Task Analysis Template

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Christmas 2013

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1 INTRODUCTION

I have used task analysis for many years and have always found it very useful for a wide range of human factors applications. However, in the last year or so people have started to show more interest in the analyses and have been asking more probing questions about the method, presentation and application. This has led me to develop a more comprehensive template for recording the findings of task analyses.

The purpose of this paper is to present my new template and to answer the questions that I am being asked (and some that I have asked myself over the years). I hope that by sharing this template more people will start to see the potential value of carrying out formal analyses of their most safety critical tasks. Also, I would like to hear from anyone willing to share ideas about how the template could be improved further. I am acutely aware that analyses are now taking longer to complete, and that there has to be a balance between the level of detail vs. the time and effort involved.

I have not changed the basic task analysis techniques that I use. I still find that Hierarchical Task Analysis is a very good way of developing structured and systematic descriptions of task methods; and HAZOP style prompt words are effective when identifying potential human failures. But there are additional activities that can be performed that lead to a deeper understanding of how a task can contribute to accidents and the methods used to control risks. This is proving to be particularly effective in the process safety field where avoidance of major accidents is the main aim.

2 QUESTIONS AND ANSWERS

I have developed the template to answer the questions that have been asked about task analysis over the years. Not all of these questions relate directly to features of the template, but I hope they give you a good idea of how all the key elements of a task analysis fit together.

Which tasks should be analysed?

Completing a task analysis to the level of detail required by this template takes time. This means it is particularly important to focus on tasks where there is likely to be the most benefit for this effort. This typically means that there are hazards that can result in major accidents and the task has a degree of complexity or other features that make it potentially vulnerable to human error. There are different ways of identifying these tasks. I described my normal approach in a previous paper[1], which advocates the scoring method presented in HSE report OTO 1999/092[2]. I know there are other methods of prioritising tasks for analysis. However, what is important is that the approach taken is systematic and focusses on both hazard and the potential for human error.

How does the analysis start?

Agreeing the task title and any assumptions or preconditions are the first stages of any analysis. But it is also useful to discuss and note potential major accidents that may be associated with the task. Any relevant safety case or report should be referred to.

One point to note: experience shows that safety cases/reports do not always cover every potential major accident. This seems to occur because of a focus on technical rather than human failures when identifying scenarios. Whilst a potential can of worms, this is a clear indication of how out task analysis and can contribute to the wider process safety topic work scope and should be an integral part of the development of a safety case/report.

How do you analyse the task?

I suggest you use Hierarchical Task Analysis to map out the task method and a list of prompt words for identifying potential human errors (e.g. a task HAZOP). These methods are discussed in my previous paper.

Section 3 of the template is used to record the findings of the analysis in a tabular format. It includes the columns that I find sufficient to record the necessary details. I know there are other templates with more columns, suggesting that there may be more information that can be recorded but I personally feel that this table is sufficient. Also, you rarely gain much by using additional columns but end up spending more time trying to decide where text needs to be recorded.

Should you record every possible error or just the 'important' ones?

There are two schools of thought about whether you should record errors for every task step or just the ones that may have serious safety or environmental consequences. I tend to record errors for every step, even if the consequence is of less importance (e.g. financial or commercial) for a number of reasons, including:

- It really does not take long to record the less important errors;
- It demonstrates that every step of the task has been examined. This is difficult to do if you don't record errors for all steps as it is not clear if an error was not recorded because it was considered to be unimportant or because the step had been overlooked;

[1] http://abrisk.co.uk/papers/Task_Risk_Management-practical_guide02.pdf

[2] http://www.hse.gov.uk/research/otopdf/1999/oto99092.pdf

- Identifying potential financial and commercial consequences can be useful to the company. Showing these additional spin-off benefits can help to increase 'buy in' to task analysis.

How do you link the task with potential major accidents?

Although I have always identified potential major accident consequences when carrying out task analysis, I have not always managed to create a clear link with the scenarios identified in safety cases/reports. This has meant it was sometimes difficult to provide the full picture of how the human factors risks of major accidents had been identified, assessed, and were being managed.

The very simple solution I have developed to improve these links has been to add a standard code against any consequences identified in the human error analysis that is considered to be a potential major accident - I use the abbreviation 'MAH'. This makes it very easy to look through a task analysis in order to pick out the steps of most interest from a process safety perspective.

How do you link Performance Influencing factors to a task?

I use the HSE's list of Performance Influencing Factors (PIFs)[3] to carry out my assessments, but with 25 on the list it is impractical to review every PIF for every step of a task.

My solution is to review the PIFs for each main section or sub-task (not step). I use the PIF column in the main assessment table (Section 3 of the template) to simply identify the ones that are likely to be most relevant. I use a simple number code to refer to the PIFs from the list, and add a couple of words of explanation.

Even when only reviewing the main sub-tasks I find there is a lot of repetition, which is not really a surprise as most PIFs have a fairly wide influence. I tend not to record duplicates. As I work through the sub-tasks I just add any PIFs not already mentioned above. Having been through the sub-tasks I do have a quick scan through all the task steps just to check whether any have specific issues that have not been identified at the sub-task level.

I do recognise that this approach does have some potential weakness because it may not link specific PIFs to task steps. However, I feel it provides a suitable balance between effort required and benefits obtained.

How do you evaluate PIFs?

The section above describes how I identify PIFs relevant to a task. It appears to me that lots of people finish their assessments at that point, which I feel is of limited value. In order to create more value from the PIF identification I have developed a PIF evaluation, which I record in Section 4 of the template.

I complete the evaluation by reviewing the PIFs identified in the task analysis (see above). I use the 'key points' column to explain why the PIF is considered relevant to the task, which then forms the basis of a site visit and task walkthrough. The 'site assessment' column is used to record the evaluation, noting good and bad features. The 'action' column is used to record recommendations for improvement. In some cases there may be a number of key points associated with a single PIF, whilst other PIFs may not be considered relevant to the task.

How do you support your PIF evaluation?

I think it is inevitable that a PIF evaluation will always be quite subjective, which means it will always be open to challenge. I have concluded that the best way of supporting the evaluation is to take photos and collect any other relevant images (e.g. control graphic print-

[3] http://www.hse.gov.uk/humanfactors/topics/pifs.pdf

out). I use Section 4.2 of the template for this. A short description is included, along with notes about whether the PIF was considered good or bad.

What do you do once the assessment is complete?

Like all assessments, there is no point carrying out task analyses unless you do something with the findings. The action column in both the task analysis table (Section 3 of the template) and PIF evaluation (Section 4) are used to record recommendations that emerge as the analysis progresses. Also, I believe it is useful to take a step back at the end and review what you have learnt. I use this to form the main summary, which is presented in Section 2 of the template. I feel this is really the output from the analysis, whilst the remainder of the information recorded on the template is the data used to make the assessment.

I use the Task Criticality Overview (Section 2.1 of the template) to determine whether the initial assessment of the task criticality has changed now that a thorough task analysis has been completed (i.e. it is possible that additional hazards or potential errors have been identified, or risk controls may be less effective than assumed). As I use a scoring system to assign criticality when prioritising the tasks to be analysed it is quite easy to compare the before and after results. Experience has shown that, whilst individual scores have changed, the overall criticality (i.e. high, medium or low) remains valid.

A second important part of the task summary is recorded under Major Accident Potential (Section 2.2 of the template). I complete this by going through the task analysis and picking out the steps where the consequence was marked with 'MAH.' I aim to write a couple of sentences for all of the potential scenarios to explain how human errors can contribute to major accidents, the perceived risks and existing controls. Reference can be made here to any relevant improvement actions.

How do you link task analyses to the company's risk assessments?

Most companies have their own risk assessment methods, with many using matrices to determine overall risk based on potential consequence and likelihood. A common request is for the task analyses to link in with these methods. Section 2.3 of the assessment has been provided for this, although it needs to be tailored to the company's method. I typically list the major accident scenarios summarised in Section 2.2, although other health and safety considerations can be included.

To be honest, I find this adds little value to the task analysis, but it is relatively quick and easy to do and helps some people put the findings into context.

How do you demonstrate risks are As Low As Reasonably Practicable?

Ultimately, the objective of any risk assessment is to demonstrate that risks have been reduced as low as reasonably practicable (ALARP). The test for this is to identify what else can be done that could potentially reduce risks further and justifying why they have not been (or will not be) implemented. Part of this involves demonstrating that a suitable hierarchy of risk control has been implemented.

I have addressed this requirement by including a Risk Control Statement (Section 2.4 of the template). This presents a high level set of potential risk control strategies (can the hazard be eliminated or reduced, can engineering or administrative controls be implemented?). A column is provided to record current arrangements for each, and another for a discussion of the options available to reduce risk further. Finally, a statement is made about the strategy in place and whether ALARP has been achieved or further action is required.

This is usually the last thing to do when performing a task analysis. It is proving to be a very useful final review of the findings, and quite often further improvement actions are identified as a result.

What happens to the analysis?

An immediate requirement having completed a task analysis is to put a plan into place to address the recommended actions. A table is provided (Section 2.5 of the template) to summarise all actions generated during the task and error analysis, PIF evaluation and in the summing up stages (e.g. when completing the risk control statement). An important element of this is assigning ownership. Unfortunately, it is still very common to find that improvement actions resulting from task analyses are not being fulfilled in a timely and effective manner.

The longer term requirement is to keep analyses up to date. My view is that they can be viewed like any other risk assessment. This means they should be reviewed on a defined frequency or as the result of change. For sites dealing with major accident hazards and required to produce safety reports/cases, I suggest they link their task analyses to these documents. I would suggest the time between reviews should be no more than five years.

Task Analysis Template

Section 1 – Analysis Details

Task title – Transfer product from ship to storage tank

1.1 Contents

1.2 Analysis details

The task was reviewed by John Smith (Control room Operator), Rachel Jones (Area Technician), Alastair Campbell (Shift Supervisor) & Andy Brazier (Human Factors consultant) on 1 December 2013. It involved:

- Desk-top review of procedure;
- Walkthrough of procedure on plant;
- Review of Performance Influencing Factors (PIF) using check-sheet from HSE;
- Completion of human error analysis.

1.3 Review plan

This exercise should be repeated within five years (maximum) or following any significant modification to associated plant, equipment, procedure and/or task method.

Section 2 – Assessment Summary

2.1 Task Criticality Overview (based on findings of detailed analysis)

Criteria	Score	Explanation
How hazardous is the system involved?	3	Large quantities of product will be transferred
To what extent does the task involve the introduction of energy or an ignition source?	2	High capacity electric pumps are used for the transfer
To what extent does the task involves changes to the operating configuration?	2	A number of valves positions have to be changed. Also, connection involves making and breaking a flange.
What is the potential for error in performing the task?	3	Constant vigilance is required throughout the task to ensure problems are detected early. Also, to ensure storage tanks are not overfilled.
To what extent could the task affect performance of a safety system?	0	All safety systems should remain fully available throughout the task
Total	**10**	**Task criticality ranking is HIGH**

2.2 Major Accident Potential

The Task Analysis (see section 3) has been used to review the potential for this task to contribute to a major accident scenario. The following have been identified:

COMAH Scenario 1 – Drains tank overfill

The task analysis has highlighted that leaving drain valves opening before a transfer could lead to the drains tank being overfilled. If this is not detected in time, the quantity of product released could be enough to create major accident. These valves are checked at the start and end of each transfer. Also, there is a high level alarm and high high level trip that automatically close shutdown valves. However, it has been recognised that an interlock on the drain valves could further reduce the likelihood of this scenario. An action has been raised to assess the risk reduction achieved by this measure.

COMAH Scenario 2 – XXX

2.3 Risk Assessment

A risk assessment matrix has been used to evaluate the major accident potential

Scenario	Relevant risk controls	Consequence	Likelihood	Risk Region
1. Overfill drain tank	• Valves checked at start and end of transfer • High level alarm • High high level trip	High	Low	Medium
	•			

2.4 Risk Control Statement

Hierarchy of risk control	Assessment of current arrangements	Options available to reduce risk
Can the hazard be eliminated?	Only hazard is the product transferred from ship to storage tank	It is not possible to eliminate this hazard
Can the hazard be reduced?	Only hazard is the product transferred from ship to storage tank	Reducing the hazard would significantly impact on the operation of the site. Smaller ship cargos may reduce the likelihood of some major accidents. However, additional transfers would be required each year resulting in an overall increase of risk
Can additional engineering controls be implemented?	Alarms and trips protect against overfilling the slops and storage tanks.	An option to interlock drain valves has been proposed.
Can additional administrative controls be implemented?	A procedure and training plan exists. Some valves are labelled.	The procedure shall be updated to reflect the findings of this analysis. Actions have been raised to address issues with some valve labels and gap in the competence system around emergency procedures associated with ship transfers.

Based on the above assessment it is concluded that the main risks have been considered and controlled but there may be further opportunities for improvement.

2.5 Recommended actions

The table below summarises recommended actions for improvement extracted from the task and error and analysis (see section 3) and PIF report (see section 4).

No.	Reference (task step or PIF code)	Action description	Action owner
1	1.1	Add checks of valve status to existing checklist of ship departure	Mark Hughes
2	1.2	Assess the potential risk reduction of interlocking drain valves so that they cannot be opened when transfer is taking place. Depending on the outcome, either implement the change or record the justification that current controls achieve ALARP	Mark Hughes
3	J1	Survey jetty valves. Obtain and secure permanent labels to all valves.	Ian McIntyre
4	P5	Develop and implement a competence module for emergency procedures related to product transfer from ships	Lucy Davies
5			
6			

Section 3. Task and Error Analysis

3.1 Preconditions

- Ship is securely moored at jetty
- Pre-arrival check-list has been completed
- Gangway is in position
- Etc.

3.2 Tabular Task Analysis

ID	Description	Additional Info	Failure Mode	Consequences	Risk Control Measures	Performance Influencing Factors	Actions
1	Confirm operational valves are in the correct position					J1 = Valve identification J2 = Valve display on control mimic J10 = Exposed to weather on jetty P5 = Knowledge of emergency procedures O2 = Working alone without direct Etc.	
1.1	Confirm loading arm valves are closed	Valves 46, 47 and 48 Check from control room and confirm status on plant	Check omitted - valve left open	Liquid may be present in loading arm. May have a small release when blank is moved before connecting.	Valves are confirmed closed and locked at the end of all transfers.		Add checks of valve status to existing checklist of ship departure
1.2	Confirm manual loading arm drain valves are closed		Check omitted - valve left open	MAH – Unintended flow to drains tank during product transfer. May overfill tank and lead to loss of containment.	Drains tank protected by high level alarm and high-high level trip. .		Assess the potential risk reduction of interlocking drain valves so that they cannot be opened when transfer is taking place. Depending on the outcome, either implement the change or record the justification that current controls achieve ALARP

ID	Description	Additional Info	Failure Mode	Consequences	Risk Control Measures	Performance Influencing Factors	Actions
1.3	Etc.						
1.4							
2	Etc.						
2.1							
2.2							
2.3							
3	Etc.					J9 = within team, ship, security	

Section 4. Performance Influencing Factors (PIF)

4.1 PIF Evaluation Report

No.	PIF	Key points	Site Assessment	Action
	Job factors			
J1	Clarity of signs, signals, instructions and other information	Valve identification	Valve labelling is variable.	Survey jetty valves. Obtain and secure permanent labels to all valves.
J2	System/equipment interface (labelling, alarms)	Valve display on control mimic	Control mimic is clear. Identification and status of valves is easy to identify.	
J3	Difficulty/complexity of task			
J4	Routine or unusual			
J5	Procedures inadequate or inappropriate			
J6	Preparation for task (e.g. permits, risk assessments, checking)			
J7	Time available/required - Divided attention			
J8	Tools appropriate for task			
J9	Communication, with colleagues, supervision, contractor, other			
J10	Working environment (noise, heat, space, lighting, ventilation)	Exposed to weather on jetty	A small shelter provides some protection for workers. There is little that can be done to improve this.	
J11	Access to worksite or equipment (including use of tools)			
	Person factors			

No.	PIF	Key points	Site Assessment	Action
P1	Physical capability and condition			
P2	Fatigue (acute from temporary situation, or chronic)			
P3	Stress/morale			
P4	Work overload/underload			
P5	Competence to deal with circumstances	Knowledge of emergency procedures	Emergency procedures exist but no records to confirm every operator has received suitable training and assessment.	Develop and implement a competence module for emergency procedures related to product transfer from ships
P6	Motivation vs. other priorities			
	Organisation factors			
O1	Work pressures e.g. production vs. safety			
O2	Level and nature of supervision / leadership	Working alone without direct	Indirect supervision is available at all times. Operators are only allowed to work with direct supervision once they have passed an assessment.	
O3	Communication			
O4	Manning levels			
O5	Clarity of roles and responsibilities			
O6	Peer pressure			
O7	Consequences of failure to follow rules/procedures			
O8	Organisational learning (learning from experiences)			
O9	Organisational or safety culture, e.g. everyone breaks the rules			

4.2 PIF evidence including photos

Valve not labelled. Action raised to address

Pump start/stop. Design and layout consistent with others on site. Well located. No issues