Guidance on human factors safety critical task analysis
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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>v</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>vi</td>
</tr>
<tr>
<td>1 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Background</td>
<td>1</td>
</tr>
<tr>
<td>1.2 What is safety critical task analysis?</td>
<td>1</td>
</tr>
<tr>
<td>1.3 The benefits of safety critical task analysis</td>
<td>1</td>
</tr>
<tr>
<td>1.4 Scope</td>
<td>2</td>
</tr>
<tr>
<td>1.4.1 Purpose</td>
<td>2</td>
</tr>
<tr>
<td>1.4.2 Focus</td>
<td>2</td>
</tr>
<tr>
<td>2 Safety critical task analysis process</td>
<td>4</td>
</tr>
<tr>
<td>2.1 Overview</td>
<td>4</td>
</tr>
<tr>
<td>2.2 Step 1 - Identify main site hazards</td>
<td>4</td>
</tr>
<tr>
<td>2.3 Step 2 - Identify safety critical tasks</td>
<td>5</td>
</tr>
<tr>
<td>2.3.1 If existing documentation is adequate</td>
<td>5</td>
</tr>
<tr>
<td>2.3.2 If existing documentation is not adequate</td>
<td>6</td>
</tr>
<tr>
<td>2.3.3 What types of task are of interest?</td>
<td>8</td>
</tr>
<tr>
<td>2.4 Step 3 - Understand the tasks</td>
<td>10</td>
</tr>
<tr>
<td>2.5 Step 4 - Represent the safety critical tasks</td>
<td>12</td>
</tr>
<tr>
<td>2.6 Step 5 - Identify human failures and performance influencing factors</td>
<td>13</td>
</tr>
<tr>
<td>2.6.1 Group-based approaches</td>
<td>15</td>
</tr>
<tr>
<td>2.7 Step 6 - Determine safety measures to control risk of human failures</td>
<td>16</td>
</tr>
<tr>
<td>2.8 Step 7 - Review the effectiveness of the process</td>
<td>18</td>
</tr>
<tr>
<td>2.9 Illustrative examples of outputs</td>
<td>18</td>
</tr>
<tr>
<td>2.10 Frequently asked questions</td>
<td>24</td>
</tr>
<tr>
<td>3 Supporting methods and techniques</td>
<td>26</td>
</tr>
<tr>
<td>3.1 Hierarchical task analysis (HTA)</td>
<td>26</td>
</tr>
<tr>
<td>3.1.1 Brief description</td>
<td>26</td>
</tr>
<tr>
<td>3.1.2 Applicability</td>
<td>26</td>
</tr>
<tr>
<td>3.1.3 Pros and cons</td>
<td>27</td>
</tr>
<tr>
<td>3.1.4 Examples and further reading</td>
<td>27</td>
</tr>
<tr>
<td>3.2 Human HAZOP and team/guideword based variants</td>
<td>27</td>
</tr>
<tr>
<td>3.2.1 Brief description</td>
<td>27</td>
</tr>
<tr>
<td>3.2.2 Applicability</td>
<td>28</td>
</tr>
<tr>
<td>3.2.3 Pros and cons</td>
<td>28</td>
</tr>
<tr>
<td>3.2.4 Examples and further reading</td>
<td>28</td>
</tr>
<tr>
<td>3.3 Other techniques</td>
<td>28</td>
</tr>
<tr>
<td>3.3.1 Fault tree analysis (FTA)</td>
<td>28</td>
</tr>
<tr>
<td>3.3.2 Event tree analysis (ETA)</td>
<td>31</td>
</tr>
<tr>
<td>3.3.3 Bow tie analysis</td>
<td>31</td>
</tr>
<tr>
<td>3.3.4 Additional techniques</td>
<td>32</td>
</tr>
<tr>
<td>4 Case studies</td>
<td>34</td>
</tr>
<tr>
<td>4.1 Case study 1 - Chemical offloading operation</td>
<td>34</td>
</tr>
<tr>
<td>4.2 Case study 2 - Power plant control room operation</td>
<td>36</td>
</tr>
</tbody>
</table>
FOREWORD

Historically there has been a disparity in major accident hazard (MAH) safety reports and safety cases between the level of analysis of technical failures and human failures. The analysis of technical failures has usually dominated even though the importance of human failures is well known.

There are some signs that this is beginning to change with a higher volume of human factors (HF) analyses being conducted. There is a growing awareness within the energy and allied industries of how such studies lead to better management of the risk of human failures, with consequent improvements in safety and reductions in losses. Regulators are also responding to public expectations concerning proactive risk management, with requirements that safety critical human tasks are comprehensively analysed and their risk appropriately assessed.

Although there are benefits in encouraging deeper analysis of safety critical tasks (SCTs), there has been a lack of available information to help those without a HF background. Non-HF specialist staff should be knowledgeable enough in safety critical task analysis (SCTA) to participate in projects, commission work and to use the results from these analyses. Therefore the Energy Institute (EI) Human and Organisational Factors Committee (HOFCOM) commissioned the preparation of this publication to help fill this gap. The intention is that HF SCTA will become part of the wider safety assessment toolbox, leading to better integration of human failure assessment into safety studies.

This publication has drawn on many existing sources from the public domain, and has supplemented these with input from practitioners and case study material provided by industry. It is aimed primarily at those without an HF background but who have some knowledge of safety risk assessment.

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1 INTRODUCTION

1.1 BACKGROUND

It has been argued that the assessment of human tasks in relation to major accident hazards (MAHs) has lagged behind the analysis of process and engineering safety issues (Lucas, Human error predictions and controls). Yet there is widespread awareness in the energy industry that human failures whilst performing safety critical tasks (SCTs) have contributed to major accidents, such as Piper Alpha, Chernobyl and Texas City, and these failures have been exhaustively described in accident reports. Less well reported, but known through anecdotes and near miss data, are the large number of events where human actions have prevented major accidents through timely interventions.

The industry is responding by conducting a larger number of human factors (HF) task analyses. In addition, in recent guidance to onshore (HSE, Safety report assessment guide: Human factors) and offshore industries (HSE, Assessment principles for offshore safety cases (APOS)) safety regulators have declared that they want to see a clear demonstration that safety critical human tasks are analysed and assessed to the appropriate standard in order to prevent foreseeable failures.

The Energy Institute (EI) has already published Guidance on investigating and analysing human and organisational factors aspects of incidents and accidents. However, learning lessons from accidents and incidents after they take place should also be complemented by a proactive analysis of SCTs in order to prevent accidents and incidents occurring.

The most common way to do this is to carry out a safety critical task analysis (SCTA).

1.2 WHAT IS SAFETY CRITICAL TASK ANALYSIS?

Task analysis can be simply defined as the study of what a person is required to do, in terms of actions and mental processes, to achieve a goal (Kirwan and Ainsworth, A guide to task analysis). SCTA extends this into a process by which the impact of HF on MAHs can be assessed. This publication is concerned with SCTs where HF could contribute to MAHs in positive or negative ways, including:

− initiating events;
− prevention and detection;
− control and mitigation, and
− emergency response.

The process of SCTA is interpreted as including:

− determining which tasks are safety critical;
− understanding which human action or inaction might make a failure more likely or more serious, and
− guiding the user in how to identify and install adequate layers of protection for these SCTs, in order to reduce the likelihood or consequences of human failure.

1.3 BENEFITS

Conducting SCTA is a key step in improving proactive management of MAH risk - simply improving the HF aspects of SCTs through ad hoc responses to accidents and incidents is not adequate. SCTA will ensure better risk control by identifying potential improvements
in, amongst others, plant and equipment design, task design, the operational environment, procedures and training. In turn this will lead to improved safety performance and reduced business losses. There could also be associated benefits such as fewer significant environmental events.

Scheduling SCTA at appropriate points in the design phase of a project will potentially also achieve cost savings, as has been achieved through the use of hazard and operability (HAZOP) studies for better process and engineering risk control.

1.4 SCOPE

1.4.1 Purpose

The main purposes of this publication are:

− to raise awareness of SCTA particularly amongst HF non-specialists to encourage its increased use, and
− to assist organisations in determining and demonstrating adequate safety measures (e.g. within offshore safety cases and control of major accident hazards (COMAH) safety reports).

In terms of expected users, it is aimed at those who:

− participate in SCTA, such as someone who is asked to provide discipline or supervisor/operator expertise in a group identification session;
− incorporate SCTA into a wider risk assessment as part of a safety report/case;
− commission SCTA and desire help with preparing a specification, and
− are required to read, understand and act upon SCTA.

Thus, the target audience includes designers, operations personnel, assessors and managers. Those who actually conduct SCTA will also benefit from consulting some of the documents in the References (Annex B) and should obtain prior experience through participation in SCTA projects. For relatively simple SCTAs someone with experience in traditional safety studies such as HAZOP studies may have most of the relevant competences (see case study 1, section 4). However, for more complicated SCTAs, specialised HF support may be required (see case study 2, section 4).

1.4.2 Focus

The focus for this publication is on MAH safety rather than occupational safety. It links to the type of MAH safety analysis that would be conducted at a project design stage or for safety report/safety case updates.

The publication covers: analysis of tasks; human failure assessment (qualitative\(^1\)); and risk reduction/control. It does not describe quantification of human failure rate. In some circumstances there could be benefits in quantification. For example:

− where the SCTA is part of a wider risk assessment that is using quantitative risk criteria, and
− where the SCTA is helping to decide whether a manual or an automated system is safer, and where relative failure rates are an important part of that comparison.

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\(^1\) Note that the HSE states that its expectation is for a qualitative analysis of human performance. However, particular risk assessment tools may drive analysts towards quantification (e.g. layers of protection analysis (LOPA)) (HSE core topic 3: Identifying human failures).