SAFETY IN OFFSHORE ENGINEERING
AN ACADEMIC COURSE COVERING SAFETY IN OFFSHORE WIND

D.J. Cerda Salzmann, PhD
Delft University of Technology – DUWIND
Stevinweg 1, 2628 CN Delft, The Netherlands
Tel.: +31 15 27 85077, E-mail: d.j.cerdasalzmann@tudelft.nl

ABSTRACT

Offshore projects are known for their challenging conditions, generally leading to high risks. Therefore no offshore project can go without a continuous and extensive assessment on safety issues. The Delft University of Technology is currently developing a course “Safety in Offshore Engineering” which deals with the entire scope of safety aspects that are to be taken into account in the offshore industry. This course is offered within the Offshore Engineering Master curriculum and is scheduled to commence in April 2012. Next to general safety awareness, the analyses and verification methods of safety aspects are presented throughout the different phases of offshore projects: design, fabrication, installation, operation and decommissioning. Focus points of this course are: tools for safety analyses (e.g. Hazid, FMEA, safety cases), provisions for validation (e.g. guidelines, certification), communication and interfaces between disciplines.

The main goals of this course are to create awareness of safety topics in the offshore industry and provide an overview of the different safety topics within various disciplines. Additionally the course will provide tools for safety analyses as well as knowledge on implementation and control. This paper briefly outlines the content of the course “Safety in Offshore Engineering” while focusing strongly on its application within the offshore wind industry.

1 INTRODUCTION

The development of offshore wind projects has been progressing significantly over recent years. Parties involved have recognized the importance of proper safety management from the very beginning. A ‘good industry practice’ for this, however, has proven difficult to outline precisely as it has not yet been fully captured in guidelines or standards. The current offshore wind industry state-of-art approach towards safety appears to be a blend of offshore oil & gas industry practices and lessons learned from the development of the offshore wind farms up to date. In turn, the oil & gas industry is renowned for its “safety first” approach as being its industry practice, mainly due to the high risks involved in processing hydrocarbons.

The Offshore Engineering Master curriculum of the Delft University of Technology has since long provided a thorough set of academic courses to prepare future engineers for the offshore industry. Aspects of safety are included in different courses, but always within the context of the course subjects. A more coherent and explicit approach towards education on safety aspects was therefore considered desirable. This led to the development of a new course entitled “Safety in Offshore Engineering”. The goal of this course is to provide a sound overview of the many safety topics arising in the different disciplines throughout the stages of an offshore project and presenting tools for the analysis, implementation and control on safety matters.
2 COURSE CONTENT

2.1 COURSE SET-UP

The “Safety in Offshore Engineering” course is scheduled as a 2 ECTS course in the final 4th quarter of the academic year. During the first seven weeks of this quarter, the education is provided through 4 lectures of 1 hour per week. The course set-up is shown below in Table 1:

<table>
<thead>
<tr>
<th>Week</th>
<th>General introduction: Background, awareness, culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2</td>
<td>Methods for safety analyses</td>
</tr>
<tr>
<td>Week 3</td>
<td>Safety during the design phase</td>
</tr>
<tr>
<td>Week 4</td>
<td>Safety during the fabrication phase</td>
</tr>
<tr>
<td>Week 5</td>
<td>Safety during the installation phase</td>
</tr>
<tr>
<td>Week 6</td>
<td>Safety during the operational phase</td>
</tr>
<tr>
<td>Week 7</td>
<td>Practical Case Studies</td>
</tr>
</tbody>
</table>

The lectures are to be provided by both university staff and industry specialists. The aim is to have presenters from the oil and gas industry as well as from the offshore wind industry in each week. The second week will comprise of the more theoretical lectures to explain the different methodologies used throughout the various project phases. This way the more practical lectures can focus on the actual application of the methodologies through real-life examples.

2.2 GENERAL INTRODUCTION

The course is to start with a general introduction including definition of terms and the perception of safety. The general awareness on safety and risks of a person can be influenced by many different factors: the type of industry, the type of job, the company policy, personal experience and training, just to name a few. Company policies can be used as an example of how monitoring, records and auditing can lead to a continuously improving safety policy. Examples of accidents will be given to highlight the importance of the entire topic.

2.3 METHODS FOR SAFETY ANALYSES

A large variety of methodologies exists for analyzing risks at forehand and thereby enabling mitigating measures to be implemented at an early stage. Examples are:

- Failure Mode and Effect Analysis (FMEA)
- Hazard Identification study (HAZID)
- Hazard and Operability study (HAZOP)
- Job Safety Analysis (JSA)

An overview and explanation of the different methods is to be provided as well as examples of application. The theoretical part is explicitly presented separately and at the beginning of the course to provide the students with enough knowledge of terminologies and their content for the more practical lectures by industry speakers.
2.4 SAFETY DURING THE DESIGN PHASE

The design of any offshore structure or system demands high quality engineering and the design process should thus be considered as a crucial phase safety-wise. Whether it concerns the design of turbines, support structures, vessels, platforms or cranes, the design procedure should start with a clear basis of design, with well defined demands. Also the environmental condition data used, assumptions made and safety and load factors chosen are to be agreed upon by designer, client and certifying authority. The use of design codes is to be elaborated upon as well as the certification process of the final design.

2.5 SAFETY DURING THE FABRICATION PHASE

For this part of the course, the fabrication phase is defined as the time frame in which the turbines, structures, dedicated vessels or tools are being fabricated. The safety aspects during the fabrication phase can be separated into two main parts: safety on the working floor and safety through quality assurance and control on all items produced. The first part will require risk awareness of all workers on the floor and good job preparations. The second part must be ensured through the use of good (certified) materials and proper quality control as well as well trained personnel.

2.6 SAFETY DURING THE INSTALLATION PHASE

The installation of any offshore wind farm is an endearing challenge considering the fact that large and heavy components are to be assembled in offshore conditions. On top of that, the large number of structures is often to be installed during one season to benefit from favourable weather conditions. This calls for a carefully prepared installation procedure with short cycle times. The optimization of such an installation cycle must be balanced with a thorough safety policy leading to an approved installation plan. The installation phase also requires a large installation spread where different disciplines meet. The necessity for good communication and overview is therefore to be highlighted. It is noted that decommissioning will also be considered within this set of lectures, as it can be seen as “reversed installation”.

2.7 SAFETY DURING THE OPERATIONAL PHASE

After the commissioning of an offshore wind turbine, its operational life starts. During a wind turbines lifetime there are two main safety issues to be considered related to Operation & Maintenance (O&M): the access procedure and high risk maintenance jobs. The risks involved with accessing offshore wind turbines either by vessels or by helicopters has been long recognized and has led to a diversity of dedicated solutions. The high risk jobs (e.g. blade inspections) call for skilled and well trained personnel.

2.8 PRACTICAL CASE STUDIES

In the final lecture week, the different methodologies presented for safety analyses and their practical use during the different phases of an offshore project, will be put to use in a set of practical case studies where students will be challenged to participate in an interactive way. The objective of the final week is to consolidate the lecture information by application of the knowledge.
3 OUTLOOK

With the course starting by the end of April 2012, preparations are now in progress. The objective of this course is clear: to create a next generation of offshore engineers with a more solid awareness of safety aspects within the different phases of a project cycle by offering an explicitly safety-focussed set of lectures. A quick overview of the contents is given in Figure 1. All parties interested in contributing to this course by providing a one hour lecture are encouraged to contact the author.

![Diagram of course content]

**Figure 1** Overview of the course content