Collision Risk Analyses for Offshore Wind Energy Installations

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ABSTRACT

Over the period of one decade, Germanischer Lloyd (GL) has developed and applied risk analysis procedures to assess the collision risks for offshore wind energy installations (WEI). The revised GL guideline focuses on the identification and assessment of collision risks between ships and wind energy installations. Other risks (e.g. collision risks with air traffic) are discussed, but not in the same depth as ship-WEI collisions. The basic approach is a pragmatic mix of formal procedure and empirical data required for model applications. Basic assumptions were harmonized in 2004 between major providers of such risk analyses for offshore WEIs in Europe. The basic assumptions and their underlying reasoning are described. The guideline is an important contribution to ensure comparability, repeatability and transparency of such risk analysis. The guideline addresses the main factors influencing collision probability and damage extent, including risk control measures. Concepts are illustrated by applications taken from existing or planned North Sea installations. While illustrative examples are all taken from the North Sea, the procedure has been applied more widely.

KEY WORDS: wind energy; offshore; risk assessment; collision.

INTRODUCTION

Modern safety engineering offers assorted methods to assess complex systems and their risk for man and environment. The main task is to apply these proven methods appropriately within risk analyses for offshore wind farms (OWF). Germanischer Lloyd (GL) has developed a guideline for this purpose (GL, 2010). The assessment of accidents ends with the quantification of spilled pollutants, harm to property or persons. Subsequent damage due to spilled substances can be investigated in environmental risk or impact analyses and is not subject of the GL guideline.

The risk analysis is a documented approach to ensure the retraceability of lines of arguments and calculations. An OWF risk analysis should assert verifiably

− whether a planned OWF fulfils the safety requirements,
− whether under some failure conditions threats to persons or environment may arise and
− what the associated consequences would be, how they are to be rated and how they could be managed.

The risk analysis should be made in the early project stages to be most beneficial and cost efficient. Safety starts with the conceptual design of a wind farm. Later corrections of shortcomings due to neglected systematic investigations are generally costly.

The GL guideline for OWF risk analyses has the following objectives:

− Common structure and similar scope, level of detail, approach and quality make submitted risk analyses comparable and reproducible. This facilitates the review for the authorities and accelerates the approval process.

− The OWF operator understands better what is required and analysed within a risk analysis. This promotes an early focus on safety aspects.

− General public and lobbies can read, understand and interpret risk analysis reports better.

BASE DATA AND ASSUMPTIONS

Harmonized Assumptions

Following a request of German authorities, experts of Germanischer Lloyd harmonized basic assumptions for OWF risk analyses in cooperation with other major providers of risk analyses in 2004. In particular, there were common basic assumptions for the scenarios involving powered and drifting ships, intended to ensure comparable results by different expert consultants. The harmonised assumptions are integrated in the English GL guideline (GL, 2010).

Traffic and Environment

The shipping traffic in the considered area should be described in terms of line traffic and spread-out traffic. Line traffic is limited to shipping channels and traffic separation zones; the rest is denoted as spread-out traffic. Ship routes are to be displayed in suitable charts along with the OWF perimeter. A quantification of line and spread-out traffic is indispensable for the risk analysis. Local maritime authorities and/or service providers should be contacted to obtain data concerning shipping traffic. Generally data from several sources should be compared. Data sources must be documented. For the analysis, the following points should be considered:

− For all shipping routes in the vicinity of the OWF, the traffic direction has to be considered.