WTGs, OSSs) are						5. Ensure WTG lights are compatible with night vision technologies to ensure they						

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
				constructed and regarding the issuance of Notices to Mariners (NTMs). 6. The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures will be provided. WTG foundation will also be marked with temporary lighting during construction phase 7. Aviation obstruction lighting will be provided on constructed WTGs and OSSs in accordance with FAA and BOEM requirements.						do not obstruct pilot visibility when night vision technologies are being used.						
		Adverse wind condition or sea state	1. Inability to perform SAR; Potential personnel injury /fatality event during night	1. Aviation obstruction lighting will be provided on constructed WTGs and OSSs in accordance with FAA and BOEM requirements. 2. The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures will be provided. WTG foundation will also be marked with temporary lighting during construction phase. 3. Atlantic Shores will regularly coordinate with the USCG and NOAA on chart updates as Project components (e.g., foundations, WTGs, OSSs) are constructed and regarding the issuance of Notices to Mariners (NTMs). 4. A Marine Coordination Center is to be established, led by a Marine Coordinator. Activities of this Center will include monitoring daily vessel movements, implementing of communication protocols with external vessels, and monitoring safety buffers. The Marine Coordinator will be Atlantic Shore's primary point of contact with USCG, port authorities, state and local law enforcement, marine patrol, port operators, and commercial operators (e.g., ferry, tourist, and fishing boat operators).	4		4	D	Red	14. Develop pilot training specific to operation within windfarm to ensure pilots are aware of hazards associated with the flying within and around wind farm area. 4. Review needs for development of training covering the following areas: • Search planning efforts • pilot training • Hoist training • Pilot familiarization training • Lessons learned from international rescue training 3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation. 2. Develop an Emergency Response Plan (ERP) to specify coordination, shutdown, and rescue procedures associated with wind farm. The ERP will need to reviewed and updated regularly based on feedback received from Atlantic Shores and the USCG as windfarm operations evolve.	4		4	C	Yellow	

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
				5. Ability to shutdown wind turbines on request (shutdown time) Implementation of rotor emergency braking system to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts. Bi-annual testing of the communication and rotor braking systems.						1. Evaluate need for VHF direction finding equipment to aid helicopter search and rescue operation. Presence of windfarm may lead to scenario where helicopter pilots might have difficulty in navigating through windfarm. Presence of VHF direction finding equipment will support helicopter pilots during search and rescue operation.						
				6. Real-time meteorological/oceanographic measurements (waves, wind, currents) will be monitored across the Lease Area and this information can be shared with USCG.												
				7. Pilot training specific to operation within windfarm												
	3. Navigational equipment failure	Equipment malfunction	1. Potential difficulty in navigating through wind farm; potential for air craft damage if collision with WTG; personnel injury/fatality.	1. The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures will be provided. WTG foundation will also be marked with temporary lighting during construction phase	5	2	5	B	Yellow	2. Develop an Emergency Response Plan (ERP) to specify coordination, shutdown, and rescue procedures associated with wind farm. The ERP will need to reviewed and updated regularly based on feedback received from Atlantic Shores and the USCG as windfarm operations evolve.	5	2	5	B	Yellow	1. WTG will not be preferred to be used for navigational purpose other than visual aid during clear weather condition
				2. Each WTG will have unique physical identification marked to aid as visual navigational and can support search planning												
		Equipment malfunction	1. Inability to continue search operation and potential return to base	1. Each WTG will have unique physical identification marked to aid as visual navigational and can support search planning	3		3	D	Yellow	2. Develop an Emergency Response Plan (ERP) to specify coordination, shutdown, and rescue procedures associated with wind farm. The ERP will need to reviewed and updated regularly based on feedback received from Atlantic Shores and the USCG as windfarm operations evolve.	3		3	D	Yellow	1. Most likely backup helicopter will be sent to continue SAR operation during equipment malfunction
				2. The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures will be provided. WTG foundation will also be marked with temporary lighting during construction phase												
	4. Sensor interference (human or equipment)	WTG Radar interference	1. See recommendation; during the workshop consensus was not reached on effects of WTGs and radar interference and team recommended additional review as indicated in recommendation.							6. Review impact on aircraft radar readings due to WTG presence and if it can lead to any consequence of interest provide adequate safeguards accordingly.						

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
	5. Communications failure	Equipment malfunction	1. Potential difficulty in navigating through wind farm; potential for aircraft damage if collision with WTG, personnel injury/fatality Most likely scenario will be aircraft not to fly through wind farm	1. The WTGs and OSSs marked and lit in accordance with USCG and BOEM requirements, including alphanumeric tower designation, distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures will be provided. WTG foundation will also be marked with temporary lighting during construction phase	5	2	5	B	Yellow		5	2	5	B	Yellow	
				2. Ability to shutdown wind turbines on request (shutdown time) Implementation of rotor emergency braking system to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts. Bi-annual testing of the communication and rotor braking systems.												
		Equipment malfunction	1. Inability to continue search operation and potential return base	1. Ability to shutdown wind turbines on request (shutdown time) Implementation of rotor emergency braking system to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts. Bi-annual testing of the communication and rotor braking systems.	3		3	D	Yellow		5	2	5	B	Yellow	
				2. Constructed WTGs and OSSs will be marked and lit in accordance with USCG and BOEM requirements. WTG foundation will also be marked with temporary lighting during construction phase												
				3. All construction/decommissioning vessels will display appropriate navigation lights and day shapes as per regulatory requirements.												
	6. Passing vessels /proximity to shipping lanes	Refer to ship navigational safety risk assessment.		1. Coordination will be carried out with local port authorities on development of vessel traffic management plans for the various staging ports.												
	7. Simultaneous operations (SIMOPS)	Surface SIMOPS operation is not expected to affect SAR operations														
				1. Aircraft frequency monitoring	5	2	5	B	Yellow		5	2	5	B	Yellow	

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
		Aerial windfarm operations	1. Potential for collision risk with windfarm aircrafts	2. A Marine Coordination Center is to be established, led by a Marine Coordinator. Activities of this Center will include monitoring daily vessel movements, implementing of communication protocols with external vessels, and monitoring safety buffers. The Marine Coordinator will be Atlantic Shore's primary point of contact with USCG, port authorities, state and local law enforcement, marine patrol, port operators, and commercial operators (e.g., ferry, tourist, and fishing boat operators).												
2. Wind farm Infrastructure	1. Obstruction	Wind farm presence	1. Potential impact on search patterns in area around wind farm; potential delay in SAR operations - Refer to above scenario							3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.						
		Wind farm presence	1. Potential limitation on aircraft response during aircraft emergency, delayed arrival to safe landing area/ potential aircraft damage; personnel fatality/injury		5	2	5	A	Yellow	15. Review if substation helipad can act as a safe haven for CG helicopters during emergency scenarios	5	2	5	A	Yellow	
		Wind farm presence	1. Potential increase in personnel presence (e.g., eco-tourism, recreational fishing etc.) in wind farm area leading to potential increase in high likelihood of incidents. Scenario was not risk ranked.	1. A Fisheries Liaison Officer has been hired as part of an overall Fisheries Communication Plan and will communicate and coordinate with the local commercial and recreational fishing community during the construction phase.						3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.						
		Wind farm presence	1. SAR-Operation software provides feedback for search planning based on data (wind conditions, current patterns) collected from subject SAR area. Presence of wind farm might impact optimized search pattern and probability of success calculations leading to impact on SAR decision making process. Potential delay in SAR operations.	1. Atlantic Shores will regularly coordinate with the USCG and NOAA on chart updates as Project components (e.g., foundations, WTGs, OSSs) are constructed and regarding the issuance of Notices to Mariners (NTMs).												
		Wind farm presence	1. Reduced effectiveness of searching of small objects in wind farm area - Potential delay in SAR operations.	1. Provision of access ladders as a possible refuge for distressed mariners and a signaling device (to indicate presence on the structure).	4		4	D	Red	3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.	4		4	B	Yellow	

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
										7. Consider implementing passive monitoring in wind farm area to aid in locating of personnel during search operation in wind farm during emergency situations						
										8. Consider limiting access (e.g., safety zones) to wind farm during adverse weather conditions.						
		Wind farm presence	1. Potential impact on HF radar readings leading to potential inaccuracy in environmental data which will impact drift estimates; potential inability located objects during SAR operation. Potential windfarm shadow impact on surface wind and wave/current parameters around base of individual wind turbine base; ineffective SAR search planning; potential to impact survival time calculations. Impact of radar shadow on east of windfarm area	1. Real-time meteorological/oceanographic measurements (waves, wind, currents) will be monitored across the Lease Area and this information can be shared with USCG/NOAA.	3		3	C	Yellow	3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.	3		3	B	Blue	
				2. Radar interference study is performed to review impact of wind farm on HF radar readings						9. Review communication protocol to inform concerned authority on emergency situations within windfarm area						
				3. Provision of access ladders as a possible refuge for distressed mariners and a signaling device (to indicate presence on the structure).						16. Consider means measuring meteorological/oceanographic conditions outside of windfarm area to aid in Coast guard SAR operations outside of wind farm area.						
		Spacing	1. Potential impact/restriction on helicopter flight path in wind farm area; impact on search efficiency specifically regarding small objects (e.g., PIW)	1. Pilot training specific to operation within windfarm	5		5	D	Red	10. Review developing operating limitation of aircraft within wind farm to ensure aircraft can operate safely within wind farm area.	5		5	B	Yellow	1. Fixed wing aircraft operations is not part of this scope
				2. Ability to orient and brake wind turbine to facilitate search operation						11. Review means to limit the time helicopter spends in wind farm area during SAR operation						2. Micro siting could further degrade CG operations within wind farm
										12. Review minimum spacing between WTGs to ensure to help mitigated risk of helicopters operations within wind farm area specifically during adverse weather conditions and icing conditions.						
										3. Investigate if high-resolution thermal/infrared detection systems can be deployed across the Lease Area to assist in location of persons in water and/or vessels, across all weather conditions, and day/night operation.						
		Adjacent Windfarm - Ocean Wind	1. Limitation on helicopter flight path due to lack of transit corridor between two wind farms. Note: Interface issues between adjacent wind farm is under review													

Node: 1. SAR operations within/around the windfarm																
Hazard	Hazardous Scenario	Causes	Consequences	Safeguards	Risk Ranking					Recommendations	Mitigated Risks					Remarks
					P	E	SR	LR	RR		P	E	SR	LR	RR	
			and is not part of this study scope. Scenario was not risk ranked													
		Icing conditions	1. Inability to fly over the wind farm due to icing conditions, will require fly around wind farm, potential longer flight path; delay in SAR operations.	1. Blades can be oriented to allow for nearly 1 nm access corridor in east west direction	3		3	D	Yellow	12. Review minimum spacing between WTGs to ensure to help mitigated risk of helicopters operations within wind farm area specifically during adverse weather conditions and icing conditions. 13. Review needs for a single dedicated access corridor (>=1 nm) for helicopter through wind farm in a north-south direction	3		3	C	Yellow	
	2. Turbulence	Wind turbine turbulence	1. Potential impact on helicopter operation. Scenario was not risk ranked.	1. Pilot training specific to operation within windfarm 2. Ability to orient and brake wind turbine to facilitate search operation 3. Ability to orient and brake wind turbine to minimize turbulence during SAR operation												
	3. Emergency response infrastructure	Incident/emergency on turbine while crew is present	1. Emergency operation will be performed by Atlantic shore for WTG emergency events/incidents. Scenario was not risk ranked.	1. Windfarm will be supported by standby support vessel 2. Pilot training specific to rescue operation on wind turbines 3. Wind farm emergency response plan will include different mode of operation and applicable contingency measures												
3. Helicopter Operations	1. Helicopter type	No causes of concern identified														
4. SAR operation	1. Static shock	Static electricity	1. Potential for static electric hazards from WTG to helicopters; Existing risk and scenario was not risk ranked.	1. WTGs will be grounded 2. Helicopter SAR operational manual includes grounding requirements												
	2. Hoist operation	No causes of concern identified														