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Risk-related information needed through the planning process for offshore activities

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ABSTRACT

Planning and plan quality influence safe and efficient execution of work in offshore oil and gas activities. An important basis for developing good plans and making good decisions during the planning process is to have the right information available at the right time. In this study, we identify what risk-related information that is needed at what stages in the planning process to develop plans in which the risk for major accidents has been explicitly addressed. The result is an overview of the analysis and information needs for four main decision arenas through the planning process. The paper builds on previous studies on the planning process for maintenance activities, studies of major accident theories and investigations reports for hydrocarbon leaks, interviews of offshore and onshore personnel, observations of meetings and workshop with two operating companies from the Norwegian Continental Shelf.

1. Introduction

Major accidents are characterized by complex causal patterns with many factors influencing the occurrence of such accidents. Related to maintenance and operations in the offshore petroleum industry, the causes can be found not just in the execution of the work, but also in the preparations and planning before performing the work. In an earlier paper (Sarshar et al., 2015), we reviewed 24 investigation reports of gas leaks on the Norwegian Continental Shelf and found that in 18 of these cases, factors related to planning could be identified as contributing factors to the incidents. Through the planning process of offshore work activities, significant risks to HSE (Health, Safety and Environment) are to be identified and addressed. This forms the basis to enable safe and efficient performance of work with the time and resources available. In the same study (ibid), the planning process was studied in detail with respect to how major accident risk is managed. The study identified that having the right information available at the right time was an important basis for developing good plans and making good decisions during the planning process. The planning process works as an organisational barrier which enables management of major accident risk through risk identification, prioritization, mitigation and compensating measures. This is however not utilized to its potential today as one might not be precise on what type of information is needed to support certain considerations and decisions.

Of the identified factors influencing major accident risk in the planning process (Sarshar et al., 2015), some are related to sharing information, e.g. «Information flow», «Communication" and "Misunderstandings". The challenges related to these factors were elaborated in a second paper (Sarshar et al., 2016a). In this paper, we move into the topic of information in more detail, and address the following problem: *what types of information are required to ensure that the best possible basis is available for making good decisions in the planning phase*? One way of approaching this problem is to frame it in terms of what decision support people engaged in planning need, i.e. what type of decisions are made and what information is required to make these decisions and to maintain focus on major accident prevention throughout the planning process.

The scope of this paper is limited to the planning processes for operational, work order and work permit planning. It focuses on the information needed to establish a sound basis for the planning process and not on how the information should be used. The decision-making process itself is therefore not addressed. We also make the assumption that personnel involved in planning have required competence and time available to utilize the information in a relevant manner. The focus in our study is on major accident risk and not on occupational safety and health, although we acknowledge the importance of safe execution of work.

The paper is structured as follows. Section 2 discusses earlier work related to the scope of this paper. Section 3 describes the research method applied. Section 4 provides the main results. Section 5 and Section 6 discusses and concludes the work.

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Abbreviations

CCR	Central control room
FAR	Fatal accident rate
HRA	Human reliability analysis
HSE	Health, safety and environment
PS	Operational plan
POB	People on board
POG	Production optimization group
PSAN	etroleum safety authority of Norway
QRA	Quantitative risk assessment
SJA	Safe job analysis
TRA	Total risk assessment
WO	Work order
WP	Work permit

2. Background

This section first describes a general planning process for the offshore maintenance activities, second describes the different decision arenas and their focus on major accident risk, and third provides an overview of relevant work.

2.1. The planning process

A general planning process for offshore maintenance activities has been described in earlier papers (Sarshar et al., 2015, 2016a). To provide the operational context a brief description of the planning processes is provided next.

Planning of maintenance and offshore operations can be divided in several phases spanning from several years to a daily plan. The planning is normally done by the onshore organisation and communicated to the offshore organisation which is responsible for execution of the plans, along with handling unplanned activities. The time horizon of the different plans spans from years to days. The main plan spans for a year, the operational plan for up to three months, the work order plan for up to two weeks and work permits are applied for before the job is executed the following day.

The three planning phases focused on in this study include: operational, work order and work permit plan. They contain several steps including: identifying the need for performing the work, establishing and assessing the activities, coordinating them on a plan and approval of the plan.

Information is one of the key aspects that must be managed through the planning process. With information, we refer to risk-related information that supports decision making. In other words, information that contributes to reduce and understand the uncertainties about activity, technical and external factors contributing to the overall system risk.

The different planning steps for the operational plan, the work order plan and work permits are provided in Table 1 with a description and an overview of major accident related assessments. These are based on Sarshar et al., 2015 (Tables 1 and 2).

Aspects from major accident theories related to planning (Sarshar et al., 2015) can include communication, information and data sharing which are necessary for all involved parties to have an adequately shared understanding of the thoughts behind plan activities. Since the plan is made over several phases, traceability of decisions and underlying information must be in place to better aid those who need to replan a task due to e.g. new circumstances. Assumptions made in earlier planning phases must now be known so they can be verified before new decisions are made.

The relation found between the planning process, and the potential for major accidents is mediated by the influence of a set of contributing factors (ibid). When these factors are in non-optimal states, the risk that major accidents have not been properly addressed increases. Using the influencing factor “communication” as an example; when communication is lacking or when procedures are not known to all involved, the risk that the plan, resulting from the planning process, will not adequately address major accident risk increases.

These findings highlight the need for clarifying what type of risk-related information is needed through the planning process to manage major accident risk related to maintenance activities.

2.2. Decision arenas and meetings

Within the planning phases there are decision arenas such as meetings in which work activities and plans are discussed and approved (illustrated in Fig. 1). Daily meetings are highlighted with grey background while less frequent meetings have dashed outlines. Activities and actions occurring between these meetings are shown with a white background. While there are many decision arenas through the planning process, the four most important regarding the managing of major accident risk include the operational plan meeting, work order plan meeting, work permit meeting and morning meetings (highlighted in the figure). Important decisions with respect to managing risk are also made in other meetings and arenas, but these four represent the most important decisions arenas through the planning process and are emphasized in our study.

Operational plan meetings occur every two weeks and looks three months ahead. The operational plan contains information about the activities on the installation with respect to drilling, operations, maintenance, inspection and modifications. Its goal is to maintain the installation's total risk picture with respect to major accidents, production and development. The plan focuses on risk levels, priorities and resources within and across installations. It is to make sure that the activity levels are regulated in order to stay within the framework conditions. The objective is to assess activities for HSE issues, their influence on area risk, their criticality and the technical integrity.

Work order plan meetings occur on a weekly basis and look two weeks ahead. The objective is to plan for safe, efficient and sustainable execution of work on the installation. The main activity is to schedule and coordinate activities on plan according to resource needs.

Work permit meetings occur every day and focus on the following days activities. The objective is to assess work permits, coordinate and assess them for simultaneous execution.

Morning meetings occur daily and focus on today's activities. The objective is to emphasize required preparations and coordination for execution of the work.

The planning phases focused on contain several steps: identifying the need for performing the work, establishing and assessing the activities, coordinating them on a plan and approval of the plan. While these are the steps primarily for the operational plan and work order plan, the work permit system focus on correct execution of the planned work offshore. For the operational and work order plan there are several assessment and coordination activities prior to the *operational plan meeting* and *work order plan meeting* respectively. In these meetings the plan is discussed and approved. Offshore, the *work permit meeting* addresses the work permits and their approval while the *morning meeting* focus on approval of today's activities. In our study we focus on the decisions made in these meetings, the analysis needs (performed in the steps prior to the meetings) and their need for risk-related information.

2.3. Related work

Kongsvik et al. (2015) suggest several principles for improving